Cochrane Library

Cochrane Database of Systematic Reviews

Negative pressure wound therapy for surgical wounds healing by primary closure (Review)

Norman G, Shi C, Goh EL, Murphy EMA, Reid A, Chiverton L, Stankiewicz M, Dumville JC

Norman G, Shi C, Goh EL, Murphy EMA, Reid A, Chiverton L, Stankiewicz M, Dumville JC.
Negative pressure wound therapy for surgical wounds healing by primary closure.
Cochrane Database of Systematic Reviews 2022, Issue 4. Art. No.: CD009261.
DOI: 10.1002/14651858.CD009261.pub7.

www.cochranelibrary.com

TABLE OF CONTENTS

[Intervention Review]

Negative pressure wound therapy for surgical wounds healing by primary closure

Gill Norman[1], Chunhu Shi[1], En Lin Goh[2], Elizabeth MA Murphy[3], Adam Reid[4], Laura Chiverton[5], Monica Stankiewicz[6], Jo C Dumville[1]

[1]Division of Nursing, Midwifery and Social Work, School of Health Sciences, Faculty of Biology, Medicine and Health, University of Manchester, Manchester Academic Health Science Centre, Manchester, UK. [2]Oxford Trauma, Nuffield Department of Orthopaedics, Rheumatology and Musculoskeletal Sciences, Oxford, UK. [3]Ward 64, St. Mary's Hospital, Manchester Foundation NHS Trust, Manchester, UK. [4]School of Biological Sciences, Faculty of Biology, Medicine & Health, Manchester, UK. [5]NIHR Clinical Research Facility, Great Ormond Street Hospital, London, UK. [6]Chermside Community Health Centre, Community and Oral Health Directorate, Brisbane, Australia

Contact: Gill Norman, gill.norman@manchester.ac.uk.

Editorial group: Cochrane Wounds Group.
Publication status and date: New search for studies and content updated (conclusions changed), published in Issue 4, 2022.

Citation: Norman G, Shi C, Goh EL, Murphy EMA, Reid A, Chiverton L, Stankiewicz M, Dumville JC.Negative pressure wound therapy for surgical wounds healing by primary closure. *Cochrane Database of Systematic Reviews* 2022, Issue 4. Art. No.: CD009261. DOI: 10.1002/14651858.CD009261.pub7.

ABSTRACT

Background

Indications for the use of negative pressure wound therapy (NPWT) are broad and include prophylaxis for surgical site infections (SSIs). Existing evidence for the effectiveness of NPWT on postoperative wounds healing by primary closure remains uncertain.

Objectives

To assess the effects of NPWT for preventing SSI in wounds healing through primary closure, and to assess the cost-effectiveness of NPWT in wounds healing through primary closure.

Search methods

In January 2021, we searched the Cochrane Wounds Specialised Register; the Cochrane Central Register of Controlled Trials (CENTRAL); Ovid MEDLINE (including In-Process & Other Non-Indexed Citations); Ovid Embase and EBSCO CINAHL Plus. We also searched clinical trials registries and references of included studies, systematic reviews and health technology reports. There were no restrictions on language, publication date or study setting.

Selection criteria

We included trials if they allocated participants to treatment randomly and compared NPWT with any other type of wound dressing, or compared one type of NPWT with another.

Data collection and analysis

At least two review authors independently assessed trials using predetermined inclusion criteria. We carried out data extraction, assessment using the Cochrane risk of bias tool, and quality assessment according to Grading of Recommendations, Assessment, Development and Evaluations methodology. Our primary outcomes were SSI, mortality, and wound dehiscence.

Main results

In this fourth update, we added 18 new randomised controlled trials (RCTs) and one new economic study, resulting in a total of 62 RCTs (13,340 included participants) and six economic studies. Studies evaluated NPWT in a wide range of surgeries, including orthopaedic, obstetric, vascular and general procedures. All studies compared NPWT with standard dressings. Most studies had unclear or high risk of bias for at least one key domain.

Primary outcomes

Eleven studies (6384 participants) which reported mortality were pooled. There is low-certainty evidence showing there may be a reduced risk of death after surgery for people treated with NPWT (0.84%) compared with standard dressings (1.17%) but there is uncertainty around this as confidence intervals include risk of benefits and harm; risk ratio (RR) 0.78 (95% CI 0.47 to 1.30; I^2 = 0%). Fifty-four studies reported SSI; 44 studies (11,403 participants) were pooled. There is moderate-certainty evidence that NPWT probably results in fewer SSIs (8.7% of participants) than treatment with standard dressings (11.75%) after surgery; RR 0.73 (95% CI 0.63 to 0.85; I^2 = 29%). Thirty studies reported wound dehiscence; 23 studies (8724 participants) were pooled. There is moderate-certainty evidence that there is probably little or no difference in dehiscence between people treated with NPWT (6.62%) and those treated with standard dressing (6.97%), although there is imprecision around the estimate that includes risk of benefit and harms; RR 0.97 (95% CI 0.82 to 1.16; I^2 = 4%). Evidence was downgraded for imprecision, risk of bias, or a combination of these.

Secondary outcomes

There is low-certainty evidence for the outcomes of reoperation and seroma; in each case, confidence intervals included both benefit and harm. There may be a reduced risk of reoperation favouring the standard dressing arm, but this was imprecise: RR 1.13 (95% CI 0.91 to 1.41; I^2 = 2%; 18 trials; 6272 participants). There may be a reduced risk of seroma for people treated with NPWT but this is imprecise: the RR was 0.82 (95% CI 0.65 to 1.05; I^2 = 0%; 15 trials; 5436 participants). For skin blisters, there is low-certainty evidence that people treated with NPWT may be more likely to develop skin blisters compared with those treated with standard dressing (RR 3.55; 95% CI 1.43 to 8.77; I^2 = 74%; 11 trials; 5015 participants). The effect of NPWT on haematoma is uncertain (RR 0.79; 95 % CI 0.48 to 1.30; I^2 = 0%; 17 trials; 5909 participants; very low-certainty evidence). There is low-certainty evidence of little to no difference in reported pain between groups. Pain was measured in different ways and most studies could not be pooled; this GRADE assessment is based on all fourteen trials reporting pain; the pooled RR for the proportion of participants who experienced pain was 1.52 (95% CI 0.20, 11.31; I^2 = 34%; two studies; 632 participants).

Cost-effectiveness

Six economic studies, based wholly or partially on trials in our review, assessed the cost-effectiveness of NPWT compared with standard care. They considered NPWT in five indications: caesarean sections in obese women; surgery for lower limb fracture; knee/hip arthroplasty; coronary artery bypass grafts; and vascular surgery with inguinal incisions. They calculated quality-adjusted life-years or an equivalent, and produced estimates of the treatments' relative cost-effectiveness. The reporting quality was good but the evidence certainty varied from moderate to very low. There is moderate-certainty evidence that NPWT in surgery for lower limb fracture was not cost-effective at any threshold of willingness-to-pay and that NPWT is probably cost-effective in obese women undergoing caesarean section. Other studies found low or very low-certainty evidence indicating that NPWT may be cost-effective for the indications assessed.

Authors' conclusions

People with primary closure of their surgical wound and treated prophylactically with NPWT following surgery probably experience fewer SSIs than people treated with standard dressings but there is probably no difference in wound dehiscence (moderate-certainty evidence). There may be a reduced risk of death after surgery for people treated with NPWT compared with standard dressings but there is uncertainty around this as confidence intervals include risk of benefit and harm (low-certainty evidence). People treated with NPWT may experience more instances of skin blistering compared with standard dressing treatment (low-certainty evidence). There are no clear differences in other secondary outcomes where most evidence is low or very low-certainty. Assessments of cost-effectiveness of NPWT produced differing results in different indications. There is a large number of ongoing studies, the results of which may change the findings of this review. Decisions about use of NPWT should take into account surgical indication and setting and consider evidence for all outcomes.

PLAIN LANGUAGE SUMMARY

Dressings that use negative pressure for closed surgical wounds

Key messages

Negative pressure wound therapy (NPWT) probably results in fewer surgical site infections (SSIs) than standard dressings in people with closed wounds after surgery.

NPWT probably makes no difference to the proportion of people with wound reopening (dehiscence) after surgery and may make little or no difference to the number of people who die.

NPWT may increase the number of people with skin blistering after surgery but may make little or no difference to other outcomes.

The cost-effectiveness of NPWT and how certain we are about this depends on the type of surgery.

What are surgical wounds healing by primary closure?

Surgical wounds healing by primary closure are incisions created by surgery where the edges have been brought together, usually by using stitches or staples. Most surgical wounds heal in this way. A potential complication of surgery is SSI, an infection at the site of a surgical wound. The proportion of people who develop an SSI after surgery can be as high as 40%. An SSI can cause pain and discomfort, as well as increasing a person's length of hospital stay and cost of treatment.

What did we want to find out?

NPWT is a sealed wound dressing attached to a vacuum pump which sucks fluid away from the wound. This may assist with wound healing and reduce risk of infection. We wanted to find out whether NPWT was better compared with standard wound dressings (usually gauze and tape) for treating people who had had surgery and had wounds which had been closed. We were interested in complications including SSI; wound reopening (dehiscence) and death for any reason. We also looked at several other outcomes including the need for another operation, the need to be admitted to hospital again, pain, quality of life, as well as some specific types of complications (haematoma (an accumulation of blood under the skin), seroma (an accumulation of clear fluid under the skin), skin blisters).

We also wanted to find out whether NPWT was cost-effective for treating people who had closed surgical wounds.

What did we do?

We searched for randomised controlled trials (clinical studies where the treatment people receive is chosen at random). This type of study design provides the most reliable evidence about the effects of a treatment. We searched for studies that compared any type of NPWT with standard dressings in people who had had surgery and had a wound which had been closed. We compared and summarised their results, and rated our confidence in the evidence.

What did we find?

We found 62 studies which compared NPWT with standard dressings and looked at surgical site complications. A variety of NPWT systems was used. A total of 13,340 people have been included in this review. A wide variety of surgeries was included such as knee and hip operations, caesarean sections, operations for broken bones and abdominal surgeries. There were more women than men included in the review because several large trials included only women having caesarean sections. Most of the people included in the review live in North America, Europe or Australasia.

Eleven studies (6384 people) reported on risk of death and found that there may be a lower risk with NPWT compared with standard dressings but this is not clear. Forty-four studies (11,403 people) looking at SSI were combined, and found that NPWT probably reduced the risk of SSI compared with standard dressings. Twenty-three studies (8724 people) found that there is probably little or no difference in wound reopening between NPWT and standard dressings. For most other outcomes, the evidence showed that there may not be clear differences between the treatments, or that we are uncertain about the true effect of the treatments. The exception was skin blistering where NPWT may increase the proportion of people who experience this after surgery.

Six cost-effectiveness studies were included in the review. These studies looked at women who had had caesarean sections, people with lower limb fractures, knee and hip surgeries, vascular surgery and heart surgery. All these studies used clinical information from trials included in this review. NPWT is probably cost-effective for caesarean section wounds in obese women and probably not cost-effective for fracture surgery wounds but we are less sure about its cost-effectiveness in the other types of surgery.

What limited our confidence in the evidence?

Our confidence in the evidence was limited by different reasons for different outcomes. Given the small number of people who died, the results for death are likely to change with more evidence. For SSI, approximately half the people were in studies using methods likely to introduce errors. For wound reopening and most other outcomes, our confidence was reduced by a combination of these reasons. For skin blistering, our confidence was reduced by differences between the studies as well as study methods.

How up to date is this review?

This review is up to date to January 2021.

SUMMARY OF FINDINGS

Summary of findings 1. Negative pressure wound therapy compared with standard dressing for surgical wounds healing by primary closure

Negative pressure wound therapy compared with standard dressing for surgical wounds healing by primary closure

Patient or population: adult patients with surgical wounds healing by primary closure
Setting: general surgical, orthopaedic or obstetric wards in acute-care hospitals
Intervention: negative pressure wound therapy (NPWT)
Comparison: standard dressing

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	№ of participants (studies)	Certainty of the evidence (GRADE)	Comments
	Risk with standard dressing	Risk with NPWT				
Mortality (proportion of participants dying in each group at follow-up of between 30 days and six months)	Study population		RR 0.78 (0.47 to 1.30)	6384 (11 studies)	⊕⊕⊖⊖ Low[1]	There may be a reduced risk of death after surgery for people treated with NPWT compared with standard dressings but there is uncertainty around this as confidence intervals include risk of benefit and harm.
	12 per 1000	3 fewer deaths per 1000 people (6 fewer to 4 more)				
Surgical site infection (proportion of participants in each group with SSI; follow-up of 30 days except where other time points specified as primary outcome measure in study)	Study population		RR 0.73 (0.63 to 0.85)	11403 (44 studies)	⊕⊕⊕⊖ Moderate[2]	Treatment with NPWT after surgery probably decreases the incidence of surgical site infection compared with a standard dressing.
	117 per 1000	31 fewer SSI per 1000 people (10 fewer to 43 fewer)				
Dehiscence (proportion of participants in each group with wound dehiscence; follow-up of 30 days except where other time points specified as primary outcome measure in study)	Study population		RR 0.97 (0.82 to 1.16)	8724 (23 studies)	⊕⊕⊕⊖ Moderate[3]	There is probably little or no difference in wound dehiscence between people treated with NPWT and standard dressings after surgery.
	70 per 1000	2 fewer dehiscence per 1000 people (13 fewer to 11 more)				

Reoperation (proportion of participants in each group requiring reoperation for reasons related to wound; follow-up of 30 days except where other time points specified as primary outcome measure in study)	Study population 50 per 1000	6 more reoperations per 1000 people (4 fewer to 20 more)	1.13 (0.91 to 1.41)	6272 (18 studies)	⊕⊕⊖⊖ Low[3]	There may be a higher incidence of reoperation in people treated with NPWT compared with standard dressings but there is uncertainty around this as confidence intervals include risk of benefit and harm.
Seroma (proportion of participants in each group with seroma; follow-up of 30 days except where other time points specified as primary outcome measure in study)	Study population 43 per 1000	8 fewer seroma per 1000 people (15 fewer to 2 more)	RR 0.82 (0.65 to 1.05)	5436 (15 studies)	⊕⊕⊖⊖ Low[4]	There may be a lower incidence of seroma in people treated with NPWT compared with standard dressings but there is uncertainty around this as confidence intervals include risk of benefit and harm.
Haematoma (proportion of participants in each group with haematoma; follow-up of 30 days except where other time points specified as primary outcome measure in study)	Study population 14 per 1000	3 fewer haematoma per 1000 people (7 fewer to 4 more)	RR 0.79 (0.48 to 1.30)	5909 (17 studies)	⊕⊖⊖⊖ Very low[5]	It is uncertain what the effect of NPWT compared with standard dressing is for incidence of haematoma.
Skin blisters (proportion of participants in each group with at least one skin blister; follow-up of 30 days except where other time points specified as primary outcome measure in study)	Study population 19 per 1000	48 more blistering cases per 1000 people (8 more to 146 more)	RR 3.55 (1.43 to 8.77)	5015 (11 studies)	⊕⊕⊖⊖ Low[6]	NPWT may increase the risk of developing skin blisters compared with a standard dressing.

*__The risk in the intervention group__ (and its 95% confidence interval) is based on the assumed risk in the comparison group and the __relative effect__ of the intervention (and its 95% CI).

CI: confidence interval; **NPWT:** negative pressure wound therapy; **RR:** risk ratio

GRADE Working Group grades of evidence
High certainty: we are very confident that the true effect lies close to that of the estimate of the effect.
Moderate certainty: we are moderately confident in the effect estimate; the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
Low certainty: our confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect.
Very low certainty: we have very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect.

[1]Downgraded twice for very serious imprecision resulting from very low event rates which produced wide confidence intervals
[2]Downgraded once for high risk of bias in various domains, affecting approximately 50% of participants
[3]Downgraded once for a combination of high risk of bias in various domains and imprecision
[4]Downgraded once for risk of bias in various domains and once for imprecision
[5]Downgraded once for high risk of bias in various domains and twice for very serious imprecision
[6]Downgraded once for high risk of bias in various domains, and once for inconsistency

BACKGROUND

Description of the condition

An estimated 4511 operations per 100,000 population are carried out annually worldwide, equating to one operation each year for every 22 people (Lancet Commission on Global Surgery 2015). This figure is higher in high-income countries. For example, in Australia in 2013/14, there were approximately 2.4 million surgical procedures in a population of 23.4 million, or around one operation each year for every 10 people (ABS 2014). One of the complications of surgery is surgical site infection (SSI), which is an infection that occurs at the site of a surgical incision or in an organ space within 30 days of the surgery. The overall incidence of SSI is 1.9% (Berrios-Torres 2017), but it may be as high as 40% in some populations (Maehara 2017). The impact on patients of experiencing surgical complications such as an SSI can be considerable (Pinto 2016; Tanner 2012). As well as causing pain and discomfort for the patient, SSI increases the length of hospital stay and the cost of treatment (De Lissovoy 2009).

Surgical wounds generally heal by primary closure during which the wound edges are brought together so that they are adjacent to each other. Wound closure is usually assisted by the use of sutures (stitches), staples, adhesive tape, or glue (Coulthard 2010), and healing begins within hours of closure (Rodero 2010). Some types of surgical wounds, such as sternal wounds, are more difficult to heal due to their anatomical position or an increased likelihood of infection (Toeg 2017); so too are surgical wounds in patients with certain types of underlying characteristics such as advanced age or medical conditions including malnutrition, uncontrolled diabetes, cardiovascular disease, compromised immunity, and morbid obesity (Baronski 2008; Waisbren 2010; Winfield 2016).

Failure of a wound to heal may also be the result of dehiscence (separation of the wound edges). Reasons for dehiscence are either technical, such as sutures breaking, cutting through tissue or knots slipping, inadequate splinting (Baronski 2008), or patient-related factors such as wound infection and obesity (Sandy-Hodgetts 2015). Chronic obstructive pulmonary disease is a major risk factor for dehiscence in sternal surgery (Olbrecht 2006). A serious complication of dehiscence following laparotomy is wound evisceration, where the wound separates completely, exposing the underlying organs. Where evisceration occurs, the mortality rate in the postoperative period may be as high as 45% (Kenig 2012).

Description of the intervention

Negative pressure wound therapy (NPWT) has been used to treat wounds since the late 1990s (Fleischmann 1997; Morykwas 1997). Negative pressure wound therapy has been recommended for a wide range of indications including open abdominal wounds (Stevens 2009), open fractures (Stannard 2009), burn wounds (Kantak 2016), pressure ulcers (Mandal 2007), traumatic wounds (Kanakaris 2007), diabetic foot ulcers (Eneroth 2008), split-thickness skin grafts (Blume 2010), sternal wounds (Sjogren 2011), and after clean surgery in obese patients (Dragu 2011). Negative pressure wound therapy is increasingly being used prophylactically on closed incisional wounds to prevent surgical site complications (De Vries 2016; Norman 2020), as well as being used on wounds healing by secondary intention (left open to heal from the bottom up) such as chronic or infected wounds (Dumville 2015).

Negative pressure wound therapy consists of a closed, sealed system that applies negative pressure (suction) to the wound surface. The wound is covered or packed with an open-cell foam or gauze dressing, usually over a silicone layer, and sealed with an occlusive drape. Intermittent or continuous suction is maintained by connecting suction tubes from the wound dressing to a vacuum pump and liquid waste collector. Standard negative pressure rates range from -50 mmHg to -125 mmHg (Ubbink 2008; Vikatmaa 2008). The longest-established device is the vacuum-assisted closure (VAC) system (KCI, San Antonio, Texas) (Morykwas 1997). However, alternatives have been developed and are being used (Visser 2017). Portable versions of the device have been introduced for use in community settings (Hurd 2014; Ousey 2014). An emerging advance has been the addition of 'instillations' of sterile water, saline, antiseptics, or antibiotics to VAC therapy, as in new negative pressure wound therapy with instillation (NPWTi) systems such as V.A.C. VeraFlo Therapy (KCI, San Antonio, Texas) (Gabriel 2014; Gupta 2016).

How the intervention might work

In humans, the wound-healing process is regarded as occurring in four consecutive and overlapping stages, namely: haemostasis, inflammation, proliferation, and remodelling (Velnar 2009). The precise way in which NPWT may aid in this process is unclear. Experimental evidence suggests that NPWT may assist wound healing by increasing local blood flow and the production of granulation tissue (Xia 2014), and may encourage other changes to the microenvironment of the wound by reducing bacterial contamination, oedema, and exudate (Banwell 2003). Other mechanisms for healing have been investigated using animal models. For example, an increase in fibrocytes (stem cells involved in wound healing) was demonstrated in an NPWT-treated group of diabetic rats compared with a control group (Chen 2017). Expressions of vascular endothelial growth factor receptors, which are involved in healing, were also seen to increase when NPWT was compared with a control group of rabbits (Tanaka 2016). One of the basic theoretical principles underpinning the development of NPWT is that it increases perfusion or blood flow. However, this was challenged in an experimental study using healthy volunteers that showed that local blood flow decreased as suction pressure increased (Kairinos 2009), while a study in closed incisional wounds in a porcine model (Malmsjö 2014) found little impact on wound perfusion with any tested system, and some slight decreases in blood flow in superficial tissue. In closed incisions healing by primary intention, NPWT also delivers a sealed environment, preventing or reducing bacterial entry to the wound, while removing blood and exudate from the wound. A systematic review of laboratory studies in both acute and chronic wound models (Glass 2014) suggests that NPWT shifts the cytokine profile to being less inflammatory but that, although there may be differences in mechanisms between acute and chronic wounds, in both cases wound healing is promoted through changes in the expression of multiple enzymes such as the matrix metallo-proteinases. There are multiple probable mediators of a possible effect of NPWT on wound healing in closed surgical incisions and these are not yet fully understood.

Why it is important to do this review

Surgical wounds that become infected and/or that fail to heal may cause considerable distress to patients and impact negatively on the physical, social, emotional, and economic aspects of

their lives (Andersson 2010; McCaughan 2018). Investigations into interventions to avoid wound breakdown are therefore important. Negative pressure wound therapy was approved by the US Food and Drug Administration (FDA) for the treatment of non-healing wounds in 1995 (Kloth 2002). More recently, a multinational expert working group has issued guidelines for the use of the therapy for diabetic foot ulcers, complex leg ulcers, pressure ulcers, dehisced sternal wounds, open abdominal wounds, and traumatic wounds (Expert Working Group 2008). While NPWT has become an accepted part of modern wound-healing techniques, there have also been reports of severe adverse events associated with the therapy. Problems have included stomal dehiscence (Steenvoorde 2009), extraperitoneal bladder leakage (Heuser 2005), necrotising fasciitis (Citak 2010), bleeding after cardiac surgery (Petzina 2010), pain (Apostoli 2008), secondary wound formation (Karabacak 2016), and anxiety (Keskin 2008). Communiqués issued in 2009 by the FDA reported six deaths and 77 injury reports associated with the use of NPWT. The information sheets contained warnings and recommendations for consumers and healthcare practitioners about the use of the treatment in certain circumstances (FDA 2009a; FDA 2009b).

Since the introduction of NPWT, there has been an explosion of publications, including an increasing number of RCTs, which have been influential in changing practice. Along with an increase in primary studies and other non-research publications, there has been a concomitant increase in the number of systematic reviews (Hyldig 2016; Ingargiola 2013; Karlakki 2013; Ubbink 2008; Vikatmaa 2008; Willy 2017); this has increased recently, with several reviews of NPWT for closed surgical wounds in general, and many more focused on particular types of surgery, since the last update of this review (Appendix 1). Many reviews have included non-randomised controlled trials; have considered both acute and chronic wounds; and, as with the primary studies, some have received industry sponsorship (Kairinos 2014). In addition, concerns have been raised about the premature termination of studies (Gregor 2008). It is therefore unsurprising that some recent reviews have concluded that the evidence for the effectiveness of NPWT remains uncertain (Hyldig 2016; Webster 2014; WHO 2016). None of the reviews published to date, with the exception of previous versions of this review (Norman 2020; Webster 2019), have included formal cost-effectiveness studies. NPWT is a rapidly expanding therapy with widening indications for its use, so new trials continue to emerge. None of the identified reviews included the very large RCTs published since the last version of this review, which were known to have reported data. Consequently, an updated systematic review was required to summarise the current evidence for the effect of NPWT on the healing of surgical wounds by primary closure.

A glossary of main terms is given in Appendix 2.

OBJECTIVES

To assess the effects of NPWT for preventing surgical site infection in wounds healing through primary closure, and to assess the cost-effectiveness of NPWT in wounds healing through primary closure.

METHODS

Criteria for considering studies for this review

Types of studies

This section follows the methods used in the last update (Norman 2020). For changes to this section since the protocol (Webster 2011) and other previous versions of the review (Webster 2014; Webster 2019), please see Differences between protocol and review.

We included published or unpublished randomised controlled trials (RCTs) or cluster-RCTs that evaluated the effects of NPWT on surgical wounds healing by primary closure. We excluded cross-over trials and quasi-randomised studies where, for example, treatment allocation was made through alternation or by date of birth.

We also included comparative full and partial economic evaluations conducted within the framework of eligible RCTs (i.e. cost-effectiveness analyses, cost-utility analyses, and cost-benefit analyses).

Types of participants

We included trials involving people of any age and in any care setting that assessed the use of NPWT for uninfected surgical wounds healing by primary closure in all intervention groups. We excluded trials where NPWT was used as a dressing following a skin graft (including split-skin grafts and full-skin grafts); flap closure surgery; skin graft donor sites; or surgery involving harvesting veins following flap elevation. We also excluded wounds that could not be closed immediately due to damaged tissue (e.g. in severe trauma), infection, or chronicity (wounds healing by delayed primary intention or secondary intention).

Types of interventions

The primary intervention was NPWT for closed surgical incisions delivered by any mode, or simple closed-system suction drainage; continuously or intermittently over any time period and at any pressure. The comparison interventions were any standard dressing (e.g. gauze) or any advanced dressing (e.g. hydrogels, alginates, hydrocolloids); or comparisons between different negative pressure devices. The use of a particular negative pressure system, device or protocol (e.g. different pressures) had to be the only systematic difference between the intervention groups.

Types of outcome measures

Primary outcomes

- Mortality (all-cause)
- Surgical site infection (superficial, deep or organ space)
- Dehiscence

Secondary outcomes

- Reoperation
- Readmission to hospital within 30 days for a wound-related complication
- Seroma, expressed as the proportion of participants in each group with seroma
- Haematoma, expressed as the proportion of participants in each group with haematoma

- Skin blisters, expressed as the proportion of participants in each group with blisters
- Pain (measured by any valid pain assessment instrument)
- Quality of life (measured by any valid assessment instrument and including utility scores representing health-related quality of life)
- Incremental cost-effectiveness ratio (ICER) or other measure of relative cost-effectiveness

We accepted study authors' definitions of SSI, dehiscence and wound-related complications requiring reoperation. We anticipated that outcomes would be reported at 30 days but accepted any duration of follow-up unless otherwise specified. Where data were reported at multiple durations of follow-up, we used data at 30 days or an equivalent time point unless another duration was specified as the primary measure in the study.

Search methods for identification of studies

Electronic searches

We searched the following electronic databases to identify reports of relevant clinical trials and cost effectiveness studies:

- the Cochrane Wounds Specialised Register (searched 6 January 2021);
- the Cochrane Central Register of Controlled Trials (CENTRAL; 2020, Issue 12) in the Cochrane Library (searched 6 January 2021);
- Ovid MEDLINE including In-Process & Other Non-Indexed Citations (1946 to 6 January 2021);
- Ovid Embase (1974 to 6 January 2021);
- EBSCO CINAHL Plus (Cumulative Index to Nursing and Allied Health Literature; 1937 to 6 January 2021).

We searched the NHS (National Health Service) Economic Evaluation Database (NHS EED; 2015, Issue 2) for a previous version of this review (Webster 2019). As NHS EED has not been updated since 2015, we did not search it for this update or the previous update in 2020.

The search strategies for the Cochrane Wounds Specialised Register, CENTRAL, Ovid MEDLINE, Ovid Embase and EBSCO CINAHL Plus can be found in Appendix 3. We combined the Ovid MEDLINE search with the Cochrane Highly Sensitive Search Strategy for identifying randomised trials in MEDLINE: sensitivity- and precision-maximising version (2008 revision) (Lefebvre 2021). We combined the Embase search with the Ovid Embase filter developed by the UK Cochrane Centre (Lefebvre 2021). We combined the CINAHL Plus search with the trial filter developed by Glanville 2019. There were no restrictions with respect to language, date of publication or study setting. We combined Ovid MEDLINE, Ovid Embase and EBSCO CINAHL Plus searches with filters developed by the Centre for Reviews and Dissemination for the identification of economic studies (CRD 2013).

We also searched the following clinical trials registries:

- ClinicalTrials.gov (www.clinicaltrials.gov) (searched 7 January 2021);
- World Health Organization (WHO) International Clinical Trials Registry Platform (http://apps.who.int/trialsearch/Default.aspx) (searched 7 January 2021).

Search strategies for clinical trial registries can be found in Appendix 3. Details of the search strategies used for the previous version of the review are given in Norman 2020.

Searching other resources

We checked the citation lists of papers identified by the above strategies for further reports of eligible studies. We contacted corresponding authors of identified studies where key information was missing or unclear. In the first version of this review, we contacted the manufacturers and distributors of devices used to deliver NPWT, such as vacuum-assisted (VAC) closure (KCI, San Antonio, Texas); SNaP Wound Care System Dressing (Spiracur Inc, Sunnyvale, California); Venturi Avanti and Venturi Compact (Talley Group, Romsey, UK); and RENASYS EZ (Smith & Nephew, Hull, UK). We did not contact manufacturers or distributors for this update.

Data collection and analysis

We carried out data collection and analysis according to the methods stated in the published protocol (Webster 2011), which have been updated where appropriate to reflect changes in guidance in revisions to the *Cochrane Handbook for Systematic Reviews of Interventions* (Li 2021). Changes from the protocol or previous published versions of the review are documented in Differences between protocol and review.

Three authors of the previous version of this review were authors of some of the papers included in the review. To prevent any form of bias, none of them were involved in extracting data or assessing quality for any of the studies in which they were investigators.

Selection of studies

Two review authors independently reviewed titles and abstracts identified by the search. We retrieved full reports of all potentially relevant trials for further assessment of eligibility based on the inclusion criteria. We settled differences of opinion by consensus. There was no blinding of study authorship.

Data extraction and management

Two review authors independently extracted the following data using a pre-designed checklist:

- methods (number of participants eligible and randomised, adequacy of randomisation, allocation concealment, blinding, completeness of follow-up);
- participant characteristics and exclusions;
- type of surgery;
- setting;
- study dates;
- interventions;
- number of participants per group;
- prospective registration on a clinical trials registry;
- information about ethics approval, consent, and conflict of interest;
- source of funding;
- economic data (healthcare costs);
- outcomes.

For cost-effectiveness studies, we additionally extracted data relating to study design, analytical approach, sources of

effectiveness and cost data, perspective, utility valuation, measures of benefit, and analysis of uncertainty.

Any discrepancies were resolved through discussion. One review author entered data into the Review Manager 5 software (Review Manager 2020); and a second author checked the data for accuracy. Where necessary, we attempted to contact study authors of the original reports for clarification. When more than one publication arose from a study, we extracted data from all relevant publications but did not duplicate data.

Assessment of risk of bias in included studies

Two review authors independently assessed the eligible trials for risk of bias using the Cochrane tool for assessing risk of bias (Higgins 2017). This tool addresses six specific domains, namely sequence generation, allocation concealment, blinding, incomplete outcome data, selective outcome reporting, and other potential sources of bias (see Appendix 4 for details of the criteria on which our judgements were based). We assessed blinding and completeness of outcome data for each outcome separately. We completed a risk of bias table for each eligible study. Any disagreements between review authors were resolved by consensus. We contacted investigators of included trials to resolve any ambiguities. Assessment of risk of bias is presented as a Risk of bias summary figure (Figure 1), which shows all the judgements in a cross-tabulation of study by entry.

Figure 1. Risk of bias summary: review authors' judgements about each risk of bias item for each included study

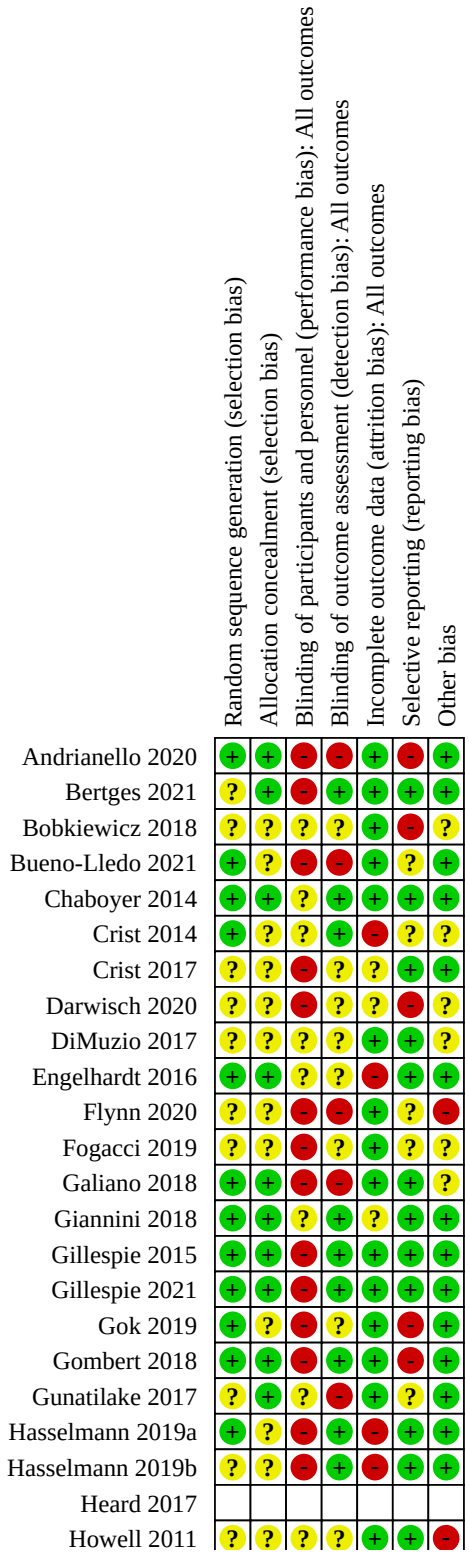
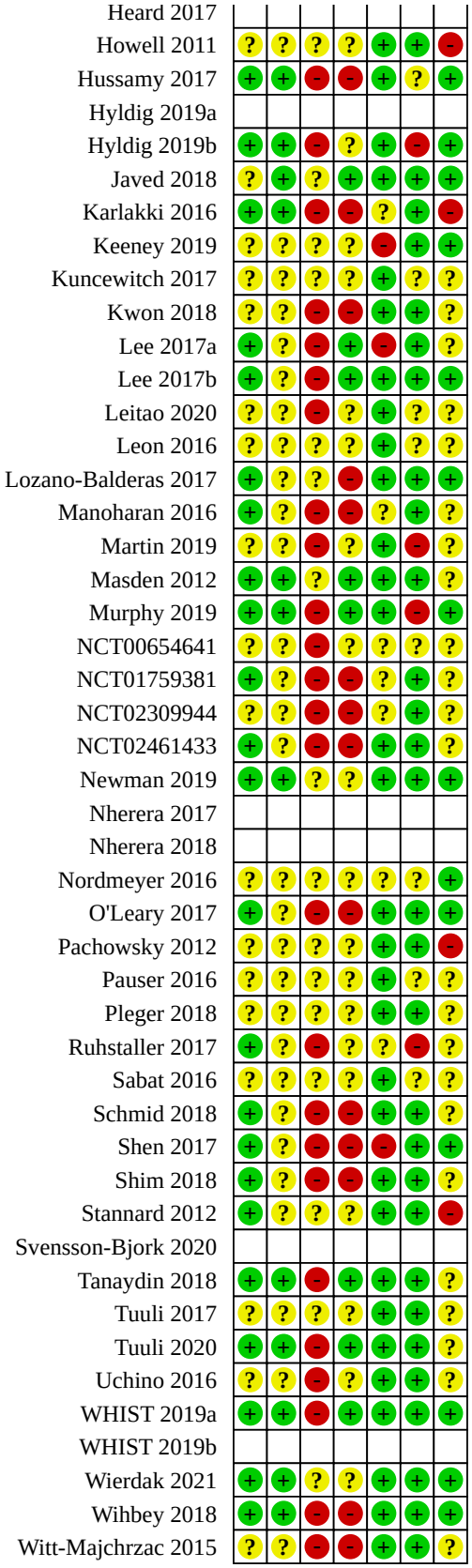


Figure 1. (Continued)



We reported bias and, more generally, study limitations within economic evaluations, using the checklist from the Consolidated Health Economic Evaluation Reporting Standards (CHEERS) (Husereau 2013), and used the scoring system reported by Hope 2017 to assess the overall quality of each study, expressed as a percentage. Specifically, we allocated 1 point for each item that was fully met, 1/2 point if the item was partially met, and 0 for each item that was not met. We summed the total score and calculated a percentage (total score/total number of items less any non-applicable (N/A) item). We classified the quality of a report as follows: 85% or higher as excellent; 70% to 84% as very good quality; 55% to 70% as good quality; and below 55% as poor quality.

Measures of treatment effect

For individual trials, we extracted the numbers with an event for each treatment group and used them to calculate the risk ratio (RR) with its 95% confidence interval (CI). For statistically significant effects, we planned to calculate the number needed to treat for an additional beneficial outcome (NNTB) or number needed to treat for an additional harmful outcome (NNTH) from the risk difference. However, based on the quality of the data and lack of evidence of effect for most outcomes, we decided not to conduct these calculations. For continuous outcomes, we extracted the mean and standard deviation (SD) and calculated the mean difference (MD) or, if the scale of measurement differed across trials, the standardised mean difference (SMD), each with its 95% CI. For economic studies, we focused on measures of relative cost-effectiveness such as the incremental cost-effectiveness ratio (ICER) as reported in the primary study.

Unit of analysis issues

Where studies randomised wounds or body parts as opposed to individuals and there were multiple wounds per participant, and we were unable to obtain further information from trialists, we did not include them in the meta-analysis but instead presented narrative summaries of the results in Appendix 5.

We also included studies with split-body designs, where patients undergoing bilateral procedures were enrolled and one wound was randomised to one treatment and the other to the alternative treatment. These approaches are similar to the 'split-mouth' approach (Lesaffre 2009). These studies should be analysed using paired data which reflects the reduced variation in evaluating different treatments on the same person. However, it was unclear whether such an analysis had been undertaken. We have noted this lack of clarity in the risk of bias assessment and in the notes in the Characteristics of included studies table. These studies were analysed separately from the parallel-group trials and the results are presented in Appendix 5.

In some cases, trials enrolled a mixture of participants undergoing unilateral and bilateral procedures and it was not possible to separate the paired and unpaired data. We noted the results of these trials but did not analyse them further; results are presented in Appendix 5. If included studies had randomised at the participant level and measured outcomes at the wound level, we planned to treat the participant as the unit of analysis when the number of wounds assessed appeared equal to the number of participants (e.g. one wound per person).

If a future update identifies cluster-RCTs, we would note whether studies presented outcomes at the level of the cluster or at the level of participants. Unit of analysis issues can occur if studies randomise at the cluster level but the outcome data are analysed at the level of the participant. We would note whether data from participants in a cluster were (incorrectly) treated as independent. In this case, we would record this as part of the risk of bias assessment (using the 'other risks' domain). Where possible, we would then adjust for clustering ourselves using appropriate methods (Higgins 2021). If no such adjustment were possible, we would record the results but would not include them in a meta-analysis.

Dealing with missing data

Where it appeared that data had been excluded from the analyses, we attempted to contact authors for these missing data. If data remained missing despite our best efforts to obtain them, we conducted an available-case analysis, based on the numbers of participants for whom outcome data were known. No imputations were made. We did not conduct planned best-case and worst-case analyses, nor did we calculate SDs from standard errors (SE) (Li 2021).

Assessment of heterogeneity

Assessment of heterogeneity can be a complex, multifaceted process. Firstly, we considered clinical and methodological heterogeneity, that is, the degree to which the included studies varied in terms of participant, intervention, outcome, and characteristics such as length of follow-up. This assessment of clinical and methodological heterogeneity was supplemented by information regarding statistical heterogeneity, assessed using the Chi^2 test (we considered a significance level of $P < 0.10$ to indicate statistically significant heterogeneity) in conjunction with the I^2 statistic (Higgins 2003). The I^2 examines the percentage of total variation across RCTs that is due to heterogeneity rather than chance (Higgins 2003). In general, I^2 values of 40% or less may not be important (Higgins 2003), while values of 75% or more indicate considerable heterogeneity (Deeks 2011). However, these figures are only a guide, and it has been recognised that statistical tests and metrics may miss important heterogeneity. Thus, while these were assessed, the overall assessment of heterogeneity considered these measures in combination with the methodological and clinical assessment of heterogeneity. Where there was evidence of high heterogeneity (e.g. an I^2 of 75% or higher, or visual indications from the forest plot), we attempted to explore this further; see Data synthesis for details on how we handled potential heterogeneity in the data analyses.

Assessment of reporting biases

We assessed selective outcome reporting for each trial as part of our appraisal of risk of bias. In addition, as a large number of trials were included in the meta-analysis for one of our primary outcomes (surgical site infection), we also assessed publication bias using a funnel plot (Li 2021). We noted the particular risk of outcome reporting bias for a post hoc exploration which we undertook of superficial and deep SSI and its implications for the certainty of the data.

Data synthesis

Where studies were clinically similar and outcome measurements comparable, we pooled results using a random-effects model and reported the pooled estimate together with its 95% CI. Where

statistical synthesis of data from more than one study was not possible or considered inappropriate, we conducted a narrative review of eligible studies.

We were unable to pre specify the amount of clinical, methodological, and statistical heterogeneity in the included studies, thus we used a random-effects approach for meta-analysis. Conducting meta-analysis with a fixed-effect model in the presence of even minor heterogeneity may provide overly narrow CIs. We would only have used a fixed-effect approach when clinical and methodological heterogeneity was assessed as minimal, and the assumption that a single underlying treatment effect was being estimated held. Chi^2 and I^2 were used to quantify heterogeneity but were not used to guide the choice of a model for meta-analysis. We would have exercised caution when meta-analysed data were at risk of small-study effects because, in such a case, use of a random-effects model may be unsuitable. In this case, or where there were other reasons to question the selection of a fixed-effect or random-effects model, we planned to assess the impact of the approach using sensitivity analyses to compare results from alternate models, but this was not implemented (Thompson 1999).

We presented data using forest plots, where possible. For dichotomous outcomes, we presented the summary estimate as an RR with 95% CI. Where continuous outcomes were measured, we presented an MD with 95% CI; we planned to pool SMD estimates where studies measured the same outcome using different methods.

Economic analyses

We have presented a tabulated analysis of the identified economic data in accordance with current guidance on the use of economics methods in the preparation of Cochrane Reviews (Aluko 2021). We classified the economic evaluation according to the framework described by Husereau and colleagues (Husereau 2013). We tabulated the main characteristics and results of the identified economic evaluation studies and augmented these with a narrative description. The methods used are discussed, and the key results of the studies compared. We assessed the quality of the studies using the CHEERS checklist (Husereau 2013).

We expected the results of cost-effectiveness studies to vary according to the particular circumstances of each study. For example, the comparator treatment, such as standard care, may differ for different types of wounds and in different settings. Our analysis placed the results of the economic studies in context and entailed a discussion of scenarios that were likely to lead to the most cost-effective use of the therapy, as well as the least cost-effective use.

We intended to capture and report all substantial costs that were observed to differ between participants administered NPWT and participants administered standard care as part of the economic analysis. However, we did not treat cost or resource use as an outcome in itself but as a component of cost-effectiveness. We therefore used the currency and price year together with the principal sources of resource costings in each original study. The primary trial outcome (adverse events) is relevant to the economic analysis as it may indicate a difference in the number of hospital bed days and specialist time required and a possible improvement in quality of life of the participant.

We examined information on the change in health-related quality of life via utilities measured by a multi-attribute utility instrument (MAUI) or other approaches (such as the time trade-off, standard gamble) where possible. These data are ideally reported in trials for both the group treated with NPWT and a control group receiving the comparator wound care. We assessed the utility data for comparability and representativeness considering issues such as the types of wounds included, the patient populations, timing of the baseline point and follow-up collection, the MAUI used, and the algorithm for scoring the MAUI. We planned to discuss the potential impact on health-related quality of life attributable to the intervention as part of the analysis. As with cost and resource use data, we treated utility data as a component of cost-effectiveness. If differences were observed in the rates of adverse events, wound infections, and complications resulting from the treatment of the wound, we planned to discuss the economic implications as part of the economic analysis.

Subgroup analysis and investigation of heterogeneity

Investigations of heterogeneity were not required as inconsistency was low for all outcomes, nor did we consider any population, intervention, or comparator subanalyses to be appropriate. We had originally planned a range of subgroup analyses in the protocol for this review, including type of setting, type of device, type of surgery, and type of comparison dressing. Based on the current interest in NPWT as a treatment for wounds healing by primary intention, and given the available data, we have conducted one of these suggested analyses: a subgroup analysis for different types of surgery defined in line with broad clinical grouping. We have also presented the data subgrouped by types of surgery based on contamination class. The decision to define surgery in two ways was a post hoc decision resulting in an exploratory analysis and, as with all subgroup analysis, the results should be interpreted with caution.

Subgroup analyses by type of surgery have been conducted for SSI - the primary outcome for which sufficient studies were available. For the outcome of dehiscence, we have grouped the studies in the analysis by their broad clinical grouping but have not implemented the subgroup analysis as there were too few studies in some groups.

For the outcome of SSI, we also performed an exploratory post hoc analysis in which we looked at studies which reported separate data for superficial SSIs and for deeper infections (classed as "deep" or "deep and organ space" SSIs), or which only reported either superficial or deep infection. Where infections were reported using the Szilagyi classification (Szilagyi 1972), we considered Szilagyi class I or II to be superficial and class III to be deep infections.

Sensitivity analysis

We performed a sensitivity analysis on the primary outcomes of SSI and dehiscence to assess the influence of removing studies classified as being at high or unclear risk of bias from the meta-analysis. We excluded studies that were assessed as having high or unclear risk of bias in the key domains of adequate generation of the randomisation sequence, adequate allocation concealment, and blinding of outcome assessor.

Summary of findings and assessment of the certainty of the evidence

We have presented the main outcomes of the review in a Summary of findings (SoF) table. This table presents key information concerning the quality of the evidence, the magnitude of the effects of the interventions examined, and the sum of available data for the main outcomes (Schünemann 2021a). Summary of findings tables also include an overall grading of the evidence related to each of the primary outcomes, using the GRADE approach. The GRADE approach defines the certainty of a body of evidence as the extent to which one can be confident that an estimate of effect or association is close to the true quantity of specific interest. The quality of a body of evidence involves consideration of within-trial risk of bias, directness of evidence, heterogeneity, precision of effect estimates, and risk of publication bias (Schünemann 2021b). We planned to create a separate SoF table for each comparison evaluated. We have presented the following outcomes in the SoF table for the comparison of NPWT with standard care:

- incidence of mortality;
- incidence of surgical site infection;
- incidence of dehiscence;
- Incidence of reoperation;
- incidence of seroma;
- incidence of haematoma;
- incidence of skin blisters.

For other outcomes, we conducted a GRADE assessment and presented these assessments in a narrative format within the Results section but did not present them in separate Summary of findings tables. We based the GRADE assessment of cost-effectiveness evidence on the RCT evidence on which the evaluation was based. Where appropriate, we followed Murad 2017 in our rating of the evidence where there was no single estimate of effect or where a pooled estimate represented only a minority of the evidence. In all cases, we followed the advice of the GRADE working group in our use of statements to communicate our GRADE assessments of evidence (Santesso 2020).

RESULTS

Description of studies

See Characteristics of included studies; Characteristics of excluded studies; Characteristics of studies awaiting classification; Characteristics of ongoing studies. Outcome data for intervention studies are given in Table 1 and Table 2; economic data are summarised in Table 3.

Results of the search

We searched for both intervention studies and economic evaluations. The results of these searches are reported separately below, and summarised in Figure 2. Over the lifetime of the review, we have now assessed a total of 2561 records from electronic searches as abstracts for intervention studies with 783 screened at full-text stage, although many of these were clinical trial registry records. For economic evaluation studies, we have assessed 502 records as abstracts and thirteen as full texts.

Figure 2. Study flow diagram

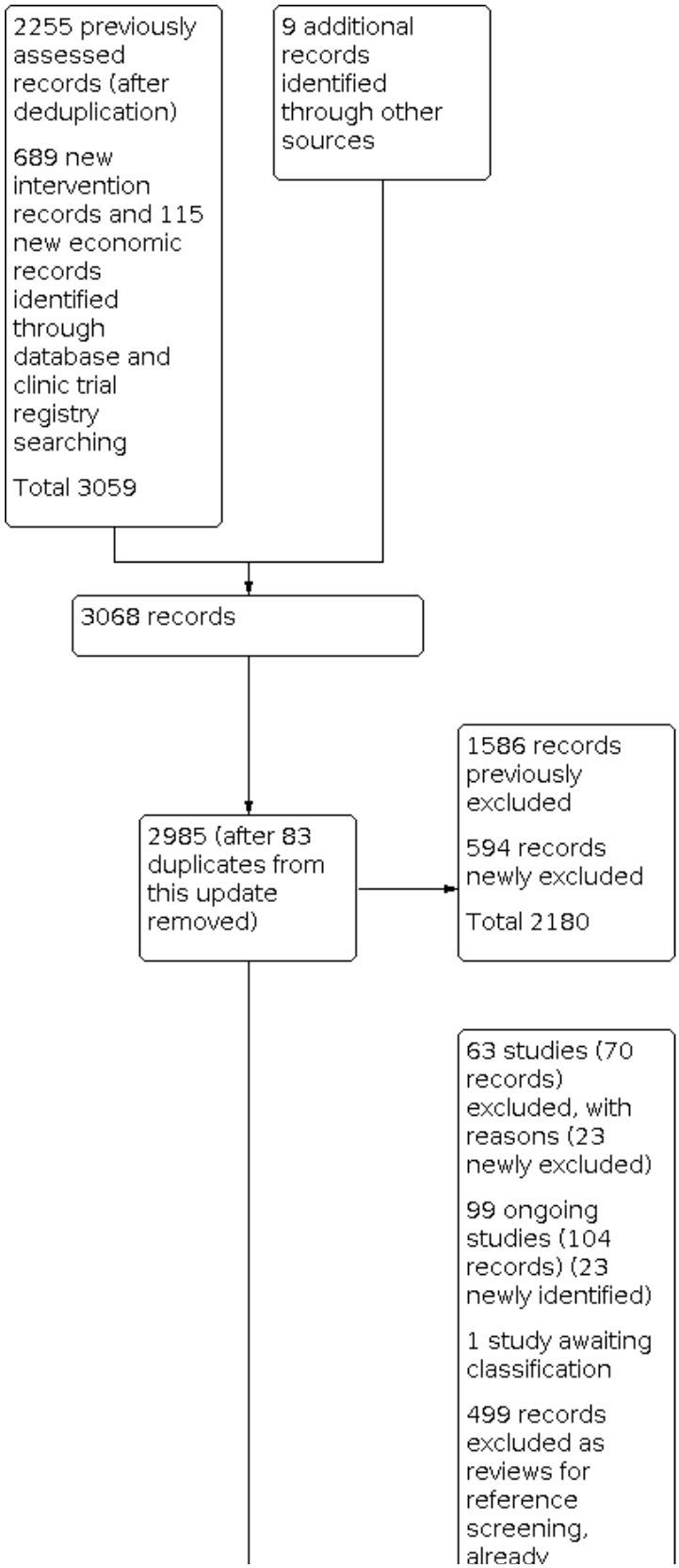


Figure 2. (Continued)

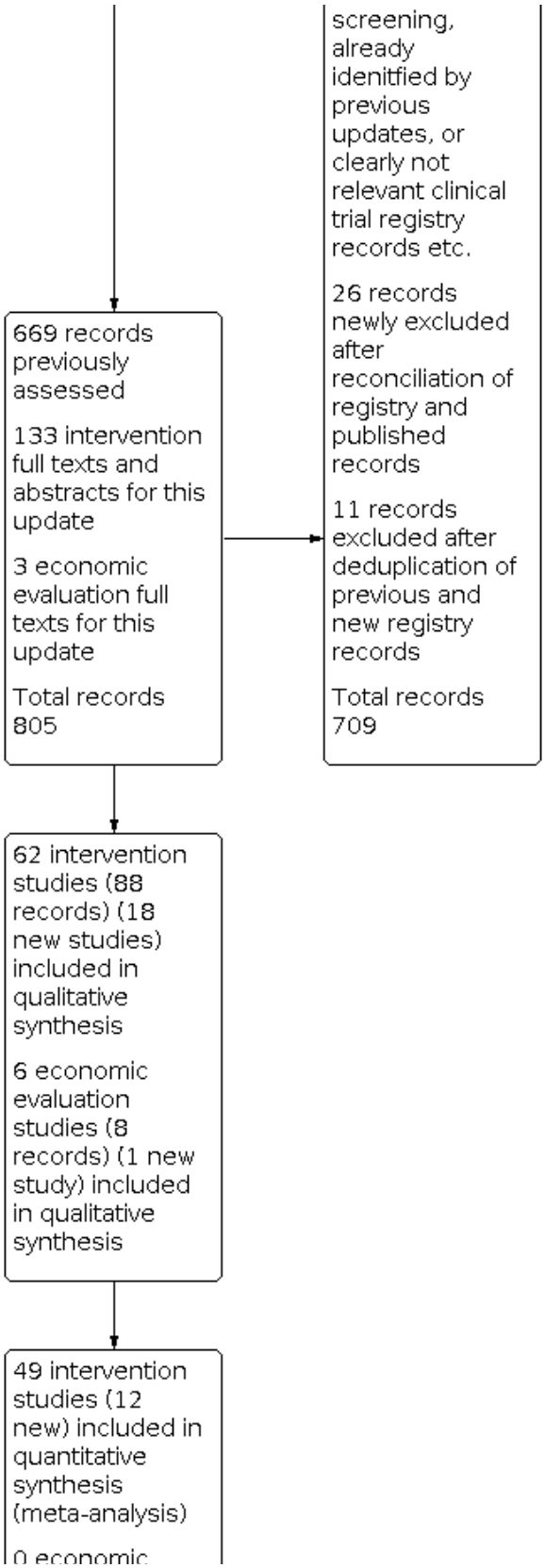
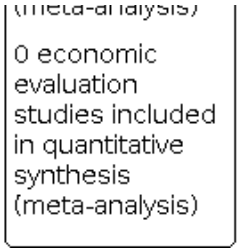


Figure 2. (Continued)



Interventions search

For this fourth update, we identified 689 unique new intervention records through our electronic search including the search of trial registry platforms. We retrieved 124 publications for inspection including full texts, abstracts, and trial registry records; and nine references identified from citation checking making a total of 133 full-text records. From these, 18 new intervention studies reported in 26 records were eligible for inclusion in the review update; six of the newly identified studies were reported in abstract form only or as trial registry data reports only. We also identified several additional records for previously identified trials including four previously only available as abstracts. The previous update included 44 intervention studies.

This update therefore includes 62 intervention studies reported in 88 records, of which 18 studies are newly identified (Andrianello 2020; Bertges 2021; Bueno-Lledo 2021; Darwisch 2020; Flynn 2020; Fogacci 2019; Gok 2019; Gillespie 2021; Hasselmann 2019a; Hasselmann 2019b; Leitao 2020; NCT00654641; NCT01759381NCT02309944; NCT02461433; Tuuli 2020; Uchino 2016; Wierdak 2021) and 44 were previously included (Bobkiewicz 2018; Chaboyer 2014; Crist 2014; Crist 2017; DiMuzio 2017; Engelhardt 2016; Galiano 2018; Giannini 2018; Gillespie 2015; Gombert 2018; Gunatilake 2017; Howell 2011; Hussamy 2017; Hyldig 2019a ; Javed 2018; Karlakki 2016; Keeney 2019; Kuncewitch 2017; Kwon 2018; Lee 2017a; Lee 2017b; Leon 2016; Lozano-Balderas 2017; Manoharan 2016; Martin 2019; Masden 2012; Murphy 2019; Newman 2019; Nordmeyer 2016; O'Leary 2017; Pauser 2016; Pachowsky 2012; Pleger 2018; Ruhstaller 2017; Sabat 2016; Schmid 2018; Shen 2017; Shim 2018; Stannard 2012; Tanaydin 2018; Tuuli 2017; WHIST 2019a; Wihbey 2018; Witt-Majchrzac 2015).

Economic analysis search

Electronic searches for previous versions of the review yielded 387 references and five included studies (Heard 2017; Hyldig 2019b; Nherera 2018Nherera 2017; WHIST 2019b). For this update, we identified a further 115 publications; three of which were retrieved for full-text examination; one of these was included (Svensson-Bjork 2020), bringing the number of economic evaluations to six studies reported in eight publications. We also identified an additional publication for WHIST 2019b. All of these studies were based on RCTs included in the intervention review (Chaboyer 2014; Hasselmann 2019a; Hyldig 2019a; Karlakki 2016; WHIST 2019a; Witt-Majchrzac 2015). We are aware that an economic evaluation based on Gillespie 2021 is ongoing (author communication).

Included studies

Types of participants

In this fourth update, we included 18 additional intervention studies enrolling 5887 extra participants (Andrianello 2020; Bertges 2021; Bueno-Lledo 2021; Darwisch 2020; Flynn 2020; Fogacci 2019; Gok 2019; Gillespie 2021; Hasselmann 2019a; Hasselmann 2019b; Leitao 2020; NCT00654641; NCT01759381NCT02309944; NCT02461433; Tuuli 2020; Uchino 2016; Wierdak 2021). We also identified additional publications for several previously included studies, including the full text for three studies previously only available as an abstract (Hussamy 2017; Martin 2019; Ruhstaller 2017).

The review now includes 13,340 participants. A number of the newly identified studies were large, including in particular Gillespie 2021 (2035 participants) and Tuuli 2020 (1608 participants), both in women having caesarean sections. Sample sizes now range from 2 to 2035 participants (this update also identified two trials which reported data after very early termination, with 2 and 11 participants, respectively).

Participants had a wide range of surgical procedures, including obstetric, orthopaedic, vascular and general surgeries:

- Eight studies enrolled people undergoing knee or hip arthroplasties (Giannini 2018; Gillespie 2015; Howell 2011; Karlakki 2016; Keeney 2019; Manoharan 2016; Newman 2019; Pachowsky 2012).
- Ten studies enrolled women undergoing caesarean section (Chaboyer 2014; Gillespie 2021; Gunatilake 2017; Hussamy 2017; Hyldig 2019b; NCT00654641; Ruhstaller 2017; Tuuli 2017; Tuuli 2020; Wihbey 2018).
- Ten studies enrolled people having peripheral vascular procedures (Bertges 2021; DiMuzio 2017; Engelhardt 2016; Gombert 2018; Hasselmann 2019a; Hasselmann 2019b; Kwon 2018; Lee 2017b; Pleger 2018; Sabat 2016).
- Fourteen studies enrolled people undergoing abdominal procedures (Bobkiewicz 2018; Bueno-Lledo 2021; Flynn 2020; Gok 2019; Kuncewitch 2017; Leitao 2020; Leon 2016; Lozano-Balderas 2017; Murphy 2019; NCT02309944; O'Leary 2017; Shen 2017; Uchino 2016; Wierdak 2021).
- Six studies enrolled people undergoing surgery for limb fracture (Crist 2014; Crist 2017; Nordmeyer 2016; Pauser 2016; Stannard 2012; WHIST 2019a).
- Three studies enrolled people undergoing cardiac surgery (Darwisch 2020; Lee 2017a; Witt-Majchrzac 2015).
- Three studies enrolled people undergoing hepatopancreatiobiliary procedures (Andrianello 2020; Javed 2018; Martin 2019).

- Three studies enrolled people undergoing breast surgery (Fogacci 2019; Galiano 2018; Tanaydin 2018).
- Two studies enrolled people with mixed wound types of surgical wounds (Masden 2012; NCT02461433).
- One study (Shim 2018) enrolled people requiring surgery for hand injuries.
- One study (Schmid 2018) enrolled people having inguinal lymph node dissection.
- One study (NCT01759381) enrolled people having spinal surgery.

Most studies were conducted in North America (28 studies), Europe (24 studies) or Australasia (five studies); Israel, Japan and South Korea were also represented and two studies did not report where they were conducted.

Types of interventions

Most studies used one of a small number of commercially available NPWT systems:

- Seven studies used the vacuum-assisted closure (VAC) negative pressure device (KCI, San Antonio, Texas), set to −125 mmHg (Crist 2014; Crist 2017; Howell 2011; Lozano-Balderas 2017; Masden 2012; Stannard 2012; Wihbey 2018).
- Twenty studies used the PICO system (Smith & Nephew, Hull, UK) (Andrianello 2020; Bueno-Lledo 2021; Chaboyer 2014; Darwisch 2020; Flynn 2020; Fogacci 2019; Galiano 2018; Giannini 2018; Gillespie 2015; Gillespie 2021; Hyldig 2019b; Keeney 2019; Karlakki 2016; Martin 2019; Nordmeyer 2016; O'Leary 2017; Tanaydin 2018; Tuuli 2017; Uchino 2016; Witt-Majchrzac 2015).
- Twenty-four studies used the PREVENA system (KCI, San Antonio, Texas) (Bertges 2021; DiMuzio 2017; Engelhardt 2016; Gombert 2018; Gok 2019; Gunatilake 2017; Hasselmann 2019a; Hasselmann 2019b; Javed 2018; Kwon 2018; Lee 2017a; Lee 2017b; Leitao 2020; Manoharan 2016; Murphy 2019; NCT02309944; NCT02461433; Newman 2019; Pachowsky 2012; Pauser 2016; Pleger 2018; Ruhstaller 2017; Sabat 2016; Tuuli 2020).
- A minority of studies did not specify the device but described it in varying degrees of detail (Bobkiewicz 2018; Hussamy 2017; Kuncewitch 2017; Leon 2016; Schmid 2018; Shen 2017; WHIST 2019a); two studies gave no details but just stated that they used negative pressure dressings (NCT00654641; NCT01759381).
- One study (Shim 2018) used CuraVac (CGBio, Seongnam-si, Gyeonggido, Korea) and one study (Wierdak 2021) used NANOVA.

Comparators were mostly described as standard care, standard dressings, usual care or conventional dressings, care or therapy. Where specified, dressings were most commonly described as gauze or nonadherent or containing these components. A small number of studies reported using dressings with specific properties such as silver or iodine-impregnated dressings and some reported the use of steri-strips in some or all wounds.

Types of economic assessments

All of the six included economic studies used clinical effectiveness data, in particular data on SSIs, from RCTs included in this review to assess measures of cost-effectiveness; several also derived resource use and cost data from the trial data but other sources were also used to inform estimates of cost-effectiveness.

Two obstetric surgery studies looked at use of NPWT in women undergoing caesarean section (Heard 2017; Hyldig 2019a); these were based on the RCTs of Chaboyer 2014 and Hyldig 2019b, respectively. Heard 2017 used the perspective of the Australian public healthcare provider with resources priced in AUD (Australian dollars) at 2014 values; while Hyldig 2019a used a Danish healthcare perspective; resource costs in Euro were reported after transformation from Danish Krona at 2015 values.

Two orthopaedic surgery studies were also identified. The WHIST 2019b study was undertaken alongside the WHIST 2019a RCT in people having surgery for lower limb fractures. Nherera 2017 looked at NPWT in people having knee and hip arthroplasties and was based on Karlakki 2016. Both studies were undertaken in a UK context with an NHS perspective and resources priced in pounds sterling (GBP) at 2017/18 and 2015/16 values, respectively. WHIST 2019b also used an NHS and personal social services (PSS) (including indirect costs) perspective.

An assessment in cardiac surgery, Nherera 2018, looked at people having coronary artery bypass graft (CABG) surgery and was based on Witt-Majchrzac 2015. A German Statutory Health Insurance payer perspective was employed and resource costs were priced in Euro.

An assessment in vascular surgery, Svensson-Bjork 2020, looked at people having vascular surgery with inguinal incisions and was based on Hasselmann 2019a. This adopted a societal perspective which was not defined; the trial on which the study was based was undertaken in Sweden and costs were calculated in SEK converted to EUR.

All studies, except Svensson-Bjork 2020, used clinical outcome data to assess the quality-adjusted life year gained (QALY). A QALY is a generic measure of disease burden including both the quality and the quantity of life lived (NICE 2013; NICE 2018), and can be used in combination with cost data to assess the value for money of medical interventions (NICE 2013). One QALY equates to one year in perfect health and a year of less than perfect health is worth less than one, while death is considered to be worth zero (Heard 2017). The estimated incremental cost-effectiveness ratio (ICER) considers the mean cost per QALY. Some studies used the ICER(s), together with their 95% credible intervals (CrI) to calculate the probability of NPWT being cost-effective at particular "willingness-to-pay" thresholds. Svensson-Bjork 2020 calculated an ICER based on differences in score of a disease-specific quality of life measure.

Excluded studies

The previous update of this review excluded a total of 40 studies (for reasons, see Characteristics of excluded studies). For this update, we excluded 23 new studies. These were excluded for the following reasons: ineligible population (Cocjin 2019; De Rooij 2020; Kim 2020; Monsen 2015Mujahid 2020; NCT00724750; Seidel 2020; Stannard 2009; Wang 2019; Yongchao 2017); ineligible intervention (Lychagin 2021; Xu 2019; Zhang 2020) ineligible study design (Abesamis 2019; Cantero 2016; Dragu 2011; Echeribi 2015; Fang 2020; Kim 2015; Licari 2020; Muoghalu 2019; Stapleton 2015; Zhuang 2020). We also identified additional references for a number of already excluded studies. The total number of excluded studies in this update is 63.

Ongoing studies

Screening by two review authors identified a total of 99 ongoing studies, primarily from the trial registry search; this number incorporates 20 newly identified studies and also several published protocols identified from the main database search. Some studies listed as ongoing in the previous version of the review have now been identified as published studies and moved to included or excluded studies, as appropriate. For this new update, we identified five published protocols (Brennfleck 2020; Donlon 2019; Kim 2020b; Rezk 2019; Sandy-Hodgetts 2020) in addition to the six we had previously included (Jorgensen 2018; Masters 2018; Mihaljevic 2015; Sandy-Hodgetts 2017; Nguyen 2017; SUNRRISE 2017). We also identified a number of trial registry records which we have judged to represent ongoing potentially relevant studies. We were able to link some previously listed trial records to included or excluded studies or to published protocols so the total number of ongoing studies is now 99 (the previous version of the review contained 89).

Studies awaiting classification

We did not identify any additional studies which are awaiting classification from this update. There is one study awaiting classification pending author contact (Nagata 2018).

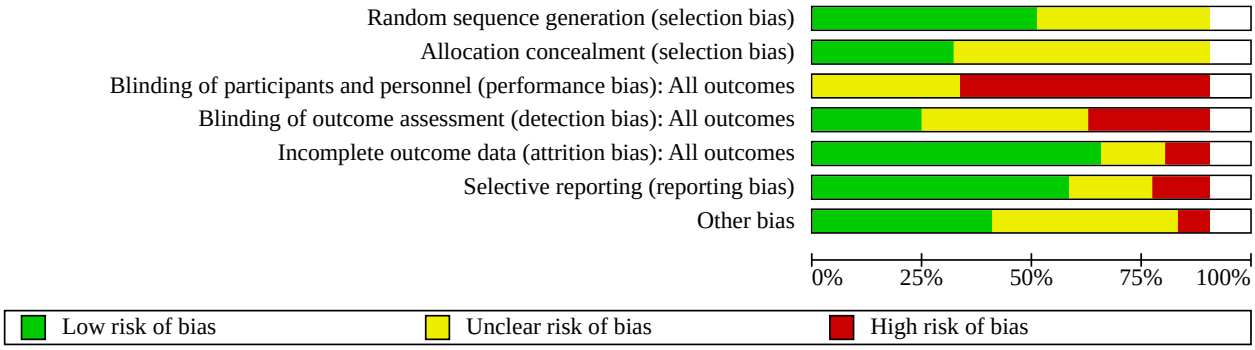
Risk of bias in included studies

Given that we anticipated unclear or high risks of performance bias in all studies due to the nature of the intervention (Appendix 4), we regarded the domains of sequence generation, allocation concealment and blinding of outcome assessment (detection bias) as having key importance: nine studies (Chaboyer 2014; Giannini 2018; Gillespie 2015; Gombert 2018; Masden 2012; Murphy 2019; Tanaydin 2018; Tuuli 2020; WHIST 2019a) were at low risk of bias for all three of these domains. Conversely, nineteen studies were at high risk for one or more of these (Andrianello 2020; Bueno-Lledo 2021; Flynn 2020; Galiano 2018; Gunatilake 2017; Hussamy 2017; Karlakki 2016; Kwon 2018; Lozano-Balderas 2017; Manoharan 2016; NCT01759381; NCT02309944; NCT02461433; O'Leary 2017; Schmid 2018; Shen 2017; Shim 2018; Wihbey 2018; Witt-Majchrzac 2015). The remaining 34 studies were at unclear risk of bias for one or more of these domains.

We included a number of studies reported only in abstract form or as trial registry records only; these had multiple domains at unclear risk of bias because of the constraints of the form in which they were published. One study was a planned interim analysis (Sabat 2016). A number of studies used designs which either mixed paired and unpaired data (for example, by recruiting participants with a mixture of unilateral and bilateral wounds and randomising them differently) or simply used different units of randomisation and analysis (Howell 2011; Kwon 2018; Pleger 2018; Sabat 2016; Stannard 2012). Four studies employed split-person designs and it was not clear whether the paired data had been taken into account in the analysis (Galiano 2018; Manoharan 2016; Schmid 2018; Tanaydin 2018; in one other study, the analysis clearly used paired data (Hasselmann 2019b). These studies were all considered to have a high or unclear risk of bias for the domain of other sources of bias, depending on the reporting of the study and whether other considerations were present.

See Figure 3 and Figure 1 for the Risk of bias summary; details of the risk of bias judgements for each domain and their rationales for each study are given in Characteristics of included studies. Risk of bias, or more specifically study quality, for the economic studies is shown in Table 4.

Figure 3. Risk of bias graph: review authors' judgements about each risk of bias item presented as percentages across all included studies



Risk of bias in economic studies

We used the Consolidated Health Economic Evaluation Reporting Standards (CHEERS) checklist (Husereau 2013) to assess the quality of the reports of the six included economic studies (Heard 2017; Hyldig 2019a; Nherera 2017; Nherera 2018; Svensson-Bjork 2020; WHIST 2019b). All studies scored > 80% on the checklist, indicating very good reporting quality. Additionally, data for the Nherera 2017 and the Nherera 2018 studies were drawn from the Karlakki 2016 and Witt-Majchrzac 2015 trials, which were at high risk for detection bias, while data for the Svensson-Bjork 2020 study was drawn from Hasselmann 2019a which was at high risk for attrition bias. The two items that were least well addressed were 'Measurement and valuation of preference based outcomes' and 'Choice of model'. The full assessments for each study are shown in Table 4.

The lead author in the Nherera 2017 and Nherera 2018 studies was an employee of Smith & Nephew, which manufactures the intervention product used in the studies.

Effects of interventions

See: **Summary of findings 1** Negative pressure wound therapy compared with standard dressing for surgical wounds healing by primary closure

See Summary of findings 1 for the main comparison: NPWT compared with standard dressing for surgical wounds healing by primary closure. Studies which reported a relevant outcome but which could not be included in the pooled analysis because of methodological or reporting issues are noted and reported fully in Appendix 5. As random-effects analyses were used throughout, each pooled result presented is an average effect, rather than a common effect and should be interpreted as such.

Comparison 1: NPWT compared with standard dressing (62 trials, 13340 participants)

All of the studies for this comparison compared a negative pressure device with a standard dressing. The included surgery types were diverse: study devices varied by manufacturer, and standard dressings differed based on individual hospital preference.

Primary outcomes

Primary outcome data are summarised in Table 1.

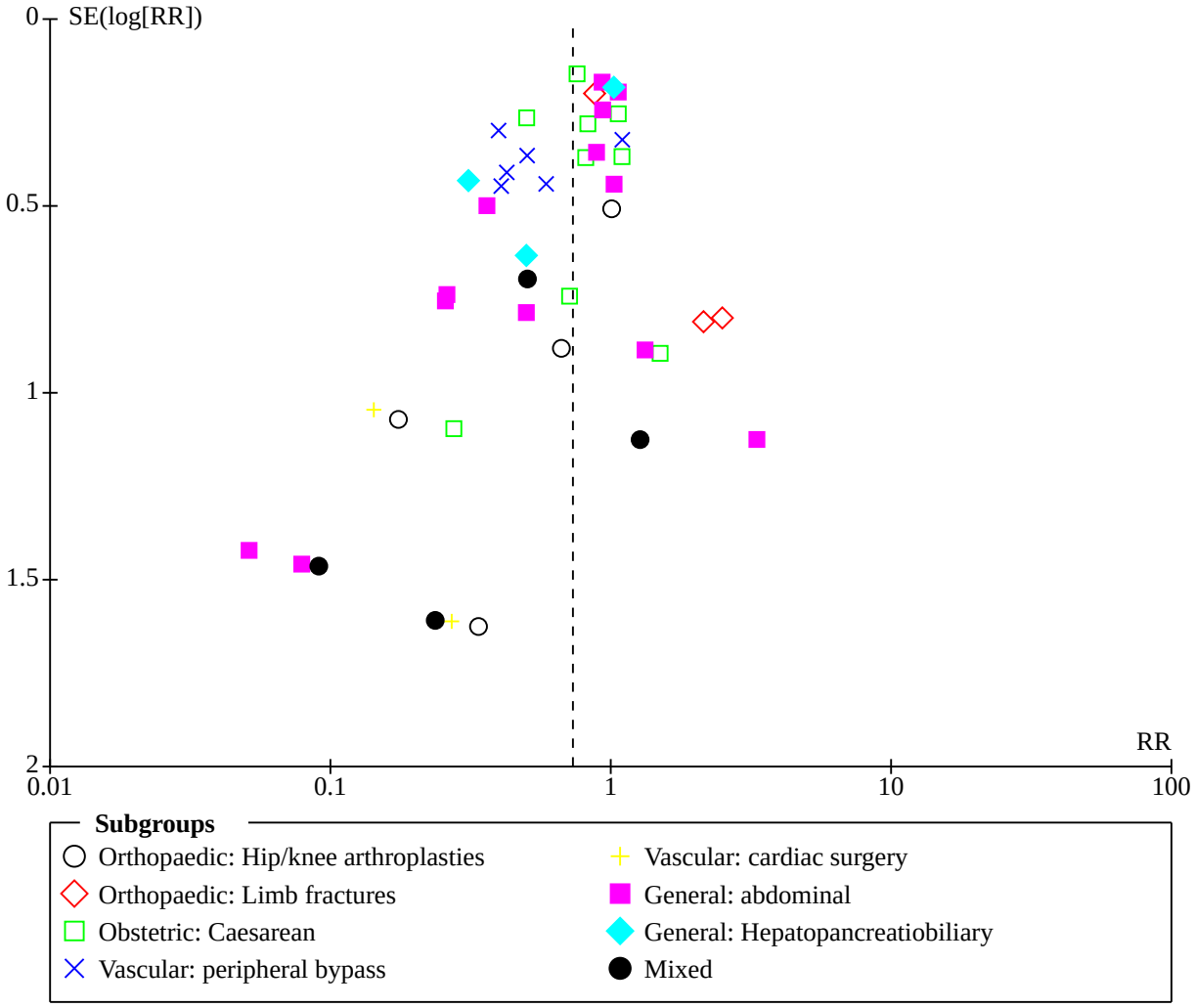
Mortality (follow-up period 30 days to 90 days or unspecified)

Thirteen studies reported mortality and we pooled data from 11 studies (6384 participants). There may be a reduced risk of mortality for people treated with NPWT (27/3213 (0.84%)) compared with those treated with standard dressings (37/3171 (1.17%)). The RR was 0.78 (95% CI 0.47 to 1.30; I^2 = 0%) (Analysis 1.1). This is low-certainty evidence downgraded twice for very serious imprecision due to small numbers of events which produced wide confidence intervals which include the possibility of both harm and benefit as well as no effect. Using mortality data recorded at three months instead of six months in the largest trial (WHIST 2019a, with data for 1456 participants) made little difference to the pooled effect estimate (RR 0.69, 95% CI 0.40 to 1.21; I^2 = 0%).

Surgical site infection (follow-up period 30 days to 12 months or unspecified)

Fifty-four studies reported this outcome. We pooled incident SSI data from 44 studies (11,403 participants). The evidence showed that NPWT probably reduces the incidence of SSI in participants treated with NPWT (496/5716 (8.68%)) compared with standard dressing (668/5687 (11.75%)); RR 0.73 (95% CI 0.63 to 0.85; I^2 = 29%) (Analysis 1.2). This is moderate-certainty evidence downgraded once for high risk of bias in domains other than performance bias. We assessed this analysis for evidence of publication bias but there was no clear evidence of this despite some asymmetry in the funnel plot (Figure 4); we judged that the effect estimate was unlikely to have been substantively influenced by this.

Figure 4. Funnel plot of comparison: 1 Negative pressure wound therapy versus standard dressing, outcome: 1.2 Surgical site infection



Sensitivity analyses

We applied a prespecified sensitivity analysis which included only the eight studies (5809 participants) which reported SSI and were judged to be at low risk of bias in the key domains of randomisation, allocation concealment and blinding of outcome assessment. This did not materially change the estimate of the effect of NPWT (RR 0.81, 95% CI 0.67 to 0.97; I^2 = 14%) based on 224/2925 (7.66%) SSI in NPWT groups compared with 272/2884 (9.43%) in standard dressing groups.

A post hoc analysis which included only the 19 studies (7151 participants) with no domain judged to be at high risk of bias (except performance bias) also found a similar result (RR 0.78, 95% CI 0.63 to 0.96; I^2 = 27%) based on 272/3596 (7.56%) SSI in NPWT groups compared with 337/3555 (9.48%) in standard dressing groups. We ran this analysis to explore the impact of removing all studies with any domain at high risk of bias but retaining those where risk of bias in key domains was unclear; this is a common approach to sensitivity analysis in Cochrane reviews. A formal GRADE assessment for a post hoc analysis is not appropriate but this result, together with the prespecified analysis, suggests that the result of the main analysis is likely to be robust to known high risk of bias in the studies contributing data.

The results of the primary analysis and the two sensitivity analyses suggest that the lower bound of the 95% CI is unaltered by reductions in both numbers of participants and events and risks of bias. The estimate of effect and the upper bound of the 95% CI show more sensitivity to reduced numbers of participants and uncertainties around key risks of bias. This suggests that the widening of the confidence intervals is not simply a consequence of increasing imprecision but reflects a tendency for studies which are not known to be free from key biases to produce larger estimates of effect. It may also reflect the greater influence in the analysis of the low risk of bias WHIST trial which only assessed deep SSI.

Subgroup analyses

Of the prespecified subgroup analyses, we were only able to conduct the comparison based on different types of surgery: conducted in two different ways: type of surgery (e.g. treatment of

limb fractures; caesarean sections etc.) and surgery contamination class (e.g. clean, clean-contaminated etc.). The results of these analyses are shown in Analysis 1.2 and Analysis 1.3. There was no clear evidence of a difference between the subgroups based on type of surgery (I^2 for subgroup differences = 2.4% and P associated with X^2 for subgroup differences = 0.23)) or between subgroups based on contamination classes (I^2 for subgroup differences = 329% and P associated with X^2 for subgroup differences = 0.12). The type of SSI assessed is not independent of the surgical indication (e.g. some fracture surgery studies focus on deep SSI) and we consider this below.

Types of SSI

In this update, we also looked at studies which reported separate data for superficial SSIs and for deeper infections (classed as deep or deep and organ space SSIs), or which only reported either superficial or deep infections. This was an exploratory analysis as we did not pre specify that we would assess the classes of infection identified separately. This analysis included studies which reported more detailed information about the outcome of SSI or which specified that they would only include SSIs which were superficial or deep. For these analyses to be considered reliable, we would need to obtain this level of detail from all the included studies: this is very low-certainty evidence but these results suggest that we might usefully explore uncertainty as to whether NPWT acts equally for all types of SSI.

Superficial SSI: Twenty-six studies reported SSIs which were identified as being superficial. Where studies reported the Szilagyi classification (Szilagyi 1972), we considered Szilagyi class I or II SSIs to be superficial. Twenty-two studies (5539 participants) contributed data to a pooled estimate of effect. The RR was 0.70 (95% CI 0.53 to 0.92; I^2 = 70%) (Analysis 1.4).

Deep SSI: Twenty-four studies reported SSIs which were identified as being deep. Where studies reported deep and organ/space SSIs separately, we combined these for this analysis. Where studies reported the Szilagyi classification (Szilagyi 1972), we considered Szilagyi class III SSIs to be deep. Twenty-two studies (8521 participants) contributed data to a pooled estimate of effect. The RR was 0.95 (95% CI 0.76 to 1.18; I^2 = 0%) (Analysis 1.5).

Summary of findings for SSI

There is moderate-certainty evidence from a large number of participants across a range of surgical indications that NPWT following surgery probably results in a lower risk of SSI compared with standard dressings. This evidence was downgraded once due to risks of bias in various domains.

A sensitivity analysis which only included the eight trials with low risk of bias in key domains (approximately half of the total participants), also showed a lower proportion of participants with SSI in the NPWT groups compared to the standard dressing groups.

Dehiscence (follow-up period 30 days to an average of 113 days or unspecified)

Thirty studies reported dehiscence. We combined results from 23 studies (8724 participants). There is moderate-certainty evidence that there is probably little or no difference in dehiscence between people treated with NPWT (290/4378 (6.62%)) and those treated with standard dressing (303/4346 (6.97%)); RR 0.97 (95% CI 0.82 to 1.16; I^2 = 4%). The evidence was downgraded once for a combination of risk of bias affecting a substantial minority of participants and imprecision as the 95% CI included both benefit and harm as well as no effect. A funnel plot showed no evidence of substantial publication bias.

Sensitivity and subgroup analyses

We applied a prespecified sensitivity analysis which included only the six studies (5395 participants) which reported dehiscence and were judged to be at low risk of bias in the key domains of randomisation, allocation concealment and blinding of outcome assessment. This did not substantially change the estimate of the effect of NPWT (RR 1.01, 95% CI 0.71 to 1.42; I^2 = 17%) based on 138/2666 (5.18%) dehiscences in NPWT groups compared with 136/2629 (5.17%) in standard dressing groups. The evidence remains moderate certainty as it was downgraded once for imprecision.

We have presented the analysis with studies arranged according to the type of surgery undertaken for information only; the number of studies in the analysis meant that some subgroups are represented by a single study and we have not undertaken any analysis of the effect of subgroups.

Summary of findings for dehiscence

Moderate-certainty evidence suggests there is probably little or no difference in dehiscence between participants treated with NPWT and those treated with standard dressings following surgery.

Secondary outcomes

Secondary outcome data are summarised in Table 2.

Reoperation (follow-up period 30 days to an average of 113 days or unspecified)

Twenty-two trials assessed reoperations. We were able to combine data from 18 of these (6272 analysed participants). The pooled RR was 1.13 (95% CI 0.91 to 1.41; I^2 = 2%). This is low-certainty evidence which suggests that, while there may be an increase in the incidence of reoperation for people treated NPWT compared with standard dressings, this is uncertain because the confidence intervals included both benefit and harm. Evidence was downgraded once for high risk of bias (various domains) and once for imprecision due to low numbers of events (330 reoperations in total) producing wide confidence intervals which included the possibility of both benefit and harm as well as no effect of the intervention (Analysis 1.7). The WHIST 2019a study also reported much smaller numbers of subsequent surgeries as being due to wound complications; these data are shown in Table 2.

Wound-related readmission to hospital within 30 days (follow-up period 10 days to 90 days)

Nineteen trials assessed wound-related readmissions. We were able to combine data from 15 of these (5853 participants). The pooled RR was 0.98 (95% CI 0.70 to 1.38; I^2 = 14%). This is low-certainty evidence of no clear difference, downgraded twice for imprecision; low numbers of events resulted in wide confidence intervals which included the possibility of both benefit and harm as well as no difference between the groups (Analysis 1.8).

Seroma (follow-up period 10 days to 6 weeks)

Nineteen trials assessed seroma. We were able to combine data from 15 of these (5436 participants). There is low-certainty evidence that, while there may be a reduced incidence of seroma for people treated NPWT compared with standard dressings, this is uncertain because the confidence intervals included both benefit and harm. The pooled RR was 0.82 (95% CI 0.65 to 1.05; I^2 = 0%). The evidence was downgraded once for risk of bias and once for imprecision (Analysis 1.9).

Haematoma (follow-up period 30 days to 6 weeks)

Twenty-three trials assessed haematoma. We were able to combine data from 17 of these (5909 participants). The effect of NPWT on haematoma is uncertain.The pooled RR was 0.79 (95 % CI 0.48 to 1.30; I^2 = 0%). This evidence is very low-certainty, downgraded once for risk of bias and twice for very serious imprecision; the number of events was very low (71) and this resulted in wide, fragile confidence intervals which included both the possibility of benefit and harm as well as no effect (Analysis 1.10).

Skin blisters (follow-up period 6 weeks to 12 months)

Twelve trials reported on skin blistering. We were able to combine data from 11 of these (5015 participants). Participants treated with NPWT may be more likely to develop skin blisters compared to those treated with standard dressing. The pooled RR was 3.55 (95% CI 1.43 to 8.77; I^2 =74%). An additional study (Howell 2011) had unit of analysis issues and is reported in Appendix 5; this study was stopped early due to the high rate of blistering in the NPWT group; blistering also contributed to the early stopping decision in Tuuli 2020 (included in analysis). This is low-certainty evidence downgraded once for risk of bias and once for inconsistency. We did not further downgrade for imprecision because we considered that this was a consequence of the inconsistency (Analysis 1.11).

Pain

Fourteen studies assessed pain, but reported it in different ways. Data from only two studies with a total of 632 participants (Flynn 2020; Leitao 2020) could be pooled; other studies are summarised here and reported fully in Appendix 5. The pooled RR for the proportion of participants treated with NPWT compared with those treated with standard dressings was 1.52 (95% CI 0.20, 11.31; I^2 = 34%) (Analysis 1.12). Four trials in women undergoing caesarean section, including the very large trial by Gillespie 2021, reported different aspects and measures of pain. The large WHIST 2019a trial in lower limb fractures also reported measures of pain. The overall certainty of the evidence, including the pooled estimate from two trials and the twelve trials which could not be, is low. This was due to downgrading once for inconsistency and once for a combination of risk of bias across multiple domains in several trials and some imprecision.

Quality of life

Quality of life was measured using a recognised scale by seven studies (Bertges 2021; Chaboyer 2014; Hasselmann 2019a; Hyldig 2019b; Karlakki 2016; Lee 2017a; WHIST 2019a). In four cases, these estimates were then used to inform calculations of QALY in subsequent or integrated cost-effectiveness analyses. The data from Chaboyer 2014 and Karlakki 2016 were not reported although they were then used in the cost-effectiveness analyses; data from Hasselmann 2019a were reported in Svensson-Bjork 2020. Another study (Manoharan 2016), reported some data but did not use a validated scale; we have not analysed this further. We are aware that Gillespie 2021 recorded quality of life information but this is not yet available. One study assessed quality of life but was terminated before meaningful data were collected (NCT02461433).

Hasselmann 2019a (reported in Svensson-Bjork 2020) assessed quality of life using the Vascuqol-6 before surgery and at 30 days postoperatively. Data were available at both time points for 39/59 of participants in the NPWT group and 42/60 in the standard dressing group. Means and statistical significance but not variance were reported. The paper reported a statistically significant difference between NPWT and standard dressing groups in preoperative scores but not 30-day scores.

Lee 2017a reported EuroQol-5D (EQ-5D) scores for the NPWT group of 78 (26 participants) and 63 for the standard dressing group (17 participants). No measures of variance were reported and we could not analyse the data further.

Bertges 2021 reported EQ-5D scores for each group as mean (SD) at baseline and at 30 days. In the NPWT group (115 participants) the baseline score was 11.7 (1) compared to 11.8 (1) in the standard dressing group. At 30 days, the mean scores were 12.1 (1) and 12.2 (1) respectively.

Hyldig 2019b used the EQ-5D-5L and reported the EQ-Index and EQ-VAS at 30 days together with 95% CI for each group of obese women having caesarean sections. The scoring algorithm was not reported but the Danish-specific context was considered. The mean difference in the EQ-Index was 0.00 (95% CI -0.01 to 0.01); on the EQ-VAS the mean difference was 1.00 (95% CI -1.23 to 3.23).

WHIST 2019a reported EQ-5D-3L; EQ-VAS and Disability Rating Index (DRI), each at both three and six months scored using the UK algorithm. We report the three-month data here (this is based on more participants); six-month data is detailed in Table 3. The mean (SD) EQ-5D for the NPWT group was 0.5 (0.29) compared with 0.6 (0.30) in the standard dressing group giving a mean difference of -0.10 (95% CI -0.14 to -0.06). For the EQ-VAS, the results were 64.1 (22.24) compared with 64.7 (21.15) giving a mean difference of -0.60 (95% CI -3.28 to 2.08) but this difference was not sustained at six months. The results of the DRI were 51.6 (23.46) in the NPWT group compared with 51.1 (23.92) in the standard dressing group giving a mean difference of 0.50 (95% CI -2.50 to 3.50). Approximately 60% of the 1548 participants in the trial contributed to each estimate.

We have chosen not to pool the data from Hyldig 2019b and WHIST 2019a because of the very different surgical indications and time points of the assessments. This evidence is impacted on by the fact that it was not based on all the participants in WHIST but nevertheless there is moderate-certainty evidence that, at relevant time points for each surgical indication, there is probably little clinically important difference in the quality of life of participants assessed by aspects of the EQ-5D.

Economic outcomes

We focus here on the relative cost-effectiveness of NPWT and standard dressings; the costs and QALY estimates which contributed to these are detailed in Table 3 and Appendix 6.

Using the CHEERS checklist (for a summary of ratings, see Table 4), we rated the overall quality of all the reports as very good, but the

studies used different modelling assumptions. Results therefore depend on which resources were incorporated into the model, and on the cost-effectiveness threshold used. We note that large numbers of participants were included in the trials informing two of the analyses, providing evidence for key areas of obstetric and orthopaedic surgery. GRADE assessments were based on the RCTs which provided the clinical inputs to the assessments in all cases, and the utility data in all except one instance (costs were derived from a range of sources).

Incremental cost-effectiveness ratio (ICER)

All of the studies, except Svensson-Bjork 2020, used QALY along with costs data to inform an estimate of relative cost-effectiveness.

For caesarean sections in obese women, Hyldig 2019a concluded that NPWT was dominant to standard dressings but did not report the base case ICERs (ICERs were reported for subgroups). Heard 2017 concluded that NPWT was probably cost-effective relative to standard care, estimating an ICER value of GBP 20.65 per QALY gained. This is moderate-certainty evidence downgraded once for imprecision. An additional trial (Ruhstaller 2017) reported a cost of USD 15,000 per SSI prevented in this group based on a reported device cost and a number needed to treat to prevent one infection (Table 3). Limited reporting prevented us from evaluating this data further.

In orthopaedic surgery, the WHIST 2019b study reported a base case ICER of GBP 396,531 using an NHS/PSS perspective; other perspectives and sensitivity analyses produced higher estimates. Based on these estimated ICERs, NPWT was calculated to have a very low probability of cost-effectiveness at any willingness-to-pay threshold considered. This is high-certainty evidence assessed in terms of deep SSI; it is moderate-certainty evidence for SSI overall, downgraded once for indirectness.

Based on deterministic results, Nherera 2017 estimated that NPWT was dominant over standard dressings in hip or knee replacement surgery, as NPWT was cost-saving and improved QALYs. This was based on clinical data from the Karlakki 2016 trial from which utility estimates were also derived. This is low-certainty evidence downgraded once for imprecision and once for risk of bias.

In general surgery, in people undergoing CABG surgery, Nherera 2018 concluded that NPWT was dominant to standard dressings for both SSIs avoided and QALY gained but did not report the ICER. This was based on clinical data from the Witt-Majchrzac 2015 trial; but utility estimates were derived from the published literature. This is very low-certainty evidence downgraded twice for imprecision and once for risk of bias.

In vascular surgery, Svensson-Bjork 2020 concluded that NPWT was cost-effective over standard dressings in patients undergoing open inguinal vascular surgery, due to reduced SSI incidence at no higher costs. This study did not use QALYs but did calculate an ICER based on a value of EUR 719 per unit of Vascuqol-6 score increase. This is low-certainty evidence downgraded once for risk of bias and once for imprecision.

DISCUSSION

Summary of main results

Wound complications

This systematic review synthesises RCT evidence on the effects of NPWT on death, SSI and dehiscence following acute surgery in which wounds are primarily closed. We added 18 additional RCTs (5887 participants) to this fourth update, bringing the total number of RCTs to 62 (13,340 participants). This represents an increase of almost 80% in the number of participants from the previous version of the review. More than half of the additional participants (3659) were accounted for by two trials in women undergoing caesarean section. We have also added one new cost-effectiveness study, bringing the total to six, and the number of participants included in source trials to 2886.

Despite the addition of a substantial number of RCTs - and a very substantial number of participants - there remains moderate-certainty evidence that NPWT probably reduces the incidence of SSI in surgical wounds healing by primary closure. Evidence was downgraded once for high risks of bias across various domains in trials which contributed approximately half the participants in the analysis, but the result was supported by a prespecified sensitivity analysis including only trials with low risks of bias in key domains, although the upper bound of the confidence interval may be influenced by the effects of risk of bias in the included studies. Pre-planned subgroup analyses did not show clear evidence of differential effects across different types of surgery. Exploratory analysis of reported SSI data suggested that there is scope for investigating the types of SSI for which NPWT may be most effective; exploratory analysis of available data raises the possibility that superficial SSI is reduced with little difference in deep SSI. The results of the large high-quality publicly funded WHIST trial in fracture surgery, which only assessed deep SSI, would tend to support this.

The addition of more RCTs with many more participants means that there is now moderate-certainty evidence that there is probably little or no difference in the incidence of wound dehiscence in people treated with NPWT compared to standard dressings; this evidence was downgraded once for concerns about risk of bias and imprecision. The result was supported by a prespecified sensitivity analysis including only trials with low risks of bias in key domains. However, the evidence for mortality remains of low certainty; that there may be a difference between the groups but this is not certain; although we added seven studies and large numbers of participants to the analysis, event rates remained very low, leading to wide confidence which included the possibility of both benefit and harm as well as no effect.

For most of our secondary outcomes, we found no clear difference between the groups. There is low-certainty evidence that there may be little or no difference between NPWT and standard dressings for readmission to hospital. For reoperation, there may be a reduced incidence with standard dressings and, for seroma, there may be a reduced incidence with NPWT but both of these are affected by uncertainty as the confidence intervals included both benefit and harm. For haematoma, we are uncertain what the effect of NPWT is compared with standard dressings because the evidence is very low certainty. Evidence was downgraded because of imprecision due to small numbers of events and, in some cases, also because of risks

of bias across various domains. However, this update found low-certainty evidence that people treated with NPWT may experience a higher incidence of skin blistering compared to those treated with standard dressings (downgraded once for risk of bias and once for inconsistency).

For pain, the evidence was disparate, being reported for different time points and using different measures; in many cases, it was very poorly reported. Where data were available, most studies, including the large and well-conducted WHIST and DRESSING trials, found little difference between the groups. There is low-certainty evidence that there may not be a clear difference in pain, however assessed, between people treated with NPWT and those in standard treatment groups. For quality of life, there is moderate-certainty evidence that there is probably little difference in EQ-5D scores between participants treated with NPWT and standard dressings at time points relevant to the surgery involved.

We did not identify any trials which compared different types of NPWT with each other. There are, however, a small number of ongoing trials which are undertaking such comparisons.

Economic outcomes

Six economic studies, Heard 2017; Hyldig 2019a; Nherera 2017; Nherera 2018; Svensson-Bjork 2020; WHIST 2019b, based on results from six RCTs, Chaboyer 2014; Hasselmann 2019a; Hyldig 2019b; Karlakki 2016; WHIST 2019a; Witt-Majchrzac 2015, compared the cost-effectiveness of NPWT with standard dressings. The economic evaluations used different methods and different perspectives and relied on source data from very different trials. The economic studies were well reported but our further assessment of the certainty of the evidence rested on our assessments of the trials which contributed clinical data to the models. The trials on which the economic analyses were based varied considerably. While the sample sizes of four of the studies were relatively small (80 to 220 participants) (Chaboyer 2014; Hasselmann 2019a; Karlakki 2016; Witt-Majchrzac 2015), in two cases, the trials were large; Hyldig 2019a was based on a trial in 876 women whilst WHIST 2019b used data from a trial which enrolled 1548 participants with lower limb fractures. Two studies were at low risk of bias other than performance bias (Chaboyer 2014; WHIST 2019a). In Hyldig 2019b, one domain was at unclear risk of bias and one at high risk while Hasselmann 2019a; Karlakki 2016; and Witt-Majchrzac 2015 had multiple domains with high or unclear risks of bias. The type of SSI considered in the clinical and cost-effectiveness analyses also differed between the trials; the WHIST 2019a trial considered only deep SSI whilst all the other studies considered all types of SSI and superficial SSI predominated.

Results of the analyses based on these trials also differed. Three studies across three different surgical indications (caesarean section in obese women; joint arthroplasty and CABG) found that NPWT was a dominant strategy (Hyldig 2019a; Nherera 2017; Nherera 2018); Svensson-Bjork 2020 also concluded that NPWT was cost-effective over standard dressings in patients undergoing open inguinal vascular surgery, due to reduced SSI incidence. However, Heard 2017 reported that total costs for the episode of care in caesarean section were higher with NPWT than with standard dressings and found that value for money from NPWT was relatively low. In the WHIST 2019b study, NPWT was not cost-effective in fracture surgery at any threshold of willingness-to-pay.

The measurement of costs was reasonable in all studies although different healthcare system perspectives were employed. The measurement of health states, using the SF-12 version 2 in Heard 2017, the SF-36 in Nherera 2017, the Vascuquol-6 in Svensson-Bjork 2020 and versions of the EQ-5D in Hyldig 2019a and WHIST 2019b was also reasonable. However, the approach to scoring the SF-36 in Nherera 2017, which used a non-preferenced based algorithm developed in the 1990s, is questionable, especially since the SF-6D, a preference-based scoring algorithm for the SF-36 with country-specific weights for the UK (Kharroubi 2007), the USA (Craig 2013), and other countries, is available. Without using a preference-based scoring system, the gains in QALYs estimated by Nherera 2017 may have been over- or understated. In Nherera 2018, the valuations of health states were derived from published literature rather than from the trial participants. Svensson-Bjork 2020 did not use QALYs but derived an ICER from the measurement of health state and clinical and cost data.

All cost-effectiveness estimates should be interpreted in the context of the certainty of the clinical evidence base. In the case of NPWT in primary closure of surgical wounds, this was judged to be moderate or low for most outcomes with very low-certainty evidence for some outcomes which are likely to be important to patients, such as blistering of the skin and pain. The largest trial with a low overall risk of bias supported an analysis which did not find NPWT to be cost-effective while a small trial with low risks of bias supported an analysis which showed low value for NPWT. The less certain evidence from other trials supported analyses which found NPWT was cost-effective. Consequently, there is moderate-certainty evidence that NPWT is probably not cost-effective for fracture surgery, high-certainty evidence that it is not cost-effective if only deep SSI are considered, and moderate-certainty evidence that it probably is cost-effective for caesarean sections in obese women. Evidence for cost-effectiveness in arthroplasty or vascular surgery with inguinal incision is low certainty, while evidence for CABG surgery is very low certainty.

Overall completeness and applicability of evidence

Indications for the use of NPWT following surgery are broadening (Acosta 2017; DeCarbo 2010; Pellino 2015; Webb 2017), with a range of systems on the market, including those designed for use on closed, clean wounds (Allen 2011; Gabriel 2014; Gupta 2016).

Studies included in this review used NPWT across a wide range of surgical indications. However, the majority of the participants were undergoing a small number of procedures - obstetric surgery (caesarean section) or orthopaedic surgery for either limb fracture or knee/hip arthroplasty. Trials in women undergoing caesarean section accounted for almost 40% of the participants, while orthopaedic procedures accounted for almost 20%. Abdominal surgeries accounted for approximately 15% of participants and peripheral vascular procedures were also represented by substantial numbers of participants. Although other procedures were represented, there is proportionally much less evidence for these.

While many trials were small (half had 100 or fewer participants), more than a quarter (17 trials) had 200 or more participants and, of these, eight had more than 400 participants with three randomising over 1500 people. These three largest trials together accounted for almost 40% of the participants and were undertaken in the

two areas most represented in the review: caesarean section and fracture surgery.

Because of the number of trials and the number of participants in caesarean section surgery, there were several substantial trials enrolling only women in the review. This means that women accounted for considerably more than half of participants in the review. Most of the women in the studies of caesarean section were obese. Since obese patients have higher rates of SSI (Althumairi 2016), these studies represented a population of particular interest. There were no studies involving children.

The magnitude of the negative pressure applied varied between trials and it is unclear whether different pressures produced different outcomes. Animal studies indicate that performance is similar across the range of pressures used in the included trials (Morykwas 2001).

Another limitation in the studies was the variation in durations of follow-up, which ranged from the 7th postoperative day to 12 months after surgery. This is partly the result of the different level of follow-up appropriate to different surgical indications - for instance, the two largest trials were in lower limb fracture surgery and caesarean; longer follow-up is required for the former indication compared with the latter. However, in many cases, short duration of follow-up is likely to have missed instances of SSI and other events occurring after discharge from hospital and may contribute to an under-estimation of SSI incidence in both the NPWT and standard dressing groups. Description of the criteria used for SSI diagnosis and other events also varied and was sometimes absent, meaning that the true comparability of events between trials is uncertain.

In some cases, we know that trials only assessed deep SSI. In particular, one of the largest studies, the WHIST trial, only assessed deep SSI. Evidence from our exploratory analysis of trials reporting events which we know to be superficial or deep from the trial reports suggests that there may be a differential effect, with NPWT having a greater impact on superficial than deep infections. This would be important to explore given the proportionally greater clinical impact of deep infections.

Cost-effectiveness evidence was limited to trial-based evaluations using evidence from RCTs included in the effectiveness review. Inclusion of other relevant, high-quality studies using model-based evaluations (drawing on different types of evidence) might change the cost-effectiveness evidence base.

Finally, the included studies were limited as, although there was a wide geographical spread, almost all the studies were from higher-income countries.

Quality of the evidence

The certainty of the evidence is moderate for the primary outcomes of SSI and dehiscence but low for the primary outcome of mortality. Evidence for most secondary outcomes is low or very low, due to risks of bias, small sample sizes, and wide confidence intervals that included both an effect and no effect or even a harm of the intervention. There is moderate-certainty evidence for quality of life in two indications and for pain in one indication. The evidence for cost-effectiveness is moderate certainty that NPWT is probably not cost-effective in fracture surgery and low or very low-certainty evidence that it may be cost-effective in other indications.

Limitations in study design, implementation and reporting

We assessed risk of bias according to six domains: sequence generation, allocation concealment, blinding, selective outcome reporting, incomplete follow-up, and other potential biases. Our assessments of the risk of bias for a number of these domains found that all but four of the included studies, Chaboyer 2014; Gillespie 2015; Gillespie 2021; WHIST 2019a, showed limitations in study design and implementation or reporting of these, which have been reported elsewhere in the review (Figure 1). We had particular concern, where blinding of the intervention was difficult or impossible, that there was subsequent uncertainty about allocation concealment and blinding of outcome assessment. We assumed the risk of performance bias to be unclear unless there was information to the contrary and we did not downgrade for high risk of performance bias alone. We did downgrade for high risk of bias in all other domains including blinding of outcome assessment (detection bias), where a substantial number of studies had a high risk. A number of studies used non-standard designs and it was not clear that these were adequately accounted for in the authors' analyses. Where this was the case, we did not include the studies in the meta-analyses we conducted but reported them separately; this included several studies which adopted an intra-individual (split-body) approach analogous to the 'split-mouth' design (Lesaffre 2009).

Another consideration was the involvement of industry in at least 28 (where reported) of the 62 included trials. However, the largest trials in our review were all funded from non-industry sources meaning that, although almost half of trials had industry funding, fewer than half of participants were in industry funded studies. Authors from the Karlakki 2013 trial disclosed conflicts of interest, with all benefiting from funding from the manufacturer of the NPWT device. There continues to be a concern with the issue of manufacturer sponsorship in studies of healthcare products. For example, a review of the effect of manufacturer involvement on studies of NPWT examined 24 studies where 19 had manufacturer involvement. Importantly, 18 of the 19 manufacturer-funded studies showed a positive effect for the manufacturer's product, while one was "impartial" (Kairinos 2014).

Indirectness of evidence

There was no indirectness, as the participants, interventions, and outcomes in the included studies were within the scope of the published review protocol. However, the evidence may not be directly relevant to children undergoing surgery. The high proportion of the participants in particular surgical indications may also be considered in assessing the relevance of the review to a particular population, although we did not find evidence of statistical differences in the effect estimates between different types of surgery.

Unexplained heterogeneity or inconsistency of results

Statistical heterogeneity was low for almost all of the outcomes we assessed and, although there was substantial clinical heterogeneity, subgroup analysis for the primary outcome suggests that this did not substantially impact on our results. There was also variation in aspects of clinical methods, with negative pressure devices, control dressings, length of follow-up and definition of SSI varying between studies but the low levels of statistical heterogeneity in our analyses - and visual inspection of forest plots - suggests that, with the exception of the outcome of skin

blistering, these factors did not substantially impact on effect estimates. We consider that differences in study characteristics may be responsible for some of the variability which was observed, as larger trials with less risk of bias were not evenly distributed across surgical indications. We also consider that the type (severity) of SSI considered may be a potential source of heterogeneity, based on exploratory analyses, and that further research is required in this area. The type of SSI assessed and reported was not independent of the surgical indication evaluated and this needs to be taken into account when considering these results. Standardised methods for assessing and reporting pain in studies of NPWT are needed to improve the evidence base for this important outcome.

Imprecision of results

This update of our review included a large number of participants from newly identified trials. The confidence intervals for the primary outcome of SSI were not large but they were relatively wide in view of the number of participants now included in our analysis. Confidence intervals were wide in all of the other pooled outcomes, with most crossing 1, indicating uncertainty about whether NPWT was associated with an increase or reduction in outcomes. For dehiscence, it is probably the case that NPWT does have little or no effect on some of the outcomes assessed and that this is accurately reflected in confidence intervals which cross the line of no effect. The imprecision for other outcomes was due to studies being underpowered to assess what, in many cases, were uncommon events. The low certainty of the evidence for most outcomes stemmed wholly or partly from this imprecision. However, it may be the case that NPWT had little or no effect on some of the outcomes assessed.

Publication bias

We feel confident that our comprehensive electronic searches, coupled with reference checking and cross-checking of trial registry searches, identified all existing, published RCTs addressing the review question, helping to limit bias in the review process.The funnel plot (Figure 4) includes all published studies that reported on SSI, but a failure to include results from any unpublished studies may have affected the plot's relative symmetry. However, there were a large number of studies (99 ongoing trials) identified primarily through a search of the clinical trial registries. Whilst many of these are ongoing, or were scheduled to conclude only recently, there are a number which have concluded some time previously but have not yet been published or had results uploaded to the registry.

Potential biases in the review process

Clearly described procedures were followed to prevent potential bias in the review process. We conducted a careful literature search, and the methods we used were transparent and reproducible. It is possible that studies published in journals that were outside our search strategy may have been missed. We attempted to contact ten authors, but only two responded. Consequently, we may have underestimated the quality of some studies, simply because their publications did not include the information we required to assess study quality. We have already mentioned our concern about commercial funding, which may have influenced the results of our review. Three of the authors of previous versions of this review (Webster, Chaboyer, and Scuffham) were also investigators of studies included in the review (Chaboyer 2014; Gillespie 2015; Heard 2017). We were careful to ensure that the trials in which they were involved were critically appraised and that the data were extracted by others. None of the authors of this review has any conflicts of interest or associations with manufacturers of products included in the review. Differences between the published protocol (Webster 2011), previous versions of this review (Webster 2014; Webster 2019), and the methods used for the last update Norman 2020 have been described, and a rationale provided in the Differences between protocol and review section. This update follows the methods used in Norman 2020.

Agreements and disagreements with other studies or reviews

This update identified a substantial number of recently published systematic reviews and meta-analyses of the use of NPWT, both generally and in specific surgical indications. These publications are listed in Appendix 1. This is reflective of the fact that research in this area is very active as evidenced by the large number of ongoing studies identified in this review. However, it may also indicate duplication of research efforts and a need for co-ordination of evidence synthesis work in this field. Most but not all of the almost 30 reviews identified by this update were focused on specific surgical indications. These included breast surgery, orthopaedic surgery including those focused on one or both of hip and knee arthroplasty, vascular surgery, abdominal surgery including specifically laparotomy, obstetric surgery (caesarean sections) and perineal surgery.

Of the five recent reviews which were general in scope, three included non-randomised studies as well as RCTs. The two reviews which included only RCTs included fewer trials than this update (44 and 45 RCTs) (Li 2019; Shiroky 2020). Three of the reviews undertook GRADE assessment and their assessment of the evidence for the outcome of SSI ranged from low to high certainty. All five of the reviews found a benefit of NPWT compared with standard dressings for the outcome of SSI. The results of our review are broadly consistent with those of these previous reviews, which included similar numbers of trials to the previous version of this review. Reviews identified by previous versions of our review included many fewer trials (e.g. Hyldig 2016); however the finding of a potential benefit to NPWT for SSI prevention has remained constant. The principal change is that the certainty of the evidence for the effect of treatment has increased as the number of available trials and participants has increased in more recent reviews.

A 2019 MedTech briefing from the UK National Instituate for Health and Care Excellence (NICE) summarised evidence for only one type of NPWT (Prevena) and found that it was effective in reducing complications compared with standard care; this included only seven studies (NICE 2019). The latest World Health Organization (WHO) guideline for the prevention of surgical site infection (WHO 2016) states: "The panel suggests the use of prophylactic negative pressure wound therapy (pNPWT) in adult patients on primarily closed surgical incisions in high-risk wounds". However, the recommendation was labelled "conditional" based on a number of issues, including low-quality evidence and the inclusion of non-RCT evidence. Finally, Willy 2017 published international multidisciplinary consensus recommendations suggesting the use of NPWT for a number of patient categories, including those at high risk of SSI. The review contained 100 studies (including RCTs, case series, editorials, cohort studies, technical reports, systematic reviews, and expert opinion), so the conclusions are highly uncertain. In addition, two employees of Acelity, NPWT

device manufacturers, were involved in preparing the manuscript, and all of the authors of the review are consultants to an Acelity company (Willy 2017). As with other reviews, the differences between the findings of our review and the guidelines may be attributable to the more recent search and hence greater volume of available evidence, including evidence from large well-conducted RCTs which we were able to include.

AUTHORS' CONCLUSIONS

Implications for practice

NPWT for surgical wounds healing by primary closure probably reduces the rate of SSI compared with standard wound dressings but probably does not change the incidence of wound dehiscence. This conclusion is based on moderate-certainty evidence which was affected by high risk of bias in approximately half the included trials. NPWT may increase the proportion of people who experience skin blistering after surgery. This is based on low-certainty evidence which was affected by risk of bias and inconsistency. Although there were some large, generally well-conducted studies included in the review, these were concentrated in a few surgical indications (caesarean section, fracture surgery, hip and knee arthroplasty and abdominal surgery). A concomitantly high proportion of the participants were undergoing these procedures. Although we did not find evidence for substantial differences between the different types of surgery, this weighting should be borne in mind. There may be no or little difference in the occurrence of many important complications associated with surgical incisions, including mortality, reoperation, readmission to hospital and seroma (low-certainty evidence of no clear effect). The effects of NPWT on the incidence of haematoma and pain are uncertain. NPWT probably does not substantively alter quality of life scores following fracture surgery or caesarean section. Estimates of cost-effectiveness should be interpreted in the context of the healthcare system, the surgical indication and the uncertainty underlying the studies on which the modelling was based.

Implications for research

Use of NPWT for closed surgical incisions remains a topic of interest, with a large number of other systematic reviews being published recently. A very large number of records of ongoing studies were identified in our review of clinical trials registries and we are aware of one ongoing economic evaluation based on data from the largest trial in the review. Review updates may be required to include the data from trials as they become available. A living systematic review or family of such reviews may be an appropriate undertaking, given the rapidly increasing volume of literature and the number of currently ongoing studies.

Sharing of individual participant data from studies would contribute to understanding of circumstances in which NPWT may be beneficial. If further new trials are undertaken - perhaps in surgical indications with relatively sparse data and a high incidence of SSI - the type (severity) of SSI should be recorded using recognised classifications. There is scope for research to use the data from the extant and ongoing studies to identify the types of SSI which may be most likely to be avoided if NPWT is used. Such research may also support the investigation of mechanisms which may underlie the potentially differential effects of NPWT on different types of SSI. The risk of SSI occurring varies across surgical indications and the impact of superficial and deep SSI differ both clinically and from a cost-effectiveness perspective; these factors should be considerations in further exploration of existing data and in any new primary research. Ongoing studies are comparing the use of different types of NPWT, the results of these may indicate future approaches for research and would inform further updates of this review and potentially a network meta-analysis.

The outcomes of pain and health-related quality of life were not reported by most studies. Pain in particular was reported using a range of different criteria and approaches. Future studies should use recognised methods to evaluate health-related quality of life, which is important to patients and also supports cost-effectiveness analysis. Consideration should be given to reporting the proportion of participants with postoperative pain at common time points, although other measures of pain may also be appropriate.

ACKNOWLEDGEMENTS

The authors would like to thank Ljubiša Paden who provided peer referee feedback on this update, and also Dirk Ubbink, Gill Worthy, Fausto Biancari, Susanne Cunliffe, Patricia Davies, Ian Schemilt, Liz McInnes, Nuala Livingstone, Ian Chetter and another referee who wished to remain anonymous, who provided feedback on previous versions of this review.

They would also like to thank copy editors Jenny Bellorini, Elizabeth Royle, Lisa Winer and Anne Lethaby for their contribution to previous versions of this review, and Anne Lethaby for copy editing this version of the review. We continue to be grateful to Zhenmi Liu, Joan Webster, Wendy Chaboyer and Karen Sherriff who were authors on previous versions of this review. We are grateful to Deborah Ganderton for her assistance with data extraction and quality appraisal in this update. We would also like to thank those study authors who responded to our queries in this and previous versions of the review.

We are also grateful to the following people for their assistance with previous updates: Paul Scuffham who was also an author on previous versions of this review and has assisted with the interpretation of the economic evidence and provided comments on the review draft in a subsequent version; Louise Hussey for assistance with screening and classification of ongoing studies; Jennifer Brown for assistance in screening of German language studies; Emma Connaughton for assistance with the Plain Language Summary.

Gill Norman, Chunhu Shi, Jo Dumville and Liz Murphy are partially funded by the National Institute for Health Research Applied Research Collaboration Greater Manchester. The views expressed in this publication are those of the authors and not necessarily those of the National Institute for Health Research or the Department of Health and Social Care.

The National Health and Medical Research Council (NHMRC) provided funding for previous versions of this review from its Centre of Research Excellence scheme, which funded one or more of the authors.

To retain the independence of the editorial process, Nuala Livingstone, Network Associate Editor, signed off this review for publication.

REFERENCES

References to studies included in this review

Andrianello 2020 *{published data only}*

Andrianello S, Landoni L, Bortolato C, Iudici L, Tuveri M, Pea A, et al.Negative pressure wound therapy for prevention of surgical site infection in patients at high risk after clean-contaminated major pancreatic resections: a single-center, phase 3, randomized clinical trial. *Surgery* 2020;**27**:27.

Bertges 2021 *{published data only}*

* Bertges DJ, Smith L, Scully RE, Wyers M, Eldrup-Jorgensen J, Suckow B, et al, PREVENA Trial Investigators.A multicenter, prospective randomized trial of negative pressure wound therapy for infrainguinal revascularization with a groin incision. *Journal of Vascular Surgery* 2021;**74**(1):257-67.

Bertges D, Smith L, Scully R, Wyers M, Eldrup-Jorgenson J, Suckow B, et al.Multicenter, prospective randomized trial of negative pressure wound therapy for infrainguinal revascularization groin incisions. *Journal of Vascular Surgery* 2020;**72**(3):e286.

Bobkiewicz 2018 *{published data only}*

Bobkiewicz A, Francuzik W, Krokowicz L, Borejsza-Wysocki M, Walczak D, Szmeja J, et al.Effect of closed incision negative pressure wound therapy on incidence rate of surgical site infection after stoma reversal: a preliminary report. *Colorectal Disease* 2018;**20**(Suppl 4):56.

Bueno-Lledo 2021 *{published data only}*

Bueno-Lledo J, Franco-Bernal A, Garcia-Voz-Mediano MT, Torregrosa-Gallud A, Bonafe S.Prophylactic single-use negative pressure dressing in closed surgical wounds after incisional hernia repair: a randomized, controlled trial. *Annals of Surgery* 2021;**273**(6):1081-6.

Chaboyer 2014 *{published data only}*

Chaboyer W, Anderson V, Webster J, Sneddon A, Thalib L, Gillespie BM.Negative pressure wound therapy on surgical site infections in women undergoing elective caesarean sections: a pilot RCT. *Healthcare* 2014;**30**(2):417-28.

Crist 2014 *{published and unpublished data}*

Crist BD, Khazzam M, Della Rocca GJ, Murtha Y, Stannard JP.Role of acute negative pressure wound therapy over primarily closed surgical incisions in hip, pelvis, and acetabular fracture surgery - a prospective randomized trial. In: Pelvis & Acetabulum (Orthopaedic Trauma Association Annual Meeting); 2014. 2014:Paper 65; p 270.

Crist 2017 *{published data only}*

Crist BD, Oladeji LO, Khazzam M, Della Rocca GJ, Murtha YM, Stannard JP.Role of acute negative pressure wound therapy over primarily closed surgical incisions in acetabular fracture ORIF: a prospective randomized trial. *Injury* 2017;**48**(7):1518-21.

Darwisch 2020 *{published data only}*

* Darwisch A, Fajfrova Z.Negative pressure therapy after median sternotomy on closed incision: a randomized controlled study. *Thoracic and Cardiovascular Surgeon* 2020;**68**:S 01. [DOI: 10.1055/s-0040-1705502]

Darwisch A.Negative pressure therapy after median sternotomy on closed incision: a randomized controlled study . *Clinical and Experimental Cardiology (2nd Middle East Heart Congress)* 2020;**109**:no pagination.

DiMuzio 2017 *{published data only}*

DiMuzio P, Staley C, Reiter D, McCullough M, Goss S, Arosemena M, et al.A randomized study evaluating negative-pressure therapy to decrease vascular groin wound complications. *Journal of Vascular Surgery* 2017;**65**(6S):133S.

Engelhardt 2016 *{published data only}*

* Engelhardt M, Rashad NA, Willy C, Müller C, Bauer C, Debus S, et al.Closed-incision negative pressure therapy to reduce groin wound infections in vascular surgery: a randomised controlled trial. *International Wound Journal* 2018;**15**(3):327-32. [DOI: 10.1111/iwj.12848]

Engelhardt M, Willy C, Beck T.Negative pressure wound dressing for reduction of surgical site infections in the groin in vascular surgery. In: European Society of Vascular Medicine Conference; 2016 May 8-10; Rome (Italy). 2016:10.

Flynn 2020 *{published data only}*

Flynn J, Choy A, Leavy K, Connolly L, Alards K, Ranasinha S, et al.Negative pressure dressings (PICOTM) on laparotomy wounds do not reduce risk of surgical site infection. *Surgical Infections* 2020;**21**(3):231-8.

Fogacci 2019 *{published data only}*

Fogacci T, Cattin F, Samorani D.The negative pressure therapy with PICO as a prevention of surgical site infection in high risk patients undergoing breast surgery. *Annals of Oncology* 2019;**30 (supp 3)**:iii39-iii44.

* Fogacci T, Cattin F, Semprini G, Frisoni G, Fabiocchi L, Samorani D.The negative pressure therapy with PICO as a prevention of surgical site infection in high risk patients undergoing breast surgery. *Breast Journal* 2020;**26**:1071-3.

Galiano 2018 *{published data only}*

Galiano RD, Hudson D, Shin J, Van der Hulst R, Tanaydin V, Djohan R, et al.Incisional negative pressure wound therapy for prevention of wound healing complications following reduction mammaplasty: erratum. *Plastic & Reconstructive Surgery Global Open* 2018;**23**(6 (2)):e1720.

* Galiano RD, Hudson D, Shin J, Van der Hulst R, Tanaydin V, Djohan R, et al.Incisional negative pressure wound therapy for prevention of wound healing complications following reduction mammaplasty. *Plastic and Reconstructive Surgery Global Open* 2018;**6**(1):e1560.

Giannini 2018 *{published data only}*

Giannini S, Mazzotti A, Luciani D, Lullini G, Tedesco G, Andreoli I, et al.Postoperative wound management with negative pressure

wound therapy in knee and hip surgery: a randomised control trial. *Journal of Wound Care* 2018;**27**(8):520-5.

Gillespie 2015 *{published data only}*

Gillespie BM, Rickard CM, Thalib L, Kang E, Finigan T, Homer A, et al.Use of negative-pressure wound dressings to prevent surgical site complications after primary hip arthroplasty: a pilot RCT. *Surgical Innovation* 2015;**22**(5):488-95.

Gillespie 2021 *{published and unpublished data}*

ACTRN12615000286549.Negative pressure wound therapy versus standard care dressing to prevent surgical site infections in obese women undergoing caesarean section. www.anzctr.org.au/Trial/Registration/TrialReview.aspx?id=368069 (first received 25 February 2015).

Gillespie BM, Webster J, Ellwood D, Stapleton H, Whitty JA, Thalib L, et al.ADding negative pRESSure to improve healING (the DRESSING trial): a RCT protocol. *BMJ Open* 2016;**6**:e010287.

* Gillespie BM, Webster J, Ellwood D, Thalib L, Whitty JA, Mahomed K, et al.Closed incision negative pressure wound therapy versus standard dressings in obese women undergoing caesarean section: multicentre parallel group randomised controlled trial. *BMJ* 2021;**373**:n893.

Gok 2019 *{published data only}*

Gok MA, Kafadar MT, Yegen SF.Comparison of negative-pressure incision management system in wound dehiscence: a prospective, randomized, observational study. *Journal of Medicine & Life* 2019;**12**(3):276-83.

Gombert 2018 *{published data only}*

* Gombert A, Babilon M, Barbati ME, Keszei A, Von Trotha KT, Jalaie H, et al.Closed incision negative pressure therapy reduces surgical site infections in vascular surgery: a prospective randomised trial (AIMS trial). *European Journal of Vascular and Endovascular Surgery* 2018;**56**(3):442-8.

Gombert A, Babilon M, Langer S, Greiner A, Kalder J, Jalaie H, et al.Incision management systems for reduction of inguinal wound complications in vascular surgery [Inzisions-management-systeme zur reduktion von inguinalen wundheilungsstörungen in der gefäßchirurgie]. *Gefasschirurgie* 2017;**22**(8):542-7.

Gunatilake 2017 *{published data only}*

Gunatilake RP, Swamy GK, Brancazio LR, Smrtka MP, Thompson JL, Gilner JB, et al.Closed-incision negative-pressure therapy in obese patients undergoing cesarean delivery: a randomized controlled trial. *American Journal of Perinatology Reports* 2017;**7**(3):e151-7.

Hasselmann 2019a *{published data only}*

Hasselmann J, Björk J, Svensson-Björk R, Butt T, Acosta S.Proposed classification of incision complications: analysis of a prospective study on elective open lower-limb revascularization. *Surgical Infections* 2020;**21**(4):384-90.

Hasselmann J, Bjork J, Svensson-Bjork R, Acosta S.Inguinal vascular surgical wound protection by incisional negative pressure wound therapy: "a randomized controlled trial" INVIPS Trial. *European Journal of Vascular and Endovascular Surgery* 2019;**58**(6):e726-7.

* Hasselmann J, Bjork J, Svensson-Bjork R, Acosta S.Inguinal vascular surgical wound protection by incisional negative pressure wound therapy: a randomized controlled trial - INVIPS Trial. *Annals of Surgery* 2020;**271**(1):48-53.

Hasselmann J, Kühme T, Björk J, Acosta S.Incisional negative pressure wound therapy in the prevention of surgical site infection after vascular surgery with inguinal incisions: rationale and design of a randomized controlled trial (INVIPS-Trial). *Surgical Science* 2015;**6**(12):562.

Hasselmann 2019b *{published data only}*

* Hasselmann J, Björk J, Svensson-Björk R, Acosta S.Inguinal vascular surgical wound protection by incisional negative pressure wound therapy: a randomized controlled trial - INVIPS Trial. *Annals of Surgery* 2020;**271**(1):48-53.

Hasselmann J, Björk J, Svensson-Björk R, Acosta S.Inguinal vascular surgical wound protection by incisional negative pressure wound therapy “a randomized controlled trial” INVIPS Trial. *European Journal of Vascular and Endovascular Surgery* 2019;**58**(6):e726-7.

Hasselmann J, Björk J, Svensson-Björk R, Butt T, Acosta S.Proposed classification of incision complications: analysis of a prospective study on elective open lower-limb revascularization. *Surgical Infections* 2020;**21**(4):384-90.

Hasselmann J, Kühme T, Björk J, Acosta S.Incisional negative pressure wound therapy in the prevention of surgical site infection after vascular surgery with inguinal incisions: rationale and design of a randomized controlled trial (INVIPS-Trial). *Surgical Science* 2015;**6**(12):562.

Heard 2017 *{published data only}*

* Heard C, Chaboyer W, Anderson V, Gillespie BM, Whitty JA.Cost-effectiveness analysis alongside a pilot study of prophylactic negative pressure wound therapy. *Journal of Tissue Viability* 2017;**26**(4):79-84.

Tuffaha HW, Gillespie BM, Chaboyer W, Gordon LG, Scuffham PA.Cost-utility analysis of negative pressure wound therapy in high-risk cesarean section wounds. *Journal of Surgical Research* 2015;**195**(2):612-22.

Howell 2011 *{published and unpublished data}*

Howell RD, Hadley S, Strauss E, Pelham FR.Blister formation with negative pressure dressings after total knee arthroplasty. *Current Orthopaedic Practice* 2011;**22**(2):176-9.

Hussamy 2017 *{published data only}*

Hussamy DJ, Wortman AC, McIntire DD, Leveno KJ, Casey BM, Roberts SW.A randomized trial of closed incision negative pressure therapy in morbidly obese women undergoing cesarean delivery. *American Journal of Obstetrics and Gynecology* 2018;**218**(1):S35.

* Hussamy DJ, Wortman AC, McIntire DD, Leveno KJ, Casey BM, Roberts SW.Closed incision negative pressure therapy in morbidly obese women undergoing cesarean delivery: a

randomized controlled trial. *Obstetrics and Gynecology* 2019;**134**(4):781-9.

NCT02289157.Negative Pressure Wound Therapy in Cesarean Section (NPWTCS). clinicaltrials.gov/ct2/show/NCT02289157 (first received 13 November 2014).

Hyldig 2019a *{published data only}*

Hyldig N, Moller S, Joergensen JS, Bille C.Clinical evaluation of scar quality following the use of prophylactic negative pressure wound therapy in obese women undergoing cesarean delivery: a trial-based scar evaluation. *Annals of Plastic Surgery* 2020;**85**(6):e59-65.

* Hyldig N, Vinter CA, Kruse M, Mogensen O, Bille C, Sorensen JA, et al.Prophylactic incisional negative pressure wound therapy reduces the risk of surgical site infection after caesarean section in obese women: a pragmatic randomised clinical trial. *BJOG* 2019;**126**(5):628-35.

Hyldig 2019b *{published data only}*

* Hyldig N, Joergensen JS, Wu C, Bille C, Vinter CA, Sorensen JA, et al.Cost-effectiveness of incisional negative pressure wound therapy compared with standard care after caesarean section in obese women: a trial-based economic evaluation. *BJOG* 2019;**126**(5):619-27.

Hyldig N, Vinter CA, Kruse M, Lamont RF, Sørensen JA, Mogensen O.Prevention of surgical wound infection in obese women undergoing cesarean section: a randomised controlled trial. portal.findresearcher.sdu.dk/en/publications/prevention-of-surgical-wound-infection-in-obese-women-undergoing- (accessed prior to 4 March 2022).

Hyldig N.Incisional Negative Pressure Wound Therapy: the Clinical Effect on Post-Caesarean Wound Complications in Obese Women [PhD Thesis]. 1 edition. Odense (Denmark): University Press of Southern Denmark: University of Southern Denmark, 2016.

Jørgensen JS, Hyldig N.The happy belly study. Prevention of postoperative surgical site infection following caesarean section in women with BMI ≥ 30. glademaver.dk/uploads/HappyBellyStudy_protocol.pdf (accessed prior to 1 April 2020).

Javed 2018 *{published data only}*

Javed AA, Teinor J, Wright M, Ding D, Burkhart RA, Hundt J, et al.Negative pressure wound therapy for surgical-site infections: a randomized trial. *Annals of Surgery* 2018;**10**:10.

Karlakki 2016 *{published data only}*

Karlakki SL, Hamad AK, Whittall C, Graham NM, Banerjee RD, Kuiper JH.Incisional negative pressure wound therapy dressings (iNPWTd) in routine primary hip and knee arthroplasties: a randomised controlled trial. *Bone & Joint Research* 2016;**5**(8):328-37.

Keeney 2019 *{published data only}*

Keeney JA, Cook JL, Clawson SW, Aggarwal A, Stannard JP.Incisional negative pressure wound therapy devices improve short-term wound complications, but not long-term infection rate following hip and knee arthroplasty. *Journal of Arthroplasty* 2019;**34**:723-8.

Kuncewitch 2017 *{published data only}*

* Kuncewitch M, Blackham A, Clark CJ, Dodson RM, Russel G, Levine E, et al.Effect of negative pressure wound therapy on wound complications following pancreatectomy. *Gastroenterology* 2017;**152**(5 Suppl 1):S1273.

Kuncewitch MP, Blackham AU, Clark CJ, Dodson RM, Russell GB, Levine EA, et al.Effect of negative pressure wound therapy on wound complications post-pancreatectomy. *American Surgeon* 2019;**85**(1):1-7.

Kwon 2018 *{published data only}*

Kwon J, Staley C, McCullough M, Goss S, Arosemena M, Abai B, et al.A randomized clinical trial evaluating negative pressure therapy to decrease vascular groin incision complications. *Journal of Vascular Surgery* 2018;**68**(6):1744-52.

Lee 2017a *{published data only}*

Lee AJ, Sheppard CE, Kent WD, Mewhort H, Sikdar KC, Fedak PW.Safety and efficacy of prophylactic negative pressure wound therapy following open saphenous vein harvest in cardiac surgery: a feasibility study. *Interactive Cardiovascular and Thoracic Surgery* 2017;**24**(3):324-8.

Lee 2017b *{published data only}*

* Lee K, Murphy PB, Ingves MV, Duncan A, DeRose G, Dubois L, et al.Randomized clinical trial of negative pressure wound therapy for high-risk groin wounds in lower extremity revascularization. *Journal of Vascular Surgery* 2017;**66**(6):1814-9.

Murphy P, Lee K, Dubois L, DeRose G, Forbes T, Power A.Negative pressure wound therapy for high-risk wounds in lower extremity revascularization: study protocol for a randomized controlled trial. *Trials* 2015;**6**(1):504.

Leitao 2020 *{published and unpublished data}*

Leitao MM, Zhou Q, Schiavone MB, Cowan RA, Smith E, Iasonos A, et al.A phase 3 randomized controlled trial of preventive negative pressure wound therapy in postoperative incision management. *Gynecologic Oncology* 2020;**159**:53.

Leon 2016 *{published data only}*

Leon M, Barragan C, Garcia Perez JC, Guedea M, Sanz G, Gonzalez C.Negative pressure therapy to reduce SSI in open colorectal surgery: prospective, randomised and multicenter study. *Colorectal Disease* 2016;**18**(Suppl 1):7.

Lozano-Balderas 2017 *{published data only}*

Lozano-Balderas G, Ruiz-Velasco-Santacruz A, Díaz-Elizondo JA, Gómez-Navarro JA, Flores-Villalba E.Surgical site infection rate drops to 0% using a vacuum-assisted closure in contaminated/dirty infected laparotomy wounds. *American Surgeon* 2017;**83**(5):512-4.

Manoharan 2016 *{published data only}*

Manoharan V, Grant AL, Harris AC, Hazratwala K, Wilkinson MP, McEwen PJ.Closed incision negative pressure wound therapy vs conventional dry dressings after primary knee arthroplasty:

a randomized controlled study. *Journal of Arthroplasty* 2016;**31**(11):2487-94.

Martin 2019 *{published data only}*

Martin RC, O'Neill CH.Negative-pressure therapy for hepatectomy and pancreatectomy: a randomized trial for surgical site infection prevention. *Hepato Pancreato Biliary Journal* 2019;**21**(Suppl 1):S26-7.

* O'Neill CH, Martin RC.Negative-pressure wound therapy does not reduce superficial SSI in pancreatectomy and hepatectomy procedures. *Journal of Surgical Oncology* 2020;**122**(3):480-6.

Masden 2012 *{published data only (unpublished sought but not used)}*

Masden D, Goldstein J, Endara M, Xu K, Steinberg J, Attinger C.Negative pressure wound therapy for at-risk surgical closures in patients with multiple comorbidities: a prospective randomized controlled study. *Annals of Surgery* 2012;**255**(6):1043-7.

Murphy 2019 *{published data only}*

Chadi SA, Vogt K, Knowles S, Murphy PB, Van Koughnett JA, Brackstone M.Negative pressure wound therapy use to decrease surgical nosocomial events in colorectal resections (NEPTUNE): study protocol for a randomized controlled trial. *Trials* 2015;**16**(1):322.

* Murphy PB, Knowles S, Chadi SA, Vogt K, Brackstone M, Koughnett JA, et al.Negative pressure wound therapy use to decrease surgical nosocomial events in colorectal resections (NEPTUNE): a randomized controlled trial. *Annals of Surgery* 2019;**270**(1):38-42.

Murphy PB, Knowles SA, Chadi SA, Vogt KN, Brackstone M, Van Koughnett JA, et al.Negative pressure wound therapy use to decrease surgical nosocomial events in colorectal resections (NEPTUNE): a randomized controlled trial. *Journal of the American College of Surgeons* 2018;**227**:S70.

NCT00654641 *{unpublished data only}*

NCT00654641.Prevention of wound complications after cesarean delivery in obese women utilizing negative pressure wound therapy. clinicaltrials.gov/show/NCT00654641 (first received 8 April 2008).

NCT01759381 *{unpublished data only}*

NCT01759381.Incisional negative pressure wound therapy. clinicaltrials.gov/ct2/show/results/NCT01759381 (first received 3 January 2013).

NCT02309944 *{unpublished data only}*

NCT02309944.Negative pressure wound therapy in obese gynecologic oncology patients. clinicaltrials.gov/ct2/show/NCT02309944 (first received 5 December 2014).

NCT02461433 *{unpublished data only}*

NCT02461433.Surgical application of VAC dressings In obese patients to reduce wound complications (SAVIOR). clinicaltrials.gov/ct2/show/NCT02461433 (first received 3 June 2015).

Newman 2019 *{published data only}*

Newman JM, Siqueira MB, Klika AK, Molloy RM, Barsoum WK, Higuera CA.Use of closed incisional negative pressure wound therapy after revision total hip and knee arthroplasty in patients at high risk for infection: a prospective, randomized clinical trial. *Journal of Arthroplasty* 2019;**34**(3):554-9.

Nherera 2017 *{published data only}*

Nherera LM, Trueman P, Karlakki SL.Cost-effectiveness analysis of single-use negative pressure wound therapy dressings (sNPWT) to reduce surgical site complications (SSC) in routine primary hip and knee replacements. *Wound Repair and Regeneration* 2017;**25**(3):474-82.

Nherera 2018 *{published data only}*

Nherera LM, Trueman P, Schmoeckel M, Fatoye FA.Cost-effectiveness analysis of single use negative pressure wound therapy dressings (sNPWT) compared to standard of care in reducing surgical site complications (SSC) in patients undergoing coronary artery bypass grafting surgery. *Journal of Cardiothoracic Surgery* 2018;**13**(1):103.

Nordmeyer 2016 *{published data only}*

Nordmeyer M, Pauser J, Biber R, Jantsch J, Lehrl S, Kopschina C, et al.Negative pressure wound therapy for seroma prevention and surgical incision treatment in spinal fracture care. *International Wound Journal* 2016;**13**(6):1176-9.

O'Leary 2017 *{published data only}*

Carter MR, Burton M, Anglim B, Concannon E, Pierce C, Coffee SN, et al.A randomised controlled trial of negative pressure wound therapy at primary closure of midline laparotomy wounds. *Irish Journal of Medical Science* 2016;**185**:S111.

* O'Leary DP, Peirce C, Anglim B, Carter M, Hickey K, Coffey JC.Prophylactic negative pressure dressing use in closed laparotomy wounds following abdominal operations: a randomized, controlled, open-label trial: the P.I.C.O. trial. *Annals of Surgery* 2017;**265**(6):1082-6.

Pachowsky 2012 *{published data only}*

Pachowsky M, Gusinde J, Klein A, Lehrl S, Schulz-Drost S, Schlechtweg P, et al.Negative pressure wound therapy to prevent seromas and treat surgical incisions after total hip arthroplasty. *International Orthopaedics* 2012;**36**(4):719-22.

Pauser 2016 *{published data only}*

Pauser J, Nordmeyer M, Biber R, Jantsch J, Kopschina C, Bail HJ.Incisional negative pressure wound therapy after hemiarthroplasty for femoral neck fractures - reduction of wound complications. *International Wound Journal* 2016;**13**(5):663-7.

Pleger 2018 *{published data only}*

Pleger SP, Nink N, Elzien M, Kunold A, Koshty A, Böning A.Reduction of groin wound complications in vascular surgery patients using closed incision negative pressure therapy (ciNPT): a prospective, randomised, single-institution study. *International Wound Journal* 2018;**15**(1):75-83.

Ruhstaller 2017 *{published data only}*

Ruhstaller K, Downes K, Chandrasekaren S, Elovitz MA, Srinivas S, Durnwald C.PROphylactic wound VACuum therapy after cesarean section to prevent wound complications in the obese population: a randomised controlled trial (the PROVAC study). *American Journal of Obstetrics and Gynecology* 2017;**216**(1 Suppl 1):S34.

* Ruhstaller K, Downes KL, Chandrasekaran S, Srinivas S, Durnwald C.Prophylactic wound vacuum therapy after cesarean section to prevent wound complications in the obese population: a randomized controlled trial (the ProVac study). *American Journal of Perinatology* 2017;**34**(11):1125.

Sabat 2016 *{published data only}*

Sabat J, Tyagi S, Srouji A, Pechman D, Gupta AM, Lucido D, et al.Prophylactic negative pressure therapy for femoral incision in vascular surgery: preliminary results of a prospective randomised trial. *Journal of Vascular Surgery* 2016;**63**:94S.

Schmid 2018 *{published data only}*

Schmid S, Seitz A, Haller B, Fritsche H, Huber T, Burger M, et al.Results of the first interim analysis of the PräVAC trial: prevention of wound complications following inguinal lymph node dissection in patients with penile cancer using epidermal vacuum-assisted wound closure. *European Urology* 2018;**17**(2 Suppl):e51.

* Schmid SC, Seitz AK, Haller B, Fritsche H-M, Huber T, Burger M, et al.Final results of the PräVAC trial: prevention of wound complications following inguinal lymph node dissection in patients with penile cancer using epidermal vacuum-assisted wound closure. *World Journal of Urology* 2021;**39**(2):613-20.

Shen 2017 *{published data only}*

Shen P, Blackham AU, Lewis S, Clark CJ, Howerton R, Mogal HD, et al.Phase II randomized trial of negative-pressure wound therapy to decrease surgical site infection in patients undergoing laparotomy for gastrointestinal, pancreatic, and peritoneal surface malignancies. *Journal of the American College of Surgeons* 2017;**224**(4):726-37.

Shim 2018 *{published data only}*

Shim HS, Choi JS, Kim SW.A role for postoperative negative pressure wound therapy in multitissue hand injuries. *Biomed Research International* 2018;**2018**(4):1-7.

Stannard 2012 *{published data only}*

Stannard JP, Volgas DA, McGwin G 3rd, Stewart RL, Obremskey W, Moore T, et al.Incisional negative pressure wound therapy after high-risk lower extremity fractures. *Journal of Orthopaedic Trauma* 2012;**26**(1):37-42.

Svensson-Bjork 2020 *{published data only}*

Svensson-Bjork R, Saha S, Acosta S, Gerdtham UG, Hasselmann J, Asciutto G, et al.Cost-effectiveness analysis of negative pressure wound therapy dressings after open inguinal vascular surgery - the randomised INVIPS-Trial. *Journal of Tissue Viability* 2020;**30**:30.

Tanaydin 2018 *{published data only}*

Holford NC.Negative-pressure wound therapy - does it lower the risk of complications with closed wounds following breast surgery? *Expert Review of Medical Devices* 2020;**17**(10):1017-9.

* Tanaydin V, Beugels J, Andriessen A, Sawor JH, Van der Hulst RR.Randomized controlled study comparing disposable negative-pressure wound therapy with standard care in bilateral breast reduction mammoplasty evaluating surgical site complications and scar quality. *Aesthetic Plastic Surgery* 2018;**42**(4):927-35. [DOI: 10.1007/s00266-018-1095-0]

Tanaydin V, Beugels J, Andriessen A, Sawor JH, Van der Hulst RR.Randomized controlled study comparing disposable negative-pressure wound therapy with standard care in bilateral breast reduction mammoplasty evaluating surgical site complications and scar quality. *Aesthetic Plastic Surgery* 2018;**42**(4):Erratum in: Aesthetic Plastic Surgery 2018; 42 (4):1176.

Tuuli 2017 *{published data only}*

Tuuli MG, Martin S, Stout MJ, Steiner HL, Harper LM, Longo S, et al.Pilot randomized trial of prophylactic negative pressure wound therapy in obese women after cesarean delivery. *American Journal of Obstetrics and Gynecology* 2017;**216**(1 Suppl 1):S245.

Tuuli 2020 *{published data only}*

Tuuli MG, Liu J, Tita AT, Longo S, Trudell A, Carter EB, et al.Effect of prophylactic negative pressure wound therapy vs standard wound dressing on surgical-site infection in obese women after cesarean delivery: a randomized clinical trial. *JAMA* 2020;**324**(12):1180-9.

Uchino 2016 *{published data only}*

Uchino M, Hirose K, Bano T, Chohno T, Takesue Y, Ikeuchi H.Randomized controlled trial of prophylactic negative-pressure wound therapy at ostomy closure for the prevention of delayed wound healing and surgical site infection in patients with ulcerative colitis. *Digestive Surgery* 2016;**33**(6):449-54.

WHIST 2019a *{published data only}*

Achten J, Vadher K, Bruce J, Nanchahal J, Spoors L, Masters JP, et al.Standard wound management versus negative-pressure wound therapy in the treatment of adult patients having surgical incisions for major trauma to the lower limb - a two-arm parallel group superiority randomised controlled trial: protocol for wound healing in surgery for trauma (WHIST). *BMJ Open* 2018;**8**(6):e022115.

Campolier M, Knight R, Spoors L, Achten J, Costa M.Assessing the quality of data collection in clinic; lessons from the wound healing in surgical trauma (WHiST) RCT. *Trials* 2019;**20**(Supp 1):P-34.

Costa ML, Achten J, Knight R, Bruce J, Dutton SJ, Madan J, et al.Effect of incisional negative pressure wound therapy vs standard wound dressing on deep surgical site infection after surgery for lower limb fractures associated with major trauma. The WHIST randomized clinical trial. *JAMA* 2020;**323**(6):519-26.

* Costa ML, Achten J, Knight R, Png ME, Bruce J, Dutton S, et al.Negative-pressure wound therapy compared with standard dressings following surgical treatment of major trauma to the lower limb: the WHiST RCT. *Health Technology Assessment* 2020;**24**(38):1-86.

Knight R, Spoors LM, Costa ML, Dutton SJ.Wound healing in surgery for trauma (WHIST): statistical analysis plan for a randomised controlled trial comparing standard wound management with negative pressure wound therapy. *Trials* 2019;**20**(1):186.

WHIST 2019b *{published data only}*

* Costa ML, Achten J, Knight R, Png ME, Bruce J, Dutton S, et al.Standard wound management versus negative pressure wound therapy following surgical treatment of major trauma to the lower limb: the WHiST randomised controlled trial. *HTA Monograph* 2020;**24**(38):1-86.

Png ME, Madan JJ, Dritsaki M, Achten J, Parsons N, Fernandez M, et al.Cost-utility analysis of standard dressing compared with incisional negative-pressure wound therapy among patients with closed surgical wounds following major trauma to the lower limb. *Bone and Joint Journal* 2020;**102**(8):1072-81.

Wierdak 2021 *{published data only}*

Wierdak M, Pisarska-Adamczyk M, Wysocki M, Major P, Kolodziejska K, Nowakowski M, et al.Prophylactic negative-pressure wound therapy after ileostomy reversal for the prevention of wound healing complications in colorectal cancer patients: a randomized controlled trial. *Techniques in Coloproctology* 2021;**25**:185-93.

Wihbey 2018 *{published data only}*

Wihbey KA, Joyce EM, Spalding ZT, Jones HJ, MacKenzie TA, Evans RH, et al.Prophylactic negative pressure wound therapy and wound complication after cesarean delivery in women with class II or III obesity: a randomized controlled trial. *Obstetrics and Gynecology* 2018;**132**(2):377-84.

Witt-Majchrzac 2015 *{published data only}*

Witt-Majchrzac A, Żelazny P, Snarska J.Preliminary outcome of treatment of postoperative primarily closed sternotomy wounds treated using negative pressure wound therapy. *Polski Przeglad Chirurgiczny* 2015;**86**(10):456-65.

References to studies excluded from this review

Abesamis 2019 *{published data only}*

Abesamis GM, Chopra S, Vickery K, Deva AK.A comparative trial of incisional negative-pressure wound therapy in abdominoplasty. *Plastic and Reconstructive Surgery - Global Open* 2019;**7**(5):e2141.

Albert 2012 *{published data only}*

Albert NM, Rock R, Sammon MA, Bena JF, Morrison SL, Whitman A, et al.Do patient and nurse outcome differences exist between 2 negative pressure wound therapy systems? *Journal of Wound Ostomy and Continence Nursing* 2012;**39**:259-66.

Al-Inany 2002 *{published data only}*

Al-Inany H, Youssef G, ElMaguid AA, Abdel Hamid M, Naguib A.Value of subcutaneous drainage system in obese females undergoing cesarean section using Pfannenstiel incision. *Gynecologic and Obstetric Investigation* 2002;**53**(2):75-8.

Anderson 2014 *{published data only}*

Anderson V, Chaboyer W, Gillespie B, Fenwick J.The use of negative pressure wound therapy dressing in obese women undergoing caesarean section: a pilot study. *Evidence-Based Midwifery* 2014;**12**:23-8.

Athanasiou 2018 *{published data only}*

Athanasiou AN, Spartalis M, Spartalis E.Prophylactic negative pressure dressing use in closed laparotomy wounds after abdominal operations. *Annals of Surgery* 2018;**268**(1):e19-20.

Banasiewicz 2013 *{published data only}*

Banasiewicz T, Bobkiewicz A, Borejsza-Wysocki M.Portable VAC therapy improve the results of the treatment of the pilonidal sinus - randomized prospective study. *Polski Przeglad Chirurgiczny* 2013;**85**:371-6.

Bi 2017 *{published data only}*

Bi XQ, Li Y, Xiao L.Application of modified negative-pressure drainage nursing in neck dissection patients: a randomised controlled trial. *International Journal of Oral and Maxillofacial Surgery* 2017;**46**:116.

Bondokji 2011 *{published data only}*

Bondokji S, Rangaswamy M, Reuter C, Farajalla Y, Mole T, Cockwill J, et al.Clinical efficacy of a new variant of a foam-based NWPT system. *Journal of Wound Care* 2011;**20**:64-7.

Braakenburg 2006 *{published data only}*

Braakenburg A, Obdeijn MC, Feitz R, Van Rooij IA, Van Griethuysen AJ, Klinkenbijl JH.The clinical efficacy and cost effectiveness of the vacuum-assisted closure technique in the management of acute and chronic wounds: a randomized controlled trial. *Plastic and Reconstructive Surgery* 2006;**118**:390-7.

Cantero 2016 *{published data only}*

Cantero R, Rubio-Perez I, Leon M, Alvarez M, Diaz B, Herrera A, et al.Negative-pressure therapy to reduce the risk of wound infection following diverting loop ileostomy reversal: an initial study. *Advances in Skin & Wound Care* 2016;**29**(3):114-8.

Chang 2018 *{published data only}*

Chang EI.Discussion: comparison between negative-pressure fixation and film dressing in wound management after tissue expansion: a randomized controlled trial. *Plastic and Reconstructive Surgery* 2018;**142**(1):42-3.

Chiang 2017 *{published data only}*

Chiang N, Rodda OA, Sleigh J, Vasudevan T.Effects of topical negative pressure therapy on tissue oxygenation and wound healing in vascular foot wounds. *Journal of Vascular Surgery* 2017;**66**(2):564-71.

Chio 2010 *{published and unpublished data}*

Chio EG, Agrawal A.A randomized, prospective, controlled study of forearm donor site healing when using a vacuum dressing. *Otolaryngology - Head and Neck Surgery* 2010;**142**(2):174-8.

Cocjin 2019 *{published data only}*

Cocjin HG, Jingco JK, Tumaneng FD, Coruña JM.Wound-healing following negative-pressure wound therapy with use of a locally developed AquaVac system as compared with the Vacuum-Assisted Closure (VAC) system. *Journal of Bone & Joint Surgery, American Volume* 2019;**101**(22):1990-8.

Costa 2018 *{published data only}*

Bruce J, Verdun A, Davis S, Achten J, Parsons N, Hennings S, et al.Using photographic images to aid wound assessment within a randomised controlled trial of standard wound management versus negative pressure wound therapy: UK WOLLF trial. *Trials* 2017;**18**(Supple 1):P283 (page 107).

Cook R, Thomas V, Martin R.Negative pressure dressings are no better than standard dressings for open fractures. *BMJ Open* 2019;**364**:k4411.

* Costa ML, Achten J, Bruce J, Davis S, Hennings S, Willett K, et al.Negative-pressure wound therapy versus standard dressings for adults with an open lower limb fracture: the WOLLF RCT. *Health Technology Assessment* 2018;**22**(73):1-162.

Costa ML, Achten J, Bruce J, Totton E, Petrou S, Lamb SE, et al.Effect of negative pressure wound therapy vs standard wound management on 12-month disability among adults with severe open fracture of the lower limb: the WOLLF randomized clinical trial. *JAMA* 2018;**319**(22):2280-8.

Petrou S, Parker B, Masters J, Achten J, Bruce J, Lamb SE, et al, WOLLF Trial Collaborators.Cost-effectiveness of negative-pressure wound therapy in adults with severe open fractures of the lower limb: evidence from the WOLLF randomized controlled trial. *Bone & Joint Journal* 2019;**101-B**(11):1392-401.

De Rooij 2020 *{published data only}*

De Rooij L, Van Kuijk SM, Van Haaren ER, Janssen A, Vissers YL, Beets GL, et al.A single-center, randomized, non-inferiority study evaluating seroma formation after mastectomy combined with flap fixation with or without suction drainage: protocol for the Seroma reduction and drAin fRee mAstectomy (SARA) trial. *BMC Cancer* 2020;**20**(1):735.

Dorafshar 2012 *{published data only (unpublished sought but not used)}*

Dorafshar AH, Franczyk M, Gottlieb LJ, Wroblewski KE, Lohman RF.A prospective randomized trial comparing subatmospheric wound therapy with a sealed gauze dressing and the standard vacuum-assisted closure device. *Annals of Plastic Surgery* 2011;**69**(1):79-84.

Dragu 2011 *{published data only}*

Dragu A, Schnurer S, Unglaub F, Wolf MB, Beier JP, Kneser U, et al.Wide topical negative pressure wound dressing treatment for patients undergoing abdominal dermolipectomy following massive weight loss. *Obesity Surgery* 2011;**21**(11):1781-6.

Echeribi 2015 *{published data only}*

Echebiri NC, McDoom MM, Aalto MM, Fauntleroy J, Nagappan N, Barnabei VM.Prophylactic use of negative pressure wound therapy after cesarean delivery. *Obstetrics & Gynecology* 2015;**125**(2):299-307.

Eisenhardt 2012 *{published data only}*

Eisenhardt SU, Schmidt Y, Thiele JR, Iblher N, Penna V, Torio-Padron N, et al.Negative pressure wound therapy reduces the ischaemia/reperfusion-associated inflammatory response in free muscle flaps. *Journal of Plastic, Reconstructive & Aesthetic Surgery* 2012;**65**:640-9.

Erne 2018 *{published data only}*

Erne F, Wetzel S, Wulker N, Gesicki M, Hofmann UK.Closed suction drainage after primary total knee arthroplasty: a prospective randomized trial. *Journal of Knee Surgery* 2018;**31**(8):804-10.

Fang 2020 *{published data only}*

Fang C-L, Changchien C-H, Chen M-S, Hsu C-H, Tsai C-B.Closed incision negative pressure therapy following abdominoplasty after breast reconstruction with deep inferior epigastric perforator flaps. *International Wound Journal* 2020;**17**(2):326-31.

Fleming 2018 *{published data only}*

Fleming CA, Kuteva M, O'Hanlon K, O'Brien G, McGreal G.Routine use of PICO dressings may reduce overall groin wound complication rates following peripheral vascular surgery. *Journal of Hospital Infection* 2018;**99**(1):75-80.

Frazee 2018 *{published data only}*

Frazee R, Manning A, Abernathy S, Isbell C, Isbell T, Kurek S, et al.Open vs closed negative pressure wound therapy for contaminated and dirty surgical wounds: a prospective randomized comparison. *Journal of the American College of Surgeons* 2018;**226**(4):507-12.

Grauhan 2013 *{published data only}*

Grauhan O, Navasardyan A, Hofmann M, Müller P, Stein J, Hetzer R.Prevention of poststernotomy wound infections in obese patients by negative pressure wound therapy. *Journal of Thoracic and Cardiovascular Surgery* 2013;**145**:1387-92.

Hu 2009 *{published data only}*

Hu KX, Zhang HW, Zhou F, Yao G, Shi JP, Wang LF, et al.A comparative study of the clinical effects between two kinds of negative-pressure wound therapy. *Zhonghua Shao Shang Za Zhi* 2009;**24**:253-7.

Johannesson 2008 *{published data only}*

Johannesson A, Larsson GU, Oberg T, Atroshi I.Comparison of vacuum-formed removable rigid dressing with conventional rigid dressing after transtibial amputation: similar outcome in a randomized controlled trial involving 27 patients. *Acta Orthopaedica* 2008;**97**:361-9.

Joos 2015 *{published data only}*

Joos A.Use of vacuum therapy in pilondal sinus: a randomized controlled study comparing negative pressure wound therapy versus standard wound care after surgical excision [Einsatz der

vakuumtherapie beim sinus pilonidalis. Eine randomisierte kontrollierte studie zum vergleich der unterdruck-wundtherapie versus standard-wundversorgung nach chirurgischer exzision]. *Coloproctology* 2015;**37**(3):210-2.

Kim 2007 *{published data only}*

Kim EK, Hong JP.Efficacy of negative pressure therapy to enhance take of 1-stage allodermis and a split-thickness graft. *Annals of Plastic Surgery* 2007;**58**:536-40.

Kim 2015 *{published data only}*

Kim YH, Hwang KT, Kim JT, Kim SW.What is the ideal interval between dressing changes during negative pressure wound therapy for open traumatic fractures? *Journal of Wound Care* 2015;**24**(11):536-42.

Kim 2020 *{published data only}*

Kim PJ, Lavery LA, Galiano RD, Salgado CJ, Orgill DP, Kovach SJ, et al.The impact of negative-pressure wound therapy with instillation on wounds requiring operative debridement: pilot randomised, controlled trial. *International Wound Journal* 2020;**17**(5):1194-208.

Krishnamoorthy 2012 *{published data only}*

Krishnamoorthy B, Al-Fagih OS, Madi MI, Najam O, Waterworth PD, Fildes JE, et al.Closed suction drainage improves clinical outcome in patients undergoing endoscopic vein harvesting for coronary artery bypass grafting. *Annals of Thoracic Surgery* 2012;**93**(4):1201-5.

Li 2016 *{published data only}*

Li PY, Yang D, Liu D, Sun SJ, Zhang LY.Reducing surgical site infection with negative-pressure wound therapy after open abdominal surgery: a prospective randomized controlled study. *Scandanavian Journal of Surgery* 2016;**106**(3):189-95.

Licari 2020 *{published data only}*

Licari L, Campanella S, Carolla C, Viola S, Salamone G.Closed incision negative pressure therapy achieves better outcome than standard wound care: clinical outcome and cost-effectiveness analysis in open ventral hernia repair with synthetic mesh positioning. *Cureus* 2020;**5**:e8283.

Llanos 2006 *{published and unpublished data}*

Llanos S, Danilla S, Barraza C, Armijo E, Pineros JL, Quintas M, et al.Effectiveness of negative pressure closure in the integration of split thickness skin grafts. A randomized, double-masked, controlled trial. *Annals of Surgery* 2006;**244**(5):700–5.

Lychagin 2021 *{published data only}*

Lychagin AV, Rosenberg N, Gritsyuk A.Evaluation of the potential complications of surgical wound drainage in primary total hip arthroplasty: a prospective controlled double-blind study. *Hip International* 2021;**31**(5):589-92. [DOI: 10.1177/1120700020941749]

Moisidis 2004 *{published data only}*

Moisidis E, Heath T, Boorer C, Ho K, Deva AK.A prospective, blinded, randomized, controlled clinical trial of topical negative pressure use in skin grafting. *Plastic and Reconstructive Surgery* 2004;**114**:917-22.

Monsen 2015 *{published data only}*

Monsen C, Acosta S, Mani K, Wann-Hansson C.A randomised study of NPWT closure versus alginate dressings in peri-vascular groin infections: quality of life, pain and cost. *Journal of Wound Care* 2015;**24**(6):252-60.

Mouës 2004 *{published data only}*

Mouës CM, Van den Bemd GJ, Heule F, Hovius SE.A prospective randomized trial comparing vacuum therapy to conventional moist gauze therapy. In: Second World Union of Wound Healing Societies Meeting; 2004 July 8-13; Paris (France). 2004:6. [Abstract A001]

Mouës CM, Van den Bemd GJ, Meerding WJ, Hovius SE.Cost analysis comparing vacuum-assisted closure wound therapy to conventional moist gauze therapy. In: Second World Union of Wound Healing Societies Meeting; 2004 July 8-13; Paris (France). 2004:87. [Abstract A008]

* Mouës CM, Vos MC, Van den Bemd GJ, Stijnen T, Hovius SE.Bacterial load in relation to vacuum-assisted closure wound therapy: a prospective randomized trial. *Wound Repair and Regeneration* 2004;**12**:11-7.

Mouës CM, Vos MC, Van den Bemd GJ, Stijnen T, Hovius SE.Bacterial load in relation to vacuum-assisted closure wound therapy. In: 13th Conference of the European Wound Management Association; 2003 May 22-24; Pisa (Italy). 2003:69.

Mouës 2007 *{published data only}*

Mouës CM, Van den Bemd GJ, Heule F, Hovius SE.Comparing conventional gauze therapy to vacuum-assisted closure wound therapy: a prospective randomised trial. *Journal of Plastic, Reconstructive & Aesthetic Surgery* 2007;**60**:672-81.

Mujahid 2020 *{published data only}*

Mujahid AM, Khalid FA, Ali N, Sajjad Y, Khan H, Tarar MN.Vacuum-assisted closure in integration of skin graft over scalp wounds: a randomised control trial. *Journal of the College of Physicians and Surgeons Pakistan* 2020;**30**(2):163-7.

Muller-Sloof 2018 *{published data only}*

Muller-Sloof E, De Laat HE, Hummelink SL, Peters JW, Ulrich DJ.The effect of postoperative closed incision negative pressure therapy on the incidence of donor site wound dehiscence in breast reconstruction patients: DEhiscence PREvention Study (DEPRES), pilot randomized controlled trial. *Journal of Tissue Viability* 2018;**27**(4):262-6.

Muoghalu 2019 *{published data only}*

Muoghalu ON, Eyichukwu GO, Iyidobi E, Anyaehie UE, Madu KA, Okwesili IC.A comparison of the use and non-use of closed suction wound drainage in open reduction and internal fixation of femoral shaft fractures. *International Orthopaedics* 2019;**43**(9):2003-8.

NCT00724750 *{unpublished data only}*

NCT00724750.Comparison of two methods of negative pressure wound therapy. clinicaltrials.gov/ct2/show/NCT00724750 (first received 30 July 2008).

Pellino 2014 *{published data only}*

Pellino G, Sciaudone G, Candilio G, Campitiello F, Selvaggi F, Canonico S.Effects of a new pocket device for negative pressure wound therapy on surgical wounds of patients affected with Crohn's disease: a pilot trial. *Surgical Innovation* 2014;**21**:204-12.

Petkar 2012 *{published data only (unpublished sought but not used)}*

Petkar K, Dhanraj P, Sreekar H.Vacuum closure as a skin-graft dressing: a comparison against conventional dressing. *European Journal of Plastic Surgery* 2012;**35**:579-84.

Rahmanian-Schwarz 2012 *{published data only}*

Rahmanian-Schwarz A, Willkomm LM.A novel option in negative pressure wound therapy (NPWT) for chronic and acute wound care. *Handchirurgie Mikrochirurgie Plastiche Chirurgie* 2012;**38**:573-7.

Seidel 2020 *{published data only}*

Seidel D, Diedrich S, Herrle F, Thielemann H, Marusch F, Schirren R, et al.Negative pressure wound therapy vs conventional wound treatment in Subcutaneous Abdominal Wound Healing Impairment: the SAWHI randomized clinical trial. *JAMA Surgery* 2020;**155**(6):469-78.

Sinha 2016 *{published data only}*

Sinha M, Anand HP, Batra A.Coming-of-age in management of post-caesarean surgical-site infections: an ingenious vacuum assisted closure! *BJOG* 2016;**123**(S2):152-3.

Stannard 2006 *{published data only}*

Stannard JP, Robinson JT, Anderson ER, McGwin G Jr, Volgas DA, Alonso JE.Negative pressure wound therapy to treat hematomas and surgical incisions following high-energy trauma. *Journal of Trauma* 60;**6**:1301-6.

Stannard 2009 *{published data only}*

Stannard JP, Volgas DA, Stewart R, McGwin G Jr, Alonso JE.Negative pressure wound therapy after severe open fractures: a prospective randomized study. *Journal of Orthopaedic Trauma* 2009;**23**(8):552-7.

Stapleton 2015 *{published data only}*

Stapleton H.Wound healing in obese women following caesarean section. *Australian Nursing & Midwifery Journal* 2015;**23**(3):34.

Svensson-Bjork 2018 *{published data only}*

Svensson-Bjork R, Hasselmann J, Acosta S.Evaluation of inguinal vascular surgical scars treated with closed incisional negative pressure wound therapy using three-dimensional digital imaging - a randomized controlled trial on bilateral incisions. *Wound Repair and Regeneration* 2018;**26**(1):77-86.

Trofa 2019 *{published data only}*

Trofa DP, Paulino FE, Munoz J, Villacis DC, Irvine JN, Jobin CM, et al.Short-term outcomes associated with drain use in shoulder arthroplasties: a prospective, randomized controlled trial. *Journal of Shoulder and Elbow Surgery* 2019;**28**(2):205-11.

Visser 2017 *{published data only}*

Visser R, Milbrandt K, Lum Min S, Wiseman N, Hancock BJ, Morris M, et al.Applying vacuum to accomplish reduced wound infections in laparoscopic pediatric surgery. *Journal of Pediatric Surgery* 2017;**52**:849-52.

Walker 2018 *{published data only}*

Walker ME, Tsay C, Broer PN, Zhu VZ, Sturrock T, Ng R, et al.A prospective, randomized-controlled pilot study comparing closed suction versus negative pressure drains for panniculectomy patients. *Journal of Plastic, Reconstructive and Aesthetic Surgery* 2018;**71**(3):438-9.

Wang 2019 *{published data only}*

Wang Z.The effects of vacuum sealing drainage on improving the efficacy of reducing wound infection and lower extremity deep venous thrombosis in patients with orthopedic trauma. *International Journal of Clinical and Experimental Medicine* 2019;**12**(12):13839-46.

Xu 2019 *{published data only}*

Xu C, Jia CQ, Kuo FC, Chai W, Zhang MH, Chen JY.Does the use of a closed-suction drain reduce the effectiveness of an antibiotic-loaded spacer in two-stage exchange arthroplasty for periprosthetic hip infection? A prospective, randomized, controlled study. *BMC Musculoskeletal Disorders* 2019;**20**(1):583.

Yongchao 2017 *{published data only}*

Yongchao Y, Zhigang S, Zhiyun X, Xiaofei Y, Chunyu X, Junhui L, et al.Bilayered negative-pressure wound therapy preventing leg incision morbidity in coronary artery bypass graft patients: a randomized controlled trial. *Medicine* 2017;**96**(3):1-6.

Yu 2017 *{published data only}*

Yu Y, Song Z, Xu Z, Ye X, Xue C, Li J, et al.Bilayered negative-pressure wound therapy preventing leg incision morbidity in coronary artery bypass graft patients: a randomized controlled trial. *Medicine* 2017;**96**(3):e5925.

Zhang 2020 *{published data only}*

Zhang JZ, Zhao K, Li JY, Meng HY, Zhu YB, Zhang YZ.Prophylactic closed suction drainage is irrelevant to accelerated rehabilitation after open reduction and internal fixation for closed distal femur fractures. *Orthopaedic Audio-Synopsis Continuing Medical Education [Sound Recording]* 2020;**12**(6):1768-75.

Zhuang 2020 *{published data only}*

Zhuang J, Zheng W, Yang S, Ye J.Modified subcutaneous suction drainage to prevent incisional surgical site infections after radical colorectal surgery. *Translational Cancer Research* 2020;**9**(2):910-7.

Zotes 2015 *{published data only}*

Zotes V, Mier JM, Cortes G.Negative pressure wound therapy in a potentially infected wound after empyema surgery. *Interactive CardioVascular and Thoracic Surgery* 2015;**21**:187.

References to studies awaiting assessment

Nagata 2018 *{published data only}*

Nagata T, Miura K, Homma Y, Fukamizu H.Comparison between negative-pressure fixation and film dressing in wound management after tissue expansion: a randomized controlled trial. *Plastic and Reconstructive Surgery* 2018;**142**(1):37-41.

References to ongoing studies

ACTRN12615000175572 *{unpublished data only}*

ACTRN12615000175572.Do suction assisted negative pressure dressings reduce the incidence of surgical site infections after abdominal surgery: a randomized controlled trial. anzctr.org.au/Trial/Registration/TrialReview.aspx?ACTRN=12615000175572 (first received 23 February 2015).

ACTRN12618001611213 *{published data only}*

ACTRN12618001611213 2018.Does the use of negative pressure wound therapy reduce the rate of post operative wound infection after bowel surgery. The effect of PICO dressings on surgical site infection following bowel resection: a randomised controlled trial. apps.who.int/trialsearch/Trial2.aspx?TrialID=ACTRN12618001611213 (first received 28 September 2018).

ACTRN12618002006224 *{published data only}*

ACTRN12618002006224.Testing the effectiveness of negative pressure wound therapy in the at risk obstetric population for the prevention of surgical wound complications: the CYGNUS Trial. apps.who.int/trialsearch/Trial2.aspx?TrialID=ACTRN12618002006224 (first received 13 December 2018).

ACTRN12619000785101 *{unpublished data only}*

ACTRN12619000785101.Negative pressure wound therapy to reduce incisional wound infections - a randomised control trial. www.anzctr.org.au/Trial/Registration/TrialReview.aspx?id=377632&isReview=true (first received 20 May 2019).

Brennfleck 2020 *{published data only}*

* Brennfleck FW, Linsenmeier L, Junger HH, Schmidt KM, Werner JM, Woeh D, et al.Negative pressure wound therapy (NPWT) on closed incisions to prevent surgical site infection in high-risk patients in hepatopancreatobiliary surgery: study protocol for a randomized controlled trial — the NP-SSI trial. *Trials* 2020;**21**(1):918.

DRKS00015136.Negative pressure wound therapy (NPWT) on closed incisions to prevent surgical site infection in HPB-surgery. apps.who.int/trialsearch/Trial2.aspx?TrialID=DRKS00015136 (first received 19 February 2019).

ChiCTR -IOR-15006439 *{unpublished data only}*

ChiCTR-IOR-15006439.Prevention surgical site infection with using negative pressure wound therapy in abdominal incision. www.chictr.org.cn/showproj.aspx?proj=11034 (first received 24 May 2015).

CTRI/2019/08/020895 *{unpublished data only}*

CTRI/2019/08/020895.To study the effect of negative pressure dressings in preventing surgical site infection after emergency midline abdominal surgery. ctri.nic.in/Clinicaltrials/showallp.php?mid1=35648&EncHid=&userName=020895 (first received 23 August 2019).

CTRI/2020/11/028795 *{unpublished data only}*

CTRI/2020/11/028795.Usage of vaccum therapy in closed abdominal incision in reducing surgical site infection. ctri.nic.in/Clinicaltrials/showallp.php?mid1=48750&EncHid=&userName=028795 (first received 1 November 2020).

Donlon 2019 *{published data only}*

* Donlon NE, Boland PA, Kelly ME, Schmidt K, Cooke F, Neary PM, et al.Prophylactic negative wound therapy in laparotomy wounds (PROPEL trial): randomized controlled trial. *International Journal of Colorectal Disease* 2019;**34**(11):2003-10.

NCT03871023.Prophylactic negative wound therapy in laparotomy wounds. clinicaltrials.gov/show/nct03871023 (first received 7 March 2019).

DRKS00006199 *{unpublished data only}*

DRKS00006199.Postoperative negative pressure incision therapy following open colorectal surgery: a randomized-controlled trial. www.drks.de/drks_web/navigate.do?navigationId=trial.HTML&TRIAL_ID=DRKS00006199 (first received 20 August 2014).

DRKS00011033 *{unpublished data only}*

DRKS00011033.Evaluation of negative pressure incisional therapy in urgent gastro-intestinal surgery for reduction of superficial surgical site infections compared to non-occlusive conventional plaster - a prospective, randomized, controlled, multicenter clinical trial. www.drks.de/drks_web/navigate.do?navigationId=trial.HTML&TRIAL_ID=DRKS00011033 (first received 30 August 2016).

DRKS00021494 *{unpublished data only}*

DRKS00021494.Single use negative pressure wound therapy system (Prevena ™) compared to standard wound care after spinal surgery. www.drks.de/drks_web/navigate.do?navigationId=trial.HTML&TRIAL_ID=DRKS00021494 (first received 5 October 2020).

ISRCTN30055885 *{unpublished data only}*

ISRCTN30055885.The role of PREVENA vacuum dressings in patients undergoing breast surgery affecting both sides. www.who.int/trialsearch/Trial2.aspx?TrialID=ISRCTN30055885 (first received 13 August 2020).

ISRCTN31224450 *{unpublished data only}*

ISRCTN31224450.Negative pressure therapy in large incisional hernia surgery. www.isrctn.com/ISRCTN31224450 (first received 26 March 2013).

ISRCTN43457163 *{unpublished data only}*

ISRCTN43457163.Preventing abdominal surgical wound infections with negative pressure wound therapy dressings:

Surgical Wound Infection Prevention by Early Intervention using Topical negative pressure therapy – the SWIPE IT trial. www.isrctn.com/ISRCTN43457163 (first received 12 May 2020).

ISRCTN55305726 *{unpublished data only}*

ISRCTN55305726.WHITE 7 - WHISH – Wound Healing In Surgery for Hip fractures. www.isrctn.com/ISRCTN55305726 (first received 31 May 2017).

Jorgensen 2018 *{published data only}*

Jorgensen MG, Toyserkani NM, Hyldig N, Chakera AH, Holmich LR, Thomsen JB.Prevention of seroma following inguinal lymph node dissection with prophylactic, incisional, negative-pressure wound therapy (SEROMA trial): study protocol for a randomized controlled trial. *Trials* 2018;**19**(1):441.

JPRN-UMIN000029706 *{unpublished data only}*

JPRN-UMIN000029706.Effects of closed incision negative-pressure wound therapy in implant-based breast reconstruction: a randomized controlled trial. upload.umin.ac.jp/cgi-open-bin/ctr_e/ctr_view.cgi?recptno=R000033947 (first received 25 October 2017).

JPRN-UMIN000030936 *{unpublished data only}*

JPRN-UMIN000030936.A randomized phase II study to evaluate efficacy of negative pressure wound therapy on prophylaxis of the incisional hernia after reversal of temporaly diverting stoma. upload.umin.ac.jp/cgi-open-bin/icdr_e/ctr_view.cgi?recptno=R000035332 (first received 22 January 2018).

Kim 2020b *{published data only}*

KCT0004063.The effectiveness of negative pressure wound dressing for the wound healing after stoma closure. cris.nih.go.kr/cris/en/search/search_result_st01.jsp?seq=14206 (first received 13 June 2019).

* Kim S, Kang SI.The effectiveness of negative-pressure wound therapy for wound healing after stoma reversal: a randomised control study (SR-PICO study). *Trials* 2020;**21**(1):24.

Masters 2018 *{published data only}*

Masters JP, Achten J, Cook J, Dritsaki M, Sansom L, Costa ML.Randomised controlled feasibility trial of standard wound management versus negative-pressure wound therapy in the treatment of adult patients having surgical incisions for hip fractures. *BMJ Open* 2018;**8**(4):e020632.

Mihaljevic 2015 *{published data only}*

Mihaljevic AL, Schirren R, Muller TC, Kehl V, Friess H, Kleeff J.Postoperative negative-pressure incision therapy following open colorectal surgery (Poniy): study protocol for a randomized controlled trial. *Trials* 2015;**16**(1):1-11.

NCT01770067 *{unpublished data only}*

NCT01770067.Prophylactic treatment of high-risk patients with cardiovascular implantable electronic devices (CIED) with continuous in-situ ultra high-dose antibiotics (CITA) under regulated negative pressure-assisted wound therapy (RNPT). clinicaltrials.gov/ct2/show/record/NCT01770067 (first received 17 January 2013).

NCT01891006 *{unpublished data only}*

NCT01891006.Intervention for postpartum infections following caesarean section (APIPICS). clinicaltrials.gov/ct2/show/NCT01891006 (first received 2 July 2013).

NCT01905397 *{unpublished data only}*

NCT01905397.Negative pressure wound therapy to reduce surgical site infection. clinicaltrials.gov/show/NCT01905397 (first received 23 July 2013).

NCT02020018 *{unpublished data only}*

NCT02020018.Negative pressure wound therapy for prevention of poststernotomy infection. clinicaltrials.gov/ct2/show/NCT02020018 (first received 24 December 2013).

NCT02064270 *{unpublished data only}*

* NCT02064270.PICO: a prospective, randomized, controlled clinical study to assess the prevention of postsurgical incision healing complications in patients undergoing primary or revision knee arthroplasty (KA) or total hip arthroplasty (THA), treated with either single-use negative pressure wound therapy (NPWT) or standard postsurgical dressings. clinicaltrials.gov/ProvidedDocs/70/NCT02064270/Prot_SAP_001.pdf (first received 17 Feb 2014).

NCT02064270.Study to compare negative pressure wound therapy or standard dressings after orthopedic surgery (PICO). clinicaltrials.gov/ct2/show/NCT02064270 (first received 17 February 2014).

NCT02118558 *{unpublished data only}*

NCT02118558.Negative pressure wound therapy – PREVENA – in prevention of infections after total knee arthroplasty (TKA). clinicaltrials.gov/ct2/show/NCT02118558 (first received 21 April 2014).

NCT02302222 *{unpublished data only}*

NCT02302222.The management of closed surgical incisions resulting from incisional hernia repair and/or functional panniculectomy using the Prevena Customizable Dressing. clinicaltrials.gov/ct2/show/NCT02302222 (first received 26 November 2014).

NCT02331485 *{unpublished data only}*

NCT02331485.Randomised control study to assess the role of negative pressure wound therapy (NPWT) in the management of wound in surgical patient. clinicaltrials.gov/ct2/show/NCT02331485 (first received 6 January 2015).

NCT02348034 *{unpublished data only}*

NCT02348034.A randomized controlled trial exploring the ability of negative pressure wound therapy (NPWT) to reduce colorectal surgical site infections (SSI). clinicaltrials.gov/ct2/show/NCT02348034 (first received 28 January 2015).

NCT02408835 *{unpublished data only}*

NCT02408835.Negative pressure wound therapy in groin dissection. clinicaltrials.gov/ct2/show/record/NCT02408835 (first received 6 April 2015).

NCT02492854 *{unpublished data only}*

NCT02492854.Standard versus PICO dressings in lower-extremity bypass patients (PICO-LEB). clinicaltrials.gov/ct2/show/NCT02492854 (first received 9 July 2015).

NCT02509260 *{unpublished data only}*

NCT02509260.Prevena incisional negative pressure wound therapy in re-operative colorectal surgery. clinicaltrials.gov/ct2/show/NCT02509260 (first received 27 July 2015).

NCT02558764 *{unpublished data only}*

NCT02558764.Effects of preventive negative pressure wound therapy with PICO on surgical wounds of kidney transplant patients. clinicaltrials.gov/ct2/show/NCT02558764 (first received 24 September 2015).

NCT02664168 *{unpublished data only}*

NCT02664168.A comparative study to assess the prevention of surgical site infection (SSI's) in revision total joint arthroplasty patients treated with single-use negative pressure wound therapy (PICO) or standard care dressings (AQUACEL Ag surgical dressing). clinicaltrials.gov/ct2/show/NCT02664168 (first received 26 January 2016).

NCT02682316 *{unpublished data only}*

NCT02682316.Negative pressure wound therapy in post-operative incision management. clinicaltrials.gov/ct2/show/NCT02682316 (first received 15 February 2016).

NCT02790385 *{unpublished data only}*

NCT02790385.Negative pressure wound therapy - a multi-centered randomized control trial (NPWT). clinicaltrials.gov/ct2/show/NCT02790385 (first received 3 June 2016).

NCT02799667 *{unpublished data only}*

NCT02799667.Do single use negative pressure dressings reduce wound complications in obese women after cesarean delivery? clinicaltrials.gov/ct2/show/NCT02799667 (first received 15 June 2016).

NCT02892435 *{unpublished data only}*

NCT02892435.Prevena incision management system vs conventional management for wound healing. clinicaltrials.gov/ct2/show/NCT02892435 (first received 8 September 2016).

NCT02901405 *{unpublished data only}*

NCT02901405.NPWT in soft tissue sarcoma surgery. clinicaltrials.gov/ct2/show/NCT02901405 (first received 15 September 2016).

NCT02901613 *{unpublished data only}*

NCT02901613.Prophylactic post-cesarean incisional negative-pressure wound therapy in morbidly obese patients. clinicaltrials.gov/ct2/show/NCT02901613 (first received 15 September 2016).

NCT02926924 *{unpublished data only}*

NCT02926924.Prophylactic application of an incisional wound vac to prevent wound complications in obese spine surgery patients. clinicaltrials.gov/ct2/show/NCT02926924 (first received 6 October 2016).

NCT02954835 *{unpublished data only}*

NCT02954835.Negative pressure therapy for groin wounds. clinicaltrials.gov/ct2/show/NCT02954835 (first received 3 November 2016).

NCT02967627 *{unpublished data only}*

NCT02967627.VAC dressings for colorectal resections (VACCRR). clinicaltrials.gov/ct2/show/record/NCT02967627 (first received 18 November 2016).

NCT03000010 *{unpublished data only}*

NCT03000010.Wound Vac bandage comparison after spinal fusion (WV). clinicaltrials.gov/ct2/show/NCT03000010 (first received 21 December 2016).

NCT03010137 *{unpublished data only}*

NCT03010137.Incisional negative pressure wound therapy in high risk patients undergoing panniculectomy: a prospective randomized controlled trial. clinicaltrials.gov/ct2/show/NCT03010137 (first received 4 January 2017).

NCT03021668 *{unpublished data only}*

NCT03021668.Comparison between wound vacuum dressing and standard closure to reduce rates of surgical site infections. clinicaltrials.gov/ct2/show/NCT03021668 (first received 16 January 2017).

NCT03061903 *{unpublished data only}*

NCT03061903.Closed incision negative pressure therapy vs standard of care (Prevena). clinicaltrials.gov/ct2/show/NCT03061903 (first received 23 February 2017).

NCT03069885 *{unpublished data only}*

NCT03069885.iNPWT in immediate breast reconstruction. clinicaltrials.gov/ct2/show/record/NCT03069885 (first received 3 March 2017).

NCT03082664 *{unpublished data only}*

NCT03082664.Negative pressure wound therapy to prevent wound complications following cesarean section in high risk patients. clinicaltrials.gov/ct2/show/NCT03082664 (first received 17 March 2017).

NCT03144726 *{unpublished data only}*

NCT03144726.RCT on NPWT for incisions following major lower-limb amputation to reduce surgical site infection. clinicaltrials.gov/ct2/show/NCT03144726 (first received 9 May 2017).

NCT03175718 *{unpublished data only}*

NCT03175718.INPWT on wound complications & clinical outcomes after lower extremity sarcoma surgery preop radiation therapy patients (VAC). clinicaltrials.gov/ct2/show/NCT03175718 (first received 6 June 2018).

NCT03180346 *{unpublished data only}*

NCT03180346.A prospective, randomized, comparative study to assess the prevention of surgical site infection (SSIs) in revision total joint arthroplasty patients treated with single-use negative pressure wound therapy (PICO) or standard care dressings

(AQUACEL Ag Surgical Dressing). clinicaltrials.gov/ct2/show/NCT03180346 (first received 8 June 2017).

NCT03250442 *{unpublished data only}*

NCT03250442.Evaluating the outcomes for incisional application of negative pressure for nontraumatic amputations. clinicaltrials.gov/ct2/show/NCT03250442 (first received 15 August 2017).

NCT03269968 *{unpublished data only}*

NCT03269968.Use of negative pressure wound therapy in morbidly obese women after cesarean delivery. clinicaltrials.gov/ct2/show/record/NCT03269968 (first received 1 September 2017).

NCT03274466 *{unpublished data only}*

NCT03274466.Closed incision negative pressure therapy versus standard of care surgical dressing in revision total knee arthroplasty (PROMISES). clinicaltrials.gov/ct2/show/NCT03274466 (first received 7 September 2017).

NCT03321799 *{unpublished data only}*

NCT03321799.Comparison of negative pressure wound therapy versus conventional dressings for the prevention of wound complications after revision THA. clinicaltrials.gov/ct2/show/NCT03321799 (first received 26 October 2017).

NCT03345771 *{unpublished data only}*

NCT03345771.Antimicrobial barrier dressing versus closed-incision negative pressure therapy in the obese primary total joint arthroplasty. clinicaltrials.gov/ct2/show/NCT03345771 (first received 17 November 2017).

NCT03346694 *{unpublished data only}*

NCT03346694.Reducing surgical site infection rates using an alternative sternal dressing. clinicaltrials.gov/ct2/show/NCT03346694 (first received 17 November 2017).

NCT03395613 *{unpublished data only}*

NCT03395613.Negative pressure incision management system in infrainguinal vascular surgery. clinicaltrials.gov/ct2/show/NCT03395613 (first received 10 January 2018).

NCT03402945 *{unpublished data only}*

NCT03402945.Prevention of Infections in Cardiac Surgery (PICS) Prevena study (PICS-Prevena). clinicaltrials.gov/ct2/show/NCT03402945 (first received 18 January 2018).

NCT03414762 *{unpublished data only}*

NCT03414762.PICO negative pressure wound therapy in obese women undergoing elective cesarean delivery. clinicaltrials.gov/ct2/show/NCT03414762 (first received 30 January 2018).

NCT03458663 *{unpublished data only}*

NCT03458663.Randomized trial comparing Prevena and ActiV.A.C. system to conventional care after Bascom's cleft lift surgery. clinicaltrials.gov/ct2/show/NCT03458663 (first received 8 March 2018).

NCT03460262 *{unpublished data only}*

NCT03460262.Negative pressure wound therapy for prevention of groin infection following vascular surgery (PICO). clinicaltrials.gov/ct2/show/NCT03460262 (first received 9 March 2018).

NCT03512470 *{unpublished data only}*

NCT03512470.Clinical study on the prevention of surgical wound complications for aneurysmal thoracic-abdominal aortic pathology using the "PREVENA" system (TVAC). clinicaltrials.gov/ct2/show/NCT03512470 (first received 20 April 2018).

NCT03632005 *{unpublished data only}*

NCT03632005.Negative pressure wound therapy vs sterile dressing for patients undergoing thoracolumbar spine surgery. ClinicalTrials.gov/show/NCT03632005 (first received 8 August 2018).

NCT03688438 *{unpublished data only}*

NCT03688438.WoundVac in obese patients undergoing lumbar surgery. ClinicalTrials.gov/show/NCT03688438 (first received 26 September 2018).

NCT03716687 *{unpublished data only}*

NCT03716687.Prophylactic negative pressure wound therapy for high risk laparotomy wounds. A randomized prospective clinical trial. clinicaltrials.gov/ct2/show/NCT03716687 (first received 21 October 2018).

NCT03773575 *{unpublished data only}*

NCT03773575.Evaluation of closed incision negative pressure dressing (PREVENA) to prevent lower extremity amputation wound complications. ClinicalTrials.gov/show/NCT03773575 (first received 10 December 2018).

NCT03781206 *{unpublished data only}*

NCT03781206.Negative pressure wound therapy for wound healing after stoma reversal. ClinicalTrials.gov/show/NCT03781206 (first received 13 December 2018).

NCT03816293 *{unpublished data only}*

NCT03816293.SUpPress SSI - single use negative pressure wound therapy (NPWT) to reduce surgical site infections. clinicaltrials.gov/ct2/show/NCT03816293 (first received 22 January 2019).

NCT03820219 *{unpublished data only}*

NCT03820219.Incisional negative pressure wound therapy in patients undergoing spine surgery. ClinicalTrials.gov/show/NCT03820219 (first received 25 January 2019).

NCT03886818 *{unpublished data only}*

NCT03886818.Efficacy of negative pressure wound therapy after total ankle arthroplasty. ClinicalTrials.gov/show/NCT03886818 (first received 20 March 2019).

NCT03900078 *{unpublished data only}*

NCT03900078.Incisional negative pressure wound therapy for resection of soft tissue tumors [Inzisionelle negative drucktherapie nach resektion von weichteiltumoren - eine

prospektive, randomisierte, kontrollierte klinische studie]. clinicaltrials.gov/ct2/show/NCT03900078 (first received 26 March 2019).

NCT03905213 *{unpublished data only}*

NCT03905213.Prevention of surgical wound infection. clinicaltrials.gov/show/nct03905213 (first received 20 March 2019).

NCT03935659 *{published data only}*

NCT03935659.Negative pressure wound therapy for surgical site infection prevention in common femoral artery exposure. ClinicalTrials.gov/show/NCT03935659 (first received 25 April 2019).

NCT03948412 *{unpublished data only}*

NCT03948412.Negative pressure wound therapy (PREVENA) versus standard dressings for incision management after renal transplant incision management with Prevena after renal transplant (IMPART) trial. clinicaltrials.gov/ct2/show/NCT03948412 (first received 5 May 2019).

NCT04039659 *{unpublished data only}*

NCT04039659.POstoperative Negative-pressure Incision Therapy Following LIver TRANSplant: a randomized controlled trial (PONILITRANS). clinicaltrials.gov/ct2/show/NCT04039659 (first received 31 July 2019).

NCT04110353 *{unpublished data only}*

NCT04110353.Prophylactic closed incision negative pressure wound therapy on abdominal wounds - clinical and economic perspectives: a multi-centre randomised trial. clinicaltrials.gov/ct2/history/NCT04110353?A=2&B=2&C=merged#StudyPageTop (first received 1 October 2019).

NCT04174183 *{unpublished data only}*

NCT04174183.Evaluation of the effectiveness of a closed-incision negative-pressure therapy (Prevena®) on bilateral groin incision. ClinicalTrials.gov/show/NCT04174183 (first received 22 November 2019).

NCT04214236 *{unpublished data only}*

NCT04214236.CiNPT for abdominoplasties in post-bariatric patients study. ClinicalTrials.gov/show/NCT04214236 (first received 2January 2020).

NCT04265612 *{unpublished data only}*

NCT04265612.Effect of the negative pressure therapy dressing compared with the hydrogel dressing on surgical wound infection in cardiac surgery. clinicaltrials.gov/ct2/show/NCT04265612 (first received 11 February 2020).

NCT04434820 *{unpublished data only}*

NCT04434820.External negative pressure dressing system vs traditional wound dressing for cesarean section incision in obese women. clinicaltrials.gov/ct2/show/NCT04434820 (first received 17 June 2020).

NCT04453319 *{unpublished data only}*

NCT04453319.Efficacy of negative pressure wound closure therapy by PICO System in prevention of complications of femoral artery exposure. ClinicalTrials.gov/show/NCT04453319 (first received 1 July 2020).

NCT04455724 *{unpublished data only}*

NCT04455724.Negative pressure incisional wound therapy for high-risk ventral hernia repair. ClinicalTrials.gov/show/NCT04455724 (first received 2 July 2020).

NCT04496180 *{unpublished data only}*

NCT04496180.Prevena to prevent surgical site infection after emergency abdominal laparotomy. ClinicalTrials.gov/show/NCT04496180 (first received 3 August 2020).

NCT04520841 *{unpublished data only}*

NCT04520841.Clinical trial comparing negative pressure wound therapy and standard dry dressings: monocentric randomized clinical trial comparing negative pressure wound therapy (PREVENA™) and standard dry dressings on oozing of closed incision after revision total hip and knee arthroplasty surgery or lower extremity amputation surgery. clinicaltrials.gov/ct2/show/NCT04520841 (first received 20 August 2020).

NCT04539015 *{unpublished data only}*

NCT04539015.Assess the efficacy of Prevena Plus vs SOC to closed incision in pts undergoing CAWR and other laparotomy procedures. ClinicalTrials.gov/show/NCT04539015 (first received 4 September 2020).

NCT04584957 *{unpublished data only}*

NCT04584957.Prophylactic negative pressure wound therapy (VAC) in Gynecologic Oncology (GO). ClinicalTrials.gov/show/NCT04584957 (first received 14 October 2020).

NCT04618406 *{unpublished data only}*

NCT04618406.The effect of negative pressure wound therapy on wound healing in major amputations of the lower limb. ClinicalTrials.gov/show/NCT04618406 (first received 5 November 2020).

Nguyen 2017 *{published data only}*

Nguyen V, Webb M, Neely Panton O.Incisional negative pressure wound therapy following colorectal resection: preliminary report from a single site, prospective, randomized control trial. *Surgical Endoscopy* 2017;**31**(Suppl 1):S226.

NL6488 *{unpublished data only}*

NTR6675.PREventing surgical site occurrences using negative preSSURE wound therapy? The PRESSURE trial. www.trialregister.nl/trialreg/admin/rctview.asp?TC=6675 (first received 6 October 2017).

NTR6481 *{unpublished data only}*

NTR6481.Randomized controlled clinical trial incisional NPWT versus sterile surgical dressing for surgical wounds after arterial vascular surgery. www.trialregister.nl/trialreg/admin/rctview.asp?TC=6481 (first received 1 June 2017).

Rezk 2019 *{unpublished data only}*

NCT01913132.PICO above incisions after vascular surgery. clinicaltrials.gov/ct2/show/NCT01913132 (first received 31 July 2013).

* Rezk F, Astrand H, Acosta S.Incisional negative pressure wound therapy for the prevention of surgical site infection after open lower limb revascularization - rationale and design of a multi-center randomized controlled trial. *Contemporary Clinical Trials Communications* 2019;**16**:no pagination (100469).

Sandy-Hodgetts 2017 *{unpublished data only}*

ACTRN12612001275853.Effectiveness of Negative Pressure Wound Therapy (NPWT) in the prevention of post-operative surgical wound dehiscence in at risk patients following abdominal surgery; a multicentre randomised control trial. www.anzctr.org.au/Trial/Registration/TrialReview.aspx?id=362626 (first received 13 June 2012).

* Sandy-Hodgetts K, Leslie GD, Parsons R, Zeps N, Carville K.Prevention of postsurgical wound dehiscence after abdominal surgery with NPWT: a multicentre randomised controlled trial protocol. *Journal of Wound Care* 2017;**26**(Suppl 2):S23-6.

Sandy-Hodgetts 2020 *{unpublished data only}*

ACTRN12618000026224p [provisional].Negative pressure dressing in pilonidal surgery. www.anzctr.org.au/Trial/Registration/TrialReview.aspx?id=373010 (first received 2 June 2017).

* Sandy-Hodgetts K, Parsons R, Norman R, Fear MW, Wood FM, White SW.Effectiveness of negative pressure wound therapy in the prevention of surgical wound complications in the cesarean section at-risk population: a parallel group randomised multicentre trial - the CYGNUS protocol. *BMJ Open* 2020;**10**(10):e035727.

SUNRRISE 2017 *{published data only}*

ACTRN12619000496112.Single use negative pressure dressing for reduction In surgical site infection following emergency laparotomy. www.who.int/trialsearch/Trial2.aspx?TrialID=ACTRN12619000496112 (first received 27 March 2019).

* SUNRRISE Study Group.An international pragmatic randomized controlled trial to compare a single-use negative pressure dressing versus the surgeon's preference of dressing to reduce the incidence of surgical site infection following emergency laparotomy: the SUNRRISE trial protocol. *Colorectal Disease* 2021;**23**(4):989-1000.

SUNRRISE study group.Single use negative pressure dressing for reduction in surgical site infections following emergency laparotomy - the SUNRRISE trial. *Colorectal Disease* 2017;**19**(Suppl 2):14.

TCTR20170331001 *{unpublished data only}*

TCTR20170331001.Antiseptic dressing versus negative pressure dressing techniques for uncomplicated pediatric appendicitis, randomized controlled trial. www.who.int/trialsearch/trial2.aspx?Trialid=tctr20170331001 (first received 29 March 2017).

Additional references

ABS 2014

Australian Bureau of Statistics (ABS).3101.0 - Australian Demographic Statistics, Jun 2014. www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/3101.0Main+Features1Jun%202014?OpenDocument (accessed 5 March 2018).

Acosta 2017

Acosta S, Björck M, Wanhainen A.Negative-pressure wound therapy for prevention and treatment of surgical-site infections after vascular surgery. *British Journal of Surgery* 2017;**104**(2):e75-84.

Allen 2011

Allen G, Kirk J, Jones J, Rauen B, Fritzsche S.Navigating new technologies in negative pressure wound therapy. *Plastic Surgical Nursing* 2011;**31**(2):65-72.

Althumairi 2016

Althumairi AA, Canner JK, Gearhart SL, Safar B, Fang SH, Wick EC, et al.Risk factors for wound complications after abdominoperineal excision: analysis of the ACS NSQIP database. *Colorectal Disease* 2016;**18**(7):260-6.

Aluko 2021

Aluko P, Graybill E, Craig D, Henderson C, Drummond M, Wilson EC, et al, Campbell and Cochrane Economics Methods Group.Chapter 20: Economic evidence. In: Higgins JP, Thomas J, Chandler J, Cumpston M, Li T, Page MJ, et al (editors). Cochrane Handbook for Systematic Reviews of Interventions version 6.2 (updated February 2021). Cochrane, 2021. Available from www.training.cochrane.org/handbook.

Andersson 2010

Andersson AE, Bergh I, Karlsson J, Nilsson K.Patients' experiences of acquiring a deep surgical site infection: an interview study. *American Journal of Infection Control* 2010;**38**(9):711-7.

Apostoli 2008

Apostoli A, Caula C.Pain and basic functional activities in a group of patients with cutaneous wounds under V.A.C therapy in hospital setting. *Professioni Infermieristiche* 2008;**61**(3):158-64.

Banwell 2003

Banwell PE, Teot L.Topical negative pressure (TNP): the evolution of a novel wound therapy. *Journal of Wound Care* 2003;**12**(1):22-8.

Baronski 2008

Baronski S, Ayello E.Wound Care Essentials. Practice and Principles. Ambler (PA): Lippincott, Williams & Wilkins, 2008.

Berrios-Torres 2017

Berríos-Torres SI, Umscheid CA, Bratzler DW, Leas B, Stone EC, Kelz RR, et al.Centers for Disease Control and Prevention guideline for the prevention of surgical site infection, 2017. *JAMA Surgery* 2017;**152**:784-91.

Blume 2010

Blume PA, Key JJ, Thakor P, Thakor S, Sumpio B.Retrospective evaluation of clinical outcomes in subjects with split-thickness skin graft: comparing V.A.C.® therapy and conventional therapy in foot and ankle reconstructive surgeries. *International Wound Journal* 2010;**7**(6):480-7.

Brazier 2004

Brazier JE, Roberts J.The estimation of a preference-based measure of health from the SF-12. *Medical Care* 2004;**42**:851-9.

Chen 2017

Chen D, Zhao Y, Li Z, Shou K, Zheng X, Li P, et al.Circulating fibrocyte mobilization in negative pressure wound therapy. *Journal of Cellular and Molecular Medicine* 2017;**21**:1513-22.

Citak 2010

Citak M, Backhaus M, Meindl R, Muhr G, Fehmer T.Rare complication after VAC-therapy in the treatment of deep sore ulcers in a paraplegic patient. *Archives of Orthopaedic Trauma Surgery* 2010;**130**:1511-4.

Coulthard 2010

Coulthard P, Esposito M, Worthington HV, Van der Elst M, Van Waes OJ, Darcey J.Tissue adhesives for closure of surgical incisions. *Cochrane Database of Systematic Reviews* 2010, Issue 5. Art. No: CD004287. [DOI: 10.1002/14651858.CD004287.pub3]

Craig 2013

Craig BM, Pickard AS, Stolk E, Brazier JE.US valuation of the SF-6D. *Medical Decision Making* 2013;**33**(6):793–803.

CRD 2013

Centre for Reviews and Dissemination.NHS EED search filters. www.crd.york.ac.uk/crdweb/s (accessed prior to 2 April 2020).

Cristofolini 2012

Cristofolini M, Worlitzsch D, Wienke A, Silber RE, Borneff-Lipp M.Surgical site infections after coronary artery bypass graft surgery: incidence, perioperative hospital stay, readmissions, and revision surgeries. *Infection* 2012;**40**:397-404.

DeCarbo 2010

DeCarbo WT, Hyer CF.Negative-pressure wound therapy applied to high-risk surgical incisions. *Journal of Foot and Ankle Surgery* 2010;**49**:299-300.

De Lissovoy 2009

De Lissovoy G, Fraeman K, Hutchins V, Murphy D, Song D, Vaughn BB.Surgical site infection: incidence and impact on hospital utilization and treatment costs. *American Journal of Infection Control* 2009;**37**:387-97.

De Vries 2016

De Vries FE, Wallert ED, Solomkin JS, Allegranzi B, Egger M, Dellinger EP, et al.A systematic review and meta-analysis including GRADE qualification of the risk of surgical site infections after prophylactic negative pressure wound therapy compared with conventional dressings in clean and contaminated surgery. *Medicine* 2016;**95**(36):e4673.

Drummond 2005

Drummond MF, Sculpher MJ, Torrance GW, O'Brien BJ, Stoddart GL.Methods for the Economic Evaluation of Health Care Programs. 3rd edition. Oxford (UK): Oxford University Press, 2005.

Dumville 2015

Dumville JC, Owens GL, Crosbie EJ, Peinemann F, Liu Z.Negative pressure wound therapy for treating surgical wounds healing by secondary intention. *Cochrane Database of Systematic Reviews* 2015, Issue 6. Art. No: CD011278. [DOI: 10.1002/14651858.CD011278.pub2]

Eneroth 2008

Eneroth M, Van Houtum WH.The value of debridement and vacuum-assisted closure (V.A.C.) therapy in diabetic foot ulcers. *Diabetes/Metabolism Research and Reviews* 2008;**24**(Suppl 1):S76-80.

Expert Working Group 2008

Expert Working Group.Vacuum assisted closure: recommendations for use. A consensus document. *International Wound Journal* 2008;**5**(Suppl 4):1-19.

FDA 2009a

US Food and Drug Administration (FDA).Negative pressure wound devices draw FDA notice, advice. Consumer health information. December 2009. www.medpagetoday.com/upload/2009/12/11/UCM193750.pdf (accessed 5 March 2018).

FDA 2009b

US Food and Drug Administration (FDA).Serious complications associated with negative pressure wound therapy systems. Preliminary public health notification. November 2009. www.o-wm.com/content/rare-be-aware-serious-complications-associated-with-negative-pressure-wound-therapy-systems (accessed 5 March 2018).

Fleischmann 1997

Fleischmann W, Lang E, Russ M.Treatment of infection by vacuum sealing. *Unfallchirurg* 1997;**100**:301-4.

Gabriel 2014

Gabriel A, Kahn KM.New advances in instillation therapy in wounds at risk for compromised healing. *Surgical Technology International* 2014;**24**:75-81.

Glanville 2019

Glanville J, Dooley G, Wisniewski S, Foxlee R, Noel-Storr A.Development of a search filter to identify reports of controlled clinical trials within CINAHL Plus. *Health Information and Libraries Journal* 2019;**36**(1):73-90.

Glass 2014

Glass GE, Murphy GF, Esmaeili A, Lai L-M, Nanchahal J.Systematic review of molecular mechanism of action of negative-pressure wound therapy. *British Journal of Surgery* 2014;**101**(13):1627-36.

Gregor 2008

Gregor S, Maegele M, Sauerland S, Krahn JF, Peinemann F, Lange S.Negative pressure wound therapy: a vacuum of evidence? *Archives of Surgery* 2008;**143**:189-96.

Gupta 2016

Gupta S, Gabriel A, Lantis J, Téot L.Clinical recommendations and practical guide for negative pressure wound therapy with instillation. *International Wound Journal* 2016;**13**:159-74.

Heuser 2005

Heuser M, Laabs SO, Plothe KD.Extraperitoneal bladder leakage after provision of topical negative therapy: a case report. *Journal of Wound Care* 2005;**14**:406.

Higgins 2017

Higgins JP, Altman DG, Sterne JA (editors).Chapter 8: Assessing risk of bias in included studies. In: Higgins JP, Churchill R, Chandler J, Cumpston MS (editors), Cochrane Handbook for Systematic Reviews of Interventions version 5.2.0 (updated June 2017), Cochrane, 2017. Available from www.training.cochrane.org/handbook/archive/v5.2.

Higgins 2021

Higgins JP, Eldridge S, Li T (editors).Chapter 23: Including variants on randomized trials. In: Higgins JP, Thomas J, Chandler J, Cumpston M, Li T, Page MJ, et al (editors). Cochrane Handbook for Systematic Reviews of Interventions version 6.2 (updated February 2021). Cochrane, 2021. Available from www.training.cochrane.org/handbook.

Hope 2017

Hope SF, Webster J, Trieu K, Pillay A, Ieremia M, Bell C, et al.A systematic review of economic evaluations of population-based sodium reduction interventions. *PLOS One* 2017;**12**(3):e0173600.

Hurd 2014

Hurd T, Trueman P, Rossington A.Use of a portable, single-use negative pressure wound therapy device in home care patients with low to moderately exuding wounds: a case series. *Ostomy/Wound Management* 2014;**60**:30-6.

Husereau 2013

Husereau D, Drummond M, Petrou S, Carswell C, Moher D, Greenberg D, et al.Consolidated Health Economic Evaluation Reporting Standards (CHEERS) statement. *International Journal of Technology Assessment in Health Care* 2013;**29**:117-22.

Hyldig 2016

Hyldig N, Birke-Sorensen H, Kruse M, Vinter C, Joergensen JS, Sorensen JA, et al.Meta-analysis of negative-pressure wound therapy for closed surgical incisions. *British Journal of Surgery* 2016;**103**:477-86.

Ingargiola 2013

Ingargiola MJ, Daniali LN, Lee ES.Does the application of incisional negative pressure therapy to high-risk wounds prevent surgical site complications? A systematic review. *ePlasty* 2013;**13**:e49.

Kairinos 2009

Kairinos N, Voogd AM, Botha PH, Kotze T, Kahn D, Hudson DA, et al.Negative-pressure wound therapy II: negative-pressure wound therapy and increased perfusion. Just an illusion? *Plastic and Reconstructive Surgery* 2009;**123**:601-12.

Kairinos 2014

Kairinos N, Pillay K, Solomons M, Hudson DA, Kahn D.The influence manufacturers have on negative-pressure wound therapy research. *Plastic and Reconstructive Surgery* 2014;**133**(5):1178-83.

Kanakaris 2007

Kanakaris NK, Thanasas C, Keramaris N, Kontakis G, Granick MS, Giannoudis PV.The efficacy of negative pressure wound therapy in the management of lower extremity trauma: review of clinical evidence. *Injury* 2007;**38**(Suppl 5):S9-18.

Kantak 2016

Kantak NA, Mistry R, Halvorson EG.A review of negative-pressure wound therapy in the management of burn wounds. *Burns* 2016;**42**:1623-33.

Karabacak 2016

Karabacak E, Mutluoglu M, Memis A, Ay H.Unexpected wound occurring following negative pressure wound therapy. *International Wound Journal* 2016;**13**(2):289-90. [DOI: 10.1111/iwj.12232]

Karlakki 2013

Karlakki S, Brem M, Giannini S, Khanduja V, Stannard J, Martin R.Negative pressure wound therapy for management of the surgical incision in orthopaedic surgery: a review of evidence and mechanisms for an emerging indication. *Bone & Joint Research* 2013;**2**:276-84.

Kenig 2012

Kenig J, Richter P, Żurawska S, Lasek A, Zbierska K.Risk factors for wound dehiscence after laparotomy - clinical control trial. *Poliski Przeglad Chirurgiczny* 2012;**84**:565-73.

Keskin 2008

Keskin M, Karabekmez FE, Yilmaz E, Tosun Z, Savaci N.Vacuum-assisted closure of wounds and anxiety. *Scandinavian Journal of Plastic and Reconstructive Surgery and Hand Surgery* 2008;**42**:202-5.

Kharroubi 2007

Kharroubi SA, Brazier JE, Roberts J, O'Hagan A.Modelling SF-6D health state preference data using a nonparametric Bayesian method. *Journal of Health Economics* 2007;**26**:597-612.

Kloth 2002

Kloth LC.5 questions and answers about negative pressure wound therapy. *Advances in Skin and Wound Care* 2002;**15**:226-9.

Lancet Commission on Global Surgery 2015

Lancet Commission on Global Surgery.Number of surgical procedures (per 100,000 population). data.worldbank.org/indicator/SH.SGR.PROC.P5 (accessed 5 March 2018).

Lefebvre 2021

Lefebvre C, Glanville J, Briscoe S, Littlewood A, Marshall C, Metzendorf M-I, et al.Chapter 4: Searching for and selecting studies. In: Higgins JP, Thomas J, Chandler J, Cumpston M, Li T, Page MJ, et al (editors). Cochrane Handbook for Systematic Reviews of Interventions version 6.2 (updated February 2021). Cochrane, 2021. Available from www.training.cochrane.org/handbook.

Lesaffre 2009

Lesaffre E, Philstrom B, Needleman I, Worthington H.The design and analysis of split-mouth studies: what statisticians and clinicians should know. *Statistics in Medicine* 2009;**28**:3470-82.

Li 2019

Li HZ, Xu XH, Wang DW, Lin YM, Lin N, Lu HD.Negative pressure wound therapy for surgical site infections: a systematic review and meta-analysis of randomized controlled trials. *Clinical Microbiology and Infection* 2019;**25**(11):1328-38.

Li 2021

Li T, Higgins JP, Deeks JJ (editors).Chapter 5: Collecting data. In: Higgins JP, Thomas J, Chandler J, Cumpston M, Li T, Page MJ, et al (editors). Cochrane Handbook for Systematic Reviews of Interventions version 6.2 (updated February 2021). Cochrane, 2021. Available from www.training.cochrane.org/handbook.

Maehara 2017

Maehara Y, Shirabe K, Kohnoe S, Emi Y, Oki E, Kakeji Y, et al.Impact of intra-abdominal absorbable sutures on surgical site infection in gastrointestinal and hepato-biliary-pancreatic surgery: results of a multicenter, randomized, prospective, phase II clinical trial. *Surgery Today* 2017;**47**:1060-71.

Malmsjö 2014

Malmsjö M, Huddleston E, Martin R.Biological effects of a disposable canisterless negative pressure wound therapy system. *ePlasty* 2014;**14**:e15.

Mandal 2007

Mandal A.Role of topical negative pressure in pressure ulcer management. *Journal of Wound Care* 2007;**16**:33-5.

McCaughan 2018

McCaughan DM, Sheard L, Cullum N, Dumville J, Chetter I.Patients' perceptions and experiences of living with a surgical wound healing by secondary intention: a qualitative study. *International Journal of Nursing Studies* 2018;**77**:29-38.

Morykwas 1997

Morykwas MJ, Argenta LC, Shelton-Brown EI, McGuirt W.Vacuum-assisted closure: a new method for wound control and treatment: animal studies and basic foundation. *Annals of Plastic Surgery* 1997;**38**:553-62.

Morykwas 2001

Morykwas MJ, Faler BJ, Pearce DJ, Argenta LC.Effects of varying levels of subatmospheric pressure on the rate of granulation tissue formation in experimental wounds in swine. *Annals of Plastic Surgery* 2001;**47**:547-51.

Murad 2017

Murad HM, Mustafa RA, Schunemann HJ, Sultan S, Santesso N.Rating the certainty in evidence in the absence of a single estimate of effect. *Evidence Based Medicine* 2017;**22**(3):85-7.

NICE 2013

National Institute for Health and Care Excellence (NICE).Judging whether public health interventions offer value for money. Local government briefing [LGB10]. September 2013. www.nice.org.uk/advice/lgb10/chapter/judging-the-cost-effectiveness-of-public-health-activities (accessed 7 March 2018).

NICE 2018

National Institute for Health and Care Excellence (NICE).Quality-adjusted life year (QALYS). NICE glossary. www.nice.org.uk/glossary?letter=q (accessed 7 March 2018).

NICE 2019

NICE: National Institute for Health and Care Excellence.Prevena incision management system for closed surgical incisions. www.nice.org.uk/advice/mib173/chapter/summary (accessed 27 August 2021).

Olbrecht 2006

Olbrecht VA, Barreiro CJ, Bonde PN, Williams JA, Baumgartner WA, Gott VL, et al.Clinical outcomes of noninfectious sternal dehiscence after median sternotomy. *Annals of Thoracic Surgery* 2006;**82**:907-8.

Ousey 2014

Ousey KJ, Milne J.Exploring portable negative pressure wound therapy devices in the community. *British Journal of Community Nursing* 2014;**19**(Suppl):S14-20.

Pellino 2015

Pellino G, Sciaudone G, Selvaggi F, Canonico S.Prophylactic negative pressure wound therapy in colorectal surgery. Effects on surgical site events: current status and call to action. *Updates in Surgery* 2015;**67**(3):235-45.

Petzina 2010

Petzina R, Malmsjo M, Stamm C, Hetzer R.Major complications during negative pressure wound therapy in poststernotomy mediastinitis after cardiac surgery. *Journal of Thoracic and Cardiovascular Surgery* 2010;**140**(5):1133-6.

Pinto 2016

Pinto A, Faiz O, Davis R, Almoudaris A, Vincent C.Surgical complications and their impact on patients' psychosocial well-being: a systematic review and meta-analysis. *BMJ Open* 2016;**6**:e007224.

Poruk 2016

Poruk KE, Lin JA, Cooper MA, He J, Makary MA, Hirose K, et al.A novel, validated risk score to predict surgical site infection after pancreaticoduodenectomy. *Journal of the International Pancreato Biliary Associationord)* 2016;**18**:893-9.

Review Manager 2020 [Computer program]

Nordic Cochrane Centre, The Cochrane Collaboration Review Manager 5 (RevMan 5).Version 5.4. Copenhagen: Nordic Cochrane Centre, The Cochrane Collaboration, 2020.

Rodero 2010

Rodero MP, Khosrotehrani K.Skin wound healing modulation by macrophages. *International Journal of Clinical and Experimental Pathology* 2010;**3**(7):647-53.

Sandy-Hodgetts 2015

Sandy-Hodgetts K, Carville K, Leslie GD.Determining risk factors for surgical wound dehiscence: a literature review. *International Wound Journal* 2015;**12**(3):265-75.

Santesso 2020

Santesso N, Glenton C, Dahm P, Garner P, Akl EA, Alper B, et al, GRADE Working Group.GRADE guidelines 26: informative statements to communicate the findings of systematic reviews of interventions. *Journal of Clinical Epidemiology* 2020;**119**:126-35.

Schünemann 2021a

Schünemann HJ, Vist GE, Higgins JP, Santesso N, Deeks JJ, Glasziou P, et al.Chapter 15: Interpreting results and drawing conclusions. In: Higgins JP, Thomas J, Chandler J, Cumpston M, Li T, Page MJ, et al (editors). Cochrane Handbook for Systematic Reviews of Interventions version 6.2 (updated February 2021). Cochrane, 2021. Available from www.training.cochrane.org/handbook.

Schünemann 2021b

Schünemann HJ, Higgins JP, Vist GE, Glasziou P, Akl EA, Skoetz N, et al.Chapter 14: Completing 'Summary of findings' tables and grading the certainty of the evidence. In: Higgins JP, Thomas J, Chandler J, Cumpston M, Li T, Page MJ, et al (editors). Cochrane Handbook for Systematic Reviews of Interventions version 6.2 (updated February 2021). Cochrane, 2021. Available from www.training.cochrane.org/handbook.

Shiroky 2020

Shiroky J, Lillie E, Muaddi H, Sevigny M, Choi WJ, Karanicolas PJ.The impact of negative pressure wound therapy for closed surgical incisions on surgical site infection: a systematic review and meta-analysis . *Surgery* 2020;**167**(6):1001-9.

Shmueli 1999

Shmueli A.Subjective health status and health values in the general population. *Medical Decision Making* 1999;**19**(2):122-7.

Sjogren 2011

Sjogren J, Gustafsson R, Nilsson J, Lindstedt S, Nozohoor S, Ingemansson R.Negative-pressure wound therapy following cardiac surgery: bleeding complications and 30-days mortality in 176 patients with deep sternal wound infection. *Interactive Cardiovascular and Thoracic Surgery* 2011;**12**(12):117-20.

Steenvoorde 2009

Steenvoorde P, Den Outer A, Neijenhuis P.Stomal mucocutaneous dehiscence as a complication of topical negative pressure used to treat an open abdomen: a case series. *Ostomy/Wound Management* 2009;**55**(6):44-8.

Stevens 2009

Stevens P.Vacuum-assisted closure of laparotomy wounds: a critical review of the literature. *International Wound Journal* 2009;**6**(4):259-66.

Strugala 2017

Strugala V, Martin R.Meta-analysis of comparative trials evaluating a prophylactic single-use negative pressure wound therapy system for the prevention of surgical site complications. . *Surgical Infections* 2017;**17**(7):810-9.

Szilagyi 1972

Szilagyi DE, Smith RF, Elliott JP, Vrandecic MP.Infection in arterial reconstruction with synthetic grafts. *Annals of Surgery* 1972;**176**:321-3.

Tanaka 2016

Tanaka T, Panthee N, Itoda Y, Yamauchi N, Fukayama M, Ono M.Negative pressure wound therapy induces early wound healing by increased and accelerated expression of vascular endothelial growth factor receptors. *European Journal of Plastic Surgery* 2016;**39**:247-56.

Tanner 2012

Tanner J, Padley W, Davey S, Murphy K, Brown B.Patients' experiences of surgical site infection. *Journal of Infection Prevention* 2012;**13**(5):164-8.

Toeg 2017

Toeg H, French D, Gilbert S, Rubens F.Incidence of sternal wound infection after tracheostomy in patients undergoing cardiac surgery: a systematic review and meta-analysis. *Journal of Thoracic and Cardiovascular Surgery* 2017;**153**(6):1394-400.

Tuffaha 2015

Tuffaha HW, Gillespie BM, Chaboyer W, Gordon LG, Scuffham PA.Cost-utility analysis of negative pressure wound therapy in high-risk cesarean section wounds. *Journal of Surgical Research* 2015;**195**(2):612-22.

Ubbink 2008

Ubbink DT, Westerbos SJ, Nelson EA, Vermeulen H.A systematic review of topical negative pressure therapy for acute and chronic wounds. *British Journal of Surgery* 2008;**95**(6):985-92.

Velnar 2009

Velnar T, Bailey T, Smrkolj V.The wound healing process, an overview of the cellular and molecular mechanisms. *Journal of International Medical Research* 2009;**37**:1528-42.

Vikatmaa 2008

Vikatmaa P, Juutilainen V, Kuukasjarvi P, Malmivaara A.Negative pressure wound therapy: a systematic review on effectiveness and safety. *European Journal of Vascular and Endovascular Surgery* 2008;**36**(4):438-48.

Waisbren 2010

Waisbren E, Rosen H, Bader AM, Lipsitz SR, Rogers SO Jr, Eriksson E.Percent body fat and prediction of surgical site infection. *Journal of the American College of Surgeons* 2010;**210**(4):381-9.

Webb 2017

Webb LX.The impact of negative pressure wound therapy on orthopaedic infection. *Orthopedic Clinics of North America* 2017;**48**(2):167-79.

WHO 2016

World Health Organization (WHO).Chapter 4.19: Prophylactic negative pressure wound therapy. Global Guidelines for the Prevention of Surgical Site Infection. 2016. apps.who.int/iris/bitstream/10665/250680/1/9789241549882-eng.pdf?ua=1 (accessed 7 March 2018).

Willy 2017

Willy C, Agarwal A, Andersen CA, Santis G, Gabriel A, Grauhan O, et al.Closed incision negative pressure therapy: international multidisciplinary consensus recommendations. *International Wound Journal* 2017;**14**(2):388-99.

Wilson 1986

Wilson AP, Treasure T, Sturridge MF, Grüneberg RN.A scoring method (ASEPSIS) for postoperative wound infections for use in clinical trials of antibiotic prophylaxis. *Lancet* 1986;**327**(8476):311-2.

Winfield 2016

Winfield RD, Reese S, Bochicchio K, Mazuski JE, Bochicchio GV.Obesity and the risk for surgical site infection in abdominal surgery. *American Journal of Surgery* 2016;**82**(4):331-6.

Xia 2014

Xia CY, Yu AX, Qi B, Zhou M, Li ZH, Wang WY.Analysis of blood flow and local expression of angiogenesis-associated growth factors in infected wounds treated with negative pressure wound therapy. *Molecular Medicine Reports* 2014;**9**(5):1749-54.

Zeidler 2008

Zeidler J, Mittendorf T, Vahldiek G, Von der Schulenburg JM.Comparative cost analysis of outpatient and inpatient rehabilitation for cardiac diseases [Kostenvergleichsanalyse der ambulanten und stationären kardiologischen Rehabilitation]. *Herz* 2008;**33**:440-7.

References to other published versions of this review

Norman 2020

Norman G, Goh EL, Dumville JC, Shi C, Liu Z, Chiverton L, et al.Negative pressure wound therapy for surgical wounds healing by primary closure. *Cochrane Database of Systematic Reviews* 2020, Issue 6. Art. No: CD009261. [DOI: 10.1002/14651858.CD009261.pub6]

Webster 2011

Webster J, Stankiewicz M, Scuffham P, Chaboyer WP, Sherriff K.Negative pressure wound therapy for skin grafts and surgical wounds healing by primary intention. *Cochrane Database of Systematic Reviews* 2011, Issue 8. Art. No: CD009261. [DOI: 10.1002/14651858.CD009261.pub3]

Webster 2014

Webster J, Stankiewicz M, Scuffham P, Chaboyer WP.Negative pressure wound therapy for skin grafts and surgical wounds healing by primary intention. *Cochrane Database of Systematic Reviews* 2014, Issue 10. Art. No: CD009261. [DOI: 10.1002/14651858.CD009261.pub3]

Webster 2019

Webster J, Liu Z, Norman G, Dumville JC, Chiverton L, Scuffham P, et al.Negative pressure wound therapy for surgical wounds healing by primary closure. *Cochrane Database of Systematic Reviews* 2019, Issue 3. Art. No: CD009261. [DOI: 10.1002/14651858.CD009261.pub4]

* Indicates the major publication for the study

CHARACTERISTICS OF STUDIES

Characteristics of included studies *[ordered by study ID]*

Andrianello 2020

Study characteristics

Methods	**Study design:** randomised controlled trial **Study grouping:** parallel **Ethics and informed consent:** Ethics Committee of the Provinces of Verona and Rovigo; written informed consent at hospital admission **Follow-up period:** 30 days **Sample size estimate:** yes; rate of SSI in patients considered at high risk accounted for 33% of cases. Hypothesised that NPWT could reduce this to 10% of cases (based on literature). With the significance threshold set at 0.05 and power set at 80%, the sample size calculation suggested a recruitment target

Andrianello 2020 *(Continued)*

	of 94 patients (47 in each group). Considering a possible dropout rate of 5% to 10% of cases because of re-laparotomy for bleeding or septic complications, the final recruitment target was extended to 100 patients (50 in each group). **ITT analysis:** yes**number randomised:** 100, **number analysed:** 95 **Funding:** this work was supported by Associazione Italiana per la Ricerca sul Cancro (AIRC n.12182 and n.17132); the Italian Ministry of Health (FIMPCUP_J33G13000210001); and the FP7 European Community Grant Cam-Pac (n. 602783). Smith & Nephew Healthcare (Hull, UK) supplied the devices used for the study. **Preregistration:** NCT03700086
Participants	**Location:** Italy **Intervention group:** 50,**control group:** 50 **Mean age: intervention group** median (IQR) 69 (12), **control group** median (IQR) 64 (17) **Inclusion criteria:** patients scheduled for a major clean-contaminated surgical procedure for periampullary neoplasms - namely, PD total pancreatectomy or gastro-jejunal and biliary bypass with the presence of at least one of the following indicators of high risk for SSI (assessed after wound closure): body mass index 30 kg/m^2 , diabetes mellitus, chronic use of steroids, neoadjuvant therapy, American Society of Anesthesiologists score 3, Charlson comorbidity index 1, time of surgery 360 min, and estimated blood loss 1 L. **Exclusion criteria:** previous abdominal surgery, no indicator of high risk for SSI
Interventions	**Aim/s:** to assess whether a disposable device for NPWT could reduce the incidence of SSI in patients at high risk for SSI after surgery for periampullary neoplasms, given the standardised surgical technique and clinical pathway of a high-volume center for pancreatic surgery. **Group 1 (NPWT) intervention:** PICO portable NPWT device (Smith & Nephew Healthcare, Hull, UK); dressing changed after 3 days, NPWT maintained for 7 days. **Group 2 (control) intervention:** sterile gauze dressing until day 3 then standard sterile dressing (OPSITE, Smith & Nephew) **Study date/s:** July 2018 to October 2019
Outcomes	• SSI • Mortality • Seroma • Haematoma • Reoperation **Validity of measure/s:** CDC definition for SSI **Time points:** 7 days, 30 days, 90 days for mortality
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "At this point [post wound closure], randomization was provided in a 1:1 ratio, using a computer-generated randomization list kept by independent data managers and concealed to the investigators". Comment: computer-generated randomisation sequence
Allocation concealment (selection bias)	Low risk	Quote: "At this point [post wound closure], randomization was provided in a 1:1 ratio, using a computer-generated randomization list kept by independent data managers and concealed to the investigators"

Andrianello 2020 *(Continued)*

		Comment: sequence was kept by independent data managers and concealed from the investigators.
Blinding of participants and personnel (performance bias) All outcomes	High risk	The nature of the intervention means that blinding of participants and personnel was unlikely.
Blinding of outcome assessment (detection bias) All outcomes	High risk	Quote: "All objective evaluations were performed by different clinicians involved in patient care during their postoperative course. All subjective evaluations, including the VAS and SBSES, were performed by a single physician (L.I.) who was blinded to the type of wound closure". Comment: blinded outcome evaluation reported but not for all outcomes - and seemed probable not for outcomes considered in review.
Incomplete outcome data (attrition bias) All outcomes	Low risk	An ITT analysis included 95% of 100 randomised participants; reasons for 5 participants not being included were provided and related to people not receiving the intervention.
Selective reporting (reporting bias)	High risk	There were disparities between the planned and the reported outcomes. In particular, mortality was not reported although it was planned to be assessed.
Other bias	Low risk	No evidence of other bias

Bertges 2021

Study characteristics	
Methods	**Study design:** randomised controlled trial **Study grouping:** block randomisation by site. Study participants were randomised at enrolment. Parallel-group design but with some participants with more than one treated wound (potential unit of analysis issue). **Ethics and informed consent:** patients provided written informed consent for participation. No information on ethical approval. **Follow-up period:** 30 days **Sample size estimate:** a prospective power analysis was performed before initiation of the trial. A sample size of 121 patients per group was estimated for a total enrolment of 242, with a power of 0.8 and an a of 0.05 based on a composite primary outcome event rate of 30% to 40%. **ITT analysis:** yes, **number randomised:** 252, **number analysed:** 242 **Funding:** Acelity KCI (San Antonio, Tex) **Preregistration:** the study protocol was published on ClinicalTrials.gov (identifier, NCT02389023).
Participants	**Location:** USA **Intervention group:** n = 118, **control group:** n = 124 **Mean age:** 67, **intervention group:** 67 (58-76), **control group:** 67 (59-75) **Inclusion criteria:** > 18 years and open vascular surgery for arterial occlusive disease via a groin incision. Surgery included infrainguinal bypass with an autogenous or a prosthetic conduit and/or femoral endarterectomy with or without patch angioplasty. Procedures could be performed with or without concomitant proximal and/or distal peripheral vascular intervention. The index groin could have un-

Bertges 2021 *(Continued)*

	dergone previous procedures (including inflow or outflow for existing grafts). However, the incision from the previous operation must have healed before inclusion in the present study. In cases of bilateral infrainguinal bypass or bilateral femoral endarterectomy, the right and left groin incisions were randomised to the same dressing protocol. **Exclusion criteria:** (1) any groin incision on the index leg within the previous 12 weeks; (2) infrainguinal bypass without a groin incision such as poplitealetibial/pedal bypass; (3) suprainguinal procedures such as open or endovascular abdominal aortic aneurysm repair or aortofemoral/bifemoral bypass; (4) current chemotherapy or radiation therapy; (5) the use of an investigational drug for peripheral arterial disease within 4 weeks of screening or participation in another non-observational clinical trial in the previous 30 days; (6) surgical incision in the groin without primary closure, including previously open or infected wounds; (7) sensitivity or allergy to silver; (8) previous enrolment in the present randomised controlled trial; and/or (9) the inability or refusal to provide written informed consent.
Interventions	**Aim/s:** assess the effects of closed incision negative pressure therapy (ciNPT) on groin wound complications after infrainguinal bypass and femoral endarterectomy. **Group 1 (NPWT) intervention:** ciNPT (PREVENA; 3M KCI, St Paul, Minn); the ciNPT dressing was intended to remain in place for 5 to 7 days and was followed by standard incision coverage with gauze for a total of 2 weeks after surgery. Early removal of the ciNPT dressing for clinical reasons was allowed at the discretion of the attending surgeon. **Group 2 (control) intervention:** standard sterile gauze dressing; silver dressings not permitted otherwise at surgeon's discretion. **Study date/s:** April 2015 to August 2019
Outcomes	• SSIs, including deep infections • Dehiscence • Mortality • Seroma/haematoma (composite outcome) • Readmission (for wound infection) • Reoperation (return to OR for wound infection) • Pain • Health-related quality of life (EQ 5D-3L) **Validity of measure/s:** EuroQoL 5D-3L score for QoL CDC definition for SSI **Time points:** 30 days
Notes	In cases of bilateral infrainguinal bypass or bilateral femoral endarterectomy, the right and left groin incisions were randomised to the same dressing protocol.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Quote: "The patients were randomised before surgery using a randomised block design to ciNPT or standard sterile gauze dressings." Quote: "Block randomization by site was performed, and the study participants were randomised at enrollment". Comment: unclear risk of bias because the random sequence generation method was not specified.
Allocation concealment (selection bias)	Low risk	Allocation was concealed from the co-ordinators who had assigned patients to the ciNPT group.

Bertges 2021 *(Continued)*

Blinding of participants and personnel (performance bias) All outcomes	High risk	"Blinding of the patients, physicians and study personnel to the use of ciNPT was not practically possible given the nature of the dressing." "For logistical reasons the surgeon was also aware of the allocation at the start of the operation."
Blinding of outcome assessment (detection bias) All outcomes	Low risk	"The investigators were kept unaware of the outcomes, which were not revealed until after enrolment and follow-up had been completed."
Incomplete outcome data (attrition bias) All outcomes	Low risk	"Follow up at 30 days was complete for 98% of the patients."
Selective reporting (reporting bias)	Low risk	No evidence of selective reporting.
Other bias	Low risk	No evidence of any other source of bias.

Bobkiewicz 2018

Study characteristics	
Methods	**Study design:** randomised controlled trial **Study grouping:** parallel **Ethics and informed consent:** not reported **Follow-up period:** not reported **Sample size estimate:** not reported **ITT analysis:** yes,**number randomised:** 30, **number analysed:** 30 **Funding:** not reported **Preregistration:** not reported
Participants	**Location:** Poland **Intervention group:** 15,**control group:** 15 **Mean age:** not reported **Inclusion criteria:** people undergoing surgery for stoma reversal **Exclusion criteria:** not reported
Interventions	**Aim/s:** to investigate the efficiency of closed incision negative pressure wound therapy (ciNPWT) portable system on the incidence rate of SSI after stoma reversal surgery. **Group 1 (NPWT) intervention:** closed incision negative pressure wound therapy portable system changed every 3 days or earlier in case of unsealed system or absorbed entirely with wound exudate. **Group 2 (control) intervention:** standard dressing changed every day **Study date/s:** not reported
Outcomes	• SSI • Wound dehiscence • Haematoma

Bobkiewicz 2018 *(Continued)*

	Validity of measure/s: Superficial SSI was defined according to definition of Centers for Disease Control and Prevention. **Time points:** not reported
Notes	Abstract only

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	No information provided
Allocation concealment (selection bias)	Unclear risk	No information provided
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	No information provided but, for both participants and personnel, frequency of dressing changes differed systematically meaning blinding was unlikely to be successful.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	No information provided
Incomplete outcome data (attrition bias) All outcomes	Low risk	All randomised participants included in analysis for SSI.
Selective reporting (reporting bias)	High risk	Partial reporting of some outcomes.
Other bias	Unclear risk	Insufficient information to determine if there was additional risk of bias.

Bueno-Lledo 2021

Study characteristics

Methods	**Study design:** RCT **Study grouping:** parallel **Ethics and informed consent:** approved by the Ethics Committee of the La Fe University Hospital; written informed consent. **Follow-up period:** 30 days **Sample size estimate:** yes; assuming that the percentage of patients developing SSOs at 30 days post-surgery following elective hernia repair is at most 30% and can be reduced to 10% in the treatment group, a sample size of 150 patients was required to achieve 80% power with an at-risk of 5%, including an anticipated 10% loss to follow-up. Thus, 75 patients were required in each group. **ITT analysis:** no; analysis performed on per-protocol basis (150 randomised, 146 analysed). **Funding:** study sponsored by La Fe University Hospital. Authors stated the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Bueno-Lledo 2021 *(Continued)*

	Preregistration: NCT03576222
Participants	**Location:** Spain **Intervention group:** 75,**control group:** 75 **Mean age: intervention group** 51.6 (23.2), **control group** 51.3 (19.4) **Inclusion criteria:** male and female patients > 18 years' old with IH type W2 (transverse hernia defect with 4–10 cm) or W3 (transverse hernia defect over 10 cms) according to European Hernia Society (EHS) classification. **Exclusion criteria:** patients under the age of 18 years, patients unable to give written consent, patients who had abdominal surgery reintervention within 30 days before the hernia repair, patients who had undergone emergency hernia surgery, pregnant patients, and patients with hepatic cirrhosis and IH not involving the midline.
Interventions	**Aim/s:** to evaluate whether the prophylactic application of a specific single-use negative pressure (sNPWT) dressing on closed surgical incisions after incisional hernia (IH) repair decreases the risk of surgical site occurrences (SSOs) and the length of stay. **Group 1 (NPWT) intervention:** sNPWT (PICO; Smith & Nephew, London, UK). Dressing left in situ for 6 days/during hospital stay. **Group 2 (control) intervention:** conventional dressing (MEPORE pro; Molnlycke, Goteborg, Sweden) **Study date/s:** May 2017 to January 2020
Outcomes	• SSI • Dehiscence • Seroma • Haematoma **Validity of measure/s:** SSI was defined as an infection that occurred at the site of a surgical incision or in an organ space within 30 days of the surgery. Wound dehiscence was defined as the splitting apart or rupturing of the margins of a previously closed wound along some or all of its length. **Time points:** 12 days; 30 days
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "Randomization was performed on a 1:1 basis to either the treatment group or the control group. The sequence was generated on www.randomization.com and allocation was concealed using closed envelopes." Comment: computer-generated randomisation
Allocation concealment (selection bias)	Unclear risk	Quote: "Randomization was performed on a 1:1 basis to either the treatment group or the control group. The sequence was generated on www.randomization.com and allocation was concealed using closed envelopes." Comment: closed envelopes but unclear if opaque or sequentially numbered.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Quote: "The operating surgeon was not blinded to the dressing being applied to the wound." Comment: personnel not blinded; participant blinding unlikely due to nature of the intervention.
Blinding of outcome assessment (detection bias)	High risk	Quote: "Patients were assessed again at 12 (wound clip removal) and 30 days in the outpatient clinic and the wound examined for evidence of SSOs by the

Bueno-Lledo 2021 *(Continued)*

All outcomes		same study assessor, who was a member of the operating surgical team and who was not blinded to the treatment group." Comment: outcome assessor not blinded.
Incomplete outcome data (attrition bias) All outcomes	Low risk	146/150 participants included in analysis; no difference between groups and reasons for loss reported.
Selective reporting (reporting bias)	Unclear risk	Some outcomes which were not prespecified were reported (readmission; re-operation). All prespecified outcomes were reported.
Other bias	Low risk	No evidence of other sources of bias.

Chaboyer 2014

Study characteristics	
Methods	**Study design:** randomised controlled trial **Study grouping:** parallel **Ethics and informed consent:** yes **Follow-up period:** 6 weeks **Sample size estimate:** pilot study **ITT analysis:** yes, **number randomised:** 92, **number analysed:** 87 **Funding:** non-industry **Preregistration:** yes
Participants	**Location:** Queensland, Australia **Intervention group:** n = 35,**control group:** n = 35 **Mean age: intervention group** = 30.6 years (IQR 5.5),**control group** = 30.7 years (IQR 5.0) **Inclusion criteria:** booked for elective caesarean section; pre-pregnancy BMI ≥ 30; able to provide consent. **Exclusion criteria:** women whose condition changed to require urgent caesarean section; previous participation in the trial; existing infection.
Interventions	**Aim/s:** to assess the feasibility of a definitive RCT to test the effectiveness and safety of prophylactic NPWT in obese women after caesarean section. **Group 1 (NPWT) intervention:** PICO dressing applied over the primarily closed incision by the surgeon in the operating room. Dressing was left on for 4 days or longer if drainage continued, unless soiled or dislodged. **Group 2 (control) intervention:** Comfeel dressing applied over the primarily closed incision by the surgeon in the operating room. Dressing was left on for 4 days or longer if drainage continued, unless soiled or dislodged. **Study date/s:** July 2012 to April 2014
Outcomes	• Surgical site infection • Type of SSI • Hospital readmission • Dehiscence; blisters

Chaboyer 2014 *(Continued)*

	• Haematoma **Validity of measure/s:** CDC definitions and criteria for superficial, deep, and organ/space SSI were used for the primary outcome and SF-12 for quality of life. **Time points:** 1, 2, 3, and 4 weeks postsurgery
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "computer generated 1:1 ratio with blocks of randomly varying sizes"
Allocation concealment (selection bias)	Low risk	A centralised web-based randomised service was accessed.
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	There was no information on this.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Quote: "a separate person ... assessed the outcome and was blinded to the allocation".
Incomplete outcome data (attrition bias) All outcomes	Low risk	2 women in the intervention group and 3 in the control group were lost to follow-up, but an ITT analysis was used.
Selective reporting (reporting bias)	Low risk	Planned outcomes reported. Protocol registered on ANZCTR.
Other bias	Low risk	No other biases detected

Crist 2014

Study characteristics	
Methods	**Study design:** randomised controlled trial **Study grouping:** parallel **Ethics and informed consent:** ethics approved and consent obtained **Follow-up period:** 12 months **Sample size calculation:** not stated **ITT analysis:** available-case analysis **Funding:** non-industry **Preregistration:** yes
Participants	**Location:** USA **Intervention group:** n = 55,**control group:** n = 60

Crist 2014 *(Continued)*

	Mean age: intervention group = 47.2 years (SD 19.6),**control group** = 48.3 years (SD 20.1). Data extracted from results section of ClinicalTrials.gov (NCT00635479). **Inclusion criteria:** patients that had undergone an open surgical exposure for hip, pelvis, or acetabular fracture. **Exclusion criteria:** none stated
Interventions	**Aim/s:** to determine the effectiveness of using NPWT over primarily closed surgical incisions used for open reduction and internal fixation of hip, pelvis, and acetabular fracture surgery. **Group 1 (NPWT) intervention:** quote "negative pressure dressing applied over the primarily closed incision sterilely in the operating room. NPWT was left on for 2 days or longer if drainage continued". **Group 2 (control) intervention:** quote "standard gauze dressing"; description not provided. **Study date/s:** not provided
Outcomes	• Infection • LOS • Total serious adverse events **Validity of measure/s:** not provided **Time points:** followed for 12 months
Notes	Conference abstract. Additional information provided by the investigator and from a search of ClinicalTrials.gov (NCT00635479).

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Evidence:** quote; "computer randomization" **Comment:** correspondence with author
Allocation concealment (selection bias)	Unclear risk	**Evidence:** quote; "opaque sealed envelope opened in the OR" **Comment:** correspondence with author; but unclear whether envelopes were sequentially numbered?
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Insufficient information
Blinding of outcome assessment (detection bias) All outcomes	Low risk	**Evidence:** quote; "yes" **Comment:** correspondence with author
Incomplete outcome data (attrition bias) All outcomes	High risk	**Evidence:** quote; "55 patients randomised to the NPWT group and 60 patients randomised to the standard dressing group. The NPWT group included 49 patients and the gauze group included 42 patients that completed the 12 month follow-up". **Comment:** 10.9% participants in NPWT group and 30.0% of those in control group were lost to follow-up.
Selective reporting (reporting bias)	Unclear risk	**Comment:** protocol registered on ClinicalTrials.gov with identifier (NCT00635479). Expected outcomes were reported in the abstract, but other

Crist 2014 *(Continued)*

		outcomes specified in the protocol were not reported (such as total serious adverse events). These may be included when the full trial is published.
Other bias	Unclear risk	**Comment:** no other biases detected

Crist 2017

Study characteristics

Methods	**Study design:** randomised controlled trial **Study grouping:** parallel **Ethics and informed consent:** ethics approved and consent obtained **Follow-up period:** not stated **Sample size calculation:** not stated **ITT analysis: number randomised:** 71, **number analysed:** 66 **Funding:** no external funding **Preregistration:** not stated
Participants	**Location:** USA **Intervention group:** n = 33, **control group:** n = 33 **Mean age (range): intervention group** = 44 (19 to 87), **control group** = 43 (18 to 92) **Inclusion criteria:** patients at least 18 years of age with an acetabular fracture that required ORIF. **Exclusion criteria:** less than 18 years old; pregnant; unable to provide informed consent; or if their injury could be treated nonoperatively or percutaneously.
Interventions	**Aim/s:** to determine if iNPWT decreased the risk of deep infection when used over primarily closed surgical incisions for acetabular fracture ORIF. **Group 1 (NPWT) intervention:** iNPWT (VAC; KCI, San Antonio, TX) over their surgically closed incision **Group 2 (control) intervention:** a standard postoperative (dry gauze) dressing **Study date/s:** March 2008 to September 2012
Outcomes	• Infection **Validity of measure/s:** the clinical diagnosis of infection was determined from the drainage at the operative site in addition to 1 or more of the classic signs and symptoms of inflammation (redness, heat, swelling, pain). Deep infections were those that required operative debridement. Bacteriological cultures obtained at the time of operative debridement. **Time points:** 10 to 21 days, 6 weeks, 12 weeks, and every 6 to 8 weeks thereafter until bony union occurred.
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Not reported

Crist 2017 *(Continued)*

Allocation concealment (selection bias)	Unclear risk	Not reported
Blinding of participants and personnel (performance bias) All outcomes	High risk	Quote: "we did not blind the patients and staff to treatment group." Comment: no blinding of personnel or participants
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Not reported
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Approximately 7% of participants were lost to follow-up; reasons for losses were not reported. No more information provided.
Selective reporting (reporting bias)	Low risk	Expected outcomes reported
Other bias	Low risk	None detected

Darwisch 2020

Study characteristics	
Methods	**Study design:** RCT **Study grouping:** parallel **Ethics and informed consent:** not reported **Follow-up period:** not reported **Sample size estimate:** not reported **ITT analysis:** not reported **Funding:** not reported **Preregistration:** not reported
Participants	**Location:** Germany **Intervention group:** 249 (56 with BMI >/= 35),**control group:** 279 (66 with BMI >/= 35) **Mean age: intervention group:** not reported; **control group:** not reported **Inclusion criteria:** patients after cardiac surgery performed via median sternotomy. **Exclusion criteria:** not reported
Interventions	**Aim/s:** to evaluate NPWT as a prevention and therapy of superficial infection. **Group 1 (NPWT) intervention:** PICO dressing (Smith & Nephew, Netherlands) **Group 2 (control) intervention:** standard dry dressing **Study date/s:** not reported
Outcomes	• SSI **Validity of measure/s:** not reported

Darwisch 2020 *(Continued)*

	Time points: not reported
Notes	Abstract only

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Quote: "patients after cardiac surgery performed via median sternotomy (n = 528) were after stratification according to the marker body mass index (BMI ≥ 35) randomised to receive either a PICO dressing (PD) (Smith & Nephew, Netherlands) (n = 56/193) or a standard dry dressing (SDD) (n = 66/213)." Comment: no information as to how the randomisation sequence was generated.
Allocation concealment (selection bias)	Unclear risk	Quote: "patients after cardiac surgery performed via median sternotomy (n = 528) were after stratification according to the marker body mass index (BMI ≥ 35) randomised to receive either a PICO dressing (PD) (Smith & Nephew, Netherlands) (n = 56/193) or a standard dry dressing (SDD) (n = 66/213)." Comment: no information on how or whether allocation concealment was undertaken.
Blinding of participants and personnel (performance bias) All outcomes	High risk	There was no information on this but the nature of the intervention made blinding of both personnel and participants difficult to ensure.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	There was no information on how the outcomes were assessed.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	The reporting of the outcome data was unclear and there was insufficient information to determine whether there was a risk of attrition bias.
Selective reporting (reporting bias)	High risk	The reporting of the outcome of SSI (the only reported outcome) was unclear and it appeared likely that the reported data did not correspond to the planned analysis. It was unclear whether additional outcomes were planned to be assessed but were not reported.
Other bias	Unclear risk	It was very unclear whether there might be additional risks of bias; this publication was available only as an abstract.

DiMuzio 2017

Study characteristics

Methods	**Study design:** randomised controlled trial **Study grouping:** parallel **Ethics and informed consent:** not provided **Follow-up period:** 30 days **Sample size calculation:** not stated

DiMuzio 2017 *(Continued)*

	ITT analysis: number randomised: 120, **number analysed:** 120 **Funding:** not stated **Preregistration:** not stated
Participants	**Location:** Philadelphia, USA **Intervention group (high risk):** n = 59,**control group (high risk):** n = 60, **(3 arms: low risk:** n = 21**)** **Mean age:** not provided **Inclusion criteria:** femoral incisions closed primarily following elective vascular surgery. **Exclusion criteria:** none stated
Interventions	**Aim/s:** to prospectively evaluate negative pressure therapy as a means to decrease wound complications and associated healthcare costs. **Group 1 (NPWT) intervention:** NPWT **Group 2 (control) intervention:** standard gauze dressing **Study date/s:** not provided
Outcomes	• Infection • LOS • Reoperation • Readmission **Validity of measure/s:** not provided **Time points:** over 30 days
Notes	Conference abstract

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Not reported
Allocation concealment (selection bias)	Unclear risk	Not reported
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	No information reported
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Not reported
Incomplete outcome data (attrition bias) All outcomes	Low risk	140 (3 arms) were enrolled and analysed
Selective reporting (reporting bias)	Low risk	Planned outcomes reported
Other bias	Unclear risk	No other biases detected

Engelhardt 2016

Study characteristics	
Methods	**Study design:** randomised controlled trial **Study grouping:** parallel **Ethics and informed consent:** ethics approved and consent obtained. **Follow-up period:** primary endpoint of the study was the occurrence of SSIs. **Sample size calculation:** not stated **ITT analysis:** no **number randomised:** 141, **number analysed:** 132 **Funding:** not stated **Preregistration:** not stated
Participants	**Location:** Germany **Intervention group (high risk):** n = 64,**control group (high risk):** n = 68 **Mean age (range): intervention group** = 72 (64 to 75),**control group** = 70 (60 to 78) **Inclusion criteria:** all consecutive patients scheduled for vascular surgery with a femoral cutdown; age > 18 years and the need for an open, nonemergency surgical procedure for peripheral arterial disease or aneurysm involving the femoral artery using a longitudinal femoral cutdown in the groin. **Exclusion criteria:** dementia (not capable of informed consent) and declining to participate.
Interventions	**Aim/s:** to determine whether closed-incision negative pressure therapy is able to reduce SSI rate in the groin after vascular surgery. **Group 1 (NPWT) intervention:** NPWT was applied on the closed skin intraoperatively. The system is comprised of a therapy unit containing a pump with a 45-millilitre canister delivering a continuous negative pressure of 125 mmHg and a self adhesive dressing with a foam bolster that manifolds the negative pressure to the incision area. A special polyester interface layer protects the skin from direct contact with the foam bolster, while at the same time allowing delivery of negative pressure and fluid removal. **Group 2 (control) intervention:** absorbent adhesive dressing. **Study date/s:** January 2012 and October 2014
Outcomes	• Infection **Validity of measure/s:** all wounds were documented with photos and classified according to the Szilagyi classification. Grade I infections only involved the skin (dermal infection); grade II extended to the subcutaneous tissue without reaching the vessels; and grade III finally involved the artery or bypass. **Time points:** 5th postoperative day and 6 weeks after surgery.
Notes	

Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Random assignment of the participants to the 2 treatment groups was performed according to an external randomisation sequence.
Allocation concealment (selection bias)	Low risk	Sealed randomisation envelopes were provided by an external institution. On eligibility confirmation, the sequential randomisation envelope was opened, and the assignment was allocated.

Engelhardt 2016 *(Continued)*

Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Insufficient information
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Quote: "all wounds were documented by photography and classified according to the Szilagyi classification". Comment: unclear whether outcome assessment was blinded.
Incomplete outcome data (attrition bias) All outcomes	High risk	ITT not used; 141 participants were randomised, and 132 completed the study; 9 participants (6%) did not complete follow-up due to urgent reoperation or death during follow-up.
Selective reporting (reporting bias)	Low risk	Planned outcomes reported
Other bias	Low risk	None detected

Flynn 2020

Study characteristics	
Methods	**Study design:** RCT **Study grouping:** parallel **Ethics and informed consent:** approved by the Monash Health Human Research Ethics Committee **Follow-up period:** 7 days plus further checks (time point not reported) **Sample size estimate: yes:** estimated SSI of 20% with conventional dressings, based on SSI rates in colorectal patients in the literature and SSI rates reported previously in institution. Estimated SSI of 5% with the PICOTM dressing, as a clinically significant risk reduction. Aiming for power of 80%, alpha 0.05 with estimated effect size 15%, the number of patients required per arm was 88 patients. **ITT analysis:** no, per-protocol analysis not including those with cancelled or ineligible surgery, major protocol breaches or withdrawals (213 randomised; 188 analysed; losses divided equally between groups). **Funding:** Smith and Nephew, the company that produces the PICO dressing. **Preregistration:** not reported
Participants	**Location:** Australia **Intervention group:** 109, **control group:** 108 **Mean age: intervention group** 64.2 (13.2);**control group** 66.8 (13.3) **Inclusion criteria:** adult patients undergoing laparotomy for at least clean/contaminated surgery and those patients at moderate to high risk for SSI, with 1 or more of the following risk factors: overweight or obese (body mass index [BMI] > 25); diabetes; contaminated surgery (perforation or abscess); non-elective (subacute) clean/contaminated surgery; and incision primarily closed **Exclusion criteria:** underwent mini-laparotomy or relook surgery or were pregnant.
Interventions	**Aim/s:** to determine if there was any reduction in infections in laparotomy incisions after clean-contaminated surgery in moderate-risk patients by using negative pressure dressings, specifically PICO system, as a prophylactic measure on primarily closed incisions. **Group 1 (NPWT) intervention:** PICO dressing (Smith & Nephew, St. Petersburg, PL) in place for 7 days or until day of discharge

Flynn 2020 *(Continued)*

	Group 2 (control) intervention: conventional dressing **Study date/s:** March 2015 to September 2017
Outcomes	• SSI • Dehiscence • Haematoma • Skin blistering • Pain (presence of) **Validity of measure/s:** incision infection was defined according to VICNISS definitions of superficial (skin and subcutaneous tissue) and deep (fascia and/or muscle) incisional or organ/space infection (VICNISS is the major healthcare infection surveillance organisation for Victoria, which is based on a model from the U.S. Centers for Disease Control and Prevention). **Time points:** 7 days and a later questionnaire following discharge (time not reported)/inspection of outpatient records.
Notes	Smith and Nephew received ongoing updates of all findings but did not have any active input or editorial power over the study protocol, day-to-day running of the trial or reporting of findings. Several of the authors received some financial payment from the trial budget to cover additional hours worked as a part of the study. The study statistician is a paid employee of the School of Public Health and Preventive Medicine, Monash University who also received payment for the statistical analysis, which was received via the trial investigators, with no direct contact with the sponsors.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Quote: "Patients were randomised in blocks, with pre-prepared randomization envelopes opened at the time of consent." Comment: it was not clear how the randomisation sequence was generated.
Allocation concealment (selection bias)	Unclear risk	Quote: "Patients were randomised in blocks, with pre-prepared randomization envelopes opened at the time of consent." Comment: unclear if the envelopes were sealed, opaque or sequentially numbered.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Quote: "The study was not blinded; patients obviously could not be blinded, and the small research team meant the recruitment and post-operative assessment were often performed by the same people." Comment: neither participants nor personnel were blinded.
Blinding of outcome assessment (detection bias) All outcomes	High risk	Quote: "In the majority of cases, the diagnosis of incision infection was made or confirmed by the treating clinician, who was not involved directly in the trial but also not blinded." Comment: outcome assessor was not blinded.
Incomplete outcome data (attrition bias) All outcomes	Low risk	A substantial number of participants were lost after randomisation and were not included in the analysis. These were equally divided between the groups and the reasons were given; mostly these participants were not treated with the eligible surgical procedure. Although they represented > 10% of the randomised participants, the risk of bias from not including them appeared low.
Selective reporting (reporting bias)	Unclear risk	The secondary outcomes reported were not always clearly prespecified, making it difficult to determine whether there may be a risk of reporting bias.

Flynn 2020 *(Continued)*

Other bias	High risk	Quote: "Most patients were recruited pre-operatively but as a result of slow recruitment, a small number of patients undergoing laparoscopic surgery, that was converted to an open procedure were recruited in the first 24 hours post-operatively, and any such patient randomly assigned to the PICO dressing would undergo a change of dressing at that time." Comment: some people in the NPWT group underwent an additional dressing change in the first 24 hours, which effectively changed their treatment allocation.

Fogacci 2019

Study characteristics	
Methods	**Study design:** RCT **Study grouping:** parallel **Ethics and informed consent:** approved and validated by the Area Vasta Romagna Ethics committee; consent not reported. **Sample size estimate:** not reported **ITT analysis:** not reported **Funding:** not reported **Preregistration:** not reported
Participants	**Location:** Italy **Intervention group:** 50, **control group:** 50 **Mean age: intervention group** not reported; **control group** not reported **Inclusion criteria:** people undergoing either quadrantectomy, mastectomy, or breast reconstruction. with 1 or more of the following risk factors for surgical site complications: obesity (BMI < 29.9 [sic]), diabetes mellitus, smoker, previous radiotherapy on the affected breast, and predisposing comorbidities (collagen pathologies, vasculopathies, and previous neo-adjuvant chemotherapy of any kind). **Exclusion criteria:** not further reported (patients who did not meet the inclusion criteria)
Interventions	**Aim/s:** to determine the effectiveness of NPWTin breast surgery in high-risk patients **Group 1 (NPWT) intervention:** PICO plaster (Smith & Nephew), unchanged for 7 days **Group 2 (control) intervention:** standard tissue-non-tissue plaster (Farmapore, Farmac-Zabban), changed on a three day basis up to complete healing **Study date/s:** April 2017 to June 2018
Outcomes	• SSI • Readmission **Validity of measure/s:** not reported **Time points:** not reported; stated that there was long-term follow-up.
Notes	Information on ITT analysis updated

Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**

Fogacci 2019 *(Continued)*

Random sequence generation (selection bias)	Unclear risk	Quote: "The study consists of a prospective randomised trial." Comment: no information on how the randomisation sequence was derived.
Allocation concealment (selection bias)	Unclear risk	Quote: "The study consists of a prospective randomised trial." Comment: no information on whether or how allocation concealment was achieved.
Blinding of participants and personnel (performance bias) All outcomes	High risk	No information on blinding but nature of intervention made it unlikely that participants or study personnel could be blinded.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	No information on who performed outcome assessment; stated only that participants were checked during long term follow-up.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Quote: "All the patients have been checked along time". Comment: appeared that all participants were included in analysis.
Selective reporting (reporting bias)	Unclear risk	The primary and secondary outcomes were not clearly specified or reported.
Other bias	Unclear risk	There were no clear additional sources of bias but reporting was insufficient.

Galiano 2018

Study characteristics	
Methods	**Study design:** randomised controlled trial **Study grouping:** intra-individual (split person) **Ethics and informed consent:** ethics approval was first obtained at the institution of the principal investigator (R.D.G.), institutional review board at Northwestern University, Chicago, (STU00062369 - 5/22/2012), and at each of the other sites. Before entry into the study, all patients signed informed consent forms. **Follow-up period:** 21 days (90 days) **Sample size estimate:** 197 patients would be required to detect an absolute difference of 10% in the complication rate between bilateral breasts treated either with NPWT or SC dressings, assuming 20% of wounds treated with SC dressings and 10% of wounds treated with NPWT develop a healing complication (a 50% reduction) and that there were 26% discordant pairs. This is on the basis of a 2-sided McNemar's test at the α = 5% level of significance and 80% power. The sample size was rounded up to 200. **ITT analysis:** yes, **number randomised:** 200, **number analysed:** 199 **Funding:** Smith & Nephew Wound Management, Inc. **Preregistration:** registered under the name "A prospective, randomised, intra-patient, comparative, open, multi-centre study to evaluate the efficacy of a single-use negative pressure wound therapy (NPWT) System on the prevention of postsurgical incision healing complications in patients undergoing reduction mammaplasty," ClinicalTrials.gov identification number NCT01640366 (clinicaltrials.gov/show/NCT1640366).
Participants	**Location:** multicentre across 6 sites – USA (n = 3), France (n = 1), South Africa (n = 1), the Netherlands (n = 1) **Intervention group:** n = 199, **control group:** n = 199 **Mean age:** 35.7 (18–65), **intervention group:** 35.7 (18–65), **control group:** 35.7 (18–65)

Galiano 2018 *(Continued)*

	Inclusion criteria: women aged > 18 years who had undergone elective surgery for bilateral reduction mammaplasty and having postsurgical incisions of similar length on each breast were included in the study. **Exclusion criteria:** presurgical – pregnancy or lactation, using steroids or other immune modulators known to affect healing, history of radiation of the breast, tattoos in the area of the incision, skin conditions such as cutis laxa that would result in poor healing or widened scars, patients with a known significant history of scar problems (i.e. hypertrophic scarring or keloids), and known allergies to product components. Postsurgical – incisions still actively bleeding and incisions > 12 inches (30 cm) maximum linear dimension.
Interventions	**Aim/s:** to assess the efficacy and cost-effectiveness of the Single-Use Negative Pressure Wound Therapy (NPWT) system (PICO) with regard to the reduction of postsurgical incision healing complications during the immediate postoperative treatment phase, and to assess the medium-term aesthetic appearance and quality of the resultant scar, in patients undergoing reduction mammoplasty, compared with standard care. **Group 1 (NPWT) intervention:** the NPWT device was PICO (Smith & Nephew Medical Limited, Hull, United Kingdom), a portable, single-use (disposable after 7 days) NPWT system delivering -80mm Hg (nominal) negative pressure to the wound surface. Treatment commenced on day 0 and lasted up to 14 days. The pump has a 7-day lifespan, and the associated PICO NPWT dressing is left in place up to 7 days. Each PICO kit comes with 2 NPWT dressings, so, according to the needs of the individual patient and the level of exudate, dressing changes were permitted before 7 days at the investigator's clinical judgement. Participating physicians were advised to discontinue treatment on day 14 and return patients to SC (see below) if the incision was still not closed at this time point. **Group 2 (control) intervention:** 3M STERI-Strip (3M Health Care, St. Paul, Minn.). STERI-Strips were placed along the entire axis of the incision and covered with a dry gauze dressing or nonadherent dressing. Alternatively, investigators could use a nonadherent dry dressing if STERI-Strips were not deemed appropriate by the principal investigator at that site. **Study date/s:** 1 June 2012 to 9 April 2014
Outcomes	• SSI • Dehiscence • Haematoma • Seroma **Validity of measure/s:** N/R **Time points:** 21 days after surgery
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "Treatment randomization was within-patient (i.e. right or left breast) via a central Web site, www.SealedEnvelope.com". Comment: computerised generation of randomisation sequence
Allocation concealment (selection bias)	Low risk	Quote: "Treatment randomization was within-patient (i.e. right or left breast) via a central Web site, www.SealedEnvelope.com". Comment: centralised service used for allocation
Blinding of participants and personnel (performance bias) All outcomes	High risk	Quote: "Treatment could not be blinded". Comment: participants and personnel could not be blinded.
Blinding of outcome assessment (detection bias)	High risk	Quote: "Treatment could not be blinded".

Galiano 2018 *(Continued)*

All outcomes		Comment: this was stated as a limitation for personnel and there was no information that another individual performed the outcome assessment.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Comment: low attrition rate; only 1 participant was not included in the analysis.
Selective reporting (reporting bias)	Low risk	Comment: all prespecified outcomes reported
Other bias	Unclear risk	Comment: unclear if the analysis took account of the paired data resulting from the split-person design.

Giannini 2018

Study characteristics	
Methods	**Study design:** randomised controlled trial **Study grouping:** parallel **Ethics and informed consent:** ethics approved and consent obtained **Follow-up period:** 7 days **Sample size estimate:** power analysis based on 80% chance of detecting decrease in ASEPSIS score from 10 to 5 **ITT analysis:** per-protocol analysis, **number randomised:** 110, **number analysed:** 100 **Funding:** Smith & Nephew **Preregistration:** not reported
Participants	**Location:** Italy (single site) **Intervention group:** 58,**control group:** 52 **Mean age: intervention group** 66.0 (8.9),**control group** 66.8 (11.5) **Inclusion criteria:** patients aged 40 to 80 years old, indicated for hip or knee revision performed through the same surgical approach of primary surgery (hip: direct lateral approach, knee: medial parapatellar approach) **Exclusion criteria:** patients undergoing revision surgery due to periprosthetic fracture or prosthetic joint infection, antibiotic therapy within the last month; declined to take part in the study.
Interventions	**Aim/s:** to compare the effectiveness in wound healing of negative pressure wound therapy versus a standard dressing in patients who underwent hip or knee revision surgery. **Group 1 (NPWT) intervention:** single use, 80 mmHg sub-atmospheric NPWT dressing (PICO, Smith & Nephew, UK) changed only if the dressing was completely saturated with fluids. **Group 2 (control) intervention:** a traditional povidone-iodine gauze and patch wound dressing (sterile folded non-woven gauze swabs, Rays Spa, Italy, and Hypafix dressing retention tape, Essity Aktiebolag, Sweden) changed depending on the wound leakage. **Study date/s:** February 2013 to June 2015
Outcomes	• SSI: the severity of wound infection measured by the ASEPSIS score - a quantitative scoring method using objective criteria based on wound appearance to evaluate wound infection (higher score = worse wound healing; a score > 10 = the increasing probability and severity of infection). • Pain (VAS) at dressing change

Giannini 2018 *(Continued)*

	• Blisters **Validity of measure/s:** the reference for the ASEPSIS score was given in the study report, suggesting the ASEPSIS score is valid. **Time points:** 7 days
Notes	The leading author received honoraria from Smith & Nephew and the study was financially supported by Smith & Nephew.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "Randomisation was performed by a web based, independent randomisation service (Sealed Envelope, UK) to ensure allocation concealment. The allocation was created using permuted blocks." Comment: computer-generated randomisation sequence
Allocation concealment (selection bias)	Low risk	Quote: "Randomisation was performed by a web based, independent randomisation service (Sealed Envelope, UK) to ensure allocation concealment. The allocation was created using permuted blocks." Comment: independent randomisation service used to conceal allocation
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Blinding was not reported but different criteria for dressing changes would have revealed allocation to both participants and personnel.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Quote: "the clinician was blinded regarding to the treatment group". The clinician undertaking the wound evaluation was blinded to treatment group.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Quote: "A number of patients (n = 10) were excluded from the data analysis due to septic loosening of the prosthesis once the results of microbiological and histological examinations were obtained". Comment: 8 participants in the treatment group and 2 in the control group were excluded from the analysis on this basis of the reason of septic loosening which could only be detected postoperatively. The power calculation allowed for a 20% dropout but it was not clear how this differential removal from the analysis may have affected the results.
Selective reporting (reporting bias)	Low risk	No evidence of selective reporting
Other bias	Low risk	No evidence of any other source of bias

Gillespie 2015

Study characteristics

Methods	**Study design:** randomised controlled trial **Study grouping:** parallel

Gillespie 2015 *(Continued)*

	Ethics and informed consent: yes **Follow-up period:** 6 weeks **Sample size estimate:** pilot study **ITT analysis:** yes, **number randomised:** 70, **number analysed:** 70 **Funding:** non-industry **Preregistration:** yes
Participants	**Location:** Queensland, Australia **Intervention group:** n = 35,**control group:** n = 35 (primary hip arthroplasty) **Mean age: intervention group** = 62.5 years (SD 12.4),**control group** = 63.8 years (SD 14.0) **Inclusion criteria:** undergoing elective primary total hip arthroplasty, aged >/= 18 years, able to provide informed consent and attended hospital preadmission clinic. **Exclusion criteria:** people with an existing infection, had previously participated in the trial or were unable to speak and understand English.
Interventions	**Aim/s:** to assess the use of NPWT on surgical sites to prevent infections and other wound complications after elective primary arthroplasty and to determine the feasibility of conducting a larger trial. **Group 1 (NPWT) intervention:** PICO dressing applied over the primarily closed incision by the surgeon in the operating room. On day 5, the dressing was changed to OPSITE Post-Op Visible. **Group 2 (control) intervention:** Comfeel dressing reinforced with 2 absorbent dressings, and then with a self-adhesive, non-woven tape, which was applied over the primarily closed incision by the surgeon in the operating room. Participants were discharged with their dressing intact. **Study date/s:** March 2013 to May 2014
Outcomes	• SSI • Dehiscence • Haematoma • Seroma • Hospital readmission • Cost of dressings **Validity of measure/s:** CDC definitions and criteria for superficial, deep, and organ/space SSI were used for the primary outcome. **Time points:** 30 days and 6 weeks postsurgery
Notes	Investigator contacted for additional details

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "computer generated randomised schedule 1:1 ratio in randomly varying blocks was prepared by the statistician on the research team (not involved in recruitment)".
Allocation concealment (selection bias)	Low risk	Quote: "on skin closure, the RNA opened the next sealed, opaque, numbered envelope".
Blinding of participants and personnel (performance bias) All outcomes	High risk	Quote:"Masking was not possible for those administering the intervention, and nor was it possible to mask the patients receiving it". Comment: personnel and participants were not blinded.

Gillespie 2015 *(Continued)*

Blinding of outcome assessment (detection bias) All outcomes	Low risk	Quote: "the independent outcome assessors as well as the data analyst were blinded to group allocation".
Incomplete outcome data (attrition bias) All outcomes	Low risk	An ITT analysis was used.
Selective reporting (reporting bias)	Low risk	Planned outcomes reported. Protocol pre-registered on ANZCTR.
Other bias	Low risk	None detected

Gillespie 2021

Study characteristics	
Methods	**Study design:** randomised control trial **Study grouping:** parallel design **Ethics and informed consent:** informed consent obtained; approved by the ethics committees of the Royal Brisbane and Women's Hospital and Griffith University **Follow-up period:** 30 days **Sample size estimate:** calculated the sample size based on the proportion of women who developed a SSI within 30 days of CS. Conservatively estimated that 15% of women in the control group were likely to develop an SSI; determined that an absolute reduction in rate of SSI of 5 percentage points would be clinically important. The sample size required to detect a reduction in the cumulative incidence of SSI at 30 days from 15% to 10% was 950 per group (90% power and 5% significance level; inflated the sample size by 10% to allow for loss to follow up (n = 1045/group; total sample size 2090). **ITT analysis:** yes; **number randomised:** 2035**, number analysed:** 2035 **Funding:** Australian National Health and Medical Research Council **Preregistration:** ANZCTR identifier 12615000286549
Participants	**Location**: Australia (4 tertiary hospitals) **Intervention group:** 1017,**control group:** 1018 **Mean age:** 31 (5.5) vs 31 (5.4) **Inclusion criteria**: women booked for elective (category 4) or for semi-urgent (categories 2-3) caesarean section; who recorded a pre-pregnancy BMI of ≥ 30 kg/m^2 and were able to give informed consent. **Exclusion criteria:** women who needed an urgent CS (category 1), had an infection in hospital including during labour or immediately prior to CS, had participated in the trial in a previous pregnancy, or were unable to speak or understand English with no interpreter present.
Interventions	**Aims**: to determine the effectiveness of closed incision negative pressure wound therapy (NPWT) compared with standard dressings in preventing surgical site infection (SSI) in obese women undergoing caesarean section. **Group 1 (NPWT) intervention:** women assigned to the NPWT group received a PICO™ dressing (Smith & Nephew, Hull, UK), which was left intact for approximately 5-7 days as recommended by the manufacturer.

Gillespie 2021 *(Continued)*

	Group 2 (control) intervention: women received the standard hospital dressing. The choice of standard dressings was based on the treating obstetrician's usual choice of dressing, (e.g. hydrocolloid or transparent) applied according to the manufacturer's recommendations. The standard dressing was left intact for 5-7 days.
Outcomes	**Primary** • SSI (including superficial, deep or organ/body space) • Dehiscence • Mortality (included in the serious adverse events outcome) **Secondary** • Haematoma • Seroma • Blistering • Readmission • Reoperation • Pain **Validity of measure/s**: CDC definition for SSI **Time points**: 30 days
Notes	Full cost-effectiveness analysis planned to be reported separately (protocol).

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "We used a web based central randomisation service to randomly assigned eligible, consenting women (1:1) just before the caesarean procedure to receive either a closed incision NPWT dressing or the standard hospital dressing. To ensure that equal numbers of participants were assigned to each group, we used random block sizes of four, six, and eight, stratified by hospital". Comment: appropriate methods used to generate randomisation sequence
Allocation concealment (selection bias)	Low risk	Quote: "Allocation was concealed until after skin closure". Comment: central randomisation service (above) and concealed allocation reported
Blinding of participants and personnel (performance bias) All outcomes	High risk	Quote: "The nature of the intervention meant that women, clinical staff, and research staff were not blinded to treatment after allocation". Comment: unblinded participants and personnel
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Quote: "Data were reviewed by two independent, blinded outcome assessors to determine primary and secondary wound endpoints, and discrepancies were adjudicated by a third blinded assessor. Principal investigators, including the trial statistician, were also blinded to group allocation". Comment: blinded outcome assessment
Incomplete outcome data (attrition bias) All outcomes	Low risk	All randomised women were included in the ITT analysis; only for AE was a per-protocol analysis adopted (this impacts the outcome of blistering) and was prespecified; attrition to PP analysis was low and balanced.

Gillespie 2021 *(Continued)*

Selective reporting (reporting bias)	Low risk	All planned outcomes were fully reported.
Other bias	Low risk	No evidence of any other source of bias; well reported.

Gok 2019

Study characteristics	
Methods	**Study design:** randomised controlled trial **Study grouping:** parallel design **Ethics and informed consent:** ethics approved and consent obtained **Follow-up period:** not given; but mean hospitalisation length in days 13.23 (SD 6.715); the study was terminated on the 7th day if any problem existed. **Sample size estimate:** not reported **ITT analysis:** yes; all participants were included in analysis **Funding:** not reported **Preregistration:** not reported
Participants	**Location:** Turkey **Intervention group (NPWT):** 20 participants; **group 2 (control group):** 20 participants; **group 3 (**aspiration drainage): 20 participants **Mean age:** overall mean age 64.3 years (SD 8.9) (range: 46 to 85 years); **intervention group** - not given; **control group** - not given **Inclusion criteria:** all patients that were subjected to surgical procedures, with risk factors for wound site problems according to the National Nosocomial Infection Surveillance Committee (NNIS) and nosocomial infections. These factors were represented by contaminated wounds, procedures longer than 2.5 hours, obesity, diabetes or chronic obstructive lung disease, high ASA scores, smoking, malnutrition and immunosuppression. **Exclusion criteria:** gynaecological or pregnant patients, relaparotomy candidates and patients scheduled for palliative operations
Interventions	**Aim/s:** "to select the best incision management system to keep the incision edges together and prevent wound opening, and infection by protecting the incision" **Group A (NPWT) intervention:** the postoperative use of negative-pressure incision management system (KCI, Prevena incision management system, USA) **Group B (control) intervention:** standard dressings that were changed, if necessary, 48 hours after the surgery **Group C:** "aspiration drainage, where drains were applied to the subcutaneous space (50 cc negative-pressure system, Bicakcilar, Istanbul, Turkey) but standard dressings were utilised as well. All drains were removed when the amount of daily discharge was lower than 5 cc". **Study date/s:** not reported
Outcomes	• Wound dehiscence • Local signs of surgical site inflammation (endurance, infective discharge, pus and warm skin): data were not fully reported **Validity of measure/s:** not given

Gok 2019 *(Continued)*

	Time points: 7 days treatment
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "Three groups were randomised using a computer-generated system". Comment: it was likely that an appropriate random sequence generation approach was used.
Allocation concealment (selection bias)	Unclear risk	Quote: "Three groups were randomised using a computer-generated system". Comment: no information on allocation concealment
Blinding of participants and personnel (performance bias) All outcomes	High risk	No information but participants (at least) could not be blinded
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	No information
Incomplete outcome data (attrition bias) All outcomes	Low risk	Comment: low attrition rate because all participants were included in the analysis
Selective reporting (reporting bias)	High risk	Comment: it appeared not to report data on local signs of surgical site inflammation (endurance, infective discharge, pus and warm skin). However, it was unclear if this was a prespecified outcome.
Other bias	Low risk	Comment: no evidence of any other source of bias

Gombert 2018

Study characteristics

Methods	**Study design:** randomised controlled trial **Study grouping:** parallel **Ethics and informed consent:** ethics approved and consent obtained **Follow-up period:** 30 days **Sample size estimate:** yes, based on SSI rate expected in treatment group (3%) and difference of 0.14 between groups with 10% dropout **ITT analysis:** no, **number randomised:** 204, **number analysed:** 188 **Funding:** Acelity, San Antonio, TX, USA **Preregistration:** yes
Participants	**Location:** Germany (2 sites) **Intervention group:** 98,**control group:** 90

Gombert 2018 *(Continued)*

	Mean age: intervention group 67.9 (10.1), **control group** 65.2 (8.4) **Inclusion criteria:** vascular surgery for peripheral arterial disease involving longitudinal groin incision for vascular surgical procedures involving the arterial system of the lower extremity or the iliac arteries; a comorbidity profile including smoking (active or past history), cardiac risk factors (e.g. hypertension, coronary heart disease, or history of myocardial infarction), and metabolic disorders (e.g. diabetes, dyslipidaemia, hyperhomocysteinaemia, or chronic renal failure). Dyslipidaemia was defined as hypertriglyceridaemia (> 150 mg/dL) or hypercholesterolaemia (total cholesterol > 200 mg/dL). Chronic kidney disease was defined as glomerular filtration rate (GFR) < 60 mL/min/1.73m^2. **Exclusion criteria:** age below 18 years, pregnancy, local skin infection, simultaneous participation in another clinical trial, and immunosuppressive medication; emergency procedures. When a groin incision was performed on both sides, only 1 side was randomised and assessed for this study.
Interventions	**Aim/s:** to assess the potential benefits of ciNPT application after groin incisions for vascular surgery **Group 1 (NPWT) intervention:** closed incision negative pressure therapy (ciNPT); Prevena (continuous pressure of 125 mmHg); removed 5-7 days postoperatively, after which no further wound dressings were used unless SSIs occurred **Group 2 (control) intervention:** Cosmopore E (Hartmann, Heidenheim, Germany) was applied as the wound dressing; changed daily **Study date/s:** July 2015 to May 2017
Outcomes	• SSI (7 days after the surgery) • Pain • Readmission • Surgical revision (reoperation) **Validity of measure/s:** SSIs were clinically assessed and classified using the Szilagyi classification (grades I-III) **Time points:** 7, 15, 30 days
Notes	Register: Clinicaltrials.gov NCT02395159

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "The randomisation sequence was computer generated using the random allocation rule, and allocation was implemented using a centralised web based system to ensure allocation concealment." Comment: computer-generated randomisation sequence
Allocation concealment (selection bias)	Low risk	Quote: "The randomisation sequence was computer generated using the random allocation rule, and allocation was implemented using a centralised web based system to ensure allocation concealment." Comment: centralised allocation system
Blinding of participants and personnel (performance bias) All outcomes	High risk	Quote: "The nature of the therapy meant that double blinded treatment was not possible. Furthermore, blinding of the vascular surgeons was not achievable". Comment: personnel could not be blinded.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Quote: "Until the seventh day after surgery, each wound was assessed by two physicians. From this point, the wound was assessed by at least three profes-

Gombert 2018 *(Continued)*

		sionals (triple assessment). The involved wound care nurses were blinded. Furthermore, each wound was documented by photography."
Incomplete outcome data (attrition bias) All outcomes	Low risk	16 randomised participants were neither treated nor analysed; their group assignment was unclear. 6 of these did not undergo groin surgery (screening failures), 10 needed reoperation within 48 hours for occlusion of the treated vessel and were treated as dropouts. Fully documented.
Selective reporting (reporting bias)	High risk	Pain data and other device-related complications did not appear to be reported despite being assessed. Trial protocol obtained.
Other bias	Low risk	No evidence of other sources of bias. We noted that antibiotics were used in more people in the control group than in the NPWT group.

Gunatilake 2017

Study characteristics	
Methods	**Study design:** randomised controlled trial **Study grouping:** parallel **Ethics and informed consent:** yes **Follow-up period:** 42 ± 10 days **Sample size estimate:** not stated **ITT analysis:** yes, **number randomised:** 92, **number analysed:** 92 **Funding:** non-industry **Preregistration:** yes
Participants	**Location:** Texas, USA **Intervention group:** n = 46,**control group:** n = 46 **Mean age (SD): intervention group** = 30.4 (5.7),**control group** = 29.7 (5) **Inclusion criteria:** 18 years of age with BMI 35 kg/m^2 at the time of delivery **Exclusion criteria:** women with skin or systemic infections, chorioamnionitis (defined by maternal fever + 1 clinical criterion), critical illness, or high-risk for anaesthesia (ASA class P4, P5, or P6)
Interventions	**Aim/s:** to compare short-term clinical outcomes among obese pregnant women undergoing caesarean delivery who received ciNPT or a standard-of-care dressing. **Primary outcome/s:** SSO: unanticipated local inflammation, wound infection, seroma, haematoma, dehiscence, and need for surgical or antibiotic intervention **Secondary outcome/s:** not stated **Group 1 (NPWT) intervention:** a sterile, "peel-and-place" multilayer dressing (wicking fabric, reticulated foam, and adhesive) was placed over participant's closed incision. The dressing's tubing was then attached to a compact, portable negative pressure therapy unit that delivered 125 mmHg of continuous pressure to the dressing and removed exudates into a disposable canister. Duration of ciNPT was 5 to 7 days, immediately following surgery. **Group 2 (control) intervention:** Steri-Strips (3M Health Care, ½ inch, St Paul, MN), sterile gauze, and Tegaderm (3M Health Care, transparent film dressings (nonpenetrable barrier)) were applied to the closed surgical incision for at least 1 day and no longer than 2 days.

Gunatilake 2017 *(Continued)*

	Study date/s: between 2012 and 2014
Outcomes	• Postoperative SSOs: included unanticipated local inflammatory response, prolonged drainage, fluid collection, dehiscence, and surgical site intervention. • Surgical interventions: included antimicrobials for SSI, surgical drainage of the incision, surgical incision packing, adjunctive negative-pressure therapy, debridement, or reoperation. **Validity of measure/s:** wound scoring system; surgical site assessments included the supplementary outcomes of incisional pain scores at rest and with pressure on the closed incision, as measured by the Wong–Baker Faces Scale. **Time points:** all participants were followed up postoperatively for 42 ± 10 days via periodic incisional assessments (postoperative days 1, 2, 6, 14, and 42).
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Study personnel obtained the next sequentially numbered, opaque randomisation envelope, which contained the randomly assigned treatment group for the participant.
Allocation concealment (selection bias)	Low risk	Study personnel obtained the next sequentially numbered, opaque randomisation envelope, which contained the randomly assigned treatment group for the participant.
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Insufficient information
Blinding of outcome assessment (detection bias) All outcomes	High risk	Although a standardised wound scoring system was utilised to minimise bias, the postoperative examiner was privy to the treatment group.
Incomplete outcome data (attrition bias) All outcomes	Low risk	An ITT analysis was used.
Selective reporting (reporting bias)	Unclear risk	Planned outcomes reported. Protocol preregistered on ClinicalTrials.gov (identifier NCT01450631)
Other bias	Low risk	None detected

Hasselmann 2019a

Study characteristics

Methods	**Study design:** randomised control trial **Study grouping:** parallel design, 2 arms **Ethics and informed consent:** ethics approved, consent informed **Follow-up period:** 3 months

Hasselmann 2019a *(Continued)*

Sample size estimate: assuming a reduced infection rate from 30% to 10% in the open vascular surgery group, 80% power, 5% significance level resulting in a minimal total sample size of 147 inguinal incisions including an anticipated 10% loss to follow-up

ITT analysis: available case analysis

Funding: funded by public Swedish funds stemming from Skåne County (Region Skåne), the Skåne University Hospital, and the Hulda Almroth foundation since 2015. The research group received an unrestricted unconditional research grant and a donation of 100 PICO dressing kits from Smith and Nephew in 2013.

Preregistration: ClinicalTrials.gov NCT01913132

Participants	**Location:** Sweden **Intervention group**: n = 75 participants randomised, 59 analysed; **control group**: n = 79 participants randomised, 61 analysed **Mean age: intervention group** - median 72 years (IQR 9.5), **control group** - median 70 years (IQR 11.6) **Inclusion criteria:** all adult patients scheduled for elective vascular surgery with inguinal incisions **Exclusion criteria:** patients who were unable to comprehend the study, unable to give written consent, or had ongoing infections in the inguinal area
Interventions	**Aim/s:** to determine the effect of negative pressure wound therapy (NPWT) on closed incisions after inguinal vascular surgery regarding surgical site infections (SSIs) and other wound complications **Group 1 (NPWT) intervention:** NPWT dressing (PICO, Smith & Nephew, UK) **Group 2 (control) intervention:** standard wound dressing (Vitri Pad, ViTri Medical, Sweden) or OPSITE Post-Op Visible (Smith and Nephew, London, UK) **Study date/s:** November 2013 to October 2018
Outcomes	• SSI among patients with unilateral incisions • Wound dehiscence • Mortality (reported though not stated as an outcome) • Reoperation (surgical wound revision) (%) • Hematoma (%) • Seroma/lymphocele (%) • Readmission any cause 30 d postoperatively (%) • HRQoL reported in Svensson-Bjork 2020 **Validity of measure/s:** "SSI was reported according to the revised criteria outlined by the Centers for Disease Control and Prevention (CDC), USA ... and, to achieve a higher degree of objectivity, also by the modified ASEPSIS score criteria and definitions..." **Time points:** 3 months (90 days)
Notes	139 inguinal vascular. The unit of randomisation was participating patient's inguinal incisions. Data of Hasselmann 2019a and Hasselmann 2019b were reported in the same publication and collected during the same study. The trial investigators randomised 154 participants with unilateral incisions into two groups and 24 participants (with bilateral incisions, i.e. 48 incisions) into two groups. The former- Hasselmann 2019a used individually randomised trial design whilst the latter Hasselmann 2019b had a split-body design. Therefore, we considered them as two separate evaluations (Hasselmann 2019a for the case of unilateral incisions and Hasselmann 2019b for the case of bilateral incisions).

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "The randomization was conducted by the center's research assistants using opaque randomization envelopes that were prepared with 25 twice-

Hasselmann 2019a *(Continued)*

		folded 'NPWT' sheets and 'Standard' sheets. One randomization sheet was removed from the envelope, the randomization result registered on the informed consent sheet and the randomization sheet subsequently discarded. New randomization envelopes were prepared when required..." Quote: "In this study we apply simple randomization using an opaque randomization envelope containing equal numbers of 'PICO' and 'standard' notes." Comment: low risk of bias because it used a simple randomisation method for cases with unilateral incisions
Allocation concealment (selection bias)	Unclear risk	Quote: "The randomization was conducted by the center's research assistants using opaque randomization envelopes that were prepared with 25 twice-folded 'NPWT' sheets and 'Standard' sheets. One randomization sheet was removed from the envelope, the randomization result registered on the informed consent sheet and the randomization sheet subsequently discarded. New randomization envelopes were prepared when required." Comment: unclear if the allocation was concealed
Blinding of participants and personnel (performance bias) All outcomes	High risk	Comment: no information; nature of intervention made it very unlikely that either could be blinded.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Quote: "The primary outcomes were assessed at the standardized follow-up visits by nurses and physicians in the outpatient clinic, who were not connected to the study and blinded to dressing allocation". Comment: low risk of detection bias
Incomplete outcome data (attrition bias) All outcomes	High risk	Quote: "...178 patients were randomised between November 2013 and October 2018 with the 90-day follow-up completed by December 2018 (Fig. 1). One hundred twenty patients with unilateral incisions ... were included in the analysis". Comment: high risk of bias as the proportion of attrition data (34/154 participants with unilateral incisions) was high; many did not receive the allocated dressing and it was not clear why - this accounted for most of the attrition and the lack of explanation was concerning.
Selective reporting (reporting bias)	Low risk	Comment: all prespecified outcomes were reported.
Other bias	Low risk	Comment: no evidence of other bias

Hasselmann 2019b

Study characteristics	
Methods	**Study design:** randomised control trial **Study grouping:** parallel design, 2 arms; with a split-body design (that is, it randomly allocated different interventions to either the right or left incision of the same person). **Ethics and informed consent:** ethics approved, consent informed **Follow-up period:** 3 months

Hasselmann 2019b *(Continued)*

	Sample size estimate: assuming a reduced infection rate from 30% to 10% in the open vascular surgery group, 80% power, 5% significance level resulting in a minimal total sample size of 147 inguinal incisions including an anticipated 10% loss to follow-up **ITT analysis:** available case analysis **Funding:** funded by public Swedish funds stemming from Skåne County (Region Skåne), the Skåne University Hospital, and the Hulda Almroth foundation since 2015. The research group received an unrestricted unconditional research grant and a donation of 100 PICO dressing kits from Smith and Nephew in 2013. **Preregistration:** ClinicalTrials.gov NCT01913132
Participants	**Location:** Sweden **Intervention group**: 24 incisions randomised (24 participants with bilateral incisions), 19 analysed; **control group**: 24 incisions randomised (24 participants with bilateral incisions), 19 analysed **Mean age: intervention group** - median 73.2 years (IQR 10.1), **control group** - median 73.2 years (IQR 10.1) **Inclusion criteria:** all adult patients scheduled for elective vascular surgery with inguinal incisions **Exclusion criteria:** patients who were unable to comprehend the study, unable to give written consent, or had ongoing infections in the inguinal area
Interventions	**Aim/s:** to determine the effect of negative pressure wound therapy (NPWT) on closed incisions after inguinal vascular surgery regarding surgical site infections (SSIs) and other wound complications **Group 1 (NPWT) intervention:** NPWT dressing (PICO, Smith & Nephew, UK) **Group 2 (control) intervention:** standard wound dressing (Vitri Pad, ViTri Medical, Sweden) or OPSITE Post-Op Visible (Smith and Nephew, London, UK) **Study date/s:** November 2013 to October 2018
Outcomes	The development of SSI or other wound complications in the inguinal area during the first 90 days postoperatively, including: • SSI among patients with bilateral incisions; • surgical wound revision (%); • haematoma (%); • seroma/lymphocele (%); • wound dehiscence; • readmission any cause 30 d postoperatively (%). **Validity of measure/s:** "SSI was reported according to the revised criteria outlined by the Centers for Disease Control and Prevention (CDC), USA ... and, to achieve a higher degree of objectivity, also by the modified ASEPSIS score criteria and definitions..." **Time points:** 3 months
Notes	139 inguinal vascular. The unit of randomisation was participating patient's inguinal incisions. Data of Hasselmann 2019a and Hasselmann 2019b were reported in the same publication and collected during the same study. The trial investigators randomised 154 participants with unilateral incisions into two groups and 24 participants (with bilateral incisions, i.e. 48 incisions) into two groups. The former Hasselmann 2019a used an individually randomised trial design whilst the latter Hasselmann 2019b had a split-body design. Therefore, we considered them as two separate evaluations (Hasselmann 2019a for the case of unilateral incisions and Hasselmann 2019b for the case of bilateral incisions).

Risk of bias

Bias	Authors' judgement	Support for judgement

Hasselmann 2019b *(Continued)*

Random sequence generation (selection bias)	Unclear risk	Quote: "The randomization was conducted by the center's research assistants using opaque randomization envelopes that were prepared with 25 twice-folded 'NPWT' sheets and 'Standard' sheets. One randomization sheet was removed from the envelope, the randomization result registered on the informed consent sheet and the randomization sheet subsequently discarded. New randomization envelopes were prepared when required..." Quote: "In case of bilateral incisions, the randomization result was applied to the right inguinal incision, whereas the left incision received the opposite dressing regime". Quote: "In this study we apply simple randomization using an opaque randomization envelope containing equal numbers of 'PICO' and 'standard' notes. In bilateral groin incisions, the draw from the envelope dictates the wound dressing selection in the right inguinal incision and the contralateral incision is automatically assigned the alternate dressing". Comment: unclear risk of bias because it appeared to use an alternate allocation approach but this evaluation used a split-body design so it was unclear how likely the selection bias would be.
Allocation concealment (selection bias)	Unclear risk	Quote: "The randomization was conducted by the center's research assistants using opaque randomization envelopes that were prepared with 25 twice-folded 'NPWT' sheets and 'Standard' sheets. One randomization sheet was removed from the envelope, the randomization result registered on the informed consent sheet and the randomization sheet subsequently discarded. New randomization envelopes were prepared when required." Comment: unclear if the allocation was concealed
Blinding of participants and personnel (performance bias) All outcomes	High risk	Comment: no information and hard to conceal allocation from participants
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Quote: "The primary outcomes were assessed at the standardized follow-up visits by nurses and physicians in the outpatient clinic, who were not connected to the study and blinded to dressing allocation". Comment: low risk of detection bias
Incomplete outcome data (attrition bias) All outcomes	High risk	Quote: "... (Fig. 1) ... 19 with bilateral incisions were included in the analysis". Comment: high risk of bias as the proportion of attrition data (10/48 incisions) was high
Selective reporting (reporting bias)	Low risk	Comment: all prespecified outcomes were reported.
Other bias	Low risk	Comment: no evidence of other bias, appropriate analysis

Heard 2017

Study characteristics	
Methods	**Study design:** cost-effectiveness analysis. Data drawn from the Chaboyer 2014 RCT **Analytical approach:** trial-based evaluation

Heard 2017 *(Continued)*

	Effectiveness data: data from pilot RCT (N = 87) (Chaboyer 2014). Key effectiveness inputs were SSI and quality of life (SF-12) at up to 4 weeks post-discharge in trial. **Perspective:** Australian public health care provider **Utility valuations:** QALYs were calculated from SF-12 data. QoL indices (utility weights) were calculated using the method of Brazier and Roberts. QALYs were estimated from the utility weights using the standard area under the curve method. **Adjustment:** QALYs were adjusted for differences in baseline SF-12 indices using the regression-based adjustment of Manca, Hawkins and Sculpher. **Measure of benefit:** surgical site infection avoided; QALY **Cost data:** measured in AUSD; in hospital resource use data were collected by direct observation or chart audit during the trial. Included cost of intervention, nursing time for dressing changes, hospital (inpatient) care. No discount rate was applied due to the short time horizon. **Analysis of uncertainty:** a nonparametric bootstrap with 1000 replications was used to construct 95% percentile method confidence intervals (CIs) for the estimates. A sensitivity analysis used only post-discharge QALYs, ignoring the period of hospitalisation (the base case analysis calculating QALYs from utility weights assumed that the change in QoL over the hospital stay was linear). **Funding:** Office of Health and Medical Research, Queensland Health, the National Health and Medical Research Council Centre of Research Excellence in Nursing and a Gold Coast University Hospital Private Practice grant.
Participants	**Location:** Obstetric unit, Australia **Intervention group:** n = 46,**control group:** n = 46 (obese women (> 30 BMI) undergoing elective CS) **Mean age: intervention group** = 30.6 years (SD 5.5),**control group** = 30.7 years (SD 5.0) **Inclusion criteria:** booked for elective CS; pre-pregnancy BMI > 30; able to provide consent. **Exclusion criteria:** women whose condition changed to require urgent CS; previous participation in the trial; existing infection.
Interventions	**Aim/s:** to evaluate whether NPWT is cost-effective compared with standard care in preventing surgical site infection among obese women undergoing caesarean section. **Group 1 (NPWT) intervention:** NPWT: PICO (Smith and Nephew) dressing applied over the primarily closed incision by the surgeon in the operating room. Dressing was left on for 4 days, or longer if drainage continued, unless soiled or dislodged (n = 44) in Heard 2017 trial). **Group 2 (Comparator)** intervention: Comfeel dressing applied over the primarily closed incision by the surgeon in the operating room. Dressing was left on for 4 days, or longer if drainage continued, unless soiled or dislodged (n = 43 in a trial). **Study date/s:** July 2012 to April 2014
Outcomes	For data see Heard 2017 and for clinical data see Chaboyer 2014 in additional table 1 • Surgical site infection • Costs (AUSD) • QALY (measure of benefit). • ICER with 95% CI (AUSD per unit outcome) to inform probability of intervention being cost-effective
Notes	Authors' conclusions: NPWT may be cost-effective in the prophylactic treatment of surgical wounds following elective caesarean section in obese women. Larger trials could clarify the cost-effectiveness of NPWT as a prophylactic treatment for SSI. Sensitive capture of QALYs and cost offsets will be important given the high level of uncertainty around the point estimate cost-effectiveness ratio which was close to conventional thresholds.

Heard 2017 *(Continued)*

	Quality rating according to the CHEERS checklist was 83.3%.

Howell 2011

Study characteristics	
Methods	**Study design:** randomised controlled trial **Ethics and informed consent:** not reported **Sample size calculation:** yes **Follow-up period:** 12 months **ITT analysis:** all participants completed the study **Funding:** the study was supported by KCI, the manufacturer of the negative pressure device.
Participants	**Location:** New York University Hospital for Joint Disorders, New York, NY, USA **Intervention group:** n = 24,**control group:** n = 36 **Mean age:** not reported **Inclusion criteria:** patients undergoing unilateral or bilateral primary total knee arthroplasty who were obese (BMI > 30), who met criteria of increased risk for postoperative wound drainage and who were prescribed enoxaparin sodium for deep vein thrombosis prophylaxis. **Exclusion criteria:** patient refusal to participate in the study, revision total knee replacement, prior knee surgery (except arthroscopy), and patients with documented diabetes mellitus.
Interventions	**Aim/s:** to compare the number of days to dry wound in a negative pressure dressings group compared with a static pressure dressings group**Intervention/s in both groups:** "all patients received three doses of peri-operative intravenous antibiotics and were maintained on subcutaneous DVT prophylaxis for 30 days after surgery". **Group 1 (NPWT) intervention:** "subsequent to the closure of the surgical incision, a negative pressure dressing (VAC Therapy, Kinetic Concepts Inc., San Antonio, Texas) was applied under sterile conditions. A medical grade open cell polyurethane ether foam (pore size of 400-600 micrometers) was cut into the shape of a rectangle approximately 5 cm in width and a length sufficient to cover the entire linear wound. The knee was held in 151° of flexion, and the foam was secured over the incision by the application of a specialized adhesive drape, provided in the NPWT system. An evacuation tube with side ports was embedded within the reticulated foam, allowing negative pressure to be applied equally over the entire wound bed. The foam-evacuation tube complex attached to a programmable vacuum pump applied a -125 mmHg continuous vacuum pressure to the wound. The NPWT dressing remained in place for a 48-hour period, after which time clean, dry gauze dressings were applied and changed on daily basis until the wound was dry". **Group 2 (SPD) intervention:** "patients in the control arm had their surgical wound covered in the operating room with a sterile, dry gauze dressing that was held in place with a perforated, stretchable cloth tape. This initial dressing remained in place for 48 hours after which time clean, dry gauze dressings were applied and changed on a daily basis until the wound was dry". **Study date/s:** not stated
Outcomes	• Days to dry wound • Deep wound infection • Blister formation **Time points:** participants followed up for 12 months postsurgery
Notes	

Howell 2011 *(Continued)*

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	**Comment:** not described
Allocation concealment (selection bias)	Unclear risk	Quote: "randomised with blinded envelopes to either the treatment with negative pressure wound therapy group or a control group using sterile gauze" Comment: unclear if envelopes were sequentially numbered or opaque
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	**Comment:** insufficient information
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	**Evidence:** not described
Incomplete outcome data (attrition bias) All outcomes	Low risk	**Evidence:** 51 participants were randomised, and 51 completed the study.
Selective reporting (reporting bias)	Low risk	**Comment:** the prespecified clinical outcomes were presented in table 1 in the trial report, and a post hoc analysis of blister occurrence was shown in Table 2. Infection rates were reported in the results section of the trial report. We could not find a published protocol.
Other bias	High risk	No baseline data were presented. In addition, groups contained unequal numbers, which could indicate undisclosed losses in 1 group.

Hussamy 2017

Study characteristics

Methods	**Study design:** randomised controlled trial **Ethics and informed consent:** the study was approved by the Institutional Review Board at the University of Texas Southwestern Medical Center; consent during antepartum hospitalisation reported . **Sample size calculation:** 440 participants to detect a 50% decrease in composite outcome **Follow-up period:** 30-60 days **ITT analysis:** yes **Funding:** study devices were provided by Kinetic Concepts Incorporated (San Antonio, Texas) **Preregistration:** NCT02289157
Participants	**Location:** USA; Texas **Intervention group:** n = 222,**control group:** n = 219 **Mean age:** intervention group: 29.1, control group: 30.3 **Inclusion criteria:** women with class III obesity (BMI > 40 kg/m^2) undergoing caesarean delivery

Hussamy 2017 *(Continued)*

	Exclusion criteria: women on anticoagulation, with HIV infection, sensitive skin disorders, or silver or acrylic allergies
Interventions	**Aim/s:** to evaluate the efficacy of incisional negative pressure wound therapy in the prevention of post-operative wound morbidity in women with class III obesity undergoing cesarean delivery **Group 1 (NPWT) intervention:** Prevena Incision Management System which was removed at discharge **Group 2 (control) intervention:** Telfa Adhesive Island Dressing 4310 inches and Steri-Strips **Study date/s:** January 2015 to July 2016 (18 months)
Outcomes	**Validity of measure/s:** not stated **Primary:** Infection, dehiscence, seroma, haematoma **Secondary:** readmission, reoperation **Time points:** 30-60 days
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Block randomisation. The allocation was stratified for the presence of labour. A computer-generated random sequence was used.
Allocation concealment (selection bias)	Low risk	All surgeons and providers were blinded to treatment allocation.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Blinding was not possible, but the risk of bias was recognised.
Blinding of outcome assessment (detection bias) All outcomes	High risk	No blinding of outcome assessment recorded (trial was described as open-label).
Incomplete outcome data (attrition bias) All outcomes	Low risk	441 participants were enrolled and analysed.
Selective reporting (reporting bias)	Unclear risk	Expected outcomes were reported in the abstract (outcomes reported did not exactly match those planned in methods).
Other bias	Low risk	No apparent additional risks of bias; reporting adequate.

Hyldig 2019a

Study characteristics

Methods	**Study design:** cost-effectiveness analysis (economic evaluation based on the Hyldig 2019b RCT) **Analytical approach:** decision-analytic model

Hyldig 2019a *(Continued)*

	Effectiveness data: data from a multicentre RCT (n = 876) (Hyldig 2019b): SSI. Both risk and severity of infection were incorporated. The Danish crosswalk value sets were used to derive preference-based index values. **Perspective:** Danish healthcare **Utility valuations:** QALYs informed by EuroQol EQ-5D-5L (scoring algorithm not specified but Danish-specific context taken into account) were calculated based on SSI costs for superficial and deep SSIs avoided including antibiotic prescription costs and need for further surgery. **Measure of benefit**: surgical site infection avoided; QALY **Cost data:** costs were estimated using data from 4 Danish National Databases and analysed from a Danish healthcare perspective with a time horizon of 3 months after birth. Conversion from DK to Euro using the year 2015 value. No discount rate was applied. Total costs consisted of four cost components: hospital costs; costs of using GPs; costs of antibiotics; and postoperative dressing cost. These were all from the Cost Database. Costs of iNPWT dressing was Euro 151.40, including device itself and time costs for its application. **Analysis of uncertainty:** probabilistic sensitivity analysis including an expanded time horizon and an extrapolation of QALY gain to 5 years (3% annual discount). Deterministic sensitivity analyses conducted to permit determination of possible uncertainty in the ICER that would result from a change in a single parameter in the analysis. Scenario analyses to evaluate the impact of missing cost and QALY data, and the influence of one outlier on the ICER. A subgroup analysis stratifying by BMI explored the impact of the intervention in women with a pre-pregnancy BMI >/= 35.
Participants	**Location:** Denmark (2 tertiary referral centres and 3 Danish teaching hospitals) **Intervention group:** n = 432, **control group:** n = 444 **Mean age:** a range from 18 to 46 years across groups; **intervention group:** 32 (SD 5), **control group** 32 (SD 5) **Inclusion criteria:** pregnant women undergoing elective or emergency caesarean section, aged >= 18 years; who had a pre-pregnancy body mass index >= 30 kg/m^2, and could read and understand Danish. **Exclusion criteria:** women who had given informed consent but subsequently delivered vaginally
Interventions	**Aim/s:** to evaluate the cost-effectiveness of incisional negative pressure wound therapy (iNPWT) in preventing surgical site infection in obese women after caesarean section. **Group 1 (NPWT) intervention:** incisional negative pressure wound therapy (iNPWT; PICO, SIZE 10 x 30 cm or 10 x 40 cm, Smith & Nephew, Hull, UK) in which dressing was left in situ for approximately 5 days (n = 432 in a trial) **Group 2 (control) intervention:** standard postoperative dressing in which dressing was left in situ for at least 24 hours (n = 444 in a trial) **Study date/s:** September 2013 to October 2016
Outcomes	For data see Hyldig 2019a and for clinical data see Hyldig 2019b in additional table 1 SSI Costs (Euro) QALY (measure of benefit). ICER with 95% CrI to inform probability of strategy being cost-effective/dominant using the willingness-to-pay threshold of 30,000 Euro/QALY
Notes	**Authors' conclusions**: Incisional NPWT appears to be cost saving compared with standard dressings but this finding was not statistically significant. The cost savings were primarily found in women with a pre-pregnancy BMI ≥ 35 kg/m^2.

Hyldig 2019a *(Continued)*

Funding: University of Southern Denmark, Odense University Hospital, the Region of Southern Denmark, Lundbeckfonden, and an unrestricted grant from the iNPWT device manufacturer Smith & Nephew (devices and operating funding)

Quality assessment: CHEERS score 91.7%

Hyldig 2019b

Study characteristics	
Methods	**Study design:** pragmatic randomised controlled trial **Study grouping:** parallel **Ethics and informed consent:** yes **Follow-up period:** 30 days **Sample size estimate:** yes; a sample size of 870 for a reduction in surgical site infection of 50% in the intervention group compared with an expected baseline event rate of 10% in the control group, with a two-sided 5% significance level and a power of 80%. **ITT analysis:** yes (for surgical site infection only),**number randomised:** 876, **number analysed:** 876 for surgical site infection and 827 for other outcomes **Funding:** grants from the University of Southern Denmark, Odense University Hospital, the Region of Southern Denmark, Lundbeckfonden, and an unrestricted grant from the iNPWT device manufacturer Smith & Nephew (devices and operating funding) **Preregistration:** yes; ClinicalTrials.gov (NCT 01890720)
Participants	**Location:** Denmark (2 tertiary referral centres and 3 Danish teaching hospitals) **Intervention group:** n = 432, **control group:** n = 444 (6 received iNWPT dressing) **Mean age:** a range from 18 to 46 years across groups; **intervention group:** 32 (SD 5), **control group** 32 (SD 5) **Inclusion criteria:** pregnant women undergoing elective or emergency caesarean section, aged >= 18 years; who had a prepregnancy body mass index >= 30 kg/m^2, and could read and understand Danish. **Exclusion criteria:** women who had given informed consent but subsequently delivered vaginally
Interventions	**Aim/s:** to investigate the effectiveness of prophylactic iNPWT after caesarean section in obese women; hypothesis: iNPWT would be associated with fewer surgical site infection and other wound complications (i.e. wound exudate and dehiscence) compared with standard postoperative dressing. **Group 1 (NPWT) intervention:** incisional negative pressure wound therapy (iNPWT; PICO, SIZE 10 X 30 cm or 10 X 40 cm, Smith & Nephew, Hull, UK) in which dressing was left in situ for approximately 5 days **Group 2 (control) intervention:** standard postoperative dressing in which dressing was left in situ for at least 24 hours **Study date/s:** September 2013 to October 2016
Outcomes	• Surgical site infection, those infections requiring antibiotic treatment within the first 30 days after caesarean section • Deep surgical site infection, those infections requiring surgery • Minor dehiscence, defined as a gap between the sides of the wound • Health-related quality of life (EQ-5D-5L) • Readmissions to hospital/contact to the general practitioner on suspicion of infection following caesarean section (listed in ClinicalTrials.gov)

Hyldig 2019b *(Continued)*

	Validity of measure/s: **Time points:** within the first 30 days after surgery
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "Participants were randomised in the operating theatre during surgery using a web-based randomisation programme with a 1:1 allocation ratio and random block sizes of 4–6, stratified by centre and type of caesarean section (emergency versus elective)." Comment: low risk of bias due to valid random sequence generation
Allocation concealment (selection bias)	Low risk	Quote: "The random allocation sequence was generated by an external data manager with no clinical involvement in the study". Comment: low risk of bias due to likely appropriate approach taken to conceal randomisation process
Blinding of participants and personnel (performance bias) All outcomes	High risk	Quote: "Blinding was not possible due to the nature of the intervention". Comment: high risk of bias because it was clearly stated no blinding of participants and personnel
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Not reported
Incomplete outcome data (attrition bias) All outcomes	Low risk	ITT analysis was conducted for surgical site infection and for other outcomes; only 22 of 432 in Group 1 and 27 of 444 in Group 2 were excluded from analyses. Low risk of attrition bias.
Selective reporting (reporting bias)	High risk	Readmission to hospital/contact to the GP was listed on ClinicalTrials.gov but not presented in the full text. High risk of reporting bias.
Other bias	Low risk	None detected

Javed 2018

Study characteristics

Methods	**Study design:** randomised controlled trial **Study grouping:** parallel **Ethics and informed consent:** yes **Follow-up period:** 30 days after operations **Sample size estimate:** yes; a sample size of 124 patients was assumed to provide a power of 80% to detect a 20% relative reduction in surgical site infection incidence (decreasing from 30% to 10%) at a 2-sided alpha level of 0.05 **ITT analysis:** yes; **number randomised:** 124, **number analysed:** 123

Javed 2018 *(Continued)*

	Funding: KCI/Acelity (Grant number #125164) **Preregistration:** not reported
Participants	**Location:** America (single site) **Intervention group:** n = 62, **control group:** n = 62 **Mean age: intervention group** mean 66.4 (SD 9.3) years, **control group** 66.1 (9.0) **Inclusion criteria:** adults (18 yrs of age) who had a SSI risk score of 1 as defined by the risk score proposed by Poruk and colleagues (Poruk 2016). This included patients who had received neoadjuvant chemotherapy, preoperative biliary stenting, or both. **Exclusion criteria:** pancreaticoduodenectomies (PD) performed minimally invasively or known allergies or sensitivity to silver or acrylic adhesives
Interventions	**Aim/s:** to evaluate the efficacy of negative pressure wound therapy for surgical-site infection (SSI) after open pancreaticoduodenectomy **Group 1 (NPWT) intervention:** negative pressure wound therapy (NPWT) device is shown in Figure S1. The PREVENA™ CUSTOMIZABLE™ device is comprised of a PREVENA™ CUSTOMIZABLE™ dressing, sealing strips, KCI drapes, and Interface Pad. **Group 2 (control) intervention:** standard closure technique **Study date/s:** January 2017 to February 2018
Outcomes	• Surgical site infection defined by the National Health Safety Network definition of the Centers for Disease Control and Prevention (CDC) • Need for reoperation • 30-day readmission related to SSI • Cost of hospitalisation **Validity of measure/s:** **Time points:** 30 days after operation
Notes	Haematoma, seroma, or skin separation were considered under the outcome of surgical site infection (SSI) according to the judgement criteria used for SSI. Data of these outcomes were not extracted or used for this review.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Quote: "Using the simple randomization method, a random allocation sequence was generated." "Once the surgeon committed to performing a PD by ruling out metastatic disease or inoperable local vascular involvement, the circulating nurse contacted the research staff for randomization. The presealed envelope was opened to randomize the patient." Comment: unclear risk of bias because the method of generating random sequence was not specified
Allocation concealment (selection bias)	Low risk	Quote: "Allocation concealment was achieved by printing allocation onto a gray-shaded card that was folded and sealed in a secured envelope before initiation of the study". Comment: low risk of bias given an appropriate strategy was used to conceal allocation

Javed 2018 *(Continued)*

Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Quote: "All patients also received standard infection-prevention measures..." Comment: insufficient information on blinding of participants and personnel
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Quote: "patients' EMR were reviewed independently by the principal investigator (MJW) blinded to study-group assignments to determine if SSI was documented at any time during the 30-day postoperative period." Comment: low risk of bias for SSI because the outcome assessors were blinded
Incomplete outcome data (attrition bias) All outcomes	Low risk	Comment: low risk of bias because 123 of 124 participants randomised were analysed. One of the 62 participants that were randomised to Group 2 (control) was excluded from the analysis because the surgeon decided to use NPWT for that person rather than the control intervention.
Selective reporting (reporting bias)	Low risk	All outcomes listed in the Methods were reported in the Results.
Other bias	Low risk	None detected

Karlakki 2016

Study characteristics	
Methods	**Study design:** randomised controlled trial **Study grouping:** parallel **Ethics and informed consent:** yes **Follow-up period:** 6 weeks **Sample size estimate:** pilot study **ITT analysis:** yes, **number randomised:** 220, **number analysed:** 209 **Funding:** study funded through a grant from Smith & Nephew UK to cover the cost of NPWT dressings and data collection costs. 2 investigators declared they had funding and consultancy fees from Smith & Nephew. **Preregistration:** no
Participants	**Location:** Oswestry, UK **Intervention group:** n = 110,**control group:** n = 110 **Mean age (SD): intervention group** = 69 (9.0),**control group** = 69.2 (9.0) **Inclusion criteria:** patients undergoing total hip or knee arthroplasties (for any indication) with any of 3 consultant surgeons **Exclusion criteria:** patients who had known allergies to dressing, were undergoing revision joint surgery, were unwilling to attend additional clinics, and those on warfarin were excluded.
Interventions	**Aim/s:** to evaluate the effectiveness of incisional negative pressure wound therapy dressing (iNPWTd) **Group 1 (NPWT) intervention:** PICO dressing applied over the primarily closed incision by the surgeon in the operating room. Dressing was left on for 4 days, or longer if drainage continued, unless soiled or dislodged.

Karlakki 2016 *(Continued)*

	Group 2 (control) intervention: Comfeel dressing applied over the primarily closed incision by the surgeon in the operating room. Dressing was left on for 4 days, or longer if drainage continued, unless soiled or dislodged. **Study date/s:** July 2012 to April 2014
Outcomes	• SSI • Blisters • Haematoma • Hospital readmission **Validity of measure/s:** not described **Time points:** 1, 2, and 6 weeks postsurgery
Notes	Investigator contacted for additional details

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "the randomisation was performed using sealed opaque envelopes with a block size of 20 shuffled envelopes". Comment: no sequence generation was required
Allocation concealment (selection bias)	Low risk	Quote: "the randomisation was performed using sealed opaque envelopes with a block size of 20 shuffled envelopes". Comment: allocation was unknown until envelope opened
Blinding of participants and personnel (performance bias) All outcomes	High risk	Quote: "This was a non-blinded single-centre randomised controlled parallel group study". Comment: non-blinded study
Blinding of outcome assessment (detection bias) All outcomes	High risk	Outcome assessors were aware of group allocation.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	7.3% in intervention group and 2.7% in control group PP analysis Comment: more participants were excluded from the analysis in the intervention group (8 intervention vs 3 control).
Selective reporting (reporting bias)	Low risk	Expected outcomes reported
Other bias	High risk	Intervention participants were seen in a wound clinic at 1 week, and control participants were not.

Keeney 2019

Study characteristics

Methods	**Study design:** randomised controlled trial

Keeney 2019 *(Continued)*

	Study grouping: parallel **Ethics and informed consent:** yes **Follow-up period:** 35 days **Sample size estimate:** not reported **ITT analysis:** no; **number randomised:** 526; **number analysed:** 398 **Funding:** institution of authors received research funding from Smith & Nephew Orthopaedics that was related to this study. **Preregistration:** not reported
Participants	**Location:** America (1 site) **Intervention group:** 185 analysed; **control group:** 213 analysed **Mean age: intervention group** 60.6 years, **control group** 60.5 years **Inclusion criteria:** consenting age, surgical treatment with primary or revision THA, surgical treatment with primary or revision TKA; and having an advanced technology device capable of digital photography **Exclusion criteria:** pregnancy, history of poor compliance with medical treatment, allergy to silicone adhesives or polyurethane films, and unwillingness to participate in an RCT
Interventions	**Aim/s:** to assess whether a portable iNPWT device affects wound appearance, postoperative wound drainage, dressing-related complications, wound healing complications, infection rates, and reoperation rates when compared with a standard of care (SOC) postoperative dressing. **Group 1 (NPWT) intervention:** incisional negative pressure wound therapy (iNPWT), a battery-operated, portable NPWT device with an exchangeable cartridge (PICO, Smith & Nephew Orthopaedics, Memphis, TN) with negative pressure applied at 80 mmHg (± 20 mmHg) for an initial period of 7 days. **Group 2 (control) intervention:** a standard of care (SOC) postoperative dressing, including nonadherent incisional cover (Adaptic or Xeroform gauze), 4-inch gauze, and an abdominal dressing. Dressings were changed on postoperative day 2 with subsequent dressing changes performed at 3- to 5-day intervals until the incision was dry. **Study date/s:** enrolment between 1 April 2014 and 31 January 2017
Outcomes	• Superficial and late wound infection rates 7/185 vs. 8/213 • Return to the operating room to manage a wound-related concern within the first 3 months **Validity of measure/s:**. **Time points:**
Notes	The number of patients randomised in either group was not reported. The authors also reported wound appearance, all-cause complications, wound drainage, and dressing concerns outcomes. These outcomes were not extracted for this review. Regarding outcomes of interest to this review, the authors also stated that "Two patients in each group underwent surgical treatment for a superficial wound infection during the first 90 days after surgery... Four TKA patients in the standard dressing control group were returned to the operating room within the first 35 days for management of a wound-related complication but deep infection was not diagnosed". These data were not extracted for this review because it was unclear whether they were systematically collected.

Risk of bias

Bias	Authors' judgement	Support for judgement

Keeney 2019 *(Continued)*

Random sequence generation (selection bias)	Unclear risk	Quote: "A total of 526 patients (22.5%) consented to participate in the study and were randomised into either the iNPWT device or SOC dressing treatment groups". Comment: unclear risk of bias because no method of generating random sequence was specified
Allocation concealment (selection bias)	Unclear risk	Not reported
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Understandably difficult to blind participants and personnel in this trial
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Quote: "Wound appearance was assessed from patient-provided incision photographs by a single trained research team member, blinded to time point and group, using a previously published and validated 100-mm visual analog scale." Comment: it appeared that only wound appearance outcome was assessed in a blinded way. However, this outcome was not of interest to this review. It was unclear whether blinding of outcome assessment was undertaken for other outcomes.
Incomplete outcome data (attrition bias) All outcomes	High risk	Quote: "A total of 526 patients (22.5%) consented to participate in the study and were randomised ... After the initial randomization, 94 patients were excluded ... After excluding 34 unicompartmental knee arthroplasty patients, 398 patients remained for assessment..." Comment: high risk of bias because a high proportion of randomised participants (24%, 128 of 526) were excluded from data analysis.
Selective reporting (reporting bias)	Low risk	All outcomes mentioned in the Methods were reported in the Results though the reporting appeared to be implicit.
Other bias	Low risk	None detected

Kuncewitch 2017

Study characteristics	
Methods	**Study design:** randomised controlled trial **Study grouping:** parallel **Ethics and informed consent:** not reported **Follow-up period:** not reported **Sample size estimate:** not reported **ITT analysis:** yes, **number randomised:** 73, **number analysed:** 73 **Funding:** not reported **Preregistration:** not reported
Participants	**Location:** not reported **Intervention group:** n = 36,**control group:** n = 37

Kuncewitch 2017 *(Continued)*

	Mean age (SD): not reported **Inclusion criteria:** high-risk surgical oncology patients undergoing laparotomy **Exclusion criteria:** not stated
Interventions	**Aim/s:** to investigate the effects of NPWT on short- and long-term wound outcomes in people undergoing pancreatectomy **Group 1 (NPWT) intervention:** NPWT **Group 2 (control) intervention:** standard surgical dressing **Study date/s:** 2012 to 2016
Outcomes	• Postoperative wound complications in the first 30 days • Incisional hernia rates • Rates of pancreatic fistula • Delayed gastric emptying **Validity of measure/s:** not described **Time points:** not stated
Notes	Only the abstract was available.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Not stated
Allocation concealment (selection bias)	Unclear risk	Not stated
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Not stated
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Not stated
Incomplete outcome data (attrition bias) All outcomes	Low risk	73 participants were enrolled and analysed.
Selective reporting (reporting bias)	Unclear risk	Expected outcomes were reported in the abstract.
Other bias	Unclear risk	Abstract only

Kwon 2018

Study characteristics	
Methods	**Study design:** randomised controlled trial

Kwon 2018 *(Continued)*

	Study grouping: parallel **Ethics and informed consent:** yes **Follow-up period:** 30 days **Sample size estimate:** pilot study informed the calculation which was based on power 0.80 to demonstrate reduction from 30% to 15% in SSI. This was based on incisions not patients. **ITT analysis:** no,**number randomised:** 123,**number analysed:** 119 incisions was the unit of analysis; 24 participants had 48 incisions. **Funding:** performed without any support, financial or otherwise, from the makers of the Prevena dressing **Preregistration:** not stated
Participants	**Location:** USA single hospital **Intervention group:** 59,**control group:** 60 incisions; 24 people contributed 48 incisions (24 to each group) **Mean age: intervention group** 64.6 (44-83), **control group** 67.4 (41-84) **Inclusion criteria:** patients aged 18 years and older undergoing elective vascular surgery under the supervision of the Division of Vascular and Endovascular Surgery at Thomas Jefferson University Hospital involving unilateral or bilateral groin incisions; presence of any of the following criteria: body mass index (BMI) > 30 kg/m^2; significant pannus overlying groin skin or abnormal skin as evidenced by fungal infection; reoperative groin surgery; placement of prosthetic vascular graft; poor nutrition (BMI < 18 kg/m^2, cachectic in appearance); immunosuppression (use of any immunosuppressive medications); and poorly controlled diabetes (HbA1c > 8%). **Exclusion criteria:** emergency operation and those unwilling or unable to provide informed consent
Interventions	**Aim/s:** to determine whether application of a negative pressure dressing (Prevena Incision Management System) is superior to a standard surgical dressing in preventing vascular groin wound complications and their associated hospital costs. **Group 1 (NPWT) intervention:** negative pressure dressing (Prevena) applied according to the manufacturer's instructions. It involved application of an antibiotic sponge (0.019% ionic silver), cut to cover the closed groin wound, covered by a clear occlusive dressing attached to a suction device that applied -125 mmHg pressure. This device was inspected daily and left in place for 5 days, after which a dry gauze dressing was placed, inspected and replaced daily until discharge. **Group 2 (control) intervention:** standard surgical dressing consisting of gauze covered by Tegaderm (3M, St. Paul, Minn). This dressing was removed on postoperative day 2 and replaced with a dry gauze dressing that was inspected and replaced daily until discharge. **Study date/s:** 1 January 2015 to 31 December 2016
Outcomes	• SSI • Dehiscence (skin) • Lymph leakage (seroma or fistula) but no Separate data on seroma • Haematoma • Reoperation • Hospital readmission • Costs **Validity of measure/s:** the Szilagyi classification of vascular wound infection was also used to classify the infection. **Time points:** daily until hospital discharge; within 10 to 14 days, whereupon staples were removed; and within 25 to 30 days to complete the study.

Kwon 2018 *(Continued)*

Notes

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Quote: "They used a coin toss to determine whether the patient was to receive standard dressing or negative pressure therapy. To maintain 1:1 randomization as well as to provide future analysis using internal controls, any high-risk patient undergoing bilateral groin incisions would receive both a standard dressing and negative pressure therapy". Comment: adequate method for the unilateral surgery; unclear for the bilateral.
Allocation concealment (selection bias)	Unclear risk	Not stated
Blinding of participants and personnel (performance bias) All outcomes	High risk	Quote: "Other than the fact that the 30-day examination occurred without the overt knowledge of the patient's initial treatment, no blinding was instituted". Comment: the surgical team, clinical staff, and patient were not blinded to the intervention status.
Blinding of outcome assessment (detection bias) All outcomes	High risk	Quote: "Wound assessment was made by both the primary surgeon and nurse practitioners.....Furthermore, a major limitation to the study was that it was not a blinded study and therefore subject to observer bias. Assessment of complications is qualitative, and ultimate management of infections, such as opening an infected wound, was left to the discretion of the attending surgeon." Comment: outcome assessment was performed by an unblinded assessor.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Quote: "Because a contralateral complication would penalize the uncomplicated groin incision in terms of LOS and hospital variable costs, in this circumstance the uncomplicated groin incision data were dropped from consideration in terms of LOS and variable costs". "As such, for the high-risk, standard dressing group (n = 60), five were dropped because of a contralateral complication (n = 55); for the high-risk, Prevena group (n = 59), eight were dropped because of a contralateral complication (n = 51)". In the intervention group, two incisions discontinued intervention because of graft failure postoperative day 1; In the control group, two incisions discontinued intervention because of reopening of incision for graft failure postoperative day 1 and fatal myocardial infarction postoperative day 3. Comment: clear from the study how many participants withdrew and the reasons.
Selective reporting (reporting bias)	Low risk	Comment: protocol not found, but according to the method, all results were reported.
Other bias	Unclear risk	This was a planned interim analysis after 80% recruitment with a stopping guideline if 50% reduction in SSI. The unit of analysis was the incision and the unit of randomisation appeared to be the incision where there was bilateral incision. Unclear how this paired data dealt with in analysis.

Lee 2017a

Study characteristics	
Methods	**Study design:** randomised controlled trial **Study grouping:** parallel **Ethics and informed consent:** yes **Follow-up period:** 6 weeks **Sample size estimate:** not reported **ITT analysis:** no, **number randomised:** 60, **number analysed:** 44 **Funding:** KCI USA Incorporated, an Acelity company **Preregistration:** yes
Participants	**Location:** Canada **Intervention group:** n = 33,**control group:** n = 27 **Mean age (± SD): intervention group** = 67.1 (± 7.2),**control group** = 68.3 (± 9.7) **Inclusion criteria:** receiving an isolated elective or semi-elective CABG and above 18 years of age living within 1 hour of the institution **Exclusion criteria:** emergent surgery, previous CABG or lower leg surgical intervention, severe peripheral vascular disease, dialysis-dependent renal failure, and chronic steroid administration
Interventions	**Aim/s:** to establish the safety and feasibility of using NPWT on the GSV harvest site postcardiac surgery and to examine the effects on infection, complications, and overall patient function **Group 1 (NPWT) intervention:** NPWT device was placed at the time of GSV harvest in the operating room and then maintained in situ until the day prior to hospital discharge or to a maximum of 7 days. The device was removed if poorly tolerated by the participant or for any safety concerns. **Group 2 (control) intervention:** conventional dry gauze dressings **Study date/s:** not stated
Outcomes	• Rates of device complication and malfunction • Rates of SSI, lower leg complications, discharge date, and quality of life at discharge and 6 weeks **Validity of measure/s:** complications were classified as major if they required a medical or surgical intervention. All complications and device malfunctions were recorded. The total length of therapy with the NPWT device was recorded, and also if therapy was prematurely interrupted for any reason. SSIs was determined through assessment of the ASEPSIS score. The incidence of leg complications was also examined including pain, heaviness, weakness, stiffness, itching, paraesthesia, numbness, burning, discolouration, rash, and oedema. These complications were graded as 'not present', 'mild', 'moderate', and 'severe'. Only the moderate and severe complaints were included for incidence analysis. Discharge dates were also recorded for all participants. Self-reported assessments of mobility, overall pain or discomfort, feelings of anxiety or depression, ability for self-care, and ability to perform usual activities were performed. These measures were graded as no issues, some issues, and severe issues or inability. Quality of life was also measured using the EQ-5D-3L Measure of Health Status. **Time points:** initial and 6 weeks
Notes	33 vs 27 participants randomised; high loss to follow-up recorded.

Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**

Lee 2017a *(Continued)*

Random sequence generation (selection bias)	Low risk	Consented patients were randomised by use of sealed ballot envelopes in a 1-to-1 fashion.
Allocation concealment (selection bias)	Unclear risk	Not stated
Blinding of participants and personnel (performance bias) All outcomes	High risk	Quote: "We performed a prospective, randomised, single-blind, single centre, clinical feasibility study". Comment: single-blinded - and the person who was blinded was the outcome assessor.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	A research assistant blinded to the grouping assessed the incision and participant prior to discharge and at 6 weeks postoperatively. A second, unblinded research assistant recorded and managed any device-related complications. Participants were discharged based on standardised institutional discharge criteria.
Incomplete outcome data (attrition bias) All outcomes	High risk	12 participants were lost to follow-up at 6 weeks, 4 in the NPWT group and 8 in the control group. These participants were not included in the data analysis.
Selective reporting (reporting bias)	Low risk	Planned outcomes reported. Protocol registered on ClinicalTtrials.gov (NCT01698372)
Other bias	Unclear risk	High loss to follow-up without reasons for loss being provided; unclear whether additional risks of bias.

Lee 2017b

Study characteristics	
Methods	**Study design:** randomised controlled trial **Study grouping:** parallel **Ethics and informed consent:** yes **Follow-up period:** 90 days **Sample size estimate:** yes **ITT analysis:** no, **number randomised:** 102, **number analysed:** 102 **Funding:** not company funded **Preregistration:** yes
Participants	**Location:** Canada **Intervention group:** n = 53,**control group:** n = 49 **Mean age: intervention group** = 69 ± 10,**control group** = 68 ± 10 **Inclusion criteria:** patients with 1 of the following 3 risk factors for SSIs were enrolled in the trial: obesity defined as a BMI of > 30 kg/m^2, previous femoral artery exposure, or presence of minor or major ischaemic tissue loss. **Exclusion criteria:** patients with pre-existing groin infection, a known allergy to dressing material, or those who could not be followed postoperatively were excluded from the study.
Interventions	**Aim/s:** to perform an RCT to study the role of NPWT on SSI in primarily closed groin incisions after lower extremity revascularisation in vascular surgery patients.

Lee 2017b *(Continued)*

	Group 1 (NPWT) intervention: NPWT remained on until either hospital discharge or postoperative day 8, whichever occurred earlier. **Group 2 (control) intervention:** standard gauze dressing (the dressing removed on postoperative day 2, and then had daily dressing changes with inspection of the wound). **Study date/s:** August 2014 to December 2015
Outcomes	• The incidence of SSI within 30 days of revascularisation • Duration of hospital stay • SSI within 90 days • Reoperation and readmission rate owing to SSI within 90 days • Mortality within 90 days **Validity of measure/s:** SSI was diagnosed using the CDC guideline as a superficial or deep infection. The Szilagyi classification of vascular wound infection was also used to classify the infection. **Time points:** once discharged, both groups were followed up in the clinic at 30 and 90 postoperative days.
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Eligible patients were randomised to NPWT or a standard sterile gauze dressing using an internet-based software, sealedenvelope.com (London, UK), using block randomisation.
Allocation concealment (selection bias)	Unclear risk	Not reported
Blinding of participants and personnel (performance bias) All outcomes	High risk	Quote: "patients and surgeons were not blinded to the treatment they had received". Comment: no blinding of participants or personnel
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Wounds were inspected at each clinic visit by a wound specialist nurse who was blinded to the treatment groups. If she was uncertain, the staff physician determined the presence or absence of an SSI. An SSI could also be diagnosed by the patient care team if there were clinical signs and symptoms of infection.
Incomplete outcome data (attrition bias) All outcomes	Low risk	102 participants were enrolled and analysed.
Selective reporting (reporting bias)	Low risk	Planned outcomes reported. Protocol registered on ClinicalTrials.gov (NCT02084017)
Other bias	Low risk	No other biases detected

Leitao 2020

Study characteristics

Leitao 2020 *(Continued)*

Methods	**Study design:** randomised control trial, abstract available only **Study grouping:** parallel design **Ethics and informed consent:** not stated **Follow-up period:** not stated; the primary outcome data were observed at 30 days postoperatively **Sample size estimate:** not stated **ITT analysis:** not stated; results suggested that all participants were probably included in the analysis **Funding:** not stated **Preregistration:** not stated
Participants	**Location:** USA (obtained from the affiliation addresses of all authors) **Intervention group:** 223 participants; **control group:** 221 participants **Mean age:** median 60 years (range 21 to 88 years); **intervention group** - not stated, **control group** - not stated **Inclusion criteria:** all patients undergoing laparotomy with presumed gynaecologic malignancy; and patients with BMI ≥ 40 kg/m^2 with benign disease **Exclusion criteria:** not stated
Interventions	**Aim/s:** to test whether preventive negative pressure wound therapy decreases the incidence of wound complications in patients of any weight or in those with morbid obesity and benign disease undergoing laparotomy for gynaecologic malignancy. **Group A (NPWT) intervention:** using a negative pressure wound therapy device (Prevena™ Customizable™ Incision Management System, KCI USA, Inc, San Antonio, TX) **Group B (control) intervention:** standard gauze **Study date/s:** February 2016 to August 2019 (the trial was closed to accrual after the second interim analysis because of futility)
Outcomes	• The development of a wound complication • SSI (superficial)* • Dehiscence* • Seroma* • Haematoma* • Pain* • Blistering* **Validity of measure/s:** author contact - superficial SSI used CDC criteria* **Time points:** postoperative 30 days
Notes	The trial was stopped early for futility because, with the second interim analysis, the authors considered that there was only a 3.9% chance that they would conclude with a positive result at the end of full enrolment. Abstract only. *Details of wound complications corresponding to review outcomes from author contact

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Quote: "Randomization, stratified by BMI, occurred only after skin closure with surgical staples was completed".

Leitao 2020 *(Continued)*

		Comment: the random sequence generation method was not specified.
Allocation concealment (selection bias)	Unclear risk	Quote: "Randomization, stratified by BMI, occurred only after skin closure with surgical staples was completed". Comment: the concealment method was not specified.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Comment: unlikely to blind participants due to nature of intervention.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Comment: no information
Incomplete outcome data (attrition bias) All outcomes	Low risk	Quote: "444 evaluable patients had been randomised (223 experimental, 221 control)... A wound complication occurred in 41 patients (18%) in the experimental arm (90% CI 14.1% to 22.7%) compared to 38 (17%) in the control arm (90% CI 13.0% to 21.4%)." Comment: no information on the attrition; but the results reported suggested it was likely to include all participants in the analysis.
Selective reporting (reporting bias)	Unclear risk	Comment: this was an abstract with the primary outcome data alone; but it was unclear if other outcomes were measured in the study.
Other bias	Unclear risk	Quote: "there was only a 3.9% chance that we would conclude with a positive result at the end of full enrollment; therefore, we stopped the trial early for futility. Updated data will be available for presentation." Comment: this study was stopped early; but it was unclear if this early stopping would lead to other bias.

Leon 2016

Study characteristics	
Methods	**Study design:** prospective, randomised, multicentre study **Study grouping:** parallel **Ethics and informed consent:** not reported **Follow-up period:** not reported **Sample size estimate:** not reported **ITT analysis:** yes, **number randomised:** 81, **number analysed:** 81 **Funding:** not reported **Preregistration:** not reported
Participants	**Location:** Spain **Intervention group:** n = 47,**control group:** n = 34 **Mean age (SD):** not reported **Inclusion criteria:** patients undergoing open and programmed colorectal surgery **Exclusion criteria:** not stated

Leon 2016 *(Continued)*

Interventions	**Aim/s:** to evaluate the benefits of negative pressure therapy to reduce surgical site infection rate in open colorectal surgery. **Group 1 (NPWT) intervention:** NPWT **Group 2 (control) intervention:** usual dressing group **Study date/s:** not reported
Outcomes	• SSI rate **Validity of measure/s:** not described **Time points:** a daily evaluation through hospitalisation and a 15- and 30-day evaluation
Notes	Only the abstract was available.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Not stated
Allocation concealment (selection bias)	Unclear risk	Not stated
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Not stated
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Not stated
Incomplete outcome data (attrition bias) All outcomes	Low risk	All enrolled participants were accounted for in the analyses.
Selective reporting (reporting bias)	Unclear risk	Not stated
Other bias	Unclear risk	Abstract only

Lozano-Balderas 2017

Study characteristics

Methods	**Study design:** randomised controlled trial **Ethics and informed consent:** ethics approved **Sample size calculation:** no **ITT analysis:** yes, **number randomised:** 81, **number analysed:** 81 **Follow-up period:** healed (when in hospital) or in a 30-day period after surgery (if discharged)

Lozano-Balderas 2017 *(Continued)*

	Funding: non-industry **Preregistration:** yes
Participants	**Location:** Mexico **Intervention group:** n = 25,**control group:** n = 27, **(3 arms: delayed primary closure group:** n = 29**)** **Median age (IQR): intervention group** = 32 (22 to 46);**control group** = 30 (20 to 43) **Inclusion criteria:** minimum age of 18; a laparotomised wound with class III or IV (contaminated/dirty-infected) surgical wounds **Exclusion criteria:** not specified
Interventions	**Aim/s:** to compare infection rates between primary, delayed primary, and vacuum-assisted closures in contaminated/dirty-infected surgical wounds. **Group 1 (NPWT) intervention:** the VAC was used with routine changes of dressings every 48 hours until healthy granulation tissue was found and a surgeon decided to close it. **Group 2 (control) intervention:** subcutaneous tissue was approximated with polyglycolic acid, and polypropylene was used for the skin. **Study date/s:** January to July 2014
Outcomes	• SSI **Validity of measure/s:** according to the CDC Surgical Wound Classification **Time points:** daily when in hospital or in a 30-day period after surgery
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "patients were allocated to each group with the software Research Randomizer® (Urbaniak, G. C., & Plous, S., Version 4.0)".
Allocation concealment (selection bias)	Unclear risk	Not stated
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	No information
Blinding of outcome assessment (detection bias) All outcomes	High risk	Outcome assessors were aware of group allocation.
Incomplete outcome data (attrition bias) All outcomes	Low risk	81 participants were enrolled and analysed.
Selective reporting (reporting bias)	Low risk	Expected outcomes reported. Protocol retrospectively registered on ClinicalTrials.gov (NCT02649543)
Other bias	Low risk	No other biases detected

Manoharan 2016

Study characteristics	
Methods	**Study design:** randomised controlled trial **Study grouping:** bilateral knees were randomised to intervention or control knees **Ethics and informed consent:** yes **Sample size estimate:** yes, but sample did not reach target, stopped due to financial constraints **Follow-up period:** 10 days **ITT analysis:** yes, **number randomised:** 21, **number analysed:** 21 **Funding:** KCI, Acelity Inc provided the negative pressure wound therapy dressings for the study. **Preregistration:** retrospectively registered as ANZCTR 12615001350516
Participants	**Location:** Queensland, Australia **Intervention group:** n = 21 knees,**control group:** n = 21 knees **Mean age (range):** 66 (45 to 80) **Inclusion criteria:** patients undergoing a bilateral knee arthroplasty **Exclusion criteria:** aged < 18 years or pregnant
Interventions	**Aim/s:** to assess the effect of NPWT on outcomes after primary arthroplasty **Group 1 (NPWT) intervention:** the intervention group received PREVENA Incision Management System, Acelity, KCI, which was placed over the closed surgical incision under sterile conditions at the end of the procedure. The NPWT device provided a continuous negative pressure of 125 mmHg for a duration of 8 days. **Group 2 (control) intervention:** the conventional dry dressing was placed over the closed surgical incision under sterile conditions at the end of the procedure. Neither the type of control dressing nor when the dressing was removed was reported. **Study date/s:** February to December 2014
Outcomes	• SSI • Blisters • Cost • QoL **Validity of measure/s:** no **Time points:** 10 to 12 days postsurgery
Notes	Investigator contacted for additional details

Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Simple randomisation was performed by the research assistants via online computer software that indicated the side to which the intervention, NPWT, would be applied.

Manoharan 2016 *(Continued)*

Allocation concealment (selection bias)	Unclear risk	The surgeons were notified on the day of surgery, before the commencement of the procedure. It was also unclear if consecutive patients for each of the 3 surgeons were recruited.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Quote: "A final evaluation form at the outpatient review assessed the patients rated experience and preference for type of dressing. The final incision assessment was performed by the surgeon and clinic nurse and was witnessed by one of the research assistants. There were no independent observers attached to this assessment." Comment: patients were aware of assignment; appeared that surgeons were not blinded.
Blinding of outcome assessment (detection bias) All outcomes	High risk	The final incision assessment was performed by the surgeon and clinic nurse and witnessed by 1 of the research assistants. There were no independent observers attached to this assessment.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	It was unclear if all participants were accounted for in the results as the numbers analysed for each outcome were not stated.
Selective reporting (reporting bias)	Low risk	Expected outcomes reported. Protocol retrospectively registered as ANZCTR 12615001350516.
Other bias	Unclear risk	No other biases detected but unclear if the analysis took paired data into account.

Martin 2019

Study characteristics	
Methods	**Study design:** RCT **Study grouping:** parallel **Ethics and informed consent:** University of Louisville IRB-approved; patient consent to surgery but not study reported **Follow-up period:** followed up at 7, 15, and 30 days, then subsequently every 2 weeks for 3 months **Sample size estimate:** pilot study; sample size calculations to stop after reaching the minimum sample needed for each arm. Literature suggests SSI rates in this population of at least 32%. Hypothesising a 50% reduction in superficial SSI incidence in patients treated with NPWT, 18 patients for each group were needed to reject the null hypothesis that SSI rates for experimental and control subjects were equal with power of 80% and a type I error probability of 5%. Planning a 15% dropout rate due to device failure meant a sample size of 40 patients, 20 patients in each arm. **ITT analysis:** yes, number randomised: 40, number analysed: 40 **Funding:** not stated; the PICO incisional negative pressure wound therapy devices used in this study were provided by Smith & Nephew, Hull, UK. **Preregistration:** not stated
Participants	**Location:** the trial investigators were based in USA and the single-centre trial was approved by a USA institution. **Intervention group:** 20,**control group:** 20 (11 hepatic resection; 9 pancreatic resection in each)

Martin 2019 *(Continued)*

	Mean age: 60.8 (SD 10.3) years,**intervention group** 59.6 (55.0-66.5), **control group** 61.2 (56.0-71.0), not stated if these were medians and ranges or other values **Inclusion criteria:** patients ≥ 18 years of age who consented to open or laparoscopic hepatic or pancreatic resection and were medically fit to undergo major resection **Exclusion criteria:** not reported
Interventions	**Aim/s:** to determine whether a difference existed in rates of SSI between patients managed with an additional postoperative NPWT versus standard dressings following hepatic and pancreatic surgery, in which the core SSI prevention strategies were used in both groups. **Group 1 (NPWT) intervention:** incisional NPWT (PICO TM, Smith & Nephew, Hull, UK) for 7 days (dressing left in place) **Group 2 (control) intervention:** sterile island dressing **Study date/s:** October 2017 to September 2018
Outcomes	• SSI • Dehiscence • Readmission **Validity of measure/s:** noninfectious and septic wound complications divided into groups of superficial (superficial or deep incisional) infection and organ space infection (OSI), according to Centers for Disease Control and Prevention (CDC) criteria; early readmissions, defined as need for repeated hospitalisation within 6 months from discharge for wound-related complications. **Time points:** 3, 7, 15, 30 days
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Quote: "Patients were randomised to either incisional negative pressure wound therapy (PICO, Smith & Nephew, Hull, UK) or sterile island dressing after stratification according to organ of resection." Comment: method of generating randomisation sequence was not clear.
Allocation concealment (selection bias)	Unclear risk	Quote: "Patients were randomised to either incisional negative pressure wound therapy (PICO, Smith & Nephew, Hull, UK) or sterile island dressing after stratification according to organ of resection." Comment: unclear if appropriate methods were used to conceal allocation.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Comment: appeared likely that it would be impossible to blind participants or personnel to treatment allocation but insufficient information.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Comment: unclear who assessed the outcomes or whether they were blinded to treatment allocation.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Comment: all participants included in the analysis.
Selective reporting (reporting bias)	High risk	Comment: stated that readmissions within 6 months were assessed but this was not reported.

Martin 2019 *(Continued)*

Other bias	Unclear risk	Comment: no evidence of other bias but insufficient information to be sure.

Masden 2012

Study characteristics	
Methods	**Study design:** randomised controlled trial **Ethics and informed consent:** the study was approved by the Georgetown University Institutional Review Board. Consent was not specifically stated, but those patients not capable of undergoing informed consent were excluded. **Sample size calculation:** yes **Follow-up period:** mean 113 days **ITT analysis:** available-case analysis **Funding:** 2 of the investigators are consultants for KCI, and the study was funded by the manufacturer of the intervention product.
Participants	**Location:** Columbus, Ohio, USA **Intervention group:** n = 50,**control group:** n = 43 **Mean age: intervention group** = 61.3 years (range 40 to 101),**control group** = 61.3 years (range 38 to 86) **Inclusion criteria:** patients scheduled to undergo radial forearm free flap **Exclusion criteria:** "patients not capable of undergoing informed consent and those patients with tape allergies or who otherwise could not tolerate NPWT ... patients with lower extremity amputations distal to the forefoot were excluded".
Interventions	**Aim/s:** to evaluate the effect of NPWT on closed surgical incisions. Prospective randomised controlled clinical trial comparing NPWT to standard dry dressings on surgical incisions. **Primary:** "to evaluate the effectiveness of NPWT in patients with multiple comorbidities" **Secondary:** "to evaluate factors that contribute to wound complication" **Intervention/s in both groups:** "the graft was covered with a single layer of paraffin gauze dressing (Jelonet, Smith & Nephew, UK); then, 3 sheets of polyurethane (high-density foam, Nuris Luisa, Santiago, Chile) with a fenestrated silicone drainage tube between the layers [was] placed over the gauze and covered with a transparent adhesive dressing (Opsite, Smith & Nephew, UK) providing the vacuum seal. We used a double layer under the tube to prevent pressure ulcers at the bed of the suction tube". **Group 1 (NPWT) intervention:** "NPWT group ... underwent placement of a V.A.C. system (KCI, San Antonio, Texas) along the line of closure set at -125 mmHg continuous pressure at the time of closure". **Group 2 (control) intervention:** "the control group ... received a standard dry sterile dressing consisting of a non-adhesive silicone layer (Mepitel, Mölnlycke Health Care AB, Göteborg, Sweden) and a bacteriostatic single silver layer (Acticoat, Smith & Nephew, Hull, UK)". **Study date/s:** October 2008 to August 2010
Outcomes	• Wound infection • Dehiscence • Reoperation • LOS **Validity of measure/s:** not stated

Masden 2012 *(Continued)*

	Time points: "all incisions assessed on the third postoperative day ... and reassessed at the first outpatient postoperative visit, as well as any subsequent visit (the last recorded infection was at 66 days post surgery)". However, the abstract stated that "average follow-up was 113 days".
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Evidence:** quote (from correspondence with the author): "used a randomization generator through Excel in groups of 8 (4 controls, 4 experimental)" **Comment:** adequate method
Allocation concealment (selection bias)	Low risk	**Evidence:** quote (from correspondence with the author): "when the patient was recruited ... they contacted one of the investigators and the patient was assigned to whichever group was next on the list". **Comment:** adequate method
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Insufficient information
Blinding of outcome assessment (detection bias) All outcomes	Low risk	**Evidence:** quote: "the evaluations were performed by a member of the research team not involved in the enrolment or the operative treatment and, thus, were blinded as to randomization group". **Comment:** adequate method
Incomplete outcome data (attrition bias) All outcomes	Low risk	**Evidence:** quote: "twelve subjects were lost to follow-up in the immediate postoperative period and were excluded from the final analysis". **Comment:** equal number of losses in both groups.
Selective reporting (reporting bias)	Low risk	**Comment:** protocol unavailable, but expected outcomes reported.
Other bias	Unclear risk	**Comment:** the standard dressing contained a silver layer, which may have influenced the outcome.

Murphy 2019

Study characteristics

Methods	**Study design:** randomised controlled trial **Study grouping:** 2 parallel groups **Ethics and informed consent:** ethics approved and consent obtained **Follow-up period:** 30 days **Sample size estimate:** yes **ITT analysis:** no, **number randomised:** 300, **number analysed:** 284; 16 participants "randomised in error") were not included in analysis

Murphy 2019 *(Continued)*

	Funding: yes **Preregistration:** yes
Participants	**Location:** 2 separate sites within a single hospital system (London Health Sciences Centre, London, Ontario, Canada) **Intervention group:** 144 analysed,**control group:** 140 analysed **Mean age: intervention group** 64 years, **control group** 64 years **Inclusion criteria:** patients who were 18 years or older and scheduled for planned (elective) colorectal resection via laparotomy with midline incision (or booked for laparoscopy if converted to an open procedure with midline incision). Eligible surgical procedures included: segmental, subtotal or total colectomies, as well as low and ultra-low anterior resection. **Exclusion criteria:** patients who were undergoing abdominoperineal resection (APR), pelvic exenteration, emergent colectomy or patients with bowel perforation at the time of operation, who were pregnant, palliative (life expectancy under 3 months) or had a known sensitivity to the NPWT device.
Interventions	**Aim/s:** to determine if negative pressure wound therapy (NPWT) reduces surgical site infection (SSI) in primarily closed incision after open and laparoscopic-converted colorectal surgery. **Group 1 (NPWT) intervention:** NPWT via a continuous vacuum set to -125 mm Hg which remained on until postoperative day (POD) 5 or the date of hospital discharge, whichever came first. **Group 2 (control) intervention:** gauze adhesive dressing which was removed on POD 2 and changed daily thereafter. **Study date/s:** January 2015 to February 2017
Outcomes	• SSI • Mortality • Reoperation **Validity of measure/s:** not reported **Time points:** 30 days postsurgery
Notes	Funding: industry grant from Kinetic Concepts Inc (San Antonio TX). The devices were also supplied free of charge.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: “Randomization will take place centrally using random permutated blocks of 4, 6 or 8 and will be stratified based on site (University Hospital or Victoria Hospital) of the operation.” Comment: adequate method
Allocation concealment (selection bias)	Low risk	Quote: “After the fascia is closed a member of the surgical team will use a centralized web-server to randomize the patient.” Comment: adequate method
Blinding of participants and personnel (performance bias) All outcomes	High risk	Quote: "we performed a single-institution, prospective, randomised, open label, blind endpoint trial". Comment: this was an open-label trial; participants and personnel were not blinded.

Murphy 2019 *(Continued)*

Blinding of outcome assessment (detection bias) All outcomes	Low risk	Quote: "The primary outcome was assessed by a blinded member of our Stoma Wound and Ostomy (SWOT) team or a physician uninvolved in the patient's care at POD five if the patient was in hospital or on the date of discharge if prior to POD five, as well as at the postoperative clinic visit occurring within the first 30 postoperative days." Comment: adequate method
Incomplete outcome data (attrition bias) All outcomes	Low risk	Quote: "Sixteen patients were excluded from the main analysis. Of the 284 patients remaining, we analyzed patients according to assigned group (144 NPWT and 140 Standard Dressing). There was no difference in demographics, type, or surgery performed or indication for surgery between groups." Comment: clear from the study how many participants were excluded; these 16 participants were excluded because they were randomised in error, with reasons given.
Selective reporting (reporting bias)	High risk	Quote: "Secondary outcomes assessed will include the need for, and duration of, at-home nursing care (home care) related to SSI. Additional secondary outcomes assessed will include the length of hospital stay, the number of return visits related to a potential or actual SSI, and cost." Comment: according to the protocol, some secondary outcomes were not reported in the results.
Other bias	Low risk	No evidence of other risk of bias.

NCT00654641

Study characteristics	
Methods	**Study design:** randomised control trial, no information on methods **Study grouping:** parallel design **Ethics and informed consent:** not reported **Follow-up period:** 6 weeks **Sample size estimate:** not reported. The investigators planned to enrol 220 women into the study. **ITT analysis:** not reported **Funding:** West Virginia University **Preregistration:** NCT00654641
Participants	**Location:** USA, West Virginia **Intervention group (NPWT):** 28 (54); **group 2 (control group):** 26 (54) **Mean age: intervention group (NPWT):** not reported; **control group:** not reported **Inclusion criteria:** undergoing Cesarean delivery, at least 18 years of age, weight greater than 199 pounds, depth of subcutaneous tissue (measured from fascia to epidermis) of greater than or equal to 4 centimetres. **Exclusion criteria:** weight less or equal to 199 pounds or less than 4 cm of subcutaneous tissue present, inability to give proper informed consent, inability to adhere to follow-up provisions of the study (return for 2 postoperative visits at 7-14 days postop and between 4-6 weeks postop), patient less than 18 years of age.

NCT00654641 *(Continued)*

Interventions	**Aim/s:** to assess whether applying negative pressure wound therapy to Caesarean section wounds in obese women can reduce the risk of wound complications. **Group A (NPWT) intervention:** negative pressure wound closure **Group B (control) intervention:** standard wound closure **Study date/s:** September 2007 to February 2010
Outcomes	**Outcomes** **Primary:** superficial or deep space surgical site infection, dehiscence, hematoma, seroma **Validity of measure/s:** not reported **Time points:** 7 to 14 days postop and between 4 to 6 weeks postop
Notes	Slow enrolment caused the closure of the trial prior to meeting enrolment target.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Stated randomised controlled trial but details of randomisation not reported.
Allocation concealment (selection bias)	Unclear risk	Not reported
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not reported, but not feasible to blind participants and personnel.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Not reported
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Lost to follow-up. Intervention group: 3/28; control group 2/26. No further details.
Selective reporting (reporting bias)	Unclear risk	No serious adverse events reported in either group. Wound complications: intervention group: 15/26, control group: 10/23. No further details.
Other bias	Unclear risk	Trial stopped early due to poor enrolment. Unclear as to whether risk of any other bias.

NCT01759381

Study characteristics

Methods	**Study design:** randomised controlled trial **Study grouping:** parallel design **Ethics and informed consent:** not stated

NCT01759381 *(Continued)*

	Follow-up period: 3 months **Sample size estimate:** not reported **ITT analysis:** not reported **Funding:** not reported **Preregistration:** NCT01759381
Participants	**Location:** USA **Intervention group (NPWT):** 11 participants; **group 2 (control group):** 8 participants; however, this study was terminated earlier and the estimated sample size was unclear **Mean age:** not reported as mean values **Inclusion criteria:** >/= 18 years of age; >/= 3 level instrumented thoracic, lumbar, or thoracolumbar spinal fusion **Exclusion criteria:** < 18 years of age; < 3 level instrumented thoracic, lumbar, or thoracolumbar spinal fusion; spinal infection at time of surgery; history of immunosuppression or chronic systemic infection; pregnancy; inability to provide informed consent.
Interventions	**Aim/s:** "to evaluate the outcome of incisional negative pressure wound therapy in preventing surgical site infections and wound complications (dehiscence) in high-risk patients undergoing complex spinal surgery" **Group A (NPWT) intervention:** NPWT received as opposed to the standard incisional dressing following complex spinal surgery. **Group B (control) intervention:** no negative pressure wound therapy device; postoperative dressings per the surgeon's standard routine. **Study date/s:** December 2012 to June 2015
Outcomes	Death Number of participants with postoperative infection **Validity of measure/s:** not given **Time points:** 3 months after surgery
Notes	Information is from NCT01759381 registry. This study was terminated earlier and the estimated sample size was unclear. Data were available only for 19 participants.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "The allocation of patients (no NPWT device versus applying an NPWT device) will be determined by computer-generated randomization". Comment: low risk of bias as a proper randomisation method was used.
Allocation concealment (selection bias)	Unclear risk	No information
Blinding of participants and personnel (performance bias) All outcomes	High risk	High risk of bias as NCT01759381 stated this was an open-label trial.
Blinding of outcome assessment (detection bias)	High risk	High risk of bias as NCT01759381 stated this was an open-label trial.

NCT01759381 *(Continued)*
All outcomes

Incomplete outcome data (attrition bias) All outcomes	Unclear risk	No information. The trial was terminated earlier and the estimated sample size was unclear.
Selective reporting (reporting bias)	Low risk	All prespecified outcomes were reported in records of NCT01759381.
Other bias	Unclear risk	This study was terminated earlier and it was unclear how the early stopping affected the study results.

NCT02309944

Study characteristics	
Methods	**Study design:** randomised controlled trial **Study grouping:** parallel design **Ethics and informed consent:** not stated; consent informed **Follow-up period:** 4 weeks **Sample size estimate:** assuming the standard of care group has a complication rate of 25%, the sample size of 200 (100 in each group) could detect a complication rate in the NPWT group of 10% as being statistically significantly lower using a two-sized Z-test with a significance level of 0.05. This represents a clinically significant change in complication rates while remaining a feasible number to recruit within the study sites. **ITT analysis:** not reported as it was unclear how many participants were randomised (93 participants originally consented, 1 withdrew consent and 11 did not return updated HIPAA forms and therefore could not be included in the analysis). **Funding:** not reported **Preregistration:** NCT02309944
Participants	**Location:** USA **Intervention group (NPWT):** 43 participants; **group 2 (control group):** 38 participants; however, 100 participants were expected according to the published data analysis plan **Mean age:** mean 59.1 years (SD 10.4); **intervention group (NPWT):** 59.6 (11.4); **control group:** 58.4 (9.9) **Inclusion criteria:** known or suspected gynaecologic or other abdominal malignancy (such as colorectal, liver, pancreatic, kidney and stomach) for which laparotomy is planned; obese - defined as a Body Mass Index (BMI) ≥ 35 kg/m^2 as calculated in the Epic computer record; 18 years and older (adult, older adult). **Exclusion criteria:** known true tape allergy; sensitivity to silver; history of intolerance to Negative Pressure Wound Therapy.
Interventions	**Aim/s:** "to test whether the use of a new wound closure technique can decrease the rates of wound complications in obese cancer patients" **Group A (NPWT) intervention:** standard surgical closure as used by the standard of care group plus placement of the KCI Prevena™ Incision Management System over the closed incision. It will be removed on postoperative day 2 or 3 as clinically indicated and prior to the patient's discharge from the hospital.

NCT02309944 *(Continued)*

	Group B (control) intervention: standard wound closure, closure of the fascia with a looped polydioxanone (PDS) suture, closure of the subcutaneous space if > 2 cm deep, followed by staple or suture closure of the skin **Study date/s:** not reported
Outcomes	Number of participants who experience wound complications (wound dehiscence or infection) All-cause mortality Serious adverse events (events were collected by non-systematic assessment) Other (not including serious) adverse events (events were collected by non-systematic assessment) **Validity of measure/s:** not given **Time points:** 1 month after surgery (for wound complications outcome)
Notes	Study protocol and statistical analysis plan document was available at NCT02309944. Contact address: Deanna G. Teoh, MD, Mayo Mail Code 395 420 Delaware St SE Minneapolis, MN 55455 Phone: 612-265-6503 Fax: 612-626-0665 Email: dkteoh@umn.edu Author contacted but unable to supply further data on outcomes. Adverse events included: superficial wound infection; requiring readmission. These events were collected by non-systematic assessment.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Quote: "Randomization will occur at the time of registration. To prevent bias and minimize the possibility of confounding, consenting patients will be randomly assigned 1:1 to either NPWT or standard of care". Comment: unclear risk of bias as the random sequence generation method was not specified.
Allocation concealment (selection bias)	Unclear risk	No information
Blinding of participants and personnel (performance bias) All outcomes	High risk	This is an open-label trial as clinicaltrials.gov/ct2/show/results/NCT02309944 stated.
Blinding of outcome assessment (detection bias) All outcomes	High risk	This is an open-label trial as clinicaltrials.gov/ct2/show/results/NCT02309944 stated.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Comment: it was unclear how many participants were randomised. It was stated that 93 participants originally consented, one withdrew consent and 11 did not return updated HIPAA forms and therefore could not be included in the analysis; and of the 81 analysed, 2 had no follow-up data for the primary outcome (wound complications).
Selective reporting (reporting bias)	Low risk	Comment: the data analysis plan was available and data for all prespecified outcomes were reported.
Other bias	Unclear risk	Comment: this trial was expected to enroll 100 participants in each group, but enrolled only 93 and analysed only 81. It seemed to be terminated earlier.

NCT02461433

Study characteristics	
Methods	**Study design:** randomised controlled trial **Study grouping:** parallel design **Ethics and informed consent:** ethics approved; consent informed **Follow-up period:** 5 weeks **Sample size estimate:** alpha set at 0.05, and power of at least 80%; to detect a smallest difference of 17%, a total of 108 patients to be enrolled **ITT analysis:** not reported as this study was terminated earlier and no result was reported **Funding:** not reported; Kinetic Concept Inc. listed as the sponsor **Preregistration:** NCT02461433
Participants	**Location:** USA **Intervention group (NPWT):** 1 participant; **group 2 (control group):** 1 participant; however, 108 participants were expected according to the published data analysis plan but the study was terminated when only 2 participants were included **Mean age:** mean 39.5 years (range 34 to 45); **intervention group (NPWT):** 34 (34 to 34); **control group:** 45 (45 to 45) **Inclusion criteria:** patient has been informed of the nature of the study, and has provided written informed consent, approved by the appropriate Institutional Review Board (IRB)/Medical Ethics Committee (MEC) of the respective clinical site; patient meets the criteria for and is undergoing open surgery at Johns Hopkins Medical Institutes; patient with BMI ≥ 30 at the time of surgery; patient agrees to return for all required clinical follow-up for the study. **Exclusion criteria:** known allergic reaction to acrylic adhesives or silver; known history of intolerance to any component of Prevena Incision Management System TM; very fragile skin around incision site; bleeding disorder or refuses blood transfusion; malignancy or other condition limiting life expectancy to < 5 years; pregnancy.
Interventions	**Aim/s:** "to determine whether application of an incisional wound Prevena trademark (TM) dressing (applies negative pressure to wounds) in the obese (BMI ≥ 30) surgical patient will reduce surgical site infections (SSI) when compared to the standard of care dressing" **Group A (NPWT) intervention:** Prevena Incision Management system, following surgery **Group B (control) intervention:** standard dressing, i.e. standard of care dressing including but not limited to gauze **Study date/s:** not reported
Outcomes	All-cause mortality Incidence of postoperative surgical site infection Dehiscence, seroma and haematoma (reported as number of aggregate events) Readmission events Pain General health **Validity of measure/s:** SSI assessed according to National Healthcare Safety Network - Center for Disease Control guidelines; pain and general health assessed by Short Form Survey (SF)-36

NCT02461433 *(Continued)*

	Time points: 7 days after surgery (for SSI); 14 days for other outcomes
Notes	The study was terminated when only 2 participants were included, though 108 participants were expected to be included according to the published data analysis plan. Data were available on the ClinicalTrials.gov and the published data analysis plan, and were only available for the two participants.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "Randomization will be divided into 4 strata based on the patient's diabetes and smoking statuses (diabetic smoker/diabetic non-smoker/non-diabetic smoker/non-diabetic non-smoker). The 4 strata have been computer-generated in a 1:1 ratio of Prevena vs standard dressing in each strata". Comment: low risk of bias due to the use of a proper randomisation method.
Allocation concealment (selection bias)	Unclear risk	No information
Blinding of participants and personnel (performance bias) All outcomes	High risk	Quote: "This is a prospective single blinded randomised clinical trial. It is blinded in order to minimize any potential bias the participants may have for or against the new Prevena in comparison to the standard of care dressing". Comment: high risk of bias as this was a single-blinded study and personnel were not blinded.
Blinding of outcome assessment (detection bias) All outcomes	High risk	High risk of bias as this was a single-blinded study and assessors were probably unblinded.
Incomplete outcome data (attrition bias) All outcomes	Low risk	This study was terminated earlier and none of the only 2 participants randomised was lost to follow-up.
Selective reporting (reporting bias)	Low risk	All prespecified outcomes were reported for the only 2 participants randomised.
Other bias	Unclear risk	This study was terminated earlier as sponsor stopped funding and the risk of bias due to the early stopping was unclear for this case.

Newman 2019

Study characteristics

Methods	**Study design:** randomised controlled trial **Study grouping:** Parallel **Ethics and informed consent:** **Follow-up period:** 12 weeks **Sample size estimate:** determined using an estimated wound complication rate (associated with current standard of care protocols) of 20% and a desired wound complication rate of 5%. Using a significance level of 0.05 with a power of 80%, the sample was estimated at 160 total subjects, with 80 subjects assigned to each group. **ITT analysis:** yes,**number randomised:** 160, **number analysed:** 159

Newman 2019 *(Continued)*

	Funding: KCI/Acelity Inc. (San Antonio TX) **Preregistration:** Yes
Participants	**Location:** US Hospital **Intervention group:** 80,**control group:** 80 **Mean age: intervention group** 65 (SD 11), **control group** 65 (SD 11) **Inclusion criteria:** patients who were scheduled to undergo revision THA or TKA by one of the 6 fellowship-trained orthopaedic surgeons met at least 1 of the following criteria: body mass index greater than 35 kg/m^2, use of anticoagulants other than aspirin, peripheral vascular disease, depression, diabetes mellitus, current smoker, history of a periprosthetic joint infection in the limb undergoing revision surgery, on immunomodulators or corticosteroids, current history of cancer or haematological malignancy, inflammatory arthritis, renal failure or dialysis, malnutrition, liver disease, history of organ transplant, or human immunodeficiency virus infection. **Exclusion criteria:** lived more than 100 miles from the hospital, less than 18 years of age, had a silver allergy, had a history of wound coverage with soft tissue flaps on the index joint, or had a recent acute wound complication (i.e. defined as less than 4 weeks since previous surgery in the affected joint). Additionally, patients were excluded if they were enrolled in another interventional study, had no risk factors, undergoing a conversion arthroplasty, were not having implants revised, surgery was cancelled, altered mental status, and were screened but already met enrolment capacity.
Interventions	**Aim/s:** to compare the use of ciNPWT with our standard of care dressing in revision arthroplasty patients who were at high risk to develop wound complications **Group 1 (NPWT) intervention:** ciNPWT device (PREVENA; KCI/Acelity, San Antonio, TX) for at least 2 days unless a wound complication was reported **Group 2 (control) intervention:** standard of care silver-impregnated wound dressing (AQUACEL; ConvaTec, Greensboro, NC) for at least 7 days unless a wound complication was reported **Study date/s:** eligibility assessed from August 2014 to January 2017
Outcomes	• SSI • Dehiscence • Haematoma • Blisters • Readmission • Reoperation **Validity of measure/s:** clear definitions given but not using validated measures **Time points:** 2, 4 and 12 weeks
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote "Patients who consented and enrolled to be included in the study were block randomised by categorizing as hip or knee surgery groups and then were assigned a sealed, opaque envelope that was randomly generated by an independent researcher who allocated them." Comment: computer-generated randomisation sequence
Allocation concealment (selection bias)	Low risk	Quote "an independent researcher [ ] who allocated them [in] groups and then were assigned a sealed, opaque envelope that was randomly generated by an independent researcher who allocated them to receive either a ciNPWT device

Newman 2019 *(Continued)*

		(PREVENA; KCI/Acelity, San Antonio, TX) or the standard of care silver-impregnated wound dressing (AQUACEL; ConvaTec, Greensboro, NC). The envelopes were opened on the day of surgery and the surgeon was informed as to which group the patient was randomly assigned at the time of dressing placement. After a patient consented to be involved in the study, the next sequential envelope was selected." Comment: central allocation-generated opaque sealed sequential envelopes
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	The nature of the intervention made blinding of participants and some personnel very difficult but no clear information.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Quote "Wounds were examined at 2, 4, and 12 weeks after the procedure. Any complication reported was visualised at the time of the evaluation." Comment: did not state who performed the outcome assessment or whether they were blinded to intervention group.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Quote "One patient in the treatment arm was lost to follow-up and was not included in the analyses." Comment: all except 1 participant were included in the analysis.
Selective reporting (reporting bias)	Low risk	All of the planned outcomes were fully reported.
Other bias	Low risk	No evidence of additional bias and reasonable reporting to suggest none.

Nherera 2017

Study characteristics	
Methods	**Study design:** cost-effectiveness analysis (based on the Karlakki 2016 RCT) **Analytical approach:** trial-based decision analytic model (Based on Karlakki 2016, N = 220) **Effectiveness data:** data from the UK trial (Karlakki 2016) **Perspective:** UK National Health Service **Utility valuations:** time horizon of 6 weeks for surgical site complications (SSI) avoided and length of stay. Expected complications in standard care taken from the RCT. No discount rate was applied due to the short time horizon. Complications were assumed to have standard costs, readmission was excluded from the base case. Utility values were obtained from converting quality of life that was measured using SF-36. **Measure of benefit:** surgical site complication avoided; QALY (obtained from the NICE guideline on surgical site infections 2008). **Cost data**: costs derived from standard cost references with resource utilisation valued in GBP (2015/16). Costs were also converted to USD by factor 1.42. (1) NHS reference costs of relevant medical diagnosis groups used for inpatient care (with confidence intervals). Model assumed all standard care dressing costs and nursing costs included in these. (2) Cost of a GP visit taken from Unit Costs and Social Care 2015–2016; (3) costs of oral antibiotics taken from the national Drug Tariff; length of stay (not considered in costs) (4) Cost of NPWT was taken from the national Drug Tariff. **Analysis of uncertainty:** sensitivity analysis used to model discounted price for intervention through NHS bulk purchasing; additional length of stay following complications and readmission. Baseline da-

Nherera 2017 *(Continued)*

	ta were varied across the 95% CI from the trial. Probabilistic sensitivity analysis for cost-effectiveness at willingness-to-pay threshold.
Participants	**Location:** UK hospital **Intervention group:** n = 110,**control group:** n = 110 **Mean age (SD): intervention group** = 69 (9.0),**control group** = 69.2 (9.0) **Inclusion criteria:** patients undergoing THAs or TKAs (for any indication) with 3 consultant surgeons (SLK, NMG, and RDB – authors of this study) **Exclusion criteria:** patients who had known allergies to dressing, were undergoing revision joint surgery, were unwilling to attend additional clinics, and those on warfarin were excluded.
Interventions	**Aim/s:** to evaluate the cost-effectiveness of single-use negative pressure wound therapy in patients undergoing primary hip and knee replacements **Group 1 (NPWT) intervention:** incisional negative pressure wound therapy dressing (iNPWTd) PICO dressing applied over the primarily closed incision by the surgeon in the operating room. Dressing was left on for 1 week (n = 110). **Group 2 (Control) intervention:** conventional dressing (either Mepore (Mölnlycke Health Care AB) or Tegaderm (3M Health Care Ltd)) applied over the primarily closed incision by the surgeon in the operating room. Dressing was left on for an unspecified period, and changed to OPSITE Post-Op Visible dressing on the second postoperative day (n = 110). All patients received enoxaparin postsurgery. **Study date/s:** July 2012 to April 2014
Outcomes	For data see Nherera 2017 and for clinical data see Karlakki 2016 in additional table 1 Costs (GBP) SSI complications avoided QALY (measure of benefit) Probability of being cost-effective using NICE threshold of £20,000/QALY
Notes	Funding: 2 authors are employees of Smith & Nephew. The Karlakki 2016 RCT was funded by Smith & Nephew. Authors' conclusions: single-use negative pressure wound therapy can be considered a cost-saving intervention to reduce surgical site complications following primary hip and knee replacements compared with standard care. Providers should consider targeting therapy to those patients at elevated risk of surgical site complications to maximise efficiency. Quality rating using the CHEERS checklist was 85.4%.

Nherera 2018

Study characteristics	
Methods	**Study design:** cost-effectiveness analysis (based partly on the Witt-Majchrzac 2015 RCT) **Analytical approach:** Decision analytic model **Effectiveness data:** baseline data on revision operations, length of stay, readmissions to hospital, and mortality were derived from single-centre prospective observational study over 36 months in Germany. Effectiveness data for NPWT were taken from the trial (n = 80) of Witt-Majchrzac 2015 (SSI and wound dehiscence). A length of stay reduction was applied from a meta-analysis (Strugala 2017). All-cause

Nherera 2018 *(Continued)*

	mortality was obtained from German Federal Statistical Office and assumptions about relationship between mortality and revision surgery applied from literature. **Perspective:** Germany Statutory Health Insurance payer **Utility valuations:** Health state utilities were sourced from published literature including discharge with and without complications from study by Tuffaha 2015. **Measure of benefit:** Wound healing without complications (complications avoided); QALY **Cost data:** Costs derived from standard cost references, resource utilisation valued in Euro. Inpatient care taken data from Cristofolini 2012. Patient stay costs from hospital management site; reimbursement cost for procedure from Germany Diagnosis Relater group Report Browser 2017. Standard care dressing's costs and nursing costs covered in the diagnosis-related group costs. Rehabilitation costs obtained from a study by Zeidler 2008. One community doctor and cardiologist visit cost, and the cost of community nurse visit once a week estimated. No discounting done due to a short time horizon (12 weeks) **Analysis of uncertainty:** One-way sensitivity analyses; probabilistic sensitivity analyses using Monte Carlo simulation; subgroup analysis for people with high BMI
Participants	**Location:** Hospital, Poland **Intervention group:** n = 40,**control group:** n = 40 **Mean age: intervention group** = 66.2 (± 8), 53 to 80,**control group** = 62.1 (± 9.1), 41 to 78 **Inclusion criteria:** patients who underwent an off-pump coronary artery bypass grafting procedure, using the internal mammary artery **Exclusion criteria:** not stated
Interventions	**Aim/s:** To estimate the cost-effectiveness of single use negative pressure wound therapy (sNPWT) compared with standard of care in patients following coronary artery bypass grafting surgery (CABG) procedure to reduce surgical site complications (SSC) defined as dehiscence and sternotomy infections **Group 1 (NPWT) intervention:** Primary closure with NPWT (PICO, Smith & Nephew) using continuous negative pressure of −80 mmHg. Dressing changed on day 2 or 3 and on day 5 or 6 after surgery. **Group 2 (control)** Conventional dressings applied after primary closure. Dressings changed daily **Study date/s:** not stated
Outcomes	**Outcomes** (for data see additional table 1; for clinical data see Witt-Majchrzac 2015) Costs Wound healing without complication (complications avoided); QALY (measure of benefit) ICER Probability of being cost-effective
Notes	Authors' conclusions: The sNPWT can be considered a cost-saving intervention that reduces surgical site complications following CABG surgery compared with standard care. We however recommend that additional economic studies should be conducted as new evidence on the use of sNPWT in CABG patients becomes available to validate the results of this economic analysis. Funding: NR for economic evaluation; see Witt-Majchrzac 2015 for RCT funding Quality rating using the CHEERS checklist was 87.0%.

Nordmeyer 2016

Study characteristics	
Methods	**Study design:** randomised controlled trial **Study grouping:** parallel **Ethics and informed consent:** yes **Sample size estimate:** no **Follow-up period:** unknown **ITT analysis:** yes, **number randomised:** 20, **number analysed:** unclear **Funding:** unclear. MHB gave scientific presentations for KCI. **Preregistration:** no
Participants	**Location:** Nuremberg, Germany **Intervention group:** n = 10,**control group:** n = 10 **Mean age: intervention group** = 52.3 (16.3),**control group** = 57.8 (15.2) **Inclusion criteria:** patients with spinal fractures who were scheduled for internal fixation **Exclusion criteria:** not reported
Interventions	**Aim/s:** to evaluate the different aspects of wound healing in spinal fractures treated with internal fixation **Group 1 (NPWT) intervention:** the iNPWT group was treated with a PICO system (Smith & Nephew, UK). The PICO system was left on the wound for 5 days including the day of surgery. In addition to daily clinical examination, all wounds/seroma were analysed by ultrasonography on day 5 and day 10 after surgery. **Group 2 (control) intervention:** standard department wound dressing consisting of dry wound coverage (compresses attached to the skin) was used. **Study date/s:** not reported
Outcomes	• Seroma **Validity of measure/s:** ultrasound was used as a standardised imaging modality to detect seromas in the wound area. **Time points:** day 5 and day 10 after surgery
Notes	Investigator contacted for additional details.

Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Not reported
Allocation concealment (selection bias)	Unclear risk	Not reported
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Not reported

Nordmeyer 2016 *(Continued)*

Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Not reported
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Numbers analysed were not reported.
Selective reporting (reporting bias)	Unclear risk	Only seroma reported, not wound infection; unclear if all planned outcomes addressed.
Other bias	Low risk	None identified

O'Leary 2017

Study characteristics	
Methods	**Study design:** randomised controlled trial **Study grouping:** parallel **Ethics and informed consent:** yes **Sample size estimate:** yes, but it was based on a reduction in SSI from 35% to 10% **ITT analysis:** yes, **number randomised:** 50, **number analysed:** 49 **Follow-up period:** 30 days **Funding:** support was received from Smith & Nephew. The authors were responsible for trial design, data analysis, and manuscript writing. The decision to publish trial results was made between study authors and study sponsors. **Preregistration:** ClinicalTrials.gov registration NCT02780453 (registered after study completed – May 2016)
Participants	**Location:** Limerick, Ireland **Intervention group:** n = 25,**control group:** n = 25 **Mean age: intervention group** = 58 (range 31 to 73),**control group** = 63 (range 33 to 76) **Inclusion criteria:** patients undergoing elective or emergency open abdominal surgery with a clean, clean-contaminated, or contaminated wound. **Exclusion criteria:** dirty wound; BMI ≥ 40; ASA grade > 3
Interventions	**Aim/s:** to assess the effect of NPWT on SSI **Group 1 (NPWT) intervention:** PICO dressing (Smith & Nephew) was applied to the wound by the operating surgeon, and the edges of the dressing were reinforced with self-adherent tape. **Group 2 (control) intervention:** transparent waterproof dressing (Smith & Nephew) **Study date/s:** February 2013 to April 2016
Outcomes	• SSI • Reoperation • Pain **Validity of measure/s:** CDC definitions and criteria for superficial, deep, and organ/space SSI were used for the primary outcome. A visual analogue scale was used to assess pain.

O'Leary 2017 *(Continued)*

	Time points: day 4 and day 30 postsurgery
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Randomisation codes were generated on www.randomization.com.
Allocation concealment (selection bias)	Unclear risk	Allocation was performed using a "closed envelope method".
Blinding of participants and personnel (performance bias) All outcomes	High risk	Quote: "A randomised, controlled, open-label trial" Comment: no blinding
Blinding of outcome assessment (detection bias) All outcomes	High risk	Quote: "the ... study assessor was a senior member of the operating surgical team. The study assessor was not blinded to the treatment group".
Incomplete outcome data (attrition bias) All outcomes	Low risk	1 participant was removed from the intervention arm for a protocol violation, but ITT analysis was provided.
Selective reporting (reporting bias)	Low risk	Expected outcomes reported, but the study protocol was published after the completion of the trial.
Other bias	Low risk	No other bias identified

Pachowsky 2012

Study characteristics

Methods	**Study design:** randomised controlled trial **Ethics and informed consent:** ethics approved and consent obtained **Sample size calculation:** no **ITT analysis:** yes, **number randomised:** 19, **number analysed:** 19 **Follow-up period:** 10 days **Funding:** support received from Smith & Nephew. The authors were responsible for trial design, data analysis, and manuscript writing. The decision to publish trial results was made between study authors and study sponsors. **Preregistration:** no
Participants	**Location:** University Hospital, Erlangen, Germany **Intervention group:** n = 9,**control group:** n = 10 **Mean age: intervention group** = 66.2 years (SD 17.83),**control group** = 70.0 years (SD 11.01) **Inclusion criteria:** "consecutive patients who were scheduled for a total hip arthroplasty (THA) for osteoarthritis of the hip were randomised".

Pachowsky 2012 *(Continued)*

	Exclusion criteria: not stated
Interventions	**Aim/s:** to evaluate the use of NPWT to improve wound healing after total hip arthroplasty **Intervention/s in both groups:** "the surgical intervention was identical for both groups. All patients received two Redon drains, one in the deep area of the wound close to the prostheses and one above the closed fascia. The postoperative physiotherapy and mobilisation was also identical for both groups. Both groups received perioperative prophylaxis with antibiotics either Augmentin (amoxicillin trihydrate with potassium clavulanate) or ciprofloxacin". **Group 1 (NPWT) intervention:** "the NPWT group was treated with a PREVENA™ system (KCI, San Antonio, USA). The PREVENA system was left on the wound for five days including the day of surgery". **Group 2 control:** the control group received "the standard wound dressing of our department, consisting of a dry wound coverage". **Study date/s:** not stated
Outcomes	• Incidence of seroma (by ultrasound) • Amount of wound drainage in the Redon drain canisters • Duration of prophylactic antibiotics • Secretion from the wound **Validity of measure/s:** "all patients underwent an ultrasound (Zonare, Z.one Ultra SP 4.2, Erlangen, ZONARE Medical Systems, Inc., Mountain View, USA) of the wound". **Time points:** day 5 and day 10 of postoperative period
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Not stated
Allocation concealment (selection bias)	Unclear risk	Not stated
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Not stated
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Dressings were left in place for 5 days. The ultrasound was performed on day 5. It was unclear if the person performing the ultrasound was aware of the group to which the participant had been allocated.
Incomplete outcome data (attrition bias) All outcomes	Low risk	All enrolled participants were accounted for in the analyses.
Selective reporting (reporting bias)	Low risk	Results for outcomes identified in the methods section were reported. We did not see the original protocol.
Other bias	High risk	**Evidence:** quote: "Matthias H. Brem gave scientific presentations for KCI. The PREVENA wound treatment system was provided by KCI free of charge". Support was received from Smith & Nephew. The authors were responsible for trial design, data analysis, and manuscript writing. The decision to publish trial results was made between study authors and study sponsors.

Pachowsky 2012 *(Continued)*

	1 participant in the NPWT group removed the Redon drain by himself on the first postoperative day.

Pauser 2016

Study characteristics	
Methods	**Study design:** randomised controlled trial **Study grouping:** parallel **Ethics and informed consent:** yes **Sample size estimate:** no **Follow-up period:** 10 days **ITT analysis:** yes, **number randomised:** 21, **number analysed:** 21 **Funding:** "Prevena wound treatment system was provided by KCI free of charge". **Preregistration:** no
Participants	**Location:** Nuremberg, Germany **Intervention group:** n = 11,**control group:** n = 10 **Mean age: intervention group** = 81.6 ± 5.2 years,**control group** = 82.6 ± 8.6 years **Inclusion criteria:** patients with femoral neck fracture who were scheduled for hip hemiarthroplasty **Exclusion criteria:** not stated
Interventions	**Aim/s:** "to evaluate different aspects of wound healing after fractures of the femoral neck treated by hemiarthroplasty" **Group 1 (NPWT) intervention:** the iNPWT group was treated with a PREVENA system (KCI, San Antonio, Texas). The PREVENA system was left on the wound for 5 days including the day of surgery. **Group 2 control:** control group received the standard wound dressing of our department, consisting of a dry wound coverage (compresses attached to the skin). **Study date/s:** not reported
Outcomes	• Seroma **Validity of measure/s:** ultrasound was used as a standardised imaging modality to detect seromas in the wound area. **Time points:** day 5 and day 10 after surgery
Notes	Investigator contacted for additional details.

Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Insufficient information given
Allocation concealment (selection bias)	Unclear risk	Insufficient information given

Pauser 2016 *(Continued)*

Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Insufficient information given
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Insufficient information given
Incomplete outcome data (attrition bias) All outcomes	Low risk	All those recruited appeared to have been included in the analysis.
Selective reporting (reporting bias)	Unclear risk	Unclear if all the planned outcomes were reported fully.
Other bias	Unclear risk	Data for the NPWT group reported at day 5 and day 10, but data for the control group only reported overall.

Pleger 2018

Study characteristics	
Methods	**Study design:** randomised controlled trial **Study grouping:** parallel **Ethics and informed consent:** yes **Sample size estimate:** no **Follow-up period:** 30 days postoperatively **ITT analysis:** yes, **number randomised:** 129 groin incisions (100 participants), **number analysed:** 129 incisions **Funding:** "funded by our own department, without any financial or scientific involvement or support from KCI, ACELITY Company" **Preregistration:** no
Participants	**Location:** Germany **Intervention group:** n = 58 incisions,**control group:** n = 71 incisions **Mean age: intervention group** = 71 (range 54 to 89),**control group** = 66.5 (range 41 to 86) **Inclusion criteria:** vascular procedures with access to the common femoral artery with at least 1 of the known main risk factors of wound healing: age > 50 years, diabetes mellitus, renal insufficiency, malnutrition, obesity, and chronic obstructive pulmonary disease. **Exclusion criteria:** not stated
Interventions	**Aim/s:** to investigate the effectiveness of ciNPT compared with conventional therapy with regard to the incidence of groin WHC on postoperative days 5 to 7 and 30 and the incidence of surgery revisions 30 days postoperatively after various vascular surgeries. **Group 1 (NPWT) intervention:** ciNPT applied for postoperative days 5 to 7 **Group 2 (control) intervention:** a conventional adhesive plaster that was changed daily

Pleger 2018 *(Continued)*

	Study date/s: 1 February to 30 October 2015
Outcomes	• Wound complications including SSI **Validity of measure/s:** Szilagyi classification **Time points:** the first evaluation took place on postoperative days 5 to 7 during the hospital stay, while the second evaluation was conducted on postoperative day 30 in the outpatient clinic.
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Insufficient information given
Allocation concealment (selection bias)	Unclear risk	Insufficient information given
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Insufficient information given
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Not stated
Incomplete outcome data (attrition bias) All outcomes	Low risk	All those recruited appeared to have been included in the analysis.
Selective reporting (reporting bias)	Low risk	Results for outcomes identified in the Methods section were reported. We did not see the original protocol.
Other bias	Unclear risk	Unequal number of participants in each group; results reported per fracture, so there was a potential unit of analysis issue.

Ruhstaller 2017

Study characteristics

Methods	**Study design:** randomised controlled trial **Study grouping:** parallel **Ethics and informed consent:** ethics approved, informed consent **Follow-up period:** 4 weeks **Sample size estimate:** assuming a rate of 10% for the primary outcome in the control group (based on prior studies in obese women) and a 5% complication rate in the intervention group, 90% power, and an α of 0.05. Based on this calculation, 621 patients required in each arm of the study. However, for this feasibility study of sufficient size to estimate the true rate of the outcome, an a priori enrolment goal of 10% of the calculated sample size was selected with the additional allowance of 10% loss to follow-up, which resulted in a sample size of 68 patients per arm.

Ruhstaller 2017 *(Continued)*

	ITT analysis: yes, **number randomised:** 136, **number analysed**: 119 **Funding:** supported by the National Institute of Health Reproductive Epidemiology Training Gran (T32-HD007440); KCI collaborated in the trial **Preregistration:** clinicaltrials.gov NCT02128997
Participants	**Location:** Philadelphia, USA **Intervention group:** n = 67,**control group:** n = 69 **Mean age:** NPWT group - median 27 years (24 to 32); control group - median 29 years (IQR 24 to 34) **Inclusion criteria:** BMI greater than or equal to 30 kg/m^2 at less than or equal to 22 weeks of gestation; woman is labouring; woman is having an unplanned caesarean section; woman will have Pfannenstiel skin incision; has the ability to take a picture and email it to a secure account; receives prenatal care in the University of Pennsylvania health system and plans to follow up postpartum in the system; is 18 years of age or older. **Exclusion criteria:** woman cannot read or speak English; is not 18 years of age or older; does not have ability to send a picture by email; has pre-existing diabetes mellitus (type 1 or type 2), is using chronic steroids or immunosuppressants, OR is being actively treated for a malignancy; woman is undergoing a scheduled caesarean section; woman is allergic to silver.
Interventions	**Aim/s:** to determine whether NPWT lowers the rate of wound complications in obese pregnant women undergoing an unscheduled intrapartum caesarean section. **Group 1 (NPWT) intervention:** NPWT device (PREVENA Incision Management System; Acelity), applied until day 3 postoperatively. **Group 2 control:** standard postcaesarean wound care - a Telfa bandage overlaid with a 4 cm × 4 cm gauze pad and surgical tape, removed 24 hours postoperatively. **Study date/s:** May 2014 to March 2016
Outcomes	• A composite outcome of a SSI, incision dehiscence, or wound opening by a provider that required packing during the 4-week postsurgical period • Any readmission for a wound issue within 4 weeks of discharge: an office or emergency room visit • Quality of life: difficulty with activities of daily living on postoperative day 2 (range: 0 for “no difficulty” to 4 “so much difficulty I could not do it”) • Sharp and tingling pain scores • Blisters • Cost: the associated costs of use of NPWT versus those associated with treatment of SSIs after a caesarean **Validity of measure/s:** SSI - defined as erythema and/or purulent drainage with or without fever that required antibiotic therapy; incision dehiscence or wound opening - any disruption of the skin closure with subcutaneous tissue exposure or a wound opening that required packing. **Time points:** 4 weeks postsurgery
Notes	Cost data: at a per-device cost of $544, prevention of a single infection would cost approximately $15,000. Thus, the prevention of one SSI after a caesarean delivery would increase postsurgical health care costs, an additional $10,300 beyond the average cost attributed to the infection itself.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Once decision for caesarean delivery was established, randomisation was performed using a computer-generated randomisation scheme (Research Electronic Data Capture (REDCap)).

Ruhstaller 2017 *(Continued)*

Allocation concealment (selection bias)	Unclear risk	Not reported
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not reported; however, it was unlikely to be possible to blind participants and personnel.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Not reported
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	**Intervention group:** n = 61/67 (91%);**control group:** n = 58/69 (84%). It was unclear if reasons for loss to follow-up were similar across groups.
Selective reporting (reporting bias)	High risk	Most results for outcomes identified in the Methods section were reported; but data on quality of life not reported.
Other bias	Unclear risk	No other bias identified but insufficient reporting.

Sabat 2016

Study characteristics	
Methods	**Study design:** 1:1 parallel-group randomised controlled trial **Study grouping:** parallel **Ethics and informed consent:** yes **Sample size estimate:** no **Follow-up period:** 4 months **ITT analysis:** no **Funding:** not stated **Preregistration:** not stated
Participants	**Location:** Philadelphia, USA **Intervention group:** n = 33 wounds,**control group:** n = 30 wounds (total 49 participants) **Mean age:** not reported **Inclusion criteria:** people undergoing open vascular surgery involving a groin incision **Exclusion criteria:** not stated
Interventions	**Aim/s:** to compare the effect of postoperative negative pressure therapy to conventional dressings on wound occurrences. **Group 1 (NPWT) intervention:** NPWT device **Group 2 control:** conventional dressing (gauze and Tegaderm) **Study date/s:** not stated
Outcomes	• SSI

Sabat 2016 *(Continued)*

	• Wound dehiscence
Notes	Abstract only; unit analysis

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Not stated
Allocation concealment (selection bias)	Unclear risk	Not stated
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Not stated
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Not stated
Incomplete outcome data (attrition bias) All outcomes	Low risk	All those recruited appeared to have been included in the analysis.
Selective reporting (reporting bias)	Unclear risk	Results for outcomes identified in the Methods section were reported. We did not see the original protocol.
Other bias	Unclear risk	Unit of analysis issue - unclear if accounted for.

Schmid 2018

Study characteristics

Methods	**Study design:** randomised controlled trial **Study grouping**: within-person design **Ethics and informed consent:** ethics approval from the Faculty of Medicine, Technical University Munich; informed consent reported **Follow-up period:** 14 days **Sample size estimate:** planned accrual 100 people, sample size calculation reported **ITT analysis: number randomised:** 31 **number analysed:** 31 **Funding:** Open Access funding provided by Projekt DEAL. The NPWT dressing used was provided by KCI. **Preregistration:** DRKS00005257
Participants	**Location:** Germany **Intervention group:** 31 wounds, **control group:** 31 wounds **Mean age:** 62 (median); range 34 to 82 years**intervention group:** NA, **control group:** NA

Schmid 2018 *(Continued)*

	Inclusion criteria: patients with penile cancer and indication for bilateral inguinal lymphadenectomy according to EAU guideline: tumour stage ≥ pT1 G2 or palpable inguinal lymph nodes). **Exclusion criteria:** status post-inguinal surgery or any medical conditions leading to an impaired inguinal lymph drainage. Status post-repair of inguinal hernia was no exclusion criterion, if date of surgery was > 3 months in the past and no swelling or oedema was detectable. Allergy to acrylic adhesive, unable to give informed consent or age less than 18 years.
Interventions	**Aim/s:** to prospectively analyse the effect of an epidermal vacuum wound dressing on lymphorroe, complications and reintervention in patients with inguinal lymphadenectomy for penile cancer. **Group 1 (NPWT) intervention:** epidermal negative-pressure wound dressings (Prevena; KCI, San Antonio, Texas, USA) for 7-8 days. **Group 2 (control) intervention:** conventional wound care treatment consisting of a subcutaneous suction drain as well as pressure dressings. **Study date/s:** May 2013 to 2017
Outcomes	• Reintervention (reoperation) • SSI may be included in wound complications but not reported • Pain • Mortality **Validity of measure/s:** no definition of SSI reported **Time points:** 14 days
Notes	Trial was stopped early for futility after the accrual of the first 31 patients (shortly after the planned interim analysis)

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "intervention and control side were randomly allocated based on a computer-generated randomization list with a block size of ten". Comment: computer-generated randomisation sequence
Allocation concealment (selection bias)	Unclear risk	No statement
Blinding of participants and personnel (performance bias) All outcomes	High risk	Open study (no masking) (obtained from protocol)
Blinding of outcome assessment (detection bias) All outcomes	High risk	Open study (no masking) (obtained from protocol)
Incomplete outcome data (attrition bias) All outcomes	Low risk	All participants included in the analysis with the exception of 1 participant who died during follow-up.
Selective reporting (reporting bias)	Low risk	Appeared that all planned outcomes were reported.
Other bias	Unclear risk	No obvious source of bias but insufficient information to be certain.

Shen 2017

Study characteristics	
Methods	**Study design:** randomised controlled trial **Study grouping:** parallel **Ethics and informed consent:** yes **Sample size estimate:** yes (based on a real SSI reduction of 6% from 17% to 11%) **Follow-up period:** 30 days **ITT analysis:** yes, **number randomised:** 375, **number analysed**: 265 **Funding:** non-industry **Preregistration:** yes
Participants	**Location:** Wake Forest University Health Sciences, North Carolina, USA **Intervention group:** n = 187,**control group:** n = 188 **Median age (range): intervention group** = 59.5 (25 to 85),**control group** = 62 (30 to 81) **Inclusion criteria:** patients who underwent open resection of intra-abdominal neoplasms, where the scheduled procedure was to be performed via midline laparotomy and was a clean-contaminated (class II) case (included gastric, small bowel, and colorectal resections, as well as bile or pancreatic duct transections); the patient had the ability to understand and the willingness to sign a written informed consent document (either directly or via a legally authorised representative). **Exclusion criteria:** emergent cases; pregnant patients; clean (class I), contaminated (class III), and dirty (class IV) procedures; patients on chronic immunosuppressive medications, including steroids, within the past 3 months; patients with a history of skin allergy to iodine or adhesive drapes were not included in the study.
Interventions	**Aim/s:** to decrease the incidence of superficial and deep SSIs **Group 1 (NPWT) intervention:** PICO dressing applied over the primarily closed incision by the surgeon in the operating room. Dressing was left on for 4 days, or longer if drainage continued, unless soiled or dislodged. **Group 2 control:** Comfeel dressing applied over the primarily closed incision by the surgeon in the operating room. Dressing was left on for 4 days, or longer if drainage continued, unless soiled or dislodged. **Study date/s:** July 2012 to April 2014
Outcomes	• SSI • Seroma • Haematoma • Incisional cellulitis • Dehiscence • Wound opening for any reason **Validity of measure/s:** CDC definitions for SSI were used. **Time points:** 30 days after surgery
Notes	Investigator contacted for additional details.
Risk of bias	

Shen 2017 *(Continued)*

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "the program nQuery was used to create the randomization schema". The study used permuted-block randomisation with varying block sizes.
Allocation concealment (selection bias)	Unclear risk	Quote: "an email was sent the day before surgery to the attending surgeon about to which treatment arm the patient had been assigned". **Comment:** scope for surgeons to anticipate the randomisation sequence.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Quote: "There was no blinding of the patients or care providers to the study intervention. An email was sent the day before surgery to the attending surgeon about to which treatment arm the patient had been assigned". Comment: patients and participants were not blinded.
Blinding of outcome assessment (detection bias) All outcomes	High risk	Investigator team assessed outcomes.
Incomplete outcome data (attrition bias) All outcomes	High risk	Approximately 30% of participants were lost to follow-up or excluded from each arm of the trial. However, reasons for losses were similar between groups. NPWT group: 2 died and 19 were reoperated; standard care group: 5 died and 16 were reoperated.
Selective reporting (reporting bias)	Low risk	Prospectively reported. Outcomes were consistent with proposal (National Cancer Institute CCSG P30CA012197).
Other bias	Low risk	No other bias identified

Shim 2018

Study characteristics	
Methods	**Study design:** randomised controlled trial **Study grouping:** parallel **Ethics and informed consent:** yes **Follow-up period:** 1 year **Sample size estimate:** no **ITT analysis:** yes, **number randomised:** 51, **number analysed:** 51 **Funding:** not reported **Preregistration:** not reported
Participants	**Location: Korea;** single-centre (hospital) **Intervention group:** 30, **control group:** 21 **Mean age: intervention group** 38.77 ± 1.68, **control group** 41.38 ± 10.92 **Inclusion criteria:** > 20 years, acute multi-tissue hand injury of moderate severity (assessed by HISS score 21-50), underwent reconstruction within 3 days after injury by two surgeons. **Exclusion criteria:** history of impaired motor function, injury to the peripheral nerves and/or vessels distal to the wrist, or a bone fracture requiring transarticular fixation with a Kirchner (K) wire, a congen-

Shim 2018 *(Continued)*

	ital hand deformity, an operation history on the same hand, and underlying diseases including autoimmune diseases such as rheumatoid arthritis or systemic lupus erythematosus or those taking medications that could influence wound healing.
Interventions	**Aim/s:** to compare outcomes in patients with acute hand injury who were managed with or without NPWT after reconstructive surgery. **Group 1 (NPWT) intervention:** NPWT (CuraVAC, CGBio, Seongnam-si, Gyeonggi-do, Korea) applied at a pressure of 75 mmHg in continuous mode and secondary dressing including Vaseline gauze. **Group 2 (control) intervention:** conventional dressing, including vaseline gauze was applied over the closed skin using polyurethane foam with a compressible elastic bandage, and a short arm splint was applied in a functional position; dressing and NPWT were changed every 3 days. **Study date/s:** January 2013 to December 2016
Outcomes	• SSI/infection • Haematoma • Wound disruption (dehiscence) **Validity of measure/s:** unclear what definition was used for infection **Time points:** 1 month and 1 year
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "Patients were randomly assigned to the control or experimental group following a simple randomization procedure (computerized random numbers) achieved using opaque envelopes". Comment: randomisation with computer
Allocation concealment (selection bias)	Unclear risk	Quote: "Patients were randomly assigned to the control or experimental group following a simple randomization procedure (computerized random numbers) achieved using opaque envelopes. Allocation information to each group was not provided to reduce bias". Comment: allocation concealed with opaque envelopes but these were not noted as sequentially numbered.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Quote "This was a prospective open trial". Comment: no blinding of participants or personnel.
Blinding of outcome assessment (detection bias) All outcomes	High risk	Quote "This was a prospective open trial". Comment: no blinding of outcome assessment.
Incomplete outcome data (attrition bias) All outcomes	Low risk	No patients lost to follow-up.
Selective reporting (reporting bias)	Low risk	All prespecified outcomes fully reported.

Shim 2018 *(Continued)*

Other bias	Unclear risk	No evidence of other bias but reporting insufficient to be certain.

Stannard 2012

Study characteristics	
Methods	**Study design:** multicentre randomised controlled trial (four centres, each a level 1 trauma centre) **Ethics and informed consent:** ethics approved and consent obtained **Sample size calculation:** no **Follow-up period:** not reported **ITT analysis:** wounds, not people were assessed. **Funding:** "funds from corporate/industry were received from Kinetic Concepts, Inc to support this work".
Participants	**Location:** Columbus, Ohio, USA **Intervention group:** n = 130, participants; 141 fractures,**control group:** n = 119 participants; 122 fractures **Mean age:** not stated **Inclusion criteria:** people > 18 years of age who had sustained a high-energy tibial plateau, pilon, or calcaneus fracture and were able to comply with research protocol and willing to give informed consent. **Exclusion criteria:** non-operative calcaneus, tibia plateau, or pilon fractures; patients with open calcaneus fractures; tibial plateau or calcaneus fractures receiving definitive surgery more than 16 days after injury; pilon fractures receiving definitive surgery more than 21 days after injury; prisoners; pregnant women; patients with one of these fractures as a result of a low-energy mechanism of injury; patients or family members unable or unwilling to sign study informed consent; and patients unable to comply with the protocol.
Interventions	**Aim/s:** "to investigate the use of NPWT to prevent wound dehiscence and infection after high-risk lower extremity trauma" **Intervention/s in both groups:** dressings or NPWT were applied in the operating room and then changed on postoperative day 2 and every 1 to 2 days thereafter. **Group 1 (NPWT) intervention:** NPWT over the surgical incision after open reduction and internal fixation of the fracture. **Group 2 (control) intervention:** standard postoperative dressing (dressing not described). **Study date/s:** not stated
Outcomes	• Wound infection and dehiscence • Time to discharge from hospital **Validity of measure/s:** "all infections were confirmed with cultures". **Time points:** not stated - unclear for how long participants were followed up.
Notes	

Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**

Stannard 2012 *(Continued)*

Random sequence generation (selection bias)	Low risk	**Evidence:** quote: "patients were enrolled and then randomised to receive either standard postoperative dressings (control) or NPWT (study)". **Comment:** additional author information: "the randomization was done via a computer generated randomization program".
Allocation concealment (selection bias)	Unclear risk	**Comment:** method not clarified
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	**Evidence for participants:** not possible **Comment:** unlikely to affect outcomes **Evidence for personnel:** not possible **Comment:** unlikely to affect outcomes
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	**Evidence:** quote: "a patient was diagnosed as having an infection when a combination of clinical signs and symptoms (purulent drainage, erythema, fever, chills, etc) and laboratory data documented the infection. All infections were confirmed with cultures. Wound dehiscence was defined as any separation of the surgical incision that required either local wound care or surgical treatment". **Comment:** not clear whether those assessing outcomes were aware of group assignment.
Incomplete outcome data (attrition bias) All outcomes	Low risk	**Comment:** a total of 249 participants were recruited. The same number of participants were reported for both acute and long-term follow-up (follow-up period not defined). Given that 4 hospitals were involved in the study, it seemed unusual that complete follow-up would have occurred, suggesting that an available-case analysis may have been performed.
Selective reporting (reporting bias)	Low risk	**Comment:** registered in CTR (NCT00582998) 9 months after final data collection date, so it was unclear whether reported outcomes matched the original protocol. However, infection and dehiscence were the expected outcomes.
Other bias	High risk	**Comment:** • unequal number of participants in each group; • appeared from the protocol that data collection was over many years, but no dates or explanation in manuscript; • results reported per fracture, so there was a potential unit of analysis issue.

Svensson-Bjork 2020

Study characteristics	
Methods	**Study design:** cost-effectiveness analysis (economic evaluation based on the Hasselmann 2019a RCT) **Analytical approach:** trial-based economic analysis (decision-analytical modelling not stated) **Effectiveness data:** data were from the open inguinal vascular surgery-arm only of the Hasselmann 2019a RCT: surgical site infection incidence (used for base case analysis); and the incidence of any incisional wound complications and difference in Vascuqol-6 score (used for sensitivity analysis) . **Perspective:** healthcare perspective (the country of the societal perspective considered not specified but probably being Sweden)

Svensson-Bjork 2020 *(Continued)*

	Utility valuations: not stated (QALYs not used for the measure of benefit) **Adjustment:** only costs and outcome data in the 90 days postoperatively **Measure of benefit:** surgical site infection avoided (for base case analysis); unit of Vascuqol-6 score increased (for sensitivity analysis) **Cost data:** costs estimated based on the local county council's cost-per-patient system, and included: ward care, peri- and postoperative care, blood products, lab and microbiological tests, imaging procedures and outpatient visits, as well as hospital costs from surgery to 90 days postoperatively. Costs for primary care not included. Of these, wound dressing and medication usage obtained from medical charts and costs calculated using unit costs from the local county council's price list and the Swedish Dental and Pharmaceutical Benefit Agency (TLV) website. Costs measured in Swedish kronor (SEK) at 2019 price year and converted to euros (EUR), (1 EUR = 10.59 SEK). **Analysis of uncertainty:** sensitivity analyses conducted using different cost and outcome data: all healthcare costs and vascular procedure-related inpatient costs (for cost); and incidence of any incisional wound complications and difference in Vascuqol-6 score (for the outcomes). Two cost-effectiveness planes developed using vascular procedure-related costs and vascular procedure-related inpatient costs only, respectively, both related to difference in Vascuqol-6 score using bootstrapping with 5,000 replications. **Funding:** grants from the Swedish Medical Research Council (Diary number 2019-00435) and Skåne University Hospital; core funding from Government Grant for Clinical Research (ALF) and Region Skåne (Gerdtham). The funding sources had no influence on any part of this study. The authors declared no conflict of interest.
Participants	**Location:** Sweden **Intervention group**: n = 59; **control group**: n = 60 **Mean age: intervention group** mean 70.9 years (SD 7.1), **control group** mean 71.5 years (SD 8.4) **Inclusion criteria:** all adult patients scheduled for elective vascular surgery with inguinal incisions. **Exclusion criteria:** patients who were unable to comprehend the study, unable to give written consent, or had ongoing infections in the inguinal area.
Interventions	**Aim/s:** to evaluate the cost-effectiveness of NPWT compared to standard dressings when applied on incisions after open, inguinal vascular surgery. **Group 1 (NPWT) intervention:** NPWT dressing (PICO, Smith & Nephew, UK) **Group 2 (control) intervention:** standard wound dressing (Vitri Pad, ViTri Medical, Sweden) or OPSITE (as per clinical) **Study date/s:** November 2013 to October 2018
Outcomes	For clinical data see Hasselmann 2019a and additional tables 1 and 2 Surgical site infection incidence (for base case analysis) • Incidence of any incisional wound complications (for sensitivity analysis) • Difference in Vascuqol-6 score (for sensitivity analysis) • Costs (Euro) • Measure of benefit: surgical site infection avoided (for base case analysis); unit of Vascuqol-6 score increased (for sensitivity analysis) • ICER (without 95% CrI), that is, the difference in mean costs by the difference in outcome (Δcosts/Δoutcome) • Cost-effectiveness planes
Notes	Based on Hasselmann 2019a Authors' conclusions: NPWT is cost-effective over standard dressings in patients undergoing open inguinal vascular surgery due to reduced SSI incidence at no higher costs.

Svensson-Bjork 2020 *(Continued)*

Quality rating according to the CHEERS checklist: CHEERS score 91.7%

Tanaydin 2018

Study characteristics	
Methods	**Study design:** randomised controlled trial **Study grouping:** parallel **Ethics and informed consent:** ethics approved and consent obtained **Sample size calculation:** no **Follow-up period:** 365 days postsurgery **ITT analysis:** wounds (breasts), not people were assessed **Funding:** funded by Smith & Nephew Ltd, who provided the PICO dressings and the Cutometer and financed a research assistant for carrying out the assessments and measurements
Participants	**Location:** the Netherlands **Intervention group:** n = 32,**control group:** n = 32 (participants served as their own control) **Mean age (range):** 40.9 (18 to 61) **Inclusion criteria:** patients > 18 years of age who underwent bilateral superomedial pedicle Wise-pattern breast reduction mammoplasty and had postsurgical incisions of similar length on each breast. **Exclusion criteria:** pregnancy or lactation, using steroids, or other immune modulators known to affect wound healing; history of radiation of the breast; tattoos in the area of the incision; skin conditions such as cutis laxa that would result in poor healing or widen scars, history of radiation of the breast, patients with a known significant history of hypertrophic scarring or keloids, and postsurgical incisions still actively bleeding, exposure of blood vessels, organs, bone, or tendon at the base of the reference wound; and incisions > 12 inches (30 cm) maximum linear dimension.
Interventions	**Aim/s:** to evaluate the effectiveness of postsurgery incision treatment comparing a portable disposable NPWT system with standard care using fixation strips. **Group 1 (NPWT) intervention:** a single-use NPWT system without an exudate canister **Group 2 (control) intervention:** fixation strips (Steri-Strip; 3M, St Paul, Minnesota, USA) **Study date/s:** 1 June 2012 to 9 April 2014
Outcomes	• The number of wound-healing complications within 21 days • Aesthetic appearance and quality of scarring (additional measurements at 42, 90, 180, and 365 days) **Validity of measure/s:** wound-healing complications were defined as delayed healing (surgical incision not 100% closed at day 7 postsurgery), or occurrence of dehiscence or infection within 21 days postsurgery. **Time points:** all included participants (N = 32) had follow-up visits and assessments at screening (presurgery), day 0 (baseline, postsurgery), day 7, 21, 42, 90, 180, and 365 postsurgery.
Notes	The breasts were randomised and served as own control.

Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**

Tanaydin 2018 *(Continued)*

Random sequence generation (selection bias)	Low risk	Quote: "Randomization was used for allocation of NPWT and fixation strip to the right or left breast incision site per patient, using sealed envelopes. Treatment site information was accessed digitally (www.sealedenvelope.com) upon the start of the treatment postsurgically." Comment: appeared to be a computerised method of sequence generation.
Allocation concealment (selection bias)	Low risk	Quote: "Randomization was used for allocation of NPWT and fixation strip to the right or left breast incision site per patient, using sealed envelopes. Treatment site information was accessed digitally (www.sealedenvelope.com) upon the start of the treatment postsurgically." Comment: appeared to be a web-based allocation centre.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Quote: "As NPWT and fixation strips are optically different, blinding of the physician and patients was not feasible". Comment: participants and personnel were not blinded.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Quote: "as NPWT and fixation strips are optically different, blinding of the physician and patients was not feasible; however, data analysis was performed blinded".
Incomplete outcome data (attrition bias) All outcomes	Low risk	32 enrolled participants were accounted for in the analyses.
Selective reporting (reporting bias)	Low risk	Expected outcomes reported. Protocol retrospectively registered as NL40698.068.12/METC12-3-026.
Other bias	Unclear risk	This was a 'split-body' or 'intra-individual' design where a person with 2 wounds had 1 wound randomised to each treatment. It was not clear whether the analysis took this into account.

Tuuli 2017

Study characteristics	
Methods	**Study design:** randomised controlled trial (abstract only available) **Study grouping:** parallel **Ethics and informed consent:** not recorded **Sample size estimate:** not recorded **Follow-up period:** 30 days **ITT analysis:** yes, **number randomised:** 120, **number analysed:** 120 **Funding:** non-industry **Preregistration:** yes (NCT02578745a). Registered 11 June 2012
Participants	**Location:** St Louis, Missouri, USA **Intervention group:** n = 60,**control group:** n = 60 **Mean age:** not recorded **Inclusion criteria:**

Tuuli 2017 *(Continued)*

- gestational age ≥ 23 weeks;
- BMI ≥ 30 at the time of delivery;
- planned or unplanned caesarean delivery (procedure in which NPWT is being tested).

Exclusion criteria:

- not available for postoperative follow-up;
- contraindication to NPWT applicable to women undergoing caesarean: pre-existing infection around incision site, bleeding disorder, therapeutic anticoagulation, allergy to any component of the dressing (e.g. silicone, adhesive tape).

Interventions	**Aim/s:** to assess the feasibility of a definitive RCT to test the effectiveness and safety of prophylactic NPWT in obese women after caesarean section. **Group 1 (NPWT) intervention:** prophylactic NPWT with the PICO device (Smith & Nephew). Removed at discharge (usually on day 4). **Group 2 (control) intervention:** standard wound dressing (routine postoperative wound dressing consisting of layers of gauze and adhesive tape). The dressing was removed at 24 to 48 hours. **Study date/s:** October 2016 to March 2016
Outcomes	• **Primary outcome/s:** composite of superficial or deep surgical site infection; wound separation ≥ 2 cm; SSI; haematoma; seroma • **Secondary outcome/s:** pain score on postoperative day 2 and skin reactions **Validity of measure/s:** wound infection defined by CDC criteria (information extracted from CTR) **Time points:** 30 days
Notes	Investigator contacted for additional details.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Insufficient information in abstract to permit judgement
Allocation concealment (selection bias)	Unclear risk	Insufficient information in abstract to permit judgement
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Insufficient information in abstract to permit judgement
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Insufficient information in abstract to permit judgement
Incomplete outcome data (attrition bias) All outcomes	Low risk	Abstract indicated that 120 participants were randomised and 120 analysed. This was consistent with the number proposed in NCT02578745a.
Selective reporting (reporting bias)	Low risk	Reporting was consistent with outcomes proposed in NCT02578745a.

Tuuli 2017 *(Continued)*

Other bias	Unclear risk	None detected. Independently funded trial, however no baseline data presented.

Tuuli 2020

Study characteristics	
Methods	**Study design:** randomised controlled trial **Study grouping:** parallel **Ethics and informed consent:** the trial was approved by the institutional review board at each site prior to enrolment. All study participants provided written informed consent. **Follow-up period:** 30 days **Sample size estimate:** calculated assuming a 10% baseline risk of SSI based on data from a prior study. It was estimated that 2850 participants (1425 in each group) would be sufficient to detect a 30% relative difference (from 10% to ≤ 7%) in the risk of SSI with 80% power in a 2-tailed test with a type I error of.05 and 5% adjustment for attrition. A difference of 30% was considered clinically important and plausible, based on prior studies of negative pressure therapy after caesarean delivery. **ITT analysis:** yes, **number randomised**: 1624, **number analysed**: 1608 **Funding:** Eunice Kennedy Shriver NICHD; Acelity donated negative pressure devices and provided supplemental funding. **Preregistration:** clinicaltrials.gov/ct2/show/NCT03009110
Participants	**Location:** USA (4 academic and 2 community hospitals) **Intervention group:** n = 816 (806),**control group:** n = 808 (802) **Mean age:** 30.2 (5.6) vs 30.5 (6.1) **Inclusion criteria:** women with a BMI of 30 or more (defined at pre-pregnancy or first prenatal visit weight and height), beyond 23 weeks gestation and undergoing planned or unplanned caesarean delivery. **Exclusion criteria:** unavailable for postoperative follow-up or had a contraindication to NPWT use (preexisting infection at the incision site, bleeding disorder, therapeutic anticoagulation, or allergy to silicone or adhesive tape).
Interventions	**Aim/s:** to determine the effect of prophylactic NPWT on risks of surgical-site infection and other wound complications in obese women after caesarean delivery. **Group 1 (NPWT) intervention:** Prevena (KCI USA inc) NPWT applied immediately after repair of the surgical incision and secured with fixation adhesion strips until day of discharge, typically on postoperative day 4, or by day 7 for patients who remained hospitalised. Median duration was 4 days. **Group 2 (control) intervention:** routine postoperative wound dressing (layers of gauze and adhesive tape) for 24 hours. **Study date/s:** 8 February 2017 to 13 November 2019
Outcomes	**Primary:** • superficial or deep surgical-site infection or organ-space infection; • wound dehiscence ≥ 2 cm; • mortality. **Secondary:**

Tuuli 2020 *(Continued)*

- haematoma;
- seroma;
- pain;
- blistering;
- readmission.

Validity of measure/s: CDC National Healthcare Safety Network definitions of surgical-site infections

Time points: 30 days

Notes	The trial was overseen by an independent data and safety monitoring board. Two interim analyses were planned at 50% and 75% of recruitment. The Haybittle-Peto rule was designated as the guide for stopping the trial early for efficacy. Under this rule, the interim analyses of the primary outcome had to demonstrate an extreme difference between groups (P < 0.001) to justify stopping the trial. This rule has the advantage that the overall type I error is preserved at 0.05. No specific stopping rule for futility was designated. **The trial was stopped early for futility.**

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "A computer-generated randomization sequence was prepared by the study statistician using variable blocks of 4 and 6, stratified by study site, BMI category (30-39.9 and ≥ 40), and scheduled or unscheduled cesarean delivery." Comment: computer-generated randomisation sequence.
Allocation concealment (selection bias)	Low risk	Quote: “A patient’s group assignment was obtained from a secure website after a study number and confirmation of eligibility were entered and locked”. Comment: allocation concealment achieved through centralised procedures.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Quote: “The clinical care team could not be blinded to the interventions.” Comment: personnel could not be blinded; it appears that patients also could not be.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Quote: “The treating physician made the diagnosis of surgical-site infection. Records of all patients with any wound complications were reviewed and validated centrally in a blinded fashion by the principal investigator against the CDC National Healthcare Safety Network definitions of surgical-site infections.” Comment: blinded validation of all wound complications.
Incomplete outcome data (attrition bias) All outcomes	Low risk	1624 participants randomised; 1608 included in analysis (16 withdrawals, none lost to follow-up). Very low levels of attrition.
Selective reporting (reporting bias)	Low risk	Data were not collected for one prespecified secondary outcome: satisfaction with aesthetic appearance of the scar. This was not an outcome of interest to this review. All other outcomes were fully reported.
Other bias	Unclear risk	“The study was terminated after 1624 of 2850 participants were recruited when a planned interim analysis showed increased adverse events in the negative pressure group and futility for the primary outcome”. **Stopping early for futility (not planned for) as well as increased adverse events in NPWT group (unclear if planned for but ethically justifiable).**

Uchino 2016

Study characteristics	
Methods	**Study design:** randomised controlled trial **Study grouping:** parallel **Ethics and informed consent:** all study protocols were approved by the institutional review board at Hyogo College of Medicine. Informed consent obtained prior to surgery. **Follow-up period:** 6 week minimum **Sample size estimate:** a sample size of 18 subjects was needed for an alpha of 0.05 and 80% power based on a hypothesis that NPWT decreased wound healing duration by a mean of 10 days relative to the 24 days observed previously. **ITT analysis:** yes**number randomised**: 59 **number analysed**: 59 **Funding:** not reported **Preregistration:** UMINCTR000015325
Participants	**Location:** Japan **Intervention group:** 28,**control group:** 31 **Mean age: Intervention group:** 48.1 (14.9), **control group:** 40.4 (15.9) years **Inclusion criteria:** patients aged 18 or older with ulcerative colitis (UC) scheduled to undergo ostomy closure of ileostomy as an elective 2-stage procedure including a restorative proctocolectomy with ileal pouch anal anastomosis (IPAA). **Exclusion criteria: For per-protocol analysis only:** death, dirty/infected wound, urgent/emergency surgery, or separated double-barrel ileostomy. Patients whose incision was extended due to adhesion during surgery were also excluded.*
Interventions	**Aim/s:** to evaluate the efficacy and safety of negative pressure wound therapy during ileostomy closure. **Group 1 (NPWT) intervention:** single-use PICO (Smith and Nephew Healthcare, Hull, UK); use continued for 2 weeks of hospitalisation with changes every 3-4 days. **Group 2 (control) intervention:** wound dressing with simple adhesive plaster. **Study date/s:** November 2014 to September 2015
Outcomes	**Primary:** • SSI **Validity of measure/s:** not reported **Time points:** 4 weeks after discharge (aprox 6 weeks after surgery) and then every 4 weeks if complications
Notes	Authors reported no financial conflicts of interest. *Patients with SSI during the follow-up periods were excluded from prophylactic NPWT and from the comparison of wound-healing duration because the NPWT was stopped after SSI diagnosis. Patients who displayed complicated dermatitis due to adhesives also stopped using NPWT or simple adhesives and were excluded from the study.

Uchino 2016 *(Continued)*

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Quote: "Randomization with concealment was achieved using opaque envelopes opened in the operating room by a surgical nurse". Comment: unclear how the randomisation sequence was generated.
Allocation concealment (selection bias)	Unclear risk	Quote: "Randomization with concealment was achieved using opaque envelopes opened in the operating room by a surgical nurse". Comment: unclear if the envelopes were sealed and sequentially numbered.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Quote: "However, surgeons could make a distinction between the 2 groups during and after surgery, so this study was not blinded". Comment: participant blinding not reported but unlikely to be possible; stated that surgeons were not blinded.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	No information
Incomplete outcome data (attrition bias) All outcomes	Low risk	All participants were included in the analysis.
Selective reporting (reporting bias)	Low risk	No evidence of this
Other bias	Unclear risk	No clear evidence of this but reporting not clear on all methods.

WHIST 2019a

Study characteristics

Methods	**Study design:** randomised controlled trial **Study grouping:** parallel **Ethics and informed consent:** ethical approval and consent obtained (appropriate procedures for retrospective consent where necessary) **Follow-up period:** 6 months **Sample size estimate:** yes, full published statistical analysis plan; 1540 required to provide 90% power to detect reduction in deep infection from 15% to 9% with 20% loss to follow-up. **ITT analysis:** yes,**number randomised:** 1548 (1629 randomised but 81 did not consent or were ineligible), **number analysed:** 1547 **Funding:** National Institute for Health Research (NIHR) Health Technology Assessment programme **Preregistration:** yes
Participants	**Location:** UK (24 sites) **Intervention group:** n = 785; **control group:** n = 763

WHIST 2019a *(Continued)*

	Mean age: intervention group </= 40: 283 (36.1%); > 40: 501 (63.9%), **control group** </= 40: 278 (36.4%); > 40: 485 (63.6%) **Inclusion criteria:** adult patients (16 years minimum) presenting to hospital within 72 hours of sustaining major trauma and who required a surgical incision to treat a fractured lower limb. **Exclusion criteria:** open fracture of the lower limb that could not be closed primarily; evidence that the patient would be unable to adhere to trial procedures or complete questionnaires.
Interventions	**Aim/s:** to assess the deep surgical site infection (SSI) rate, disability, quality of life, patient assessment of the surgical scar and resource use in patients with surgical incisions associated with fractures following major trauma to the lower limbs, treated with incisional negative-pressure wound therapy (NPWT) versus standard dressings (cost-effectiveness was also assessed). **Group 1 (NPWT) intervention:** NPWT uses a non-adherent absorbent dressing covered with a semi-permeable dressing. A sealed tube connects the dressing to a built-in mini-pump that creates a partial vacuum over the wound. NPWT applied as per treating surgeon's normal practice and according to manufacturer's instructions. **Group 2 (control) intervention:** standard dressing (non-adhesive layer covered by sealed dressing or bandage). **Study date/s:** September 2016 to April 2018
Outcomes	• SSI (deep), i.e. wound infection involving the tissues deep to the skin • Dehiscence (forms part of deep SSI criteria) • Health-related quality of life (EQ-5D) and Disability rating index (DRI) • Pain (and neuropathic pain) • Resource use • Cost-effectiveness • Death (reported in Table 1 as a reason of dropout) • Reoperation (further surgery) **Validity of measure/s:** CDC definitions and criteria were used for deep infection (30 days and 90 days as per original and revised criteria) **Time points:** pre-injury, post-injury, 30 days, 3 months, 6 months
Notes	Current Controlled Trials ISRCTN 12702354 and UKCRN Portfolio ID20416 Funding (cost-effectiveness assessment) National Institute for Health Research (NIHR) Health Technology Assessment programme

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "Randomisation was on a 1:1 basis, using a validated computer randomisation program managed centrally by the Oxford Clinical Trials Research Unit... all participants were being randomised to treatment groups by simple randomisation without reference to their minimisation factors". Comment: adequate method of sequence generation.
Allocation concealment (selection bias)	Low risk	Quote: "Randomisation was on a 1:1 basis, using a validated computer randomisation program managed centrally by the Oxford Clinical Trials Research Unit". Comment: central allocation using a secure remote system; allocated treatment administered immediately after receipt of allocation.

WHIST 2019a *(Continued)*

Blinding of participants and personnel (performance bias) All outcomes	High risk	Quote: "As the wound dressings and topical devices were clearly visible, the treating surgeon and trial participants could not be blinded to treatment allocation". Comment: patients and personnel could not be blinded.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Quote: "the treating surgeons were not involved in study follow-up assessments or data collection for the trial. Data from clinical reporting forms was entered onto a central database administered by a data clerk in the trial central office. Wound photographs taken at outpatient clinic at approximately 30 days postsurgery were reviewed independently by two experienced assessors (tissue viability specialist) blinded to the treatment allocation." Comment: blinded outcome assessment.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Primary outcome all accounted for; other outcomes had available case analysis.
Selective reporting (reporting bias)	Low risk	Comment: fully reported. A planned mortality analysis was not undertaken because < 5% participants died before 30 days. Planned analyses undertaken or deviations accounted for in plan.
Other bias	Low risk	Comprehensively reported and no evidence of other sources of bias.

WHIST 2019b

Study characteristics	
Methods	**Study design:** cost-effectiveness analysis based on the WHIST 2019a RCT) **Analytical approach:** trial-based decision model **Effectiveness data:** SSI (deep) and QoL (EQ-5D) both derived from WHIST 2019 (UK multicentre RCT, N = 1548) **Perspective:** NHS and personal social services (PSS) perspectives **Utility valuations:** EQ-5D and NHS/PSS resource use values derived from 623 trial participants with complete profiles **Measure of benefit:** QALY calculated using EQ-5D-3L utility scores using UK scoring algorithm **Cost data:** unit direct medical costs associated with the intervention obtained from the NHS Supply Chain Catalogue 2018/2019. These included cost of standard dressing, the costs of orthotic cast, the cost associated with dressing change, the cost per working hour of the nurse (obtained from the Personal Social Service Research Unit (PSSRU) 2018). The cost of inpatient care derived using the NHS HRG4+ 2017/18 Reference Cost Grouper and the NHS Reference Costs 2017/18. Unit costs of medical items other than those directly attributable to the intervention sourced from the NHS Reference Costs. Medication costs sourced from the BNF. Unit costs for direct non-medical cost items obtained from PSSRU. The costs of aids and adaptations obtained from the NHS Supply Chain Catalogue. The total cost per patient for additional (private) cost items incurred by patients and their next-of-kin obtained from the patients directly. The daily median wage obtained from the Office for National Statistics. Cost data were derived from the key resource inputs of the WHIST 2019 trial and expressed in 2017/2018 UK pounds sterling (£) (completed case analyses); a societal perspective was considered in a sensitivity analysis. Unit costs adjusted to 2017/2018 prices using the NHS Hospital & Community Health Services (HCHS) index for health service resources. No discounting of costs applied due to a short-time horizon.

WHIST 2019b *(Continued)*

	Analysis of uncertainty: results of ICERs and cost-effectiveness acceptability curves (CEACs) generated via nonparametric bootstrapping with 1000 replicas for accommodating sampling (or stochastic) uncertainty and varying levels of willingness-to-pay. Sensitivity analysis incorporated societal perspective; 3 different willingness-to-pay thresholds considered.
Participants	**Location:** UK hospitals **Intervention group:** n = 785, **control group:** n = 763 **Mean age:** </= 40: 283 (36.1%); > 40: 501 (63.9%), **control group** </= 40: 278 (36.4%); > 40: 485 (63.6%) **Inclusion criteria:** adult patients (16 years minimum) presenting to hospital within 72 hours of sustaining major trauma and who required a surgical incision to treat a fractured lower limb. **Exclusion criteria:** open fracture of the lower limb that could not be closed primarily; evidence that the patient would be unable to adhere to trial procedures or complete questionnaires.
Interventions	**Aim/s:** to investigate, using appropriate statistical and economic analysis methods, the resource use, and thereby the cost-effectiveness, of NPWT versus standard dressing for wounds associated with major trauma to the lower limbs. **Group 1 (NPWT) intervention:** NPWT using a non-adherent absorbent dressing covered with a semi-permeable dressing. A sealed tube connects the dressing to a built-in mini-pump that creates a partial vacuum over the wound. NPWT applied as per treating surgeon's normal practice and according to manufacturer's instructions (n = 785 in the trial). **Group 2 (control):** standard dressing (non-adhesive layer covered by sealed dressing or bandage) (n = 763 in the trial). **Study date/s:** October 2016 to March 2016
Outcomes	**Outcomes** (for data see additional table 1 for WHIST 2019b, and for clinical data WHIST 2019a;) Costs (GBP) QALY (measure of benefit) ICER Probability of being cost-effective at 3 different thresholds
Notes	**Funding:** NIHR **Authors' conclusions:** contrary to the existing literature, incisional NPWT did not provide a clinical or economic benefit for patients having surgical incisions associated with major trauma to the lower limb. Notes: not currently a separate publication for cost-effectiveness; data taken from monograph which focused on RCT. Quality rating using the CHEERS checklist was 89.1%.

Wierdak 2021

Study characteristics	
Methods	**Study design:** randomised controlled trial **Study grouping:** parallel design, 2 arms **Ethics and informed consent:** ethics approved, informed consent **Follow-up period:** 7 days and 14 days postoperatively

Wierdak 2021 *(Continued)*

Sample size estimate: primary endpoint incidence in our population = 33%; "to demonstrate that NPWT decreased WHC by 80%, a total sample size of 70 subjects was needed for an alpha of 0.05 and 80% power. Thus, with expectations of omissions, we sought a total sample size of 38 patients in each arm".

ITT analysis: available case analysis

Funding: funded only by the Jagiellonian University Medical College own funds, without any financial or material support from the NPWT equipment producers

Preregistration: clinicaltrials.gov (NCT04088162)

Participants	**Location:** Poland **Intervention group:** 38 participants allocated to the group, and 35 analysed; **control group:** 37 participants allocated to the group, and 36 analysed **Mean age: intervention group** mean age 61.6 ± 11.3 years; **control group** mean age 62.4 ± 11.3 years **Inclusion criteria:** patients aged ≥ 18 years with a history of surgery for colorectal cancer, including formation of the protective ileostomy, who were scheduled to undergo ileostomy closure as an elective procedure. **Exclusion criteria:** emergency/urgent operation, active infection, operations other than ileostomy closure, or parastomal hernioplasty. Patients who required a second operation or transfer to the intensive care unit or other hospital wards because of non-infectious complications within the first week after surgery were excluded from analysis (retrospectively).
Interventions	**Aim/s:** to assess the usefulness of protective negative-pressure wound therapy (NPWT) in the reduction of wound healing complications (WHC) and surgical site infections (SSI) after diverting ileostomy closure in patients who underwent surgery for colorectal cancer. **Group A (NPWT) intervention:** postoperative NPWT, NANOVA negative-pressure dressing placed over the entire length of the incision, which was taken out at 72 h. **Group B (control) intervention:** customary care (without postoperative NPWT), sterile wound dressing placed over the incision with the first dressing change at 48 h postoperatively, and then daily until the removal of sutures on postoperative day 7. **Study date/s:** January 2016 to December 2018
Outcomes	• Wound healing complications (any wound condition requiring postoperative intervention; may include review eligible outcomes) • Surgical site infections • Haematoma • Seroma **Validity of measure/s:** wound healing complications were defined as any condition of the wound that required postoperative intervention other than a change of dressing or removal of stiches. Incisional surgical site infection diagnosis was made according to the criteria of the Center for Disease Control (CDC) and European Centre for Disease Prevention and Control (ECDC) for diagnosis of surgical site infection. **Time points:** 7 days and 14 days postoperatively
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "The 1:1 randomization with concealment was achieved using a random number generator (even/odd)".

Wierdak 2021 *(Continued)*

		Comment: an appropriate method was reported for sequence generation.
Allocation concealment (selection bias)	Low risk	Quote: "The 1:1 randomization with concealment was achieved using a random number generator (even/odd)... The randomization process and assignment of the patients to the groups were performed by a trial researcher who was not directly involved in the operation or postoperative care of the patient". Comment: the allocation had been concealed.
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Quote: "Until the end of the operation, patients did not know to which group they were assigned... Operating surgeons were also blinded to the randomization." Comment: it appeared to blind operating surgeons; however, it was probable that participants were not blinded after operations.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Quote: "Until the end of the operation, patients did not know to which group they were assigned... Operating surgeons were also blinded to the randomization." Comment: no information on the blinding of outcome assessment method although the record of the ClinicalTrials.gov NCT04088162 suggested blinded outcome assessment.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Quote: "A total of 75 patients were randomised to the study. Four patients (5.3%) were lost to follow-up (two were lost as a result of reoperation, one was transferred to another ward, and one was excluded because of a technical problem with NPWT device — difficulties with maintaining airtightness), and none of those patients developed WHC or SSI within 30 days". Comment: low risk of attrition bias as there was a low rate of loss to follow-up; and none of missing participants had primary outcome events.
Selective reporting (reporting bias)	Low risk	Comment: all prespecified outcomes were reported.
Other bias	Low risk	Comment: no evidence of other bias.

Wihbey 2018

Study characteristics	
Methods	**Study design:** randomized controlled trial **Study grouping:** Parallel **Ethics and informed consent:** institutional review board approval was obtained from the Dartmouth Committee for the Protection of Human Subjects on April 21, 2015 (#00005211) and from the Southern New Hampshire Medical Center Clinical Trials Office (#2015-01). Women were recruited and consented to participate in this study before the onset of active labor during any routine prenatal visit or inpatient admission. **Follow-up period:** 30 days **Sample size estimate:** Yes. 400 women (200 prophylactic negative pressure wound therapy, 200 standard dressing) would need to be recruited to have an 80% power to detect a 50% decrease in superficial surgical site infection (assuming $P < 0.05$). **ITT analysis:** Yes, **number randomised:** 166, **number analysed:** 166

Wihbey 2018 *(Continued)*

	Funding: the devices used in this study were provided by an unrestricted research grant from KCI Medical (San Antonio, Texas). **Preregistration:** Yes. This trial was registered with clinical-trials.gov (Clinical Trial Registration: NCT02390401).
Participants	**Location:** 2 centres (USA) **Intervention group:** n = 80, **control group:** n = 86 **Mean age: intervention group** 31 ± 6, **control group** 30.2 ± 5 **Inclusion criteria:** women undergoing caesarean delivery for a viable neonate and their BMI on admission to the labour and delivery floor was 35 or higher. **Exclusion criteria:** women who were younger than 18 years old, did not speak English, had an allergy to silver or adhesives products, or who had a skin incision that would not fit the device or standard dressing (e.g. "T" skin incision).
Interventions	**Aim/s:** to compare the occurrence of superficial surgical site infections in women with class II or III obesity as defined by the Centers for Disease Control and Prevention using prophylactic negative pressure wound therapy compared with standard dressings after caesarean delivery. **Group 1 (NPWT) intervention:** Prophylactic NPWT supplied by KCI Medical (San Antonio, Texas) was applied at the time of primary skin closure at caesarean delivery and was placed over the closed surgical incision under sterile conditions and removed between postoperative day 5 and 7 at the time of incision check. **Group 2 (control) intervention:** standard dressing after caesarean delivery was applied using a sterile technique. If subcuticular closure was used, sterile slim adhesive strips (also known as Steri-Strips) were applied. For both sub-cuticular and staple closure, the dressing consisted of a sterile nonadherent wound dressing (also known as Telfa), a sterile gauze, and a waterproof transparent adhesive dressing (also known as Tegaderm). The standard dressing was removed on postoperative day 2. **Study date/s:** January 2015 to January 2017
Outcomes	• Primary outcome: occurrence of surgical site infection defined according to Centers for Disease Control and Prevention criteria (superficial SSI) • Composite wound complication, including superficial, deep, or organ-space surgical site infection • Wound dehiscence • Seroma within 30 days of surgery • Haematoma within 30 days of surgery • 30-day readmission, 30-day reoperation **Validity of measure/s:** Centers for Disease Control and prevention criteria were used. **Time points:** 1 week and 30 days postoperatively
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "A randomization program (www.randomization. com, Alberta, Canada) was used to generate sealed opaque envelopes with study assignment. Women were randomised at the conclusion of the cesarean delivery, during skin closure, when the envelopes were opened by a circulating operating room nurse. Two randomization strata were created using permuted blocks with varying block sizes for women with BMIs from 35 to less than 40 and women with BMIs of 40 or higher and for each site to ensure equal distribution of study allocation across these two separate BMI categories and sites."

Wihbey 2018 *(Continued)*

		Comment: appropriate method of sequence generation.
Allocation concealment (selection bias)	Low risk	Quote: "A randomization program (www.randomization. com, Alberta, Canada) was used to generate sealed opaque envelopes with study assignment. Women were randomised at the conclusion of the cesarean delivery, during skin closure, when the envelopes were opened by a circulating operating room nurse. Two randomization strata were created using permuted blocks with varying block sizes for women with BMIs from 35 to less than 40 and women with BMIs of 40 or higher and for each site to ensure equal distribution of study allocation across these two separate BMI categories and sites." Comment: centrally-generated sequence of sealed opaque envelopes. Sequential numbering of envelopes may be inferred.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Quote: "We conducted a randomised controlled, nonblinded, multicenter study". Comment: not blinded
Blinding of outcome assessment (detection bias) All outcomes	High risk	Quote: "We conducted a randomised controlled, nonblinded, multicenter study". Comment: not blinded
Incomplete outcome data (attrition bias) All outcomes	Low risk	Small attrition rate. Worst case scenario analysis performed for patients lost to follow-up.
Selective reporting (reporting bias)	Low risk	All prespecified outcomes fully reported.
Other bias	Low risk	No evidence of other sources of bias; adequate reporting.

Witt-Majchrzac 2015

Study characteristics	
Methods	**Study design:** randomised controlled trial **Study grouping:** parallel **Ethics** yes **and informed consent:** not stated **Follow-up period:** 6 weeks **Sample size estimate:** no **ITT analysis:** yes, **number randomised:** 80, **number analysed:** 80 **Funding:** not stated **Preregistration:** no
Participants	**Location:** Olsztyn, Poland **Intervention group:** n = 40,**control group:** n = 40 **Mean age: intervention group** = 66.2 (± 8), 53 to 80,**control group** = 62.1 (± 9.1), 41 to 78 **Inclusion criteria:** patients who underwent an off-pump coronary artery bypass grafting procedure, using the internal mammary artery.

Witt-Majchrzac 2015 *(Continued)*

	Exclusion criteria: not stated
Interventions	**Aim/s:** not stated **Group 1 (NPWT) intervention:** primary closure with NPWT (PICO, Smith & Nephew) using continuous negative pressure of -80 mmHg. Dressing changed on day 2 or 3 and on day 5 or 6 after surgery. **Group 2 control:** conventional dressings were applied after closure. Dressings changed daily. **Study date/s:** not stated
Outcomes	**Primary outcome/s:** surgical site infection **Secondary outcome/s:** dehiscence; blisters; reoperation.
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Authors stated only that participants were randomised, without describing method of randomisation.
Allocation concealment (selection bias)	Unclear risk	Not reported
Blinding of participants and personnel (performance bias) All outcomes	High risk	Quote: "An open label prospective study" Comment: open-label study with no blinding.
Blinding of outcome assessment (detection bias) All outcomes	High risk	Quote: "An open label prospective study" Comment: open-label study with no blinding.
Incomplete outcome data (attrition bias) All outcomes	Low risk	There was no attrition in either arm of the trial.
Selective reporting (reporting bias)	Low risk	While no study protocol was available, outcomes identified in the aims were reported (although it was unclear if the authors may have a priori identified other outcomes that were not reported on).
Other bias	Unclear risk	Baseline imbalance in age; NPWT group was older.

Abbreviations
AE: adverse events
ANZCTR: Australian New Zealand Clinical Trials Registry
APR: abdominoperineal resection
ASA: American Society of Anesthesiologists
ASEPSIS: ASEPSIS score - a quantitative scoring method using objective criteria based on wound appearance to evaluate wound infection
AUSD: Australian dollars
BMI: body mass index
BNF: British National Formulary
CABG: coronary artery bypass graft
CDC: US Centers for Disease Control and Prevention
CEACs: cost-effectiveness acceptability curves
CHEERS: Checklist for Economic Evaluation for Health Interventions
CI: confidence interval

ciNPT: closed incision negative pressure therapy
ciNPWT: closed incision negative pressure wound therapy
CrI: credible interval
CS: caesarean section
CTR: clinical trials registry
DK: Danish Krona
DRI: Disability Rating Index
DVT: deep venous thrombosis
EAU: European Association of Urology
ECDC: European Centre for Disease Prevention and Control
EHS: European Hernia Society
EMR: electronic medical record
EQ-5D-3L/5L: EuroQoL 5D questionnaire, version 3L
EUR: Euro
EuroQol: the EuroQol group https://euroqol.org/euroqol/
GBP: British pounds
GP: general practitioner
GSV: great saphenous veinHbA1c: level of glycated haemoglobin
HCHS: hospital and community health services
HIPAA: Health Insurance Portability and Accountability Act
HISS: Hand Injury Severity Score
HIV: human immunodeficiency virus
HRQoL: health-related quality of life
ICER: Incremental cost effectiveness ratioIH: inguinal hernia
iNPWT: incisional negative pressure wound therapy
IPAA: ileal pouch anal anastomosis
IQR: interquartile range
IRB: institutional review board
ITT: intention-to-treat
LOS: length of stay
MEC: medical ethics committee
NANOVA: proprietary name for negative pressure wound therapy dressing
NHS: National Health Service (United Kingdom)
NICE: National Institute for Health and Care Excellence (United Kingdom)
NNIS: National Nosocomial Infection Surveillance Committee
NPC: negative pressure closure
NPD: negative pressure device
NPWT: negative pressure wound therapy
NR: not reported
OPSITE: proprietary dressing name
OR: operating room (theatre)
ORIF: open reduction and internal fixation surgery
OSI: organ space infection
PCA: patient-controlled analgesia
PD: pancreaticoduodenectomies
PDS: polydioxanone suture
PICO(TM): proprietary name for negative pressure wound therapy dressing
POD: postoperative day
postop: postoperative
PP analysis: per-protocol
PSS: personal social services
PSSRU: Personal Social Service Research Unit
pT1 G2: penile cancer tumour stage 1, grade 2
QALY: quality-adjusted life year
QoL: quality of life
RCT: randomised controlled trial
RNA: Research Nurse Assistant
SAWT: subatmospheric pressure wound therapy system
SBSES: Stony Brook Scar Evaluation Scale
SC: standard care
SD: standard deviation
SDD: standard dry dressing

SEK: Swedish Krona
SF-12: 12-item Short Form Health Survey
SF-36: 36-item Short Form Health Survey
SNPWT: single-use negative pressure wound therapy
SOC: standard of care
SPD: static pressure dressing
SPID: sum of pain intensity differences
SSC: surgical site complications
SSI: surgical site infection
SSO: surgical site occurrence
SWOT: Stoma wound and ostomy
THA: total hip arthroplasty
TKR: total knee replacement
TKA: total knee arthroplasty
TLV: Swedish Dental and Pharmaceutical Benefit Agency (TLV)
UC: ulcerative colitis
USD: United States dollars
VAC: vacuum-assisted closure
VAS: visual analogue scale
VICNISS: Victorian Healthcare Associated Infection Surveillance System
vs.: versus
WHC: wound-healing complication

Characteristics of excluded studies *[ordered by study ID]*

Study	Reason for exclusion
Abesamis 2019	Ineligible study design - not an RCT
Albert 2012	No acute wounds were included.
Al-Inany 2002	Ineligible intervention
Anderson 2014	Feasibility study. Predefined criteria used to assess feasibility included: recruitment (> 75% participation); loss to follow-up (< 10%); intervention fidelity (= 95%); and interrater reliability (kappa = 0.8). Assessment of clinical outcomes was not planned or conducted.
Athanasiou 2018	Commentary on an RCT; not original research
Banasiewicz 2013	Included infected wounds
Bi 2017	Ineligible intervention
Bondokji 2011	Prospective cohort study
Braakenburg 2006	Chronic and acute wounds were reported together, and further information was not available.
Cantero 2016	Ineligible study design - not an RCT
Chang 2018	Discussion article
Chiang 2017	Open wounds
Chio 2010	Skin graft study
Cocjin 2019	Ineligible patient population - open wounds
Costa 2018	Ineligible population - wounds healing by secondary intention

Study	Reason for exclusion
De Rooij 2020	Ineligible patient population
Dorafshar 2012	The study used NPWT to treat existing non-healing skin graft wounds.
Dragu 2011	Ineligible study design - not RCT
Echeribi 2015	Ineligible study design - not an RCT-based economic evaluation
Eisenhardt 2012	Skin graft study; no inclusion of wounds healing by primary closure
Erne 2018	Ineligible intervention
Fang 2020	Ineligible study design - not an RCT
Fleming 2018	Ineligible study design - not an RCT
Frazee 2018	Ineligible comparison
Grauhan 2013	Quasi-randomised study: "A total of 156 patients were enrolled and allocated to 2 study groups, alternating according to the time of operation".
Hu 2009	Acute, subacute, and chronic wounds were included. Acute wounds were defined as those that had been "open" for less than 1 week.
Johannesson 2008	The intervention dressing was not a continuous negative pressure device.
Joos 2015	Commentary on an RCT in wounds healing by secondary intention
Kim 2007	The study was not a randomised controlled trial.
Kim 2015	Ineligible study design - not an RCT
Kim 2020	Ineligible study population
Krishnamoorthy 2012	Use of NPWT was not the only difference between the groups.
Li 2016	Quasi-randomisation (by odd and even numbers)
Licari 2020	Ineligible study design - not RCT-based economic evaluation
Llanos 2006	Skin graft study
Lychagin 2021	Ineligible intervention
Moisidis 2004	Skin graft study; no inclusion of wounds healing by primary closure
Monsen 2015	Ineligible patient population
Mouës 2004	No inclusion of acute wounds
Mouës 2007	No inclusion of acute wounds
Mujahid 2020	Ineligible patient population - people with skin grafts
Muller-Sloof 2018	Ineligible population

Study	Reason for exclusion
Muoghalu 2019	Ineligible study design - not an RCT
NCT00724750	Non relevant population (not closed surgical wounds)
Pellino 2014	Non-randomised study in people with Crohn's disease
Petkar 2012	Skin graft study
Rahmanian-Schwarz 2012	Included chronic and acute wounds, and these were not separately reported
Seidel 2020	Ineligible patient population
Sinha 2016	Ineligible population; infected wounds
Stannard 2006	Ineligible population; not closed incision wounds
Stannard 2009	Ineligible patient population
Stapleton 2015	Ineligible study design - not an RCT
Svensson-Bjork 2018	Non-randomised subgroup of RCT participants
Trofa 2019	Ineligible comparison
Visser 2017	The vacuum therapy device was a syringe inserted subcutaneously into the dressing, which was used to create a vacuum. Consequently, it was not a standard, continuous pressure device.
Walker 2018	Ineligible intervention
Wang 2019	Ineligible patient population
Xu 2019	Ineligible intervention
Yongchao 2017	Ineligible patient population
Yu 2017	A drain was left inside the wound, so not strictly a primarily closed wound.
Zhang 2020	Ineligible intervention
Zhuang 2020	Ineligible study design - not an RCT
Zotes 2015	Ineligible population; infected wounds

NPWT: negative pressure wound therapy
RCT: randomised controlled trial

Characteristics of studies awaiting classification *[ordered by study ID]*

Nagata 2018

Methods	**Study design:** randomised controlled trial **Study grouping:** intra-individual **Ethics and informed consent:** N/A **Follow-up period:** 6 months

Nagata 2018 *(Continued)*

	Sample size estimate: target sample size of 20 (sample size estimate calculation not reported) **ITT analysis:** yes, **number randomised:** 13, **number analysed:** 13 **Funding:** none **Preregistration:** this trial was registered under the name "Tissue Expander (TE) Insertion Comparison of Negative Pressure Fixation (NPF) and Film Dressing (FD) Effects on Suture Wound Open Label Randomized Single Facility Comparison Test," UMIN Clinical Trial Registry number UMIN000014424.
Participants	**Location:** single-centre – Japan **Intervention group:** n = 13, **control group:** n = 13 **Mean age:** 46.2, **intervention group** 46.2, **control group** 46.2 **Inclusion criteria:** women aged 18 to 65 years undergoing tissue expander insertion for two-stage breast reconstruction after mastectomy were included. **Exclusion criteria:** excluded patients were those who (1) did not provide consent, (2) received radiotherapy after surgery, (3) had an adverse reaction to the adhesive film, (4) had a local infection or wound dehiscence at study initiation, or (5) underwent tissue expander replacement with a silicone breast implant within 6 months after the first operation.
Interventions	**Aim/s:** to evaluate the effects of negative-pressure fixation on scar appearance and histochemical properties in comparison to those for film dressing without negative pressure. **Group 1 (NPWT) intervention:** application of negative pressure inside polyurethane foam (Hydrosite Plus; Smith & Nephew, London, United Kingdom) sealed by a film dressing (Airwall; Kyowa, Osaka, Japan). **Group 2 (control) intervention:** film dressing **Study date/s:** 3 July 2014 to 31 August 2016
Outcomes	• Visual analogue scale • Scar width • Immunohistochemistry **Validity of measure/s:** N/A **Time points:** 6 months postoperative
Notes	It was unclear whether the study planned to assess any relevant outcomes.

NPWT: negative pressure wound therapy

Characteristics of ongoing studies *[ordered by study ID]*

ACTRN12615000175572

Study name	Do suction assisted negative pressure dressings reduce the incidence of surgical site infections after abdominal surgery: a randomized controlled trial
Methods	Randomised controlled trial
Participants	Patients undergoing laparotomy (where abdominal incision breaches peritoneum, and wound is large enough to at least fit the surgeon's hand)

ACTRN12615000175572 *(Continued)*

Interventions	Negative pressure wound therapy versus standard dressing used with a clear film with an absorbent layer
Outcomes	Wound infection; patient satisfaction
Starting date	2015
Contact information	peeyau.tan@monashhealth.org
Notes	

ACTRN12618001611213

Study name	The effect of PICO dressings on surgical site infection following bowel resection: a randomised controlled trial
Methods	Randomised controlled trial
Participants	All adults (aged 18 and over) undergoing elective or emergency small or large bowel resection
Interventions	Negative pressure wound therapy (PICO dressing) versus standard dressing
Outcomes	SSI; Patient and Observer Scar Assessment Scale (POSAS); patient satisfaction
Starting date	2018
Contact information	Alexandra.Gordon@midcentraldhb.govt.nz
Notes	

ACTRN12618002006224

Study name	EffiCacY of neGative pressure wound therapy in the preventioN of surgical woUnd complicationS in the cesarean section at risk population: a randomised multi-centre trial, the CYGNUS trial
Methods	Randomised controlled trial
Participants	Pregnant women between 18-50 years undergoing caesarean section
Interventions	Negative pressure wound therapy versus standard dressing
Outcomes	SSI; wound dehiscence
Starting date	2018
Contact information	kylie.sandy-hodgetts@uwa.edu.au
Notes	

ACTRN12619000785101

Study name	Negative pressure wound therapy to reduce incisional wound infections - a randomised control trial
Methods	Randomised controlled trial
Participants	People aged at least 18 years undergoing emergency laparotomy with primary closure
Interventions	NPWT (Prevena) Standard dressings
Outcomes	SSI
Starting date	02 March 2020 (actual) planned 10 June 2019
Contact information	neil.strugnell@nh.org.au
Notes	

Brennfleck 2020

Study name	Negative pressure wound therapy (NPWT) on closed incisions to prevent surgical site infection in high-risk patients in hepatopancreatobiliary surgery: the NP-SSI trial
Methods	Randomised controlled trial
Participants	People undergoing hepatopancreatobiliary surgery who are aged at least 49 years
Interventions	NPWT (Prevena) Conventional gauze dressings
Outcomes	SSI (superficial and deep) Complications including seroma, haematoma, dehiscence) Quality of life Reoperation
Starting date	1 May 2019
Contact information	frank.brennfleck at ukr.de
Notes	DRKS00015136

ChiCTR -IOR-15006439

Study name	Prevention surgical site infection with using negative pressure wound therapy in abdominal incision
Methods	Parallel randomised controlled trial

ChiCTR -IOR-15006439 *(Continued)*

Participants	High-risk patients: including abdominal surgery for malignancy, colorectal, abdominal wall reconstruction
Interventions	Negative pressure wound therapy versus routine approach
Outcomes	Rate of surgical site infection
Starting date	2015
Contact information	hpzhangly@163.com
Notes	

CTRI/2019/08/020895

Study name	To study the effect of negative pressure dressings in preventing surgical site infection after emergency midline abdominal surgery; to evaluate negative pressure dressings in decreasing surgical site infections after emergency lapatotomy: a randomized controlled study.
Methods	Randomised controlled trial
Participants	Patients of 18-65 years of age undergoing emergency midline laparotomy for peritonitis
Interventions	NPWT Conventional saline dressing
Outcomes	SSI Dehiscence
Starting date	09 September 2019
Contact information	drkartiksahni@gmail.com
Notes	

CTRI/2020/11/028795

Study name	Usage of vaccum therapy in closed abdominal incision in reducing surgical site infection; prophylactic Negative Pressure Wound Therapy in reducing surgical site infections in closed abdominal incision: a randomized controlled trial.
Methods	Randomised controlled trial
Participants	People with intestinal disease aged 18 to 80 years
Interventions	NPWT Sterile gauze
Outcomes	SSI Seroma

CTRI/2020/11/028795 *(Continued)*	
	Haematoma
	Dehiscence
	Readmission
Starting date	02 November 2020
Contact information	maharjanmanik44@gmail.com
Notes	

Donlon 2019	
Study name	Prophylactic negative wound therapy in laparotomy wounds (PROPEL trial): randomized controlled trial
Methods	Randomised controlled trial
Participants	People aged over 18 undergoing emergency or elective laparotomy for benign or malignant conditions
Interventions	NPWT Prevena
	NPWT PICO
	Standard surgical dressings
Outcomes	Superfical SSI
	Seroma
	Haematoma
	Dehiscence
Starting date	6 November 2019
Contact information	donlonn@tcd.ie
Notes	NCT03871023

DRKS00006199	
Study name	Postoperative negative pressure incision therapy following open colorectal surgery: a randomized-controlled trial
Methods	Randomised controlled trial
Participants	Patients undergoing planned elective open colorectal surgery via median or transverse laparotomy
Interventions	Negative pressure wound therapy versus standard wound dressings

DRKS00006199 *(Continued)*

Outcomes	Rate of SSI; length of hospital stay; rate of reoperations; rate of antibiotic therapy; duration of post-operative negative pressure incision therapy (intervention arm only); wound pain assessed with VAS; rate of wound complications other than wound infections; rate of serious adverse events
Starting date	1 October 2015
Contact information	Unclear
Notes	

DRKS00011033

Study name	Evaluation of negative pressure incisional therapy in urgent gastrointestinal surgery for reduction of superficial surgical site infections compared to non-occlusive conventional plaster - a prospective, randomized, controlled, multicenter clinical trial
Methods	Randomised controlled trial
Participants	Patients undergoing urgent laparotomy due to an acute gastrointestinal disorder
Interventions	Negative pressure wound therapy versus non-occlusive conventional plaster
Outcomes	SSI; prolongation of hospitalisation due to SSI; cosmetic result; safety endpoints: AEs, SAEs
Starting date	21 September 2016
Contact information	Unclear
Notes	

DRKS00021494

Study name	Single use negative pressure wound therapy system (Prevena ™) compared to standard wound care after spinal surgery
Methods	Randomised controlled trial
Participants	Patients aged at least 18 years undergoing spinal surgery in the thoracic or lumbar spine from dorsal approach
Interventions	NPWT (Prevena) Conventional OpSite dressing
Outcomes	Wound healing disorders Revision (reoperation)
Starting date	25 June 2020
Contact information	ahmed.bassem at diakovere.de
Notes	

ISRCTN30055885	
Study name	The role of PREVENA vacuum dressings in patients undergoing breast surgery affecting both sides
Methods	Randomised controlled trial
Participants	Patients who are about to undergo a bilateral mammoplasty operation
Interventions	NPWT (Prevena) Conventional dressing
Outcomes	Wound complications
Starting date	January 2019
Contact information	andrew.pieri@nuth.nhs.uk
Notes	Retrospectively registered. Use www.isrctn.com/ISRCTN30055885 to access.

ISRCTN31224450	
Study name	Negative pressure therapy in large incisional hernia surgery
Methods	Randomised controlled trial (case-control)
Participants	Patients undergoing elective surgery for incisional hernia with diameters exceeding 10 cm
Interventions	Negative pressure wound therapy versus traditional dressing
Outcomes	Primary: volume accumulated in the drains every 24 hours in millilitres; number of days needed to reduce this volume under 50 mL per 24 hours Secondary: postoperative complications; cost
Starting date	1 February 2013
Contact information	drcarlesolona@gmail.com
Notes	

ISRCTN43457163	
Study name	Surgical wound infection prevention using topical negative pressure therapy on closed abdominal incisions - the 'SWIPE IT' randomized clinical trial
Methods	Randomised controlled trial
Participants	People aged at least 16 years undergoing elective or emergency laparotomy
Interventions	NPWT (Prevena) Standard surgical dressing

ISRCTN43457163 *(Continued)*

Outcomes	SSI (superficial; deep and organ space) Dehiscence Seroma Haematoma
Starting date	2015
Contact information	Angelina.dire@gmail.com
Notes	

ISRCTN55305726

Study name	WHITE 7 - WHISH – wound healing in surgery for hip fractures
Methods	Randomised controlled trial
Participants	Adults aged 65 years or older with a hip fracture that requires surgery
Interventions	Negative pressure wound therapy versus standard wound dressing
Outcomes	Deep infection; mortality rate; QoL; complications and surgical interventions; cost consequences and resource use; mobility; residential status; recruitment rate; retention rate
Starting date	1 March 2017
Contact information	lucy.sansom@ndorms.ox.ac.uk
Notes	

Jorgensen 2018

Study name	Prevention of seroma following inguinal lymph node dissection with prophylactic, incisional, negative-pressure wound therapy (SEROMA trial)
Methods	Randomised controlled trial
Participants	Patients ≥18 years undergoing inguinal lymph node dissection for metastatic melanoma
Interventions	Negative pressure wound therapy (Smith & Nephew) versus standard dressing (Micropore)
Outcomes	Seroma; cumulative volume of aspirated seromas; cumulative number of seroma aspirations; SSI; days until the last suction drain(s) removed; cumulative volume of collected lymph fluid; EQ-5D-5L; wound dehiscence; necrosis; haematoma; length of hospitalisation; readmission times; reoperation; lymphoedema; lymphoedema-related quality of life; regional recurrence of melanoma.
Starting date	2018
Contact information	jens.sorensen@rsyd.dk

Jorgensen 2018 *(Continued)*

Notes	Duplicate with NCT03433937

JPRN-UMIN000029706

Study name	Effects of closed incision negative-pressure wound therapy in implant-based breast reconstruction: a randomized controlled trial
Methods	Randomised controlled trial
Participants	Women aged at least 20 years with breast cancer scheduled skin or nipple sparing mastectomy and immediate two-stage tissue expander/implant reconstruction
Interventions	NPWT Usual care
Outcomes	Acute postoperative complications
Starting date	1 November 2017
Contact information	mstk28@gmail.com
Notes	

JPRN-UMIN000030936

Study name	A randomized phase II study to evaluate efficacy of negative pressure wound therapy on prophylaxis of the incisional hernia after reversal of temporaly [sic] diverting stoma
Methods	Randomised controlled trial
Participants	Patients 20-85 years with temporary stoma and planned closure following initial surgery
Interventions	Negative pressure wound therapy versus standard therapy
Outcomes	Incidence of radiological incisional hernia after one year of surgery
Starting date	2018
Contact information	skomat2718@gmail.com
Notes	

Kim 2020b

Study name	The effectiveness of negative-pressure wound therapy for wound healing after stoma reversal: a randomised control study (SR-PICO study)
Methods	Randomised controlled trial

Kim 2020b *(Continued)*

Participants	People undergoing stoma reversal with purse string closure who are aged at least 20 years
Interventions	NPWT (PICO) Conventional dressing
Outcomes	SSI
Starting date	Registered 6 June 2019
Contact information	sungiry@naver.com
Notes	KCT0004063

Masters 2018

Study name	Randomised controlled feasibility trial of standard wound management versus negative-pressure wound therapy in the treatment of adult patients having surgical incisions for hip fractures
Methods	Randomised controlled trial
Participants	Patients > 65 years undergoing surgery for hip fracture
Interventions	Negative pressure wound therapy versus standard care
Outcomes	SSI (deep infection); EQ-5D-5L; mobility; mortality; late complications
Starting date	2017
Contact information	james.masters@ndorms.ox. ac.uk
Notes	

Mihaljevic 2015

Study name	Postoperative negative-pressure incision therapy following open colorectal surgery (Poniy): a randomized-controlled trial
Methods	Randomised controlled trial
Participants	All adult (≥ 18 years of age) surgical patients scheduled for elective open colorectal surgery
Interventions	Negative-pressure incision therapy device versus standard dressing
Outcomes	SSI; length of hospital stay; reoperation; duration of postoperative antibiotic treatment; duration of negative-pressure incision therapy; wound pain; wound complications; serious adverse events
Starting date	2014
Contact information	kleeff@tum.de
Notes	

NCT01770067

Study name	Prophylactic treatment of high-risk patients with cardiovascular implantable electronic devices (CIED) with continuous in-situ ultra high-dose antibiotics (CITA) under regulated negative pressure-assisted wound therapy (RNPT)
Methods	Randomised controlled trial
Participants	Patients undergoing cardiovascular implantable electronic devices surgery
Interventions	High-dose antibiotics (CITA) under regulated negative pressure-assisted wound therapy (RNPT) versus CITA
Outcomes	Lack of CIED infection
Starting date	February 2013
Contact information	Unknown
Notes	

NCT01891006

Study name	Intervention for postpartum infections following caesarean section (APIPICS)
Methods	Randomised controlled trial
Participants	Patients 18 years of age or older with postpartum infections following caesarean section
Interventions	Negative pressure wound therapy versus standard wound dressing
Outcomes	Frequency of re-rupture in each study group; length of hospitalisation; readmission to hospital; decreased health-related quality of life score; cosmetic outcome
Starting date	2013
Contact information	Nana Hyldig
Notes	

NCT01905397

Study name	Negative pressure wound therapy to reduce surgical site infection
Methods	Randomised controlled trial
Participants	Scheduled for an elective surgery in either open CRS or open HPBS
Interventions	Negative pressure wound therapy versus conventional wound therapy
Outcomes	Incidence of surgical site infection; characterisation of surgical site infection; length of hospital stay

NCT01905397 *(Continued)*

Starting date	2013
Contact information	Trey Blazer, Duke University
Notes	

NCT02020018

Study name	Negative pressure wound therapy for prevention of post-sternotomy infection
Methods	Randomised controlled trial
Participants	Patients undergoing open heart surgery
Interventions	Negative pressure wound therapy versus standard wound dressings
Outcomes	Wound infection after open-heart surgery; reoperation for wound infection; length of stay
Starting date	December 2013
Contact information	Unknown
Notes	

NCT02064270

Study name	PICO: a prospective, randomized, controlled clinical study to assess the prevention of postsurgical incision healing complications in patients undergoing primary or revision Knee Arthroplasty (KA) or Total Hip Arthroplasty (THA), treated with either single-use Negative Pressure Wound Therapy (NPWT) or standard postsurgical dressings
Methods	Randomised controlled trial
Participants	Patient is scheduled to have a surgical procedure for total knee arthroplasty or total hip arthroplasty (primary or revision procedure)
Interventions	Negative pressure wound therapy versus standard postsurgical dressings
Outcomes	Incision appearance based on VAS; drainage amount; user-friendliness for patient; number of participants with complications; return to the operating room; need for antibiotics
Starting date	Protocol dated March 2016
Contact information	JP Stannard
Notes	stannardj@health.missouri.edu

NCT02118558

Study name	Negative pressure wound therapy – PREVENA – in prevention of infections after total knee arthroplasty (TKA)
Methods	Randomised controlled trial
Participants	Patients undergoing knee arthroplasty
Interventions	Negative pressure wound therapy versus standard prophylactic therapy
Outcomes	Proportion of infections; number of participants recommended to undergo further procedural intervention due to infection
Starting date	June 2014
Contact information	Unknown
Notes	

NCT02302222

Study name	The management of closed surgical incisions resulting from incisional hernia repair and/or functional panniculectomy using the Prevena Customizable dressing
Methods	Randomised controlled trial
Participants	Adults undergoing panniculectomy or hernia repair; BMI ≥ 30; preoperatively assessed to undergo a procedure resulting in a clean/clean-contaminated wound
Interventions	PREVENA Customizable Dressing with ACTIV.A.C. therapy unit versus standard dressing
Outcomes	Incidence of SSI or dehiscence within 30 days of surgery; incidence of clinically relevant intervention (antimicrobial treatment, drainage, debridement, reoperation, application of NPWT) within 30 days of surgery
Starting date	2015
Contact information	Not stated
Notes	

NCT02331485

Study name	Randomised control study to assess the role of negative pressure wound therapy (NPWT) in the management of wound in surgical patient
Methods	Randomised controlled trial
Participants	Patients undergoing laparotomy with 1 of: high BMI; malignancy; malnutrition; type 2 diabetes; emergency surgery; post-radiochemotherapy; steroids; open colorectal resection; and at least 2 of: smoking; age > 75 years; diffuse atherosclerotic disease involving arteries
Interventions	Negative pressure wound therapy (PICO + Acticoat group) versus standard wound management

NCT02331485 *(Continued)*

Outcomes	Reduction in wound infection by 50%; reduction in length of hospital stay; decrease in antibiotic use for wound infection management; decreased cost of patient treatment
Starting date	August 2014
Contact information	mikazanowski@gmail.com; sebastian.smolarek79@gmail.com
Notes	

NCT02348034

Study name	A randomized controlled trial exploring the ability of negative pressure wound therapy (NPWT) to reduce colorectal surgical site infections (SSI)
Methods	Randomised controlled trial
Participants	Patients undergoing elective colorectal surgery
Interventions	PREVENA dressing versus usual care
Outcomes	Presence/absence of superficial surgical site infection; presence/absence of intervention-related side effects
Starting date	November 2015
Contact information	gag511@mail.usask.ca
Notes	

NCT02408835

Study name	Negative pressure wound therapy in groin dissection
Methods	Randomised controlled trial
Participants	Patients undergoing inguinal lymphadenectomy for metastatic carcinoma of cutaneous origin
Interventions	Negative pressure wound therapy versus conventional wound care
Outcomes	Time to wound healing; wound infection; lymphoedema; need for further surgical interventions to achieve wound healing; scar appearance; patient-reported outcomes
Starting date	July 2015
Contact information	s.mcallister@qub.ac.uk
Notes	

NCT02492854

Study name	Standard versus PICO dressings in lower-extremity bypass patients (PICO-LEB)
Methods	Randomised controlled trial
Participants	Patients undergoing lower extremity bypass using ipsilateral great saphenous vein harvest
Interventions	PICO single-use negative pressure dressings versus sterile gauze dressings
Outcomes	Infection of surgical site incision; function and quality of life; resource utilisation in dollars
Starting date	2015
Contact information	Jeffrey.Siracuse@bmc.org; twtcheng@bu.edu
Notes	

NCT02509260

Study name	Prevena incisional negative pressure wound therapy in re-operative colorectal surgery
Methods	Randomised controlled trial
Participants	Patients undergoing open reoperative colorectal surgery
Interventions	Negative pressure wound therapy versus standard wound dressings
Outcomes	Occurrence of superficial surgical site infection; length of hospital stay; cost-effectiveness; clinical efficacy of the device in relation to the degree of contamination
Starting date	July 2015
Contact information	ASHBURJ@ccf.org
Notes	

NCT02558764

Study name	Effects of preventive negative pressure wound therapy with PICO on surgical wounds of kidney transplant patients
Methods	Randomised controlled trial
Participants	Patients admitted for cadaveric kidney transplant surgery
Interventions	Negative pressure wound therapy versus basic wound contact absorbent dressings
Outcomes	Post-kidney transplant wound complication rates
Starting date	November 2015
Contact information	Unknown

NCT02558764 *(Continued)*

Notes	

NCT02664168

Study name	A comparative study to assess the prevention of surgical site infection (SSIs) in revision total joint arthroplasty patients treated with single-use negative pressure wound therapy (PICO) or standard care dressings (AQUACEL Ag surgical dressing)
Methods	Randomised controlled trial
Participants	Patients undergoing revision total knee arthroplasty or revision total hip arthroplasty
Interventions	Single-use negative pressure wound therapy versus AQUACEL Ag surgical dressing
Outcomes	Incidence of surgical site infection
Starting date	January 2016
Contact information	tiffany.morrison@rothmaninstitute.com
Notes	

NCT02682316

Study name	Negative pressure wound therapy in post-operative incision management
Methods	Randomised controlled trial
Participants	Women of any BMI undergoing a laparotomy procedure for a presumed gynaecologic malignancy, or morbidly obese
Interventions	Negative pressure wound therapy versus usual standard dry gauze
Outcomes	Number of postoperative wound complications
Starting date	February 2016
Contact information	Mario Leitao
Notes	

NCT02790385

Study name	Negative pressure wound therapy - a multi-centered randomized control trial (NPWT)
Methods	Randomised controlled trial
Participants	Patients undergoing posterior spinal surgery categorised as high risk for infection
Interventions	Negative pressure wound therapy versus standard gauze treatment

NCT02790385 *(Continued)*

Outcomes	Wound infection; time for wound closure; cosmetic results; caregiver/parental satisfaction; wound dehiscence; foreign body reaction
Starting date	July 2014
Contact information	Unknown
Notes	

NCT02799667

Study name	Do single use negative pressure dressings reduce wound complications in obese women after cesarean delivery?
Methods	Randomised controlled trial
Participants	Obese women (BMI > 40 kg/m^2) undergoing caesarean delivery
Interventions	Negative pressure wound therapy versus conventional dressing
Outcomes	Presence of wound complications
Starting date	May 2016
Contact information	sbakaysa@tuftsmedicalcenter.org
Notes	

NCT02892435

Study name	Prevena incision management system vs conventional management for wound healing
Methods	Randomised controlled trial
Participants	Patients submitted to contaminated or dirty abdominal surgery
Interventions	Negative pressure wound therapy versus conventional dressing
Outcomes	SSI; reduction in wound complications in participants with associated risk factors (e.g. diabetes, obesity, and cancer)
Starting date	November 2014
Contact information	alessia.garzi@gmail.com
Notes	

NCT02901405

Study name	NPWT in soft tissue sarcoma surgery

NCT02901405 *(Continued)*

Methods	Randomised controlled trial
Participants	Adults undergoing primary soft tissue sarcoma excision that is primarily closed
Interventions	Negative pressure wound therapy versus standard dressings
Outcomes	Surgical site infection; time to wound dryness; delay to discharge from hospital; adverse events; cost analysis
Starting date	2016
Contact information	ashish.mahendra@ggc.scot.nhs.uk
Notes	

NCT02901613

Study name	Prophylactic post-cesarean incisional negative-pressure wound therapy in morbidly obese patients
Methods	Randomised controlled trial
Participants	Morbidly obese patients who have undergone caesarean section
Interventions	Negative pressure wound therapy versus standard dry sterile dressing
Outcomes	Wound complications
Starting date	August 2016
Contact information	denefrc@mail.amc.edu
Notes	

NCT02926924

Study name	Prophylactic application of an incisional wound VAC to prevent wound complications in obese spine surgery patients
Methods	Randomised controlled trial
Participants	Patients scheduled to have posterior spine surgery; BMI ≥ 35
Interventions	Wound VAC versus standard dressing
Outcomes	Postoperative infection requiring return to operating room
Starting date	2016
Contact information	jaimeeg@med.umich.edu
Notes	

NCT02954835

Study name	Negative pressure therapy for groin wounds
Methods	Randomised controlled trial
Participants	Patients undergoing vascular surgery with a groin incision
Interventions	PREVENA versus traditional dressing
Outcomes	Infection rate
Starting date	2016
Contact information	thomas.bernik@ehmchealth.org; courtney.woodhull@ehmchealth.org
Notes	

NCT02967627

Study name	VAC dressings for colorectal resections (VACCRR)
Methods	Randomised controlled trial
Participants	Patients undergoing elective colorectal resection for benign or malignant disease
Interventions	Negative pressure wound therapy versus sterile gauze dressing
Outcomes	SSI; wound complication; length of stay; wound-related visits post-surgery; need for and duration of home care; blistering/reaction to wound dressings; postoperative complications.
Starting date	November 2016
Contact information	mitchell.webb@alumni.ubc.ca
Notes	

NCT03000010

Study name	Wound Vac bandage comparison after spinal fusion (WV)
Methods	Randomised controlled trial
Participants	Patients with neuromuscular scoliosis undergoing posterior spinal fusion
Interventions	Incisional wound VAC versus normal gauze bandage group
Outcomes	Prevention of wound dehiscence or infection
Starting date	2016
Contact information	mcburke@med.umich.edu

NCT03000010 *(Continued)*

Notes	

NCT03010137

Study name	Incisional negative pressure wound therapy in high risk patients undergoing panniculectomy: a prospective randomized controlled trial
Methods	Randomised controlled trial
Participants	Patients undergoing panniculectomy in preparation for renal transplantation
Interventions	Negative pressure wound therapy versus standard closure
Outcomes	Wound-healing complications; time to drain removal; scarring; pain; QoL
Starting date	December 2015
Contact information	cbailey@ucdavis.edu
Notes	

NCT03021668

Study name	Comparison between wound vacuum dressing and standard closure to reduce rates of surgical site infections
Methods	Randomised controlled trial
Participants	Patient to undergo pancreaticoduodenectomy for pancreatic tumours at the Johns Hopkins Hospital
Interventions	PREVENA Peel & Place dressing versus standard closure of surgical incision
Outcomes	Rate of surgical site infection; prolonged length of stay; rate of readmission; time to adjuvant therapy
Starting date	2017
Contact information	Matthew J Weiss, Johns Hopkins University
Notes	

NCT03061903

Study name	Closed incision negative pressure therapy vs standard care (Prevena)
Methods	Randomised controlled trial
Participants	Patients undergoing primary total hip arthroplasty through a direct anterior approach with: diabetes; obesity (BMI > 30); active smoking; previous hip surgery

NCT03061903 *(Continued)*

Interventions	PREVENA versus AQUACEL
Outcomes	Prevalence of wound complications; duration of wound-healing delay; length of hospital stay; number of days on antibiotic therapy; average cost of wound treatment
Starting date	2017
Contact information	mh3818@cumc.columbia.edu; rs3464@cumc.columbia.edu
Notes	

NCT03069885

Study name	iNPWT in immediate breast reconstruction
Methods	Randomised controlled trial
Participants	Patients ≥ 18 admitted for immediate breast reconstruction
Interventions	Negative pressure wound therapy versus standard wound dressings
Outcomes	Time to removal of surgical drains; SSI; skin necrosis; hospitalisation time; participant and observer assessment of the scars; patient satisfaction and quality of life
Starting date	November 2017
Contact information	Aarhus University Hospital
Notes	

NCT03082664

Study name	Negative pressure wound therapy to prevent wound complications following cesarean section in high risk patients
Methods	Randomised controlled trial
Participants	Caesarean section in high-risk obstetric patients
Interventions	Negative pressure wound therapy versus standard wound dressings
Outcomes	Wound complications: wound breakdown, infection, separation, dehiscence
Starting date	June 2015
Contact information	meghanhill@obgyn.arizona.edu
Notes	

NCT03144726

Study name	RCT on NPWT for incisions following major lower-limb amputation to reduce surgical site infection
Methods	Randomised controlled trial
Participants	Any patient 18 years or older undergoing amputation of the lower limb, either an above-knee amputation or below-knee amputation
Interventions	Negative pressure wound therapy versus standard dressing
Outcomes	Surgical site infection; length of stay; antibiotic use; reoperation; death
Starting date	2017
Contact information	oonagh.scallan@lhsc.on.ca
Notes	

NCT03175718

Study name	iNPWT on wound complications & clinical outcomes after lower extremity sarcoma surgery preop radiation therapy patients (VAC)
Methods	Randomised controlled trial
Participants	Patients with lower extremity soft tissue sarcoma confirmed by tissue pathology
Interventions	VAC wound dressing versus wound dressing
Outcomes	Wound complications including reoperation for superficial or deep site infection; quality of life; functional outcome; overall cost
Starting date	2017
Contact information	yalmosuli@ohri.ca; jdobransky@ohri.ca
Notes	

NCT03180346

Study name	A prospective, randomized, comparative study to assess the prevention of surgical site infection (SSIs) in revision total joint arthroplasty patients treated with single-use negative pressure wound therapy (PICO) or standard care dressings (AQUACEL Ag surgical dressing)
Methods	Randomised controlled trial
Participants	Patients undergoing revision total knee arthroplasty or revision total hip arthroplasty
Interventions	Negative pressure wound therapy versus standard care
Outcomes	SSI
Starting date	March 2017

NCT03180346 *(Continued)*

Contact information	Unknown
Notes	

NCT03250442

Study name	Evaluating the outcomes for incisional application of negative pressure for nontraumatic amputations
Methods	Randomised controlled trial
Participants	Patient requires closure of a non-traumatic transmetatarsal amputation, below-knee amputation, knee disarticulation, or above-knee amputation.
Interventions	PREVENA device versus standard dry dressing
Outcomes	Proportion of postoperative incision complications between the 2 arms; length of hospital stay; number of surgically-related wound readmissions; Medical Outcomes Study 12-item Short Form Health Survey (SF-12); percentage of closed incisions remaining closed at 1, 2, and 3 months post-hospital discharge
Starting date	2017
Contact information	paul.j.kim@gunet.georgetown.edu
Notes	

NCT03269968

Study name	Use of negative pressure wound therapy in morbidly obese women after cesarean delivery
Methods	Randomised controlled trial
Participants	Obese women undergoing elective caesarean delivery
Interventions	Negative pressure wound therapy versus standard wound dressings
Outcomes	Composite wound complication; patient survey
Starting date	October 2017
Contact information	Tetsuya Kawakita (tetsuya.x.kawakita@medstar.net)
Notes	

NCT03274466

Study name	Closed incision negative pressure therapy versus standard of care surgical dressing in revision total knee arthroplasty (PROMISES)

NCT03274466 *(Continued)*

Methods	Randomised controlled trial
Participants	Patient requires a TKA revision defined as: a 1-stage aseptic revision procedure; a 1-stage septic exchange procedure for acute postoperative infection; removal of cement spacer and re-implantation procedure; open reduction and internal fixation of periprosthetic fractures
Interventions	Closed incision negative pressure therapy (ciNPT) versus standard-of-care dressing
Outcomes	Surgical site complications; surgical site infection; deep surgical site infection
Starting date	2017
Contact information	eric.synatschk@acelity.com; jane.hart@kci1.com
Notes	

NCT03321799

Study name	Comparison of negative pressure wound therapy versus conventional dressings for the prevention of wound complications after revision THA
Methods	Randomised controlled trial
Participants	Patients > 18 years of age undergoing a revision total hip arthroplasty procedure
Interventions	Negative pressure wound therapy versus sterile antimicrobial dressings
Outcomes	Wound complications; reoperation; cost comparison
Starting date	2017
Contact information	chris.culvern@rushortho.com
Notes	

NCT03345771

Study name	Antimicrobial barrier dressing versus closed-incision negative pressure therapy in the obese primary total joint arthroplasty
Methods	Randomised controlled trial
Participants	Patients identified at preoperative testing to have an elevated BMI (> 35)
Interventions	Negative pressure wound therapy versus antimicrobial barrier dressing
Outcomes	Visual analogue scale pain score; wound evaluation scale
Starting date	2017
Contact information	Afshin.Anoushiravani@nyumc.org

NCT03345771 *(Continued)*

Notes	

NCT03346694

Study name	Reducing surgical site infection rates using an alternative sternal dressing
Methods	Randomised controlled trial
Participants	Patients who will undergo cardiac surgery via a sternotomy incision
Interventions	Standard island dressing versus PREVENA negative pressure versus Mepilex Border Post-Op Ag
Outcomes	Rates of surgical site infection pertaining to each dressing studied; impact of alternative dressings on rates of sternal wound incision infection
Starting date	2017
Contact information	jackboyd@stanford.edu; jniesen@stanfordhealthcare.org
Notes	

NCT03395613

Study name	Negative pressure incision management system in infrainguinal vascular surgery
Methods	Randomised controlled trial
Participants	Not stated
Interventions	Negative pressure wound therapy versus standard sterile gauze dressing
Outcomes	Postoperative SSI; postoperative SSI within 90 days; antibiotic prescriptions for skin and soft tissue infections; postoperative SSI within 90 days requiring surgical revision; adverse events directly related the NPWT dressing; major lower limb amputation and/or mortality; changes in reported quality of life; assessment of healthcare-related costs; assessment of quality of life during the first 7-day period.
Starting date	2018
Contact information	alireza.daryapeyma@sll.se; rebecka.hultgren@sll.se
Notes	

NCT03402945

Study name	Prevention of infections in cardiac surgery (PICS) Prevena study (PICS-Prevena)
Methods	Randomised controlled trial - 4-arm factorial design
Participants	Patients ≥ 18 years of age undergoing open-heart surgery

NCT03402945 *(Continued)*

Interventions	PREVENA and cefazolin versus PREVENA and cefazolin and vancomycin versus standard wound dressing and cefazolin versus standard wound dressing and cefazolin and vancomycin
Outcomes	Adherence to the wound management system; adherence to the antibiotic regimen; loss of follow-up; deep incisional and organ/space sternal surgical site infection; wound dehiscence; clostridium difficile infection; mortality in participants with an active infection; intensive care unit and hospital stay; pain on day 7; acute kidney injury
Starting date	2018
Contact information	prevena@phri.ca
Notes	

NCT03414762

Study name	PICO negative pressure wound therapy in obese women undergoing elective cesarean delivery
Methods	Randomised controlled trial
Participants	Obese women undergoing elective caesarean delivery
Interventions	Negative pressure wound therapy versus standard wound dressings
Outcomes	Surgical site occurrence; surgical incision intervention
Starting date	November 2018
Contact information	Sarah Pachtman (spachtman@northwell.edu)
Notes	

NCT03458663

Study name	Randomized trial comparing Prevena and ActiV.A.C. system to conventional care after Bascom's cleft lift surgery
Methods	Randomised controlled trial
Participants	Patients with recurrence after previous surgery for pilonidal disease, cases of poor postoperative healing, or primary extensive/fistulating disease referred to Randers Regional Hospital for assessment for reconstructive Bascom's cleft lift surgery
Interventions	PREVENA versus conventional postoperative care
Outcomes	Primary healing; health perception; long-term healing; early recurrence; postoperative pain
Starting date	2018
Contact information	susahaas@rm.dk; marlesoe@rm.dk
Notes	

NCT03460262

Study name	Negative pressure wound therapy for prevention of groin infection following vascular surgery (PICO)
Methods	Randomised controlled trial
Participants	High-risk patients undergoing vascular surgery with groin incision (without ongoing infection)
Interventions	PICO versus standard cutiplast
Outcomes	Rate of wound complications
Starting date	2018
Contact information	parla.astarci@uclouvain.be; julien.possoz@uclouvain.be
Notes	

NCT03512470

Study name	Clinical study on the prevention of surgical wound complications for aneurysmal thoracic-abdominal aortic pathology using the "PREVENA" system (TVAC)
Methods	Randomised controlled trial
Participants	Patients with surgical wounds to treat thoracic-abdominal aortic pathology
Interventions	PREVENA versus standard medication
Outcomes	Reduction of surgical site infections; reduction of adverse events
Starting date	2018
Contact information	domenico.baccellieri@hsr.it; elisa.simonini@hsr.it
Notes	

NCT03632005

Study name	A prospective randomized clinical trial comparing incisional negative pressure wound therapy to conventional sterile dressing in patients undergoing thoracolumbar posterior spine surgery
Methods	Randomised controlled trial
Participants	Patients ≥ 17 years who require spine surgery with a posterior midline incision that involves the thoracic, lumbar and/or sacral spine
Interventions	Negative pressure wound therapy (Prevena) versus standard dressing
Outcomes	SSI; revision; acute spinal cord injury

NCT03632005 *(Continued)*

Starting date	18 March 2017
Contact information	allan.aludino@vch.ca; leilani.reichl@vch.ca
Notes	

NCT03688438

Study name	Post operative wound complications in patients With BMI ≥ 35kg/m^2 after posterior lumbar spine surgery: a randomized clinical trial of closed-incision negative-pressure therapy
Methods	Randomised controlled trial
Participants	Patients ≥ 18 years with BMI ≥ 35 kg/m^2 undergoing posterior lumbar fusion with or without inter-body fusion
Interventions	Closed-Incision negative-pressure therapy (WoundVac) versus standard dressing
Outcomes	Wound complication; days to dry wound
Starting date	15 October 2018
Contact information	spineresearch@nortonhealthcare.org; kelly.bratcher2@nortonhealthcare.org
Notes	

NCT03716687

Study name	Prophylactic negative pressure wound therapy for high risk laparotomy wounds. Randomized prospective clinical trial
Methods	Randomised controlled trial
Participants	Patients 18-80 years undergoing high-risk laparotomy
Interventions	Negative pressure wound therapy (Hartmann) versus standard dressing
Outcomes	SSI; full thickness abdominal wall dehiscence requiring reoperation
Starting date	1 November 2018
Contact information	bankybalazs@gmail.com; fulop.andras2@gmail.com
Notes	

NCT03773575

Study name	Evaluation of closed incision negative pressure dressing (PREVENA) to prevent lower extremity amputation wound complications

NCT03773575 *(Continued)*

Methods	Randomised controlled trial
Participants	Patients ≥ 18 years undergoing lower extremity amputation
Interventions	Negative pressure wound therapy (Prevena) versus standard dressing
Outcomes	Wound complications; length of stay; 30-day return to operating room; 30-day hospital readmissions; dehiscence; seroma; lymph leak; infection; haematoma; ischaemia; necrosis; hospital costs
Starting date	15 January 2019
Contact information	laura.anatale.tardiff@jefferson.edu
Notes	

NCT03781206

Study name	Efficacy of negative pressure wound therapy (NPWT) for prevention of wound infection and improvement of wound healing after stoma reversal
Methods	Randomised controlled trial
Participants	Patients ≥ 18 years who underwent elective open or laparoscopic rectal resection ostomy construction (loop/end ileostomy; loop/end colostomy) for either oncological and inflammatory bowel disease indications
Interventions	Negative pressure wound therapy (PICO) versus standard care
Outcomes	SSI; wound healing timing; EQ-5D-5L; McGill pain questionnaire
Starting date	1 April 2019
Contact information	annalisa.maroli@humanitas.it
Notes	

NCT03816293

Study name	SUpPress SSI - single use negative pressure wound therapy (NPWT) to reduce surgical site infections (SUpPressSSI)
Methods	Randomised controlled trial
Participants	Patients ≥ 18 years undergoing caesarean section, abdominal hysterectomy or colon procedures and either obese (BMI > 30 kg/m^2) or diabetic
Interventions	Negative pressure wound therapy (Prevena) versus standard dressing
Outcomes	SSI; length of stay; readmission; seroma; haematoma; dehiscence
Starting date	1 May 2019

NCT03816293 *(Continued)*

Contact information	Susan Bleasdale, University of Illinois at Chicago
Notes	

NCT03820219

Study name	A pilot study comparing incisional negative pressure wound therapy (Prevena) to conventional sterile dressing in patients undergoing thoracolumbar posterior spine surgery
Methods	Randomised controlled trial
Participants	All patients ≥ 17 years who require spine surgery with a posterior midline incision that involves the thoracic, lumbar and/or sacral spine
Interventions	Negative pressure wound therapy (Prevena) versus standard dressing
Outcomes	SSI; seroma or dehiscence; resource time commitment; return visits
Starting date	15 March 2019
Contact information	Unknown
Notes	

NCT03886818

Study name	Evaluation of the efficacy of negative pressure wound therapy on incisional wound healing after a total ankle arthroplasty: a randomized study
Methods	Randomised controlled trial
Participants	Patients ≥ 18 years undergoing total ankle arthroplasty
Interventions	Negative pressure wound therapy (PICO) versus standard dressing
Outcomes	Number of days from suture removal to achieve complete wound healing; rate of technical failures of the PICO device, and type of failure; number and type of adverse effects related to the PICO device; rate of wound healing complications: presence of exudate; blister; necrosis; wound dehiscence; SSI; surgical revision; incremental cost-effectiveness ratio
Starting date	1 April 2019
Contact information	jean-luc.besse@chu-lyon.fr; stephanie.vincente01@chu-lyon.fr
Notes	

NCT03900078

Study name	Inzisionelle negative drucktherapie nach resektion von weichteiltumoren - eine prospektive, randomisierte, kontrollierte klinische studie

NCT03900078 *(Continued)*

Methods	Randomised controlled trial
Participants	Patients ≥ 18 years with soft tissue tumour of extremities or trunk with expected resection of > 10 cm tissue in any dimension
Interventions	Negative pressure wound therapy versus standard dressing
Outcomes	Amount of drainage fluid; wound complications; wound margin perfusion
Starting date	1 December 2018
Contact information	mehran.dadras@bergmannsheil.de; bjorn.behr@rub.de
Notes	

NCT03905213

Study name	Impact of the use of three dressings in the prevention of surgical wound infection in patients undergoing major cardiac surgery: a clinical prospective and randomized study
Methods	Randomised controlled trial (3 treatment arms)
Participants	Patients ≥ 18 years undergoing cardiac surgery
Interventions	Negative pressure wound therapy (PICCO) versus absorbent dressing (MEPILEX) versus standard dressing (MEPORE)
Outcomes	Surgical wound infection; hospital stay; antimicrobial consumption; dressing consumption cost
Starting date	1 September 2019
Contact information	massus@hotmail.es; javier.hortal@gamil.com
Notes	

NCT03935659

Study name	Negative pressure wound therapy for surgical site infection prevention in vascular surgery patients undergoing common femoral artery exposure
Methods	Randomised controlled trial
Participants	Adults ≥ 18 years with one or more of: body mass index > 30 kg/m^2; critical limb ischaemia; procedure time > 240 min; end stage renal disease on dialysis; glycated hemoglobin ≥ 8.5%; transfusion ≥ 3 units packed red blood cells; previous femoral artery cut-down
Interventions	Negative pressure wound therapy versus standard dressing
Outcomes	Superficial SSI; mortality; limb loss; emergency department visit for wound complication; local reaction to negative wound dressing
Starting date	26 March 2018

NCT03935659 *(Continued)*

Contact information	LKABBAN1@hfhs.org; arteil1@hfhs.org
Notes	

NCT03948412

Study name	Negative pressure wound therapy (PREVENA) versus standard dressings for incision management after renal transplant (IMPART)
Methods	Randomised controlled trial
Participants	Patients ≥ 18 years undergoing renal transplant
Interventions	Negative pressure wound therapy (Prevena) versus standard dressing
Outcomes	Wound complications; length of hospital stay; graft function; delayed graft function; pain score; scar quality; EQ-5D-5L; graft function; ASEPSIS wound score
Starting date	10 May 2019
Contact information	Linda.Pallot@health.nsw.gov.au
Notes	

NCT04039659

Study name	POstoperative Negative-pressure Incision Therapy following LIver TRANSplant: a Randomized Controlled Trial (PONILITRANS)
Methods	Randomised controlled trial
Participants	People aged between 18 to 70 years undergoing liver transplantation
Interventions	NPWT (PICO) Standard dressings
Outcomes	SSI Quality of life
Starting date	1 February 2019
Contact information	victorrelopez@gmail.com
Notes	

NCT04110353

Study name	Prophylactic closed incision Negative pressure wound therapy on abdominal wounds - Clinical and Economic perspectives (ProNounCE)

NCT04110353 *(Continued)*

Methods	Randomised controlled trial with stepped-wedge design
Participants	People aged at least 18 years undergoing emergency, trauma or elective contaminated abdominal operations within general surgery and/or colorectal surgery with abdominal wounds closed at time of operation and expected to heal by primary intention
Interventions	NPWT (prevena) NPWT (ciVAC) Conservative dressings
Outcomes	SSI Wound complications Mortality Quality of life
Starting date	June 2020
Contact information	eman.alkizwini@nhs.net
Notes	

NCT04174183

Study name	Evaluation of the effectiveness of a closed-incision negative-pressure therapy (Prevena®) on bilateral groin incision (PREVISION)
Methods	Randomised controlled trial with intra-individual design
Participants	People undergoing bilateral vascular groin surgery and aged at least 18 years
Interventions	NPWT (Prevena) Dry dressing
Outcomes	Wound complication Haematoma
Starting date	24 December 2019
Contact information	n.settembre@chru-nancy.fr
Notes	2019-A02416-51

NCT04214236

Study name	CiNPT for Abdominoplasties in Post-bariatric patients Study (CAPS)
Methods	Randomised controlled trial

NCT04214236 *(Continued)*

Participants	People aged at least 18 years with previous bariatric surgery for weight loss undergoing pallinculectomy with a residual BMI of at least 30 kg/m^2
Interventions	NPWT (Prevena) Standard non-adherent surgical dressing (Vaseline petrolatum gauze)
Outcomes	SSI Haematoma Seroma Reoperation Skin blistering
Starting date	1 February 2020
Contact information	caps.trial@gmail.com
Notes	

NCT04265612

Study name	Effect of the negative pressure therapy dressing compared with Hydrogel dressing (PICO/2019)
Methods	Randomised controlled trial
Participants	People aged at least 18 years undergoing elective or emergency cardiac surgery with extracorporeal circulation heart surgery with a median sternotomy.
Interventions	NPWT (PICO) Hydrogel dressing
Outcomes	SSI Dehiscence
Starting date	5 November 2019
Contact information	doctoragarrido@gmail.com
Notes	

NCT04434820

Study name	External negative pressure dressing system vs. traditional wound dressing for cesarean section incision in obese women
Methods	Randomised controlled trial

NCT04434820 *(Continued)*

Participants	Women aged at least 18 years with a BMI of 30 or greater undergoing caesarean section through a Pfannenstiel incision
Interventions	NPWT (Yuwell 7E-A portable suction unit) Traditional sterile wound dressing of gauze and tape
Outcomes	Dehiscence Pain Readmission Skin blistering SSI
Starting date	3 August 2020
Contact information	Dalia M Mokhtar, MBBCh; Ain Shams Maternity Hospital; Cairo, Al-Waili, Egypt, 11658
Notes	

NCT04453319

Study name	Efficacy of negative pressure wound closure therapy by PICO system in prevention of complications of femoral artery exposure
Methods	Randomised controlled trial
Participants	People undergoing femoral artery exposure whatever the type of surgery
Interventions	NPWT (PICO) Conventional dressing
Outcomes	SSI Haematoma Seroma Dehiscence
Starting date	31 January 2020
Contact information	soliman_mosaad@hotmail.com
Notes	

NCT04455724

Study name	Negative pressure incisional wound therapy for high-risk ventral hernia repair (N-PITH)
Methods	Randomised controlled trial

NCT04455724 *(Continued)*

Participants	People aged at least 18 years undergoing elective or emergent ventral hernia repair who have risk factors for surgical wound complications
Interventions	NPWT (Prevena) Standard sterile dressing
Outcomes	Composite of SSI, haematoma, seroma, dehiscence and other complications Quality of life
Starting date	14 December 2020
Contact information	nathan.how@medportal.ca
Notes	

NCT04496180

Study name	Prevena to prevent surgical site infection after emergency abdominal laparotomy (CiPNT/SSI)
Methods	Randomised controlled trial
Participants	Adults aged at least 18 undergoing emergency median laparotomy with an incision of at least 10 cm, septic peritoneal cavity and primary wound closure
Interventions	NPWT (Prevena) Simple standard dressing
Outcomes	SSI Reoperation Dehiscence Seroma Haematoma
Starting date	September 2020
Contact information	Ziad.abbassi@hcuge.ch
Notes	

NCT04520841

Study name	Clinical trial comparing negative pressure wound therapy and standard dry dressings (BERLYTZ)
Methods	Randomised controlled trial
Participants	People aged atleast 18 years undergoing revision of total hip or knee arthroplasty or lower limb amputation

NCT04520841 *(Continued)*

Interventions	NPWT (Prevena) Dry dressing
Outcomes	Postoperative complications Reoperation Pain
Starting date	1 June 2020
Contact information	sylvain.steinmetz@chuv.ch
Notes	

NCT04539015

Study name	Assess the efficacy of Prevena Plus vs SOC to closed incision in pts undergoing CAWR and other laparotomy procedures
Methods	Randomised controlled trial
Participants	People aged at least 18 years undergoing complex abdominal wall reconstruction with Biomesh and other major laparotomies for elective colorectal procedures, solid organ tumour resection, liver transplant and elective bowel resections with primary wound closure
Interventions	NPWT (Prevena) Standard surgical dressings
Outcomes	SSI Seroma Wound dehiscence
Starting date	9 July 2020
Contact information	agon.kajmolli@wmchealth.org
Notes	Described as cohort/observational study but described randomisation procedure

NCT04584957

Study name	Prophylactic negative pressure wound therapy (VAC) in gynecologic oncology (G.O.) (GO-VAC)
Methods	Randomised controlled trial
Participants	Women undergoing gynaecologic oncologic laparotomic surgery and standard abdominal wall closure
Interventions	NPWT (Prevena)

NCT04584957 *(Continued)*

	Standard treatment
Outcomes	SSI Wound complications
Starting date	18 September 2020
Contact information	Giovanni Scambia, Fondazione Policlinico Universitario A. Gemelli, IRCCS, Rome
Notes	

NCT04618406

Study name	The effect of negative pressure wound therapy on wound healing in major amputations of the lower limb
Methods	Randomised controlled trial
Participants	People aged 18 years and older undergoing transfemoral, knee disarticulations and transtibial amputations by non-traumatic indication
Interventions	NPWT (PICO) Standard care with silicone foam and soft dressing
Outcomes	Wound complications including dehiscence, seroma, SSI, haematoma Reoperation
Starting date	June 2021
Contact information	lars.grau.lykkeberg@rsyd.dk
Notes	

Nguyen 2017

Study name	Incisional negative pressure wound therapy following colorectal resection: preliminary report from a single site, prospective, randomized control trial
Methods	Single-institution, prospective, randomised, open-label, superiority trial
Participants	Patients scheduled for elective colorectal resection with or without creation of an ostomy (open or laparoscopic)
Interventions	Patients will be randomised to receive NPWT or conventional dressings
Outcomes	Primary outcomes will be wound complications within the first 30 postoperative days. SSI rate will also be reported as a subgroup analysis. Secondary outcomes will include length of stay, number of postoperative visits in the 30-day period, complications, wound VAC-specific complications, and patient satisfaction.
Starting date	Unclear

Nguyen 2017 *(Continued)*

Contact information	University of British Columbia (no contact details available)
Notes	Very limited information available

NL6488

Study name	PREventing Surgical Site occurrences using negative pressURE wound therapy?
Methods	Randomised controlled trial
Participants	Patients scheduled for elective, open abdominal wall reconstruction
Interventions	Negative pressure wound therapy versus conventional wound care
Outcomes	Surgical site occurrence; QoL; recurrence 1 year after surgery; individual components of primary outcome SSO; peri-incisional SSO; percentage of participants with signs of SSO on photographs by blinded outcome assessment; frequency and type of procedures related to SSO; hospital stay after surgery in days; earlier removal of iNPWT because of SSO; emergency department visits after discharge; readmission; non-primary outcome complications; cost-effectiveness
Starting date	2017
Contact information	p.r.zwanenburg@amc.nl
Notes	Previously registered as NTR6675; starting date may not reflect previous registration

NTR6481

Study name	Randomized controlled clinical trial incisional NPWT versus sterile surgical dressing for surgical wounds after arterial vascular surgery
Methods	Randomised controlled trial
Participants	Patients undergoing bypass: aortic-iliacal, iliacal-femoral, femoral-femoral, femoral-popliteal, femoral-crural, femoral-tibial; endarterectomy: iliacal, femoral; reconstruction aneurysm: femoral; embolectomy: iliacal, femoral
Interventions	Incisional negative pressure wound therapy versus sterile surgical dressing
Outcomes	Incidence of wound complications; complete wound-healing percentages; hospital stay in days; additional surgery; readmissions; extra visits to the outpatient clinic
Starting date	2017
Contact information	prevenastudie@haaglandenmc.nl
Notes	

Rezk 2019

Study name	PICO above incisions after vascular surgery
Methods	Randomised controlled trial
Participants	Patients 18 years of age and above undergoing elective vascular surgery
Interventions	Negative pressure wound therapy with PICO versus standard dressing
Outcomes	Wound infection; cost
Starting date	2013
Contact information	Stefan Acosta, Skåne University Hospital
Notes	

Sandy-Hodgetts 2017

Study name	Effectiveness of negative pressure wound therapy (NPWT) in the prevention of postoperative surgical wound dehiscence in at risk patients following abdominal surgery; a multicentre randomised control trial
Methods	Randomised controlled trial
Participants	Patients undergoing an abdominal surgical procedure that uses a midline laparotomy as the surgical entry
Interventions	Negative pressure wound therapy versus standard wound dressings
Outcomes	Occurrence of surgical wound dehiscence; occurrence of surgical site infection, economic analysis
Starting date	2012
Contact information	kylie.sandy-hodgetts@curtin.edu.au
Notes	

Sandy-Hodgetts 2020

Study name	Effect of negative pressure dressing versus standard wound dressing on the rate of wound dehiscence in patients undergoing pilonidal surgery
Methods	Randomised controlled trial
Participants	Patients undergoing pilonidal surgery
Interventions	Negative pressure wound therapy versus standard wound dressings
Outcomes	Rate of wound dehiscence; time taken for the wound to fully heal; rate of disease recurrence; analgesia requirements for the wound; ratio of wound size; patient satisfaction 2 months postoperatively; QoL

Sandy-Hodgetts 2020 *(Continued)*

Starting date	2017
Contact information	Ram.Nataraja@monashhealth.org
Notes	

SUNRRISE 2017

Study name	SUNRRISE: Single Use Negative pRessure dressing for Reduction In Surgical site infection following Emergency laparotomy
Methods	Randomised controlled trial
Participants	Patients undergoing emergency laparotomy
Interventions	Portable single-use NPWT dressings Standard dressings
Outcomes	SSI at 30 days; length of stay; readmission; reintervention; adverse events; pain; HRQoL; cost-effectiveness
Starting date	November 2017
Contact information	Dr Laura Magill, University of Birmingham, UK
Notes	ISRCTN17599457

TCTR20170331001

Study name	Antiseptic dressing versus negative pressure dressing techniques for uncomplicated pediatric appendicitis, randomized controlled trial
Methods	Randomised controlled trial (3 treatment arms)
Participants	Patients < 15 years undergoing surgery for uncomplicated appendicitis
Interventions	Negative pressure dressing versus antiseptic dressing versus conventional dressing
Outcomes	Wound infection; time to heal; wound seroma; wound dehiscence
Starting date	29 March 2017
Contact information	goofywasun@gmail.com
Notes	

ACTIV.A.C.: proprietory name for component of the PREVENA negative pressure wound therapy system
AE: adverse event
AQUACEL (Ag): proprietory name for type of silver dressing
ASEPSIS: ASEPSIS score - a quantitative scoring method using objective criteria based on wound appearance to evaluate wound infection
BMI: body mass index

CABG: coronary artery bypass graft
CAWR: complex abdominal wall reconstruction
CIED: cardiovascular implantable electronic devices
cINPT: closed incision negative pressure wound therapy
CITA: continuous in-situ ultra high dose antibiotics
ciVAC: closed incision vacuum assisted closure
CRS: cryoreduction surgery
CS: caesarean section
EQ-5D-5L: EuroQoL 5D questionnaire 5L version
HOOS: hip disability and osteoarthritis outcome score
HPB(S): hepatopancreatobiliary (surgery)
HRQoL: health-related quality of life
iNPWT: incisional negative pressure wound therapy
KA: knee arthroplasty
KOOS: knee disability and osteoarthritis outcome score
LDex: lymphedema index
LYMQOL: Lymphoedema Quality-of-Life Questionnaire
MALE: major adverse limb event
MEPILEX: proprietory dressing name
MEPORE: proprietory dressing name
MRSA: methicillin-resistant Staphylococcus aureus
NPWT: negative pressure wound therapy
OpSite: proprietory dressing name
PICCO: alternative spelling of PICO (proprietory name for type of negative pressure wound therapy)
POSAS: Patient and Observer Scar Assessment Scale
PREVENA: proprietory name for type of negative pressure wound therapy
QoL: quality of life
RCT: randomised controlled trial
RNPT: regulated negative pressure-assisted wound therapy
SAE: serious adverse event
SF-12: 12-item Short Form Health Survey
SSI: surgical site infection
SSO: surgical site occurrence
THA: total hip arthroplasty
TKA: total knee arthroplasty
VAC: vacuum-assisted closure
VAS: visual analogue scale
VR-12: Veterans RAND 12-Item Health Survey
vs.: versus

DATA AND ANALYSES

Comparison 1. Negative pressure wound therapy versus standard dressing

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1.1 Mortality	11	6384	Risk Ratio (M-H, Random, 95% CI)	0.78 [0.47, 1.30]
1.2 Surgical site infection	44	11403	Risk Ratio (M-H, Random, 95% CI)	0.73 [0.63, 0.85]
1.2.1 Orthopaedic: Hip/knee arthroplasties	4	836	Risk Ratio (M-H, Random, 95% CI)	0.69 [0.32, 1.49]
1.2.2 Orthopaedic: Limb fractures	3	1676	Risk Ratio (M-H, Random, 95% CI)	1.15 [0.61, 2.20]
1.2.3 Obstetric: Caesarean	9	5529	Risk Ratio (M-H, Random, 95% CI)	0.78 [0.65, 0.95]

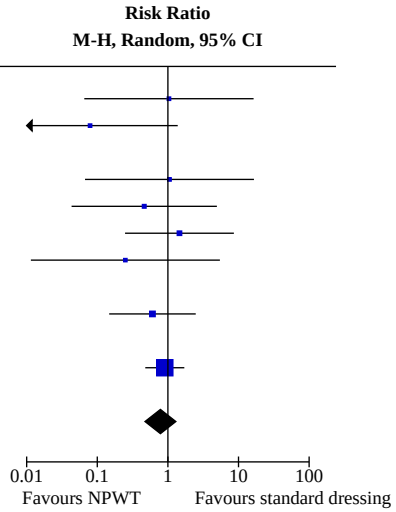
Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1.2.4 Vascular: peripheral bypass	6	895	Risk Ratio (M-H, Random, 95% CI)	0.54 [0.38, 0.77]
1.2.5 Vascular: cardiac surgery	2	136	Risk Ratio (M-H, Random, 95% CI)	0.17 [0.03, 0.96]
1.2.6 General: abdominal	13	1823	Risk Ratio (M-H, Random, 95% CI)	0.78 [0.57, 1.05]
1.2.7 General: Hepatopancreatiobiliary	3	258	Risk Ratio (M-H, Random, 95% CI)	0.58 [0.23, 1.45]
1.2.8 Mixed	4	250	Risk Ratio (M-H, Random, 95% CI)	0.46 [0.17, 1.27]
1.3 SSI grouped by contamination class	44	11403	Risk Ratio (M-H, Random, 95% CI)	0.73 [0.63, 0.85]
1.3.1 Clean	17	2288	Risk Ratio (M-H, Random, 95% CI)	0.58 [0.41, 0.81]
1.3.2 Clean-contaminated	21	7282	Risk Ratio (M-H, Random, 95% CI)	0.83 [0.72, 0.96]
1.3.3 Contaminated	3	1649	Risk Ratio (M-H, Random, 95% CI)	0.78 [0.28, 2.14]
1.3.4 Dirty	3	184	Risk Ratio (M-H, Random, 95% CI)	0.27 [0.06, 1.12]
1.4 SSI (superficial)	22	5539	Risk Ratio (M-H, Random, 95% CI)	0.70 [0.53, 0.92]
1.5 SSI (deep)	22	8521	Risk Ratio (M-H, Random, 95% CI)	0.95 [0.76, 1.18]
1.6 Dehiscence	23	8724	Risk Ratio (M-H, Random, 95% CI)	0.97 [0.82, 1.16]
1.6.1 Orthopaedic: hip/knee arthroplasty	2	229	Risk Ratio (M-H, Random, 95% CI)	0.43 [0.08, 2.35]
1.6.2 Orthopaedic: limb fracture	1	1401	Risk Ratio (M-H, Random, 95% CI)	0.27 [0.06, 1.32]
1.6.3 Obstetric: caesarean	6	5113	Risk Ratio (M-H, Random, 95% CI)	1.01 [0.82, 1.24]
1.6.4 Vascular: peripheral	3	473	Risk Ratio (M-H, Random, 95% CI)	0.99 [0.51, 1.92]
1.6.5 Vascular: cardiac	1	80	Risk Ratio (M-H, Random, 95% CI)	1.00 [0.06, 15.44]
1.6.6 General: abdominal	6	1156	Risk Ratio (M-H, Random, 95% CI)	0.88 [0.57, 1.38]
1.6.7 General: hepatopancreatiobiliary	1	40	Risk Ratio (M-H, Random, 95% CI)	0.50 [0.05, 5.08]
1.6.8 Mixed	3	232	Risk Ratio (M-H, Random, 95% CI)	0.86 [0.16, 4.55]
1.7 Reoperation	18	6272	Risk Ratio (IV, Random, 95% CI)	1.13 [0.91, 1.41]
1.8 Readmission	15	5853	Risk Ratio (M-H, Random, 95% CI)	0.98 [0.70, 1.38]
1.9 Seroma	15	5436	Risk Ratio (M-H, Random, 95% CI)	0.82 [0.65, 1.05]

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1.10 Haematoma	17	5909	Risk Ratio (M-H, Random, 95% CI)	0.79 [0.48, 1.30]
1.11 Skin blisters	11	5015	Risk Ratio (M-H, Random, 95% CI)	3.55 [1.43, 8.77]
1.12 Pain	2	632	Risk Ratio (M-H, Random, 95% CI)	1.52 [0.20, 11.31]

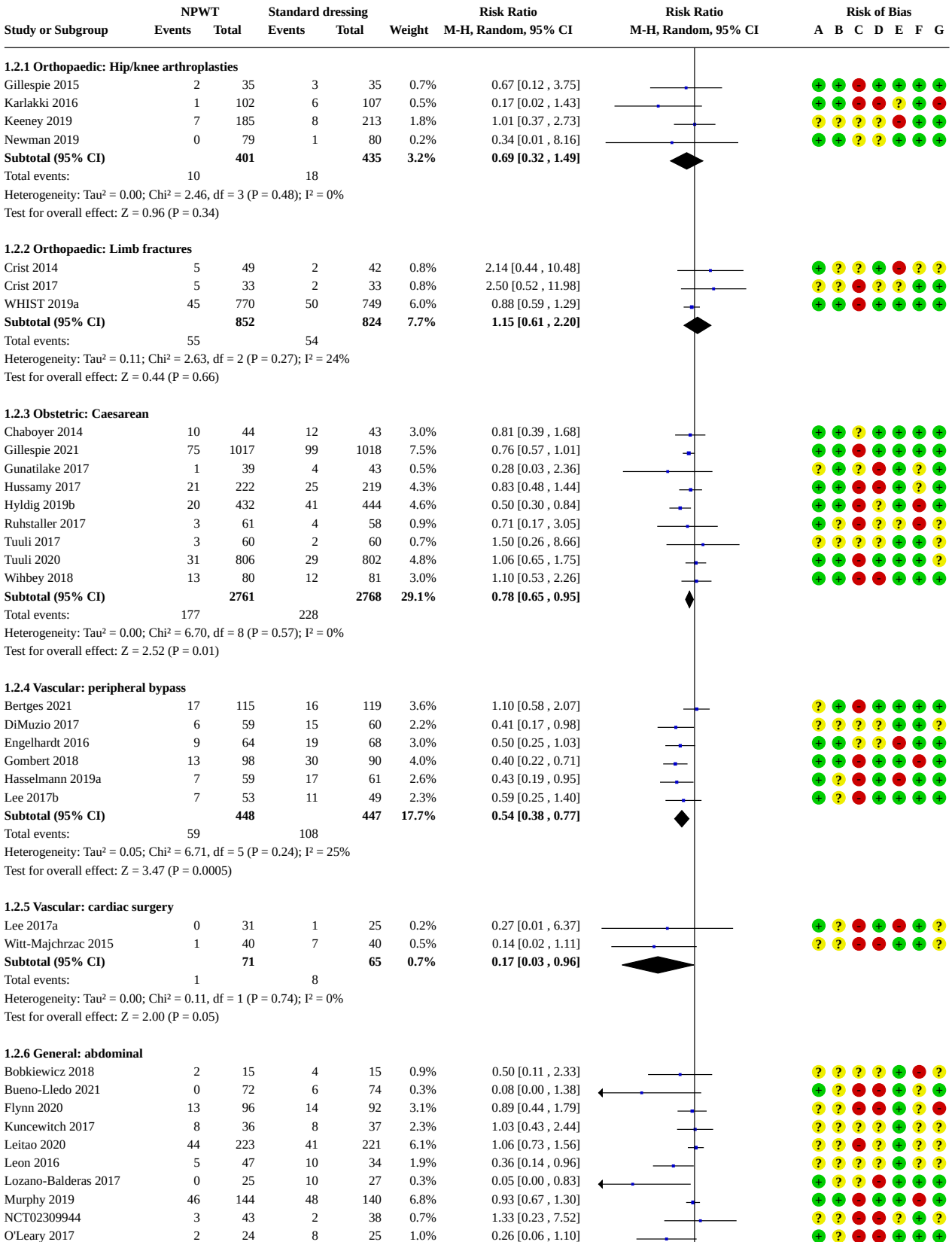
Analysis 1.1. Comparison 1: Negative pressure wound therapy versus standard dressing, Outcome 1: Mortality

Study or Subgroup	NPWT Events	NPWT Total	Standard dressing Events	Standard dressing Total	Weight	Risk Ratio M-H, Random, 95% CI
Bertges 2021	1	115	1	119	3.3%	1.03 [0.07 , 16.35]
Bueno-Lledo 2021	0	72	6	74	3.1%	0.08 [0.00 , 1.38]
Gillespie 2021	0	1017	0	1018		Not estimable
Hasselmann 2019a	1	75	1	79	3.3%	1.05 [0.07 , 16.54]
Lee 2017b	1	53	2	49	4.5%	0.46 [0.04 , 4.94]
Murphy 2019	3	144	2	140	8.0%	1.46 [0.25 , 8.60]
NCT01759381	0	11	1	8	2.7%	0.25 [0.01 , 5.45]
NCT02309944	0	43	0	38		Not estimable
Shen 2017	3	132	5	133	12.7%	0.60 [0.15 , 2.48]
Tuuli 2020	0	806	0	802		Not estimable
WHIST 2019a	18	745	19	711	62.4%	0.90 [0.48 , 1.71]
Total (95% CI)		**3213**		**3171**	**100.0%**	**0.78 [0.47 , 1.30]**
Total events:	27		37			

Heterogeneity: Tau² = 0.00; Chi² = 4.21, df = 7 (P = 0.76); I² = 0%
Test for overall effect: Z = 0.95 (P = 0.34)
Test for subgroup differences: Not applicable

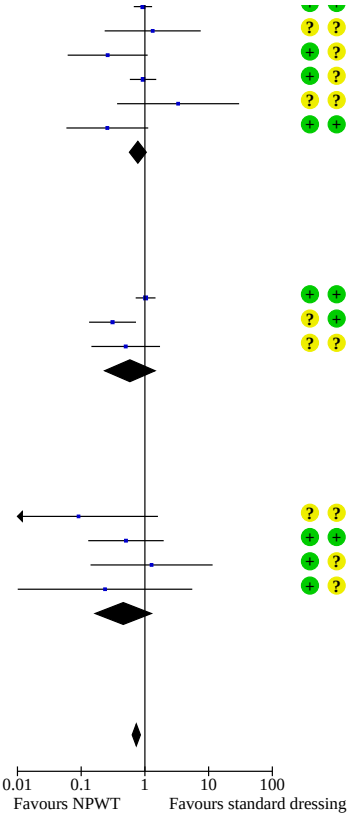


Analysis 1.2. Comparison 1: Negative pressure wound therapy versus standard dressing, Outcome 2: Surgical site infection



Analysis 1.2. (Continued)

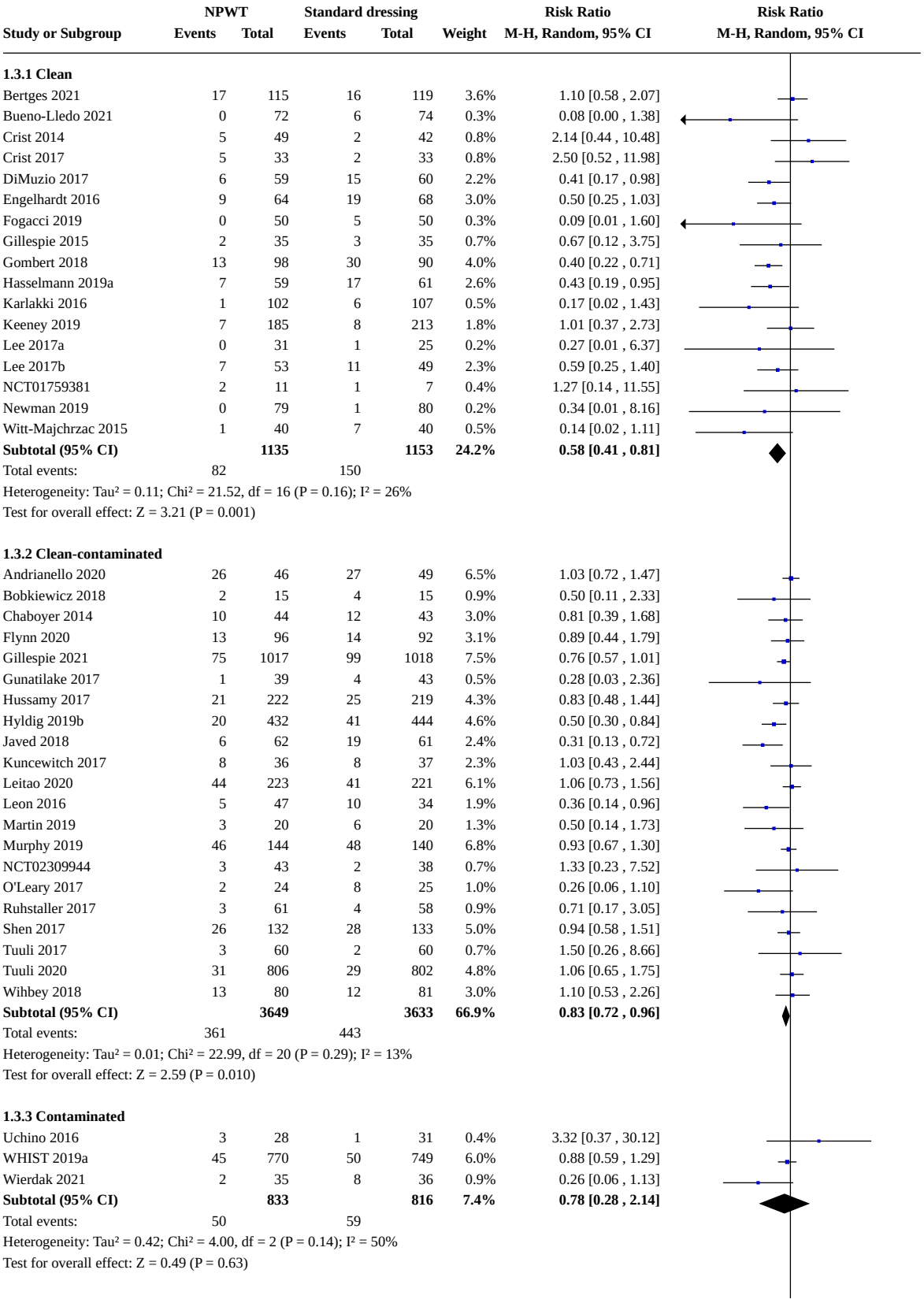
NCT02309944	3	43	2	38	0.7%	1.33 [0.23 , 7.52]
O'Leary 2017	2	24	8	25	1.0%	0.26 [0.06 , 1.10]
Shen 2017	26	132	28	133	5.0%	0.94 [0.58 , 1.51]
Uchino 2016	3	28	1	31	0.4%	3.32 [0.37 , 30.12]
Wierdak 2021	2	35	8	36	0.9%	0.26 [0.06 , 1.13]
Subtotal (95% CI)		**920**		**903**	**29.6%**	**0.78 [0.57 , 1.05]**
Total events:	154		188			
Heterogeneity: Tau² = 0.09; Chi² = 19.35, df = 12 (P = 0.08); I² = 38%						
Test for overall effect: Z = 1.64 (P = 0.10)						
1.2.7 General: Hepatopancreatiobiliary						
Andrianello 2020	26	46	27	49	6.5%	1.03 [0.72 , 1.47]
Javed 2018	6	62	19	61	2.4%	0.31 [0.13 , 0.72]
Martin 2019	3	20	6	20	1.3%	0.50 [0.14 , 1.73]
Subtotal (95% CI)		**128**		**130**	**10.1%**	**0.58 [0.23 , 1.45]**
Total events:	35		52			
Heterogeneity: Tau² = 0.47; Chi² = 8.24, df = 2 (P = 0.02); I² = 76%						
Test for overall effect: Z = 1.17 (P = 0.24)						
1.2.8 Mixed						
Fogacci 2019	0	50	5	50	0.3%	0.09 [0.01 , 1.60]
Masden 2012	3	44	5	37	1.1%	0.50 [0.13 , 1.97]
NCT01759381	2	11	1	7	0.4%	1.27 [0.14 , 11.55]
Shim 2018	0	30	1	21	0.2%	0.24 [0.01 , 5.54]
Subtotal (95% CI)		**135**		**115**	**2.0%**	**0.46 [0.17 , 1.27]**
Total events:	5		12			
Heterogeneity: Tau² = 0.00; Chi² = 2.38, df = 3 (P = 0.50); I² = 0%						
Test for overall effect: Z = 1.51 (P = 0.13)						
Total (95% CI)		**5716**		**5687**	**100.0%**	**0.73 [0.63 , 0.85]**
Total events:	496		668			
Heterogeneity: Tau² = 0.06; Chi² = 60.19, df = 43 (P = 0.04); I² = 29%						
Test for overall effect: Z = 4.11 (P < 0.0001)						
Test for subgroup differences: Chi² = 9.26, df = 7 (P = 0.23), I² = 24.4%						



Risk of bias legend

(A) Random sequence generation (selection bias)
(B) Allocation concealment (selection bias)
(C) Blinding of participants and personnel (performance bias)
(D) Blinding of outcome assessment (detection bias)
(E) Incomplete outcome data (attrition bias)
(F) Selective reporting (reporting bias)
(G) Other bias

Analysis 1.3. Comparison 1: Negative pressure wound therapy versus standard dressing, Outcome 3: SSI grouped by contamination class



Study or Subgroup	NPWT Events	NPWT Total	Standard dressing Events	Standard dressing Total	Weight	Risk Ratio M-H, Random, 95% CI
1.3.1 Clean						
Bertges 2021	17	115	16	119	3.6%	1.10 [0.58 , 2.07]
Bueno-Lledo 2021	0	72	6	74	0.3%	0.08 [0.00 , 1.38]
Crist 2014	5	49	2	42	0.8%	2.14 [0.44 , 10.48]
Crist 2017	5	33	2	33	0.8%	2.50 [0.52 , 11.98]
DiMuzio 2017	6	59	15	60	2.2%	0.41 [0.17 , 0.98]
Engelhardt 2016	9	64	19	68	3.0%	0.50 [0.25 , 1.03]
Fogacci 2019	0	50	5	50	0.3%	0.09 [0.01 , 1.60]
Gillespie 2015	2	35	3	35	0.7%	0.67 [0.12 , 3.75]
Gombert 2018	13	98	30	90	4.0%	0.40 [0.22 , 0.71]
Hasselmann 2019a	7	59	17	61	2.6%	0.43 [0.19 , 0.95]
Karlakki 2016	1	102	6	107	0.5%	0.17 [0.02 , 1.43]
Keeney 2019	7	185	8	213	1.8%	1.01 [0.37 , 2.73]
Lee 2017a	0	31	1	25	0.2%	0.27 [0.01 , 6.37]
Lee 2017b	7	53	11	49	2.3%	0.59 [0.25 , 1.40]
NCT01759381	2	11	1	7	0.4%	1.27 [0.14 , 11.55]
Newman 2019	0	79	1	80	0.2%	0.34 [0.01 , 8.16]
Witt-Majchrzac 2015	1	40	7	40	0.5%	0.14 [0.02 , 1.11]
Subtotal (95% CI)		**1135**		**1153**	**24.2%**	**0.58 [0.41 , 0.81]**
Total events:	82		150			
Heterogeneity: Tau² = 0.11; Chi² = 21.52, df = 16 (P = 0.16); I² = 26%						
Test for overall effect: Z = 3.21 (P = 0.001)						
1.3.2 Clean-contaminated						
Andrianello 2020	26	46	27	49	6.5%	1.03 [0.72 , 1.47]
Bobkiewicz 2018	2	15	4	15	0.9%	0.50 [0.11 , 2.33]
Chaboyer 2014	10	44	12	43	3.0%	0.81 [0.39 , 1.68]
Flynn 2020	13	96	14	92	3.1%	0.89 [0.44 , 1.79]
Gillespie 2021	75	1017	99	1018	7.5%	0.76 [0.57 , 1.01]
Gunatilake 2017	1	39	4	43	0.5%	0.28 [0.03 , 2.36]
Hussamy 2017	21	222	25	219	4.3%	0.83 [0.48 , 1.44]
Hyldig 2019b	20	432	41	444	4.6%	0.50 [0.30 , 0.84]
Javed 2018	6	62	19	61	2.4%	0.31 [0.13 , 0.72]
Kuncewitch 2017	8	36	8	37	2.3%	1.03 [0.43 , 2.44]
Leitao 2020	44	223	41	221	6.1%	1.06 [0.73 , 1.56]
Leon 2016	5	47	10	34	1.9%	0.36 [0.14 , 0.96]
Martin 2019	3	20	6	20	1.3%	0.50 [0.14 , 1.73]
Murphy 2019	46	144	48	140	6.8%	0.93 [0.67 , 1.30]
NCT02309944	3	43	2	38	0.7%	1.33 [0.23 , 7.52]
O'Leary 2017	2	24	8	25	1.0%	0.26 [0.06 , 1.10]
Ruhstaller 2017	3	61	4	58	0.9%	0.71 [0.17 , 3.05]
Shen 2017	26	132	28	133	5.0%	0.94 [0.58 , 1.51]
Tuuli 2017	3	60	2	60	0.7%	1.50 [0.26 , 8.66]
Tuuli 2020	31	806	29	802	4.8%	1.06 [0.65 , 1.75]
Wihbey 2018	13	80	12	81	3.0%	1.10 [0.53 , 2.26]
Subtotal (95% CI)		**3649**		**3633**	**66.9%**	**0.83 [0.72 , 0.96]**
Total events:	361		443			
Heterogeneity: Tau² = 0.01; Chi² = 22.99, df = 20 (P = 0.29); I² = 13%						
Test for overall effect: Z = 2.59 (P = 0.010)						
1.3.3 Contaminated						
Uchino 2016	3	28	1	31	0.4%	3.32 [0.37 , 30.12]
WHIST 2019a	45	770	50	749	6.0%	0.88 [0.59 , 1.29]
Wierdak 2021	2	35	8	36	0.9%	0.26 [0.06 , 1.13]
Subtotal (95% CI)		**833**		**816**	**7.4%**	**0.78 [0.28 , 2.14]**
Total events:	50		59			
Heterogeneity: Tau² = 0.42; Chi² = 4.00, df = 2 (P = 0.14); I² = 50%						
Test for overall effect: Z = 0.49 (P = 0.63)						

Analysis 1.3. (Continued)

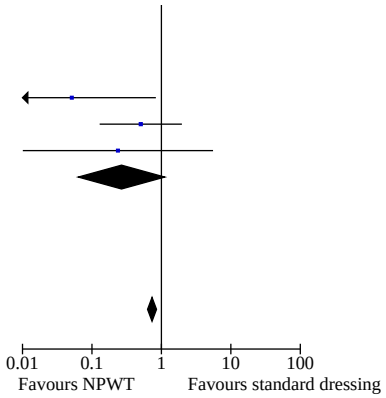
Test for overall effect: Z = 0.49 (P = 0.63)

1.3.4 Dirty						
Lozano-Balderas 2017	0	25	10	27	0.3%	0.05 [0.00 , 0.83]
Masden 2012	3	44	5	37	1.1%	0.50 [0.13 , 1.97]
Shim 2018	0	30	1	21	0.2%	0.24 [0.01 , 5.54]
Subtotal (95% CI)		**99**		**85**	**1.6%**	**0.27 [0.06 , 1.12]**
Total events:	3		16			

Heterogeneity: Tau² = 0.40; Chi² = 2.55, df = 2 (P = 0.28); I² = 22%
Test for overall effect: Z = 1.81 (P = 0.07)

Total (95% CI)		**5716**		**5687**	**100.0%**	**0.73 [0.63 , 0.85]**
Total events:	496		668			

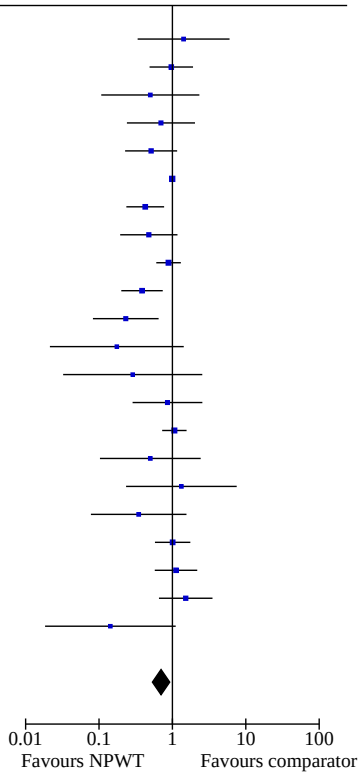
Heterogeneity: Tau² = 0.06; Chi² = 60.19, df = 43 (P = 0.04); I² = 29%
Test for overall effect: Z = 4.11 (P < 0.0001)
Test for subgroup differences: Chi² = 5.91, df = 3 (P = 0.12), I² = 49.2%



Analysis 1.4. Comparison 1: Negative pressure wound therapy versus standard dressing, Outcome 4: SSI (superficial)

Study or Subgroup	NPWT Events	NPWT Total	Standard dressing Events	Standard dressing Total	Weight	Risk Ratio M-H, Random, 95% CI
Andrianello 2020	4	46	3	49	2.6%	1.42 [0.34 , 6.01]
Bertges 2021	14	115	15	119	6.0%	0.97 [0.49 , 1.91]
Bobkiewicz 2018	2	15	4	15	2.3%	0.50 [0.11 , 2.33]
Chaboyer 2014	5	44	7	43	3.9%	0.70 [0.24 , 2.03]
Engelhardt 2016	7	58	16	68	5.2%	0.51 [0.23 , 1.16]
Gillespie 2021	70	75	93	99	9.6%	0.99 [0.92 , 1.07]
Gombert 2018	13	98	28	90	6.6%	0.43 [0.24 , 0.77]
Hasselmann 2019a	6	59	13	61	4.7%	0.48 [0.19 , 1.17]
Hussamy 2017	20	37	25	41	8.1%	0.89 [0.60 , 1.30]
Hyldig 2019b	12	432	32	444	6.2%	0.39 [0.20 , 0.74]
Javed 2018	4	62	17	61	4.0%	0.23 [0.08 , 0.65]
Karlakki 2016	1	102	6	107	1.4%	0.17 [0.02 , 1.43]
Keeney 2019	1	185	4	213	1.3%	0.29 [0.03 , 2.55]
Kuncewitch 2017	5	36	6	37	3.8%	0.86 [0.29 , 2.56]
Leitao 2020	44	223	41	221	8.1%	1.06 [0.73 , 1.56]
Martin 2019	2	20	4	20	2.3%	0.50 [0.10 , 2.43]
NCT02309944	3	43	2	38	1.9%	1.33 [0.23 , 7.52]
O'Leary 2017	2	24	6	25	2.4%	0.35 [0.08 , 1.55]
Shen 2017	21	132	21	133	6.9%	1.01 [0.58 , 1.75]
Tuuli 2020	18	806	16	802	6.1%	1.12 [0.57 , 2.18]
Wihbey 2018	12	80	8	81	5.0%	1.52 [0.66 , 3.52]
Witt-Majchrzac 2015	1	40	7	40	1.5%	0.14 [0.02 , 1.11]
Total (95% CI)		**2732**		**2807**	**100.0%**	**0.70 [0.53 , 0.92]**
Total events:	267		374			

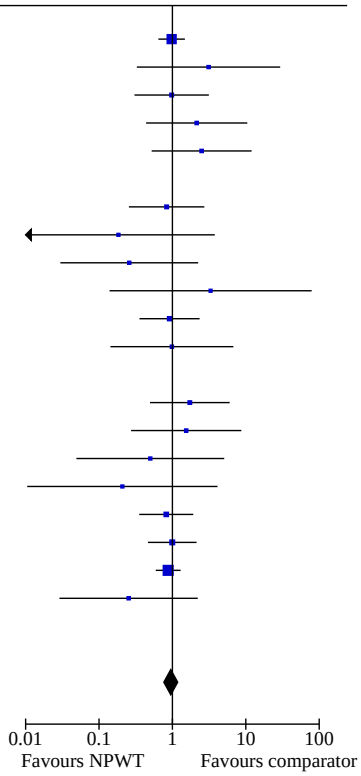
Heterogeneity: Tau² = 0.20; Chi² = 70.11, df = 21 (P < 0.00001); I² = 70%
Test for overall effect: Z = 2.58 (P = 0.01)
Test for subgroup differences: Not applicable



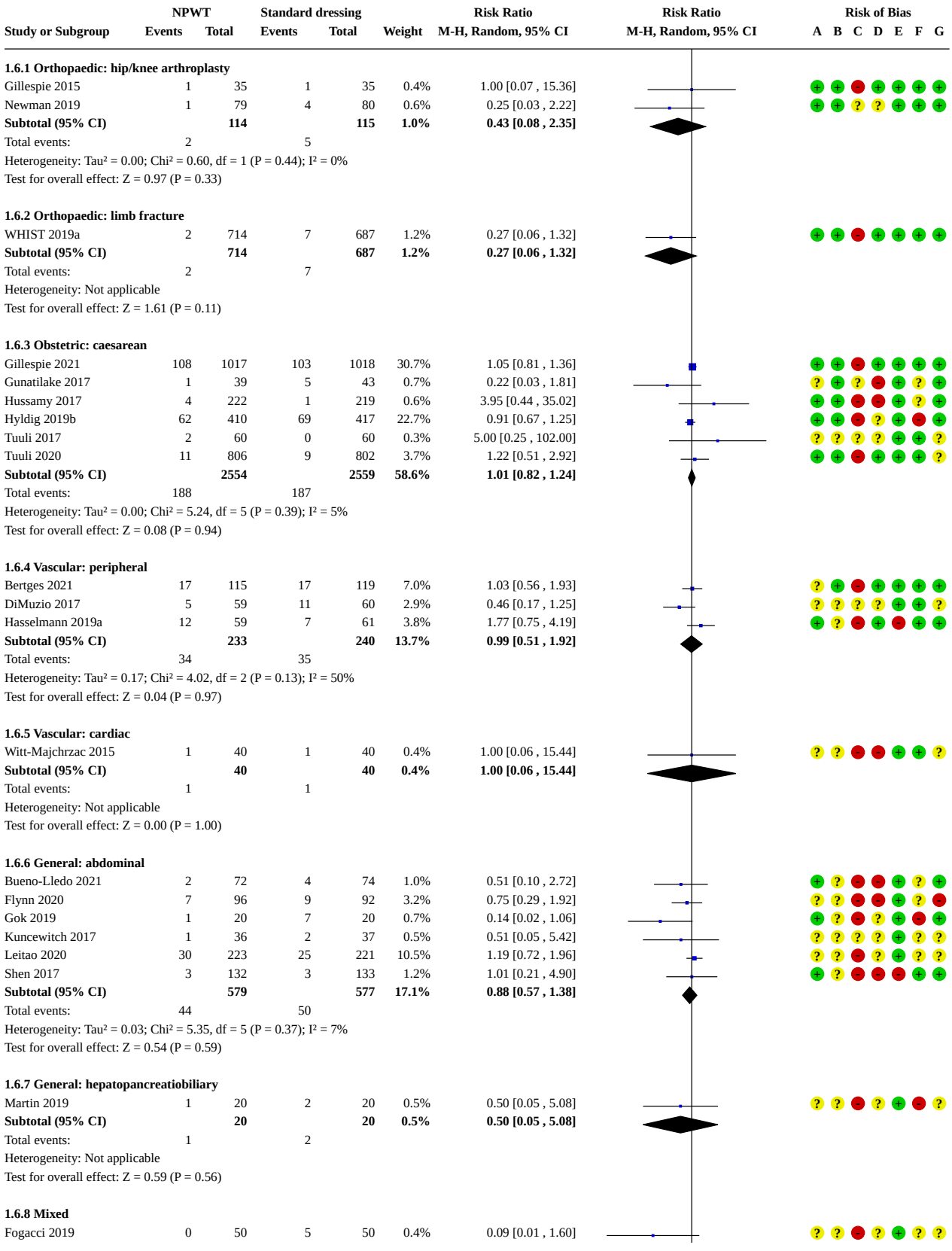
Analysis 1.5. Comparison 1: Negative pressure wound therapy versus standard dressing, Outcome 5: SSI (deep)

Study or Subgroup	NPWT Events	NPWT Total	Standard dressing Events	Standard dressing Total	Weight	Risk Ratio M-H, Random, 95% CI
Andrianello 2020	22	46	24	49	27.3%	0.98 [0.64 , 1.48]
Bertges 2021	3	115	1	119	0.9%	3.10 [0.33 , 29.41]
Chaboyer 2014	5	44	5	43	3.5%	0.98 [0.30 , 3.14]
Crist 2014	5	49	2	42	1.9%	2.14 [0.44 , 10.48]
Crist 2017	5	33	2	33	1.9%	2.50 [0.52 , 11.98]
Engelhardt 2016	0	58	0	68		Not estimable
Gillespie 2021	5	1017	6	1018	3.4%	0.83 [0.26 , 2.72]
Gombert 2018	0	98	2	90	0.5%	0.18 [0.01 , 3.78]
Hasselmann 2019a	1	59	4	61	1.0%	0.26 [0.03 , 2.25]
Hussamy 2017	1	37	0	41	0.5%	3.32 [0.14 , 78.97]
Hyldig 2019b	8	432	9	444	5.3%	0.91 [0.36 , 2.35]
Javed 2018	2	62	2	61	1.3%	0.98 [0.14 , 6.76]
Karlakki 2016	0	102	0	107		Not estimable
Keeney 2019	6	185	4	213	3.0%	1.73 [0.49 , 6.03]
Kuncewitch 2017	3	36	2	37	1.6%	1.54 [0.27 , 8.69]
Martin 2019	1	20	2	20	0.9%	0.50 [0.05 , 5.08]
O'Leary 2017	0	24	2	25	0.5%	0.21 [0.01 , 4.12]
Shen 2017	9	132	11	133	6.6%	0.82 [0.35 , 1.92]
Tuuli 2020	13	806	13	802	8.1%	1.00 [0.46 , 2.13]
WHIST 2019a	45	770	50	749	31.0%	0.88 [0.59 , 1.29]
Wihbey 2018	1	80	4	81	1.0%	0.25 [0.03 , 2.22]
Witt-Majchrzac 2015	0	40	0	40		Not estimable
Total (95% CI)		**4245**		**4276**	**100.0%**	**0.95 [0.76 , 1.18]**
Total events:	135		145			

Heterogeneity: Tau² = 0.00; Chi² = 10.94, df = 18 (P = 0.90); I² = 0%
Test for overall effect: Z = 0.47 (P = 0.64)
Test for subgroup differences: Not applicable

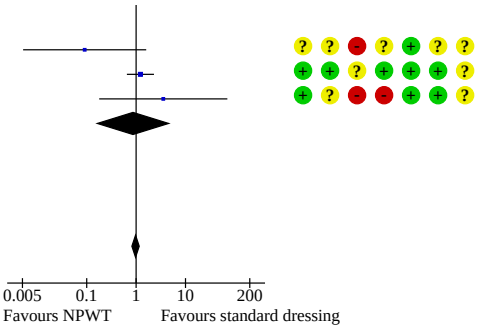


Analysis 1.6. Comparison 1: Negative pressure wound therapy versus standard dressing, Outcome 6: Dehiscence



Analysis 1.6. (Continued)

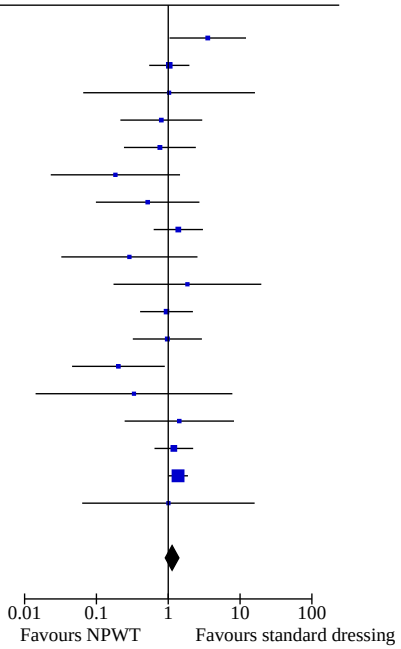
1.6.8 Mixed						
Fogacci 2019	0	50	5	50	0.4%	0.09 [0.01 , 1.60]
Masden 2012	16	44	11	37	6.8%	1.22 [0.65 , 2.30]
Shim 2018	2	30	0	21	0.3%	3.55 [0.18 , 70.34]
Subtotal (95% CI)		**124**		**108**	**7.5%**	**0.86 [0.16 , 4.55]**
Total events:	18		16			
Heterogeneity: Tau² = 1.14; Chi² = 3.92, df = 2 (P = 0.14); I² = 49%						
Test for overall effect: Z = 0.17 (P = 0.86)						
Total (95% CI)		**4378**		**4346**	**100.0%**	**0.97 [0.82 , 1.16]**
Total events:	290		303			
Heterogeneity: Tau² = 0.01; Chi² = 22.99, df = 22 (P = 0.40); I² = 4%						
Test for overall effect: Z = 0.30 (P = 0.76)						
Test for subgroup differences: Chi² = 3.96, df = 7 (P = 0.78), I² = 0%						



Risk of bias legend
(A) Random sequence generation (selection bias)
(B) Allocation concealment (selection bias)
(C) Blinding of participants and personnel (performance bias)
(D) Blinding of outcome assessment (detection bias)
(E) Incomplete outcome data (attrition bias)
(F) Selective reporting (reporting bias)
(G) Other bias

Analysis 1.7. Comparison 1: Negative pressure wound therapy versus standard dressing, Outcome 7: Reoperation

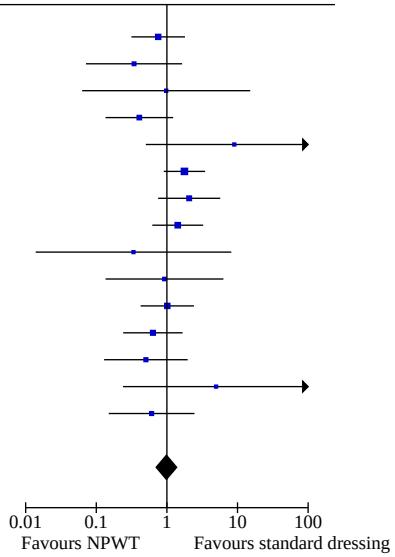
Study or Subgroup	NPWT Events	NPWT Total	Standard dressing Events	Standard dressing Total	Weight	Risk Ratio IV, Random, 95% CI
Andrianello 2020	10	46	3	49	3.1%	3.55 [1.04 , 12.10]
Bertges 2021	16	115	16	119	11.0%	1.03 [0.54 , 1.97]
Bueno-Lledo 2021	1	72	1	74	0.6%	1.03 [0.07 , 16.12]
Gillespie 2021	4	1017	5	1018	2.7%	0.80 [0.22 , 2.97]
Gombert 2018	5	98	6	90	3.5%	0.77 [0.24 , 2.42]
Gunatilake 2017	1	39	6	43	1.1%	0.18 [0.02 , 1.46]
Hasselmann 2019a	2	59	4	61	1.7%	0.52 [0.10 , 2.72]
Hussamy 2017	14	222	10	219	7.4%	1.38 [0.63 , 3.04]
Keeney 2019	1	185	4	213	1.0%	0.29 [0.03 , 2.55]
Lee 2017b	2	53	1	49	0.8%	1.85 [0.17 , 19.76]
Masden 2012	9	44	8	37	6.5%	0.95 [0.41 , 2.20]
Murphy 2019	6	144	6	140	3.8%	0.97 [0.32 , 2.94]
Newman 2019	2	79	10	80	2.1%	0.20 [0.05 , 0.90]
O'Leary 2017	0	25	1	25	0.5%	0.33 [0.01 , 7.81]
Ruhstaller 2017	3	61	2	58	1.5%	1.43 [0.25 , 8.23]
Shen 2017	19	132	16	133	11.8%	1.20 [0.64 , 2.22]
WHIST 2019a	83	578	56	534	40.0%	1.37 [1.00 , 1.88]
Wihbey 2018	1	180	1	181	0.6%	1.01 [0.06 , 15.95]
Total (95% CI)		**3149**		**3123**	**100.0%**	**1.13 [0.91 , 1.41]**
Total events:	179		156			
Heterogeneity: Tau² = 0.00; Chi² = 17.31, df = 17 (P = 0.43); I² = 2%						
Test for overall effect: Z = 1.11 (P = 0.27)						
Test for subgroup differences: Not applicable						



Analysis 1.8. Comparison 1: Negative pressure wound therapy versus standard dressing, Outcome 8: Readmission

Study or Subgroup	NPWT Events	NPWT Total	Standard dressing Events	Standard dressing Total	Weight	Risk Ratio M-H, Random, 95% CI
Bertges 2021	8	115	11	119	11.3%	0.75 [0.31 , 1.80]
Bueno-Lledo 2021	2	72	6	74	4.2%	0.34 [0.07 , 1.64]
Chaboyer 2014	1	44	1	43	1.4%	0.98 [0.06 , 15.13]
DiMuzio 2017	4	59	10	60	7.7%	0.41 [0.14 , 1.23]
Gillespie 2015	4	35	0	35	1.3%	9.00 [0.50 , 161.13]
Gillespie 2021	23	1017	13	1018	16.4%	1.77 [0.90 , 3.48]
Hasselmann 2019a	10	59	5	61	8.9%	2.07 [0.75 , 5.69]
Hussamy 2017	13	222	9	219	12.2%	1.42 [0.62 , 3.27]
Karlakki 2016	0	107	1	108	1.1%	0.34 [0.01 , 8.17]
Lee 2017b	2	53	2	49	2.8%	0.92 [0.14 , 6.31]
Newman 2019	9	79	9	80	11.4%	1.01 [0.42 , 2.42]
Ruhstaller 2017	6	61	9	58	9.6%	0.63 [0.24 , 1.67]
Shen 2017	3	118	6	119	5.4%	0.50 [0.13 , 1.97]
Tuuli 2020	2	806	0	802	1.2%	4.98 [0.24 , 103.47]
Wihbey 2018	3	80	5	81	5.1%	0.61 [0.15 , 2.46]
Total (95% CI)		**2927**		**2926**	**100.0%**	**0.98 [0.70 , 1.38]**
Total events:	90		87			

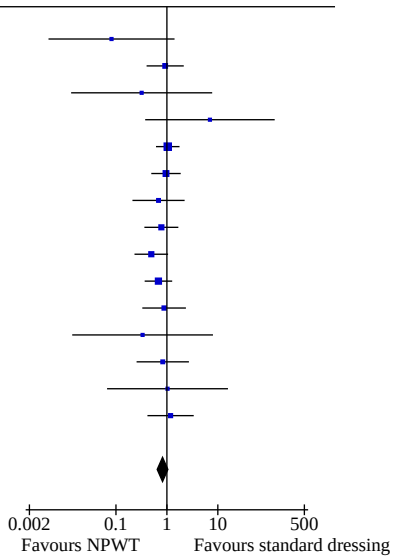
Heterogeneity: Tau² = 0.06; Chi² = 16.28, df = 14 (P = 0.30); I² = 14%
Test for overall effect: Z = 0.09 (P = 0.93)
Test for subgroup differences: Not applicable



Analysis 1.9. Comparison 1: Negative pressure wound therapy versus standard dressing, Outcome 9: Seroma

Study or Subgroup	NPWT Events	NPWT Total	Standard dressing Events	Standard dressing Total	Weight	Risk Ratio M-H, Random, 95% CI
Andrianello 2020	0	46	6	49	0.7%	0.08 [0.00 , 1.41]
Bueno-Lledo 2021	9	72	10	74	8.2%	0.93 [0.40 , 2.14]
Flynn 2020	0	96	1	92	0.6%	0.32 [0.01 , 7.75]
Gillespie 2015	3	35	0	35	0.7%	7.00 [0.37 , 130.69]
Gillespie 2021	27	1017	26	1018	20.6%	1.04 [0.61 , 1.77]
Hasselmann 2019a	13	59	14	61	13.2%	0.96 [0.49 , 1.87]
Kuncewitch 2017	4	36	6	37	4.2%	0.69 [0.21 , 2.23]
Leitao 2020	11	223	14	221	9.9%	0.78 [0.36 , 1.68]
Pachowsky 2012	4	9	9	10	10.1%	0.49 [0.23 , 1.05]
Pauser 2016	6	11	8	10	15.0%	0.68 [0.37 , 1.27]
Shen 2017	7	132	8	133	6.0%	0.88 [0.33 , 2.36]
Tuuli 2017	0	60	1	60	0.6%	0.33 [0.01 , 8.02]
Tuuli 2020	5	806	6	802	4.2%	0.83 [0.25 , 2.71]
Wierdak 2021	1	35	1	36	0.8%	1.03 [0.07 , 15.81]
Wihbey 2018	7	80	6	81	5.3%	1.18 [0.42 , 3.36]
Total (95% CI)		**2717**		**2719**	**100.0%**	**0.82 [0.65 , 1.05]**
Total events:	97		116			

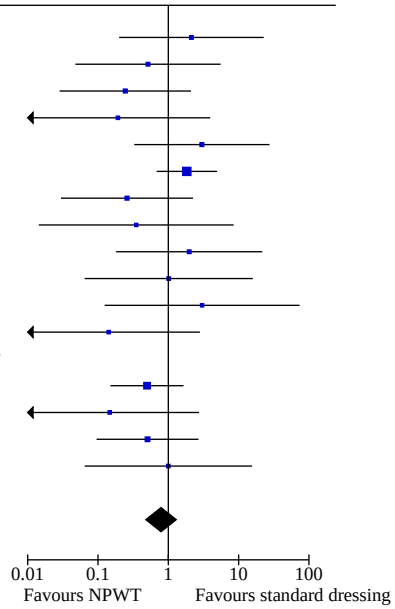
Heterogeneity: Tau² = 0.00; Chi² = 9.02, df = 14 (P = 0.83); I² = 0%
Test for overall effect: Z = 1.60 (P = 0.11)
Test for subgroup differences: Not applicable



Analysis 1.10. Comparison 1: Negative pressure wound therapy versus standard dressing, Outcome 10: Haematoma

Study or Subgroup	NPWT Events	NPWT Total	Standard dressing Events	Standard dressing Total	Weight	Risk Ratio M-H, Random, 95% CI
Andrianello 2020	2	46	1	49	4.4%	2.13 [0.20 , 22.71]
Bueno-Lledo 2021	1	72	2	74	4.4%	0.51 [0.05 , 5.54]
Chaboyer 2014	1	44	4	43	5.4%	0.24 [0.03 , 2.10]
Flynn 2020	0	96	2	92	2.7%	0.19 [0.01 , 3.94]
Gillespie 2015	3	35	1	35	5.0%	3.00 [0.33 , 27.46]
Gillespie 2021	11	1017	6	1018	25.2%	1.84 [0.68 , 4.94]
Hasselmann 2019a	1	59	4	61	5.3%	0.26 [0.03 , 2.25]
Karlakki 2016	0	102	1	107	2.4%	0.35 [0.01 , 8.48]
Leitao 2020	2	223	1	221	4.3%	1.98 [0.18 , 21.70]
Newman 2019	1	79	1	80	3.3%	1.01 [0.06 , 15.91]
Shen 2017	1	132	0	133	2.4%	3.02 [0.12 , 73.53]
Shim 2018	0	30	2	21	2.8%	0.14 [0.01 , 2.81]
Tuuli 2017	0	60	0	60		Not estimable
Tuuli 2020	4	806	8	802	17.3%	0.50 [0.15 , 1.65]
Wierdak 2021	0	35	3	36	2.9%	0.15 [0.01 , 2.74]
Wihbey 2018	2	80	4	81	8.9%	0.51 [0.10 , 2.69]
Witt-Majchrzac 2015	1	40	1	40	3.3%	1.00 [0.06 , 15.44]
Total (95% CI)		**2956**		**2953**	**100.0%**	**0.79 [0.48 , 1.30]**
Total events:	30		41			

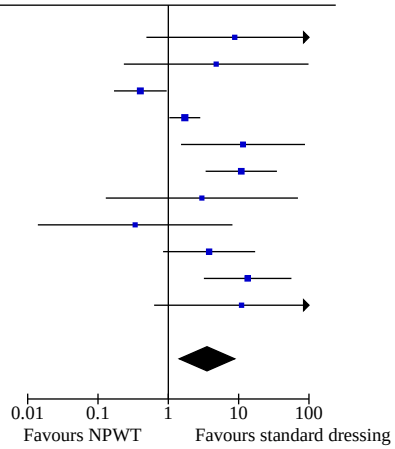
Heterogeneity: Tau² = 0.00; Chi² = 12.98, df = 15 (P = 0.60); I² = 0%
Test for overall effect: Z = 0.94 (P = 0.35)
Test for subgroup differences: Not applicable



Analysis 1.11. Comparison 1: Negative pressure wound therapy versus standard dressing, Outcome 11: Skin blisters

Study or Subgroup	NPWT Events	NPWT Total	Standard dressing Events	Standard dressing Total	Weight	Risk Ratio M-H, Random, 95% CI
Chaboyer 2014	4	44	0	43	6.0%	8.80 [0.49 , 158.66]
Flynn 2020	2	96	0	92	5.7%	4.79 [0.23 , 98.53]
Giannini 2018	6	50	15	50	13.6%	0.40 [0.17 , 0.95]
Gillespie 2021	40	996	23	983	14.8%	1.72 [1.04 , 2.84]
Karlakki 2016	11	102	1	107	8.7%	11.54 [1.52 , 87.78]
Leitao 2020	33	223	3	221	12.3%	10.90 [3.39 , 35.02]
Manoharan 2016	1	21	0	21	5.4%	3.00 [0.13 , 69.70]
Newman 2019	0	79	1	80	5.3%	0.34 [0.01 , 8.16]
Ruhstaller 2017	8	61	2	58	10.9%	3.80 [0.84 , 17.17]
Tuuli 2020	27	806	2	802	11.2%	13.43 [3.21 , 56.30]
Witt-Majchrzac 2015	5	40	0	40	6.1%	11.00 [0.63 , 192.56]
Total (95% CI)		**2518**		**2497**	**100.0%**	**3.55 [1.43 , 8.77]**
Total events:	137		47			

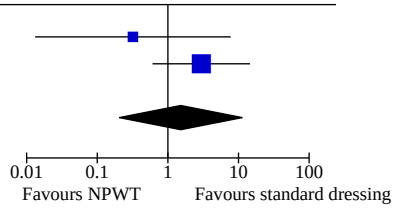
Heterogeneity: Tau² = 1.38; Chi² = 38.31, df = 10 (P < 0.0001); I² = 74%
Test for overall effect: Z = 2.74 (P = 0.006)
Test for subgroup differences: Not applicable



Analysis 1.12. Comparison 1: Negative pressure wound therapy versus standard dressing, Outcome 12: Pain

Study or Subgroup	NPWT Events	NPWT Total	Standard dressing Events	Standard dressing Total	Weight	Risk Ratio M-H, Random, 95% CI
Flynn 2020	0	96	1	92	30.1%	0.32 [0.01 , 7.75]
Leitao 2020	6	223	2	221	69.9%	2.97 [0.61 , 14.57]
Total (95% CI)		**319**		**313**	**100.0%**	**1.52 [0.20 , 11.31]**
Total events:	6		3			

Heterogeneity: Tau² = 0.84; Chi² = 1.51, df = 1 (P = 0.22); I² = 34%
Test for overall effect: Z = 0.41 (P = 0.68)
Test for subgroup differences: Not applicable



ADDITIONAL TABLES

Table 1. Primary outcome data

Study	Wounds characteristics	Comparison	Time points	Mortality	SSI	Dehiscence	Note
Andrianello 2020	Pancreatic resection	Group A: PICO dressing Group B: gauze/standard surgical dressing	7, 30 and 90 days	Stated that 90-day mortality recorded but not reported	Group A: 26/46 (4 superficial, 1 deep, 21 organ space) Group B: 27/49 (3 superficial, 3 deep, 21 organ space	-	Study analysed number of non-organ space SSIs.
Bertges 2021	Vascular groin surgery	Group A: ciNPT Group B: standard sterile gauze dressing	30 days	Mortality within 30 days: Group A: 1/115 Group B: 1/119	Group A: 17/115 patients(14/115 superficial; 3 deep) Group B: 16/119 patients (15/119 superficial; 1/119 deep)	Group A: 17/115 Group B: 17/119	A small number of participants in each group had bilateral wounds but data analyses per patient.
Bobkiewicz 2018 abstract	Stoma reversal surgery	Group A: ciNPWT Group B: standard dressing	Not reported	-	Group A: 2/15 Group B: 4/15	"In the standard dressing group the incidence of wound dehiscence was higher".	Superficial SSI defined according to CDC
Bueno-Lledo 2021	Hernia repair	Group A: PICO dressing Group B: Mepore dressing	30 days	-	Group A: 0/72 Group B: 6/74	Group A: 2/72 Group B: 4/74	
Chaboyer 2014	Caesarean section in obese women	Group A: PICO dressing Group B: Comfeel dressing	1, 2, 3, and 4 weeks post-surgery	-	Group A: 10/44 Group B: 12/43	-	-
Crist 2014	Open reduction and internal fixation	Group A: NPWT Group B: standard gauze dressing	12 months	-	Group A: 5/49 Group B: 2/42	-	-

Table 1. Primary outcome data *(Continued)*

	of hip, pelvis, and acetabular fracture surgery						
Crist 2017	Open reduction internal fixation (ORIF) for acetabular fractures	Group A: NPWT Group B: standard gauze dressing	10 to 21 days, 6 weeks, 12 weeks, and every 6 to 8 weeks thereafter until bony union occurred	-	Group A: 5/33 Group B: 2/33 *completed-case analysis - 5 lost after randomisation but group allocation not known*	-	Infection defined as "deep infection"
Darwisch 2020	Cardiac surgery - median sternotomy	Group A: Group B:	Not reported	-	Reported no sig difference in number of SSI in people with BMI < 35 (P = 0.622) or >/= 35 (P = 0.2926), n/N not reported	-	
DiMuzio 2017 Abstract	Groin wounds	Group A (59, high risk): NPWT dressing Group B (60, high risk): standard gauze dressing Group C (21, low risk): standard gauze dressing	30 days	-	Group A: 6/59 Group B: 15/60 Group C: 1/21	Group A: 8.5% Group B: 18.3% Group C: 4.8%	Contacted authors for full text Group C not included in data analysis due to baseline heterogeneity
Engelhardt 2016	Groin wound	Group A: NPWT Group B: conventional dressing	5 and 42 days	-	Group A: 9/64 Group B: 19/68	-	-
Flynn 2020	Laparotomy	Group A: PICO Group B: conventional dressing	7 days plus further follow up	-	Group A: 13/96 Group B:14/92	Group A: 7/96 (1 fascial) Group B: 9/92 (1 fascial)	
Fogacci 2019	Breast surgery	Group A: PICO	"long-term follow up"	-	Group A: 0/50 Group B: 5/50	-	

Table 1. Primary outcome data *(Continued)*

		Group B: standard dressing					
Galiano 2018	Breast surgery	Group A: NPWT, 199 wounds Group B: standard dressings, 199 wounds	21 days	-	Group A: 4/199 Group B: 6/199	Group A: 32/199 Group B: 52/199	
Giannini 2018	Hip and knee prosthetic revision	Group A single use NPWT (PICO) Group B povidone-iodine gauze and patch wound dressing	7 days	-	The severity of wound infection measured by the ASEPSIS score (higher score = worse wound healing; a score > 10 = the increasing probability and severity of infection) mean (SD) of the score: 3.0 (1.89) in Group A; 5.1 (3.89) in Group B	-	-
Gillespie 2015	Primary hip arthroplasty	Group A: PICO dressing Group B: Comfeel dressing	30 days and 6 weeks post-surgery	-	Group A: 2/35 Group B: 3/35	Group A: 1/35 Group B: 1/35	QoL reported in Heard 2017.
Gillespie 2021	Caesarean	Group A: PICO dressing Group B: standard dressing	30 days	Group A: 0/1017 Group B: 0/1018	Group A: 75/1017 (70 superficial, 4 deep, 1 organ space) Group B: 99/1018 (93 superficial, 6 deep, 0 organ space)	Group A: 108/1017 Group B: 103/1018	
Gok 2019	Abdominal surgery	Group A: NPWT, KCI Prevena incision management system Group B: standard dressing Group C: aspiration drainage	not stated; the study was terminated at day 5 postoperatively	One death was reported but the group was not clearly reported.	Stated that:"surgical site infection was detected five times less in the negative-pressure group, compared to the standard dressing group. It is also 3.5-fold less compared to the aspiration drainage group".	Group 1: 1/20 Group B: 7/20 Group C: 6/20	
Gombert 2018	Vascular surgery (groin) for PAD	Group A: NPWT (Prevena)	30 days	-	Group A: 13/98 Group B: 30/90	-	-

Table 1. Primary outcome data *(Continued)*

		Group B: Cosmopore dressing					
Gunatilake 2017	Caesarean	Group A: NPWT Group B: standard care dressing	42 ± 10 days postoperatively (days 1, 2, 6, 14, and 42)	-	Group A: 1/39 Group B: 4/43	Group A: 1/39 Group B: 5/43	ITT: n = 92; 82 completed the study.
Hasselmann 2019a	Inguinal vascular surgery	Group A: NPWT Group B: standard dressing	90 days	Group A: 1/75 Group B: 1/79	SSI among patients with unilateral incisions CDC criteria Group A: 7/59 (6 superficial; 1 deep) Group B: 17/61(13 superficial; 2 deep; 2 organ space) ASEPSIS score Group A: 7/59 Group B: 18/61	Group A: 12/59 Group B: 7/61	Data in Hasselmann 2019a and Hasselmann 2019b were reported in the same publication. These data of this row are for those with unilateral incisions randomised individually. Mortality mentioned only in the study flow figure, rather than specifying as an outcome
Hasselmann 2019b	Inguinal vascular surgery	Group A: NPWT Group B: standard dressing	90 days	Group A: 1/24 participants Group B: 1/24 participants	SSI among patients with bilateral incisions Group A: 1/19 (5.3%) incisions Group B: 5/19 (26.3%) incisions all superficial ASEPSIS criteria Group A: 1/19 Group B: 4/19	For bilateral incisions: Group A: 2/19 Group B: 2/19	Data in Hasselmann 2019a and Hasselmann 2019b were reported in the same publication. These data of this row are for those with bilateral incisions randomised with a split-body design. Mortality (mentioned only in the study flow figure, rather than specifying as an outcome) Given the split-body design, the mortality case occurred only in one person (with bilateral incisions).

Table 1. Primary outcome data *(Continued)*

Howell 2011	Knee arthroplasty	Group A: NPWT Group B: gauze dressing	Followed up for 12 months post-surgery	-	Group A: 1/24 Group B: 1/36	-	-
Hussamy 2017	Caesarean	Group A (222): NPWT Group B (219): standard dressing	30 days post-delivery	-	*Superficial SSI* Group A: 20/222 Group B: 25/219 *Organ SSI* Group A: 1/222 Group B: 0/219 *Deep Infections:* Group A: 0/222 Group B: 0/219	Group A: 4/222 Group B: 1/219	Unable to contact authors
Hyldig 2019b	Caesarean	Group A (432): NPWT Group B (444): standard dressing	30 days after operation	-	SSI Group A: 20/432 Group B: 41/444 Deep SSI Group A: 8/410 Group B: 9/417	Group A: 62/410 Group B: 69/417	
Javed 2018	Open pancreaticoduodenectomy	Group A: NPWT Group B: standard closure	30 days after operation	-	SSI Group A: 6/62 Group B: 19/61 Superficial SSI Group A: 4/62 Group B: 17/61	-	

Table 1. Primary outcome data *(Continued)*

					Deep SSI Group A: 2/62 Group B: 2/61		
Karlakki 2016	Total hip or knee arthroplasties	Group A: PICO dressing Group B: Comfeel dressing	1, 2, and 6 weeks post-surgery	-	Group A: 2/102 Group B: 6/107	-	-
Keeney 2019	Hip and knee total joint arthroplasty	Group A: iNPWT Group B: conventional wound dressing	7, 14 and 35 days after operations; 2 years	-	Superficial and late wound infection rates Group A: 7/185 Group B: 8/213	-	Additional data on return to operating rooms; and infection outcome were presented in Characteristics of included studies.
Kuncewitch 2017 Abstract	Pancreatectomy	Group A: NPWT Group B: standard surgical dressing	30 days post-surgery follow-up	-	*Superficial SSI* Group A: 5/36 Group B: 6/37 *Deep SSI* Group A: 3/36 Group B: 2/37	Group A: 1/36 Group B: 2/37	Unable to contact authors
Kwon 2018	Vascular groin incisions (high risk)	Group A: NPWT Group B: standard gauze	30 days	-	Any Group A: 6/59 Group B: 12/60 Major Group A: 5/59 Group B: 12/60	Any Group A: 1/59 Group B: 1/60 Major Group A: 0/59 Group B: 0/60	

Table 1. Primary outcome data *(Continued)*

Lee 2017a	Great saphenous vein harvest	Group A: NPWT Group B: standard surgical dressing	Initial assessment: not specified; endpoint assessment: 6 weeks	-	Group A: 0/31 Group B: 1/25	-	2 participants died (sepsis; stroke). 2 participants were delirious and unable to complete QoL; all other objective evaluations were done (all 4 in NPWT)
Lee 2017b	High-risk groin wounds	Group A: NPWT Group B: standard care	30 days and 90 days	Mortality within 90 days: Group A: 1/53 Group B: 2/49	*In-hospital SSI* Group A: 1/53 Group B: 1/49 *30-day SSI* Group A: 6/53 Group B: 9/49 *90-day SSI* Group A: 7/53 Group B: 11/49	-	Latest time point of SSI data used for analysis
Leitao 2020 Abstract	Laparotomy for gynaecologic malignancy	Group A: NPWT, KCI Prevena™ Customizable™ Incision Management System Group B: standard gauze	Postoperative 30 days	-	Superficial SSI Group A: 44/223 Broup B: 41/221	Superficial dehiscence Group A: 30/223 Broup B: 25/221	The development of a wound complication was reported as a composite outcome including multiple types of events; but data were not reported for each complication separately (overall, 41 patients (18%) in Group A (90% CI 14.1% to 22.7%); and 38 (17%) in Group B (90% CI 13.0% to 21.4%). Data in main table obtained from author contact
Leon 2016 Abstract	Open colorectal surgery	Group A: NPWT Group B: usual dressing	15-day and 30-day evaluation	-	Group A: 5/47 Group B: 10/34	-	Unable to contact authors

Table 1. Primary outcome data *(Continued)*

Lozano-Balderas 2017	Laparotomised patients with class III or IV (contaminated/dirty-infected) surgical wounds	Group A: vacuum-assisted closure Group B: primary closure Group C: delayed primary closure	Daily when in hospital or in a 30-day period after surgery	-	Group A: 0/25 Group B: 10/27 Group C: 5/29	-	Group C (delayed primary closure) not included in data analysis due to irrelevant wounds
Manoharan 2016	Primary arthroplasty	Group A: NPWT Group B: conventional dry dressing	10 to 12 days post-surgery	-	-	-	-
Martin 2019	Hepatectomy or pancreatectomy	Group A: NPWT (PICO) Group B: sterile island dressing	30 days then biweekly for 3 months	-	Overall Group A: 3/20 Group B: 6/20 Deep space Group A: 2/20 Group B: 4/20 Superficial Group A: 1/20 Group B: 2/20	Group A: 1/20 Group B: 2/20 all mild to moderate - all associated with SSI	-
Masden 2012	Radial forearm free flap	Group A: NPWT Group B: dry dressing	Not clear	-	Group A: 3/44 Group B: 5/37	Group A: 16/44 Group B: 11/37	-
Murphy 2019	Colorectal resections	Group A: NPWT Group B: standard gauze dressing	30 days	Group A: 3/144 Group B: 2/140	Group A: 46/144 Group B: 48/140	-	

Table 1. Primary outcome data *(Continued)*

NCT00654641	Caesarean sections	Group A: Negative pressure wound closure Group B: Standard wound closure	6 weeks	no serious adverse events reported	-	-	The development of a wound complication was reported as a composite outcome including multiple types of events; data were not reported for each complication separately (overall, 15 patients in Group A (53.57%) and 10 in Group B (38.46%)
NCT01759381	Spinal surgery	Group A: NPWT Group B: standard wound closure	3 months	Group A: 0/11 Group B: 1/8	Group A: 2/11 Group B: 1/7	-	
NCT02309944	Laparotomy for suspected gynaecologic malignancy	Group A: NPWT Group B: standard wound closure	4 weeks	Within 12 weeks after surgery: Group A: 0/43 Group B: 0/38	SSI: Group A: 3/43 Group B: 2/38	Wound complication (Wound dehiscence or infection): Group A: 9/42 Group B: 12/37	SSI was reported by the original investigators as two separate types of adverse events: superficial wound infection requiring readmission, and superficial wound infection; and the investigators stated adverse event data were collected by non-systematic assessment. We combined data of these two types of adverse events together for SSI in this table. The investigators also considered both wound dehiscence and infection into the composite outcome of wound complication (Group A 9/42; Group B 12/37). However, data for either part of the composite outcome were not available.

Table 1. Primary outcome data *(Continued)*

NCT02461433	Obese patients who underwent any elective open surgery	Group A: Prevena negative pressure wound therapy Group B: standard dressing	5 weeks	Group A: 0/1 Group B: 0/1	Group A: 0/1 Group B: 0/1	-	Dehiscence, seroma and hematoma were reported as number of aggregate events.
NCT01759381	Spinal surgery	Group A: NPWT Group B: control without NPWT	3 months	Group A: 0/11 Group B: 1/8	Group A: 2/11 Group B: 1/7	-	-
Newman 2019	Total hip or knee replacements	Group A: ciNPWT Group B: standard silver dressing	12 weeks	-	Group A: 0/79 Group B: 1/80	Dehiscence Group A: 1/79 Group B: 4/80	
Nordmeyer 2016	Spinal fractures treated with internal fixation	Group A: PICO dressing Group B: standard dressing	Day 5 and day 10 after surgery	-	-	-	-
O'Leary 2017	Open abdominal surgery	Group A: PICO dressing Group B: transparent waterproof dressing	Day 4 and day 30 post-surgery	-	Group A: 2/24 Group B: 8/25	-	-
Pachowsky 2012	Hip arthroplasty	Group A: NPWT Group B: standard dressing	Day 5 and day 10 in postoperative period	-	-	-	Very small sample size
Pauser 2016	Fractures of the femoral neck treated by hemiarthroplasty	Group A: NPWT Group B: standard dressing	Day 5 and day 10 after surgery	-	-	-	Very small sample size
Pleger 2018	Groin wound	Group A: NPWT (n = 58 incisions) Group B:	Days 5 to 7 and 30 after surgery	-	Group A: 1/58 Group B: 10/71	*Superficial wound dehiscence* Group A: 3/58 Group B: 4/71	Unit of analysis error: 100 participants with 129 groin incisions

Table 1. Primary outcome data *(Continued)*

		control dressing (n = 71 incisions)				*Deep wound dehiscence with fat necrosis* Group A: 1/58 Group B: 4/71	
Ruhstaller 2017	Unplanned caesarean section	Group A: NPWT Group B: standard care	4 weeks post-surgery	-	Group A: 2/61 Group B: 4/58	-	-
Sabat 2016 Abstract	Groin wounds in vascular surgery	Group A: NPWT Group B: conventional dressing (gauze and Tegaderm)	4 months post-surgery	-	Group A: 2/30 Group B: 7/33	Group A: 3/30 Group B: 8/33	-
Schmid 2018	Inguinal lymph node dissection	Group A: NPWT (Prevena) Group B: conventional compression bandages	14 days after surgery	Within-person study; 1 death reported	–	–	Reported wound complication as a composite (unspecified outcome): complications of any grade in 23/31 on each side; grade 3 complications in 3/31 conventional and 6/31 NPWT wounds
Shen 2017	Open resection of intra-abdominal neoplasms	Group A: PICO dressing Group B: Comfeel dressing	30 days after surgery	Group A: 3/132 Group B: 5/133	Group A: 26/132 Group B: 28/133	Group A: 3/132 Group B: 3/133	-
Shim 2018	Reconstructive surgery for acute hand injuries	Group A: NPWT Group B: conventional dressing	1 month and 1 year	-	Group A: 0/30 Group B: 1/21	Wound disruption Group A: 2/30 Group B: 0/21	-
Stannard 2012	Tibial plateau, pilon, or calcaneus fracture	Group A: NPWT Group B: standard dressing	Not stated	-	Group A: 14/144 Group B: 23/122	Group A: 12/139	Unit of analysis error

Table 1. Primary outcome data *(Continued)*

						Group B: 20/122	
Tanaydin 2018	Bilateral breast reduction mammoplasty	Group A: NPWT Group B: standard care (fixation strips)	21 days	-	-	Group A: 5/32 Group B: 10/32	32 participants served as their own control.
Tuuli 2017	Caesarean delivery	Group A: NPWT Group B: standard dressing	30 days	-	Group A: 3/60 Group B: 2/60	Group A: 2/60 Group B: 0/60	-
Tuuli 2020	Caesarean delivery	Group A: NPWT Group B: standard dressing	30 days	Group A: 0/806 Group B: 0/802	Group A: 31/806. Superficial/deep/organ space: 18/11/2 Group B: 29/802 Superficial/deep/organ space: 16/11/2	Group A: 11/806 Group B: 9/802	Trial stopped due to adverse skin reactions and futility
Uchino 2016	Ileostomy closure in patients who underwent surgery for ulcerative colitis	Group A: NPWT Group B: standard dressing	6 weeks	-	Group A: 3/28 Group B: 1/31	-	
WHIST 2019a	Lower limb fracture	Group A: NPWT Group B: standard dressing	30 days 90 days	Planned analysis could not be conducted 3 months Group A: 12/745	Deep infection 30 days Group A: 45/770 Group B: 50/749 90 days (available case data)	Dehisced but not deep SSI 30 days Group A: 2/714 Group B: 7/687 90 days	

Table 1. Primary outcome data *(Continued)*

				Group B: 15/711 6 months Group A: 18/745 Group B: 19/711	Group A: 72/629 Group B: 78/590	Group A: 2/563 Group B: 2/525 14 of those with deep infection dehisced or deliberately opened.	
Wierdak 2021	Ileostomy closure in patients who underwent surgery for colorectal cancer	Group A: NPWT, NANOVA negative-pressure dressing Group B: customary care using sterile wound dressings	7 days and 14 days postoperatively	-	Incidence of surgical site infections: Group A: 2/35 (5.7%) patients Group B: 8/36 (22.2%) patients	-	Incidence of wound healing complications were reported: 3/35 (8.6%) patients Group A and 11/36 (30.6%) in Group B (P = 0.020)
Wihbey 2018	Caesarean delivery	Group A: NPWT Group B: standard dressing	1 week and 30 days follow-up	–	Superficial Group A: 12/80 Group B: 8/81 Deep Group A: 0/80 Group B: 0/81 Organ Group A: 1/80 Group B: 4/81	Group A: 14/80 Group B: 13/81	-
Witt-Majchrzac 2015	Coronary artery bypass surgery	Group A: NPWT Group B: conventional dressing	6 weeks follow-up	-	Group A: 1/40 Group B: 7/40	Group A: 1/40 Group B: 1/40	-

ASEPSIS: ASEPSIS score - a quantitative scoring method using objective criteria based on wound appearance to evaluate wound infection
BMI: body mass index
cINPWT: closed incisional negative pressure wound therapy
CDC: Center for Disease Control
ICER: incremental cost-effectiveness ratio
IQR: interquartile range
ITT: intention-to-treat

KCI: name of company which manufactures a negative pressure wound therapy system
NANOVA: proprietary name for negative pressure wound therapy system
NPWT: negative pressure wound therapy
PAD: peripheral arterial disease
PICO: proprietary name for single use negative pressure wound therapy system
QALY: quality-adjusted life year
QoL: quality of life
SD: standard deviation
SSI: surgical site infection

Table 2. Secondary outcome data

Study	Wound characteristics	Comparison	Time-points	Reoperation	Readmission	Seroma	Haematoma	Skin blisters	Pain	Quality of Life	Notes
Andrianello 2020	Pancreatic resection	Group A: PICO dressing Group B: gauze/standard surgical dressing	7, 30 and 90 days	Group A: 10/46 Group B: 3/49* *calculated using flow chart. Reop = relaparotomy		Group A: 0/46 Group B: 6/49	Group A: 2/46 Group B: 1/49	-	-	-	
Bertges 2021	Vascular groin surgery	Group A: ciNPT Group B: standard sterile gauze dressing	30 days	Group A: 16/115 Group B: 16/119	Group A: 8/115 Group B: 11/119 (readmissions for wound infection)	Reported composite data for seroma and haematoma Group A: 3/115 Group B: 1/119	Reported composite data for seroma and haematoma: Group A: 3/115 Group B: 1/119	-	EQ-5D: Group A (n = 115) mean pain score-baseline = 1.8 (+/-0.6) 14 days = 2.2 (+/-0.6)	EQ-5D: Group A (n = 115) mean QOL score baseline = 11.7 (+/-1)	EQ-5D for QoL incorporated pain score.

Table 2. Secondary outcome data *(Continued)*

									30 days = 2.3 (+/- 0.6) Group B (n = 119) mean pain score baseline = 1.7 (+/- 0.5) 14 days = 2.2 (+/- 0.5) 30 days 2.4 (+/- 0.6)	30 days = 12.1 (+/- 1) Group B (n = 119) mean QOL score- baseline = 11.8 (+/- 1) 30 days = 12.2 (+/- 1)	
Bobkiewicz 2018	Stoma reversal surgery	Group A: ciNPWT Group B: standard dressing	Not reported	-	-	-	"In the standard dressing group the incidence of haematoma was higher".	-	-	-	Superficial SSI defined according to CDC
Bueno-Lledo 2021	Hernia repair	Group A: PICO dressing Group B: Mepore dressing	30 days	Group A: 1/72 Group B: 2/74 revision after discharge	Group A: 2/72 Group B: 6/74	Group A: 9/72 Group B: 10/74	Group A: 1/72 Group B: 2/74				
Chaboyer 2014	Caesarean section in obese women	Group A: PICO dressing Group B: Comfeel dressing	1, 2, 3, and 4 weeks	Group A: 1/44	-	-	Group A: 1/44	Group A: 4/44	-	-	

Table 2. Secondary outcome data *(Continued)*

			post-surgery	Group B: 1/43			Group B: 4/43	Group B: 0/43			
Crist 2014	Open reduction and internal fixation of hip, pelvis, and acetabular fracture surgery	Group A: NPWT Group B: standard gauze dressing	12 months	-	-	-	-	-	-	-	
Crist 2017	Open reduction internal fixation for acetabular fractures	Group A: NPWT Group B: standard gauze dressing	10 to 21 days, 6 weeks, 12 weeks, every 6 to 8 weeks thereafter until bony union occurred	-	-	-	-	-	-	-	Infection defined as "deep infection"
Darwisch 2020	Cardiac surgery - median sternotomy	Group A: PICO dressing Group B: standard surgical dressing	Not reported	-	-	-	-	-	-	-	
DiMuzio 2017	Groin wounds	Group A (59, high risk): NPWT dressing Group B (60, high risk): standard gauze dressing Group C (21, low risk): standard gauze dressing	30 days	-	Group A: 6.8% Group B: 16.7% Group C: 4.8%	-	-	-	-	-	Contacted authors for full text Group C not included in data analysis due to base-

Table 2. Secondary outcome data *(Continued)*

											line heterogeneity
Engelhardt 2016	Groin wound	Group A: NPWT Group B: conventional dressing	5 and 42 days	-	-	-	-	-	-	-	
Flynn 2020	Laparotomy	Group A: PICO Group B: conventional dressing	7 days plus further follow-up	-	-	Group A: 0/96 Group B: 1/92	Group A: 0/96 Group B: 2/92	Group A: 2/96 Group B: 0/92	Group A: 0/96 Group B: 1/92		
Fogacci 2019	Breast surgery	Group A: PICO Group B: standard dressing	"long term follow-up"	-	Group A: mean 3.78 (range 2-8) readmission as outpatient Group B: mean 4.18 (range 2-14)	-	-	-	-		
Galiano 2018	Breast surgery	Group A: NPWT, 199 wounds Group B: standard dressings, 199 wounds	21 days	-	-	Group A: 0/199 Group B: 1/199	Group A: 2/199 Group B: 3/199	-	-	-	
Giannini 2018	Hip and knee prosthetic revision	Group A: single-use NPWT (PICO) Group B: povidone-iodine gauze and patch wound dressing	7 days	-	-	-	-	Group A: 6/50 Group B: 15/50	Pain at dressing change Group A: mean 2.6 (median 2, range 1-6)	-	

Table 2. Secondary outcome data *(Continued)*

									Group B: mean 4.8 (median 5, range 2-7)		
Gillespie 2015	Primary hip arthroplasty	Group A: PICO dressing Group B: Comfeel dressing	30 days and 6 weeks post-surgery	-	Group A: 4/35 Group B: 0/35	Group A: 3/35 Group B: 0/35	Group A: 3/35 Group B: 1/35	-	-	-	QoL reported in Heard 2017
Gillespie 2021	Caesarean	Group A: PICO dressing Group B: standard dressing	30 days	Group A: 4/1017 Group B: 5/1018	Group A: 23/1017 Group B: 13/1018	Group A: 27/1017 Group B: 26/1018	Group A: 11/1017 Group B: 6/1018	Group A: 40/996 Group B: 23/983	Group A: 21/1017 Group B: 11/1018	-	QoL presumed to be in the forthcoming economics paper
Gombert 2018	Vascular surgery (groin) for PAD	Group A: NPWT (Prevena) Group B: Cosmopore dressing	30 days	Group A: 5/98 Group B: 6/90	-	-	-	-	Assessed but not reported	-	
Gunatilake 2017	Caesarean	Group A: NPWT Group B: standard care dressing	42 ± 10 days postoperatively (days 1, 2, 6, 14, and 42)	Group A: 1/39 Group B: 6/43	-	-	-	-	Pain reductions at rest Group A: 39/46 Group B: 20/46 Pain reductions with incisional pressure Group A: 42/46 Group B: 25/46	-	ITT: n = 92; 82 completed the study

Table 2. Secondary outcome data *(Continued)*

Hassel-mann 2019a	Inguinal vascular surgery	Group A: NPWT Group B: standard dress-ing	90 days	For uni-later-al inci-sions: Group A: 2/59 (3.4%) Group B: 4/61 (6.6%)	Data at 30 days for uni-later-al inci-sions: Group A: 10/59 (16.9%); Group B: 5/61 (8.2%)	For uni-later-al inci-sions: Group A: 13/59 (22.0%) Group B: 14/61 (23.0%)	For uni-later-al inci-sions: Group A: 1/59 (1.7%) Group B: 4/61 (6.6%)	-	-	Vas-cuquol-6 preoper-ative Group A: 9.1 (n = 41) Group B: 10.6 (n = 43) 30 days Group A: 14.9 (n = 39) Group B: 15.3 (n = 42)	QoL da-ta taken from Svens-son-Bjork 2020
Hassel-mann 2019b	Inguinal vascular surgery	Group A: NPWT Group B: standard dress-ing	90 days	For bilat-eral inci-sions: Group A: 1/19 (5.3%) Group B: 1/19 (5.3%)	Data at 30 days for bilat-eral inci-sions: Group A: 3/19 (15.8%) Group B: 2/19 (10.5%)	For bilat-eral in-cisions: Group A: 3/19 (15.8%) Group B: 4/19 (21.1%)	For bilat-eral in-cisions: Group A: 0/19 (0%) Group B: 0/19 (0%)	-	-	-	
Howell 2011	Knee arthro-plasty	Group A: NPWT Group B: gauze dressing	12 months post-surgery	-	-	-	-	Group A: 15/24 Group B: 3/36	-	-	

Table 2. Secondary outcome data *(Continued)*

Hussamy 2017	Caesarean section	Group A: NPWT Group B: standard dressing	30 days post-delivery	Group A: 14/222 Group B: 10/219	Group A: 12/222 Group B: 9/219	-	-	-	-	-	Abstract reported 13 participants in Group A were readmitted. Paper reported 12.
Hyldig 2019b	Caesarean section	Group A: NPWT Group B: standard dressing	30 days after operation	-	Mentioned in ClinicalTrials.gov but outcome data not reported	-	-	-	-	EQ index value Group A: mean = 0.86, 95% CI 0.85 to 0.87 Group B: mean = 0.86, 95% CI 0.84 to 0.87 Overall self-rated health status (EQ VAS) Group A: mean = 83, 95% CI 82 to 85; Group B: mean = 82, 95% CI 80 to 83	

Table 2. Secondary outcome data *(Continued)*

Javed 2018	Open pancreaticoduodenectomy	Group A: NPWT Group B: standard closure	30 days after operation	Need for reoperation (RR 0.25; 95% CI 0.03 to 2.32; P = 0.21)	Rate of 30-day readmission for SSI (RR 0.49; 95% CI 0.13 to 1.88; P = 0.32) Rate of 30-day readmission (RR 0.41; 95% CI 0.15 to 1.09; P = 0.07)	-	-	-	-	-	
Karlakki 2016	Total hip or knee arthroplasties	Group A: PICO dressing Group B: Comfeel dressing	1, 2, 6 weeks postsurgery	-	Group A: 0/107 Group B: 1/108	-	Group A: 0/102 Group B: 1/107	Group A: 11/102 Group B: 1/107	-	-	
Keeney 2019	Hip and knee total joint arthroplasty	Group A: iNPWT Group B: conventional wound dressing	7, 14, 35 days after operations; 2 years	Return to the operating room to manage a wound-related concern within the first 3 months Group A: 1/185	-	-	-	-	-	-	Additional data on return to operating rooms; and infection outcome were presented in Characteristics of included studies.

Table 2. Secondary outcome data *(Continued)*

				Group B: 4/213							
Kuncewitch 2017	Pancreatectomy	Group A: NPWT Group B: standard surgical dressing	30 days post-surgery follow-up	-	-	Group A: 4/36 Group B: 6/37	-	-	-	-	Unable to contact authors
Kwon 2018	Vascular groin incisions (high risk)	Group A: NPWT Group B: standard gauze	30 days	Group A: 5/59 Group B: 11/60	Group A: 4/59 Group B: 10/60	Reported composite outcome including seroma only	Any Group A: 0/59 Group B: 1/60 Major Group A: 0/59 Group B: 1/60	-	-	-	
Lee 2017a	Great saphenous vein harvest	Group A: NPWT Group B: standard surgical dressing	Initial assessment: not specified; endpoint assessment: 6 weeks	-	-	-	-	-	-	EQ-5D-3L: Group A (n = 26): 78 Group B (n = 17): 63 P = 0.172	2 participants died (sepsis; stroke). 2 participants were delirious and unable to complete QoL; all other objective evaluations were done (all 4 in NPWT).
Lee 2017b	High-risk groin wounds	Group A: NPWT Group B: standard care	30 days and 90 days	Group A: 2/53 Group B: 1/49	Group A: 2/53 Group B: 2/49	-	-	-	-	-	Latest time point of SSI data used for analysis

Table 2. Secondary outcome data *(Continued)*

				for SSI	*for SSI*						
Leitao 2020	Laparotomy	Group A: NPWT Group B: standard care	30 days	-	-	Group A: 11/223 Group B: 14/221	Group A: 2/223 Group B: 1/221	Group A: 33/223 Group B: 3/221	Group A: 6/223 Group B: 2/221	-	Data obtained from author contact (composite outcome in publication)
Leon 2016	Open colorectal surgery	Group A: NPWT Group B: usual dressing	15-day and 30-day evaluation	-	-	-	-	-	-	-	Unable to contact authors
Lozano-Balderas 2017	Laparotomised patients with class III or IV (contaminated/dirty-infected) surgical wounds	Group A: vacuum-assisted closure Group B: primary closure Group C: delayed primary closure	Daily when in hospital or in a 30-day period after surgery	-	-	-	-	-	-	-	Group C (delayed primary closure) not included in data analysis due to irrelevant wounds
Manoharan 2016	Primary arthroplasty	Group A: NPWT Group B: conventional dry dressing	10 to 12 days post-surgery	-	-	-	-	Group A: 1/21 Group B: 0/21	-	-	
Martin 2019	Hepatectomy or pancreatectomy	Group A: NPWT (PICO) Group B: sterile island dressing	30 days then biweekly for 3 months	-	Stated that readmission within 6 months assessed but no data	-	-	-	-	-	
Masden 2012	Radial forearm free flap	Group A: NPWT Group B: dry dressing	Not clear	Group A: 9/44	-	-	-	-	-	-	

Table 2. Secondary outcome data *(Continued)*

				Group B: 8/37							
Murphy 2019	Colorectal resections	Group A: NPWT Group B: standard gauze dressing	30 days	Group A: 6/144 Group B: 6/140	-	-	-	-	-	-	
NCT00654641	Caesarean sections	Group A: Negative pressure wound closure Group B: Standard wound closure	6 weeks	-	-	-	-	-	-	-	The development of a wound complication was reported as a composite outcome including multiple types of events; data were not reported for each complication separately (overall, 15 patients in Group A (53.57%) and 10 in Group B (38.46%)
NCT01759381	Spinal surgery	Group A: NPWT Group B: standard wound closure	3 months	-	-	-	-	-	-	-	
NCT02309944	Laparotomy for suspected gynaecologic malignancy	Group A: NPWT Group B: Standard wound closure	4 weeks		Readmission due to superficial wound infection Up to 12 weeks						Only readmission due to wound infection data were available and this outcome was considered as a type of adverse events.

Table 2. Secondary outcome data *(Continued)*

					Group A: 2/43 Group B: 0/38						The original investigators stated adverse events were collected by non-systematic assessment.
NCT02461430	Obese patients who undergo any elective open surgery	Group A: Prevena negative pressure wound therapy Group B: standard dressing	5 weeks	-	Group A: 0/1 Group B: 0/1	-	-	-	SF-36 Group A: mean 100 (range 100 to 100), n = 1 Group B: mean 100 (range 100 to 100), n = 1	General health (SF-36) Group A: mean 100 (range 100 to 100), n = 1 Group B: mean 65 (range 65 to 65), n = 1	
Newman 2019	Total hip or knee replacements	Group A: ciNPWT Group B: standard silver dressing	12 weeks	Reoperation 2 weeks Group A: 0/79 Group B: 1/80 4 weeks Group A: 1/79 Group B: 3/80	Readmission 2 weeks Group A: 5/79 Group B: 6/80 4 weeks Group A: 9/79 Group B: 9/80	-	Haematoma Group A: 1/79 Group B: 1/80	Skin blisters Group A: 0/79 Group B: 1/80	-	-	

Table 2. Secondary outcome data *(Continued)*

				12 weeks Group A: 2/79 Group B: 10/80	12 weeks Group A: 16/79 Group B: 19/80						
Nordmeyer 2016	Spinal fractures treated with internal fixation	Group A: PICO dressing Group B: standard dressing	Day 5 and day 10 after surgery	-	-	-	-	-	-	-	
O'Leary 2017	Open abdominal surgery	Group A: PICO dressing Group B: transparent waterproof dressing	Day 4 and day-30 post-surgery	Group A: 0/25 Group B: 1/25	-	-	-	-	Reported "no difference"	-	
Pachowsky 2012	Hip arthroplasty	Group A: NPWT Group B: standard dressing	Day 5 and day 10 in postoperative period	-	-	Group A: 4/9 Group B: 9/10	-	-	-	-	Very small sample size
Pauser 2016	Fractures of the femoral neck treated by hemiarthroplasty	Group A: NPWT Group B: standard dressing	Day 5 and day 10 after surgery	-	-	Group A: 6/11 Group B: 8/10	-	-	-	-	Very small sample size
Pleger 2018	Groin wound	Group A: NPWT (n = 58 incisions) Group B: control dressing (n = 71 incisions)	Days 5 to 7 and 30 after surgery	-	-	Group A: 0/58 Group B: 1/71	Group A: 0/58 Group B: 8/71	-	-	-	Unit of analysis error: 100 participants with 129 groin incisions

Table 2. Secondary outcome data *(Continued)*

Ruhstaller 2017	Unplanned caesarean section	Group A: NPWT Group B: standard care	4 weeks post-surgery	Wound requiring opening/packing data: Group A: 3/61 Group B: 2/58	Data from Conference Abstract: Group A: 6/61 Group B: 9/58	-	-	Group A: 8/61 Group B: 2/58	Sharp pain at day 2 (0–10): Group A: median 6 (IQR 4 to 8), n = 61 Group B: median 5.5 (IQR 3 to 8), n = 58 Tingling pain at day 2 (0–10): Group A: median 2 (IQR 0 to 6), n = 61 Group B: median 1.5 (IQR 0 to 6), n = 58	Outcome mentioned but data not reported	
Sabat 2016	Groin wounds in vascular surgery	Group A: NPWT Group B: conventional dressing (gauze and Tegaderm)	4 months post-surgery	-	-	-	-	-	-	-	
Schmid 2018	Inguinal lymph node dissection	Group A: NPWT (Prevena) Group B: conventional compression bandages	14 days after surgery	Group A: 13/31 Group B: 14/31	-	-	-	-	Median pain score Group A: 2 (0-2)	-	Reported wound complication as a composite (unspecified outcome):

Table 2. Secondary outcome data *(Continued)*

									Group B: 1 (0-3)		complications of any grade in 23/31 on each side; grade 3 complications in 3/31 conventional and 6/31 NPWT wounds
Shen 2017	Open resection of intra-abdominal neoplasms	Group A: PICO dressing Group B: Comfeel dressing	30 days after surgery	Group A: 19/132 Group B: 16/133	Group A: 3/118 Group B: 6/119	Group A: 7/132 Group B: 8/133	Group A: 1/132 Group B: 0/133	-	-	-	
Shim 2018	Reconstructive surgery for acute hand injuries	Group A: NPWT Group B: conventional dressing	1 month and 1 year	-	-	-	Group A: 0/30 Group B: 2/21	-	-	-	
Stannard 2012	Tibial plateau, pilon, or calcaneus fracture	Group A: NPWT Group B: standard dressing	Not stated	-	-	-	-	-	-	-	Unit of analysis error
Tanaydin 2018	Bilateral breast reduction mammoplasty	Group A: NPWT Group B: standard care (fixation strips)	21 days	-	-	-	-	-	-	-	32 participants served as their own control.
Tuuli 2017	Caesarean delivery	Group A: NPWT Group B: standard dressing	30 days	-	-	Group A: 0/60 Group B: 1/60	Group A: 0/60 Group B: 0/60	-	Pain score (on 0-to-10 scale) was significantly	-	

Table 2. Secondary outcome data *(Continued)*

									lower with prophylactic NPWT (median (IQR): 0 (0, 1) vs 1 (0, 3), P = 0.02)	
Tuuli 2020	Caesarean delivery	Group A: NPWT Group B: standard dressing	30 days	-	Group A: 2/806 Group B: 0/802	Group A: 5/806 Group B: 6/802	Group A: 4/806 Group B: 8/802	Group A: 27/806 Group B: 2/802	Pain Score 0-10. Group A: 3 (0 to 5) at discharge. 0 (0 to 2) at day 30 Group B: 3 (0 to 5) at discharge. 0 (0 to 2) at day 30	-
Uchino 2016	Ileostomoy reversal	Group A: NPWT Group B: standard dressing	6 weeks	-	-	-	-	-	-	-
Wierdak 2021	Ileostomoy reversal	Group A: NPWT Group B: standard dressing	7/14 days	-	-	Group A: 1/35 Group B: 1/36	Group A: 0/35 Group B: 3/36	-		
WHIST 2019a	Lower limb fracture	Group A: NPWT Group B: standard dressing	30 days 90 days	Deliberate surgical reopening	-	-	-	-	VAS (median IQR)	DRI 3 months Group A:

Table 2. Secondary outcome data *(Continued)*

	or surgical treatment of wound complications Group A: 2/715 1/573 Group B: 2/688 2/575	
	Further surgery Group A: 83/578: Group B 56/534	
		3 months Group A: 3.0 (1.0, 6.0) 365 Group B: 4.0 (2.0, 5.0) 339 6 months Group A: 3.0 (1.0, 5.0) 419 Group B: 3.0 (1.0, 5.0) 368
	Proportion with neuropathic pain (DN4 >/= 3) also reported	EQ-5D (utility) 3 months Group A: 0.5 (0.29) 528 Group B: 0.5 (0.30) 470 6 months Group A: 0.6 (0.28) 486
		51.6 (23.46) (507) Group B: 51.1 (23.92) (456) 6 months Group A: 40.6 (24.98) (469) Group B: 40.2 (26.73) 432

Table 2. Secondary outcome data *(Continued)*

										Group B: 0.6 (0.29) 446 EQ-5D (VAS) 3 months Group A: 64.1 (22.24) 531 Group B: 64.7 (22.78) 478 6 months Group A: 69.7 (21.15) 489 Group B: 69.4 (21.76) 449
Wihbey 2018	Caesarean delivery	Group A: NPWT Group B: standard dressing	1 week and 30 days follow-up	Group A: 1/80 Group B: 1/81	Group A: 3/80 Group B: 5/81	Group A: 7/80 Group B: 6/81	Group A: 2/80 Group B: 4/81	-	-	-
Witt-Majchrzac 2015	Coronary artery bypass surgery	Group A: NPWT	6 weeks follow-up	-	-	-	Group A: 1/40	Group A: 5/40	-	-

Table 2. Secondary outcome data *(Continued)*

	Group B: conventional dressing	Group B: 1/40	Group B: 0/40

CDC: Center for Disease Control
CI: confidence interval
cINPT: closed incision negative pressure therapy
cINPWT: closed incision negative pressure wound therapy
DN4: DN4 (Douleur Neuropathique 4) questionnaire
DRI: Disability Rating Index
EQ(VAS): EuroQoL Visual Analogue Scale
EQ-5D-3L: EuroQoL 5D questionnaire, version 3L
INPWT: incisional negative pressure wound therapy
IQR: inter-quartile range
ITT: intention-to-treat
NPWT: negative pressure wound therapy
PAD: peripheral arterial disease
PICO: proprietary name for single use negative pressure wound therapy system
QoL: quality of life
RR: relative risk/risk ratio
SF-36: 36-Item Short Form Survey
SSI: surgical site infection
VAS: visual analogue scale
vs: versus

Table 3. Economic outcome data

Economic Study	RCT base	Population and perspective	Comparison	Time points	Dressing-related costs	Resource use	QALY	Relative cost-effectiveness (e.g. ICER)	Notes
Heard 2017	Chaboyer 2014	Population: Obese women undergoing caesarean section Perspective: Australian public health care provider	Group A: PICO dressing Group B: Comfeel dressing	4 weeks	NPWT AUD 180 Standard AUD 5 Dressing change cost (nurse time) AUD 35 for each group	Group A (44): 2871.5 ± 182.1 AUD Group B (43): 2806.6 ± 260.4 AUD	Group A (44): 0.067 ± 0.01 Group B (43): 0.066 ± 0.01	Per SSI prevented: ICER AUD 1347 (95% CI dominant to 41,873) Per QALY gained: ICER AUD 42,340 (95% CI dominant to 884,019)	Data drawn from Chaboyer 2014
Hyldig 2019a	Hyldig 2019b	Population: Obese women	NPWT	30 days	NPWT €151.40	Total healthcare costs	NPWT: 0.863	ICER not reported for all participants; NPWT report-	Data drawn

Table 3. Economic outcome data *(Continued)*

		undergoing caesarean section Perspective: Danish healthcare	Standard dressing		Standard €0.67 (assumed included in cost of treatment)	NPWT: €5793.60 Standard: €5840.89 Cost difference: €47.29	Control: 0.856	ed as dominant; subgroups reported	from Hyldig 2019b
Nherera 2017	Karlakki 2016	Population: People undergoing total hip/knee arthroplasty Perspective: UK NHS	NPWT Standard dressing	6 weeks	Cost of NPWT: £144 (120 to 150). Standard dressings assumed zero	Group A (102): 5602 ± 7954 GBP Group B (107): 6713 ± 9559 GPB	Group A (102): 0.116 ± 0.01 Group B (107): 0.115 ± 0.01	ICER not reported but NPWT described as technically dominant	Data drawn from Karlakki 2016
Nherera 2018	Witt-Majchrzac 2015	Population: People undergoing coronary artery bypass surgery Perspective: German Statutory Health Insurance payer	NPWT Standard dressing	6 weeks	NPWT: €153.00 (114.75 to 191.25) above standard cost	NPWT: €19,986 Standard: €20,572	NPWT: 0.8904 Standard: 0.8593 +0.0311 for NPWT	NPWT reported as dominant for both SSI avoided and QALY gained in base case analysis	Data drawn from Witt-Majchrzac 2015
Svensson-Bjork 2020	Hasselmann 2019a	Population: adult patients for elective vascular surgery with inguinal incisions Perspective: healthcare (other details were not specified; but the trial was run in Sweden)	NPWT dressing (PICO) Standard wound dressing	90 days	NPWT: EUR 208 Standard dressing: EUR 45	All healthcare costs in total: NPWT - EUR 19,281 Standard dressing - EUR 17,575 Vascular procedure-related costs in total (including dressing-related costs): NPWT - EUR 16,621	-	NPWT considered as cost-effective over standard dressings: base case analysis of vascular procedure-related costs - ICER = approximately EUR 19 per cent in SSI incidence, meaning an increased cost of EUR 1853 per SSI avoided Sensitivity analysis using costs for vascular procedure-related inpatient care only - ICER = approximately EUR 2 per cent in SSI inci-	Data drawn from Hasselmann 2019a; no QALYs

Table 3. Economic outcome data *(Continued)*

						Standard dressing - EUR 16,285		dence, corresponding to an increased cost of EUR 204 per SSI avoided Sensitivity analysis of vascular procedure-related costs and gain in Vascuqol-6 score - ICER = EUR 719 per unit of Vascuqol-6 score increased	
WHIST 2019b	WHIST 2019a	Population: People undergoing surgery for lower limb fracture Perspective: UK NHS and PSS	NPWT Standard dressing	3 months 6 months	Cost of intervention including dressing (plus cast, initial inpatient care, antibiotics, dressing changes) Group A: £5420.66 (5559.95) Group B: £4774.15 (4633.18)	Total cost after initial intervention - baseline to 6 months NHS and PSS Group A: £3100.83 (11251.93) Group B: £2330.83 (7863.51) Societal (inc NHS & PSS) Group A: £6248.64 (13074.32) Group B: £6027.23 (17737.28)	Group A: 0.40 (0.22) Group B: 0.41 (0.24)	£396,531/QALY gained (NHS & PSS perspective) £679,482 per QALY gained (societal perspective) £454,903 per QALY (complete case analysis)	Data drawn from WHIST 2019a
-	DiMuzio 2017 [1]	Groin wounds	NPWT Standard dressing	30 days	-	Group A: USD 30,492 Group B: USD 36,537 NPWT reduced cost per patient of USD 6045 (USD 30,492 + USD 500 (device) in NWPT group vs USD	-	-	Data not linked to cost-effectiveness

Table 3. Economic outcome data *(Continued)*

						36,537 in dressing group)			
-	Gillespie 2015 [1]	Total hip/knee arthroplasty	NPWT Standard dressing	30 days 6 weeks	Group A: AUS 38.4 ± AUS 13.6 Group B: AUS 3.01 ± AUS 1.2	-	-	-	Data not linked to cost-effectiveness
-	Javed 2018 [1]	Open pancreaticoduodenectomy	NPWT Standard dressing	30 days	-	Median cost of hospitalisation $43,823 (IQR, $36,820–$59,352) No between-group data	-	-	Data not linked to cost-effectiveness
-	Kwon 2018 [1]	Vascular groin incisions (high risk)	NPWT Standard dressing	30 days	-	Costs (hospital) Group A: $29,292 +/- 6 $29,320 (n = 51; range, $8816-$192,658) Group B: $30,678 6 $23,338 (n = 55; range, $9071-$131,464) Costs (post index procedure) Group A: $30,492 +/- $30,678 ($8816-$192,658) Group B:	-	-	Data not linked to cost-effectiveness

Table 3. Economic outcome data *(Continued)*

						$36,537 +/- $28,889 (range, $9071-$131,4640*			
-	Manoharan 2016	Primary arthroplasty	NPWT Standard dressing	10-12 days	Group A: AUS 285.94 ± AUS 28.54 Group B: AUS 43.51 ± AUS 64.23	-			Data not linked to cost-effectiveness
-	Ruhstaller 2017	Caesarean section	NPWT Standard dressing	4 weeks	NPWT cost: USD $544 Standard dressing: NR	-	-	At a per-device cost of $544, prevention of a single infection would cost approximately $15,000. This is based on a number needed to treat for an additional beneficial outcome of 28. Thus, the prevention of one SSI after a caesarean delivery would increase post-surgical healthcare costs, an additional $10,300 beyond the average cost attributed to the infection itself.	Data not linked to cost-effectiveness

[1] RCTs reporting cost data which were not subsequently used in an economic analysis
AUD: Australian dollars
CI: confidence intervals
EUR: Euro
GBP: pounds sterling (UK pounds)
ICER: incremental cost-effectiveness ratio
IQR: Interquartile range
NHS: National Health Service (UK)
NPWT: negative pressure wound therapy
NR: not reported
PSS: personal social services
QALY: quality adjusted life year
RCT: randomised controlled trial
SSI: surgical site infection
UK: United Kingdom
USD: United States dollar

*The trial by Kwon was conducted in the US so we have assumed that costs given in dollars are in USD although this was not stated in the paper.

Table 4. Quality assessment of economic studies using the Consolidated Health Economic Evaluation Reporting Standards (CHEERS) checklist

Sections	Items	Item number	Heard 2017	Hyldig 2019a	Nherera 2017	Nherera 2018	Svensson-Bjork 2020	WHIST 2019a
Title and abstract	Title	1	✓	✓	✓	✓	✓	X
	Abstract	2	✓	✓	✓	✓	✓	≠*
Introduction	Background and objectives	3	✓	✓	✓	✓	✓	✓
Methods	Target population and subgroups	4	✓	✓	✓	✓	✓	✓
	Setting and locations	5	✓	✓	✓	✓	✓	✓
	Study perspectives	6	✓	✓	✓	✓	≠	✓
	Comparators	7	✓	✓	✓	✓	✓	✓
	Time horizon	8	X	✓	✓	✓	✓	✓
	Discount rate	9	✓	✓	✓	✓	N/A	✓
	Choice of health outcomes	10	✓	✓	≠	✓	✓	✓
	Measurement of effectiveness	11a	≠	≠	N/A	≠	✓	≠
		11b	N/A	N/A	✓	≠	N/A	N/A
	Measurement and valuation of preference-based outcomes	12	≠	✓	≠	X	N/A	✓
	Estimating resources and costs	13a	✓	✓	N/A	N/A	✓	✓
		13b	N/A	N/A	✓	✓	N/A	N/A
	Currency, price date and conversion	14	✓	✓	≠	✓	✓	✓
	Choice of model	15	≠	≠	≠	✓	≠	≠

Table 4. Quality assessment of economic studies using the Consolidated Health Economic Evaluation Reporting Standards (CHEERS) checklist *(Continued)*

	Assumptions	16	✓	✓	✓	✓	✓	✓
	Analytical methods	17	✓	✓	✓	✓	✓	✓
Results	Study parameters	18	✓	✓	✓	✓	✓	✓
	Incremental costs and outcomes	19	✓	✓	✓	≠	✓	✓
	Characterising uncertainty	20a	≠	≠	N/A	N/A	✓	✓
		20b	N/A	N/A	≠	≠	N/A	N/A
	Characterising heterogeneity	21	X	✓	✓	N/A	N/A	N/A
Discussion	Study findings, limitations, generalisability and current knowledge	22	✓	✓	✓	✓	✓	✓
Others	Source of funding	23	✓	✓	X	X	✓	✓
	Conflicts of interest	24	✓	✓	✓	✓	✓	✓
Total			20/24 (83.3%)	22.5/24 (91.7%)	20.5/24 (85.4%)	20/23* (87.0%)	19/24 (79.2%)	20.5/23* (89.1%)

✓ Item met in full
≠ Item partially met
X Item not met
N/A = Not applicable
*Scored out of 23 because item 21 is not applicable to these studies

APPENDICES

Appendix 1. Relevant systematic reviews

Reviews of NPWT in surgery

We identified the following systematic review publications which related to NPWT following surgery in general:

1. De Vries FE, Wallert ED, Solomkin JS, Allegranzi B, Egger M, Dellinger E, et al. A systematic review and meta-analysis including GRADE qualification of the risk of surgical site infections after prophylactic negative pressure wound therapy compared with conventional dressings in clean and contaminated surgery. Medicine 2016;95(36):1-9.
2. Fernandez LG, Matthews MR, Sibaja Alvarez P, Norwood S, Villarreal DH. Closed incision negative pressure therapy: review of the literature. Cureus 2019;11(7):e5183.
3. Li HZ, Xu XH, Wang DW, Lin YM, Lin N, Lu HD. Negative pressure wound therapy for surgical site infections: a systematic review and meta-analysis of randomised controlled trials. Clinical Microbiology and Infection 2019;25(11):1328-38.
4. Shiroky J, Lillie E, Muaddi H, Sevigny M, Choi WJ, Karanicolas PJ. The impact of negative pressure wound therapy for closed surgical incisions on surgical site infection: a systematic review and meta-analysis. Surgery (United States) 2020;167(6):1001-9.
5. Zwanenburg PR, Tol BT, Obdeijn MC, Lapid O, Gans SL, Boermeester MA. Meta-analysis, meta-regression, and GRADE assessment of randomised and nonrandomized studies of incisional negative pressure wound therapy versus control dressings for the prevention of postoperative wound complications. Annals of Surgery 2020;272(1):81-91.

Reviews of NPWT in specific indications

We identified systematic review publications on NPWT in the following surgical indications:

Abdominal or surgery

1. Boland PA, Kelly ME, Donlon NE, Bolger JC, Mehigan BJ, McCormick PH, et al. Prophylactic negative pressure wound therapy for closed laparotomy wounds: a systematic review and meta-analysis of randomised controlled trials. Irish Journal of Medical Science 2020;25:25.
2. Kuper TM, Murphy PB, Kaur B, Ott MC. Prophylactic negative pressure wound therapy for closed laparotomy incisions: a meta-analysis of randomised controlled trials. Annals of Surgery 2020;271(1):67-74.
3. Meyer J, Roos E, Buchs N, Ris F, Toso C. Prophylactic negative-pressure wound therapy for prevention of surgical site infection in open abdominal surgery: a systematic review and meta-analysis. Techniques in Coloproctology 2020;24:658.
4. Meyer J, Roos E, Abbassi Z, Toso C, Ris F, Buchs NC. The role of perineal application of prophylactic negative-pressure wound therapy for prevention of wound-related complications after abdomino-perineal resection: a systematic review. International Journal of Colorectal Disease 2021;36(1):19-26.
5. Meyer J, Roos E, Abbassi Z, Buchs NC, Ris F, Toso C. Prophylactic negative-pressure wound therapy prevents surgical site infection in abdominal surgery: an updated systematic review and meta-analysis of randomised controlled trials and observational studies. Clinical Infectious Diseases 2020 August 20 [Epub ahead of print]. [DOI: 10.1093/cid/ciaa1203]
6. Wells CI, Ratnayake CB, Perrin J, Pandanaboyana S. Prophylactic negative pressure wound therapy in closed abdominal incisions: a meta-analysis of randomised controlled trials. World Journal of Surgery 2019;43(11):2779-88.
7. Sahebally SM, McKevitt K, Stephens I, Fitzpatrick F, Deasy J, Burke J, et al. Negative pressure wound therapy for closed laparotomy incisions in general and colorectal surgery: a systematic review and meta-analysis. JAMA Surgery 2018;153(11):e183467.

Breast surgery

1. Cagney D, Simmons L, O'Leary DP, Corrigan M, Kelly L, O'Sullivan MJ, et al. The efficacy of prophylactic negative pressure wound therapy for closed incisions in breast surgery: a systematic review and meta-analysis. World Journal of Surgery 2020;44(5):1526-37.
2. Cagney D, Simmons L, O'Leary P, Liew A, Redmond HP. The efficacy of prophylactic negative pressure wound therapy versus standard dressing for closed incisions in breast surgery: a systematic review & meta-analysis. British Journal of Surgery 2019;106(Suppl 5):20.

Obstetric surgery

1. Huang HP, Zhao WJ, Pu J, He F. Prophylactic negative pressure wound therapy for surgical site infection in obese women undergoing cesarean section: an evidence synthesis with trial sequential analysis. Journal of Maternal-Fetal & Neonatal Medicine 2019;1-8.
2. Yu L, Kronen RJ, Simon LE, Stoll CR, Colditz GA, Tuuli MG. Prophylactic negative-pressure wound therapy after cesarean is associated with reduced risk of surgical site infection: a systematic review and meta-analysis. American Journal of Obstetrics and Gynecology 2018;218(2):200-10.

Orthopaedic surgery

1. Ailaney N, Johns WL, Golladay GJ, Strong B, Kalore NV. Closed incision negative pressure wound therapy for elective hip and knee arthroplasty: a systematic review and meta-analysis of randomised controlled trials. Journal of Arthroplasty. 2020; 36(7):2402-11.

2. Kim J-H, Lee D-H. Negative pressure wound therapy vs conventional management in open tibia fractures: systematic review and meta-analysis. Injury 2019;50(10):1764-72.
3. Kim J-H, Kim H-J, Lee D-H. Comparison of the efficacy between closed incisional negative-pressure wound therapy and conventional wound management after total hip and knee arthroplasties: a systematic review and meta-analysis. Journal of Arthroplasty 2019;34(11):2804-14.
4. Li Y, Wu B, Liu Y. The effect of negative pressure therapy on closed wound after the orthopedic surgery of lower limb: a meta-analysis. Surgical Innovation 2020;27(2):165-172.
5. Matar HE, Emms N, Raut V. Effectiveness of negative-pressure wound therapy following total hip and knee replacements. Journal of Long-Term Effects of Medical Implants 2019;29(1):51-7.
6. Wang C, Zhang Y, Qu H. Negative pressure wound therapy for closed incisions in orthopedic trauma surgery: a meta-analysis. Journal of Orthopaedic Surgery 2019;14(1):427.
7. Wang L, Xu X, Cao JG, Liu J. Negative pressure wound therapy in total hip and knee arthroplasty: a meta-analysis. Journal of Comparative Effectiveness Research 2019;8(10):791-7.
8. Yaghmour KM, Hossain FS, Konan S. Clinical and health-care cost analysis of negative pressure dressing in primary and revision total knee arthroplasty: a systematic review and meta-analysis. Journal of Bone & Joint Surgery (American volume); 2020;24:24.

Perineal surgery

Cahill C, Fowler A, Williams LJ. The application of incisional negative pressure wound therapy for perineal wounds: a systematic review. International Wound Journal 2018;15(5):740-8.

Vascular surgery

1. Antoniou GA, Onwuka CC, Antoniou SA, Russell D. Meta-analysis and trial sequential analysis of prophylactic negative pressure therapy for groin wounds in vascular surgery. Journal of Vascular Surgery 2019;70(5):1700-10.e6.
2. Gombert A, Dillavou E, D'Agostino R Jr , Griffin L, Robertson JM, Eells M. A systematic review and meta-analysis of randomised controlled trials for the reduction of surgical site infection in closed incision management versus standard of care dressings over closed vascular groin incisions. Vascular 2020;28(3):274-84.
3. Gombert A, Dillavou E, D'Agostino R. Evaluating a single use closed incision negative pressure therapy system over closed groin incisions following vascular surgery: meta-analysis of comparative trials. European Journal of Vascular and Endovascular Surgery 2019;58 (6 Suppl 3):e572-3.
4. Sexton F, Healy D, Keelan S, Alazzawi M, Naughton P. A systematic review and meta-analysis comparing the effectiveness of negative-pressure wound therapy to standard therapy in the prevention of complications after vascular surgery. International Journal of Surgery 2020;76:94-100.
5. Svensson-Bjork R, Zarrouk M, Asciutto G, Hasselmann J, Acosta S. Negative pressure wound therapy versus standard dressings on closed incisions for the prevention of surgical site infections after vascular surgery - a systematic review and meta-analysis of randomised controlled trials. European Journal of Vascular and Endovascular Surgery 2019;58 (6 Suppl 2):e354-5.
6. Wee IJ, Syn N, Choong AM. Closed incision negative pressure wound therapy in vascular surgery: a systematic review and meta-analysis. European Journal of Vascular & Endovascular Surgery 2019;58(3):446-454.

Appendix 2. Glossary of terms

Term	Description
Dehiscence	Wound dehiscence is a complication of surgery in which a wound breaks open along the line of the surgical incision.
Negative pressure wound therapy (NPWT)	Negative pressure wound therapy is based on a closed, sealed system that produces negative pressure to the wound surface. The wound is covered or packed with an open-cell foam or gauze dressing and sealed with an occlusive drape. Intermittent or continuous suction is maintained by connecting suction tubes from the wound dressing to a vacuum pump and liquid waste collector. Standard negative pressure rates range between −50 mmHg and −125 mmHg (Ubbink 2008; Vikatmaa 2008).
Risk ratio (RR)	The risk ratio, or relative risk (RR) is the probability that a member of a group who is exposed to an intervention will develop an event relative to the probability that a member of an unexposed group will develop that same event.

Appendix 3. Search strategies

Cochrane Wounds Specialised Register

1 MESH DESCRIPTOR Negative-Pressure Wound Therapy EXPLODE ALL AND INREGISTER

2 MESH DESCRIPTOR Suction EXPLODE ALL AND INREGISTER

3 MESH DESCRIPTOR Vacuum EXPLODE ALL AND INREGISTER

4 "negative pressure" or negative-pressure or TNP or NWPT or NPWT AND INREGISTER

5 (sub-atmospheric or subatmospheric) AND INREGISTER

6 ((seal* next surface*) or (seal* next aspirat*)) AND INREGISTER

7 (wound near3 suction*) AND INREGISTER

8 (wound near3 drainage) AND INREGISTER

9 ((foam next suction) or (suction next dressing*)) AND INREGISTER

10 ((vacuum next therapy) or (vacuum next dressing*) or (vacuum next seal*) or (vacuum next assist*) or (vacuum near closure) or (vacuum next compression) or (vacuum next pack*) or (vacuum next drainage) or VAC) AND INREGISTER

11 ("vacuum-assisted") AND INREGISTER

12 #1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 AND INREGISTER

13 MESH DESCRIPTOR Surgical Wound Infection EXPLODE ALL AND INREGISTER

14 MESH DESCRIPTOR Surgical Wound Dehiscence EXPLODE ALL AND INREGISTER

15 surg* near5 infect* AND INREGISTER

16 surg* near5 wound* AND INREGISTER

17 surg* near5 site* AND INREGISTER

18 surg* near5 incision* AND INREGISTER

19 surg* near5 dehisc* AND INREGISTER

20 wound* near5 dehisc* AND INREGISTER

21 #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 AND INREGISTER

22 #12 AND #21 AND INREGISTER

The Cochrane Central Register of Controlled Clinical Trials (CENTRAL) and NHS Economic Evaluation Database (NHS EED)

#1 MeSH descriptor: [Negative-Pressure Wound Therapy] explode all trees

#2 MeSH descriptor: [Suction] explode all trees

#3 MeSH descriptor: [Vacuum] explode all trees

#4 ("negative pressure" or negative-pressure or TNP or NWPT or NPWT):ti,ab,kw

#5 (sub-atmospheric or subatmospheric):ti,ab,kw

#6 ((seal* next surface*) or (seal* next aspirat*)):ti,ab,kw

#7 (wound near/3 suction*):ti,ab,kw

#8 (wound near/3 drainage):ti,ab,kw

#9 ((foam next suction) or (suction next dressing*)):ti,ab,kw

#10 ((vacuum next therapy) or (vacuum next dressing*) or (vacuum next seal*) or (vacuum next assist*) or (vacuum near closure) or (vacuum next compression) or (vacuum next pack*) or (vacuum next drainage) or VAC):ti,ab,kw

#11 ("vacuum-assisted"):ti,ab,kw

#12 (#1 or #2 or #3 or #4 or #5 or #6 or #7 or #8 or #9 or #10 or #11)

#13 MeSH descriptor: [Surgical Wound Infection] explode all trees

#14 MeSH descriptor: [Surgical Wound Dehiscence] explode all trees

#15 surg* near/5 infect*:ti,ab,kw

#16 surg* near/5 wound*:ti,ab,kw

#17 surg* near/5 site*:ti,ab,kw

#18 surg* near/5 incision*:ti,ab,kw

#19 surg* near/5 dehisc*:ti,ab,kw

#20 wound* near/5 dehisc*:ti,ab,kw

#21 #13 or #14 or #15 or #16 or #17 or #18 or #19 or #20

#22 #12 and #21

The Cochrane Central Register of Controlled Clinical Trials (CENTRAL) Trial Registry specific search via the Cochrane Register of Studies (CRS)

1 MESH DESCRIPTOR Negative-Pressure Wound Therapy EXPLODE ALL AND CENTRAL:TARGET

2 MESH DESCRIPTOR Suction EXPLODE ALL AND CENTRAL:TARGET

3 MESH DESCRIPTOR Vacuum EXPLODE ALL AND CENTRAL:TARGET

4 "negative pressure" or negative-pressure or TNP or NWPT or NPWT AND CENTRAL:TARGET

5 (sub-atmospheric or subatmospheric) AND CENTRAL:TARGET

6 ((seal* next surface*) or (seal* next aspirat*)) AND CENTRAL:TARGET

7 (wound near3 suction*) AND CENTRAL:TARGET

8 (wound near3 drainage) AND CENTRAL:TARGET

9 ((foam next suction) or (suction next dressing*)) AND CENTRAL:TARGET

10 ((vacuum next therapy) or (vacuum next dressing*) or (vacuum next seal*) or (vacuum next assist*) or (vacuum near closure) or (vacuum next compression) or (vacuum next pack*) or (vacuum next drainage) or VAC) AND CENTRAL:TARGET

11 ("vacuum-assisted") AND CENTRAL:TARGET

12 #1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11

13 MESH DESCRIPTOR Surgical Wound Infection EXPLODE ALL AND CENTRAL:TARGET

14 MESH DESCRIPTOR Surgical Wound Dehiscence EXPLODE ALL AND CENTRAL:TARGET

15 surg* near5 infect* AND CENTRAL:TARGET

16 surg* near5 wound* AND CENTRAL:TARGET

17 surg* near5 site* AND CENTRAL:TARGET

18 surg* near5 incision* AND CENTRAL:TARGET

19 surg* near5 dehisc* AND CENTRAL:TARGET

20 wound* near5 dehisc* AND CENTRAL:TARGET

21 #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20

22 #12 AND #21

23 (NCT0* or ACTRN* or ChiCTR* or DRKS* or EUCTR* or eudract* or IRCT* or ISRCTN* or JapicCTI* or JPRN* or NTR0* or NTR1* or NTR2* or NTR3* or NTR4* or NTR5* or NTR6* or NTR7* or NTR8* or NTR9* or SRCTN* or UMIN0*):AU AND CENTRAL:TARGET

24 http*:SO AND CENTRAL:TARGET

25 #23 OR #24

26 #22 AND #25

Ovid MEDLINE - RCT

1 exp Negative-Pressure Wound Therapy/

2 exp Suction/

3 exp Vacuum/

4 (negative pressure or negative-pressure or TNP or NPWT or NWPT).tw.

5 (sub-atmospheric or subatmospheric).tw.

6 ((seal* adj surface*) or (seal* adj aspirat*)).tw.

7 (wound adj2 suction*).tw.

8 (wound adj5 drainage).tw.

9 ((foam adj suction) or (suction adj dressing*)).tw.

10 vacuum-assisted.tw.

11 ((vacuum adj therapy) or (vacuum adj dressing*) or (vacuum adj seal*) or (vacuum adj closure) or (vacuum adj assist*) or (vacuum adj compression) or (vacuum adj pack*) or (vacuum adj drainage) or (suction* adj drainage) or VAC).tw.

12 or/1-11

13 exp Surgical Wound Infection/

14 exp Surgical Wound Dehiscence/

15 (surg* adj5 infect*).tw.

16 (surg* adj5 wound*).tw.

17 (surg* adj5 site*).tw.

18 (surg* adj5 incision*).tw.

19 (surg* adj5 dehisc*).tw.

20 (wound* adj5 dehisc*).tw.

21 or/13-20

22 12 and 21

23 randomized controlled trial.pt.

24 controlled clinical trial.pt.

25 randomi?ed.ab.

26 placebo.ab.

27 clinical trials as topic.sh.

28 randomly.ab.

29 trial.ti.

30 or/23-29

31 exp animals/ not humans.sh.

32 30 not 31

33 22 and 32

Ovid MEDLINE – Economic

1 exp Negative-Pressure Wound Therapy/

2 exp Suction/

3 exp Vacuum/

4 (negative pressure or negative-pressure or TNP or NPWT or NWPT).tw.

5 (sub-atmospheric or subatmospheric).tw.

6 ((seal* adj surface*) or (seal* adj aspirat*)).tw.

7 (wound adj2 suction*).tw.

8 (wound adj5 drainage).tw.

9 ((foam adj suction) or (suction adj dressing*)).tw.

10 vacuum-assisted.tw.

11 ((vacuum adj therapy) or (vacuum adj dressing*) or (vacuum adj assist*) or (vacuum adj seal*) or (vacuum adj closure) or (vacuum adj compression) or (vacuum adj pack*) or (vacuum adj drainage) or (suction* adj drainage) or VAC).tw.

12 or/1-11

13 exp Surgical Wound Infection/

14 exp Surgical Wound Dehiscence/

15 (surg* adj5 infect*).tw.

16 (surg* adj5 wound*).tw.

17 (surg* adj5 site*).tw.

18 (surg* adj5 incision*).tw.

19 (surg* adj5 dehisc*).tw.

20 (wound* adj5 dehisc*).tw.

21 or/13-20

22 12 and 21

23 economics/

24 exp "costs and cost analysis"/

25 economics, dental/

26 exp "economics, hospital"/

27 economics, medical/

28 economics, nursing/

29 economics, pharmaceutical/

30 (economic* or cost or costs or costly or costing or price or prices or pricing or pharmacoeconomic*).ti,ab.

31 (expenditure* not energy).ti,ab.

32 value for money.ti,ab.

33 budget*.ti,ab.

34 or/23-33

35 ((energy or oxygen) adj cost).ti,ab.

36 (metabolic adj cost).ti,ab.

37 ((energy or oxygen) adj expenditure).ti,ab.

38 or/35-37

39 34 not 38

40 letter.pt.

41 editorial.pt.

42 historical article.pt.

43 or/40-42

44 39 not 43

45 Animals/

46 Humans/

47 45 not (45 and 46)

48 44 not 47

49 22 and 48

Ovid Embase – RCT

1 exp suction drainage/

2 exp vacuum assisted closure/

3 (negative pressure or negative-pressure or TNP or NPWT or NWPT).tw.

4 (sub-atmospheric or subatmospheric).tw.

5 ((seal* adj surface*) or (seal* adj aspirat*)).tw.

6 (wound adj2 suction*).tw.

7 (wound adj5 drainage).tw.

8 ((foam adj suction) or (suction adj dressing*)).tw.

9 vacuum-assisted.tw.

10 ((vacuum adj therapy) or (vacuum adj dressing*) or (vacuum adj seal*) or (vacuum adj assist*) or (vacuum adj closure) or (vacuum adj compression) or (vacuum adj pack*) or (vacuum adj drainage) or (suction* adj drainage) or VAC).tw.

11 or/1-10

12 exp Surgical Wound Infection/

13 exp Surgical Wound Dehiscence/

14 (surg* adj5 infection*).tw.

15 (surg* adj5 wound*).tw.

16 (surg* adj5 site*).tw.

17 (surg* adj5 incision*).tw.

18 (surg* adj5 dehisc*).tw.

19 (wound* adj5 dehisc*).tw.

20 or/12-19

21 11 and 20

22 Randomized controlled trial/

23 Controlled clinical study/

24 Random$.ti,ab.

25 randomization/

26 intermethod comparison/

27 placebo.ti,ab.

28 (compare or compared or comparison).ti.

29 ((evaluated or evaluate or evaluating or assessed or assess) and (compare or compared or comparing or comparison)).ab.

30 (open adj label).ti,ab.

31 ((double or single or doubly or singly) adj (blind or blinded or blindly)).ti,ab.

32 double blind procedure/

33 parallel group$1.ti,ab.

34 (crossover or cross over).ti,ab.

35 ((assign$ or match or matched or allocation) adj5 (alternate or group$1 orintervention$1 or patient$1 or subject$1 or participant $1)).ti,ab.

36 (assigned or allocated).ti,ab.

37 (controlled adj7 (study or design or trial)).ti,ab.

38 (volunteer or volunteers).ti,ab.

39 trial.ti.

40 or/22-39

41 (exp animal/ or animal.hw. or nonhuman/) not (exp human/ or human cell/ or (human or humans).ti.)

42 40 not 41

43 21 and 42

Ovid Embase - Economic

1 exp suction drainage/

2 exp vacuum assisted closure/

3 (negative pressure or negative-pressure or TNP or NPWT or NWPT).tw.

4 (sub-atmospheric or subatmospheric).tw.

5 ((seal* adj surface*) or (seal* adj aspirat*)).tw.

6 (wound adj2 suction*).tw.

7 (wound adj5 drainage).tw.

8 ((foam adj suction) or (suction adj dressing*)).tw.

9 vacuum-assisted.tw.

10 ((vacuum adj therapy) or (vacuum adj dressing*) or (vacuum adj seal*) or (vacuum adj assist*) or (vacuum adj closure) or (vacuum adj compression) or (vacuum adj pack*) or (vacuum adj drainage) or (suction* adj drainage) or VAC).tw.

11 or/1-10

12 exp Surgical Wound Infection/

13 exp Surgical Wound Dehiscence/

14 (surg* adj5 infection*).tw.

15 (surg* adj5 wound*).tw.

16 (surg* adj5 site*).tw.

17 (surg* adj5 incision*).tw.

18 (surg* adj5 dehisc*).tw.

19 (wound* adj5 dehisc*).tw.

20 or/12-19

21 11 and 20

22 health-economics/

23 exp economic-evaluation/

24 exp health-care-cost/

25 exp pharmacoeconomics/

26 or/22-25

27 (econom* or cost or costs or costly or costing or price or prices or pricing or pharmacoeconomic*).ti,ab.

28 (expenditure* not energy).ti,ab.

29 (value adj2 money).ti,ab.

30 budget*.ti,ab.

31 or/27-30

32 26 or 31

33 letter.pt.

34 editorial.pt.

35 note.pt.

36 or/33-35

37 32 not 36

38 (metabolic adj cost).ti,ab.

39 ((energy or oxygen) adj cost).ti,ab.

40 ((energy or oxygen) adj expenditure).ti,ab.

41 or/38-40

42 37 not 41

43 exp animal/

44 exp animal-experiment/

45 nonhuman/

46 (rat or rats or mouse or mice or hamster or hamsters or animal or animals or dog or dogs or cat or cats or bovine or sheep).ti,ab,sh.

47 or/43-46

48 exp human/

49 exp human-experiment/

50 or/48-49

51 47 not (47 and 50)

52 42 not 51

53 21 and 52

EBSCO CINAHL Plus - RCT

S46 S22 AND S45

S45 S44 NOT S43

S44 S23 OR S24 OR S25 OR S26 OR S27 OR S28 OR S29 OR S30 OR S31 OR S32 OR S33 OR S34 OR S35 OR S36 OR S37

S43 S41 NOT S42

S42 MH (human)

S41 S38 OR S39 OR S40

S40 TI (animal model*)

S39 MH (animal studies)

S38 MH animals+

S37 AB (cluster W3 RCT)

S36 MH (crossover design) OR MH (comparative studies)

S35 AB (control W5 group)

S34 PT (randomized controlled trial)

S33 MH (placebos)

S32 MH (sample size) AND AB (assigned OR allocated OR control)

S31 TI (trial)

S30 AB (random*)

S29 TI (randomised OR randomized)

S28 MH cluster sample

S27 MH pretest-posttest design

S26 MH random assignment

S25 MH single-blind studies

S24 MH double-blind studies

S23 MH randomized controlled trials

S22 S12 AND S21

S21 S13 OR S14 OR S15 OR S16 OR S17 OR S18 OR S19 OR S20

S20 TI (wound* N5 dehisc*) OR AB (wound* N5 dehisc*)

S19 TI (surg* N5 dehisc*) OR AB (surg* N5 dehisc*)

S18 TI (surg* N5 incision*) OR AB (surg* N5 incision*)

S17 TI (surg* N5 site*) OR AB (surg* N5 site*)

S16 TI (surg* N5 wound*) OR AB (surg* N5 wound*)

S15 TI (surg* N5 infection*) OR AB (surg* N5 infection*)

S14 (MH "Surgical Wound Dehiscence")

S13 (MH "Surgical Wound Infection")

S12 S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8 OR S9 OR S10 OR S11

S11 TI (foam suction or suction dressing* or suction drainage) OR AB (foam suction or suction dressing* or suction drainage)

S10 TI vacuum-assisted OR AB vacuum-assisted

S9 TI (vacuum therapy or vacuum dressing* or vacuum seal* or vacuum closure or vacuum compression or vacuum pack or vacuum drainage or vacuum assisted or VAC) OR AB (vacuum therapy or vacuum dressing* or vacuum seal* or vacuum closure or vacuum compression or vacuum pack or vacuum drainage or vacuum assisted or VAC)

S8 TI (wound N5 drainage) OR AB (wound N5 drainage)

S7 TI (wound N5 suction*) OR AB (wound N5 suction*)

S6 TI ((seal* N1 surface* or seal* N1 aspirat*)) OR AB ((seal* N1 surface* or seal* N1 aspirat*))

S5 TI (sub-atmospheric or subatmospheric) OR AB (sub-atmospheric or subatmospheric)

S4 TI (negative pressure or negative-pressure or TNP or NPWT or NWPT) OR AB (negative pressure or negative-pressure or TNP or NPWT or NWPT)

S3 (MH "Negative Pressure Wound Therapy")

S2 (MH "Vacuum")

S1 (MH "Suction+")

EBSCO CINAHL Plus – Economic

S44 S22 AND S43

S43 S40 NOT (S41 OR S42)

S42 (ZT "doctoral dissertation") or (ZT "masters thesis")

S41 MH "Animal Studies"

S40 S35 NOT S39

S39 S36 OR S37 OR S38

S38 PT commentary

S37 PT letter

S36 PT editorial

S35 S33 OR S34

S34 TI (cost or costs or economic* or pharmacoeconomic* or price* or pricing*) OR AB (cost or costs or economic* or pharmacoeconomic* or price* or pricing*)

S33 S29 OR S32

S32 S30 OR S31

S31 MH "Health Resource Utilization"

S30 MH "Health Resource Allocation"

S29 S23 NOT S28

S28 S24 OR S25 OR S26 OR S27

S27 MH "Business+"

S26 MH "Financing, Organized+"

S25 MH "Financial Support+"

S24 MH "Financial Management+"

S23 MH "Economics+"

S22 S12 AND S21

S21 S13 OR S14 OR S15 OR S16 OR S17 OR S18 OR S19 OR S20

S20 TI (wound* N5 dehisc*) OR AB (wound* N5 dehisc*)

S19 TI (surg* N5 dehisc*) OR AB (surg* N5 dehisc*)

S18 TI (surg* N5 incision*) OR AB (surg* N5 incision*)

S17 TI (surg* N5 site*) OR AB (surg* N5 site*)

S16 TI (surg* N5 wound*) OR AB (surg* N5 wound*)

S15 TI (surg* N5 infection*) OR AB (surg* N5 infection*)

S14 (MH "Surgical Wound Dehiscence")

S13 (MH "Surgical Wound Infection")

S12 S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8 OR S9 OR S10 OR S11

S11 TI (foam suction or suction dressing* or suction drainage) OR AB (foam suction or suction dressing* or suction drainage)

S10 TI vacuum-assisted OR AB vacuum-assisted

S9 TI (vacuum therapy or vacuum dressing* or vacuum seal* or vacuum closure or vacuum compression or vacuum pack or vacuum drainage or vacuum assisted or VAC) OR AB (vacuum therapy or vacuum dressing* or vacuum seal* or vacuum closure or vacuum compression or vacuum pack or vacuum drainage or vacuum assisted or VAC)

S8 TI (wound N5 drainage) OR AB (wound N5 drainage)

S7 TI (wound N5 suction*) OR AB (wound N5 suction*)

S6 TI ((seal* N1 surface* or seal* N1 aspirat*)) OR AB ((seal* N1 surface* or seal* N1 aspirat*))

S5 TI (sub-atmospheric or subatmospheric) OR AB (sub-atmospheric or subatmospheric)

S4 TI (negative pressure or negative-pressure or TNP or NPWT or NWPT) OR AB (negative pressure or negative-pressure or TNP or NPWT or NWPT)

S3 (MH "Negative Pressure Wound Therapy")

S2 (MH "Vacuum")

S1 (MH "Suction+")

US National Institutes of Health Ongoing Trials Register (ClinicalTrials.gov)

(surgery OR surgical OR postoperative OR operative OR incision OR incisional OR incisions) AND (negative pressure OR vacuum assisted OR NPWT OR TNP) | incision dehiscence

(surgery OR surgical OR postoperative OR operative OR incision OR incisional OR incisions) AND (negative pressure OR vacuum assisted OR NPWT OR TNP) | incision infection

(surgery OR surgical OR postoperative OR operative OR incision OR incisional OR incisions) AND (negative pressure OR vacuum assisted OR NPWT OR TNP) | operative wound

(surgery OR surgical OR postoperative OR operative OR incision OR incisional OR incisions) AND (negative pressure OR vacuum assisted OR NPWT OR TNP) | postoperative complications

(surgery OR surgical OR postoperative OR operative OR incision OR incisional OR incisions) AND (negative pressure OR vacuum assisted OR NPWT OR TNP) | postoperative infection

(surgery OR surgical OR postoperative OR operative OR incision OR incisional OR incisions) AND (negative pressure OR vacuum assisted OR NPWT OR TNP) | surgery

(surgery OR surgical OR postoperative OR operative OR incision OR incisional OR incisions) AND (negative pressure OR vacuum assisted OR NPWT OR TNP) | surgical incision

(surgery OR surgical OR postoperative OR operative OR incision OR incisional OR incisions) AND (negative pressure OR vacuum assisted OR NPWT OR TNP) | surgical site infection

(surgery OR surgical OR postoperative OR operative OR incision OR incisional OR incisions) AND (negative pressure OR vacuum assisted OR NPWT OR TNP) | surgical wound

(surgery OR surgical OR postoperative OR operative OR incision OR incisional OR incisions) AND (negative pressure OR vacuum assisted OR NPWT OR TNP) | surgical wound dehiscence

(surgery OR surgical OR postoperative OR operative OR incision OR incisional OR incisions) AND (negative pressure OR vacuum assisted OR NPWT OR TNP) | seroma

World Health Organization International Clinical Trials Registry Platform

"negative pressure" or "vacuum assisted" or NPWT or TNP
AND
surgery or surgical or postoperative or operative or incision or incisional or incisions

Appendix 4. Risk of bias criteria

1. Was the allocation sequence randomly generated?

Low risk of bias

The investigators describe a random component in the sequence generation process such as: referring to a random number table; using a computer random number generator; coin tossing; shuffling cards or envelopes; throwing dice; drawing of lots.

High risk of bias

The investigators describe a non-random component in the sequence generation process. Usually, the description would involve some systematic, non-random approach, for example: sequence generated by odd or even date of birth; sequence generated by some rule based on date (or day) of admission; sequence generated by some rule based on hospital or clinic record number.

Unclear

Insufficient information about the sequence generation process is provided to permit judgement of low or high risk of bias.

2. Was the treatment allocation adequately concealed?

Low risk of bias

Participants and investigators enrolling participants could not foresee assignment because one of the following, or an equivalent method, was used to conceal allocation: central allocation (including telephone, web-based, and pharmacy-controlled randomisation); sequentially numbered drug containers of identical appearance; sequentially numbered, opaque, sealed envelopes.

High risk of bias

Participants or investigators enrolling participants could possibly foresee assignments and thus introduce selection bias, such as allocation based on: using an open random allocation schedule (e.g. a list of random numbers); assignment envelopes were used without appropriate safeguards (e.g. if envelopes were unsealed or nonopaque or not sequentially numbered); alternation or rotation; date of birth; case record number; any other explicitly unconcealed procedure.

Unclear

Insufficient information to permit judgement of low or high risk of bias. This is usually the case if the method of concealment is not described or not described in sufficient detail to permit a definitive judgement, for example if the use of assignment envelopes is described, but it remains unclear whether envelopes were sequentially numbered, opaque, and sealed.

3. Blinding - was knowledge of the allocated interventions adequately prevented during the study?

Low risk of bias

Any one of the following.

- No blinding, but the review authors judge that the outcome and the outcome measurement are not likely to be influenced by lack of blinding.
- Blinding of participants and key study personnel ensured, and unlikely that the blinding could have been broken.
- Either participants or some key study personnel were not blinded, but outcome assessment was blinded, and the non-blinding of others was unlikely to introduce bias.

High risk of bias

Any one of the following.

- No blinding or incomplete blinding, and the outcome or outcome measurement is likely to be influenced by lack of blinding.
- Blinding of key study participants and personnel attempted, but it is likely that the blinding could have been broken.
- Either participants or some key study personnel were not blinded, and the non-blinding of others was likely to introduce bias.

Unclear

Either of the following.

- Insufficient information is provided to permit judgement of low or high risk of bias.
- The study did not address this outcome.

4. Were incomplete outcome data adequately addressed?

Low risk of bias

Any one of the following.

- No missing outcome data.
- Reasons for missing outcome data are unlikely to be related to true outcome (for survival data, censoring is unlikely to be introducing bias).
- Missing outcome data are balanced in numbers across intervention groups, with similar reasons for missing data across groups.
- For dichotomous outcome data, the proportion of missing outcomes compared with observed event risk is not enough to have a clinically relevant impact on the intervention effect estimate.
- For continuous outcome data, plausible effect size (difference in means or standardised difference in means) among missing outcomes is not enough to have a clinically relevant impact on observed effect size.
- Missing data have been imputed using appropriate methods.

High risk of bias

Any one of the following.

- Reason for missing outcome data is likely to be related to true outcome, with either an imbalance in numbers or reasons for missing data across intervention groups.
- For dichotomous outcome data, the proportion of missing outcomes compared with observed event risk is enough to induce clinically relevant bias in intervention effect estimate.
- For continuous outcome data, plausible effect size (difference in means or standardised difference in means) among missing outcomes is enough to induce clinically relevant bias in observed effect size.
- 'As-treated' analysis done with substantial departure of the intervention received from that assigned at randomisation.
- Potentially inappropriate application of simple imputation.

Unclear

Either of the following.

- Insufficient reporting of attrition/exclusions to permit judgement of low or high risk of bias (e.g. number randomised not stated, no reasons for missing data provided).
- The study did not address this outcome.

5. Are reports of the study free of the suggestion of selective outcome reporting?

Low risk of bias

Either of the following.

- The study protocol is available and all of the study's prespecified (primary and secondary) outcomes that are of interest in the review have been reported in the prespecified way.
- The study protocol is not available, but it is clear that the published reports include all expected outcomes, including those that were prespecified (convincing text of this nature may be uncommon).

High risk of bias

Any one of the following.

- Not all of the study's prespecified primary outcomes have been reported.
- One or more primary outcomes are reported using measurements, analysis methods, or subsets of the data (e.g. subscales) that were not prespecified.
- One or more reported primary outcomes were not prespecified (unless clear justification for their reporting is provided, such as an unexpected adverse effect).
- One or more outcomes of interest in the review are reported incompletely so that they cannot be entered in a meta-analysis.
- The study report fails to include results for a key outcome that would be expected to have been reported for such a study.

Unclear

Insufficient information is provided to permit judgement of low or high risk of bias. It is likely that the majority of studies will fall into this category.

6. Other sources of potential bias

Low risk of bias

The study appears to be free of other sources of bias.

High risk of bias

There is at least one important risk of bias. For example, the study:

- had a potential source of bias related to the specific study design used;
- had extreme baseline imbalance;
- has been claimed to have been fraudulent; or
- had some other problem.

Unclear

There may be a risk of bias, but there is either:

- insufficient information to assess whether an important risk of bias exists; or
- insufficient rationale or evidence that an identified problem will introduce bias.

Appendix 5. Results of studies not included in pooled analyses

This appendix contains the results of studies which reported specified outcomes but could not be included in the pooled analyses we conducted; together with brief explanations of the methodological or reporting issues for this.

Primary outcomes

Mortality

Two studies reported mortality and could not be included in the pooled analysis. Schmid 2018 reported one death from 31 people in a split-person trial while Hasselmann 2019b reported one death from 24 people in a split-person trial. In a third study (Gok 2019), one death was reported but we are uncertain which group this was in or whether any other deaths occurred.

SSI

Ten studies (Darwisch 2020; Galiano 2018; Giannini 2018; Gok 2019; Hasselmann 2019b; Howell 2011; Kwon 2018; Pleger 2018; Sabat 2016; Stannard 2012) reported SSI data but could not be included in the pooled analysis.

One study in 528 people undergoing cardiac surgery with median sternotomy (Darwisch 2020) reported that there was no significant difference in the number of SSIs in people with BMI either less than 35 (P = 0.622) or 35 or above (P = 0.2926).

One study in 100 people undergoing revision surgery on hip or knee prostheses (Giannini 2018) reported the ASEPSIS score (Wilson 1986). The authors reported that the mean score was 3.0 (SD 1.89) in the NPWT group compared with 5.1 (SD 3.89) in the standard dressing group; higher scores are indicative of a worse outcome. We could not analyse this data further, as the component elements of the score were not reported.

One study in 60 people undergoing abdominal surgeries (Gok 2019) reported that surgical site infection was detected five times less in the negative-pressure group, compared to the standard dressing group. It was also 3.5-fold less common compared to the aspiration drainage group.

Several studies randomised or analysed wounds rather than individuals. Stannard 2012 reported results for this outcome including 249 participants who had sustained open fractures, requiring surgery for closure. Randomisation was by individual participant, but some participants had multiple wounds. Outcome data were collected and analysed by wound, not participant, so we have not carried out further analysis as clustering was not taken into account in this study. The investigators reported that there were 14/144 (9.7%) SSIs in the NPWT group compared with 23/122 (18.9%) SSIs in the standard dressing group. Pleger 2018 randomised 100 participants with 129 groin wounds, and outcome data were collected and analysed by groin wound. The investigators reported that there were 1/58 (1.7%) SSIs in the NPWT group compared with 10/71 (14.1%) SSIs in the standard dressing group. Sabat 2016 enrolled 49 people undergoing peripheral vascular surgery and randomised 63 wounds. The investigators reported 2/30 (6.7%) SSI in the NPWT compared with 7/33 in the standard dressing group (21.2%). Kwon 2018 used a design which combined a parallel-group approach for most participants undergoing peripheral vascular surgery (75/99), with a split-person design for 24 participants with bilateral surgeries, and then analysed all data at the level of the surgical incision. It was not clear how the combined design and different types of data (paired and unpaired) were accounted for in the analysis and the two were not reported separately, so we have not carried out further analysis. The investigators reported 6/59 (10.2%) SSIs in the NPWT group compared with 12/60 (20.0%) in the standard dressing group. Howell 2011 also included some participants with more than

one wound (51 participants with 60 wounds) in knee arthroplasty; numbers of SSI were reported as 1/24 in the NPWT group compared with 1/36 in the standard dressing group.

Galiano 2018 used a split-person design in women undergoing bilateral breast surgery. The reported results were 4/199 (2%) SSI in the NPWT and 6/199 (3%) in the standard dressing group. Hasselmann 2019b used a split-person design in inguinal vascular surgery; the results were reported as 1/19 incisions in the NPWT group and 5/19 in the standard dressing group; this analysis did take paired data into account.

Superficial SSI

Kwon 2018, Hasselmann 2019b; Howell 2011 and Pleger 2018 were not included in the analysis because of the use of wounds as the unit of analysis and/or randomisation (see above). We note the results reported for these studies as follows: Kwon 2018 3/59 compared with 5/60; Howell 2011 0/24 compared with 0/36 and Pleger 2018 5/58 compared with 28/71 superficial SSIs (incisions were the unit of analysis in each case).

Deep SSI

Kwon 2018, Howell 2011 and Pleger 2018 were not included in the analysis because of the use of wounds as the unit of analysis and/or randomisation (see above). We note the results reported for these studies as follows: Kwon 2018 3/59 versus 7/60; Hasselmann 2019b 1/19 versus 5/19; Howell 2011 1/24 compared with 1/36 and Pleger 2018 0/58 versus 2/71 deep SSIs (incisions were the unit of analysis in each case).

Dehiscence

Seven studies (Galiano 2018; Hasselmann 2019b; NCT02309944; NCT02461433; Pleger 2018; Stannard 2012; Tanaydin 2018) reported dehiscence data but could not be included in the pooled analysis.

Two studies (NCT02309944; NCT02461433) reported dehiscence as part of a composite outcome and data could not be disaggregated (see Table 1).

Two studies reported dehiscence, but randomised wounds as opposed to individuals. Stannard 2012 assessed dehiscence in participants with an open fracture requiring surgical closure. Participants were randomised individually, but more than one wound per participant were included in the results. We did not have individual patient data, and the trial investigators did not account for clustering in their analysis, so further analysis was not undertaken (NPWT 12/139 (8.6%) versus standard dressing 20/122 (16.4%)). Pleger 2018 randomised 100 participants with 129 groin wounds, and outcome data were collected and analysed by groin wound. There were 3/58 (5.2%) superficial dehiscences in the NPWT group compared with 4/71 (5.6%) in the standard dressing group, and 1/58 (1.7%) deep wound dehiscences with fat necrosis in the NPWT group compared with 4/71 (5.6%) in the standard dressing group. Sabat 2016 randomised 63 wounds from 49 participants undergoing peripheral vascular surgery and reported 3/30 instances of dehiscence in the NPWT group compared with 8/33 in the standard dressing group.

Two studies in breast surgery reported dehiscence, but in each case they employed a split-person design in women undergoing bilateral surgery (Galiano 2018; Tanaydin 2018); in neither study was it clear whether the analysis took the paired data into account. Although these studies were not included in the main pooled analysis, we were able to combine them separately. The two studies reported 37/231 dehiscences in the NPWT group compared with 62/231 in the standard dressing group. The pooled RR was 0.60 (95% CI 0.41 to 0.86; I^2 = 0%). Hasselmann 2019b used a split-person design in inguinal vascular surgery; the results were reported as 2/19 in the NPWT group and 2/19 in the standard dressing group; this analysis did take paired data into account.

Secondary outcomes

Reoperation

Four studies (Hasselmann 2019b; Javed 2018; Kwon 2018; Schmid 2018) reported on reoperation but could not be included in the pooled analysis.

One trial reported data which allowed us to use only a generic inverse variance approach to calculate an RR. Javed 2018 enrolled 123 participants undergoing open pancreaticoduodenectomy and had a RR of 0.25 (95% CI 0.03 to 2.08) for reoperation.

One trial (Kwon 2018) used a mixed design involving both paired and unpaired data which we report but have not analysed further. The authors reported that there were 5/59 reoperations in the NPWT group compared with 11/60 with standard dressings. One trial (Schmid 2018) used a split-person design and reported re-intervention due to complications in 13/31 wounds treated with NPWT compared with 14/31 in those with standard treatment. Hasselmann 2019b also used a split-person design and reported 1/19 reoperations in the NPWT group and 1/19 in the standard dressing group.

Readmission

Four studies (Fogacci 2019; Hasselmann 2019b; Javed 2018; Kwon 2018) reported on readmission but could not be included in the pooled analysis.

One trial reported the mean number of times participants were readmitted as outpatients. Fogacci 2019 enrolled 100 women undergoing breast surgery and reported a mean of 3.78 (range 2-8) readmissions as outpatients for women treated with NPWT and a mean of 4.18 (range 2-14) outpatient readmissions in those treated with standard dressings.

One trial reported an RR but not the data used to calculate it. Javed 2018 enrolled 123 participants undergoing open pancreaticoduodenectomy and had a RR of 0.41 (95% CI 0.15 to 1.09) for all readmissions at 30 days. An RR for SSI-related readmission was also reported.

One trial (Kwon 2018) used a mixed design involving both paired and unpaired data which we report but have not analysed further. The authors reported that there were 4/59 (6.8%) readmissions in the NPWT group compared with 10/60 (16.7%) with standard dressings.

One trial (Hasselmann 2019b) used a split-person design and reported 3/19 readmissions in the NPWT group compared with 2/19 in the standard dressing group.

Seroma

Four studies (Bertges 2021; Galiano 2018; Hasselmann 2019b; Pleger 2018) reported on seroma but could not be included in the pooled analysis.

Pleger 2018, randomising 100 participants with 129 groin wounds, reported 0/58 seromas in the NPWT group compared with 1/71 in the standard dressing group. Galiano 2018 used a split-person design in breast surgery and reported zero events in the NPWT arm (0/199) and one (1/199) in the standard dressing arm. Bertges 2021 enrolled participants undergoing vascular groin surgery and reported a composite outcome for seroma or haematoma; in the NPWT group 3/115 participants experienced the composite outcome compared with 1/119 in the standard dressing group. One trial (Hasselmann 2019b) used a split-person design and reported 3/19 in the NPWT group compared to 4/19 in the standard treatment group.

Haematoma

Six studies (Bertges 2021; Bobkiewicz 2018; Galiano 2018; Hasselmann 2019b; Kwon 2018; Pleger 2018) reported on haematoma but could not be included in the pooled analysis.

Pleger 2018, randomising 100 participants with 129 groin wounds, reported that there were 0/58 cases of haematoma in the NPWT group compared with 8/71 in the standard dressing group. Kwon 2018 used a mixed design involving both paired and unpaired data which we report but have not analysed further. The authors reported that there were zero events (0/59) in the NPWT group compared with 1/60 with standard dressings. Galiano 2018 used a split-person design in breast surgery and reported 2/199 events in the NPWT arm and 3/199 in the standard dressing arm. One trial (Bobkiewicz 2018) enrolled 30 participants and reported narratively that "in the standard dressing group the incidence of hematoma was higher" but gave no further information. Bertges 2021 enrolled participants undergoing vascular groin surgery and reported a composite outcome for seroma or haematoma; in the NPWT group, 3/115 participants experienced the composite outcome compared with 1/119 in the standard dressing group. One trial (Hasselmann 2019b) used a split-person design and reported no events in either group.

Blisters

One study (Howell 2011) reported blisters and could not be included in the pooled analysis.

Howell 2011 included some participants with more than one wound (51 participants with 60 wounds) in knee arthroplasty; numbers of people with skin blistering were 15/24 versus 3/36.

Pain

Twelve studies reported pain but could not be included in a pooled assessment (Bertges 2021; Giannini 2018; Gillespie 2021; Gombert 2018; Gunatilake 2017; NCT02461433; O'Leary 2017; Ruhstaller 2017; Schmid 2018; Tuuli 2017; Tuuli 2020; WHIST 2019a).

Four studies looked at pain in women following caesarean section. The largest study (2035 participants) by Gillespie 2021 reported the number of participants with pain requiring readmission; this did not show a clear difference between the groups (RR 1.91, 95% CI: 0.93 to 3.94). A second large study (1624 participants) (Tuuli 2020) reported median pain score at discharge and at day 30. At discharge, this was 3 (0 to 5) in both the NPWT and standard dressing groups; at 30 days, this was 0 (0 to 2) in both groups. Tuuli 2017 (120 participants) reported a lower pain level in the NPWT group (NPWT median = 0, interquartile range (IQR) = 0 to 1; standard dressing median = 1, IQR = 0 to 3; P = 0.02). Ruhstaller 2017 (136 participants) reported medians with IQR for sharp and tingling pain separately for day 2: sharp pain was 6 (4 to 8) in the NPWT group compared to 5.5 (3 to 8) in the standard dressing group, while tingling pain was 2 (0 to 6) in the NPWT group compared to 1.5 (0 to 6) in the standard group. Overall, the results of these trials suggest there may be no clear difference in pain in this group of patients.

The large WHIST 2019a trial (1549 participants) in lower limb fractures reported median and interquartile ranges for each group assessed on a visual analogue scale (VAS) at three and six months post-surgery. The figures at three months were 3.0 (IQR 1.0 to 6.0) for the NPWT group compared with 4.0 (IQR 2.0 to 5.0) in the standard dressing group. At six months, the figures for the two groups were identical. The proportions of participants with neuropathic pain were also reported.

Of the other studies which could not be combined statistically, one (Giannini 2018) reported pain at dressing change giving the mean, median and range for each group as NPWT 2.6, 2 (1 to 6) compared with 4.8, 5 (2 to 7). Another study (Gunatilake 2017) reported that there were more participants in the NPWT group with reductions in incisional pain both at rest (39/46 (84.8%) versus 20/46 (43.5%); P < 0.001) and with incisional pressure (42/46 (91.3%) versus 25/46 (54.3%); P < 0.001), compared with standard care. Bertges 2021 reported the pain score component of the EQ-5D at baseline, 14 days and 30 days; at baseline, the score was 1.8 (0.6) in the NPWT and 1.7 (0..5) in the standard dressing group; at 14 days, the scores were 2.2 (0.6) compared to 2.2 (0.5) and, at 30 days, the scores were 2.3 (0.6) compared to 2.4 (0.6); these data also contributed to the assessment of quality of life (below). Schmid 2018 used a split-person design and reported median pain for wounds during 14-day follow-up. For wounds treated with NPWT, this was 2 (0-2) and for those treated with standard dressings it was 1 (0-3). Results from one study reported "no difference" in pain (O'Leary 2017). Gombert 2018 stated that pain was assessed but did not report results of the assessment. NCT02461433 reported pain but was terminated without useful data collection.

QoL

There was no pooled analysis for quality of life; all studies are discussed in the main text.

Economic outcomes

We did not conduct pooled analyses of economic data; all studies are discussed in the main text and in Appendix 6.

Appendix 6. Cost-effectiveness results used to inform relative cost-effectiveness

There were six studies which used data from RCTs included in this review to assess measures of cost-effectiveness. Two of these looked at use of NPWT in obstetric surgery - obese women undergoing caesarean section (Heard 2017; Hyldig 2019a); these were based on the RCTs of Chaboyer 2014 and Hyldig 2019b, respectively. Two evaluations considered people having orthopaedic surgery. The WHIST 2019b study was undertaken alongside the WHIST 2019a RCT in people having surgery for lower limb fractures. Nherera 2017 looked at NPWT in people having knee and hip arthroplasties and was based on Karlakki 2016. Nherera 2018 looked at people having CABG surgery and was based on Witt-Majchrzac 2015 while Svensson-Bjork 2020 looked at people undergoing vascular surgery with inguinal incisions and was based on Hasselmann 2019a. Four studies included a formal cost-effectiveness analysis as part of their intervention (Chaboyer 2014; Hyldig 2019b; Karlakki 2016; WHIST 2019a) while another (Witt-Majchrzac 2015) contributed data to a cost-effectiveness study (Nherera 2018). Four studies had small sample sizes but Hyldig 2019b and WHIST 2019a were large publicly funded trials with strong methodology and reporting.

In addition, five studies which did not assess cost-effectiveness reported information on dressing costs or resource use (DiMuzio 2017; Gillespie 2015; Javed 2018; Kwon 2018; Manoharan 2016).

Dressing Costs

All six of the cost-effectiveness studies (Heard 2017; Hyldig 2019a; Nherera 2017; Nherera 2018; Svensson-Bjork 2020; WHIST 2019b) and three additional RCTs (Gillespie 2015; Manoharan 2016; Ruhstaller 2017) reported on dressing costs. In each case, NPWT was substantially more costly than the comparator treatment (Table 3). The studies reported dressing costs in different ways, with some summarising for the whole treatment period and others reporting costs per day or per dressing change; the largest trial (WHIST 2019b) reported a total treatment cost which incorporated the dressing cost but also the fracture cast, initial inpatient care, antibiotics and dressing changes. Cost data for dressings are reported in Table 3. All studies reported that NPWT represented a higher dressing cost than standard dressings.

Resource use

Resource use was costed for all the economic studies based on RCTs and costs related to resource use were also reported by three RCTs which did not undertake a cost-effectiveness analysis (DiMuzio 2017; Javed 2018; Kwon 2018). Data on costs are reported in Table 3. We focus on the information used, together with QALYs, to inform the analyses of cost-effectiveness.

Obstetric surgery: Caesarean sections in obese women

Chaboyer 2014 included obese women undergoing caesarean section (n = 70); Heard 2017, was based on Chaboyer 2014, and assessed resources in AUD at 2014 values. Data on costs were based on dressing costs, nursing time, length of hospital stay, and post-discharge costs (readmission, visits to healthcare professionals, and medications). Heard 2017 reported additional costs of AUD 133 for NPWT over standard dressings. Hyldig 2019b was a much larger trial which also enrolled obese women undergoing caesarean section (n = 876); Hyldig 2019a was based on this study and assessed resources in DK transformed into Euro; they found an additional cost difference of 47.29 Euro for NPWT over standard dressings.

Orthopaedic surgery: lower limb fracture surgery

Participants in WHIST 2019a were undergoing surgery for lower limb fracture; the cost-effectiveness analysis WHIST 2019b was based on this. Unit direct medical costs associated with the intervention were obtained from the NHS Supply Chain Catalogue 2018/2019. These included cost of standard dressing, the costs of orthotic cast, the cost associated with dressing change, the cost per working hour of the nurse (obtained from the Personal Social Service Research Unit (PSSRU) 2018). The cost of inpatient care was derived using NHS reference Costs 2017/18. Unit costs of additional medical items were also sourced from the NHS reference costs and medication costs were sourced from the British National Formulary (BNF). Unit costs for direct non-medical cost items were obtained from the Personal Social Services

Research Unit. Other costs were obtained from the NHS Supply Chain Catalogue, the patients and their next of kin, and the Office for National Statistics. Cost data were derived from the key resource inputs of the WHIST 2019 trial and expressed in 2017/2018 GBP; a societal perspective was considered in a sensitivity analysis. Unit costs were adjusted to 2017/2018 prices using the NHS Hospital & Community Health Services (HCHS) index for health service resources. There was no discounting of costs applied due to a short time horizon. The total costs up to six months taking an NHS and PSS perspective showed a mean difference of 770.00 GBP (95% CI 206.51 to 1333.49) more for NPWT compared with standard dressing. A societal perspective also indicated a greater cost to NPWT but with much wider confidence intervals (MD 221.41 GBP, 95% CI -1334.37 to 1777.19).

Orthopaedic surgery: hip or knee arthroplasty

Participants in the Karlakki 2016 study were those scheduled for routine knee or hip arthroplasties (n = 220). Nherera 2017, was based on Karlakki 2016, and derived costs from standard cost references for the NPWT device from the UK National Drug Tariff and an assumption that each patient used two NPWT dressings. Inpatient care was based on the average of National Health Service reference costs for knee and hip arthroplasties which, it was assumed, included the cost of the standard care dressing and nursing time. Costs associated with routine post-discharge care were not included because these costs would be similar across groups. Finally, for those who experienced a complication, an assumption was made that they had two general practitioner visits and received one prescription of antibiotics. Resource use was valued in GBP at 2015/16 values. Nherera 2017 reported cost savings of GBP 1132 for NPWT compared with standard dressings.

General surgery: CABG surgery

Participants in the Witt-Majchrzac 2015 trial (n = 80) underwent CABG surgery. They contributed clinical data to Nherera 2018 which drew both its utility and cost data from other sources. Nherera 2018 found a cost saving of 586 Euro with NPWT compared with standard dressings.

Vascular surgery: inguinal incisions

Participants in the Hasselmann 2019a trial (n = 154) underwent vascular surgery with inguinal incisions. Svensson-Bjork 2020 was based on Hasselmann 2019a and assessed resources in SEK transformed into EUR at the 2019 price year. Costs were based on the local county council's cost-per-patient system, and included: ward care, peri- and postoperative care, blood products, lab and microbiological tests, imaging procedures and outpatient visits, as well as hospital costs from surgery to 90 days postoperatively. Wound dressing and medication usage costs were calculated using unit costs from the local county council's price list and the Swedish Dental and Pharmaceutical Benefit Agency (TLV) website. They found an additional cost of EUR 1706 for NPWT over standard dressings.

Quality-adjusted life year (QALY)

Five of the six studies used QALYs; the exception was Svensson-Bjork 2020 which used a condition-specific quality of life scale and calculated costs per point increase. Each study took a different approach to the resource use and costs used to inform the model; details are provided in Characteristics of included studies. Three studies did not report SD for the QALY estimates for each group, one study reported 95% CIs for the mean difference in QALYs. Given this, we have opted not to impute SD for the majority of studies which do not report them and instead to provide an overall narrative summary.

Across all studies, despite different methods of calculating QALY and the four different surgical indications represented, the differences in QALYs between NPWT and standard dressings were uniformly extremely small.

Obstetric surgery: Caesarean sections in obese women

Heard 2017 calculated QALYs using the 12-item Short Form Health Survey (SF-12) version 2, scored with the UK preference-based algorithm (Brazier 2004), Hyldig 2019a calculated QALYs using the EQ-5D-3L utility scores. Hyldig 2019a reported QALY values of 0.863 in the NPWT group compared with 0.856 in the standard dressing group: mean difference 0.007 (95% CI -0.008 to 0.022). Heard 2017 reported QALY values of 0.067 (SD 0.01) in the NPWT group compared with 0.066 (SD 0.01) in the standard dressing group:mean difference 0.00 (-0.00 to 0.01).

Orthopaedic surgery: lower limb fracture surgery

WHIST 2019b calculated QALYs using the EQ-5D-3L utility scores. WHIST 2019b reported QALY values of 0.40 (0.22) for the NPWT group compared with 0.41 (SD 0.24) in the standard dressing group: mean difference -0.01 (95% CI -0.03 to 0.01).

Orthopaedic surgery: hip or knee arthroplasty

Nherera 2017 calculated QALYs using the 36-item Short Form Health Survey (SF-36) with a regression-based scoring algorithm developed from a sample of Jewish Israelis sampled between 1993 and 1994 (Shmueli 1999). Nherera 2017 reported QALY values of 0.116 for the NPWT group compared with 0.115 in the standard dressing group; no SDs were reported.

General surgery: CABG surgery

Nherera 2018 calculated health state utilities to generate QALYs using published literature including a study looking at discharge from hospital with and without complications (Tuffaha 2015). QALY values were reported as 0.8904 in the NPWT group compared with 0.8593 in the standard dressing group.

Vascular surgery: inguinal incisions

Svensson-Bjork 2020 did not calculate QALYs but used an alternative approach to generating ICER estimates based on the Vascuqol-6 score for participants.

WHAT'S NEW

Date	Event	Description
11 March 2022	New search has been performed	Updated; conclusions changed. 18 new RCTs; one new economic evaluation; one new author joined the review team.
11 March 2022	New citation required and conclusions have changed	Updated, conclusions changed.

HISTORY

Protocol first published: Issue 8, 2011
Review first published: Issue 4, 2012

Date	Event	Description
9 June 2020	Amended	Republished as Open Access.
2 May 2020	New citation required and conclusions have changed	Updated. Conclusions changed.
1 March 2019	New search has been performed	Second update: new citation: conclusions not changed. New search, 25 new studies included. 'Summary of findings' table added. Four new co-authors added, Gill Norman, Zhenmi Liu, Jo Dumville and Laura Chiverton.
27 August 2014	New citation required but conclusions have not changed	Four trials added (Crist 2014; Masden 2012; Petkar 2012; Stannard 2012), no change to conclusions.
27 August 2014	New search has been performed	First update, new search
13 November 2013	Amended	Acknowledgement added to the funders.
16 May 2012	Amended	Adjustments to text.

CONTRIBUTIONS OF AUTHORS

Gill Norman: designed the review update; co-ordinated the review update; extracted data; checked quality of data extraction; analysed or interpreted data; undertook quality assessment; checked quality assessment; performed statistical analysis; produced the first draft of the review update; performed previous work that was the foundation of the current review update; wrote to study authors/experts/companies; performed economic analysis; approved final review update prior to submission; is guarantor of the review update.

Chunhu Shi: extracted data; checked quality of data extraction; analysed or interpreted data; undertook quality assessment; checked quality assessment; checked quality of statistical analysis; contributed to writing or editing the review update; advised on the review update; performed previous work that was the foundation of the current review update; performed economic analysis; approved the final review update prior to submission.

En Lin Goh: checked quality of data extraction; analysed or interpreted data; checked quality assessment; contributed to writing or editing the review update; advised on the review update; performed previous work that was the foundation of the current review update; approved the final review update prior to submission.

Elizabeth Murphy: extracted data; checked quality of data extraction; undertook quality assessment; checked quality assessment; contributed to writing or editing the review update; advised on the review update; approved the final review update prior to submission.

Adam Reid: analysed or interpreted data; contributed to writing or editing the review update; advised on the review update; performed previous work that was the foundation of the current review update; approved the final review update prior to submission.

Monica Stankiewicz: contributed to writing or editing the review update; advised on the review update; performed previous work that was the foundation of the current review update; approved the final review update prior to submission.

Laura Chiverton: contributed to writing or editing the review update; advised on the review update; performed previous work that was the foundation of the current review update; approved the final review update prior to submission.

Jo Dumville: conceived the review; analysed or interpreted data; contributed to writing or editing the review update; advised on the review update; secured funding; performed previous work that was the foundation of the current review update; approved the final review update prior to submission.

Contributions of editorial base

Nicky Cullum (Co-ordinating Editor): advised on methodology, interpretation, and content; edited and approved previous versions of the review prior to publication.

Gill Rizzello (Managing Editor): co-ordinated the editorial process; advised on interpretation, and content; edited the updated review.

Sophie Bishop (Information Specialist): edited the search methods section and search strategy and ran the search for this update.

Tom Patterson (Editorial Assistant): edited the Plain Language Summary and reference sections for this update.

DECLARATIONS OF INTEREST

Gill Norman: I am partially funded by the National Institute for Health Research Applied Research Collaboration Greater Manchester. My employment at the University of Manchester is partially funded by the National Institute for Health Research through Cochrane Wounds. My work on previous versions of this review was also supported by the NIHR Manchester Biomedical Research Centre. I am an Editor for Cochrane Wounds and was not involved in the editorial process for this review.

Chunhu Shi: none known

En Lin Goh: none known

Elizabeth Murphy: I work as a healthcare professional. Work on this review was supported by an internship funded by the National Institute for Health Research Applied Research Collaboration Greater Manchester and the NIHR Manchester Biomedical Research Centre.

Adam Reid: I work as a healthcare professional.

Monica Stankiewicz: I work as an independent consultant for Griffith Health Institute, Griffith University.

Laura Chiverton: my work on this review was supported by the NIHR Manchester Biomedical Research Centre.

Jo Dumville: I received research funding from the NIHR for the production of systematic reviews focusing on high-priority Cochrane reviews in the prevention and treatment of wounds. This research was co-funded by the NIHR Manchester Biomedical Research Centre and partly funded by the National Institute for Health Applied Research Collaboration Greater Manchester. I am a joint Co-ordinating Editor of Cochrane Wounds and was not involved in the editorial process for this review.

Ljubiša Paden (peer reviewer): I received a conference speaker fee from medical device distributor Zaloker&Zaloker d.o.o. The company has confirmed that it does not distribute Negative Pressure Wound Therapy devices.

SOURCES OF SUPPORT

Internal sources

- Division of Nursing, Midwifery and Social Work, School of Health Sciences, Faculty of Biology, Medicine and Health, University of Manchester, UK

Support from Cochrane Wounds editorial base
- Royal Brisbane and Women's Hospital, Australia

Time to conduct review
- Griffith University, Australia

Time to conduct review

External sources

- NIHR Manchester Biomedical Research Centre, UK

This review was co-funded by the NIHR Manchester Biomedical Research Centre. The views expressed in this publication are those of the author(s) and not necessarily those of the NHS, the National Institute for Health Research or the Department of Health and Social Care.
- National Institute for Health Research Applied Research Collaboration Greater Manchester, UK

Several of the authors are partially funded by the National Institute for Health Research Applied Research Collaboration Greater Manchester. The views expressed in this publication are those of the authors and not necessarily those of the National Institute for Health. Research or the Department of Health and Social Care.
- National Institute for Health Research, UK

This project was supported by the National Institute for Health Research, via Cochrane Infrastructure funding to Cochrane Wounds. The views expressed are those of the authors and not necessarily those of the NIHR or the Department of Health and Social Care.

DIFFERENCES BETWEEN PROTOCOL AND REVIEW

Changes in the 2022 update

We were able to implement the prespecified sensitivity analysis which included only studies judged to be at low risk of bias in the key domains of randomisation, allocation concealment and blinding of outcome assessment for the primary outcome of dehiscence as well as for the outcome of SSI.

Changes in the 2020 update

- We have excluded one study which was previously included in error; it did not report an eligible comparison.
- We have made some changes to the inclusion criteria; primarily to clarify that trials in wounds with pre-existing infections were excluded from the review. We have also removed the outcomes of dressing cost, resource use and QALY measures as independent outcomes. We have continued to record information on these and have presented it in additional tables and an appendix to the review but we have shifted the focus of the cost-effectiveness review to assessments of relative cost-effectiveness reported as ICERs.
- We have clarified that we extracted and reported data on adverse events such as seroma and haematoma only as the number of participants in each group with an event.
- We have altered the way in which we dealt with the likelihood of performance bias in included studies in order to better recognise the role this may play even in trials in which it is hard to avoid.
- We have undertaken some exploratory analyses of the primary outcome of SSI to see if there is the potential for additional research into the impact of NPWT on SSI classed as superficial or deep and we have also undertaken an additional sensitivity analysis to further explore the impact of risk of bias on the effect estimate and its confidence intervals for this outcome.
- We have somewhat revised our approach to GRADE assessments in terms of risk of bias and have only downgraded where high risk of bias was present and the potential impact of this was considered substantive. Previously, we had downgraded where key domains had an unclear risk of bias. This new approach reflects the advice from GRADE working group.
- We have removed readmission to hospital from the Summary of Findings table in order to conform with MECIR guidance that this should include no more than seven outcomes.

Changes in the 2019 update

- We changed the title and the focus of the review. In previous versions, we included studies that investigated skin grafts and also those investigating surgical wounds expected to heal by primary intention. In the 2019 version of the review, we did not include studies of skin grafts. This decision was made after consultation with the Cochrane Wounds Editorial base and was based on the following considerations: the healing mechanisms and outcome measures are different for graft sites and incisional wounds, so there was a clear, clinical reason for focusing on one type of wound; we also clarified that trials using NPWT following surgery that involved harvesting veins following flap elevation would also be excluded. Outcomes measures from these trials (such as flap necrosis, lymphorrhagia, and lymphoedema) also differed from primary closure surgery. In addition, the number of trials reporting outcomes following the application of NPWT has been growing exponentially, with the majority of these trials focusing on previously uninvestigated types of surgery using primary closure. Because of this, it seemed timely to focus this review only on 'primary closure' surgery.

- We modified the wording of the title from 'primary intention' to 'primary closure'. The wording change was needed because closure by primary intention would mean the inclusion of grafts and flap surgery trials, whereas primary closure means the surgical edges are approximated and held together with sutures, glue, etc. Primary closure is the simplest closure technique and more accurately reflects the intention of the review.
- We removed the outcome 'graft failure' in line with the new focus of the review.
- We removed the outcome 'time to complete healing', as this outcome was deemed not to be appropriate for surgical wounds expected to heal by primary intention (it is difficult or impossible to determine or define the point of healing for a wound healing in this way). For this reason, 'proportion of surgical wounds healing by primary intention that completely heal' was removed for the first update and 'reoperation' added (see also 'Changes in previous versions' below).
- We added one additional outcome: 'readmission within 30 days for a wound-related complication'. We believe this outcome is important because, while readmission for repeat surgery is one of our current outcomes, the reason for readmission is not always stated in study reports.
- We split 'adverse events' into 'surgical site infection' and 'dehiscence'.
- We removed the words 'and including utility scores representing health-related quality of life' from the outcome 'healthcare costs' and included it under the outcome 'quality of life'.
- We split one of our secondary outcomes, 'seroma/haematoma', into two separate outcomes. This decision was based on differing definitions and aetiologies of the two conditions. A seroma is a collection of clear, serous fluid, which sometimes collects under a surgical wound, whereas a haematoma is a collection of blood outside a blood vessel.
- We changed the outcome 'fracture blisters' to 'skin blisters', as some blisters are associated with dressings that cover wounds from surgery that is not fracture surgery.
- We have split 'cost' into four separate outcomes: 'dressing-related costs', 'resource use', 'incremental cost per quality-adjusted life year', and 'estimated incremental cost-effectiveness ratio'.
- We broke up costs into two categories. The first ('dressing-related costs') is a simple cost comparison from the intervention study reports, and the second ('cost') is a full economic analysis from the two cost-effectiveness studies. This analysis contains three outcomes: resource use, incremental cost per quality-adjusted life year, and estimated incremental cost-effectiveness ratio.
- We added three additional items of data extraction: 'source of funding', 'prospective registration on a clinical trials registry', and 'economic data (healthcare costs)'. We made these additions to reflect the importance of prospective registration in the assessment of risk of bias in several domains, and in response to the insistence in many quality journals on prospectively registering clinical trials as a quality measure.
- We updated our search strategies, adding new terms for negative pressure wound therapy, and changed the term 'surgical' to 'surgical site infection' in the trial registries' search.
- We included an additional (standard) sensitivity analysis with the following wording: "We performed a sensitivity analysis on the primary outcomes (surgical site infection) to assess the influence of removing studies classified as being at high risk of bias from the meta-analysis. We excluded studies that were assessed as having high or unclear risk of bias in the key domains of adequate generation of the randomisation sequence, adequate allocation concealment, and blinding of outcome assessor. We planned but were unable to undertake a similar analysis for the outcome of dehiscence."
- We removed allocation concealment and type of randomisation from the sensitivity analyses; they are included in the new sensitivity analyses described above. We removed duration of follow-up from the sensitivity analyses.
- We changed one subgroup analysis from 'type of surgery (traumatic wounds, reconstructive procedures, other post-surgical wounds; skin grafts)' to 'type of surgery' without qualification.
- We removed one comparison (industry funded versus non-industry funded) following advice from the Cochrane Wounds Editorial base. We removed one comparison (one negative pressure closure method compared with another), as the study providing data for this comparison, Dorafshar 2012, has now been excluded in line with the new focus of the review on surgical wounds healing by primary closure only.
- We updated the methods used to assess heterogeneity and taken this into account in our analyses; we changed methods of analysis as appropriate to the evidence that is now included in this updated version.
- We used the method for classifying economic evaluation described by Husereau and colleagues (Husereau 2013), rather than the evaluation described by Drummond 2005. This decision was based on the knowledge that the Consolidated Health Economic Evaluation Reporting Standards (CHEERS) checklist has become the standard for economic evaluations. The checklist was developed in collaboration with a range of organisations, and includes Drummond as a co-author.
- We added a 'Summary of findings' table to the review and used a GRADE assessment of the certainty of the evidence throughout.

Changes to previous versions

We added a comparison (one negative pressure closure method compared with another) to the previous version of this review, but this has now been removed (see comment above).

We expanded the list of extracted data from the protocol to include:

- study dates;
- number of participants per group;
- information about ethics approval, consent, and conflict of interest.

In trials of skin grafts, graft failure is an important outcome. We failed to include this as either a primary or secondary outcome in the protocol for the original review. We also failed to include length of hospital stay, which is important for any economic analysis. Consequently, we included graft failure and length of hospital stay as additional outcomes post hoc.

- In a previous update, we removed the primary outcome "proportion of surgical wounds healing by primary intention that completely heal (surgical wounds may include split-skin grafts, full skin grafts, or any primary wound closure)". This decision was based on our experience conducting the first version of this review, where we noted that "it has become clear to us that this outcome is not appropriate for surgery that is expected to heal by primary intention; most clean surgical wounds will completely heal in a relatively short time. Moreover, determining when a surgical incision is 'completely healed' is difficult. Consequently, wound healing should not be included as a primary outcome for future updates".
- In the first version of the review, we considered any wound complications under the heading 'adverse events'. As many of these 'events' are qualitatively different and of varying levels of importance, we subsequently included only 'surgical site infection' and 'dehiscence' under the heading 'adverse events'. We moved other wound-related outcomes that were previously included under the primary outcome 'adverse events' (such as fracture blisters, seromas, etc.) to the secondary outcomes. We changed 'graft loss' to 'graft failure' and added it as a separate outcome because it is an important outcome for skin graft studies, and in our protocol we did not include any outcomes that were specific to skin grafts. We also added a new secondary outcome, 'reoperation', as this is an important outcome that indicates the severity of any wound dehiscence or graft loss.
- We changed the wording in the sections 'Unit of analysis issues' (we had not anticipated in the original version of the review that multiple wounds might be an issue) and 'Dealing with missing data' (to clarify what we intended to do).

INDEX TERMS

Medical Subject Headings (MeSH)

Blister; *Negative-Pressure Wound Therapy [methods]; Pain; Randomized Controlled Trials as Topic; Seroma [epidemiology] [etiology] [prevention & control]; *Soft Tissue Injuries; *Surgical Wound [therapy]; Surgical Wound Infection [epidemiology] [prevention & control]

MeSH check words

Humans