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Mesh versus non-mesh repair of groin hernias: a rapid review

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Abstract

Background: Mesh is frequently utilized intraoperatively for the repair of groin hernias. However, patients may request non-mesh hernia repairs owing to adverse events reported in other mesh procedures. To inform surgical safety, this study aimed to compare postoperative complications between mesh and non-mesh groin hernia repairs and identify other operative and patient-related risk factors associated with poor postoperative outcomes.

Methods: Ovid MEDLINE and grey literature were searched to 9 June 2021 for studies comparing mesh to non-mesh techniques for primary groin hernia repair. Outcomes of interest were postoperative complications, recurrence of hernia, pain and risk factors associated with poorer surgical outcomes. Methodological quality was appraised using the AMSTAR 2 tool.

Results: The systematic search returned 4268 results, which included seven systematic reviews and five registry analyses. Mesh repair techniques resulted in lower hernia recurrence rates, with no difference in chronic pain, seroma, haematoma or wound infection, compared to non-mesh techniques. Risk factors associated with increased risk of hernia recurrence were increased body mass index (BMI), positive smoking status and direct hernia. These were independent of surgical technique. Patients under 40 years of age were at increased risk of postoperative pain.

Conclusions: Surgical repair of primary groin hernias using mesh achieves lower recurrence rates, with no difference in safety outcomes, compared with non-mesh repairs. Additional risk factors associated with increased recurrence include increased BMI, history of smoking and hernia subtype.

Introduction

Hernias are protrusions of organs, or part of organs, through the cavity which lines it.[1] They are generally stratified by anatomical location, with inguinal and femoral hernias (collectively known as groin hernias) the most common type of hernia. Groin hernias are frequently encountered with or without symptoms in clinical practice with an estimated lifetime risk of 27% in men and 3% in women, and can be symptomatic or asymptomatic.[1] Surgical repair is indicated for symptomatic hernias, with inguinal hernia repair being one of the most frequently performed operations globally.[2] Repair can be achieved by suturing the defect closed, or by implanting surgical mesh to reinforce the weakened or damaged tissue.[1]

The successful use of mesh products in hernia repair prompted the introduction of similar products for urogynaecological procedures.[3] Urogynaecological mesh was used to reinforce weakened vaginal walls in pelvic organ prolapse and support the urethra or bladder in stress urinary incontinence. However, amid safety concerns – specifically ongoing pain, infection, bleeding and urinary problems[4] – international regulatory agencies cancelled approval of these devices and medical societies no longer recommend their use.[5–7] An exception is the use of midurethral sling for the treatment of stress urinary incontinence, which is still considered safe and effective.[8,9]

Surgeons have noted public confusion regarding the use of mesh products intraoperatively.[10] Patients are requesting non-mesh hernia repairs[10] despite increased hernia recurrence when mesh is not used.[1,2] Owing to public misinformation and failure of clarification of terminology, surgeons have noted that patients are confusing adverse events associated with mesh used for urogynaecological procedures with mesh used for hernia repair.[10,11] Approximately half of surgical hernia repair patients may have felt that the use of mesh increases the risk of complications or would have no benefit compared to a non-mesh repair.[11] Clarifying the safety of mesh is important. However, focusing solely on mesh as the key safety concern may omit discussion of other factors that could potentially affect the postoperative outcomes. Thus, there is a need to both evaluate the safety of mesh and identify other risk factors associated with hernia repair to better inform patients and providers. Accordingly, this study aimed to compare outcomes after hernia repair with mesh versus without mesh and identify operative and patient-related factors associated with poor outcomes.

Table 1 PICO criteria for study selection

Population	Patients undergoing surgical repair of an inguinal or femoral hernia
Intervention	Hernioplasty using mesh (open or laparoscopic)
Comparator	Herniorrhaphy without mesh (open or laparoscopic)
Outcomes	Pain Recurrence Seroma Haematoma Wound infection Other adverse events (testicular atrophy, urinary retention, neurovascular or visceral injury) Length of stay Risk factors
Study designs	Systematic reviews, meta-analyses, registry analyses

Methods

This study comprised a rapid review that was broadly congruent with PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) statement standards.[12]

Search strategy

A systematic search of Ovid MEDLINE was performed from database inception to 9 June 2021. The full search strategy is outlined in Appendix A in Data S1. A research librarian designed the search strategy, which included text and medical subject heading terms relating to hernia, mesh repair, non-mesh repair, safety and adverse events. Study design was limited to systematic reviews, meta-analyses and registry analyses to identify high-level evidence with the longest length of follow-up. Searches were not limited by language to avoid publication bias; however, study selection was limited to English articles. No date limits were applied. In addition to the systematic search, the following hernia registry websites were searched for relevant publications: Swedish Groin Hernia Registry, Danish Hernia Database, Herniamed, Evereg, Club Hernie and the Abdominal Core Health Quality Collaborative.

Study selection was performed in duplicate by two authors, who independently reviewed records by title and abstract, and then by full text. Articles were imported into Rayyan[13] (Qatar Computing Research Institute, Ar-Rayyan, Qatar) with differences settled via consensus. Data were extracted by one author and reviewed by another author. Extracted data included author, year, study design, patient demographics, surgical technique, follow-up duration and outcomes of interest.

Study selection

The PICO (Population, Intervention, Comparator and Outcome) framework guided the search strategy and study selection. Table 1 outlines the PICO criteria used for study selection.

Sliding, hiatal, incisional, umbilical and bilateral hernias were excluded. Similarly, strangulated hernias and hernias necessitating emergency surgery were excluded. Postoperative pain is often delineated into acute and chronic, and in this study only chronic pain was included, defined as pain lasting over 1 month post-surgery. Systematic reviews were excluded if more than 50% of included studies were not from WHO mortality stratum A countries.[14] Where reviews had more than 50% overlap of included studies, the review with the largest number of studies was included to avoid overlapping data. Where registry studies sourced data from the same database with matching inclusion criteria and dates, the study with the largest number of patients was included. Registry studies with more than 1000 included patients were considered.

Data analysis

The direction of effect for odds ratios was standardized to mesh versus non-mesh to allow comparison between studies. This was

achieved by taking the reciprocal of reported odds ratios for included studies reporting non-mesh versus mesh.

Methodological quality

Methodological quality was appraised using AMSTAR 2 (A MeaSurement Tool to Assess systematic Reviews 2[15]) for systematic reviews, and the Institute of Health Economics (IHE) quality appraisal checklist for case series studies and cohort studies for registry studies.[16] Quality was assessed by two authors independently and disagreements were settled via consensus.

Results

The systematic and database search returned 4268 results, from which 7 systematic reviews and 5 registry analyses comparing mesh techniques to non-mesh techniques were included. The PRISMA flow diagram[17] is shown in Figure 1.

Study characteristics

The characteristics of the included systematic reviews and registry analyses are summarized in Appendix B and Appendix C in Data S1. The meta-analyses included randomized controlled trials and observational studies. Patient numbers in the systematic reviews ranged from 3044[18] to 714 167,[19] and in registry analyses ranged from 2612[20] to 117 898.[21] Mesh repair techniques were predominantly Lichtenstein, totally extraperitoneal (TEP) and transabdominal preperitoneal (TAPP). Less frequently used mesh repair techniques included Prolene Hernia System, Stoppa and Trabucco. The Shouldice technique was the most performed non-mesh technique, in addition to Bassini, Modified darn, Desarda, Marcy, Moloney and McVay. Trials within the reviews were conducted in North America, Europe, Asia and Australia. Baseline characteristics were similar among mesh and non-mesh groups. Patient age ranged from 18 to 90 years (mean 49 years) and 97% were male. Most patients were undergoing repair of a unilateral primary hernia, of which inguinal hernias were the most common. Femoral hernias were included in seven studies; however, they constituted ~1% of the total included population (the remainder were inguinal hernias). The mean duration of follow-up was 35 months, ranging from 3 to 180 months (15 years).

Chronic pain was reported in six systematic reviews and two registry analyses, with follow-up ranging from 2 months to 10 years. Pain was generally measured via questionnaires, as dichotomous (present or absent) or continuous (0 to 10) variables. Hernia recurrence was reported in five systematic reviews and two registry analyses, with a minimum follow-up of 1 month postoperatively up to 5 years. Regarding other complications, seroma, haematoma and wound infections were each reported in four reviews. Secondary reported outcomes were infrequently reported; these included testicular atrophy (k = 3), urinary retention (k = 2), length of hospital stay (k = 2) and neurovascular or visceral injury (k = 1). Risk factors associated with increased adverse outcomes were reported in two systematic reviews and three registry analyses.

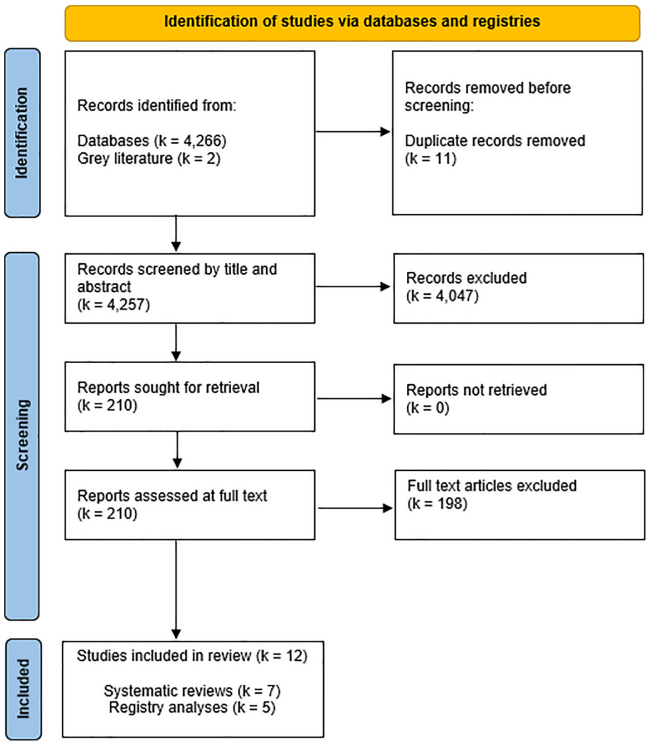

Fig. 1. PRISMA flow diagram showing study selection.

Quality of included studies

Results of the quality assessment are presented in Appendix D and Appendix E in Data **S1**. All seven systematic reviews were deemed high-quality following appraisal with AMSTAR 2. All systematic reviews used a comprehensive literature search strategy, specified the PICO, had a satisfactory method of assessing risk of bias and declared conflicts of interest. Most studies performed study selection in duplicate (k = 6), established the protocol method prior to conducting the review (k = 6), and performed data extraction in duplicate (k = 5). Few studies declared the sources of funding of the included studies (k = 3).

No methodological issues were discovered in quality assessment of the registry analyses. The objective was clearly stated, and all were multicentre, prospective studies. Inclusion and exclusion criteria were clearly defined. Competing interests and sources of support were reported in four of the five studies.

Outcomes

Results of the systematic reviews and registry analyses reporting on postoperative complications following groin hernia repair are provided in Appendix F and Appendix G in Data S1. Table 2 summarizes the reported outcomes.

Pain

Six systematic reviews provided evidence on pain, of which four had meta-analyses performed[22,23,25,26] and two were narrative syntheses.[1,18] The number of patients in the meta-analyses ranged from

Table 2 Summary of results of postoperative complications following groin repair

Outcome	Meta-analysis (range of effects) mesh versus non-mesh	Registry analyses (range) mesh versus non-mesh
Pain	OR 0.36 (95% CI 0.29 to 0.46)[22] OR 1.15 (95% CI 0.62 to 2.12)[23]	OR 0.78 (95% CI 0.63 to 0.97)[21]
Recurrence	OR 0.26 (95% CI 0.25 to 0.28)[23] RR 0.46 (95% CI 0.26 to 0.80)[1]	HR 0.25 (95% CI 0.16 to 0.40)[24]
Seroma	OR 1.04 (95% CI 0.37 to 2.94)[23] RR 1.63 (95% CI 1.03 to 2.59)[1]	NR
Haematoma	OR 0.86 (95% CI 0.58 to 1.28)[18] OR 1.56 (95% CI 0.16 to 15.52)[23]	OR 1.05 (95% CI 0.95 to 1.17)[21]
Wound infection	OR 1.24 (95% CI 0.84 to 1.84)[25] OR 1.35 (95% CI 0.38 to 4.82)[23]	OR 0.87 (95% CI 0.74 to 1.02)[21]

Abbreviations: CI, confidence interval; HR, hazard ratio; NR, no result; OR, odds ratio; RR, risk ratio.

387[26] to 4366.[22] Three meta-analyses found no significant difference in pain between mesh repair and non-mesh repair groups.[23,25,26] Effect sizes ranged from OR 0.93 (95% CI 0.53 to 1.65; $P = 0.83$)[25] to OR 1.15 (95% CI 0.62 to 2.12; $P = 0.57$).[23] In one meta-analysis, mesh repair was less likely to result in chronic pain (>12 months) compared to non-mesh repair (OR 0.36; 95% CI 0.29 to 0.46; $P < 0.00001$).[22]

The two narrative systematic reviews were in favour of mesh or noted that there were no significant differences in reported pain between mesh and non-mesh groups.[1,18] Analysis of 104 108 patients in the Swedish Hernia Registry found that patients who had a mesh repair were significantly less likely to have pain compared to those who had a non-mesh repair (OR 0.78; 95% CI 0.63 to 0.97; $P < 0.005$).[21] Another database analysis of 2612 patients did not find any difference in reported pain between mesh and non-mesh techniques.[20]

Recurrence

Hernia recurrence was evaluated in five meta-analyses.[1,18,22,23,25] The number of patients in the meta-analyses ranged from 1565[23] to 8221.[22] Four meta-analyses concluded that mesh repair significantly decreased hernia recurrence rates compared to non-mesh repair. The effect sizes were OR 0.26 (95% CI 0.25 to 0.28; $P < 0.0001$)[23] and RR 0.46 (95% CI 0.26 to 0.80; $P = 0.006$).[1] One meta-analysis found no significant difference in recurrence rates between open mesh repairs and open non-mesh repairs (risk difference (RD) 0.00; 95% CI −0.01 to 0.01; $P = 0.93$).[18] Recurrence was evaluated in two registry analyses. Both found that patients who had a mesh repair had a significantly lower risk of hernia recurrence than did those who had a non-mesh repair.[24,27] Risk of reoperation for recurrence decreased over time following mesh repairs, from hazard ratio (HR) 0.45 (95% CI 0.39 to 0.51; $P < 0.001$) after 0 to 30 months, to HR 0.25 (95% CI 0.16 to 0.40; $P < 0.001$) after 60 to 96 months (5–8 years) following surgery.[24]

Seroma

Seroma was evaluated in four meta-analyses. The number of patients in the meta-analyses ranged from 1700 to 2640.[1,18,23,25] Three meta-analyses found no difference in rates of seroma between mesh groups and non-mesh groups.[18,23,25] Effect size ranged from OR 1.04 (95% CI 0.37 to 2.94)[23] to OR 1.52 (95% CI 0.92 to 2.52; $P = 0.10$).[25] One meta-analysis concluded that mesh repair significantly increased the rate of seroma compared to non-mesh repair (RR 1.63; 95% CI 1.03 to 2.59; $P = 0.04$).[1] No registry analyses reported this outcome.

Haematoma

Haematoma was evaluated in four meta-analyses, with patient numbers ranging from 562 to 3773.[1,18,23,25] All four meta-analyses reported no significant difference in the rate of haematoma between the mesh and non-mesh repair groups. Effect sizes ranged from OR 1.56 (95% CI 0.16 to 15.52; $P = 0.35$)[23] to OR 0.86 (95% CI 0.58 to 1.28; $P = 0.59$).[18] Haematoma was evaluated in one registry analysis of 104 108 patients in the Swedish Hernia Registry.[21] The study found no difference in the rate of haematoma between mesh and non-mesh groups (OR 1.05; 95% CI 0.95 to 1.17; $P =$ NR [not reported]).[21]

Wound infection

Wound infection was evaluated in four meta-analyses, with patient numbers ranging from 1938 to 4540.[1,18,23,25] All four meta-analyses reported no significant difference in the rates of wound infection between the mesh or non-mesh repair groups. Effect sizes ranged from OR 1.24 (95% CI 0.84 to 1.84; $P = 0.28$)[25] to OR 1.35 (95% CI 0.38 to 4.82; $P = 0.39$).[23] Wound infection was evaluated in two registry analyses, both of which found no significant difference in the rate of wound infection between mesh and non-mesh groups (OR 0.87; 95% CI 0.74 to 1.02; $P =$ NR[21]; and 3.0% Lichtenstein versus 3.3% Shouldice and 2.7% Marcy; $P > 0.05$).[20]

Secondary outcomes

Other reported outcomes were testicular atrophy or injury, urinary retention, length of hospital stay and neurovascular or visceral injury. Testicular atrophy or injury following hernia repair was evaluated in three meta-analyses.[1,18,23] All meta-analyses reported no significant difference in the rate of testicular atrophy or injury between mesh and non-mesh groups. Effect sizes were RD −0.00 (95% CI −0.01 to 0.00; $P = 0.58$)[18] and RR 1.06 (95% CI 0.63 to 1.76; $P = 0.83$).[1] Urinary retention was evaluated in two meta-analyses. One meta-analysis concluded that the rate of urinary retention was significantly less following mesh repair compared with non-mesh repair (RR 0.53; 95% CI 0.38 to 0.73; $P = 0.0001$).[1] The other meta-analysis reported no significant difference between the groups (OR 0.69; 95% CI 0.48 to 0.98; $P = 0.33$).[18] Urinary

Table 3 Summary of results of systematic reviews and registry analyses reporting on risk factors of complications

Risk factor	Summary of findings
Patient factors	
BMI	Increased BMI (25–30 kg/m^2) increases risk of postoperative complications and recurrence[19,28]
Age	Younger age (<40 years) increases risk of pain[20] Older age (>65 years) increases risk of postoperative complications[21] but not recurrence[19]
Smoking status	Smoking increases risk of recurrence[19]
Gender	Female gender increases risk of recurrence[19]
Operative factors	
Length of operation	Longer operation (>50 min) increases risk of overall postoperative complications[21]
Surgeon experience†	Experienced surgeons (>26 groin hernia operations per year) decreases risk of overall postoperative complications[21]
Acute operation‡	Acute operation increases risk of overall postoperative complications,[21] but not recurrence[19]
Anaesthesia	Local anaesthesia decreases risk of postoperative complications‡,[21]
Hernia characteristics	
Hernia subtype	Primary direct hernias result in increased risk of recurrence[19]
Hernia defect size	Hernia size did not influence risk of recurrence[19]

Abbreviation: BMI, body mass index.

†All complications which came to the knowledge of the unit within 30 days after operation.

‡Operated on within 24 h of admission, with signs of strangulated or incarcerated hernia.

retention was evaluated in one registry analysis, which concluded that the rate of urinary retention was significantly less following mesh repair than it was after non-mesh repair (0.31; 95% CI 0.21 to 0.47; $P < 0.005$).[21] Length of stay was evaluated in 2 meta-analyses, which found no difference between mesh and non-mesh groups (mean difference [MD] = −0.09; 95% CI −0.44 to 0.26; $P = 0.62$[18]; weighted MD = 0.38; 95% CI −0.41 to 1.18; $P = 0.34$[23]). Neurovascular or visceral injury was evaluated in one meta-analysis, which concluded that the rate of injury was less following mesh repair than it was following non-mesh repair (RR 0.61; 95% CI 0.49 to 0.76; P <0.001).[1]

Risk factors

A summary of the results (systematic review, k = 1; registry analyses, k = 3) reporting on risk factors for postoperative complications, hernia recurrence or pain following groin hernia repair is provided in Table 3.

One narrative systematic review[19] and one registry analysis[28] reported on the effect of body mass index (BMI) on the risk of postoperative complications following groin hernia repair. The narrative systematic review included six studies and concluded that increasing BMI (>25 kg/m^2) was a risk factor for hernia recurrence.[19] The registry study included 49 094 groin hernia operations and found that increased BMI (>25 kg/m^2) increased the risk of postoperative complications (HR 1.10; 95% CI 1.03 to 1.18; $P = 0.005$) and the risk of reoperation for recurrence (HR 1.19; 95% CI 1.00 to 1.40; $P = 0.05$) when compared with patients with a BMI of 20 to 25 kg/m^2.[28] The analyses combined patients undergoing both mesh and non-mesh repairs; findings were independent of surgical technique. Further, when patients with increased BMI underwent either suture or Lichtenstein mesh repair, patients with suture repair were at increased risk of recurrence (HR 1.68; 95% CI 1.14 to 2.48; $P = 0.00$).[28] Two registry analyses[20,21] and one meta-analysis[19] reported on age as a risk factor for postoperative complications following groin hernia repair. Age was not a risk factor for hernia recurrence in a meta-analysis of 78 967 patients (RR 0.99; 95% CI 0.84 to 1.17; $P = 0.9$).[19] Patients over 65 years of age were at increased risk of overall postoperative complications compared to patients under 65 years (OR 1.26; 95% CI 1.21 to 1.31; P <0.005).[21] Patients under 40 years of age were at increased risk of postoperative pain compared with patients over 40 years (26.8% *vs.* 19.7%; $P = 0.001$), regardless of surgical technique.[20] One meta-analysis reported on the effects of smoking status on hernia recurrence.[19] Smoking was a significant and independent risk factor for recurrence following inguinal repair in the meta-analysis of 773 patients (OR 2.53; 95% CI 1.43 to 4.47; $P = 0.001$).[19] These findings were independent of mesh or non-mesh techniques. One meta-analysis reported on the effect of sex on hernia recurrence.[19] Female sex was a significant risk factor for recurrence after hernia repair in a meta-analysis of 284 898 patients (RR 1.38; 95% CI 1.28 to 1.48; P <0.001).

A registry analysis found that patients whose operations were longer than 50 min duration were at significantly increased risk of postoperative complications compared with those whose operations were less than 50 min (OR 1.27; 95% CI 1.22 to 1.33; P <0.005).[21] An additional registry analysis found that surgeon experience impacted the risk of postoperative complications.[21] Surgeons who performed greater than 26 groin hernia operations per year had a lower risk of postoperative complications compared to surgeons who performed 6 to 25 groin hernia operations per year (OR 0.93; 95% CI 0.88 to 0.98; P <0.005). This effect was even greater with surgeons who performed more than 50 groin hernia operations per year (OR 0.82; 95% CI 0.78 to 0.86; $P < 0.005$). A meta-analysis and a registry analysis reported on the effect of acute operations on the risk of complications. The meta-analysis found that acute operations did not affect the risk of recurrence compared to elective operations (RR 1.28; 95% CI 0.97 to 1.70; $P = 0.08$).[19] However, the registry analysis found that patients undergoing an acute operation were at increased risk of overall postoperative complications (OR 1.58; 95% CI 1.47 to 1.71; P <0.005).[21] A registry analysis found both regional anaesthesia (OR 1.53; 95% CI 1.43 to 1.63; P <0.005) and general anaesthesia (OR 1.30; 95% CI 1.23 to 1.37; P <0.005) resulted in an increased risk of postoperative complications when compared with local anaesthesia.[21] One meta-analysis reported on inguinal hernia subtype as a risk factor for recurrence.[19] The meta-analysis found that operating on a primary direct inguinal hernia was a significant risk factor for recurrence compared to a primary indirect hernia repair (RR 1.91; 95% CI 1.62 to 2.26; P <0.001). One meta-analysis reported on hernia defect size and

found that hernia defects larger than 3 cm did not increase the risk of hernia recurrence when compared with hernia defects smaller than 3 cm (RR 1.09; 95% CI 0.92 to 1.30; $P = 0.33$).[19]

Discussion

This review evaluated the safety and effectiveness of groin hernia repair using mesh compared with non-mesh repair and evaluated patient and operative risk factors associated with complications and recurrence. Evidence from both systematic reviews and registry analyses demonstrated that groin hernia repair using mesh is safe and effective, inferred by lower recurrence rates and similar postoperative complication rates compared to non-mesh techniques. Results were consistent with multiple international guidelines, which advise that patients older than 30 years of age with a symptomatic groin hernia should undergo a repair with mesh.[2,25,29]

Chronic pain is a significant and common postoperative complication following hernia repair.[26] This study found that pain rates were either similar or lower in patients with mesh repair compared to patients with non-mesh repairs. Postoperative pain is likely to be influenced by multiple variables, and factors other than the presence of mesh need to be considered when assessing the risk of postoperative pain following groin hernia repair. The results show that age is a risk factor for chronic pain, with younger patients (<40 years) reporting increased pain levels compared to older patients, regardless of the repair technique.[19–21] Similar results were found in studies that solely investigated mesh techniques, indicating that the presence of mesh may not be the cause of pain following groin hernia repair.[30,31] Other influencing factors not captured by the present study include preoperative pain, surgical technique (open or laparoscopic), surgery for recurrence and nerve injury.[32]

Hernia recurrence was significantly lower following mesh repair in four included meta-analyses. The systematic review that reported no difference in recurrence had the shortest follow-up duration.[18] Given that the incidence of recurrence increases over time,[33] this review may have had insufficient follow-up to accurately detect true recurrence rates. However, longer-term studies have highlighted that mesh does not simply delay hernia recurrence but improves the biomechanical strength of the surrounding tissue.[34] Given that hernia recurrence is consistently lower following mesh repair, risk factors for recurrence in addition to the choice of surgical technique need to be considered. Patients with increased BMI had increased rates of recurrence regardless of repair type.[28] Notably, in overweight patients non-mesh repairs resulted in a 68% increase in reoperation for recurrence compared to mesh repairs.[28] Positive smoking status was also significantly and independently associated with increased rates of recurrence,[19] reinforcing the substantial literature on the link between smoking and postoperative complications.[35,36] Hernia subtype significantly affects recurrence, with direct hernia repair resulting in an increased risk of recurrence compared to repair of indirect hernias. The reason for this is unclear, but possible reasons include insufficient mesh overlap or pathophysiological aspects of the respective defects.[37] The operative-related risk factors identified in this study (surgeon experience, anaesthesia type, operation length) are not unique to hernia repairs and may not reflect risk factors specific to mesh surgeries.

This review underscores the patient and operative factors – separate from the presence of mesh – that need to be considered when evaluating the safety profile of hernia repairs. Focusing solely on mesh as the proxy for postoperative complications unduly simplifies the problem. [9] Postoperative adverse events following hernia repair, including seroma, haematoma and wound infections, occur at a similar rate in mesh and non-mesh repairs.[1,18,23] Surgeons can be confident when counselling patients on hernia repair techniques that mesh for hernia repair is a safe and effective choice, resulting in lower recurrence rates with similar frequencies of pain and adverse events, compared to non-mesh techniques. Further this study's findings show that outcomes after mesh repair of groin hernias are not comparable to adverse events reported in transvaginal mesh cases. Complications caused by transvaginal mesh arise from mechanical incompatibility between the mesh and the host tissue, incomplete understanding of the underlying disease processes and the failure of surveillance and regulatory approval processes.[38] It is important to highlight that midurethral sling mesh repair is still recommended for cases of routine stress urinary incontinence.

Monitoring of healthcare quality by clinical quality registries is essential for improved patient outcomes. Multiple hernia registries worldwide actively monitor surgical quality of hernia repair.[39,40] For effective monitoring, clinical quality registries must aim to capture data on all operations in the specialty and include patient-related risk factors such as BMI, smoking status and comorbidities, as well as operative details such as length of operation and anaesthesia type.[39,40] Monitoring of these indices is essential for informative surveillance for improved patient care. Clinical quality registries offer significant returns on investment owing to their contribution to improved patient outcomes and processes of care.[41] There is currently no Australian and Aotearoa New Zealand-specific hernia registry collecting all long-term patient data following hernia repair. The ANZ Hernia society is in the process of launching a pilot study for an Australian and New Zealand clinical quality registry with a learning healthcare system for all abdominal wall hernias with anticipated national rollout in 2023. This clinical quality registry will collect patient, operative and mesh related data from all hernia operations, regardless of technique. Such a registry is critical to support postoperative surveillance and long-term patient outcomes reporting following all hernia repairs.

The therapeutic regulatory bodies of Australia (Therapeutic Goods Administration) and Aotearoa New Zealand (Medsafe) collect data on adverse events associated with medical devices, but the process is reactive and reflects only a subset of hernia operations. From December 2021, surgical mesh devices in Australia will be reclassified from Class IIb (medium risk) to Class III (high-risk), to align with the European Union framework.[42] While this increase in classification level results in more stringent pre-testing and mandatory long-term follow-up, only hernia repairs utilizing mesh will be captured. This change in regulatory processes will capture neither patient-related risk factors nor non-mesh hernia repairs, which contribute significantly to postoperative adverse events including hernia recurrence and pain.

This review has multiple limitations. Limiting the search to a single database may bias results and relevant articles may have been omitted. While this study's results were consistent with existing guidelines, applicability is limited to lower-risk hernias. It is

unclear whether mesh has a similar safety profile for hernias in regions other than the groin, or differing patient groups (e.g. complex cases, recurrent hernia, female patients or patients with existing comorbidities), however this was outside the scope of the present study. Included studies were predominantly conducted in high-income countries, thus while reflecting a bias within the literature, the relevance of these findings to countries with less available resources is unclear.

Conclusion

Surgical repair of primary groin hernia utilizing mesh results in lower recurrence rates with no difference in safety outcomes, compared with non-mesh repairs. Factors other than mesh that are associated with increased incidence of recurrence include increased BMI and smoking history. There is an urgent need to establish an Australia and Aotearoa New Zealand-specific hernia registry to provide long-term postoperative surveillance data and facilitate effective reporting of adverse events for all hernia operations. Surgeons can be confident when counselling patients on groin hernia repair techniques that the intraoperative utilization of mesh is a safe and effective choice.

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Conflict of interest

None declared.

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