



SYSTEMATIC REVIEW

Mesh, flap or combined repair of perineal hernia after abdominoperineal resection – A systematic review and meta-analysis

Sarah Sharabiany¹ | Thomas P. A. Brouwer¹ | Saskia I. Kreisel¹ | Gijsbert D. Musters¹ | Robin D. Blok¹ | Roel Hompes^{1,2} | Pieter J. Tanis^{2,3}

¹Department of Surgery, Amsterdam UMC, University of Amsterdam, Amsterdam, The Netherlands

²Department of Surgery, Amsterdam UMC, Cancer Centre Amsterdam, University of Amsterdam, Amsterdam, The Netherlands

³Department of Surgical Oncology and Gastrointestinal Surgery, Erasmus MC, Rotterdam, The Netherlands

Correspondence

Pieter J. Tanis, Department of Surgical Oncology and Gastrointestinal Surgery, Erasmus MC, Doctor Molewaterplein 30, Rotterdam 3015 GD, The Netherlands. Email: p.tanis@erasmusmc.nl

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Abstract

Aim: The aim of this systematic review was to analyse recurrence rates after different surgical techniques for perineal hernia repair.

Method: All original studies ($n \geq 2$ patients) reporting recurrence rates after perineal hernia repair after abdominoperineal resection (APR) were included. The electronic database PubMed was last searched in December 2021. The primary outcome was recurrent perineal hernia. A weighted average of the logit proportions was determined by the use of the generic inverse variance method and random effects model.

Results: A total of 19 studies involving 172 patients were included. The mean age of patients was 64 ± 5.6 years and the indication for APR was predominantly cancer (99%, 170/172). The pooled percentage of recurrent perineal hernia was 39% (95% CI: 27%–52%) after biological mesh closure, 29% (95% CI: 21%–39%) after synthetic mesh closure, 37% (95% CI: 14%–67%) after tissue flap reconstruction only and 9% (95% CI: 1%–45%) after tissue flap reconstruction combined with mesh.

Conclusion: Recurrence rates after mesh repair of perineal hernia are high, without a clear difference between biological and synthetic meshes. The addition of a tissue flap to mesh repair seemed to have a favourable outcome, which warrants further investigation.

KEYWORDS

abdominoperineal resection, flap, mesh, perineal hernia repair

INTRODUCTION

Perineal hernia after abdominoperineal resection (APR) remains a vexing problem for both patients and clinicians. In the current literature the incidence of symptomatic perineal hernia ranges from 7% to 30% [1–3]. A perineal hernia may cause discomfort, pain, wound healing problems, urogenital dysfunction and small bowel

obstruction [4–6]. Depending on the severity of symptoms, preference and experience of the surgeon, an elective repair is sometimes considered. In contrast to abdominal wall hernias, literature on perineal hernia repair is very limited.

Recurrence rates after surgical repair of a perineal hernia are high, and no consensus has been reached regarding the preferred method. Many options have been described, including primary

Sarah Sharabiany and Thomas P. A. Brouwer contributed equally.

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closure, biological and synthetic mesh closure and tissue flap reconstruction. Moreover, there are no recommendations on whether an abdominal, perineal or combined approach is best. To date, two systematic reviews have been conducted on this topic; these were published in 2012 and 2017 [7, 8]. Both studies were limited by small numbers and heterogeneity making any meaningful comparison between the outcomes of different techniques difficult. Surgical repair of symptomatic perineal hernia has increasingly gained attention, and several additional reports have been published since then.

Therefore, the aim of this systematic review was to compare outcomes between the different surgical techniques for perineal hernia repair after APR based on the most recent literature.

METHOD

Study design and participants

The inclusion criterion was all original studies describing success rates of surgical perineal hernia repair after either laparoscopic or open APR. Exclusion criteria were articles written in any language other than English, non-human population, age below 18 years, total population less than two, congenital perineal hernia and perineal hernia after sacrectomy or total pelvic exenteration. Papers published before the year 2000 were excluded to minimize the impact of technical developments over time. Also, patients who had had primary closure of a perineal hernia were excluded since this is no longer considered a valid surgical option [8]. The quality of studies was assessed using the Newcastle–Ottawa Scale (NOS). The protocol was prospectively registered in the Prospero database (registration number CRD42021274677). The systematic review was performed according to the AMSTAR2 checklist [9].

Systematic literature search

The electronic database of PubMed (1939–2021) was systematically searched with the help of a librarian. The following medical subject heading (MESH) terms were used: (“perineal” OR “perineum”) AND (“hernia”). All papers were screened for title and abstract to determine if they met the inclusion criterion. Eligible papers were retrieved and the full text was read to determine inclusion. All full-text papers were screened by two independent authors (SSH, TPAB). Any discrepancies between the two authors were resolved by a third author (GDM or PJT).

Primary and secondary outcomes

The primary outcome was recurrent perineal hernia. The different types of reconstruction were biological mesh closure, synthetic mesh closure, tissue flap reconstruction only and tissue flap reconstruction combined with mesh closure. Secondary outcomes were

the time interval between hernia repair and recurrence, and second recurrence.

Data extraction

Data extracted included gender, age, primary disease and neoadjuvant radiotherapy. Specifically, for perineal hernia repair we extracted approach and surgical technique, content of perineal hernia (e.g. small bowel, omentum), complications, follow-up duration, definition of recurrence and the recurrence rate. Time intervals between APR and repair of perineal hernia and between repair and recurrence were extracted, as well as the surgical technique for a redo for second recurrence.

Data from the included studies were extracted independently by three authors (SSH, TPAB, SIK). Any discrepancies were discussed amongst the three reviewers. If no consensus could be reached, a third author was consulted (GDM or PJT).

Data synthesis

Categorical data are presented using proportions and percentages. Numerical data were transformed from medians to means in order to calculate weighted means. For each method of perineal hernia reconstruction and approach to repair, a weighted average of the logit proportions was determined by the use of the generic inverse variance method and random effects model. Heterogeneity was assessed using I^2 and was considered significant if $I^2 > 75\%$. A p -value < 0.05 was considered statistically significant. Publication bias was assessed using a funnel plot. Analyses were performed with the use of RStudio Team (Integrated Development for R, RStudio Inc., 2019).

RESULTS

The search resulted in 872 papers, which were all screened by title and abstract. The Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) flow diagram is shown in [Figure 1](#) [3, 10–27]. A total of 19 studies, describing 172 patients, were included in this review ([Table 1](#)). Quality assessment was performed using the NOS ([Table S1](#)).

Patient characteristics and perineal hernia management

The mean age of the total cohort was 64 ± 5.6 years, and 48% (69/143) of patients were male. The indication for APR was predominantly cancer (99%, 170/172), and 94% (133/141) received neoadjuvant radiotherapy if preoperative therapy was reported. The time interval between APR and surgical repair was 42 ± 16.7 months. The surgical approach was an open perineal repair in 72% (106/147), which

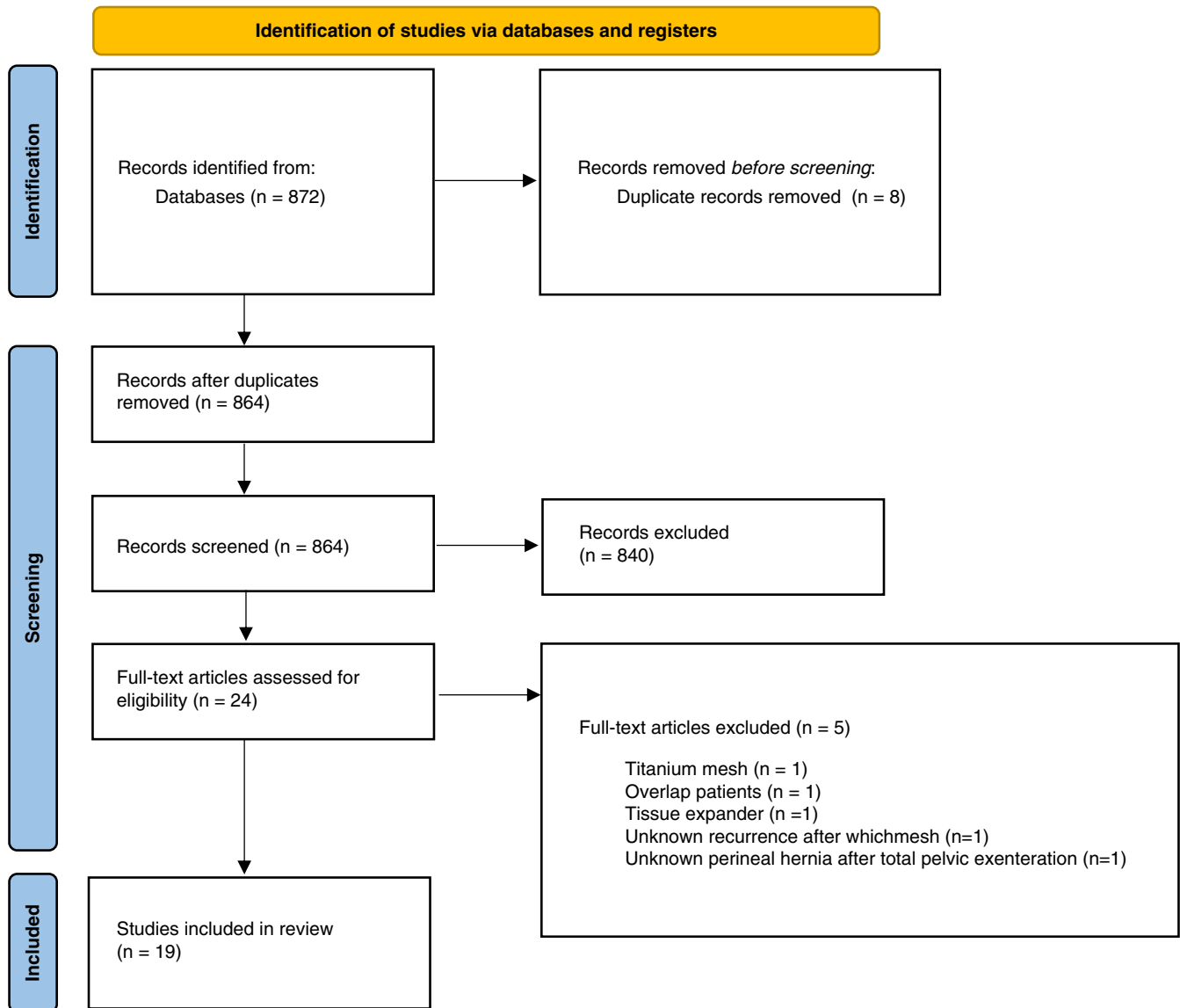


FIGURE 1 Flow diagram demonstrating the course of inclusion and exclusion of papers

was combined with an abdominal approach in 8% (8/106). In the remaining patients in whom the surgical approach was reported, a transabdominal laparoscopic [18% (27/147)] or transabdominal open repair [10% (14/147)] was performed. Synthetic mesh closure was applied in more than half of the included patients (54%, 93/172), followed by biological mesh closure (35%, 60/172). Tissue flap reconstruction, with and without mesh, was performed in 6% (10/172) and 5% (9/172), respectively. The meshes used in combination with tissue flap reconstruction were evenly distributed [synthetic mesh 50% (5/10), biological mesh 50% (5/10)]. Patient characteristics are presented in [Table 2](#).

Perineal hernia repair – pooled outcomes

Recurrent perineal hernia was assessed using physical examination only in four studies, a combination of physical and radiological examination

in five studies and was not defined in the remaining studies ([Table 1](#)). The pooled percentage of recurrent perineal hernia was 32% (95% CI: 26%–40%) after a total follow-up of 25 ± 10.6 months. The pooled recurrence rate was 39% (95% CI: 27%–52%) after biological mesh closure, 29% (95% CI: 21%–39%) after synthetic mesh closure, 37% (95% CI: 14%–67%) after only a tissue flap reconstruction and 9% (95% CI: 1%–45%) after tissue flap reconstruction combined with mesh. The pooled recurrence rates and follow-up data are presented in [Table 3](#). The corresponding forest plot is shown in [Figure 2](#).

When the perineal hernia was repaired through an abdominal approach, the pooled recurrence rate was 25% (95% CI: 14%–40%), which was 37% (95% CI 28%–47%) after a perineal approach and 19% (95% CI: 6%–49%) after a combined approach ([Table S2](#)).

Redo surgery was performed in 50% (25/50) of the patients who developed a recurrent perineal hernia. Second repair was predominantly performed using synthetic mesh closure (76%, 19/25), followed by primary closure (8%, 2/25), biological mesh closure (8%,



TABLE 1 Included studies

Study	Year	No. of patients	Study design	Type of repair	n	Recurrence	Definition of recurrence	Complications	Type complication and treatment
Morales-Cruz et al.	2021	10	Cohort	Synthetic mesh	10	3	Clinical examination and radiological assessment	2	One seroma (conservative), one small bowel obstruction (conservative)
Yamamoto et al.	2021	2	Cohort	Tissue flap + mesh ^a	2	0	Not defined	1	One seroma (percutaneous drainage)
Bertrand et al.	2020	21	Cohort	Biological mesh	15	7	Clinical examination	4	Missing
				Synthetic mesh	5	2		1	Missing
				Tissue flap only ^a	1	0		0	n.a.
Blak et al.	2020	34	Cohort	Biological mesh	13	7	Clinical examination	4	Two wound infections (one percutaneous drainage, one conservative), one wound dehiscence (conservative), one small bowel perforation (operative)
				Synthetic mesh	13	5		6	Four wound infections (three percutaneous drainage, one conservative), two fistulas (conservative)
Jafari et al.	2020	6	Case serie	Tissue flap + mesh ^a	8	0		0	n.a.
				Biological mesh	6	3	Clinical examination and radiological assessment	1	One urinary retention (conservative)
Coelho et al.	2019	4	Case serie	Tissue flap only ^a	4	2	Clinical examination and radiological assessment	0	n.a.
Hassan et al.	2019	3	Case serie	Synthetic mesh	3	0	Not defined	1	One small bowel obstruction (conservative)
Yasukawa et al.	2018	2	Case serie	Synthetic mesh	2	0	Not defined	0	n.a.
Levic et al.	2017	17	Cohort	Biological mesh	16	4	Clinical examination	1	One wound infection (conservative)
Li et al.	2017	2	Case serie	Tissue flap only ^a	1	1		0	n.a.
				Synthetic mesh	2	0	Clinical examination and radiological assessment	0	n.a.
Goedhart et al.	2016	12	Cohort	Synthetic mesh	12	3	Not defined	0	n.a.

TABLE 1 (Continued)

Study	Year	No. of patients	Study design	Type of repair	n	Recurrence	Definition of recurrence	Complications	Type complication and treatment
Allen et al.	2015	6	Case serie	Synthetic mesh	6	0	Not defined	2	One seroma (percutaneous drainage), one small bowel obstruction (operative)
Sayers et al.	2015	8	Case serie	Biological mesh	5	1	Not defined	missing	n.a.
Suzuki et al.	2015	2	Case serie	Tissue flap only ^a	3	1	Not defined	Missing	n.a.
Abbas et al.	2014	6	Case serie	Synthetic mesh	2	1	Not defined	0	n.a.
			Case serie	Biological mesh	2	0	Not defined	Missing	n.a.
				Synthetic mesh	4	0		Missing	n.a.
Martijnse et al.	2012	29	Cohort	Synthetic mesh	29	9	Clinical examination	5	Two urinary retention, one wound infection, one seroma, one fistula (all conservative)
Veenhof et al.	2007	2	Case serie	Synthetic mesh	2	1	Clinical examination and radiological assessment	1	One small bowel obstruction (conservative)
Dullucq et al	2006	3	Case serie	Synthetic mesh	3	0	Not defined	0	n.a.
De Campos et al	2005	3	Case serie	Biological mesh	3	0	Not defined	0	n.a.

Abbreviation: n.a., not applicable.

^aIncludes sub-, fascio- and musculocutaneous flaps.

TABLE 2 Patient characteristics

Variable	Missing data (%)	n(%) or mean ± SD
Sex (male)	29/172 (17)	69/143 (48)
Age (years)	32/172 (19)	64 ± 5.6
Primary disease	0/172 (0)	
Cancer		170/172 (99)
Inflammatory		1/172 (1)
Functional		1/172 (1)
Neoadjuvant therapy	31/172 (18)	
Radiotherapy		133/141 (94)
Short-course radiotherapy		18/133 (14)
Long-course radiotherapy		94/133 (71)
Type not specified		21/133 (16)
Interval between APR and perineal hernia repair (months)	72/172 (42)	42 ± 16.7
Content hernia ^a	101/172 (59)	
Small bowel		38/71 (54)
Colon		2/71 (3)
Bladder		9/71 (13)
Uterus		9/71 (13)
Omentum		33/71 (47)
Approach to hernia repair	25/172 (15)	
Perineal open		98/147 (67)
Abdominal laparoscopic		27/147 (18)
Abdominal open		14/147 (10)
Combined (abdominoperineal)		8/147 (5)
Type of perineal hernia repair	0/172 (0)	
Biological mesh		60/172 (35)
Synthetic mesh		93/172 (54)
Tissue flap only ^b		9/172 (5)
Tissue flap + mesh ^b		10/172 (6)

Abbreviation: APR, abdominoperineal resection.

^aA combination could be possible in one patient.

^bIncludes sub-, fascio- and musculocutaneous flaps.

2/25) and solely tissue flap reconstruction (8%, 2/25; Table 3). The pooled percentage of a second recurrence after redo surgery was 44% (95% CI: 20%–71%) after synthetic mesh closure. In the two patients with biological mesh closure one developed a second recurrence compared with none of the two patients with solely tissue flap reconstruction. The second recurrence rate in the two patients with primary closure was not reported.

DISCUSSION

This systematic review with pooled analyses showed that literature on perineal hernia repair after APR is still limited, with several small

TABLE 3 Perineal hernia repair – pooled outcomes

Type of repair	n (%)	Pooled recurrence (%) (95% CI)	Mean time to recurrence (months) ± SD	Missing data, n (%)	Mean total follow-up (months) ± SD	Missing data, n (%)	Type of redo repair	n (%)	Pooled second recurrence (%) (95% CI)
Total	172/172 (100)	32 (26–40)	17 ± 5.5	16/49 (33)	25 ± 10.6	44/172 (26)	Total	25/25 (100)	41 (21–65)
Biological mesh	60/172 (35)	39 (27–52)	14 ± 5.1	12/22 (55)	33 ± 18.4	36/60 (60)	Primary closure	2/25 (8)	Missing
Synthetic mesh	93/172 (54)	29 (21–39)	18 ± 5.6	3/24 (13)	21 ± 7.2	7/93 (8)	Biological mesh	2/25 (8)	50 (6–94)
Tissue flap only ^a	9/172 (5)	37 (14–67)	12 ± 0.0	1/3 (33)	n.a.	9/9 (100)	Synthetic mesh	19/25 (76)	44 (20–71)
Tissue flap + mesh ^a	10/172 (6)	9 (1–45)	n.a.	n.a.	27 ± 20.4	0/10 (0)	Tissue flap only ^a	2/25 (8)	17 (1–81)

Abbreviation: n.a., not applicable.

^aIncludes sub-, fascio- and musculocutaneous flaps.

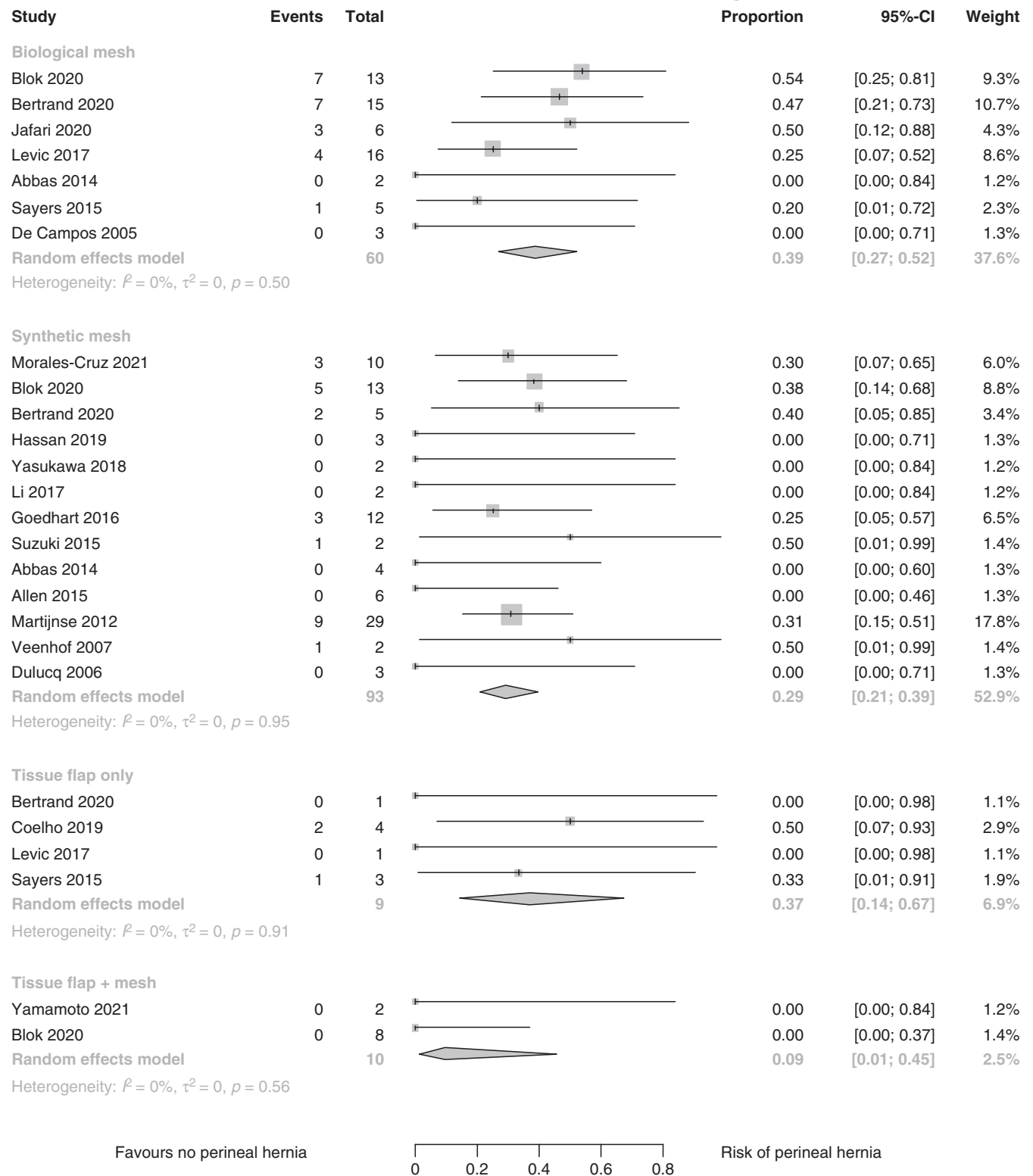


FIGURE 2 Forest plot showing the effect of type of perineal hernia repair (biological mesh, synthetic mesh, tissue flap only and tissue flap + mesh) on the risk of recurrence of perineal hernia

case series. Synthetic mesh closure was most frequently used. The pooled outcomes revealed that biological and synthetic mesh closure resulted in comparable high recurrence rates. Although only small numbers were available, tissue flap reconstruction seemed

only to be valuable when combined with mesh closure. So far no recurrences have been reported after perineal hernia repair using the combination of a tissue flap and mesh in nine patients.

The perineal hernia recurrence rate was the highest after biological mesh repair, which might be explained by the inherent features of biological mesh. However, if it was only the loss of strength of a biological mesh that causes recurrent hernias, one would expect much better results after synthetic mesh. In addition, the difference in follow-up duration between the biological (33 ± 18.4 months) and synthetic mesh (21 ± 7.2 months) group must be taken into consideration, since perineal hernias develop gradually over time. Therefore, the high recurrence rates are more likely related to the bridging type of repair, without the possibility of reinforcing a layer of fascia or any other type of tissue. This makes a perineal hernia essentially different from a ventral abdominal wall hernia.

Our previous systematic review published by Mjoli et al. included 36 studies between 1944 and 2010 with 40 individually documented patients who underwent surgical repair, and we added three patients from our institution [8]. At that time, we just summarized the scarcely available literature based on a remarkably low number of patients from papers published over a 66-year period. Balla et al. [7] included 21 studies with 108 patients in the period 2012–2016 and made an historical comparison with our pooled analysis of literature between 1944 and 2011. This revealed that the perineal approach was still most commonly used, that laparoscopy was replacing the open abdominal approach, that primary closure had been abandoned and that the use of flap reconstruction significantly increased. But recurrence rates in the more recent literature were no lower.

The total pooled recurrence rate in our study was found to be higher than in the previously performed reviews [7, 8]. An explanation for this might be the mainly incidental reports of single cases before 2010 that are at high risk of publication bias, while the more recently published small case series and cohort studies are probably more representative of true technical success. In addition, we excluded all case reports in the present review. Another explanation is related to follow-up duration. Mjoli et al. [8] already argued that the focus of the included historical papers was on the technical aspects of repair, with limited follow-up duration and lack of data on long-term outcomes. Blok et al. [12] found that the recurrence rate doubled after 12 months of follow-up, emphasizing the importance of sufficient follow-up duration to reliably assess the success of perineal hernia correction.

Four studies described a total of nine patients with tissue flap reconstruction of the pelvic floor, of whom four (44%) developed a recurrence [3, 13, 14, 18]. Tissue flaps alone might not provide enough strength, with a relatively high risk of a recurrent hernia. This is in line with a comparative cohort study from Denmark including 57 patients who underwent extralevator APR with immediate perineal reconstruction using a gluteal flap in 33 and a biological mesh in 24 patients [28]. A perineal hernia developed in seven patients with a flap (21%) after median 3.2 years of follow-up, while no perineal hernias were observed after median of 1.7 years in the biological mesh group. Therefore, mesh-only and flap-only reconstructions, regardless of the technique, seem to be insufficient to repair perineal hernias.

In the studies of Yamamoto et al. and Blok et al., tissue flap reconstruction was combined with mesh closure [10, 12]. None of the

total of 10 patients had a recurrence after a mean follow-up duration of 27 months. This suggests that combining the two methods of reconstruction might improve outcomes compared with the results of each of the techniques alone. This also makes sense from a theoretical perspective, because a mesh provides strength and a flap fills a soft tissue defect. After mesh-only reconstruction of the pelvic floor at the level of the transected levator muscles, a dead space remains at the level of the prior anal canal. Subsequently closing the subcutaneous fat and skin in the midline might not properly fill this dead space, or results in too much tension. This can lead to an accumulation of fluid, and subsequently the risk of pelvic and perineal infections. Wound complications in general are associated with a higher risk of developing a hernia [29]. A tissue flap reconstruction of the perineal defect following mesh repair provides a tension-free closure with optimal support of the mesh by well-vascularized tissue that potentially improves ingrowth. However, patient numbers are small, and the hypothetical advantages of a combined technique have to be confirmed in larger series.

This systematic review has several limitations. A major weakness is the large number of small case series, with almost half of the included studies (9 of 19) describing four or fewer patients. However, in recent years a few larger studies have been published which were not included in the previously performed systematic review of Balla et al. [7]. Furthermore, this is the first review in which recurrence rates have been pooled for type of perineal hernia repair (i.e. biological mesh, synthetic mesh, tissue flap only, combined tissue flap and mesh) [7, 8]. The quality assessment of the studies had some limitations, in particular due to the lack of a control group. Furthermore, in 10 studies there was no clear definition of a recurrent perineal hernia. In addition, studies did not examine the downsides of different perineal hernia repair techniques, for example mesh infection, small bowel fistula and donor site morbidity or flap necrosis in the case of tissue flap reconstruction. Besides, we were not able to correct for predisposing factors for perineal hernia between the different surgical closure techniques (e.g. smoking, hysterectomy, wound complications after APR, omentoplasty).

Regarding the implications for clinical practice, a synthetic mesh might be considered to be the first choice in noncontaminated perineal hernia repair, given similar pooled recurrence rates, lower costs compared with a biological mesh and no concerning data on mesh infections. Following mesh reconstruction of the pelvic floor, one might consider closure of the perineal subcutaneous fat and skin by using a fasciocutaneous transposition or rotation flap on hypothetical grounds and supported by currently available evidence, although of low quality.

CONCLUSION

This study has shown that synthetic and biological mesh closure are the most frequently used techniques for perineal hernia repair, preferably using a perineal approach. However, recurrence rates are high after both types of mesh. Tissue flap reconstruction only also appeared to be insufficient, while tissue flap reconstruction combined with a mesh seemed to be promising in preventing

recurrences after perineal hernia repair. However, numbers were low, indicating the need for large prospective studies or randomized controlled trials.

AUTHOR CONTRIBUTION

All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by Sarah Sharabiany, Thomas P.A. Brouwer and Saskia I. Kreisel. The first draft of the manuscript was written by Sarah Sharabiany, Thomas P.A. Brouwer, Saskia I. Kreisel, Gijsbert D. Musters and Pieter J. Tanis and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest.

DATA AVAILABILITY STATEMENT

Data are available from the authors upon reasonable request.

ETHICS STATEMENT

This study has been approved by the medical ethical committee of the UMC – location AMC – and has therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments.

PERMISSION TO REPRODUCE MATERIAL FROM OTHER SOURCES

There was no reproduced material used from other sources in this article.

CLINICAL TRIAL REGISTRATION

Prospero database, registration number CRD42021274677.

ORCID

Sarah Sharabiany <https://orcid.org/0000-0003-2222-2037>

REFERENCES

- Musters GD, Klaver CEL, Bosker RJI, Burger JWA, van Duijvendijk P, van Etten B, et al. Biological mesh closure of the pelvic floor after extralevator abdominoperineal resection for rectal cancer: a multicenter randomized controlled trial (the BIOPEX-study). *Ann Surg.* 2017;265(6):1074–81.
- Habr-Gama A, São Julião GP, Mattacheo A, de Campos-Lobato LF, Aleman E, Vailati BB, et al. Extralevator abdominal perineal excision versus standard abdominal perineal excision: impact on quality of the resected specimen and postoperative morbidity. *World J Surg.* 2017;41(8):2160–7.
- Sayers AE, Patel RK, Hunter IA. Perineal hernia formation following extralevator abdominoperineal excision. *Colorectal Dis.* 2015;17(4):351–5.
- Tomohiro K, Tsurita G, Yazawa K, Shinozaki M. Ileal strangulation by a secondary perineal hernia after laparoscopic abdominoperineal rectal resection: a case report. *Int J Surg Case Rep.* 2017;33:107–11.
- Kakiuchi D, Saito K, Mitsui T, Munemoto Y, Takashima Y, Amaya S, et al. Laparoscopic repair of a large perineal hernia after laparoscopic abdominoperineal resection: a case report. *Asian J Endosc Surg.* 2019;12(2):204–6.
- Harris CA, Keshava A. Education and imaging. Gastrointestinal: laparoscopic repair of acute perineal hernia causing complete small bowel obstruction. *J Gastroenterol Hepatol.* 2015;30(12):1692.
- Balla A, Batista Rodriguez G, Buonomo N, Martinez C, Hernandez P, Bollo J, et al. Perineal hernia repair after abdominoperineal excision or extralevator abdominoperineal excision: a systematic review of the literature. *Tech Coloproctol.* 2017;21(5):329–36.
- Mjoli M, Sloothak DA, Buskens CJ, Bemelman WA, Tanis PJ. Perineal hernia repair after abdominoperineal resection: a pooled analysis. *Colorectal Dis.* 2012;14(7):e400–6.
- Shea BJ, Reeves BC, Wells G, Thuku M, Hamel C, Moran J, et al. AMSTAR 2: a critical appraisal tool for systematic reviews that include randomised or non-randomised studies of healthcare interventions, or both. *BMJ.* 2017;358:j4008.
- Yamamoto S, Hamuro A, Nagahara H, Motomura H, Koyama M, Tachibana D. Long-term follow up in two cases of pelvic reconstruction using a combined VRAM flap-sacrocolpopexy for severe perineal hernia after abdominoperineal resection. *J Obstet Gynaecol Res.* 2022;48(2):510–4.
- Morales-Cruz M, Oliveira-Cunha M, Chaudhri S. Perineal hernia repair after abdominoperineal rectal excision with prosthetic mesh – a single surgeon experience. *Colorectal Dis.* 2021;23:1569–72.
- Blok RD, Brouwer TPA, Sharabiany S, Musters GD, Hompes R, Bemelman WA, et al. Further insights into the treatment of perineal hernia based on the experience of a single tertiary centre. *Colorectal Dis.* 2020;22(6):694–702.
- Bertrand K, Lefevre JH, Creavin B, Luong M, Debove C, Voron T, et al. The management of perineal hernia following abdominoperineal excision for cancer. *Hernia.* 2020;24(2):279–86.
- Coelho JAJ, McDermott FD, Cameron O, Smart NJ, Watts AM, Daniels IR. Single centre experience of bilateral gracilis flap perineal reconstruction following extra-levator abdominoperineal excision. *Colorectal Dis.* 2019;21(8):910–6.
- Hassan L, Beunis A, Ruppert M, Dhooghe V, Van den Broeck S, Hubens G, et al. Perineal hernia mesh repair: a fixation with glue, sutures and tacks. How to do it. *Acta Chir Belg.* 2019;119(6):406–10.
- Jafari M, Schneider-Bordat L, Hersant B. Biological mesh used to repair perineal hernias following abdominoperineal resection for anorectal cancer. *Ann Chir Plast Esthet.* 2020;65(4):e15–21.
- Yasukawa D, Aisu Y, Kimura Y, Takamatsu Y, Kitano T, Hori T. Which therapeutic option is optimal for surgery-related perineal hernia after abdominoperineal excision in patients with advanced rectal cancer? A report of 3 thought-provoking cases. *Am J Case Rep.* 2018;19:663–8.
- Levic K, Rosen KV, Bulut O, Bisgaard T. Low incidence of perineal hernia repair after abdominoperineal resection for rectal cancer. *Dan Med J.* 2017;64(7):A5383.
- Li J, Zhang W. How we do it: repair of large perineal hernia after abdominoperineal resection. *Hernia.* 2017;21(6):957–61.
- Goedhart-de Haan AM, Langenhoff BS, Petersen D, Verheijen PM. Laparoscopic repair of perineal hernia after abdominoperineal excision. *Hernia.* 2016;20(5):741–6.
- Suzuki T, Suwa K, Hanyu K, Ushigome T, Okamoto T, Yanaga K, et al. Topic: perineal reconstruction. *Hernia.* 2015;19(Suppl 1):S313–4.
- Abbas Y, Garner J. Laparoscopic and perineal approaches to perineal hernia repair. *Tech Coloproctol.* 2014;18(4):361–4.



23. Allen SK, Schwab K, Day A, Singh-Ranger D, Rockall TA. Laparoscopic repair of postoperative perineal hernia using a two-mesh technique. *Colorectal Dis.* 2015;17(3):O70–3.
24. Martijnse IS, Holman F, Nieuwenhuijzen GA, Rutten HJ, Nienhuijs SW. Perineal hernia repair after abdominoperineal rectal excision. *Dis Colon Rectum.* 2012;55(1):90–5.
25. Veenhof AA, van der Peet DL, Cuesta MA. Perineal hernia after laparoscopic abdominoperineal resection for rectal cancer: report of two cases. *Dis Colon Rectum.* 2007;50(8):1271–4.
26. Dulucq JL, Wintringer P, Mahajna A. Laparoscopic repair of postoperative perineal hernia. *Surg Endosc.* 2006;20(3):414–8.
27. de Campos FG, Habr-Gama A, Araujo SE, Sousa AH Jr, Nahas CR, Lupinacci RM, et al. Incidence and management of perineal hernia after laparoscopic proctectomy. *Surg Laparosc Endosc Percutan Tech.* 2005;15(6):366–70.
28. Christensen HK, Nerstrom P, Tei T, Laurberg S. Perineal repair after extralevator abdominoperineal excision for low rectal cancer. *Dis Colon Rectum.* 2011;54(6):711–7.
29. Walming S, Angenete E, Block M, Bock D, Gessler B, Haglind E. Retrospective review of risk factors for surgical wound dehiscence and incisional hernia. *BMC Surg.* 2017;17(1):19.

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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