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Is it safe not to fix the mesh in an open incisional hernia repair? Literature review

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Abstract

Introduction Review the articles with incisional hernia repair without mesh fixation in open hernia repair.

Methods A systematic search of the literature published from 01/01/2008 to 31/12/2023 was performed using Medline PubMed, Cochrane Library, and Google Scholar databases. The search used the keywords: *incisional hernia*, *open mesh repair*, *and without mesh fixation.*

Results Nine publications were identified for the present analysis. The quality of each study was assessed. Information about operative methods, main results, conclusions, and recommendations was collected.

Conclusions According to the results and findings of reviewed articles, postoperative abdominal wall hernia repair without mesh suturing is safe and can improve postoperative results. Still, there is insufficient evidence to determine whether it is associated with better outcomes than hernia repair with mesh fixation. Further clinical studies are needed to clarify whether this method is clinically essential.

Keywords Incisional hernia, Open mesh hernia repair, Without mesh fixation

Introduction

Incisional (postoperative abdominal wall) hernia is a common complication of abdominal surgery. Its incidence varies from 4 to 20% using various surgical techniques [1–3].

The only and most effective method of treating such hernias is surgery [2]. The main task of postoperative hernia treatment is to eliminate the abdominal wall hernia sack and perform abdominal wall plastic surgery in a way that prevents the hernia from recurring. According to the literature, the most effective treatment method is abdominal wall plastic surgery by implanting an alloplastic material - a synthetic mesh [4, 5]. Hernia recurrence rates for postoperative hernia repair with non-mesh hernia repair range from 14 to 46% and 11–25% with mesh [4, 6].

Several methods are used to implant the mesh into the abdominal wall: "onlay" - the mesh is fixed on the external rectus abdominis muscle; "inlay" - the mesh is fixed between the rectus muscles of the abdominal wall; "sublay" - the mesh is fixed under the muscles of the abdominal wall, on the peritoneum or the posterior leaflet of the aponeurosis (retromuscular or preperitoneal position) and "underlay", when the mesh is implanted under the peritoneum (this technique is used during laparoscopic surgery) [6–8].

Each method has its positive and negative characteristics: the results of the operations, the volume of tissue dissection, the types and sizes of the mesh, and the time and operation costs are different. Until now, it has been debated which of the methods is better, but the more common and recommended is the "sublay" method of fixing the mesh by sewing it to the tissues [9, 10].

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Currently, laparoscopic hernia operations are widely used, during which the mesh is not fixed. This has encouraged surgeons not to fixate the mesh during open hernia repair operations. The first publications appeared when the mesh was not sutured and fixed only with fibrin glue [11–13]. Subsequently, articles have been published that review the results of the operations using self-fixation meshes [14–16]. The self-gripping mesh is a polyester mesh with unique polypropylene loops that distribute even adhesion to the surface (for example, Covidien ProGrip, Medtronic ProGrip and Parietex ProGrip meshes).

According to the literature, using the method with mesh suturing requires a broader distribution of the abdominal wall tissues, which increases the operative time and costs, causes more postoperative pain, prolongs the hospitalization time, and increases the cost of treatment.

To investigate whether non-mesh fixation of postoperative hernias is a safe treatment method with potential advantages over mesh-suture operations, we conducted a systematic literature review looking for studies comparing two types of surgery, with and without traditional mesh fixation (fixing the mesh with suture).

Methods

A systematic literature review was conducted in MEDLINE, PubMed, Google Scholar, and Cochrane Library databases. Articles published from 01/01/2008 to 12/31/2023 were selected and analyzed. The search used the following keywords: incisional hernia, open mesh repair, and without mesh fixation. The sources cited in the articles in question were also reviewed. Articles in non-peer-reviewed journals and dissertations were excluded from the systematic review.

A total of 7820 publications were found according to the keywords.

Articles dealing with laparoscopic hernia repair, hernia surgery without mesh, and mesh fixation with the suture were later removed. Nine articles meeting all the selection criteria (incisional hernia, open mesh repair, without mesh fixation) were selected and analyzed for systematic analysis. Both authors screened the selected articles, analyzed them, and rejected articles unsuitable for the study.

The scheme of selection of scientific publications can be seen in Fig. 1.

Data from analysed articles were extracted, collated, and tabulated in an Excel spreadsheet before the reviewers decided which data to collect and review. Both reviewers assessed the data separately.

Results

The main comparative data of the analyzed articles according to the previously mentioned research methodology is presented in Tables 1 and 2.

In their retrospective study, J. Verhelst [14] examined 28 patients operated on by the Rives-Stopa technique using Parietex Progrip (PP) mesh. Patients were followed for 12 weeks. Patients with postoperative abdominal wall hernias of various sizes operated on from 2012 to 2014 were included in the study. The researchers found 28.6% of complications, 17.9% of which were seromas. They also note that there was a low level of postoperative pain after operations with Parietex Progrip mesh, and there were no recurrences during the follow-up period. The study had a lot of limitations - a very small sample, a short follow-up period, and a retrospective, non-randomized study. The researchers conclude that the PP mesh placed in a retromuscular position is safe and feasible for open incisional hernia repair with minimal postoperative sequela and no recurrences within the short-term follow-up.

Steven B. Hopson [15] reported their prospective study of 20 patients undergoing “onlay” hernia repair using Covidien Progrip mesh. The study was conducted on patients operated from 2012 to 2013. Patients with large postoperative hernias were operated on with follow-up for 24 months. The authors indicate that the average time of the operations was 38 min, and the mesh fixation lasted 2 min on average. The study’s results showed little postoperative pain after 1 month and a year later, and after 2 years, the patients did not notice it at all. The authors state that they had only one case of seroma, but no recurrences were observed. The study had limitations - a small sample size and no comparison with other hernia repair methods. In their conclusions, the authors state that open repair using a self-gripping mesh is a viable treatment option in patients with large incisional hernias.

I.Khansa [16] published a retrospective comparative study in which they compared 26 patients who underwent “sublay” hernia repair using a conventional mesh with fixation by sutures and “sublay” hernia repair using self-adhering mesh. The patients were observed for about 600 days. Hernia width was similar in both compared groups (7.9 vs. 7.5). Comparing the two groups, it was found that the hospital stay was shorter in the traditional grid group (5 vs. 5.6), but the using of narcotic drugs was lower in the self-adhering group (133.1 vs. 66.5). According to the study authors, no postoperative complications and recurrences were observed in both groups. Limitations of the study– small sample size, retrospective, non-randomized study. The authors’ conclusions state that self-adhering mesh repair has favourable outcomes, with low complications and hernia recurrence rates. Moreover, there are lower narcotic needs compared with patients who received transfascially sutured mesh. No patients developed chronic abdominal wall pain after hernia repair in either group.

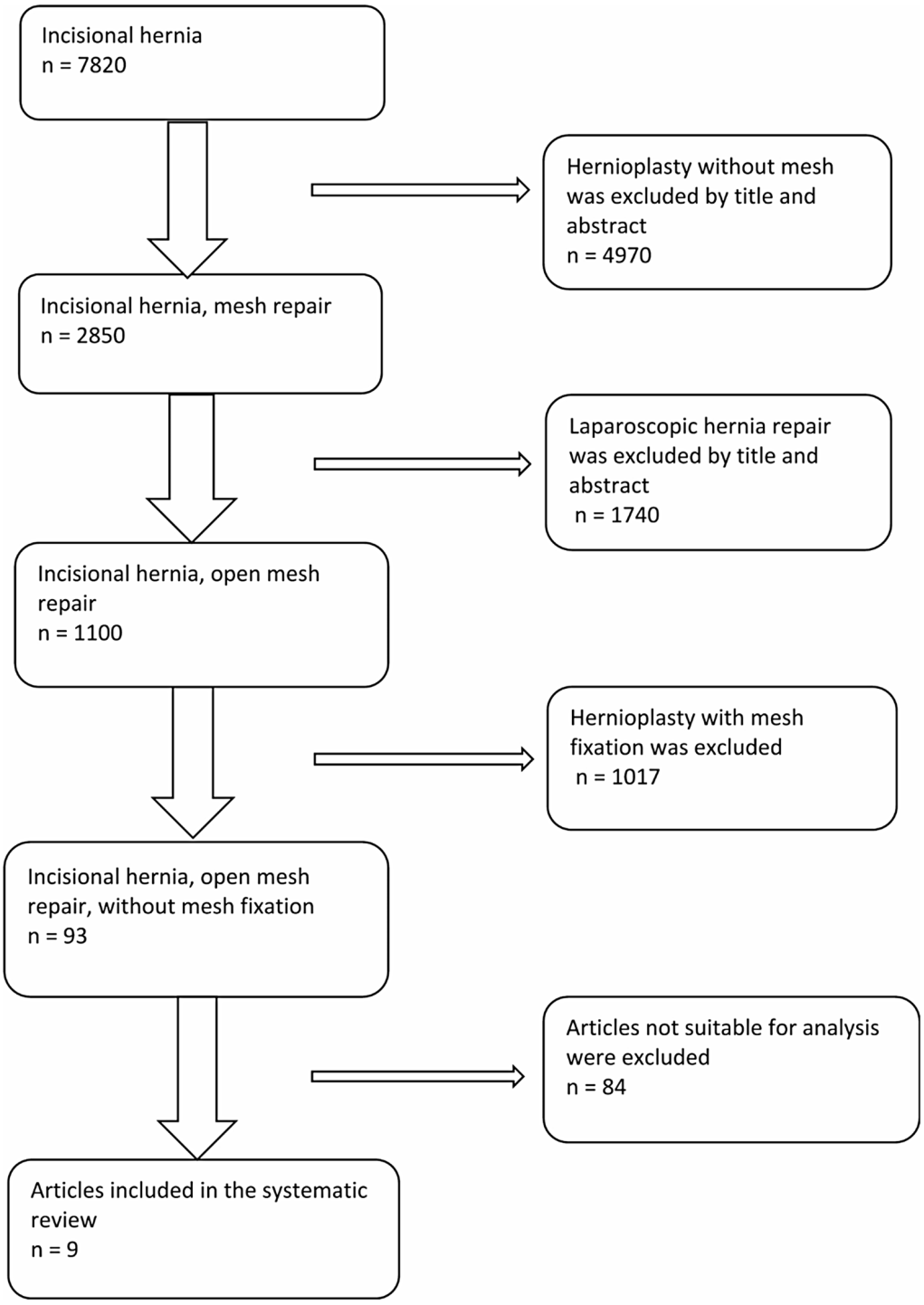

Fig. 1 Scheme of selection of scientific publications

J. Bueno-Ledo [17] published an article on prospective comparative non-randomized study. Two groups were compared - patients operated on Rives-Stoppa with self-gripping mesh and Rives-Stoppa using conventional mesh with fixation. During the study, 50 patients were examined (25 in both groups). Patients were observed postoperatively for an average of 13 months. During the study, the operation times were compared; the time of operations with self-gripping meshes was shorter (101 min vs. 121 min). Postoperative pain was compared, which was lower in the early period in the self-gripping mesh group (4.9 vs. 8.1 in 48 h, 3.1 vs. 4.3 after 48 h). The study results indicate that postoperative complications were less prevalent in the self-gripping group (11.1% vs.

Table 1 Comparison of received studies

Research/ article (authors, year)	Type of Research	Number of subjects	Mesh implantation methodology and fixation	Follow up period	Hospital stays (days)	Hernia defect size	Time of surgery (minutes)	Time of mesh fixation (minutes)
Verhelst J. 2014	Retrospective single-centre cohort study	28	Rives-Stoppa, Parietex Progrip mesh	12 weeks	5 (4–7)	0–4,99 cm (29%), 5–9,99 cm (21%), > 10 cm (46%)	-	-
Steven B. Hobson 2015	Prospective case series study	20	Onlay Covidien ProGrip mesh	24 months	2	Large size (84 ± 28 cm^2)	38 (21–66)	2 (1–5)
Khansa I. 2016	Retrospective study	26 (12 vs. 14)	Sublay, mesh with transfascial sutures vs. Self-gripping mesh	587 days vs. 612 days	5 vs. 5,6	7,9 (4,1–14,2) cm	-	-
Bueno-Ledo J. 2017	Prospective comparative non-randomized study	50 (25 vs. 25)	Rives-Stoppa, self-gripping mesh vs. PPL mesh fixed with sutures	13 (12–20) months	5,8 ± 2,2 vs. 6,6 ± 2,9	86 cm^2 ± 28 vs. 85 cm^2 ± 22	101 ± 29,5 vs. 121 ± 39,8	-
Kroese LF 2017	Retrospective single-centre cohort study	46	Rives-Stoppa, self-gripping mesh	25 months	5 (4,75 – 7)	0–4,99 cm (26%), 5–9,99 cm (35%), > 10 cm (37%)	-	-
Schembari E. 2020	Retrospective single-centre study	37	Sublay, Medtronic ProGrip mesh	18,1 ± 6,7 (10–39) months	5 (3–12)	< 4 cm (10,8%), 4–10 cm (51,4%), > 10 cm(37,8%)	-	-
Harpain F. 2020	Retrospective single-centre study	244 (127 vs.117)	Sublay, self-gripping mesh vs. non-self-gripping mesh	11 months	7(5–9) vs. 7 (5–8,5)	Mean size: 9 cm vs. 10 cm	126 vs. 140	-
Witkowski P. 2007	Prospective study	111 (85 - incisional)	Sublay, without fixation	24 months	-	103 ± 49 cm^2, < 5 cm (12%), 5–10 cm (38%), 10–15 cm (30%), > 15 cm (19%)	96 ± 32	23 ± 12
Gondal S.H. 2014	Prospective randomized comparative study	64 (32 vs.32)	Group A: Sublay without mesh fixation Group B: Onlay with mesh fixation	12 months	2,25 ± 0,8 vs. 3,96 ± 1,92	-	-	-

27.3%); both groups had no recurrences. Limitations of the study - short follow-up period. The authors point out that Rives-Stoppa repair using a self-gripping mesh is a viable treatment option in patients with incisional hernia, Progrip mesh causes less postoperative pain in the first 48 h.

Leonard F. Kroese [18], in their publication, described a retrospective cohort study conducted at Erasmus University in the Netherlands. The study included 46 patients operated on for postoperative abdominal wall hernia by Rives-Stoppa hernia repair using self-gripping mesh. The research lasted from 2012 to 2015, with a follow-up of 25 months. Patients with hernias of various sizes were operated on. The authors distinguished a low level of pain in the early postoperative period but also noted that there were 22% postoperative complications (21% seroma formation), and one patient (5.1%) had a hernia recurrence. Study limitations– retrospective study without comparison of groups and a relatively small sample. In the conclusions, the authors state that this study shows the promising use of the Progrip mesh for complex ventral hernia, sutures or tackers can be avoided.

E. Schembari [19] studied patients who underwent sublay surgery using Medtronic Progrip mesh in their retrospective study. The study was conducted from 2016 to 2018, and 37 patients were included. The average follow-up was 18 months, and cases with various sizes of hernias were studied. It is noted that there were 16.2% complications, including 5.4% seromas and 8.1% recurrences. Study limitations– retrospective study and small study sample size. In the conclusions, the authors state that this technique's major advantage is the mesh's easy and rapid placement, which does not require fixation points.

F. Harpain [20] presented an article in which they described their work and conclusions. From 2011 to 2018, a retrospective comparative study was conducted at the Department of Surgery of the University of Vienna, in which 244 patients (218 patients - with incisional hernia) participated and were divided into two groups: "sublay" hernia repair using self-gripping mesh and "sublay" hernia repair using a non-fixing mesh with fixation by sutures. Follow-up was of 11 months. The research results noted that when comparing both groups, a shorter operation time was determined in the self-gripping mesh group (126 min vs. 140 min). At the same time, the frequency of complications was higher in the self-gripping mesh group (28.3% vs. 13.7%), including seromas (17.3%

Table 2 Comparison of received studies (2)

Research/ article (authors, year)	Postoperative complications (%)	Postoperative pain (VAS)	Seroma	Recurrence	Limitations	Conclusions
Verhelst J. 2014	28,6	Low	5 (17,9%)	0	Retrospective study, small sample size, short follow up	A study shows that the PPmesh placed in a retromuscular position appears to be safe and feasible for open incisional hernia repair with minimal postoperative sequela and no recurrences in the short-term follow-up.
Steven B. Hopson 2015	0	1,8 ± 2,0 0,9 ± 1,7 at month 0,7 ± 1,7 at 1 year 0 at 2 years	1 (5%)	0	A small sample size, no comparison with other techniques	Open repair using a self-gripping mesh is a viable treatment option in patients with large incisional hernias.
Khansa I. 2016	0	-	0	0	Retrospective study, small sample size	Hernia repair using self-adhering mesh has favourable outcomes, with low complications and hernia recurrence rates. Also, there are lower narcotic needs compared with patients who received transfascially sutured mesh. No patients developed chronic abdominal wall pain after hernia repair in either group.
Bueno-Ledo J. 2017	11,1 vs. 27,3	4,9 ± 2,1 / 8,1 ± 2 (< 48 h) 3,1 ± 2,3 / 4,3 ± 3,5 (> 48 h) 2,1 ± 1 / 2,3 ± 1,1 (1 month) 1,3 ± 0,5 / 1,1 ± 1 (3 months) 0/0 (6 months)	2 (8%) vs. 3 (12%)	0	Short follow-up, to short time for recurrences	River-Stoppa repair using a self-gripping mesh is a viable treatment option in patients with incisional hernia. Progrip mesh causes less postoperative pain in the first 48 h.
Kroese LF 2017	22	38 (82,6%) without pain. 3 (6,5%)– mild pain, 4 (8,7%) moderate pain, 1 (2,2%)– severe pain	10 (21,7%)	1 (5,1%)	Retrospective study, small sample size	This study shows the promising use of the ProGrip mesh for complex ventral hernia. Sutures or tackers can be avoided.
Schembari E. 2020	16,2	-	2 (5,4%)	3 (8,1%)	Retrospective study, small sample size,	The major advantage of this technique is the easy and rapid placement of the mesh, which does not require fixation points.
Harpain F. 2020	28,3 vs. 13,7	-	22 (17,3%) vs. 8 (6,8%)	3 (2,4%) vs. 3 (2,6%)	Retrospective single-centre study All types of ventral hernia were compared	The self-gripping ProGrip mesh placed in retromuscular position in ventral hernia repair can be associated with an increased complication rate.
Witkowski P. 2007	12,6	4 (1–8)	4 (3,6%)	2 (3%)	Not randomized study	Preliminary results suggest that the sutureless sublay ventral hernia repair is a safe and effective procedure, especially in small and medium defects. It simplifies the Stoppa-Rives operation without compromising the outcome.
Gondal S.H. 2014	10,94 vs. 31,25	-	3 (4,69%) vs. 12 (18,75%)	0	A small sample size, different hernia repair techniques were compared	Sutureless "sublay" mesh hernioplasty is a better and safer technique than on "onlay" mesh hernioplasty in incisional hernia repair.

vs. 6.8%). Each group had three recurrences. Limitations of the study - retrospective study, single-centre, although with a large study sample, all types of ventral hernia were compared (not only incisional). The conclusions state that the self-gripping Progrip mesh placed in retromuscular position in ventral hernia repair can be associated with an increased complication rate.

In a multicenter study, P. Witkowski [21] examined postoperative abdominal wall hernia operations when abdominal wall plastic surgery was performed without

mesh fixation. The study was conducted from 2003 to 2005 in Italy, Poland, Russia, and Serbia. A total of 111 patients were examined; 26 were operated on for primary and 85 for postoperative abdominal wall hernias. Patients participating in the study underwent operations using the "sublay" method. The average age of the patients was 62 years, and women predominated (27% men and 73% women). The average body mass index was 28 kg/m². The mean hernia size was reported to be 103 ± 49 cm², of which 12% were < 5 cm in diameter, 38% were 5–10 cm, 30% were 10–15 cm, and 19% were bigger than 15 cm in diameter. The average duration of surgery was 96 min, and mesh implantation took 23 min. In the postoperative period, the average pain, according to VAS, was 4 points. 25% of patients felt weak pain after 6 months, after 1 year – 17%, and after 2 years– 14% of the patients, mainly those with large diameter hernias. The study indicates postoperative complications in 12.6% of patients (hematoma – 3%, seroma – 3.6%, wound suppuration – 6%). Three (2.7%) patients had hernia recurrence during the follow-up period. The study's limitations are that it was not randomized and not a comparative study. Based on the obtained results, the authors conclude that "sublay" hernia repair of postoperative abdominal wall hernia without mesh fixation is a safe and effective surgical method, especially recommended for small and medium-sized abdominal wall hernias.

The publication by S.H. Gondal [22] provides the results of the only one prospective randomized trial we found comparing two surgical techniques for postoperative abdominal wall hernia: "sublay" hernia repair without mesh fixation and "onlay" hernia repair with mesh suture. The research lasted from 2010 to 2011, and 64 patients were examined. The study participants were divided into two groups: subjects in group A underwent "sublay" hernia repair without mesh fixation, and subjects in group B underwent onlay hernia repair with mesh suturing. The average age of the patients in the study was 40 years (37.53 years in group A and 42.62 years in group B), 43.75% were male and 56.25% were female in group A, 28% were male and 72% were female in group B. In the publication, the patient's body mass index was not specified, and the hernia's size, the operation's duration, and the postoperative pain were not evaluated. Comparing groups A and B, statistically significant differences were observed in postoperative hematomas (4.69% vs. 14.06%, $p = 0.027$), wound infection rate (6.25% vs. 12.5%, $p = 0.019$), and hospitalisation time (2.25 vs. 3.96 days, $p < 0.05$). There were no recurrences in both groups. Limitations of the research: a small sample size and different hernia repair techniques were compared. Based on the results of their study, the authors conclude that "sublay" hernia repair without mesh fixation is a better and safer surgical technique for postoperative abdominal wall hernias than "onlay" hernia repair with mesh sutures.

Discussion

Postoperative (incisional) hernia of the abdominal wall is a common complication, the only treatment for which is surgery. For many years, the unsatisfactory results of using anterior abdominal wall plastics with their tissue forced surgeons to look for new hernia repair methods. In 1959, F.Usher [23] published an article describing the successful use of synthetic mesh for abdominal wall hernia repair, and in 1970, R.Stoppa and J.Rives used the "sublay" mesh implantation technique. Until now, there is no consensus on which method of mesh implantation is the best - "onlay", "inlay", "sublay", but a 2008 Cochrane systematic review [4] indicates that postoperative hernia operations using tissue-fixed mesh are characterized by lower rates of postoperative complications and hernia recurrences than mesh-free hernia repair. In the long run, there were attempts not to fix the mesh or shorten the operation time. The first operation without mesh fixation was the laparoscopic total extraperitoneal hernia repair (TEP), where the mesh was not fixed. The experience of these operations formed the basis for the hypothesis that it is possible not to fix the mesh even during open operations. In the beginning, fibrin glue was used, and several authors published the data of prospective studies [11–13]. However, it is difficult to decide on the broader use of fibrin glue and the results since no articles have been found in the last ten years that announce the use of fibrin glue for open incisional hernia plastics. Later, unique self-fixing meshes appeared [17–19]. However, these meshes are more expensive than conventional synthetic meshes. In his large-scale study, F.Harpain [20] even found that using self-adhesive meshes has a significantly higher rate of postoperative complications.

In 2007, P. Witkowski [21] published a prospective multicenter study in which primary and postoperative anterior abdominal wall hernias were treated with operations without mesh fixation. The authors indicated that this method of operation is safe and especially recommended for small and medium-sized abdominal wall hernias. Although the study was conducted in several countries and was prospective, it was not randomized and not a comparative study, so the risk of bias was high. Nevertheless, the findings of the study that hernia repair without fixing the mesh is a safe method allowed us to think about further research.

In 2014, S.H. Gondal [22] published the results of a randomized trial comparing two surgical techniques in 64 patients. The results of operations with and without fixing the mesh were compared. Patients were followed for 12 months. No hernia recurrences were observed in either group, but the non-fixed mesh group had

statistically significantly lower rates of postoperative hematoma, wound infection, and length of hospitalization. The study's results allow us to assume that treating postoperative hernias with an operation that does not fix the mesh is a safe method with better postoperative results. It should be noted that S.H. Gondal's study has shortcomings - the number of operated patients in the groups (32 subjects in each) is insufficient, and the observation period is only 12 months. The groups are compared according to the method of mesh fixation, but the types of operations are different - not fixing the "inlay" mesh but fixing the "onlay" mesh. Therefore, this study can be considered as having a high risk of bias.

Most of the analyzed studies are retrospective, with small samples, and operations are compared using different meshes, so assessing the risk of bias is difficult. Even a prospective randomized study has many limitations, so all examined studies should be considered at high risk of bias.

The reviewed research and studies have many limitations, so it isn't very easy to draw accurate conclusions. Since the limitations of most studies are that they are retrospective, small sample sizes, non-randomized or compared between different operative methods, it is practically impossible to say whether mesh fixation and non-fixation have differences or whether one method is superior. Therefore, a randomized, more extensive study is needed. It would be appropriate to analyze and compare data on postoperative pain, postoperative complications, quality of life after surgery, and hernia recurrence. When comparing the two surgical methods, it is also necessary to take into account comorbidities, BMI, hernia size, and study size.

Conclusions

Based on the results of published articles, we conclude that surgery for postoperative abdominal wall hernias without mesh fixation is a safe method. Still, its benefits are not sufficiently supported by the criteria of evidence-based medicine. To find the surgical method with the best postoperative results, randomized prospective studies are needed to compare the surgical treatment of postoperative hernias with and without mesh fixation using a sufficient sample and long-term postoperative follow-up.

Author contributions

G.V. wrote the main manuscript text. All authors reviewed the manuscript.

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Data availability

Availability of data and materialsThe datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Human and animal rights

There are no violations of human and animal rights.

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