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A new designed slit mesh method with the least recurrence and complication rate in laparoscopic hernia surgery

Remzi Akturk[a,*], Serdar Serinsoz[b]

[a] *Private Yenibosna Safa Hospital, Department of General Surgery, Istanbul, Türkiye*
[b] *Private Yenibosna Safa Hospital, Department of Radiology, Istanbul, Türkiye*

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Abstract

Aim: The aim of our study is to determine the method with the least recurrence and complication rate in laparoscopic hernia surgery. For this reason, the purpose of cutting the graft is to give it a closer and appropriate shape to the anatomy and thus to minimize the recurrence rate.

Materials and Methods: A total of 142 patients with hernias, 135 men and 7 women, were included in the study. The cases were divided into two groups; the conventional shape of the graft was applied to the first group without slit, in the second group; the graft was cut in the middle to spread around the pampiniform plexus, and the hernia sac and pampiniform plexus were dissected, and then spread around the pampiniform plexus with slit. The methods of spreading around the inguinal cord by cutting versus spreading on the inguinal cord without cutting were compared.

Results: While the slit mesh status of those with postoperative testicular edema was 100% present and 0% absent, and a statistically significant difference was determined between the groups (p=0.027). The patients' time to return home after surgery was statistically significantly higher in the slit mesh present group compared to the absent group (p=0.001). A statistically significant difference was found when those who did not have reoperation and those who had reoperation status were compared (p=0.044).

Conclusion: It was concluded that this new approach minimizes early and late recurrences with faster recovery after repair of laparoscopic extraperitoneal inguinal hernia. We suggest a slit mesh method by changing the shape and spreading the mesh without using any fixation material can also be used as a fixation method such as self-adhesive mesh and fibrin glue.

Introduction

Inguinal hernia repairs are known as one of the most common surgical procedures in general surgery clinics [1, 2]. Having sufficient experience in open and laparoscopic hernia repair is considered by many surgeons as a milestone in their careers. Open hernia repair continues to be widely performed, although it is increasingly laparoscopic, along with many other surgical procedures [3]. Despite this, there was a 265% increase in laparoscopic hernia repairs between 2000 and 2011 [4].The most important reason for this increase is that the patient's recovery is much faster and the post-surgical indications are less compared to open hernia repairs.

Grafted repairs in inguinal hernia repair are almost completely accepted today. However, quality of life, long-term pain, day surgery, laparoscopic technique, and graft fixation techniques have become controversial in inguinal hernia repair. In umbilical hernia surgeries, there is a possibility of partial or complete umbilical necrosis with possible infection of the graft. To minimize the potential risk of devascularization of the umbilical stalk, several techniques (with or without diastasis repair) have been proposed for abdominoplasty-associated UH repair to eliminate the need for any incisions near the base of the umbilicus stalk. Approaching UH by laparoscopy would theoretically reduce the risk of devascularization of the umbilicus to that encountered with a pure abdominoplasty.

Despite its advantages, laparoscopic surgery can also cause specific complications such as trocar site hernia or port site hernia [5,6]. Although many repair methods have been applied for treatment over the years, the development of post-operative indications have still not been prevented [7].

*Corresponding author:
Email address: dremzi@gmail.com (Remzi Akturk)

Common indications and testicular complications of classical anterior hernia repairs lead surgeons to seek different methods. In order to reduce these indications in conventional open hernia surgeries, the graft is cut and placed around the inguinal cord. Although this method is used very actively, it is not applied in laparoscopic surgery. In this study, we thought of adapting this method to laparoscopy. We believe that if the method of spreading around the inguinal cord by cutting an appropriate width (an average of 1 cm diameter circle depending on the inguinal cord width), as in open hernia surgeries, there will be no difference in terms of complications with the other method. Otherwise, it is possible to encounter testicular ischemia findings as in the open method [8]. Considering that especially early recurrence in laparoscopic hernia operations is generally due to inadequate dissection, we think that cutting the graft and spreading it around the cord will both require a more accurate dissection and ensure that the hernia sac is sufficiently dissected around the plexus, thus minimizing early and late recurrences.

Due to the difficulty of dissection in TEP cases, dissection may be inadequate and the graft may spread randomly and this increases the early recurrences and reoperation rate. In order to prevent the increases early recurrences and reoperation rate, unnecessary fixation is performed and the fixation material such as tack causes an increase in postoperative complications. Therefore, surgeons are avoiding using of fixation materials in laparoscopic hernia surgeries. In this study it is aimed to fix the mesh by changing on the shape and spreading the mesh without using any fixation material in order to prevent early recurrences which increase when fixation is not done. Thus, we prevent both early and late recurrences with minimal postoperative complications.

Materials and Methods

Patients

For the study ethical approval was obtained from the Bakirkoy Dr. Sadi Konuk Training and Research Hospital Clinical Research Ethics Committee (15.03.2021, 2021/149). Our study was carried out between 2010 and 2017 in Private Yenibosna Safa Hospital, Department of General Surgery. A total of 142 patients with hernias, 135 men and 7 women, were included in the study. All patients were operated for laparoscopic extraperitoneal (TEP) inguinal hernia under the supervision of the same surgeon (Op. Dr. RemziAktürk). Total intravenous anesthesia was applied to all patients.

The inclusion criteria for the patients were that they were older than 18, have a simple uncomplicated inguinal hernia, have unilateral or bilateral hernia, and have an ASA score of I/II. However, patients younger than 18, or who had significant comorbidities that made them unsuitable for general anesthesia, previous surgery to the inguinoscrotal region, the presence of occluded/strangulated inguinal hernia, an ASA Score of III / IV, or severe benign prostatic hyperplasia, cirrhotic acid, or who had acute incarcerated or suffocated hernias detected by radiological imaging (Ultrasonography and Magnetic resonance imaging) were then excluded from the study.

Study design

The cases were divided into two groups; the conventional shape of the graft was applied to the first group without slit, in the second group; the graft was cut in the middle to spread around the pampiniform plexus, and the hernia sac and pampiniform plexus were dissected, and then spread around the pampiniform plexus with slit. No mesh fixation material was used in either group. After obtaining informed consent by strictly adhering to the National Patient Rights and Ethics Regulations and the Declaration of Helsinki, laparoscopy was used applied to the cases. The parameters evaluated under the study were recorded during the intraoperative period, postoperative hospital stay, and 12-month follow-up. Data were recorded using hernia registration forms that included demographic and clinical characteristics for each patient. The type of analgesic was standardized as meloxicam 15 mg twice daily for the first 24 hours, then until day 7 (suture removal) patients decided the dose according to their needs.

Surgical technique

Extraperitoneal access was made with a 1 cm incision in the sub-umbilical region under general anesthesia. Three standard ports (one 10 mm and two mm ports) were installed. Initially, dissection of the plexus and hernia sac with 30 degrees optics was completed with blunt and sharp dissection without the use of balloons or any other dissection tool. After hemostasis control, prolene mesh was spread to the inguinal region. The patients were divided into two groups in terms of prolene mesh placement. In the first group, the prolene mesh was traditionally cut to fit the inguinal region and then spread there as shown in Figures 1A. In the second group, the prolene mesh was cut in the same way as the inguinal region and also cut from the middle of the mesh in accordance with the pampiniform plexus as shown in Figures 1B. After separation of the spermatic cord, the mesh spread around the plexus and over the inner ring. No fixative was used to fix the mesh in both groups.

Postoperative following

The patients were followed for 7,15, 30, 45, 90, 180, and 365 days. All patients were asked about their complaints and were examined for the presence of hematoma, testicular edema, reoperation, orchitis, chronic pain, seroma, testicular ischemia, recurrence, and port lateral hernias. Postoperative complications were handled with the radiology unit as shown in Figure 2. Patients with seroma formation were followed for 4 weeks, and if there was no

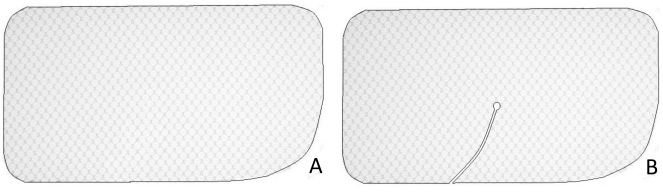

Figure 1. The mesh (A) used in the first group and the mesh (B) used in the second group.

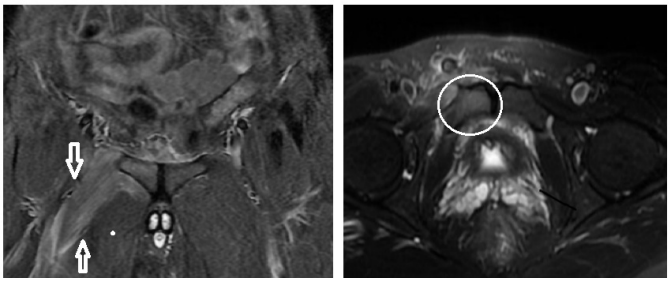

Figure 2. 42 year-old male after inguinal hernai repair (TEP; without fixation and without slit); progressive right groin pain since 2nd day of the surgery. MRI scans at postoperative 10th day, demonstrate diffuse adductor muscle edema (arrows) with right pubic ramus osteitis (circle), possible nerve injury as a complication.

improvement, the seroma was aspirated under ultrasound guidance. In the postoperative period, all patients were asked to walk, drive, and continue their work, but were warned to avoid heavy activities. Postoperative complications such as chronic inguinal pain, wound infection, hematoma, seroma, neuralgia, numbness, and other important events were evaluated. Recurrence rates were evaluated at 12-month follow-up.

All patients received a single dose of 50 mg meperidine intramuscularly immediately after surgery. Local complications such as hematoma, seroma, wound infection, and early recurrence, if any, were recorded. VAS pain scoring system was used to monitor postoperative pain as 10. Pain was recorded at postoperative 12th and 24th hours and on the 7th day after surgery.

All patients were advised to take 15 mg of meloxicam orally "as needed" and to keep a record of the analgesics consumed. Patients were encouraged preoperatively to record all additional or missed analgesic doses even after hospital discharge. In both groups, the length of hospital stay was recorded as the number of nights after surgery and the reasons for the delay in discharge were recorded. All patients were encouraged to return to their work and/or daily activities when they felt comfortable.

At the end of the follow-up period, all patients were questioned in detail in terms of signs and symptoms of relapse, and any pain, numbness or paresthesia, by phone calls and letters. Physical examination was performed on patients with any complaints or symptoms. To determine the true percentage of patients with chronic pain, patients were questioned for "any type of pain regardless of its magnitude." Patients who described the pain as "intractable" or "difficult to live with" and who needed pain medication and/or medical consultation were defined as having "unbearable pain". The primary outcome measures of the study were the recurrence rate at 2 years and the incidence of chronic pain or paresthesia.

Statistical analysis

SPPS 25 (IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp.) statistical package program was used to evaluate the data. Stratified randomization method was performed for the distribution of the individuals included in the study. Variables were expressed using mean standard deviation, percentage and frequency values. Variables were evaluated after controlling for normality and homogeneity of variances (Shapiro Wilkis and Levene Test). While performing data analysis, Independent 2-group t-test (Student's t-test) was used for comparison of two groups, and Mann Whitney-U test was used when prerequisites were not met. Categorical data were analyzed with Fisher's Exact Test and Chi-Square test. In cases where the expected frequencies are less than 20%, an evaluation was made with the "Monte Carlo Simulation Method" to include these frequencies in the analysis. The values of $p<0.05$ and $p<0.01$ were accepted for the significance level of the tests.

Results

The ages and BMI values of the patients did not differ between the mesh groups, (p=0.390) and (p=0.839), respectively. Although the patients' time to return home after surgery was statistically significantly higher in the present group than in the absent group (p=0.001), it was determined that the hospital stay and the duration of the operation did not differ between the mesh groups (p=0.168) and (p=0.447), respectively (Table 1).

While the slit of mesh status of healthy patients with normal ASA score (ASA II) was 52% for the present group, 48% for the absent group, the mesh status of patients with ASA score of mild systemic disease (ASA I) was 51% present, 49% absent.

The primary output/endpoint variables of the study were defined in Table 2. Especially Postoperative testicular edema, re-operation status (early recurrence) and postoperative testicular inflammation variables were of importance in terms of absent/present of Slit of Mesh.

While the mesh status of those who did not have bleeding during the operation was in the absent group 51%, and in the present group 49%, the mesh status of those who had bleeding during the operation was in the absent group 63%, present 38%. The mesh status of those without postoperative testicular edema was in the 50% present, 50% absent group, and the mesh status of those with postoperative testicular edema was in the present group 100%,absent group 0%, and a statistically significant difference was determined (p=0.027). A statistically significant difference was found when the patients without reoperation (slit of mesh status 100% present group, 94.2% absent group) and those with reoperation status (slit of mesh status 0% present group, 5.8% absent group) were compared (p=0.037). Also, there was a statistically significant difference between the patients without postoperative testicular inflammation (slit of mesh status 50.4% present group,49.6% absent group) and those with postoperative testicular inflammation (slit of mesh status 100% present group, 0% absent group) were compared (p=0.044) (Table 2).

After the patients with slit of mesh status present and absent were compared, those with or without urinary bladder injury, intestinal injury, postoperative seroma in the inguinal region, those without or with postoperative sub-

Table 1. Demographic comparison between groups.

	Slit of Mesh		Critical Value	p
	Present	Absent		
Age	47.73±13.451 47 (36.5-58.5)	46.32±14.258 44 (36-54)	-0.860	0.390
BMI (kg/m^2)	27.77±2.865 28 (26-29)	27.65±2.92 28 (25-30)	-0.203	0.839
Postoperative Return to Work Time (day)	7.16±1.385 7 (7-8)	6.26±1.431 7 (6-7)	-3.850	0.001
Length of Stay in Hospital (day)	1.03±0.164 1 (1-1)	1±0 1 (1-1)	-1.380	0.168
Operation Time (min)	61.4±14.385 59 (49-73.5)	63.29±13.397 65 (54.5-73)	-0.760	0.447

cutaneous emphysema, those with or without postoperative pain, those with or without postoperative testicular ischemia, postoperative, were also compared. There was no significant difference between the groups (Table 2).

Discussion

Inguinal hernias are typically asymptomatic until a bulge or swelling appears in the groin. Some patients may report pain during straining or heavy lifting. Pain and discomfort are most often associated with larger hernias that require manual compression for reduction or require manual compression while lying supine [9]. Hernia operations are performed with two methods as either open and laparoscopic [10].

There are many studies showing that minimally invasive approaches offer numerous advantages over open surgery for inguinal hernia repair [11]. Randomized controlled studies showed that there was no difference in recurrence rates when laparoscopic and open repair of inguinal hernia were compared, while chronic pain rates were reported to be significantly lower in the laparoscopic groups [12].

Today, different techniques are used to solve the postoperative pain problem. The most well-known of these techniques is the use of atraumatic mesh fixation techniques such as fibrin or butyl-2-cyyabiacrylate glues. In addition, the use of lightweight mesh has been reported to reduce the incidence of chronic inguinal pain without increasing hernia recurrence rates. Glue mesh fixation has been reported to reduce postoperative pain compared to mesh suture or tacker fixation [13,14].

In conventional open hernia surgery, the graft is cut and placed around the inguinal cord. We also tried this method in laparoscopic surgery in our study. The aim of our trial of this technique, which had not been tried before, was to create a method with the least recurrence and complication rate in laparoscopic hernia surgery. We thought that the purpose of cutting the graft was to give it a closer and more appropriate shape to the anatomy, so that we could minimize the recurrence rate. The reason for this idea was the same rationale as cutting the graft and placing it around the inguinal cord in conventional open hernia surgeries. We thought of adapting this method to laparoscopy. We wanted to compare the methods of spreading around the inguinal cord by cutting and spreading over the inguinal cord without cutting. We assumed that there will be no difference in terms of complications with the other method if the method of spreading around the inguinal cord by cutting is cut in an appropriate width (an average of 1 cm diameter circle depending on the inguinal cord width), as in open hernia surgeries. Otherwise, it is possible to encounter testicular ischemia findings as in the open method. Considering that especially early recurrence in laparoscopic hernia operations is generally due to inadequate dissection, we thought that cutting the graft and spreading it around the cord would both provide the opportunity for a smoother dissection and ensure that the hernia sac is sufficiently dissected around the plexus, thus minimizing early and late recurrences.

The cases were divided into two groups; the conventional shape of the graft was applied to the first group without slit, in the second group; the graft was cut in the middle to spread around the pampiniform plexus, and the hernia sac and pampiniform plexus were dissected, and then spread around the pampiniform plexus with slit. No mesh fixation material was used in either group. There was no significant relationship between the lengths of stay in hospital between the groups in our study. However, when the return to work rates are compared, the group in which the conventional shape of the graft was applied without slit was returned to work significantly earlier, indicating that the recovery process is faster.

There was no difference between the groups in terms of postoperative seroma in the inguinal region, postoperative subcutaneous emphysema, patients with postoperative pain, postoperative testicular ischemia, postoperative recurrence, or length of hospital stay (in days). It would be wrong to attribute this similarity of both methods to the inadequacy or failure of both techniques.

In addition to the advantage of decreasing early recurrences in the slit applied group compared to the non-applied group, testicular edema increases with pampiniform plexus dissection. We think that the reason for decreasing early recurrences is that the dissection is done adequately and properly in order to place the graft around

Table 2. Comparison of the recurrence rates of the two groups at 12-month follow-up.

			Slit of Mesh		Critical Value	p
			Present	Absent		
Gender	Male	n	69	66	0.097	0.756
		%	51.1%	48.9%		
	Female	n	4	3		
		%	57.1%	42.9%		
Hernia Side	Right	n	35	32	0.402	0.818
		%	52.2%	47.8%		
	Left	n	30	27		
		%	52.6%	47.4%		
	Bilateral	n	8	10		
		%	44.4%	55.6%		
Hernia Type	Indirect	n	47	51	1.506	0.220
		%	48.0%	52.0%		
	Direct	n	26	18		
		%	59.1%	40.9%		
ASA Score	Normal healthy patient (ASA II)	n	43	40	0.013	0.910
		%	51.8%	48.2%		
	Patient with mild systemic disease (ASA I)	n	30	29		
		%	50.8%	49.2%		
Bleeding During Surgery	Absent	n	68	66	0.418	0.518
		%	50.7%	49.3%		
	Present	n	5	3		
		%	62.5%	37.5%		
Postoperative Testicular Edema	Absent	n	68	69	4.899	*0.027*
		%	49.6%	50.4%		
	Present	n	5	0		
		%	100.0%	0.0%		
Re-operation Status (early recurrence)	Absent	n	73	65	4.053	*0.037*
		%	100.0%	94.20%		
	Present	n	0	4		
		%	0.0%	5.80%		
Postoperative Testicular Inflammation	Absent	n	70	69	4.053	*0.044*
		%	50.4%	49.6%		
	Present	n	3	0		
		%	100.0%	0.0%		
Patients with Postoperative Pain	Absent	n	64	64	1.031	0.310
		%	50.0%	50.0%		
	Present	n	9	5		
		%	64.3%	35.7%		
Postoperative Testicular Ischemia	Absent	n	71	68	0.286	0.593
		%	51.1%	48.9%		
	Present	n	2	1		
		%	66.7%	33.3%		
Recurrences after surgery	Absent	n	72	66	1.149	0.284
		%	52.2%	47.8%		
	Present	n	1	3		
		%	25.0%	75.0%		

the pampiniform plexus which is the most important point of laparoscopic inguinal hernia repair. In addition, spreading the graft around the plexus will provide fixation of the graft similar to self-adhesive grafts without the need for a fixation material such as a tack. Changing the shape of the graft will provide a repair closer to normal anatomy.

It has also been reported that the probability of local wound infection occurring after laparoscopic surgery is four times less than after open surgery, and despite this, the hospitalization times for both techniques are not very different [15]. In addition, a study by Itani et al. reported that the mean worst pain after 1 year was significantly less in the laparoscopic group [16].

The lower risk of wound infection after laparoscopic ventral hernia repair is fully compatible with other uses of laparoscopic techniques such as cholecystectomy or appendectomy. Since the total lengths of the incisions in laparoscopic surgery are shorter than in open surgery, the probability of bacteria entering the subcutaneous area is much lower. Considering the mesh position in open surgery, post-open surgery wound infection may become clinically problematic as it may require removal of an infected mesh [15]. For these reasons, laparoscopic surgery has gained considerable popularity since it was very first described and is now used for the initial treatment of inguinal hernias.

On the other hand, intra-abdominal complications are theoretically reported to be more common after laparoscopic surgery because the necessity to position the mesh against the abdominal wall requires extensive dissection of all adhesions in this area [17].

However, the present study has some important limitations. First of all, the number of patients is small to accurately judge a surgical technique. Another limitation is that placement of the prosthetic material takes approximately 12 months, so a 5-year follow-up is required to assess longer-term outcomes.

Conclusion

We suggest a slit mesh method by changing the shape and spreading the mesh without using any fixation material can also be used as a fixation method such as self-adhesive mesh and fibrin glue. It has been shown that this method, which was tried for the first time in laparoscopic surgery, is safe and applicable when applied in cases of laparoscopic extraperitoneal inguinal hernia repair. It was concluded that this new approach minimizes early and late recurrences with faster recovery after repair of laparoscopic extraperitoneal inguinal hernia.

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Conflict of interest

The authors declare no conflict of interest.

Data availability statement

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethics approval

For this study, ethical approval was obtained from the Bakirkoy Dr. Sadi Konuk Training and Research Hospital Clinical Research Ethics Committee (15.03.2021, 2021/149).

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