



Original Research

Evaluation of the effects of absorbable and nonabsorbable tacks on laparoscopic suprapubic hernia repair: A retrospective cohort study

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ABSTRACT

Background: The contradictory results of fixation methods concerning the pubic region are an obstacle to define a standardized procedure for laparoscopic repair of suprapubic hernia (LRSPH). This study aims to evaluate the effects of different tacks on LRSPH.

Materials and methods: Seventy-three patients (70 females, three males) with suprapubic hernia were admitted and had LRSPH. Absorbable tacks were used in 42 (57.5%) patients (AG group), whereas nonabsorbable tacks were used in 31 (42.5%) patients (NAG group). Patient characteristics and demographics, previous operations, previous hernia repairs, size of the defect, size of the mesh, type of the mesh, type of the tacks, operative time, conversion rate, complications, recurrences, follow-up time, numeric pain rating scale (NRS), prolonged use of analgesics and early termination of analgesics were evaluated as variables.

Results: NRS results were significantly lower in the AG group regarding the postoperative day one ($p < 0.001$) and 10 ($p:0.004$), whereas there was no statistically significant difference on postoperative sixth week. Prolonged use of analgesics was significantly higher in NAG, whereas early termination of analgesics was significantly higher in AG ($p < 0.001$). There was no patient with complaints of pain that restricted daily activities on sixth month and the following annually visits.

Conclusion: Absorbable tacks had satisfactory results with a reduction of pain and lower rates of using analgesics. However, considering the similar results of groups on long-term follow-up, it would be inaccurate to explain this situation with the property of absorption. Although the failure of attempts to bony structures during fixation with absorbable tacks could explain the lack of deep penetration, further studies are required to verify this view.

1. Introduction

Ventral hernias located less than 3–4 cm on the pubic arch in the midline are described as suprapubic hernias [1–5]. Suprapubic hernia (SPH) usually occurs following abdominal operations. Inadequate fusion of the incisions made in the proximity of musculotendinous pubic attachment has been mentioned as a cause in the literature [1–7]. SPH, similar to other types of incisional hernias, has a high recurrence possibility [8–13]. The avoidance of exploring the Retzius space and inguinal region, due to the proximity of neurovascular structures, causes inadequate mesh overlap and insufficient fixation of mesh (Fig. 1). Laparoscopic repair allows sufficient overlap and fixation of the mesh, under the guidance of better view for identifying the neurovascular and bony structures. Therefore, laparoscopic repair of suprapubic hernias (LRSPH) is the choice of treatment with decreased recurrence rates and

morbidity, as reported in the literature [1–5]. Despite the positive outcome of laparoscopy, different methods were defined in the steps of the procedure. Some authors suggested applying transabdominal sutures directly to the pubis [1,2], whereas others use only tacks for fixation [4,5]. The contradictory results of fixation methods concerning the pubic region are an obstacle to define a standardized procedure [6,7]. Most of the patients with SPH were obese. Due to the difficulty of applying transabdominal sutures to pubis in obese patients, we preferred to use tacks to fix the mesh to pubis. Although the lack of recurrence using either absorbable or nonabsorbable tacks, different findings following LRSPH led us to evaluate our experience. Therefore, we decided to present the effects of absorbable and nonabsorbable tacks on LRSPH.

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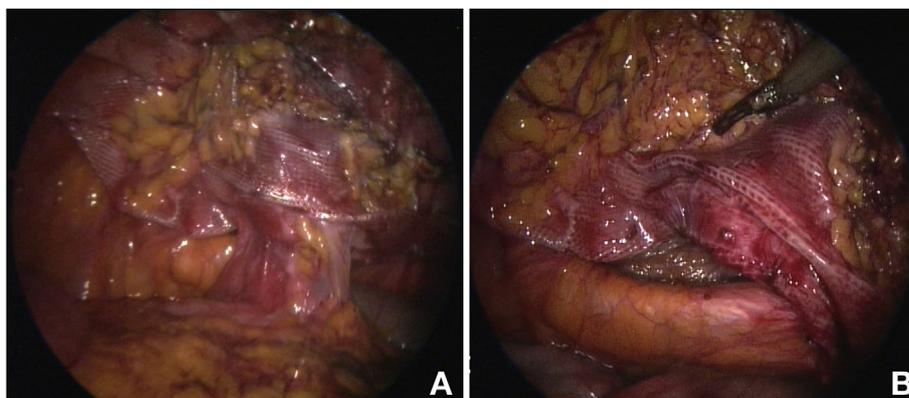


Fig. 1. Recurrent suprapubic hernia with previous laparoscopic repair.

A: Shrinkage of the mesh with insufficient fixation.

B: Unexplored Retzius space and inguinal region.

2. Material and method

Patients who underwent LRSPH between August 2012 and August 2017 were included in our study. Regarding the literature, incisional hernias less than 4 cm on pubic symphysis were accepted as suprapubic incisional hernias. Patients with large suprapubic hernias, as defined in the literature, who received laparoscopic partially extraperitoneal repair were included in the study [5]. Thus, patients who received laparoscopic transabdominal preperitoneal repair (TAPP) procedure with a superior margin below the arcuate line were excluded from the study. The study was registered (UIN:researchregistry4524) and approved by our hospital ethics committee (Reg. Number: 5141384, 2018). The study has been reported in line with the strengthening the reporting of cohort studies in surgery (STROCSS) criteria [14]. Operations were performed by two surgeons experienced in hernia repair in our department. The medical records were reviewed retrospectively from our clinic's database, records that were collected prospectively with a follow-up form, including patient characteristics and demographics, number of previous abdominal operations, number of previous hernia repairs, size of the defect, size of the mesh, type of the mesh, type of the tacks, operative time, conversion rate, complications, recurrences, follow-up time, numeric pain rating scale (NRS), prolonged use of analgesics and early termination of analgesics. Regarding the follow-up time, patients who underwent LRSPH more than 36 months ago were grouped again to evaluate long-term results.

2.1. Operative technique

The patients were positioned supine and their left arm with the same side of trocar insertion was tucked. An orogastric tube and a three-way Foley catheter was inserted routinely, following anaesthesia induction. Ports were placed as far away as possible from the hernia for a good view. The first port of 11 mm was inserted nearby Palmer's point using a mini-open approach. Following the creation of pneumoperitoneum, two additional 5 mm ports were inserted to form a triangle around the first port, and all the operations were performed with a 30-degree laparoscope. An additional 5 mm port was inserted at the contralateral side, in case of difficulty during fixation. Contents of the hernia were reduced with a combination of sharp and blunt dissection (Fig. 2B). A peritoneal flap was created with an incision crossing between the anterior superior iliac spines and the bladder was mobilized to reach the inferior part of the pubic arch (Fig. 2C). Iliac vessels, pubic symphysis and Cooper's ligaments were identified. The size of the hernia defect was measured intracorporeally following the reduction of intraabdominal pressure to 8 mmHg (Fig. 2D). Parietene™ Composite (PPC) Mesh (Covidien, Mansfield MA, USA) was used in all of the patients with long-term follow up. Depending on availability, PPC or

Ventralight™ ST (VST) Mesh (Bard Davol Inc., Warwick, RI, USA) was used in the remaining patients. The closest available size was used to cover all around the defect about 5 cm. The mesh was placed below the pubic symphysis, and the superior and lateral edges of the mesh were fixed with pre-tied 2/0 polypropylene suture to position, subsequently the mesh was fixed to the pubic bone and Cooper's ligament with tacks (Fig. 2E and F). Tacks were used to fix the mesh with the double-crown technique and the peritoneal flap was fixed over the mesh with tacks (Fig. 2G). An absorbable synthetic polyester copolymer derived from lactic and glycolic acid tacks (Absorbatack™, Covidien, Mansfield MA, USA) were used in absorbable group (AG), whereas titanium helical tacks (Protack™, Covidien, Mansfield MA, USA) were used in the non-absorbable group (NAG).

2.2. Postoperative period

An intravenous infusion of dexketoprofen trometamol (DT) 50 mg was administered every 12 h on postoperative day one routinely and in case of complaints, on the following days. Also, an oral form of DT 25 mg was prescribed on discharge. All cases were controlled on the first week, 10th day, sixth week, third month, sixth month and annually till three years to evaluate complaints and pain. The patients were asked whether they had left the use of analgesics, on the control of postoperative first week. Patients who had left DT were grouped as “early termination of analgesics”, whereas patients who had required the prescription of DT one more on the 10th day were grouped as “prolonged use of analgesics”. Although none of the patients required additional analgesics on the postoperative first week, patients who required additional analgesics or wanted to use another drug for pain on postoperative 10th day control were added in the group of “prolonged use of analgesics”. The patients were asked to rate their pain with an 11-point numeric scale, ranging from “0” representing “no pain” to “10” representing “worst possible pain” on postoperative day one, 10 and the sixth week. Also, the patients were asked to have a complaint of pain that restricts daily activities on the postoperative third month, sixth month and annually till three years.

The patients were controlled with physical examination during all visits, and ultrasonography (USG) was used annually - until the end of the study - to examine recurrence and trocar site hernia. Also, patients with symptomatic seroma were controlled on the eighth and 10th week to decide aspiration.

2.3. Statistical analysis

An Excel worksheet (Microsoft Corp, Redmond, WA) was prepared to enter the data, and the statistical analysis was carried out using IBM SPSS Statistics ver. 24.0 (IBM Co., Armonk, NY, USA). Descriptive

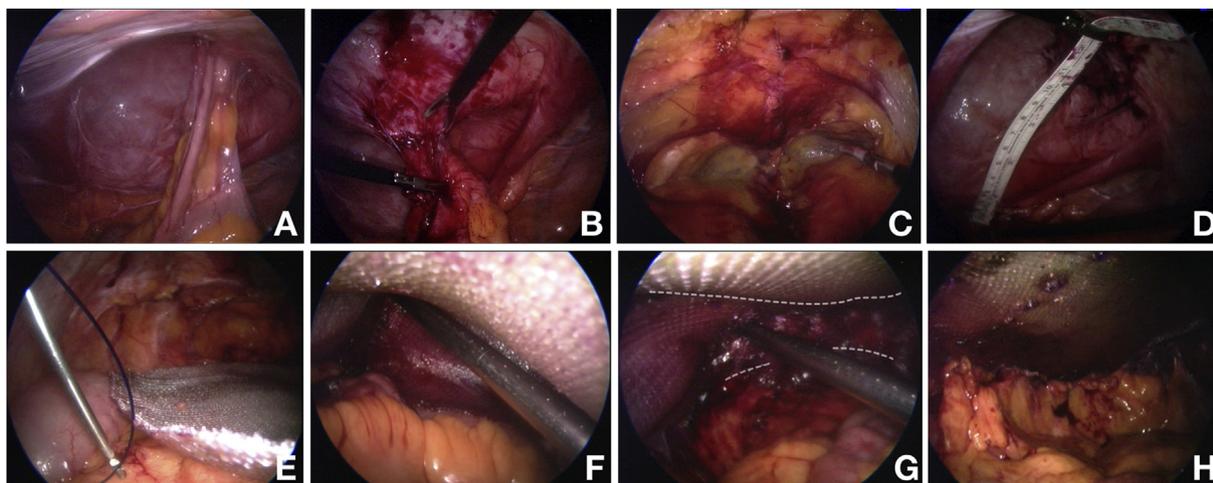


Fig. 2. Laparoscopic repair of suprapubic hernia with absorbable tacks.

A: Suprapubic hernia with adhesions.

B: Adhesiolysis with gentle traction.

C: Exploration of Retzius space following mobilization of the bladder.

D: Measurement of the size of hernia defect (note the difference regarding the width of defect following the reduction of pressure to 8 mmHg).

E: The positioning of the mesh with suture passer on lateral and superior site.

F: Fixation of the mesh to pubis.

G: Fixation of the mesh with double-crown technique.

H: Appearance of the repair following the fixation of the peritoneal flap.

statistical methods (mean, standard deviation, frequency, percent, minimum and maximum) were used to evaluate the study data. Independent samples *t*-test and the Mann-Whitney *U* test were used to compare the quantitative variables of two groups. Pearson Chi-square test and the Fisher's exact test were used to compare qualitative data. Based on the results of analysis, a *p*-value < 0.05 was considered to be statistically significant.

3. Results

A total of 78 patients with SPH underwent laparoscopic repair between August 2012 and August 2017. Despite the lack of recurrence, five patients were excluded from the study; four patients had a superior margin below the arcuate line and had laparoscopic TAPP repair; and one patient was excluded due to pregnancy on the second year, post-operatively. Therefore, 73 patients - three men and 70 women - who underwent LRSPH were included in the study. Most of the patients were obese and the mean body mass index (BMI) was 33.7 kg/m² for NAG, whereas 36.2 kg/m² in AG. The mean number of previous operations and previous hernia repair was 2.5 ± 1.8 and 1.3 ± 1.9 in NAG, 2.5 ± 2.1 and 1.2 ± 1.5 in AG, respectively. There was no statistically significant difference in terms of age, gender, BMI, previous surgery, previous hernia operation, size of the defect, size of the mesh, type of the mesh, operative time, complications, hospital stay, and follow-up time as shown in Table 1.

Assessment of pain was done with a numeric rating scale, and there was a statistically significant difference for postoperative day 1 (*p* < 0.001) and 10 (*p*:0.004) - 5.3 ± 1.2 and 2.0 ± 0.8 for NAG, 3.1 ± 1.3 and 1.3 ± 1.1 for AG, respectively -, whereas, there was no statistically significant difference on postoperative 6th week - 0.3 ± 0.6 for NAG and 0.1 ± 0.3 for AG. Prolonged use of analgesics was significantly higher in NAG, whereas early termination of analgesics was significantly higher in AG (*p* < 0.001). There was no patient with a complaint of pain that restricted daily activities on the sixth month and the following annually visits. Complications occurred in nine (12.3%) patients are depicted in Table 1 in detail. The most common complication was the symptomatic seroma, which affected five (6.84%) of the patients. Three (4.1%) patients required a single

aspiration, one (1.36%) of them needed aspiration twice, and the other (1.36%) patient needed it thrice. Two (2.73%) patients had prolonged ileus, and both of them could be discharged on postoperative day four without additional intervention. There was no conversion in our series; small bowel injury occurred in one (1.36%) patient and the enterotomy was repaired intracorporeally, and the patient was discharged on postoperative day 4 (Fig. 3). One (1.36%) patient had chronic pain for more than six weeks; oral analgesics were sufficient, and they were not needed after 12 weeks. There was no recurrence and the mean follow-up time was 37.1 ± 15.3 for NAG and 32.7 ± 16.9 for AG (*p*:0.26).

The patients who underwent LRSPH before August 2015 were grouped to evaluate the long-term results. Comparison of the groups in accordance with long-term follow up is shown in Table 2. Nineteen patients in NAG and sixteen patients in AG underwent LRSPH for more than 36 months ago, and no recurrence was observed during the follow-up period. There was no statistically significant difference in terms of age, gender, BMI, previous surgery, previous hernia operation, size of the defect, size of the mesh, operative time, complications, hospital stay and follow-up time. The PPC mesh was used in all patients with long-term follow up and the type of the mesh was not evaluated. Considering the pain, there was a statistically significant difference for postoperative day one (*p* < 0.001) and ten (*p* < 0.001) - 6 (3–8) and 2 (1–4) for NAG, 3 (1–5) and 1 (0–2) for AG, respectively - whereas, there was no statistically significant difference on postoperative week six. Prolonged use of analgesics was significantly higher in NAG, whereas early termination of analgesics was significantly higher in AG (*p*:0.002).

4. Discussion

The success of laparoscopic repair of suprapubic hernia has been mentioned in numerous studies [1–5]. Suprapubic hernias have been considered difficult to repair in the past due to the proximity of vascular, neural structures and the urinary bladder. Avoidance of entering the space of Retzius and insufficient fixation of mesh to permanent structures could result with recurrence. Common steps of the peritoneal incision to create a flap, entering the space of Retzius and meticulous dissection to view the vital structures are defined in the literature [1–7]. These steps are also similar to laparoscopic transabdominal

Table 1
Comparison of the groups in accordance with the type of tacks.

	Nonabsorbable (n = 31)	Absorbable (n = 42)	p value
Age (years)	51.2 ± 12.1	51.3 ± 8.1	0.994
Gender (Male/Female)	2/29 (6.45%/93.55%)	1/41 (2.38%/97.62%)	0.571
BMI (kg/m ²)	33.7 ± 7.8	36.2 ± 6.5	0.132
Previous surgery	2.5 ± 1.8	2.5 ± 2.1	0.999
Previous hernia operation	1.3 ± 1.9	1.2 ± 1.5	0.784
Size of the defect (cm ²)	86.9 ± 44.8	97.3 ± 63.1	0.435
Size of the mesh (cm ²)	487.1 ± 135.9	519.1 ± 221.4	0.48
Type of the mesh (PPC/VL)	19/12 (61.29%/38.71%)	20/22 (47.62%/52.38%)	0.247
Operative time (min)	102.3 ± 35.6	105.5 ± 39.3	0.72
Hospital stay (day)	1.5 ± 0.9	1.5 ± 0.7	0.997
Follow up time (months)	37.1 ± 15.3	32.7 ± 16.9	0.26
NRS Postoperative day 1	5.3 ± 1.2	3.1 ± 1.3	< 0.001
NRS Postoperative day 10	2.0 ± 0.8	1.3 ± 1.1	0.004
NRS Postoperative 6th week	0.3 ± 0.6	0.1 ± 0.3	0.181
Pain restricting activity 3rd month	1 (3.22%)	0	0.425
Prolonged use of analgesics	22 (70.96%)	7 (16.66%)	< 0.001
Early termination of analgesics	6 (19.35%)	26 (61.9%)	< 0.001
Complication	5 (16.13%)	4 (9.52%)	0.481
- Symptomatic seroma	3 (9.67%)	2 (4.76%)	
- Prolonged ileus	1 (3.23%)	1 (2.38%)	
- Enterotomy		1 (2.38%)	
- Chronic pain	1 (3.23%)		

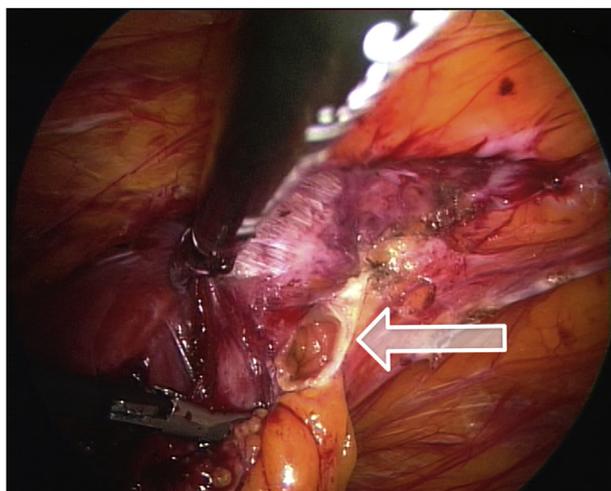


Fig. 3. Patient with enterotomy during adhesiolysis.

preperitoneal (TAPP) repair [15,16]. Despite the definition of simple steps of the procedure, different methods are described to fix the mesh to pubis [6,7]. Carbonell et al. reported two cases of recurrence before applying multiple sutures directly to the pubis and Cooper's ligament [1]. Whereas considering the recurrence following LRSPH, positive results of the double-crown technique were reported without transabdominal suture in the pubic region [4,5]. The double-crown technique is our choice of treatment in incisional hernias and we use transabdominal sutures to position the mesh in case of a large defect that requires a large mesh. In addition, the difficulty of applying multiple transabdominal sutures to pubis in obese patients should be noted as a technical detail. Although it is not mandatory, to fix the mesh to permanent structures in a simple way, a translucent mesh is useful to recognize the structures in pubis during fixation. Considering the experience gained through laparoscopic TAPP, we fixed the mesh to pubis with tacks to position the mesh in a simple way and didn't use transabdominal sutures in pubis. As a supportive finding of our view, recurrence was not observed during the follow-up period, either with the use of absorbable or nonabsorbable tacks.

Regarding the complications, there was no statistically significant difference between groups ($p:0.481$). Although there was only one

Table 2
Comparison of the groups in accordance with long-term follow up.

	Nonabsorbable (n = 19)	Absorbable (n = 16)	p value
Age (years) ^a	58 (45–69)	55 (50–62)	0.161
Gender (Male/Female)	2/17 (10.52%/89.48%)	1/15 (6.25%/93.75%)	1.0
BMI (kg/m ²) ^a	36.85 (21.75–47.17)	34.41 (25.8–43.6)	0.857
Previous surgery ^a	2 (1–9)	2 (1–8)	0.35
Previous hernia operation ^a	1 (0–8)	1 (0–7)	0.545
Size of the defect (cm ²) ^a	63 (32–180)	71.5 (18–144)	0.987
Size of the mesh (cm ²) ^a	600 (300–600)	550 (150–600)	0.832
Operative time (min) ^a	95 (55–180)	88.5 (55–177)	0.612
Complication	4 (21.05%)	2 (12.5%)	0.666
Hospital stay (day) ^a	1 (1–4)	1.5 (1–3)	0.502
Follow up time (months) ^a	49 (40–60)	41.5 (36–72)	0.612
NRS Postoperative day 1 ^a	6 (3–8)	3 (1–5)	< 0.001
NRS Postoperative day 10 ^a	2 (1–4)	1 (0–2)	< 0.001
NRS Postoperative 6th week ^a	0 (0–3)	0 (0–1)	0.461
Pain restricting activity 3rd month	1 (5.26%)	0	1.0
Prolonged use of analgesics	13 (68.42%)	2 (12.5%)	0.002
Early termination of analgesics	4 (21.05%)	12 (75%)	0.002

^a Median (min-max).

patient with chronic pain, most of the patients had complaints of pain for the initial postoperative days. As a clinical observation, patients had the similar position of holding their hands around pubis, and they were unwilling for early mobilization, whereas patients in AG were more comfortable during mobilization with a normal posture for initial postoperative days. The significant difference considering pain in comparison of groups has verified this situation. In addition, the significant difference for both early termination and prolonged use of analgesics were supportive of our view. Despite the positive results about the use of analgesics for the initial period following surgery, it would be inaccurate to describe this condition with the property of absorption. Absorbable tacks should be permanent for months for adequate support following fixation. In order to explain this condition, the experience during fixation with absorbable and nonabsorbable tacks should be compared. Titanium helical fasteners could fix a mesh

into bony structures without forcing, regardless of the pubic region. Absorbable tacks do not have this capability; fixation to periosteum and Cooper's ligament were sufficient, whereas the attempts over the pubic bone result in failure, and the lack of deep penetration to bone could explain this condition. Unlike the early postoperative period, we did not observe a difference between NAG and AG regarding pain in long-term follow-up. There was only one patient with chronic pain and the patient didn't require to use analgesics following the postoperative three months. Also, there was no patient with a complaint of pain on sixth month following surgery in both of the groups. Considering the expected effect of absorbable fasteners in long-term, the results were controversial to avoid chronic pain in LRSPH.

Most of the patients had a previous hernia repair before, and the possibility of recurrence is the most important factor for patients with a suprapubic hernia. Therefore, permanent fixation methods were used to rule out the possibility of recurrence in the past [1,2]. The absence of recurrence in our series is supportive of the idea of sufficient fixation to permanent structures rather than permanent fixation methods. In addition, a comfortable recovery period with less pain and the decreased use of analgesics are the advantages of absorbable tacks. Despite these advantages, there was no significant difference between groups regarding the mean hospital stay. It could be related to an extended adhesiolysis for some of the patients in both groups which avoided to discharge the patient on postoperative day one. The similar operative time of both groups supported this idea.

Although our study aimed to compare the results of fixation, we should mention our methods of LRSPH. Considering the bowel injury during the laparoscopic hernia repair, we apply the mesh in case of small intestine injury which could be repaired with simple sutures without contamination. Our case with enterotomy was suitable to apply the mesh at the same session. However, we should mention that we don't apply a mesh in case of colon injury or injury of an extended segment which needs resection. Although different opinions were stated when we first started LRSPH in 2012, closure of the defects before applying the mesh is becoming more advocated nowadays [17,18]. Even though we use various methods for large ventral hernias, laparoscopic repair is the preferred treatment for SPH in our clinic. Obtaining satisfactory results without the closure of defect in our initial cases led us not to change our method for LRSPH. The contradictory results of the previous SPH studies were also effective on our choice. Palanivelu et al. reported 5.8% recurrence rate in a series of 17 patients with the closure of defect, whereas the closure of the defect has not been mentioned in the largest series of LRSPH which has included 72 cases with no recurrence [3,4]. Considering the functional outcomes, our findings were remarkable. For instance, the patient presented in Fig. 1 had a BMI of over 40 kg/m², the inability of movement due to pain was a major obstacle to lose weight, and the problem was solved following LRSPH in the early period. However, our study did not cover the functional outcomes following LRSPH and did not compare the closure of the defect. Therefore, regarding our results, it could be only an assumption to suggest whether to close the defect or not. In addition, weak recommendation for closing the hernia defect in most recent guideline supports our view by considering the studies based on authors' opinions rather than prospective comparative studies [19].

Observational design is the major limitation of our study. Although our follow-up form has valuable data for hernia surgery, there was missing data due to the design of study. As an advantage, the patients did not have an allergy and a contraindication for DT in our series. In addition, gender was another limitation; most of the patients consisted of women (70/95.9%). Although the ratio of female patients was high in previous studies, it was found to be higher in our study [1–4]. Lower midline incisions were more than Pfannenstiel incisions and gynecological operations were the major cause (Table 3). As ours being a tertiary referral hospital, most of the patients referred for recurrent hernias from state hospitals or following gynecological oncology procedures from our hospital's oncology department which has resulted in

Table 3
Characteristics of patients in accordance with previous operations.

	Gynecological	Bowel	Number of operations and type of incisions
Type of previous surgery (n/%)	41 (56.2%)	32 (43.8%)	2.54 ± 1.95
Previous hernia repair (n/%)	26 (35.6%)	19 (26.1%)	1.26 ± 1.65
Midline incision	21 (28.8%)	24 (32.8%)	45 (61.6%)
Pfannenstiel	4 (5.5%)	–	4 (5.5%)
Pfannenstiel + midline incision	11 (15.1%)	6 (8.2%)	17 (23.3%)
Multiple incisions	5 (6.9%)	2 (2.7%)	7 (9.6%)

a high ratio for women. The same type of mesh has been used for patients with long-term follow up, whereas it was not available for all patients. Therefore, additional randomized clinical trials are required to verify our opinion.

5. Conclusion

The lack of recurrence in our series is supportive for the sufficiency of fixation to permanent structures rather than permanent fixation methods such as applying transabdominal sutures directly to the pubis. Absorbable tacks had satisfactory results with reduction of pain and lower rates of analgesics usage. However, considering the similar results of groups on long-term follow-up, it would be inaccurate to explain this situation with the property of absorption. Although the failure of attempts to bony structures during fixation with absorbable tacks could explain the lack of deep penetration, further studies are required to verify this view.

Ethical approval

Ethical approval was given by Dr. Lutfi Kirdar Kartal Research and Education Hospital Local Ethics Committee with the registration number: 5141384, 2018.

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There is no source of funding.

Author contribution

Hasan Ediz Sikar designed the study, collected the data and wrote this research.

Kenan Çetin helped to collect the data and analysed the data. Kemal Eyvaz helped to collect the data and helped in writing. Mehmet Gökçeimam designed the study and helped to collect the data. Levent Kaptanoğlu helped to analyse the data and helped in writing. Hasan Fehmi Küçük designed the study and helped in writing.

Conflicts of interest

All authors declare that there is no conflict of interest.

Research registration number

UIN: researchregistry4524.

Guarantor

Hasan Fehmi Küçük, Professor of Surgery.

Provenance and peer review

Not commissioned, externally peer-reviewed.

Data statement

The raw data of study have included materials which should be confidential – including the name and identification number-, therefore the raw data of the study could not be shared.

CRedit authorship contribution statement

Hasan Ediz Sikar: Conceptualization, Methodology, Investigation, Writing - original draft. **Kenan Çetin:** Formal analysis, Data curation. **Kemal Eyvaz:** Conceptualization, Writing - original draft. **Mehmet Gökçeimam:** Conceptualization, Investigation, Formal analysis. **Levent Kaptanoğlu:** Methodology, Writing - review & editing. **Hasan Fehmi Küçük:** Writing - review & editing, Supervision.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ijisu.2019.01.018>.

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