Is mesh fixation considered a routine step in transabdominal preperitoneal hernia repair? The Zagazig-Benha experience

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Introduction
Inguinal hernia repair is the most common procedure in general and visceral surgery worldwide. Over the past two decades, laparoscopic inguinal hernia repair has become more and more popular.
Objectives
The aim of the present study was to compare between fixation and nonfixation of the mesh in laparoscopic inguinal hernia repair.
Patients and methods
This prospective study was carried out on 58 consecutive male patients with inguinal hernia. The patients were divided into two groups (A and B). Group A patients were treated by using the mesh fixation transabdominal preperitoneal (TAPP) repair, and group B patients were treated by using the mesh nonfixation TAPP repair. Then, postoperative pain and hernia recurrence were evaluated for the two groups.
Results
Highly significant difference was detected between the two groups as regards postoperative pain. Whereas, only one (3.44%) recurrent case was found in group B patients, which was found to be nonsignificant.
Conclusion
Mesh fixation as a routine appears to be unnecessary in TAPP repair. It is associated with higher operative costs and an increased chronic groin pain without increasing the risk for early hernia recurrence.

Keywords:
inguinal hernia, laparoscope, mesh fixation, transabdominal preperitoneal repair

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Introduction

Inguinal hernia repair is the most common procedure in general and visceral surgery worldwide. Over the past two decades, laparoscopic inguinal hernia repair has become more and more popular [1].

In early 1990 Arregui and Doin described the transabdominal preperitoneal repair (TAPP). Around the same time, Phillips and McKernan described the totally extraperitoneal (TEP) technique of endoscopic hernioplasty in which the peritoneal cavity was not breached [2].

Laparoscopy offered less postoperative pain, less analgesic consumption, earlier return to normal activities and work, and fewer long-term complications of groin pain and permanent paresthesia, but an equivalent recurrence rate compared with open mesh repairs [3].

In the laparoscopic procedure, tension-free repair is achieved by placement of a prosthetic mesh to cover the entire groin area, including the sites of direct, indirect, and femoral hernia. The laparoscopic approach is based on the principle of tension-free repair, which has been well established by open operation by Fitzgibbons *et al*. [4].

The mesh can be placed without fixation or can be fixed into place with tuckers. These metal tuckers increase the cost and there is an increased incidence of chronic groin pain [5].

Several studies have shown that nonfixation is a viable option without an increased risk for recurrence, and that it also has the advantages of shorter operative time, less chronic groin pain, no injury to the vas deference, gonadal vessels, inferior epigastric vessels, and an overall improved quality of life when compared with tucker fixation [6].

Laparoscopic inguinal hernia repair is recommended in cases with recurrent hernia after previous anterior repair, bilateral hernias, or a unilateral hernia when the presence

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of a contralateral hernia is strongly suspected, and if repair of an inguinal hernia is concurrent with another laparoscopic procedure, provided that there is no contamination of the peritoneal cavity [7].

The implanted preperitoneal mesh theoretically may migrate away from the abdominal wall defect leading to recurrence of hernia. Therefore, mesh fixation is a solution to avoid this complication. However, tucks used for mesh fixation can entrap the sensory nerves with subsequent persistent pain and burning sensations in the inguinal region, the upper medial thigh, or the scrotal skin region. When these symptoms persist, they may result in severe morbidity [8].

Patients and methods

This prospective study was conducted from April 2013 to October 2015 at the general surgery departments of Zagazig and Benha University Hospitals after obtaining approval from the local ethical committee and after all patients had signed an informed consent. The duration of the study (about 43 months) allowed for patients' selection and at least 12 months follow-up period from the last case operated upon. Fifty-eight consecutive male patients with inguinal hernias were recruited for this study.

Patients included in this study had an inguinal hernia of any type, direct or indirect, primary or recurrent, unilateral or bilateral. Whereas patients with incarcerated hernia or pervious lower abdominal surgery, such as pfannenstiel, lower midline, and other abdominal incisions below the umbilicus on the same side of the hernia, were excluded from this study.

A unique computer-generated randomization schedule was used to divided the patients in two equal groups. This schedule consisted of alternating blocks, which were faithfully reproduced into sealed, ordered envelopes. Following mesh placement, repairs were randomized into either a fixation or nonfixation group as determined by the intraoperative opening of the next envelope in order.

Group A included 29 patients who were operated upon by using laparoscopic TAPP with fixation of the mesh by using spiral tucks. Whereas group B included 29 patients who were operated upon by using laparoscopic TAPP without fixation of the mesh.

Technique

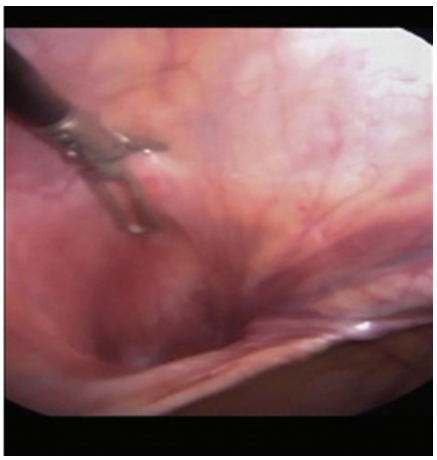
With the patient in the supine position general anesthesia was introduced and a urinary catheter was inserted. The surgeon stood on the opposite side of the hernia being operated. The monitor was placed at the foot on the side of the hernia.

A Veress needle was inserted into the peritoneal cavity with insufflations of CO_2 to a pressure of 12–15 mmHg to create pneumoperitoneum. First trocar "10 mm, supraumbilical" was used for 30°-angled laparoscope and two more were used at the lateral border of each rectus abdominis at the level of the umbilicus for instruments.

The key anatomic landmarks were identified on the inguinal region: the spermatic vessels, the medial umbilical ligament, the inferior epigastric vessels, and the vas deference. The indirect hernia was identified by the presence of a hole lateral to the junction of the vas deferens, the testicular vessels, and the inferior epigastric vessels (Fig. 1), whereas direct hernia appeared as a complete circle or hole medial to the inferior epigastric vessels and medial to the vas deferens–vascular junction.

A pair of curved scissors or the hook cautery was used to create a peritoneal flap by making a transverse incision along the peritoneum, 2 cm above the upper border of the internal inguinal ring and extending laterally 5 cm beyond the internal inguinal ring and continuing medially till the pubic tubercle (Fig. 2). Extreme care must be taken to avoid injury to the inferior epigastric vessels. Bleeding from these vessels can be controlled by cauterization or application of hemostatic clips. The incised peritoneal flap was grasped and dissected by blunt or sharp dissection near the abdominal wall to avoid injury of the vascular element till creation of a good lower peritoneal flap for closure of the peritoneum after repair.

Figure 1

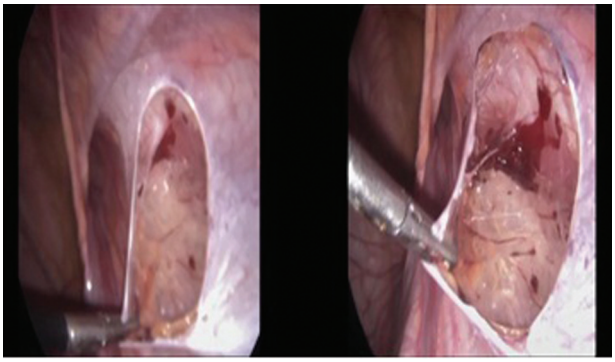


Laparoscopic view shows landmark of indirect hernia.

The hernia sac was dissected from the spermatic cord (Fig. 3) by inward traction and counter traction; blunt dissection of the sac may be necessary, with progressive inversion of the sac until the musculofascial boundary of the internal inguinal ring is identified or the complete separation of the sac. The sac was grasped at its apex and pulled inward, thus being reduced by inversion.

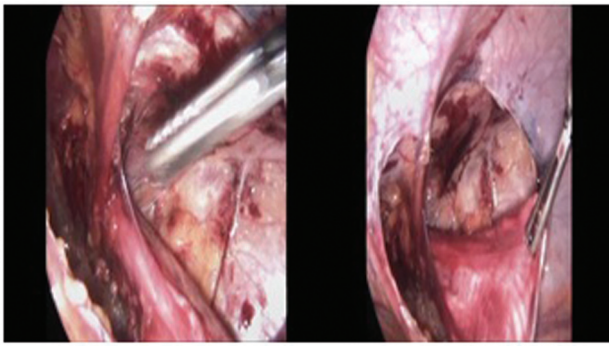
After reduction of the sac, reidentification of the anatomical landmarks (Fig. 4) and assessment of vascular elements was carried out to avoid their injury, and the tissues required for reliable mesh fixation were located. The pubic tubercle was more easily felt than seen. Cooper's ligament was seen along the pectineal prominence of the superior pubic ramus as dissection continued laterally and the fatty tissue was swept off to expose the glistening white structure. The iliopubic tract was identified at the inferior margin of the internal inguinal ring, with the spermatic cord above. Minimal dissection was carried out inferior to the iliopubic tract to avoid injury to the genital branch of genitofemoral nerve, the femoral nerve, and the lateral cutaneous nerve of the thigh.

Figure 2



Creation of peritoneal flaps.

Figure 3



Dissection on the hernia sac.

A polypropylene 15×10 cm sheet mesh was rolled into a tubular shape and introduced into the abdomen through the 10-mm port, and then the mesh was used to cover the direct space, the indirect space, and the femoral ring areas (i.e. the entire inguinal floor). No slit was made in the mesh for the cord (Fig. 5).

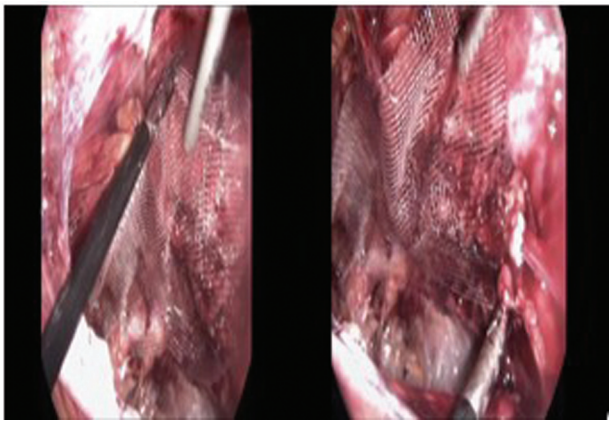
Group A patients (mesh fixation)

An endoscopic multifire spiral tucker was used to fix the mesh in place by applying tuckers, first to Cooper's ligament and then to the upper margin of the mesh fix to rectus abdominis and the fascia transversalis fascia 2 cm above the level of the internal inguinal ring to avoid injury of the inferior epigastric vessels. A two-handed technique is recommended for fixation of tuckers, one hand on the tucker and the other on the abdominal wall, thus applying external pressure to place the wall against the tucker. All tucks were placed superior to the iliopubic tract to prevent injury of the lateral cutaneous nerve of the

Figure 4

Reidentification of the landmarks of indirect hernia after peritoneal dissection.

Figure 5



Transabdominal preperitoneal repair: fashioning and fixation of the mesh.

thigh or the branches of the genitofemoral nerve. Thus, no tucks were applied inferolateral to the mesh.

Group B patients (non-fixation technique)

A 15×10 cm sheet of polypropylene mesh was fashioned to cover the direct space, the indirect space, and the femoral ring areas (i.e. the entire inguinal floor). No slit cut was made in the mesh for the cord, no tacks were placed and mesh just fashioned on defect and peritoneum closed over it.

Both groups

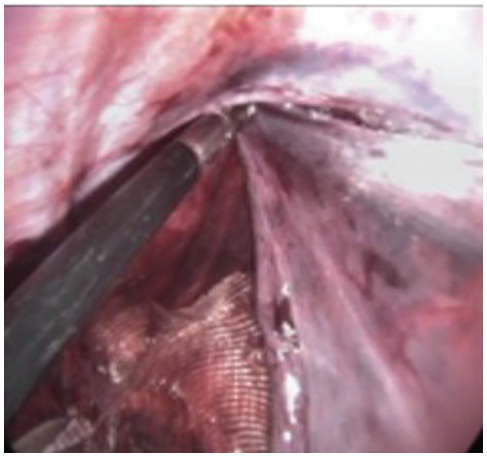
The peritoneal flap, including the redundant hernia sac, was placed over the mesh, and the peritoneum was reapproximated using a tucker (Fig. 6). Reduction of the intra-abdominal pressure to 8 mmHg, coupled with external abdominal wall pressure, facilitated a tension-free reapproximation. Alternatively, the peritoneum may be sutured over the mesh.

The peritoneal repair was inspected to ensure that there were no major gaps that might result in exposure of the mesh and subsequent formation of adhesions. The ports under direct vision were removed and the pneumoperitoneum was released. The fascia at the 10 mm port sites was sutured and the skin was closed with 4–0 absorbable subcuticular sutures.

Postoperative management and follow-up

Antibiotic coverage was continued 24 h postoperatively. Scrotal support was applied to all patients. All patients received a single dose of pethidine hydrochloride 75 mg intramuscular during the early postoperative period. After that, analgesia was maintained by nonsteroidal, anti-inflammatory drug injections (diclofenac sodium: 75 mg), and then by the oral form of the same drug upon discharge. Patients were discharged postoperatively with a follow-up scheduled for all patients on days 7 and 14 at the outpatient clinic. Further follow-up visits were scheduled on 1 month, 3 months, and 1 year for assessment of hernia recurrence.

Figure 6



Transabdominal preperitoneal repair: closure of the peritoneum.

Statistical analysis

The obtained data were presented as mean±SD, ranges, numbers, and ratios. The collected data were tabulated and analyzed using the *t*-test and the χ^2-test. Statistical analysis was conducted using the SPSS (SPSS Inc., Chicago, Illinois, USA) (version 16) for Windows statistical package. Values of *P* less than 0.05 were considered statistically significant.

Results

Fifty-eight male patients with inguinal hernia were randomly divided into two groups. Group A included 29 patients who were treated by laparoscopic TAPP with mesh fixation. Group B included 29 patients and were treated by laparoscopic TAPP with mesh nonfixation. All patients were selected to have noncomplicated hernias. There was a nonsignificant ($P>0.05$) difference between the studied patients as regards age, type of work, smoking, and side and type of hernia (Tables 1 and 2).

Highly significant difference was detected between the two groups as regards postoperative pain by using the χ^2-test (Table 3).

The price of a single disposable titanium tucker applicator was about 1500 LE for a single patient. Thus, the cost of disposable materials and equipment was less per patient in the nonfixation group.

We found no cases of recurrence in group A, whereas there was one case of recurrence (3.4%) in group B.

Table 1 Preoperative data

	n (%)		*P*
	Group A	Group B	
Age (mean±SD)	43.9±4.3	45.1±3.9	0.938
Type of work			
Heavy manual work	6 (20.8)	7 (24%)	0.855 (NS)
Moderate manual work	11 (37.9)	9 (31)	
Sedentary work	12 (41.3)	13 (45)	
Smoking			
Smokers	20 (69)	21 (73)	0.838
Nonsmokers	9 (31)	8 (27)	
Side of hernia			
Right	13 (44.8)	13 (44.8)	0.671 (NS)
Left	9 (31)	11 (38)	
Bilateral	7 (24.2)	5 (17.2)	

$P>0.05$, nonsignificant (NS). $P<0.05$, significant (S). $P<0.01$, highly significant (HS).

Table 2 Types of inguinal hernia

	n (%)		*P* value
	Group A	Group B	
Primary direct	8 (27.5)	5 (17.2)	0.611 (NS)
Primary indirect	20 (69)	20 (69)	
Combined inguinal hernia	1 (3.5)	4 (13.8)	

P>0.05, nonsignificant (NS). *P*<0.05, significant (S). *P*<0.01, highly significant.

Table 3 Postoperative pain using the Visual Analogue Scale

	Group A (mean±SD)	Group B (mean±SD)	*P* value
Early 24 h	3.5±0.7	2.9±0.7	0.0016 (HS)
After 1 week	1.6±0.4	1.1±0.3	0.06
After 1 month	0.9±0.3	0.6±0.24	0.08

P>0.05, nonsignificant (NS). *P*<0.05, significant (S). *P*<0.01, highly significant (HS).

This case was found in the first operation to have combined pantaloon hernia with abdominal wall defect of about 3.7 cm. The patient started to notice a groin bulge 2 months after operation.

Discussion

This study included 58 adult patients with inguinal hernias. The patients were randomly divided into two equal groups (29 each); patients in group A were treated by laparoscopic hernioplasty (TAPP) with fixation of the mesh using single-use titanium tuckers, and those of group B by using TAPP with nonfixation of the mesh. The patients were followed up for a period of 12 months. We compared both procedures in different aspects as regards postoperative pain, recurrence rate, and finally the financial costs in Egyptian pounds. Postoperative pain levels were assessed in the two groups using the Visual Analogue Scale, which were shown to be around 2.9 in the first 24 h in the nonfixation group and 3.5 in the fixation group, with a *P*-value of 0.0016 (highly significant), and the same was observed in the late postoperative time of 1 month – 0.6 in the nonfixation group versus 0.9 in the fixation group, with a highly significant *P* value of 0.08. Thus, the nonfixation was shown to have a significant effect in one of the most annoying postoperative conditions for the patients, that is, postoperative pain. These results were in agreement with those of Lau and Pati [9] who conducted a case–control study comparing laparoscopic inguinal hernia repair with and without mesh fixation. Lau and Pati found that the postoperative pain levels upon coughing were around 4.7±0.003 in the fixation group versus 3.6±0.553 in the non-fixation group (*P*=0.049). Also, they reported that patients experienced pain several times per week in (3.5±0.124) with fixation compared with (2.2±0.683) without fixation (*P*=0.009). Pain that was moderate or severe was experienced by (1.2±0.005) 2% of fixated repairs, but not reported by any patient with unfixed mesh (*P*=0.06). Sajid *et al.* [10] encountered a randomized control trial showed that mean pain score on Visual Analogue Scale after fixation was 4.7±0.683 compared with 4.1±0.86 after nonfixation, with a highly significant *P*-value (*P*<0.001). In contrast, our results as regards pain were in contrast with those of Neugebauer *et al.* [11]. They reported that no single patient required extra analgesic until discharge from the hospital.

In the present study, there was only one recurrent case (3.44%) in group B, which was found to be nonsignificant. We realized that cases with big defects (>3 cm), medial defects, and/or combined direct and indirect hernias were more vulnerable to recurrence and probably needed mesh fixation to guard against its migration. Sajid *et al.* [10] and Khajanchee *et al.* [12] reported no increased incidence of recurrence in the two groups. Moreover, Teng *et al.* [6] and Tam *et al.* [13] published two randomized studies and meta-analysis of six randomized, controlled trials on 36 patients that showed that nonfixation of the mesh is not associated with increased hernia recurrence rate.

However, Phillips *et al.* [14] recommended using the largest possible piece of mesh and stapling it securely as he found that inadequate fixation of the mesh, particularly at the lower medial corner, was found to be a common cause for the recurrence of laparoscopic inguinal hernia. Tucker *et al.* [15] considered adequate fixation of the mesh critical in preventing early recurrence as recurrence of the hernia could result from a combination of factors, including technical or judgment errors, as well as mesh migration.

In this study, the tucker device that was used for fixation of the mesh by titanium tucks price was 1600 LE, for a single use disposable tucker per patient, and thus the supposed savings in our study only was about 46 400 LE. Thus, it is extremely evident that the nonfixation is a valuable technique in saving money in the actual costs, which is highly significant in a country like ours with limited financial resources. Sajid *et al.* [10] and Moreno-Egea *et al.* [3] conducted randomized, prospective studies, respectively, and found that that elimination of mesh fixation resulted in a savings of 120 $ per operation.

As evidenced from the above discussion, the nonfixation technique is a successful choice in the laparoscopic inguinal hernia repair; it has no

significant disadvantage over the conventional fixation of the mesh as regards recurrence, with an advantage of decreased postoperative pain and analgesia requirements, along with the highly significant financial advantages.

Our data support the available evidence that there is no reason to routinely use a fixation device for laparoscopic hernia repair, and that repair without mesh fixation is possible with an acceptable rate of recurrence and a low rate of chronic groin pain.

Conclusion

Mesh fixation appears to be unnecessary in TAPP repair of hernia defects. It is associated with higher operative costs and an increased likelihood of developing chronic groin pain. The omission of mesh fixation did not increase the risk for early hernia recurrence except in cases highly suspected for recurrence as big defects, medial defects, and/or combined inguinal hernia defects. Such cases require further studies for clear assessment.

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Conflicts of interest

There are no conflicts of interest.

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