A comparative study of mesh fixation versus nonfixation in laparoscopic totally extraperitoneal inguinal hernia repair

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Background
Inguinal hernia repair is one of the most common elective general surgical procedures, and laparoscopic inguinal hernia repair has become very popular procedure, accounting for 15–20% of hernia operations worldwide.
Aim of the work
This study was conducted to compare mesh fixation versus nonfixation in laparoscopic totally extraperitoneal (TEP) inguinal hernia repair.
Patients and methods
This study is a prospective randomized comparative study that was carried out in the Gastrointestinal and Laparoscopic Surgery Department of Tanta University Hospitals for a year on 40 patients with inguinal hernia who underwent TEP inguinal hernia repair. They were randomized into two equal groups (20 cases): group A: with mesh fixation and group B: without mesh fixation.
Results
All patients of both groups were males. Group A had a longer operative time than group B (P=0.018). There was no significant difference in postoperative pain in both groups (P=0.6). One (5%) patient in each group had an accidental peritoneal tear. No cases needed conversion. Drain was inserted in one (5%) patient in each group (P=1). No cases had seroma or hematoma formation or chronic groin pain in both groups. One (5% each) patient in each group had scrotal edema, and postoperative surgical emphysema was present in two (10%) patients in each group. No cases of postoperative wound infection or mesh infection were seen in both groups. There was a recurrence in one patient in group B (after 1 week postoperative). The mean hospital stay is statistically insignificant in between both groups. The mean total cost is much higher in group A than group B ($P<0.001$).
Conclusion
On comparing mesh fixation or nonfixation in laparoscopic TEP repair for inguinal hernia, we recommend the technique without mesh fixation as there were no differences in the complications, hospital stay, or recurrence, but longer operative time and higher cost were seen in mesh fixation technique.

Keywords:
inguinal hernia, laparoscopic totally extraperitoneal, mesh fixation, nonfixation

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Introduction

Inguinal hernia is the most common type of hernia. The incidence is approximately 25% in males and 2% in females [1]. There are numerous procedures for inguinal hernia repair and even further variations in techniques [1].

Two laparoscopic techniques have become the most common procedures for the repair of these hernias: transabdominal preperitoneal repair (TAPP) and totally extraperitoneal (TEP) repair. Laparoscopic TEP hernia repair has gained ground, in recent years, and is preferred over TAPP, as it is less invasive and is associated with fewer complications such as port-site hernias and visceral injuries [2].

Surgeons have previously fixed the mesh using laparoscopic stapling devices, tacks, and suturing techniques, and recently adhesives. Fixation of mesh is done to prevent migration of mesh resulting in recurrence. However, fixing the mesh increases the cost, duration of procedure, hospital stay, and complications like postoperative pain [3].

Aim of the work

The aim of this study was to compare mesh fixation versus nonfixation in laparoscopic TEP inguinal hernia

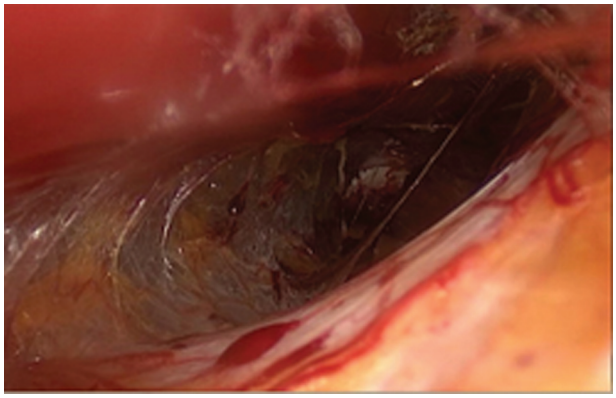
repair regarding operative time, early postoperative pain, late postoperative pain, cost, complications, hospital stay, and recurrence rate.

Patients and methods

This study is a prospective randomized comparative study that was carried out in the Gastrointestinal and Laparoscopic Surgery Department of Tanta University Hospitals for a period of 1 year (July 2017–July 2018) on 40 patients with inguinal hernia who underwent TEP inguinal hernia repair. This study is a prospective randomized comparativestudy that was carried out after ethical committee approval in the Gastrointestinal andLaparoscopic Surgery Department of Tanta UniversityHospitals for a period of one year (July 2017–July 2018)on 40 patients with inguinal hernia who underwentTEP inguinal hernia repair with accepted written consents. Our patients were randomized into two equal groups:

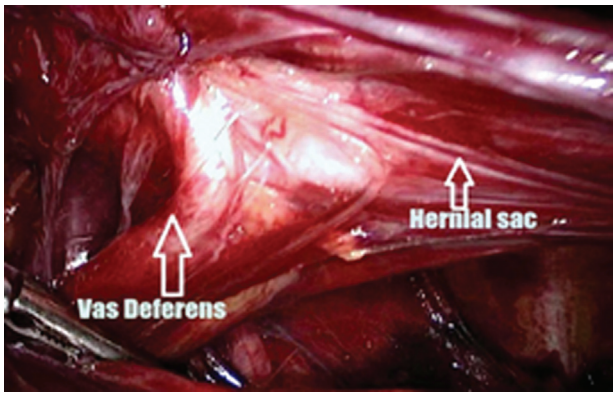
(1) Group A: the mesh was fixed with tackers (20 cases).

Figure 1



Creation of the work space.

Figure 2



Dissection of hernia sac from cord structures.

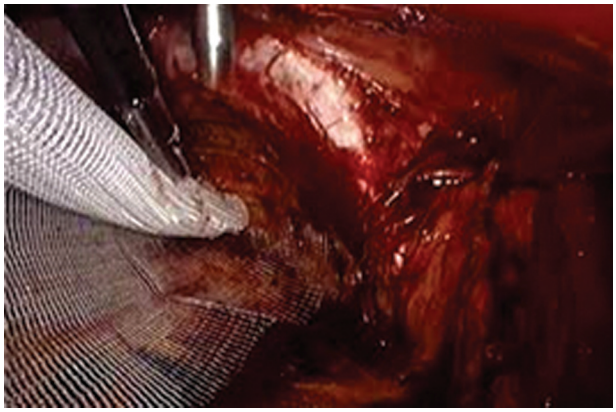
(2) Group B: the mesh was inserted without fixation (20 cases).

All patients with primary inguinal hernias above 18 years old were included. Patients with complicated (obstructed or strangulated) inguinal hernias, previous pelvic surgery, lower midline scars, and severe comorbidities, for example, severe cardiac, hepatic or renal disease, were excluded from this study.

Parietalization of cord structures, the hernial sac was identified and completely reduced while in large indirect sacs transected leaving the distal part of the sac *in situ* with extracorporeal ligation of its proximal end (Figs 1 and 2).

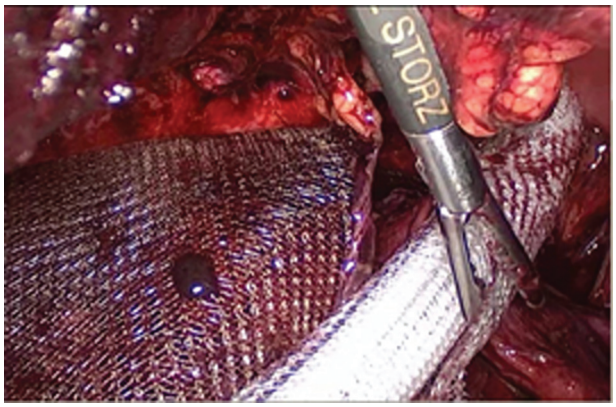
Blunt dissection was done of the lateral space between inferior epigastric vessels superiorly and cord structures inferiorly till reaching the anterior superior iliac spine laterally and visualization of psoas muscle inferiorly. A 12×15 cm polypropylene mesh introduced through the 10-mm infra-umbilical port and unfolded from medial to lateral (Figs 3 and 4).

Figure 3



Introduction of mesh.

Figure 4



Introduction of mesh.

All defects and potential hernia sites in the groin were covered (internal ring, Hesselbach's triangle, and femoral canal). The lower edge must extend well below the level of the inguinal ligament. The lateral part of the patch folded over and extended beyond the iliac vessels.

Mesh was inserted without fixation in 20 cases (Fig. 5) and fixed with tacker in other 20 cases (Fig. 6). In mesh nonfixation, we used the two 5-mm graspers over the mesh until complete deflation under vision until creeping of peritoneum and its filling over the mesh, ensuring that the inferior border of the mesh will not roll up, and then, removal of the instruments and trocars was done. This was done to avoid shrinkage of mesh. In mesh fixation, two or three tacks were usually placed only in the pectineal ligament and to the rectus muscle medially and the transversus abdominis laterally.

Suction drain was used in one patient in each group, who were fat men (BMI, 29.3–32), through lower 5-mm suprapubic port, as those hernias were large reaching the neck of the scrotum, and excessive manipulation and dissection followed. It was placed for fear of seroma formation and removed after 24 h.

The comparative evaluation criteria

Operative time, intraoperative complications, postoperative groin pain using visual analog scale after 24 h, postoperative complications, hospital stay in days, and hernia recurrence were recorded.

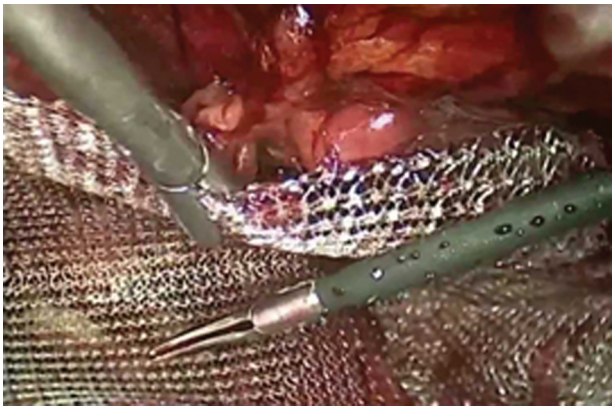
Follow-up was done weekly in the first month, and then monthly up to 6 months postoperative.

Results

In group A, all patients had unilateral hernia, eight on the right side and 12 on the left side, whereas in group B, all patients had unilateral hernia, nine on the right side and 11 on the left side. The mean age in group A was 40.10 ±12.39 years compared with group B, which was 41.60 ±15.26 years, without a statistically significant difference. All patients of both groups were males (100%).

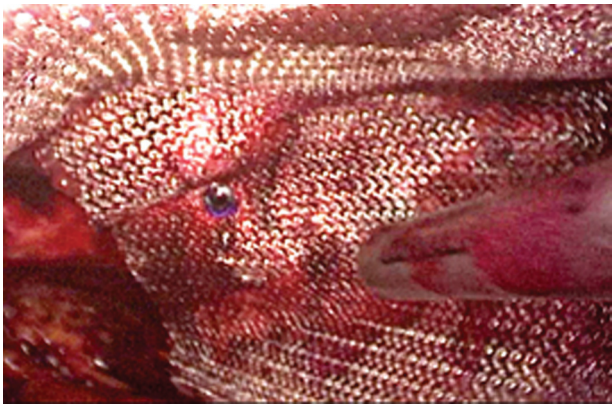
In group A, indirect hernias were found in 17 (85%) patients and direct hernias were found in three (15%) patients, whereas in group B, indirect hernias were found in 16 (80%) patients and direct hernias in four (20%) patients. The difference was statistically insignificant (P=1.000) (Table 1).

Figure 5



Mesh insertion without fixation.

Figure 6



Mesh fixation with tacks.

Table 1 Comparison between the two studied groups according to type of inguinal hernia

	Group A (N=20) [n (%)]	Group B (N=20) [n (%)]	χ^2	P
Type of inguinal hernia				
Direct	3 (15.0)	4 (20.0)	0.173	^{FE}P=1.000
Indirect	17 (85.0)	16 (80.0)		

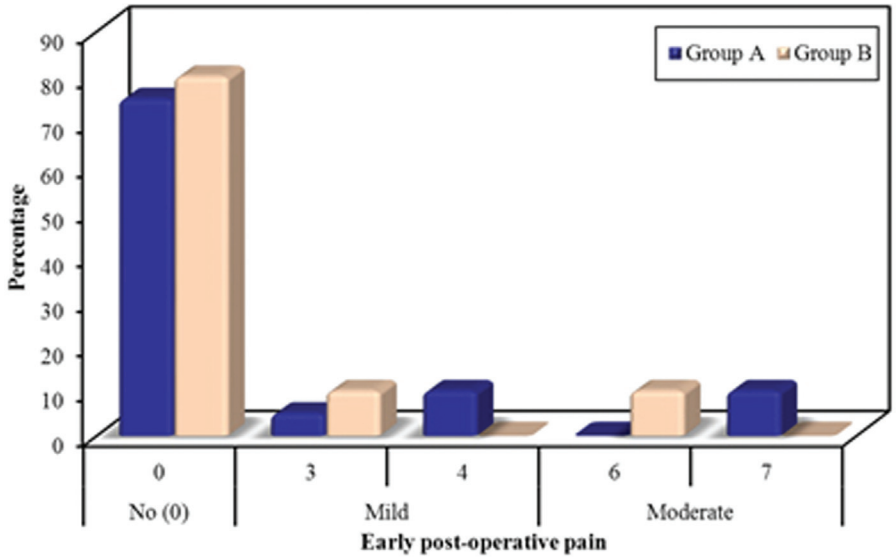
χ^2, χ^2 test; FE, Fisher's exact; MC, Monte Carlo; P, P value for comparing between the two groups.

Table 2 Comparison according to operative time

Operative time	Group A (N=20)	Group B (N=20)	t	P
Minimum–maximum	45.0–80.0	40.0–75.0	2.463*	0.018*
Mean±SD	64.0±9.95	56.0±10.59		
Median	65.0	52.50		

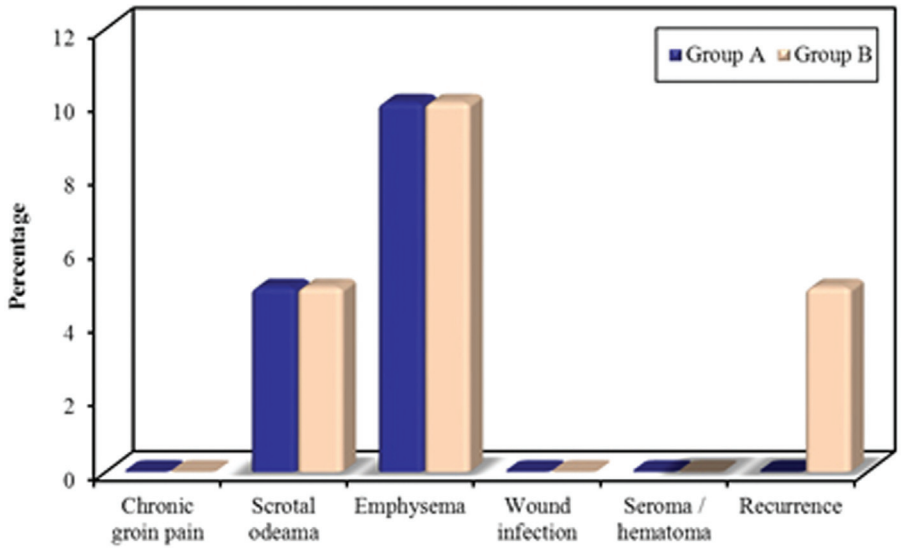
t, Student's t test. P, P value for comparing between the two groups. *Statistically significant at P value less than or equal to 0.05.

Figure 7



Comparison according to early postoperative pain according to VAPS. VAPS, visual analog pain scale.

Figure 8



Comparison according to total cost.

Group A had a longer operative time than group B (Table 2).

Visual analog pain scale (VAPS) (Fig. 7) was used for pain assessment on first day after surgery. In group A, 15 (75%) patients had no early postoperative pain; three (15%) patients had mild pain, one case with VAPS 3 and two cases with VAPS 4; and two (10%) patients had moderate pain, both with VAPS 7. In group B, 16 (80%) patients had no pain; two (10%) cases with mild pain with VAPS 3; and two (10%) patients had moderate pain, both with VAPS 6. The mean pain score according to VAPS of group A was 1.25±2.38 and in group B was 0.90±1.97, with no significant difference in postoperative pain in both groups (P=0.6).

During this study (Fig. 8), only one (5%) patient in each group had an accidental peritoneal tear that was managed by insertion of Veress needle in the peritoneal cavity to work as a vent. No cases needed conversion to open hernia repair or TAPP procedure, and there were no bowel and visceral injuries in both groups. We usedadrain in two patients (5%), one in group A and one ingroup B. Both removed after 24 h.

No cases had seroma or hematoma formation or chronic groin pain in both groups for 6-month

follow-up. One (5% each) patient in each group had scrotal edema, which was treated conservatively. Postoperative surgical emphysema was present in two (10%) patients in each group. All these cases were treated conservatively and resolved within 2–3 days postoperatively. This was statistically insignificant. There were no cases of postoperative wound infection or mesh infection in both groups (Table 3).

There was a recurrence in one (5%) patient only in group B in the postoperative visit (after 1 week) who presented with right-side oblique inguinal hernia (funicular type), with completion of dissection of the sac with high ligation and separation and leaving the distal end as the sac was too long. Incomplete sac dissection and the presence of lipoma of the cord with rolled up mesh may be the cause of the recurrence after 1 week.

On the first day postoperative, 15 (75%) patients of group A were discharged on the first day postoperatively in comparison with 16 (80%) patients who were discharged in group B as there were no postoperative complications or pain, whereas three (15%) patients on the second postoperative day were discharged in group A in comparison with two (10%) patients in group B owing to mild postoperative pain in the five patients of both groups. On the third day postoperative, two (10%) patients of group A were discharged and two (10%) patients in group B owing to drain insertion in one patient in each group, two patient in each group developed scrotal edema, and two patients of each group developed moderate postoperative pain and surgical emphysema.

The mean hospital stay in group A was 1.35±0.67 in comparison with 1.30±0.66 in group B (P=0.74), which is statistically insignificant (Table 4).

The mean total cost of the operation in group A was 4539.8±2591.2 LE whereas in group B was 639.3 ±16.24 LE (P<0.001), which was statistically significant (Table 5, Fig. 8).

Table 3 Comparison between the two studied groups according to complications

	Group A (N=20) [n (%)]	Group B (N=20) [n (%)]	χ^2	^{FE}P
Chronic groin pain	0 (0.0)	0 (0.0)	–	–
Scrotal edema	1 (5.0)	1 (5.0)	0.0	1.000
Emphysema	2 (10.0)	2 (10.0)	0.0	1.000
Wound infection	0 (0.0)	0 (0.0)	–	–
Seroma/ hematoma	0 (0.0)	0 (0.0)	–	–
Recurrence	0 (0.0)	1 (5.0)	1.026	1.000

χ^2, χ^2 test; FE, Fisher's exact; MC, Monte Carlo; P, P value for comparing between the two groups.

Discussion

This study was done to compare mesh fixation and nonfixation in TEP repair of inguinal hernia.

The mesh fixation group had a longer time than mesh nonfixation group (P=0.018). Garg *et al.* [4] in their study on 104 patients in equal groups reported that the operating time was significantly longer for the fixation group (37.7±4.3 min) more than nonfixation (35.9 ±3.6 min) (P=0.022). Moreover, according to Tam *et al.* [5] (on 463 patients in mesh fixation group and 469 patients in mesh nonfixation group), there was a significantly longer operative time for mesh fixation operations (P= 0.04). Buyukasik *et al.* [1] (on 100 patients in two equal groups) found in their

Table 4 Comparison between the two studied groups according to hospital stay

Hospital stay	Group A (N=20) [n (%)]	Group B (N=20) [n (%)]	Test of significance	P
1 day	15 (75.0)	16 (80.0)	χ^2=0.424	^{MC}P=1.000
2 days	3 (15.0)	2 (10.0)		
3 days	2 (10.0)	2 (10.0)		
Minimum–maximum	1.0–3.0	1.0–3.0	U=191.0	0.739
Mean±SD	1.35±0.67	1.30±0.66		
Median	1.0	1.0		

Table 5 Comparison between the two studied groups according to cost

Cost	Group A (N=20)	Group B (N=20)	U	P
Minimum–maximum	1900.0–8200.0	600.0–690.0	0.0*	<0.001*
Mean±SD	4539.8±2591.2	639.3±16.24		
Median	4100.0	640.0		

U, Mann–Whitney test. P, P value for comparing between the two groups. *Statistically significant at P value less than or equal to 0.05.

study that the mean operative time is statistically insignificant (P=0.136).

There was no significant difference in postoperative pain in both groups (P=0.6) in the current study. In a study by Moreno-Egea and colleagues, on 170 patients who underwent TEP approach with or without mesh fixation randomized into two equal groups, the mean pain, according to visual analog scale score in the first 24 h, was statistically insignificant [6]. This was reported also by Garg *et al.* [4] in their study (P=0.23). In the study by Taylor *et al.* [7] on 360 patients (two equal groups), pain was moderate to severe and was experienced by 2% of fixated repairs, but not reported by any patient with nonfixated mesh, with no significant difference (P=0.06).

In a long series done by Tam *et al.* [5], it was found that there was no significant difference between groups in postoperative pain, with a weighted mean difference of −0.20 (P=0.19) on day 1, but there was a statistical significant increase in the incidence of pain when more than six tacks were used (P=0.008).

Raghu *et al.* [8] in their study on 30 patients who were randomized to two groups inferred that postoperative pain was significantly less in the nonfixation group compared with the mesh fixation group. Moreover, the study by Buyukasik *et al.* [1], where pain scores were determined by numeric pain rating scale, reported that pain was significantly higher in the mesh fixation group (P=0.034).

In the current study, there was an accidental peritoneal tear in one patient in each group, with no statistical significance. A study by Khajanchee and colleagues on 129 patients found that the peritoneal lacerations occurred in 16 (12.4%) patients. Three (2.3%) required conversion to a TAPP approach, and seven (5.4%) required decompression of the peritoneal cavity using a Veress needle for completion of the extraperitoneal procedure [9].

Sawarkar *et al.* [10] in their study on 75 patients with mesh fixation found that pneumoperitoneum was seen in 24 (32.0%) patients, which was benign and managed conservatively with insertion of Veress needle. Moreover, in a study by Liew *et al.* [11] on 34 patients with tacker mesh fixation technique, pneumoperitoneum was found in three (8.8%) patients.

No cases needed conversion to open hernia repair or TAPP procedure, and there were no bowel and visceral injuries in our study. This was similar to the results of study by Krishna *et al.* [12] on 53 patients operated with laparoscopic TEP without mesh fixation. There was one conversion to TAPP technique in the study of Bansal *et al.* [13], where 160 patients underwent laparoscopic TEP inguinal hernia repair without mesh fixation. Fitiği *et al.* [14] in their study on 60 patients without mesh fixation reported that four (6.6%) patients had to be changed to open surgery because of technical problems. In a large number of cases (3868) done without the use of staple fixation, Tamme *et al.* [15] found that there was conversion to Lichtenstein or TAPP in 12 (0.23%) patients, with no bowel injury but urinary bladder injury in eight (0.15%) patients. Dulucq Louis and colleagues, found on their study of 2356 patients who underwent laparoscopic hernia repair with lap TEP without mesh fixation that there were 36 (1.5%) hernias that required conversion: 12 (0.04%) hernias were converted to open anterior Lichtenstein and 24 (0.08%) to laparoscopic TAPP technique. Most of these conversions occurred early in their experience for complicated hernias [16].

Drain was inserted in one patient in each group (5%) (P=1) and removed after 24 h in this study. The study by Garg *et al.* [4] inserted drain in mesh fixation group in six (11.5%) patients and in eight (15.4%) patients in mesh nonfixation group. Garg *et al.* [17] also suggested that the drain could significantly reduce the incidence of seroma without increasing the risk of infection. Tamme and colleagues recommends the routine use of drain in TEP technique, because release of carbon dioxide pressure is followed by bleeding from tiny capillaries, resulting in an unpredictable amount of blood collected in the preperitoneal space. Avoidance of postoperative hematomas is important to achieve a low mesh infection rate and prevent potential mesh displacement by collection fluid [15]. Although Shpitz *et al.* [18] suggested that postoperative suction drains did not reduce the frequency of sonographically detected fluid collections additionally, the placement of drainage is regarded as a potential risk of iatrogenic infection.

No cases with chronic groin pain in this study were encountered in both groups for 6-month follow-up. This was consistent with different studies such as Buyukasik *et al.* [1], Girish *et al.* [8], Moreno-Egea *et al.* [6], and Muthukumar *et al.* [19], where all patients irrespective of the groups did not experience any pain through 6 months postoperatively. In a large case study by Tam *et al.* [5], it was found that only three patients complained of neuralgia in each group, revealing no significant difference in the incidence of neuralgia between groups.

In contrast to our study, different studies showed increased incidence of chronic groin pain in mesh nonfixation approach. Garg *et al.* [4] found that the mean pain scores at 1 week, at 1 month, at 1 year, and at 2 years were higher in nonfixation group. Bansal and colleagues (160 patients) reported that the incidence of numbness over the upper part of the scrotum and thigh at 1 and 3 months of follow-up was seen in nine patients with repair by nonfixation technique. There was testicular pain and discomfort in four (2.6%) patients [13]. Messaris and colleagues conducted a study on 274 patients with without mesh fixation and found that at 12 months, all patients reported no pain at the surgical site and complete resolution of the preoperative symptoms. However, 12 (4%) patients reported pain as infrequent twinges of discomfort occurring less than three times per month, being irrelevant to any activities [20].

Regarding other postoperative complications, in this study, we had no cases of postoperative seroma or hematoma. One patient in each group (5% each) had scrotal edema, with no statistically significance. Garg *et al.* [4] found in their study that the proportion of patients with seroma formation was also similar in both groups [fix, 10.4% (n=52) and nonfixation, 15.4% (n=52), P=0.56)]. Sawarkar *et al.* [10] had one patient with seroma formation, which healed by itself. However, four patients developed seroma, which had dissipated at postoperative first month follow-up, in the study of Fitiği *et al* [14]. The study by Krishna *et al.* [12] reported scrotal edema in five (9.4%) patients. Misra *et al.* [21] in their study on 56 patients reported that scrotal edema was found in 10 (17.8%) patients. Sawarkar *et al.* [10] found that two (2.6%) patients among 75 patients who underwent TEP with mesh fixation had scrotal pain and edema.Postoperative surgical emphysema was present in two (10%) patients in each group in this study, with no statistically significant differences. Saggar and colleagues studied 100 patients who underwent TEP approach, of which 99% developed subcutaneous emphysema to varying degrees. Emphysema was not clinically apparent in only one patient, and 61% of patients developed significant emphysema. However, emphysema resolved completely in 46% of patients within 6 h, and it persisted beyond 24 h in only 16 patients [22].

Hernia recurrence occurred in one patient in mesh nonfixation group in the current study. Ayyaz *et al.* [23] found in their study on 63 patients in the study in two groups that only one recurrence was encountered in 5-year follow-up in the group of nonfixation. However, in the study by Sajid *et al.* [24], four patients developed recurrent inguinal hernia in 691 patients having mesh fixation and three patients developed recurrent inguinal hernia in 691 patients having nonmesh fixation. In contrast, other studies done by Buyukasil *et al.* [1], Girish *et al.* [8], Messaris *et al.* [20], and Chauhan and Chheda [25] reported that there was no recurrence seen in all patients in the follow-up period.

There were no statistically significant differences (P=0.74) in the mean hospital stay in our study. This was agreed also by the studies by Buyukasik *et al.* [1] and Lau and Patil [26]. Meyer *et al.* [27] did TEP repair without mesh fixation in 157 patients, and the mean hospital stay was less than 12 h in 95% of the patients.

The mean total cost was much bigger in mesh fixation group (P<0.001). This is consistent with the studies by Moreno-Egea *et al.* [6], Taylor *et al.* [7], and Girish *et al.* [8]. Ferzli *et al.* [28] in their study on 92 patients randomized into two groups reported a savings of $120 for each laparoscopic procedure done without fixation than fixation (P<0.001).

Conclusion

TEP technique with mesh insertion is now more recommended for primary inguinal hernia repair. The necessity of mesh fixation in TEP technique repair is controversial. On comparing mesh fixation or nonfixation, we recommend TEP technique without mesh fixation with only 5% recurrence, as there were no differences in the postoperative pain, operative, and postoperative complications, and hospital stay, but there was longer operative time and higher cost in mesh fixation. To reduce the cost of mesh fixation, it is recommended to use fibrin glue or intracorporeal suturing despite its challenging learning curve and narrow preperitoneal space and instrument ergonomics.

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Nil.

Conflicts of interest

This study was a comparative study in techniques of laparoscopic TEP for primary inguinal hernias without any conflict of interest.

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