

Mesh Fixation Versus Non-Fixation in Laparoscopic Trans-Abdominal Preperitoneal Repair of Inguinal Hernia: A Randomized Controlled Study

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ABSTRACT

Background: Several methods are used for mesh fixation in laparoscopic hernia repair including staples, tackers, sutures, and polycyanoacrylate derivatives.

Objective: This study aimed to compare the outcomes of fixation versus non fixation of the mesh in laparoscopic trans-abdominal preperitoneal repair (TAPP).

Patients and methods: The current study include 64 male patients who were eligible for TAPP repair. They were divided into two groups: Group A (n =32) underwent TAPP with mesh fixation, while group B (n=32) underwent TAPP without mesh fixation. Follow up was done for Operative time and times to ambulation, return to daily activity, long-term follow up for recurrence and postoperative pain.

Results: The mean age was 42.7 ± 4.5 and 44.2 ± 3.9 years in groups A and B respectively. There was significantly less mean operative time in group B than in group A. There was no statistically significant difference regarding early post-operative pain in both groups. The reported time for return to basic, home and work activities were almost the same with no reported significant difference. For long-term follow up there was statistically significant less chronic pain and FB sensation in group B. There was no reported recurrence, or testicular atrophy in both groups.

Conclusion: According to the current results, TAPP repair can be done without significant impact on the outcomes.

Keywords: Inguinal hernia, TAPP, Mesh fixation.

INTRODUCTION

One of the most common general surgical procedures carried out worldwide is the treatment of an inguinal hernia. Patients suffering from inguinal hernias have various treatment choices to choose from, such as laparoscopic mesh prosthetic repairs, open primary repair, open tension-free repair, and careful waiting [1, 2].

Laparoscopic surgery can be utilized to correct an inguinal hernia. Several techniques including the laparoscopic transabdominal preperitoneal (TAPP), completely extraperitoneal (TEP), and intraperitoneal onlay mesh methods, can be used [3]. More than 20 years ago, laparoscopic inguinal hernia repair was first performed. It is becoming more popular as an inguinal hernia treatment [4].

TAPP is an increasingly popular minimally invasive procedure for treating inguinal hernias [5]. When using the TAPP technique for laparoscopic inguinal hernia repair, there is still debate concerning mesh fixation vs non-fixation. The incidence and recurrence rate of postoperative neuralgia have not been found to be impacted by mesh fixation [6]. Inguinal hernia repair is frequently accomplished with laparoscopic surgery.

Excellent outcomes are achieved when transabdominal preperitoneal and fully extraperitoneal surgeries are carried out. Hernias still occasionally reoccur, but they are becoming less common over time, occurring at a rate of less than 3%. Improved surgical

skills, widespread mesh use, and innovative mesh fixation techniques may account for lower recurrence rates [7, 8].

The majority of fixation devices offered by medical supply companies are sutures and tacks, whether or not they are absorbable. Strong primary mesh fixation is ensured by this method of fixation, although pain and discomfort may be experienced. With the significant decline in recurrence rates, manufacturers and clinicians are increasingly concentrating on enhancing postoperative quality of life. In certain situations, the complete lack of fixation may be taken into account.

This may result in mesh migration, although it can also lessen postoperative pain. Although there are now less intrusive fixation methods available, it is important to make sure that they still deliver the same fixation [8-10]. The grey area about the efficacy of mesh fixation versus non-fixation has motivated the authors to conduct this study.

PATIENTS AND METHODS

Study design: Eligible patients were enrolled from the General Surgery Department throughout the period from April 2022 till April 2024.

Inclusion criteria: Adult patients with primary unilateral oblique inguinal hernia with an age range from 18-65 years, and patients with American Society of Anesthesiologists (ASA) grade less than 3.

Exclusion criteria: Patients with age less than 18 years, recurrent inguinal hernia, complicated and huge scrotal hernia, previous lower abdominal or pelvic surgery, general conditions contraindicate with laparoscopic surgery and BMI less than 35.

The current study included 64 male patients who were eligible for TAPP repair. They were divided by random allocation (software 1.0, 2011) into one of two groups

- Group A (n=32) underwent TAPP with mesh fixation.
- Group B (n=32) underwent TAPP without mesh fixation.

All studied cases were subjected to detailed history taking including, general and inguinal examination as well as routine laboratory investigations.

Procedure: Getting ready for a laparoscopic TAPP:

The patient was given general anesthesia for the procedure. On the operating table, the patient was put in the supine Trendelenburg position with fixation of a urinary catheter. Three ports were utilized; two 5 mm trocars were inserted at the same level of the umbilicus on both sides at the midclavicular line, and the camera port was implanted at the supraumbilical crease using an open approach. Pneumoperitoneum was subsequently achieved by CO₂ with pressure adjusted at 14 mmHg. A 30-degree telescope offers a clearer image.

Recognizing anatomical landmarks (Figure 1):

In order to locate the hernial defect and significant anatomical markers such as the umbilical ligament, the triangle of pain, the triangle of doom, and the epigastric arteries, we examined the inguinal region and the abdominal cavity.

Dissection of the peritoneal flap (Figure 2):

The peritoneum was separated from the fascia transversalis to produce a gap after the peritoneal flap was dissected at a location close to the ASIS and directed medially up to the midline in a curvilinear manner. In order to avoid damaging the bladder during dissection, avoid going over the level of the medial umbilical fold.

They identified and circumvented the inferior epigastric veins. To allow for parietalization of the spermatic cord, dissection should extend medially to the symphysis pubis, and laterally the anterior superior iliac spine and psoas major. Superiorly, it should extend up to 3 cm above the defect, and medial inferior border, which is 3 cm below the pectineal ligament.

Dissection of the hernial sac (Figure 3):

Dissection was done until the sac was completely separated from the cord and other structures. The sac was pulled inwards out of the defect.

Fixation of the mesh:

A 15 × 15 cm polypropylene mesh was employed. Tacker fixed the mesh in the fixation group in the anterior abdominal wall on both sides of the inferior epigastric vessels as well as in the Cooper's ligament. While it remained the same for the non-fixation group (Figures 4-6).

Postoperative care:

After surgery, all patients were hospitalized for a minimum of 24 hours and were released when they could tolerate food, had a bowel movement, were mobile, and their pain could be managed with oral analgesics. Any complications were communicated. Follow-up and result measurements for walking time, operational time, and return to regular activities, postoperative discomfort, and long-term monitoring for recurrence. The visual analogue score (VAS) was used to measure pain at one, three, and six months following surgery. There are four VAS scores: 0 for no pain, 1-3 for mild, 4-6 for moderate, and 7-9 for severe pain. There were reports of wound infections, postoperative seromas, postoperative hematomas, foreign body sensation, and recurrences as postoperative consequences.

Outcomes:

- **The 1st research outcome** was safe TAPP repair with minimal intra- and post-operative complication.
- The 2nd research outcome** was decrease incidence of recurrence.

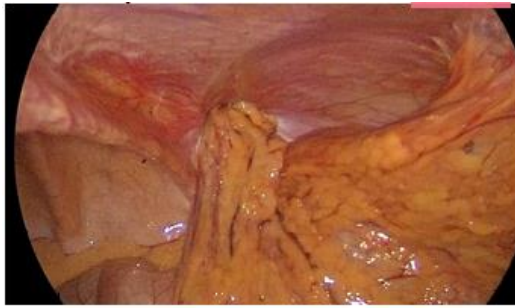


Figure (1): Identification of the hernia.



Figure (2): Creation of peritoneal flap.



Figure (3): Dissection of the sac.



Figure (4): Fixation of the mesh by tachers.



Figure (5): Mesh flattening without any fixation.



Figure (6): Closure of the peritoneum.

Ethical Approval: This study was ethically approved by the Institutional Review Board of the Faculty of Medicine, Benha University. Written informed consents were obtained from all participants. This study was executed according to the code of ethics of the World Medical Association (Declaration of Helsinki) for studies including humans.

Statistical analysis

SPSS statistics version 20 was used. To compare the measured variables between the two groups and between various time periods, a two-way mixed ANOVA was run. The ANOVA test was used to the participant's

demographic data. Mean and standard deviation were used to represent numerical data, whereas number and percentage were used to show nominal data. The threshold for significance was fixed at $P \leq 0.05$.

RESULTS

Group A underwent TAPP with mesh fixation and group B underwent TAPP without mesh fixation. The mean age was 42.7 ± 4.5 and 44.2 ± 3.9 years for groups A and B respectively. No significant difference between the preoperative comorbidities between the two groups was reported (Table 1).

Table (1): Sociodemographic data

Characteristic		Group A (N=32)	Group B (N=32)	P value
Age	Mean \pm SD	42.7 \pm 4.5	44.2 \pm 3.9	0.12
ASA Score	Mean \pm SD Range	1.2 \pm 0.6 (1-3)	1.4 \pm 0.5 (1-3)	0.57
HTN	N(%)	4(12.5%)	3(9.37%)	0.09
DM	N(%)	2(6.25%)	3(9.37%)	0.078
IHD	N(%)	1(3.12%)	1(3.12%)	1.00
Smoking	N(%)	13(40.62%)	14(43.75%)	0.91
BMI (kg/m ²)	Mean \pm SD	28.8 \pm 3.8	29.6 \pm 4.2	0.089

Table (2) showed that mean duration of hernia was 44.6 \pm 5.9 and 49.2 \pm 4.6 months in groups A and B respectively.

Table (2): Hernia characteristics

Characteristic		Group A (N=32)	Group B (N=32)	P value
Right side operation(n)	N(%)	15(47%)	14(44%)	0.14
Left side operation (n)	N(%)	17(53%)	18(56%)	0.29
Duration of hernia(months)	Mean \pm SD	44.6 \pm 5.9	49.2 \pm 4.6	0.08
Hernia diameter of the defect in cm	Mean \pm SD	2.45 \pm 0.23	2.7 \pm 0.12	0.45
Preoperative pain (VAS)	Mean \pm SD	0.75 \pm 0.1	0.78 \pm 0.12	0.56

Significant less mean operative time was reported in group B (Table 3).

Table (3): Operative data

Variable		Group A (N=32)	Group B (N=32)	P value
Operative time (Minutes)	Mean \pm SD	68.5 \pm 11.2	57.2 \pm 6.4	0.001
Intraoperative complications	N(%)	0(%)	0(%)	1.00
Postoperative hospital stay (Days)	Mean \pm SD	1.2 \pm 0.3	1.3 \pm 0.4	0.08

For the early post-operative complications no significant difference between both groups as regards the testicular oedema, hematoma, seroma or ecchymosis and surgical site infection. There was no statistically significant difference regarding early post-operative pain in both groups. The reported time for return to basic, home and work activities were almost the same with no reported significant difference (Table 4).

Table (4): Early postoperative complications (30 days follow up)

Variable		Group A (N=32)	Group B (N=32)	P value
Testicular edema				
7 days	N(%)	2(6.25%)	2(6.25%)	1.00
30 days	N(%)	1(3.12%)	0(%)	0.056
Testicular atrophy	N(%)	0(%)	0(%)	1.00
Inguinal hematoma	N(%)	4(12.5%)	3(9.37%)	0.09
Hematomas needing drainage	N(%)	0(%)	0(%)	1.00
Ecchymosis	N(%)	2(6.25%)	2(6.25%)	1.00
Seroma				
7 days	N(%)	3(9.37%)	2(6.25%)	0.078
30 days	N(%)	0(%)	0(%)	1.00
Surgical site infection	N(%)	1(3.12%)	1(3.12%)	1.00
Post operative pain VAS	Mean \pm SD	5.2 \pm 1.3	4.9 \pm 0.9	0.062
Return to basic activity	Mean \pm SD	1.4 \pm 0.45	1.2 \pm 0.5	0.16
Return to home activity	Mean \pm SD	5.1 \pm 1.6	4.8 \pm 1.78	0.27
Return to work activity	Mean \pm SD	12.33 \pm 5.3	11.2 \pm 6.1	0.089

For long-term follow-up after 6,12 and 18 months respectively there was statistically significant less chronic pain and FB sensation in Group B. there was no reported recurrence, or testicular atrophy in both group (Table 5).

Table (5): Long-term follow up

Variable		Group A (N=32)	Group B (N=32)	P value
6-month follow up				
Recurrence	N(%)	0(%)	0(%)	1.00
Pain VAS	Mean \pm SD	2.12 \pm 1.2	1.4 \pm 0.5	0.001*
Loss or change in sensation	N(%)	3(9.37%)	2(6.25%)	0.078
Abdominal wall stiffness	N(%)	5(15.6%)	4(12.5%)	0.34
F.B sensation	N(%)	8(25%)	6(18.75%)	0.01*
Testicular atrophy	N(%)	0(%)	0(%)	1.00
12-month follow up				
Recurrence	N(%)	0(%)	0(%)	1.00
Pain VAS	Mean \pm SD	0.9 \pm 0.3	0.6 \pm 0.2	0.001*
Loss or change in sensation	N(%)	2(6.25%)	2(6.25%)	1.00
Abdominal wall stiffness	N(%)	4(12.5%)	4(12.5%)	1.00
F.B sensation	N(%)	7(21.88%)	5(15.6%)	0.01*
Testicular atrophy	N(%)	0(%)	0(%)	1.00
18 month follow up				
Recurrence	N(%)	0(%)	0(%)	1.00
Pain VAS	Mean \pm SD	0.8 \pm 0.25	0.3 \pm 0.1	0.001*
Loss or change in sensation	N(%)	1(3.12%)	1(3.12%)	1.00
Abdominal wall stiffness	N(%)	3(9.37%)	2(6.25%)	0.078
F.B sensation	N(%)	7(21.88%)	4(12.5%)	0.01*
Testicular atrophy	N(%)	0(%)	0(%)	1.00

DISCUSSION

Mesh fixation techniques for TAPP have included the use of staples, tackers, sutures, and derivatives of polycyanoacrylate. Staples or tackers are more likely to cause neuropathic problems. When repairing a recurring inguinal hernia, the frequency of these problems rises to 5.7% from 0-3% in the case of inguinal hernioplasty for original hernia [11]. In the current study, there was a significantly less operative time reported in patients who underwent TAPP without mesh fixation and this was simply explained by the more time required for mesh fixation especially when tacks are not available and intracorporeal sutures were done and this was better than the reports of **Hassan et al.** [12] who reported 116.42 \pm 13.52 min in group A and 101.0 \pm 12.91 min in group B. The operative time matches with **Liu et al.** [13] who reported time range from 30 to 90 minutes.

Intraoperative consequences included abdominal wall, spermatic cord, bladder vascular, vas deferens, and intestinal injury were not reported in our study. The most common cause of inferior epigastric vascular damage to the abdominal wall was the processing of a trocar puncture. Direct vision is required when entering and exiting the trocar. Injuries to the spermatic cord, bladder, vas deferens, and intestines were typically brought on by tissue adhesion in the mesh. Therefore, a more seasoned surgeon may be able to prevent these injuries more than a less experienced one [13]. Compared to **Hassan et al.** [12] illustrations, which showed that one instance in the tacker group had intraoperative bleeding, the current study had no documented intraoperative problems in either group. This

is also significantly better than the findings of **Liu et al.** [13] who reported that 4.5% of cases involved intraoperative tissue or organ damage, including bladder, intestine, vas deferens, and abdominal wall vascular injuries and this is assumed to be due to the different learning curve and laparoscopic skills in the current study. Compared to **Wasim et al.** [14] who reported two patients with hematoma, there was a statistically significant decrease in early postoperative complications since there were no cases of hematoma that required drainage. Compared to **Wasim et al.** [14] who reported two cases, we reported that after one month, there had been no recorded cases of seroma. In the repair of recurrent hernias, the mesh fixation is very significant. Recurrence may result from early mesh displacement, bending, or shrinkage due to inadequate mesh attachment [13]. Numerous explanations have been proposed to explain why hernias recur. It was said that the cause of medial recurrence is the rolling of the mesh away from the pubic ramus, exposing Hesselbach's triangle [15, 16]. Even with all the advancements in inguinal hernia surgery, between 12% and 13% of all patients with inguinal hernias still experience recurrent hernias. A recurrence may emerge considerably later on, or it may happen quite shortly after the initial procedure, depending on what caused it [13, 17].

In the event of a direct defect, it was proposed that abdominal desufflation during TAPP raises the bottom border of the mesh and causes the inferomedial aspect to migrate from the Cave of Retzius [18]. The two most frequent reasons for inguinal hernia recurrence following hernioplasty are inadequate dissection of the myopectineal

orifice and incorrect mesh size ^[19]. Since there were no documented cases of recurrence in either group, the current study's statistically significant lower recurrence rate match the findings of **Hassan *et al.*** ^[12]. Furthermore, it is far superior to **Tolver *et al.*** ^[20] who reported two recurrence cases. According to **Mohamed *et al.*** ^[21] 3.33% of research participants who did not have mesh fixation reported recurrence. Recurrence was noted in 6.67% of the mesh-fixed trial participants. In their investigation, **Cavazzola *et al.*** ^[22] noted that there were two recurrences in the mesh fixation group and none in the non-fixation group. Following inguinal hernia repair, quality of life and chronic groin discomfort are crucial assessment factors ^[23]. Following inguinal hernia repair, postoperative chronic pain is thought to be a crucial element influencing quality of life. It typically manifests as paresthesia in the inguinal or perineal regions in addition to burning sensations in these places. ^[24]. The primary strategy to prevent chronic pain during hernioplasty is to perform appropriate surgical procedures, such as reducing suturing and fixing and avoiding damage to nerves and arteries ^[25].

In this study, we contrasted discomfort after non-fixation with mesh fixation. In our investigation, we discovered that non-fixation resulted in far less early postoperative pain than in mesh fixation. This supported our hypothesis that there is less pain in non-fixation, which is likely due to the lack of tacks or sutures used in the current investigation where study participants' postoperative pain was measured. In comparison with the group that did not have mesh fixation, we found that the group underwent laparoscopic hernia repair with mesh fixation reported much higher pain levels.

CONCLUSION

According to the current results, TAPP repair can be done without significant impact on the outcomes.

- **Declaration of conflicting interests:** NIL.
- **Funding:** NIL.

REFERENCES

1. **Harris H, Hope W, Adrales G *et al.* (2018):** Contemporary concepts in hernia prevention: Selected proceedings from the 2017 International Symposium on Prevention of Incisional Hernias. *Surgery*, 164 (2): 319-26.
2. **Mohamed A, Hisham E, Elareaf H, Mohamed A, Shaban M *et al.* (2024):** Long-Term Outcome of Desarda Technique in Elective Inguinal Hernia Repair. A 10 Year Multicenter Experience. *The Egyptian Journal of Hospital Medicine*. 96 (3): 2337-2341.
3. **McCormack K, Wake B, Fraser C *et al.* (2005):** Transabdominal pre-peritoneal (TAPP) versus totally extraperitoneal (TEP) laparoscopic techniques for inguinal hernia repair: a systematic review. *Hernia*, 9 (2): 109-14.
4. **Lukong C (2012):** Surgical techniques of laparoscopic inguinal hernia repair in childhood: a critical appraisal. *J Surg Tech Case Rep.*, 4 (1): 1-5.
5. **Eisa A, Gaber A and Harb T (2014):** Laparoscopic transabdominal preperitoneal inguinal hernia repair. *Egypt J Surg.*, 33 (2): 86-9.
6. **Subramanya M, Ashrafi D, Memon B *et al.* (2018):** Causes of recurrence in laparoscopic inguinal hernia repair. *Hernia*, 22 (1): 975-986.
7. **EU Hernia Trialists Collaboration.** Mesh compared with non-mesh methods of open groin hernia repair: systematic review of randomized controlled trials. *Br J Surg.*, 87 (7): 854-9
8. **Fränneby U, Sandblom G, Nordin P *et al.* (2006):** Risk factors for long-term pain after hernia surgery. *Ann Surg.*, 244 (2): 212-219.
9. **Bansal V, Misra M, Babu D *et al.* (2013):** A prospective, randomized comparison of long-term outcomes: chronic groin pain and quality of life following totally extraperitoneal (TEP) and transabdominal preperitoneal (TAPP) laparoscopic inguinal hernia repair. *Surg Endosc.*, 27 (7): 2373-2382.
10. **Tolver MA, Rosenberg J, Bisgaard T (2012):** Early pain after laparoscopic inguinal hernia repair. A qualitative systematic review. *Acta Anaesthesiol Scand.*, 56 (5): 549-557.
11. **Charalambous M and Charalambous C (2018):** Incidence of chronic groin pain following open mesh inguinal hernia repair, and effect of elective division of the ilioinguinal nerve. meta-analysis of randomized controlled trials. *Hernia*, 22 (3): 401-409.
12. **Hassan M, Abd Rabo A, Omran H *et al.* (2023):** Comparative study between transabdominal preperitoneal laparoscopic repair of inguinal hernia: Totally sutured technique versus using tacks technique. *The Egyptian Journal of Surgery*, 41 (2): 781-788.
13. **Liu Y, Zhu Y, Cao J *et al.* (2020):** Clinical value of the laparoscopic transabdominal preperitoneal technique in recurrent inguinal hernia repair. *Asian J Surg.*, 43 (10): 986-990.
14. **Wasim R, Mela A, Hanief R *et al.* (2015):** Comparative study of fibrin sealant versus use of tackers in inguinal hernia repair. *Cukurova Medical Journal*, 40 (3): 457-465.
15. **Deans G, Wilson M, Royston C *et al.* (1995):** Recurrent inguinal hernia after laparoscopic repair: possible cause and prevention. *Br J Surg.*, 82 (1): 539-541.
16. **Taylor C, Layani L, Liew V *et al.* (2008):** Laparoscopic inguinal hernia repair without mesh fixation, early results of a large randomised clinical trial. *Surg Endosc.*, 22 (1): 757-762.
17. **Abdel-Kader M, Ali W, Mohamed, H *et al.* (2022):** Study of Outcomes of Desarda Repair in Emergency Conditions of Inguinal Hernia. *The Egyptian Journal of Hospital Medicine*, 86 (1): 139-146
18. **Fiennes A and Taylor RS (1994):** Learning laparoscopic hernia repair: pitfalls and complications among 178 repairs. *Inguinal Hernia*, 20 (1): 270-274.
19. **Beattie D, Foley R and Callam M (2000):** Future of laparoscopic inguinal hernia surgery. *Br J Surg.*, 87 (3): 1727-1728.
20. **Tolver M, Rosenberg J, and Bisgaard (2012):** Early pain after laparoscopic inguinal hernia repair. A qualitative systematic review. *Acta Anaesthesiol Scand.*, 56 (5): 549-557.
21. **Mohamed, H, ElSheikh M, Barakat H *et al.* (2019):** A comparative study of mesh fixation versus nonfixation in laparoscopic totally extraperitoneal inguinal hernia repair. *The Egyptian Journal of Surgery*, 38 (2): 348-355.
22. **Cavazzola L and Rosen M (2013):** Laparoscopic versus open inguinal hernia repair. *Surg Clin.*, 93 (2): 1269-1279.
23. **Koning G, Andeweg C, Keus F *et al.* (2012):** The transrectus sheath preperitoneal mesh repair for inguinal hernia: technique, rationale, and results of the first 50 cases. *Hernia*, 16 (1): 295-299.
24. **Bittner R, Arregui M, Bisgaard T *et al.* (2011):** Guidelines for laparoscopic (TAPP) and endoscopic (TEP) treatment of inguinal hernia [International Endohernia Society (IEHS)]. *Surg Endosc.*, 25 (9): 2773843.
25. **Li W, Sun D, Sun Y *et al.* (2017):** The effect of transabdominalpreperitoneal (TAPP) inguinal hernioplasty on chronic pain and quality of life of patients: mesh fixation versus non-fixation. *Surg Endosc.*, 31 (2): 4238-4243.