A Comparative study of suture fixed versus nonfixed mesh techniques in laparoscopic trans-abdominal preperitoneal repair of noncomplicated adult inguinal hernia

El Ashraf M. Thabet, Ahmed M. Ali, Ayman Essawy

Department of General Surgery, Fayoum University Hospital, Fayoum, Egypt

Correspondence to El Ashraf M. Thabet, MD, MRCS, General Surgery Department, Fayoum University Hospital, Fayoum 63511, Egypt.
Tel: +20102 401 3270;
e-mail: amt03@fayoum.edu.eg

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Aim
This study aimed at comparing the effect of sutured mesh fixation and non-fixation in cases of laparoscopic trans-abdominal preperitoneal (TAPP) in terms of operative time, hospital stay, and complications particularly recurrence and chronic groin pain (CGP).

Patients and methods
This prospective randomized comparative study included 40 patients diagnosed with noncomplicated inguinal hernias admitted to the Department of Surgery at Fayoum University Hospital, Egypt from March 2019 to July 2021. Cases were divided into two groups by draw of lots; group A as mesh fixation (n=20) and group B as nonfixation (n=20).

Results
The results were calculated with χ^2test (P value). Results were found to be not significant in demographic features, in-hospital stay, hernia characteristics, and complications i.e. (intraoperative, postoperative, and long term) and were significant as regards operative time and early postoperative pain in favor of nonfixation group and results were highly significant ($P < 0.001$).

Conclusion
TAPP repair without mesh fixation shows advantages over mesh fixation, which include significantly less early postoperative inguinal pain and operative time, with comparable intraoperative, postoperative, and long-term complications (with no increase in hernia recurrence), hospital stay, and mean operative time. Hence, our study favors TAPP without mesh fixation a valuable alternative option.

Keywords:
chronic groin pain, inguinal hernia, nonfixation, recurrence, trans-abdominal preperitoneal

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Consent to participate: Informed consent was obtained from all patients according to the ethical committee of Fayoum University.

Study Approval: This study protocol was reviewed and approved by the Fayoum university ethical committee, Fayoum, Egypt.

Authors contribution: Th. EL. M formulated the research question and idea, participated in the surgical operation, and prepared the manuscript draft. A. AM participated in the surgical operations, collected the patient's data analyzed it, and wrote the manuscript draft. E. A participated in the surgical operations, and data analysis, and revised the final manuscript for publication.

Introduction

Inguinal hernia repair is the most common procedure in general surgery worldwide, and around 700 000 operations are performed each year, both in United States and in Europe [1]. The gold standard surgical procedure for inguinal hernia repair is the Lichtenstein technique with anterior flat mesh reinforcement [2]. The advantages of this technique include cost and ambulatory procedures that can be performed under local anesthesia with reduced incidence of hernia recurrence [3]. However, the drawbacks are that it is an 'open' surgical procedure requiring sutures and anterior placement of the mesh, resulting in longer postoperative recovery time and a higher incidence of chronic inguinal pain reducing patient quality of life and return to normal activities. The laparoscopic approach has the advantage of requiring less fixation, and the posterior placement of the mesh across the inguinal defect decreases postoperative recovery time, pain and complications. Both techniques have been compared by various randomized studies and meta-analyses [4].

Since the introduction of synthetic mesh in inguinal hernioplasty, the reported incidence of postoperative chronic groin pain (CGP) has increased dramatically. Postoperative inguinodynia ranges from 10% to 54% of patients undergoing hernia surgery [5].

Fixation of the mesh during LIHR is contemplated to contribute to the higher risk of postoperative CGP and nerve injury ranging from 2 to 4% [6].

The most commonly injured nerves include the genital branch of the Genito- femoral nerve and the lateral femoral cutaneous nerve [7].

Nonfixation of the mesh is theoretically a predisposing factor for hernia recurrence due to the risk of mesh displacement. These technical details in LIHR are therefore of great interest as it may have significant repercussions on postoperative CGP, neuralgia related morbidity leading to poor health-related quality of life and recurrence rates [8].

The aim of the study is to compare between the two surgical techniques; laparoscopic trans-abdominal preperitoneal repair of inguinal hernia with suture-fixed and nonfixed mesh as regards duration of surgery, postoperative hospital stays, intraoperative complications, hernia recurrence, chronic groin pain and other postoperative complications.

Patients and methods

The present randomized clinical trial with parallel groups includes 40 patients, they were diagnosed in the outpatient clinic of general surgery department of Fayoum university hospital then divided randomly into two groups group A (20 patients underwent laparoscopic TAPP repair with suture-fixed mesh) and group B (20 patients underwent laparoscopic TAPP repair with mesh nonfixation) within the duration from March 2019 to July 2021. We analyzed data refer to, age, BMI, site and type of hernia whether direct or indirect, operative time, recurrence of hernia, and chronic groin pain.

Inclusion criteria were

(1) American Society of Anesthesiology (ASA) classifications I and II.
(2) Adults aged above 18 years old diagnosed with completely reducible noncomplicated unilateral inguinal hernias.

Exclusion criteria were

(1) Patients with huge inguino-scrotal that reach scrotum and not completely reducible into the abdomen, recurrent and complicated inguinal hernias.
(2) Patients with the following conditions will be also excluded: history of cirrhosis and coagulation disorders and those were ASA classifications III and IV, who are at risk of general anesthesia.

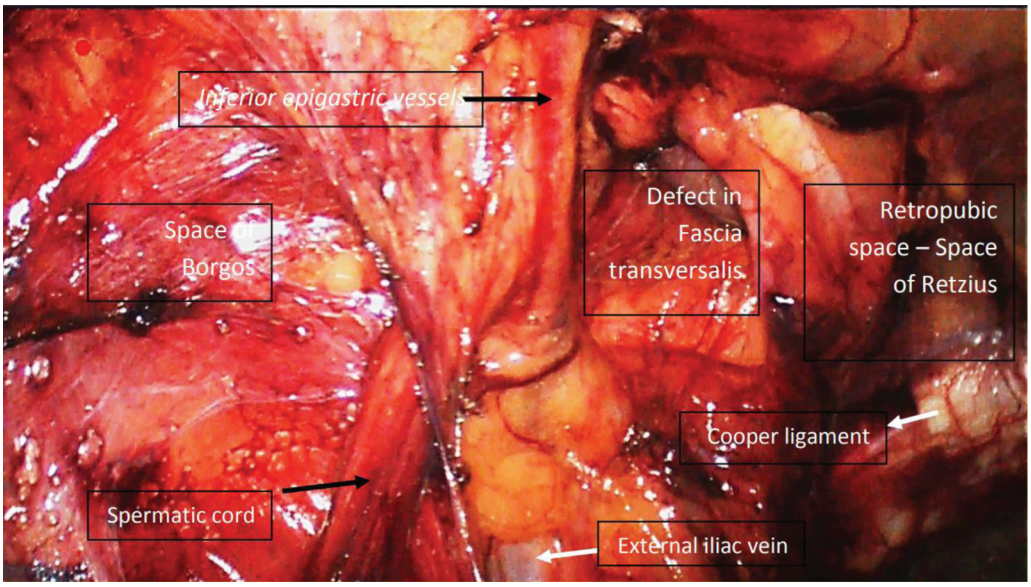
Informed consent was obtained from patients according to the ethical committee of Fayoum University.

Surgical technique

All the patients in the present study were exposed to general anesthesia. Carbon dioxide pressure set at 14 mmHg was used to establish pneumoperitoneum during the surgery. The next step was placing a 10 mm trocar 1-2 cm superior to umbilicus. Then, two 5 mm trocars were laterally inserted on the left and right sides at the level of the transverse umbilical line just lateral to the rectus sheath. Next, identification of hernial sac was performed followed by making an incision in the peritoneum. A hook diathermy was used to extend the incision from above the anterosuperior iliac spine to the lateral leaflet of the medial umbilical ligament. Then, the upward and downward dissections of the peritoneum flaps from the spermatic cord structures were performed, Fig. 1.

The size of the sac was decreased, and then, a 10 cm×15 cm-mesh (polypropylene mesh) was placed. It must be mentioned that covering the region of the inferior epigastric vessels, the internal ring, and the medial compartment was taken into consideration in the process of inserting the mesh to prevent the risk of possible recurrences. The prosthesis then lodges perfectly on the inguino-femoral wall, thus closing the entire myo-pectineal foramen. All meshes had the same size of 10 cm×15 cm. The polypropylene mesh was fixed to the Cooper ligament medially and to the under surface of rectus muscle superomedial and fascia transversalis superolateral, using three Vicryl 2/0 sutures in the mesh fixation group. It must be noted that sutures in the triangle of doom and pain were avoided. The mesh was not fixed in the mesh nonfixation group. Continuous absorbable sutures (Vicryl 2/0) were used to close the peritoneum. Mesh was fixed using suture in one group and not fixed in the other one. All patients underwent surgery under the supervision of the same surgical team, and mesh with similar type and size was used. In addition,

Figure 1



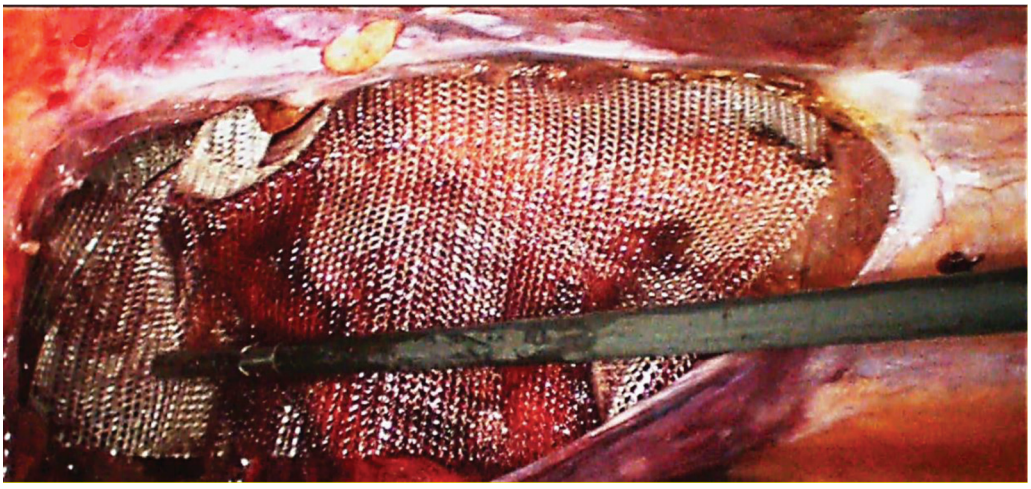
Shows the left preperitoneal space after complete dissection and complete reduction of left direct hernia sac from fascia transversalis.

equipment including laparoscopic system common to both groups was used in all operations, Fig. 2.

Assessment of outcome parameters in both groups & postoperative care

(1) The operative time was calculated from the skin incision to the skin closure.
(2) Intraoperative complications as Bleeding and injuries of hollow organs were documented if present.
(3) The length of postoperative hospital stays: all patients were hospitalized for at least the first 24 h. In general, the patient was discharged after they were fully mobile, with normal bowel habits and pain was controlled with oral analgesia.
(4) Pain Scoring Postoperative: In this study, the pain was assessed in the first 24 h after surgery, by assessing the need of nonsteroidal anti-inflammatory drugs NSAID 'times requested' and the Visual Analogue Scale. Numeric scores were obtained by measuring the horizontal distance from the low end of the scale to the marking, and then normalized on a 10-point scale from 0 'no Pain' to 10 'most severe pain'. Also, pain assessed after 1 week, 1, 3, and 6 months.
(5) Postoperative complications: As scrotal edema, SC emphysema, wound infection (assessed during the

Figure 2



Shows Positioning of the mesh within the right preperitoneal space.

hospital stay and the follow-up visits in outpatient clinic for ten days till suture removal). Recurrence and port site hernia (documented if present in a follow up duration of at least 6 months postoperative and ranged from 6 to 19 months).

Statistical analysis

The collected data was organized, tabulated and statistically analyzed using SPSS software statistical computer package version 18 (SPSS Inc., USA). For quantitative data the mean, standard deviation (SD) and range were calculated. Independent *t* test was used in comparing between the two groups as regards mean values of different variables. For qualitative data, the number and percent distribution ware calculated, chi square (χ^2) or fisher exact tests where appropriate were used as tests of significance. For interpretation of results of tests of significance, significance was adopted at *P* less than or equal to 0.05.

Results

This study included 40 patients who were randomly allocated in two groups group A that included 20 patients underwent laparoscopic TAPP with sutured mesh fixation and Group B that included 20 patients underwent laparoscopic TAPP with sutured mesh nonfixation. All cases were done at FUH by four senior experienced surgeons. Age of patients in group A ranged between (19 and 58 years) with mean age of 31.6 years and age of patients in group B ranged between (18 and 57 years) with mean age of 34.8 years (*P* value = 0359); Table 1.

(1) The operative time in group A ranged between (103-150) with mean operative time of 121.9 min and the operative time in group B ranged between (85-105) with mean age of 93.4 min Comparison of means showed that there is a statistically significant difference when *P* value < 0.0001 between study groups as regards operative time which indicated much less operative time in group of nonfixation when compared with group of fixation; Table 2.
(2) There were no intraoperative complications detected in all patients in the study.
(3) The length of postoperative hospital stay in group A ranged between (25-48 h) with mean of 35.0 h and the length of postoperative hospital stay in group B ranged between (24-40 h) with mean of 32.5 h. Comparison of means showed that there was no statistically significant difference when *P* value is 0.244 between study groups as regards the length of postoperative hospital stay; Table 2.
(4) No patients had reported postoperative complications in both study groups.
(5) There was no reported recurrence for all patients in this study.
(6) Regarding pain score after first 24 h and after the first week, it was significantly higher in group A than in group B, *P* value was 0.004 and 0.001, respectively. Pain score was zero in the two groups at the subsequent three postoperative readings 1, 3 and 6 months. After first 24 h, proportion of

Table 1 Show characteristics of included patients

Parameters	Group A (*n*=20)	Group B (*n*=20)	*P*
Age, years	31.6±11.2	34.8±10.6	0.359
BMI	23.7±2.8	25.1±2.9	0.116
Co-morbidity			
DM	1 (5.0%)	2 (10.0%)	0.548
HTN	2 (10.0%)	2 (10.0%)	1
Smoking	5 (25.0%)	6 (30.0%)	0.723
Hernia side & Type			
Right Direct	1 (5.0%)	0 (0.0%)	0.297
Right Indirect	15 (75.0%)	17 (85.0%)	
Left Direct	1 (5.0%)	1 (5.0%)	1
Left Indirect	3 (15.0%)	2 (10.0%)	

Data were represented as mean±SD, or n (%). BMI, Body Mass Index; DM, Diabetes Mellitus; HTN, Hypertension.

Table 2 Shows operative and postoperative characteristics

Parameters	Group A (*n*=20)	Group B (*n*=20)	P
Operative Time (minutes)	121.9±15.4	93.4±6.3	<0.0001
Duration of hospital stay (hours)	35.0±7.2	32.5±5.8	0.244
Postoperative pain (Frist 24 hours)			
Mild	7 (35.0%)	16 (80.0%)	0.012
Moderate	11 (55.0%)	4 (20.0%)	
Severe	2 (10.0%)	0	
Post-operative pain (Frist week)			
No pain	3 (15.0%)	13 (65.0%)	0.002
Mild	13 (65.0%)	7 (35.0%)	
Moderate	4 (20.0%)	0	
Severe	0	0	

Data were represented as mean±SD, or n (%).

patients with moderate and severe pain was a statistically higher in group A (55% and 10% for moderate and severe pain, respectively) as compared with group B (20% for moderate pain and 0% for severe pain), $P = 0.012$. After first week, only 15% for group A reported no pain versus most of patients in group B (65%), while 65% in group A reported mild pain versus 35% of patients in group B. After 3 and 6 months, all patients in both groups reported no pain; Table 2.

Discussion

In this study, we aimed at comparing between laparoscopic TAPP repair with suture-fixed mesh that was performed for 20 patients included in group A and laparoscopic TAPP repair with mesh non-fixation that was performed for 20 patients included in group B demographic features of the patients, precipitating factors for hernia, hernia characteristics, operative time, intraoperative complications, length of postoperative hospital stay, recurrence of hernia, postoperative groin pain and other complications after surgery. In this study, all patients were males whose age ranged between (19 and 58 years) with mean age of 31.6 years in Group A and ranged between (18 and 57 years) with mean age of 34.8 years in Group B. Comparison of means showed that there is no statistically significant difference when P value is 0.359 between study groups as regards patients age indicated proper matching between both groups. The mean age in group A was 43.8±16.5 years, in group B it was 45.13±14.1 years, male represents 91.3% of group A and 95.7% of group B patients, female represents 8.7% and 4.3% of group A and B, respectively, with no statistically significant differences between the two groups. Also, body mass index (BMI) or Nyhus classification or location and duration of the hernia had no statistically significant differences in both groups Kalidarei and colleagues [9].

In this study, the number of patients with indirect hernia was more than those with direct hernia and the right side more than the left side, but the two groups were identical in terms of BMI, precipitating factors of hernia, underlying diseases, subclassification of inguinal hernia, and side of hernia ($P > 0.05$). In this regard, many previous studies also reported that the prevalence of inguinal hernia in men is 12–25 times higher than that in women Tavassoli and colleagues [10]. Overall, the highest incidence rate of this disorder is observed in infancy and ages over 50 Zinner and colleagues [11]. In addition, the incidence rate of indirect inguinal hernia is 2–3 times higher than that of direct inguinal hernia Li and colleagues [12]. All patients were males, and the 2 groups did not show any significant differences in age ($P = 0.36$) Kalidarei and colleagues [9].

In this study the 1ry end point was operative time. The operative time in group A ranged between (103-150) with mean operative time of 121.9 min and the operative time in group B ranged between (85-105) with mean age of 93.4 min which indicated significant longer operative time in fixation group in relation to nonfixation group (P value < 0.0001) and this was explained by the added time needed for fixation of the mesh by three stitches including time of getting the needle in and out the abdomen. A similar finding in one study revealed that mean operative duration was 50.1±10.3 for fixation group versus 60.5±12.2 min for nonfixation group, ($P < 0.05$) Claus and colleagues [13].

Another study revealed no statistically significant difference between the two groups in terms of duration of surgery ($P > 0.05$), while length of in-hospital stay and return to work was statistically significantly higher in mesh fixation group (Group A) as compared with nonfixation group (Group B) ($P < 0.05$) Lau and colleagues [14]. In contrast to the findings of the present study, there was no significant difference between the two groups with respect to the duration of surgery as reported by a number of recent studies Lv and colleagues [15]. However, the findings of some studies revealed a shorter duration of surgery in both mesh fixation and nonfixation groups Antoniou and colleagues [16].

There were no intraoperative complications detected in all patients in this study. In this study the second end point was the length of postoperative hospital stay that was less for nonfixation group 32.5 h (24-40 h) when compared with fixation group 35 h (25-48 h) ($P < 0.244$). The extended hospital stay in the fixation group may be attributed to delay in mobilization, initiation of oral diet and pain control. A study by Kalidarei B and colleagues, Claus and colleagues [13], revealed that length of in-hospital stay and return to work was statistically significantly higher in mesh fixation group (Group A) as compared with nonfixation group (Group B) ($P < 0.05$). A study by Mohammad, H and colleagues [17]. revealed that the mean operative time in group A was 113.17±9.34 min, and in group B it was 111.3±6.49 min, the hospital stay time in group A was 2.22±0.47 days, and in group B 1.99±0.61 days with no statistically significant differences between both groups. Many studies

indicated that the length of in-hospital stay was significantly shorter in the non-fixation group Antoniou and colleagues, Ayyaz and colleagues [16,18].

In this study another comparative point was regarding pain score after first 24 h and after the first week, it was significantly higher in group A than in group B, *P*-value was 0.004 and 0.001, respectively. Pain score was zero in the two groups at the subsequent three postoperative readings, 1, 3, and 6 months. After first 24 h, proportion of patients with moderate and severe pain was a statistically higher in group A (55% and 10% for moderate and severe pain, respectively) as compared with group B (20% for moderate pain and 0% for severe pain), $P = 0.012$. After first week, only 15% for group A reported no pain versus most of patients in group B (65%), while 65% in group A reported mild pain versus 35% of patients in group B. After 1, 3, and 6 months, all patients in both groups reported no pain. In a study by Li Wand colleagues [12] the VAS scores 2 days, 3, and 6 months postoperatively of the nonfixation group were all significantly lower than those in the fixation group ($P < 0.05$). A study by Kalidarei B and colleagues [9] comparing the means of pain score of the groups after the surgery suggested that the level of pain at the 1st day after the surgery had no significant difference, while it was higher in Group A as compared with Group B at the time of release and 1 and 2 weeks after the surgery. The level of pain was reduced in both groups in 1- and 6-month follow-ups, and there was no significant difference between the groups in this respect. In fact, it can be stated that pain severity at the discharge time and at the first and second weeks after the surgery was higher in patients with mesh fixation. Many previous studies using TAPP or TEP technique indicated that fixation or nonfixation had no significant effect on the pain severity at the first 24 h after the surgery. However, the patients had higher pain level in the fixation group as compared with the nonfixation group at 1 week, 6, 1, and 12 months after the surgery, while it should be noted that pain severity in patients was significantly reduced over time Antoniou and colleagues, Ayyaz and colleagues, Sajid and colleagues [16,18–21].

In this study, there was neither recurrence nor any postoperative complications noticed in both groups. A study by Mohammad, H and colleagues [17] revealed that recurrence was occurred in 1 case in group B (4.35%) and not recorded in group A at the time of examination. Furthermore, neither group reported recurrence Kalidarei and colleagues [9]. The findings of a meta-analysis revealed that there is no significant difference between the mesh fixation and nonfixation groups in the rates of postoperative complications Darwish and Hegab [19]. In a review study, Sajid and colleagues also found that the rate risk of complications in the fixation group was 1.21 times higher than that of non-fixation group; however, the observed difference was not significant Boldo [22]. Moreover, no significant differences in the incidence rate of complications have been reported in many previous studies Schwab and colleagues, Olmi and colleagues [8,23]. In a study by Kalidarei B and colleagues [9] there was no recurrence in the fixation group, whereas there was 5.1% recurrence in the nonfixation group ($P > 0.05$). Although some studies showed a significant mesh migration with mesh nonfixation Cristaudo and colleagues [24]. Some clinical studies revealed no increase in the hernial recurrence risk in the nonfixation group Ayyaz and colleagues, Darwish and colleagues, Dehal and colleagues [18,19,25]. Moreover, studies showed no significant difference between different mesh types or methods of fixation regarding the hernial recurrence rate Cristaudo and colleagues, Tam and colleagues [24,26]. Nonfixation of mesh may lead to pain reduction in patients; however, it may lead to an increased recurrence rate due to the probability of mesh displacement Darwish and colleagues [19].

Limitations included small number of patients included in this study, no complicated cases included in this study and assessment of number of doses of analgesics required for postoperative pain control. These factors can be considered as a weakness of this study.

Conclusion

Laparoscopic TAPP with mesh nonfixation could be performed safely without fear of recurrence if it was done with an experienced surgeon provided that there is capacious properly dissected preperitoneal space for large proline mesh. This procedure was associated with less operative time and less postoperative pain.

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Conflicts of interest

The authors declare that they have no competing interest.

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