

## Laparoscopic Totally Extra-Peritoneal (TEP) Versus Transabdominal Pre-Peritoneal (TAPP) Inguinal Hernioplasty

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### ABSTRACT

**Background:** The totally extraperitoneal (TEP) and transabdominal preperitoneal (TAPP) repair are the most prominent laparoscopic techniques for the repair of inguinal hernia.

**Objective:** The current study aimed to reduce postoperative complications including recurrence rate, wound infection, and nerve injury.

**Patients and methods:** The study was a prospective comparative between TEP versus TAPP inguinal hernioplasty. The study included 60 patients who were presented in the outpatient clinic at Zagazig Hospitals University and followed up at our clinics. The cases were aliquoted randomly into 2 groups, group (I): 30 cases subjected to TAPP hernioplasty, and group (II): 30 cases subjected to TEP hernioplasty.

**Results:** The present findings showed remarkable increase in scrotal swelling frequency in TEP group than TAPP group, and also a significant elevation in subcutaneous emphysema frequency in TAPP group than TEP group, while concerning the operative complication there was not any remarkable difference between the groups. The current results revealed that during follow-up (6 months), there was not any reported recurrent cases.

**Conclusion:** TEP showed increased safety and potential peritoneal repair. On the other side, TAPP revealed easier learning curve and fine visualization. Both techniques are effective in inguinal hernia management and were associated with 0% recurrence. However, due to short follow up duration, and small sample size, longer-term studies are also recommended.

**Keywords:** Inguinal Hernioplasty, TAPP, TEP, Totally extraperitoneal, Transabdominal preperitoneal.

### INTRODUCTION

Groin hernias are organ abnormal protrusion through a weak area in the lower abdomen. The groin is the area between the abdomen and thigh, including femoral, indirect, and direct hernias<sup>(1)</sup>. Among the general surgeries, the repair of inguinal hernia is considered common worldwide, the diagnosis depends on the physical examination and history, also is distinguished by bulge appearance. Laparoscopic repair with mesh, open primary repair, and open tension-free repair with mesh are considered the most frequent treatment<sup>(2)</sup>.

Inguinal hernia represented 97% of groin hernia, while femoral hernia represented 3%. Concerning gender, the males possessed 90.2%, while females possessed 9.8% of inguinal hernia, while femoral hernia was female-predominant. The hernia risk factors included external, and patient related factors. Inguinal hernia elevated incidences were correlated with male gender, hiatal hernia, Caucasian race, older age, and lower body mass index (BMI)<sup>(3)</sup>.

Transabdominal preperitoneal (TAPP) repair includes laparoscopic assessment of peritoneal cavity and inguinal areas, also a mesh is placed against inguinal wall to reduce the sac of hernia<sup>(4)</sup>. The totally extraperitoneal repair (TEP) helps in hernia sac reduction and dissection, myopectineal orifices evaluation, and mesh placement without abdominal cavity entering<sup>(5)</sup>.

The aim of the current study was to reduce postoperative complications including recurrence rate, wound infection, and nerve injury.

### PATIENTS AND METHODS

The study was a prospective cohort study between laparoscopic TEP versus TAPP repair of inguinal hernioplasty. The study included 60 male patients that were presented in the outpatient clinic of Liver, GIT and Laparoscopic Surgery Unit at Zagazig Hospitals University during the period between January (2021) and January (2022) and were followed up at our clinics.

The cases with following criteria were subjected to the study; male cases more than 18 years old, patients with unilateral or bilateral inguinal hernia, and cases with comorbidities but fit for laparoscopic surgery.

The exclusion criteria included; cases with complicated inguinal hernia such as irreducibility, obstruction, recurrent inguinal hernia, and strangulation, patients unfit for surgery, huge inguinoscrotal hernia, and patients with inguinal hernia associated with more than grade II varicocele by U/S.

The cases were allocated randomly into 2 groups, group (I): 30 cases underwent TAPP hernioplasty, and group (II): 30 cases underwent TEP hernioplasty.

### Preoperative evaluation:

The evaluation included preoperative clinical history taking, clinical examination (general examination, vital signs, abdominal examination, and chest examination), and local examination of the hernia site to detect its type and size and to exclude any complicated hernias (such as incarcerated, irreducible, or huge hernias).

Investigations were requested for all patients, including: Laboratory tests including kidney and liver function tests, complete blood picture, fasting blood sugar levels and hepatitis markers, coagulation profile,

ECG for cases over 40s or with a positive cardiac history, and plain chest x-ray.

Imaging: Ultrasonography evaluation (pelvic abdominal and bilateral inguinal scrotal).

Preparation of the patients for surgery: Patients with chest infections required medical treatment for two weeks preoperatively.

### Operative technique:

#### 1. Operative technique of laparoscopic (TAPP) hernioplasty:

**Patient positioning:** The case was placed in the supine position, after administration of general anesthesia, routine scrubbing of the whole abdominal wall, from the nipple line till the midhighs.

**Trocar positioning:** A small supraumbilical incision and Veress needle was inserted into the peritoneal cavity. The needle inserted was verified with a saline drop test and the insufflator machine is connected to the needle. After removal of Veress needle. Trocar 10-mm (camera trocar) was inserted supraumbilically (Fig. 1).

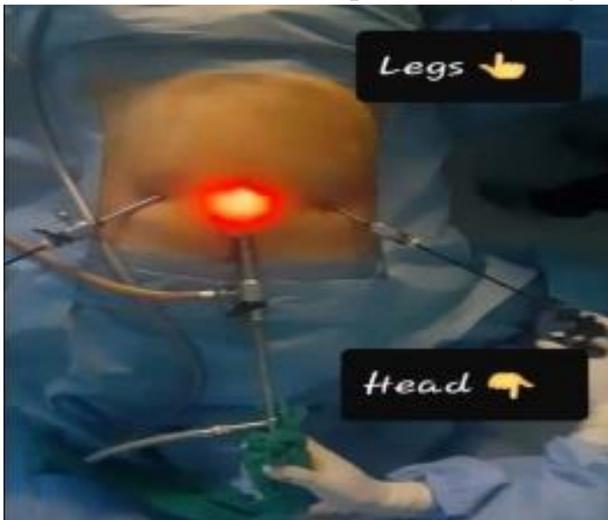


Figure (1): Patients and trocar position.

The abdominal cavity and inguinal area (type of hernia) were detected and the hernia contents were evaluated (Fig. 2).

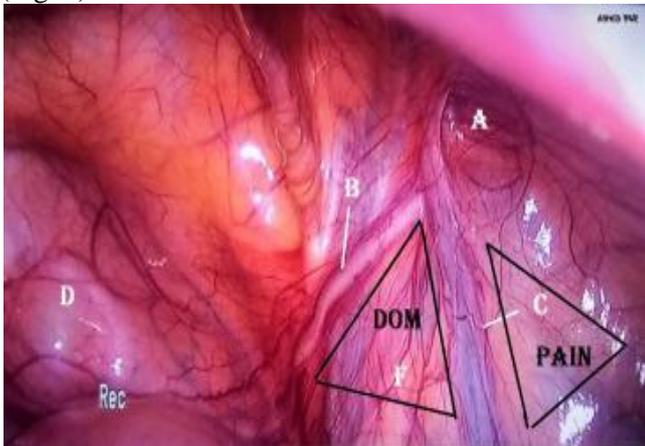


Figure (2): A- indirect inguinal hernia (deep inguinal ring), B- Vas deference, C -Testicular vessels, D-

urinary bladder, **DOM**-triangle of doom, **F**- iliac v, **Pain**-triangle of pain.

**Peritoneal flap incise:** Laparoscopic scissors with monopolar cautery were used to incise. The incision was below the arcuate line.

**Dissecting the flap and identification of important structures:** Curved scissors with monopolar cautery while grasping (atraumatic Grasper) was used for dissection of pre-peritoneal flap from a medial to lateral direction. Gentle dissection medially (Retzius space) was done and Cooper's ligament was seen. The dissection reached 1-2 cm medially behind the symphysis pubis and 2-3 cm below Cooper's ligament. Then lateral dissection (Bogros space) was performed directly on the peritoneum medially until the spermatic vessels and then the vas deferens.

#### Dissection of the hernial sac:

Dissection was done until the sac was completely isolated from the cord and other structures and dissection continued medially to the side of the bladder to give enough area for mesh placement. The sac was pulled inwards out of the defect.

#### Placement of mesh:

We used a 15 cm x 15 cm 3D mesh. Mesh was introduced through the 10 mm camera trocar by rolling in the shape of tube, then was positioned properly. The medial edge was rested on the inguinal region, and was in contact with the symphysis pubis. In order to full covering of the defected area the medial edge was extended laterally over the epigastric. (Epigastric what??)

**Mesh fixation:** The mesh was fixed by tackers, with 4 tacks applied over the iliopubic track to avoid nerve injury, and 2 tacks were applied at the level of pubic tubercle and Cooper's ligament.

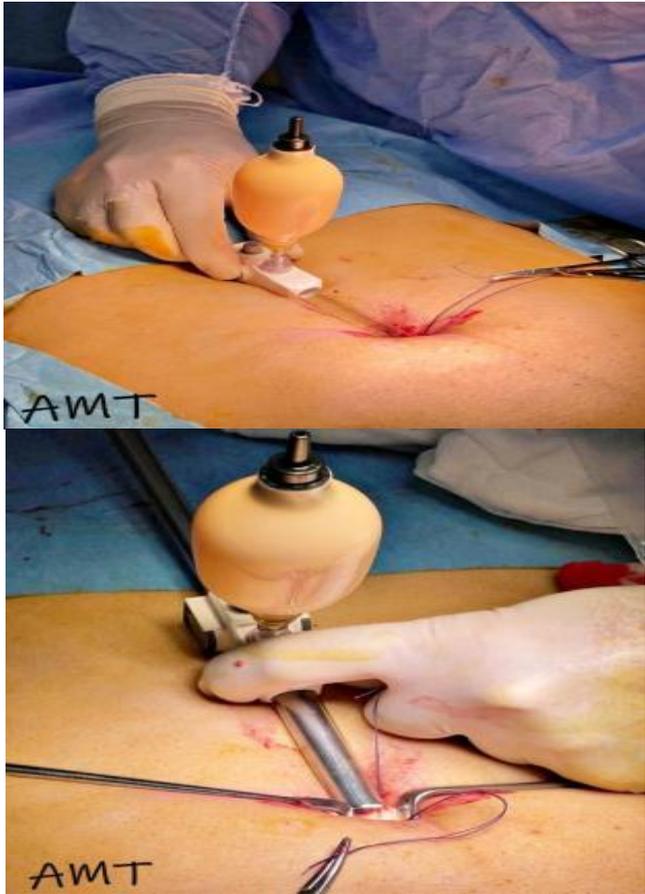
#### 2. Operative technique of laparoscopic (TEP) hernioplasty:

**Patient positioning:** The patient was placed in the supine position, after administration of general anesthesia, routine sterilization of the whole abdominal wall, from the nipple line till the midhighs.

**Create pre-peritoneal space:** Transverse skin incision just 1 inch below the umbilicus (2 cm or 3 cm) and extended with blunt dissection using large artery forceps down to the anterior rectus sheath.

#### Placement of trocar:

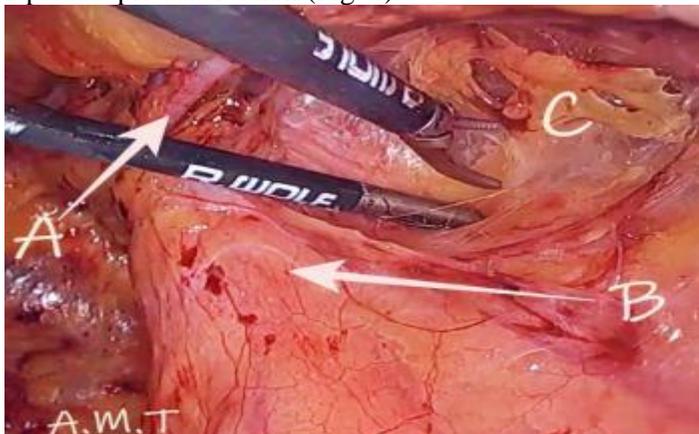
The balloon was inserted into pre-peritoneal space by the open Hasson technique passed along the posterior sheath until it contacted the pubic bone (Fig. 3).



**Figure (3):** Balloon was inserted into the pre-peritoneal space.

Carbon dioxide insufflate started at a high flow rate into pre-peritoneal space at pressure of 12 mmHg. 1<sup>st</sup> 5 mm trocar were inserted midline at three fingerbreadths above the pubic bone. 2<sup>nd</sup> middle trocar was inserted at the midway between the other two trocars. The two 5 mm trocars were placed vertically in the midline not obliquely.

**Dissecting and identification of important landmarks:** The dissection of the pre-peritoneal space was performed with a balloon dissector. Then the dissection continued with blunt forceps, which was adopted to clarify the pre-peritoneal cavity under direct laparoscopic observation (Fig. 4).



**Figure (4):** Dissector lateral space, A- Inferior. Epigastric vessels B- hernia sac. C- Bogros space.

#### **Dissecting of the hernia sac:**

**Mesh placement and fixation:** After completing dissection, 3D mesh measuring 15 cm x 12 cm was introduced through the 10 mm trocar and it was unfolded, and the whole myopectineal area was covered. The mesh lower edge was extended under the inguinal ligament level, while the lateral section was expanded under the iliac vessels. The procedure was completed after desufflation under vision until creeping of the peritoneum and its filling over the mesh, ensuring that the inferior border of the mesh would not roll up.

#### **Postoperative care:**

*All patients were given:* The majority of cases were discharged by second postoperative period and back to work within 1 week to 10 days from surgery and during a hospital stay progress notes were documented for all the patients.

#### **Parameters Assessed:**

**A. Intraoperative Parameter:** Operative time was calculated from anesthesia induction till the closure of the skin, and intraoperative complications such as bleeding, visceral and nerve injury were assessed.

**B. Postoperative parameters (during hospital stay):** Postoperative pain using the visual analog scale (VAS) where 0 indicates the least pain and 10 represents the worst possible pain, and postoperative complications such as scrotal edema, hematoma, and wound infection.

#### **Follow-up parameters:**

All patients were followed up at surgery outpatient clinic after one week then 1, 3, and 6 months later using a standardized telephone script. However, all patients were instructed to seek our advice whenever they notice something abnormal.

#### **Ethical consent:**

An approval of the study was obtained from Zagazig University Academic and Ethical Committee. Every patient signed an informed written consent for acceptance of the operation, permitting conversion to open repair, and participation in the study. Patients were informed about the postoperative period. This work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

#### **Statistical Analysis**

Data entry and analysis were performed using SPSS version 20 for data processing. Data were expressed as number and percentage for qualitative variables and mean  $\pm$  standard deviation (SD) for quantitative ones. The student "t" test was used for comparison of means of two independent groups. Chi-square test ( $X^2$ ) was used to compare qualitative data. P-value was considered significant if less than 0.05.

**RESULTS**

The age of the study group ranged between 20 and 60 years. Table 1 shows that there were no statistically significant differences between the groups in age, sex distribution, or smoking.

**Table (1):** Demographic data of the studied groups

Variable		Group I (TAPP) (n=30)		Group II (TEP) (n=30)		P
Age: (years)	Mean ± SD	42±12.92		40.37±7.46		0.55
	Range	20-60		23-59		
Variable		No	%	No	%	P
Sex:	Male	30	100	30	100	--
	Female					
Smoking:	No	13	43.3	20	66.7	0.07
	Yes	17	56.7	10	33.3	

Table 2 shows a statistically significant increase in operation time in group 2 compared to group 1.

**Table (2):** Operation data among the studied groups

Variable		Group I (TAPP) (n=30)		Group II (TEP) (n=30)		P
Operation time: (min)	Mean ± SD	98.23±9.83		116.3±12.96		<0.001 **
	Range	80-120		90-140		
Variable		No	%	No	%	P
Anesthesia:	General	30	100	30	100	-
	Spinal	0	0	0	0	

SD: Standard deviation, \*\*: Highly significant

The overall intraoperative complication rate in study patients was 13.3% (n=8/60). Peritoneal tears occurred in 3 patients and intraoperative bleeding occurred in 5 patients (Table. 3). Concerning Group I, one patient (3.3%) had vascular injuries due to minor injury of inferior epigastric vessels during peritoneal dissection, which was dealt with diathermy and bleeding was controlled. Regarding Group II, three patients (10%) had peritoneal tears leading to pneumoperitoneum, which caused loss of operative space. The situation was managed by conversion from TEP to TAPP. This event significantly increased the operative time.

**Table (3):** Operative complications

Variable		Group I (TAPP) (n=30)		Group II (TEP) (n=30)		P
		No	%	No	%	
Operative	Vascular injuries inferior epigastric vessels or branch from it	1	3.3	4	13.3	0.16
	Peritoneal tears					
	Bladder injury	0	0	3	10	0.08
	Bowel injuries	0	0	0	0	----
	Conversion TEP to open	0	0	1	3.3	0.31
	Conversion TEP to TAPP	0	0	3	10	0.08

The present findings showed remarkable increase in scrotal swelling frequency in TEP group than TAPP group, and also a significant elevation in subcutaneous emphysema frequency in TAPP group than TEP group, while concerning the operative complication there was not any remarkable difference between the groups (Table 4).

**Table (4):** Postoperative complications

Variable		Group I (TAPP) (n=30)		Group II (TEP) (n=30)		P
		No	%	No	%	
Postoperative	Hematoma	2	6.7	2	6.7	1
	Seroma	2	6.7	2	6.7	1
	Scrotal swelling	1	3.3	3	10	0.04
	Subcutaneous emphysema	4	13.3	1	3.3	0.16

In both groups as expected pain scores were higher at the first 6 hours after surgery, there was no significant difference between groups as regard VAS at 1<sup>st</sup> 24 hours postoperatively, but the group I cases showed lower mean VAS compared to group II cases. It appeared that both procedures are well tolerated with satisfactory pain levels. Most of the patients were pain-free at the first postoperative visit after one week (Table 5).

**Table (5):** VAS score in Group I and Group II at the 1st 32 hours postoperatively

VAS		Group I (TAPP) (n=30)	Group II (TEP) (n=30)	P
6 hours	Mean ± SD	5.61±1.14	6.04±0.96	0.12
24 hours	Mean ± SD	3.64±1.42	4.01±1.34	0.30
7 days after	Mean ± SD	1.29 ± 0.51	1.46 ± 0.36	0.14

Hospital stay was longer in TAPP than TEP and this was mainly related to postoperative complications and return of normal bowel movements, which were a long time in group I. All cases required more than two days to return to daily activity, and more than 13 days to return to work. There were no statistically significant differences between the studied groups in-hospital stay, return to daily activity days and return to workdays (Table 6).

**Table (6):** Hospital stays and returns to work among groups

Variable		Group I (TAPP) (n=30)	Group II (TEP) (n=30)	P
Hospital stay: (days)	Mean ± SD	1.13±0.35	1.03±0.18	0.22
	Range	1-2	1-2	
Return to daily activity: (days)	Mean ± SD	2.77±0.97	2.47±0.9	0.10
	Range	1-4	1-4	
Return to work: (days)	Mean ± SD	14.07±2.17	13.73±2.53	0.17
	Range	12-17	11 -16	

**DISCUSSION**

The current results found that the age of the studied cases ranged between 18 and 60 years, the mean of age in Group I (TAPP) was 42 ± 12.92 SD, with range (20-60) years and the mean of age in Group II (TEP) was 40.37 ± 7.46 with range (23-59) year. Regarding age, there were no remarkable differences between TEP and TAPP groups.

In agreement to our study, **Wilkinson and his colleagues**<sup>(6)</sup> regarding inguinal repair, they evaluated safety and complications of TEP versus Lichtenstein's repair and found that mean age of case with TEP was 49.40±17.88 and in open were 49.85±16.05 without remarkable variance between groups as regard age (p value 0.638). **Vinay and Balasubrahmanya**<sup>(7)</sup> in their study of inguinal repair, they compared TAPP and TEP repair and found that the mean age of TAPP group was 46.67±6.83 years and TEP group mean age was 51.33±5.94 years.

In the current study, 60 male cases were conducted to the study. In agreement to our study, **Selvi**

**and Manimegalai**<sup>(8)</sup> who compared postoperative complications in inguinal hernia repair between TEP and TAPP.

In this study, TAPP group had mean of operative time of 98.23 ± 9.83 minutes, while the mean of operative time in group II (who underwent TEP) was 116.3 ± 12.96 minutes. The operative time ranged from 80–140 minutes for all cases, according to the difficulty of the case, and the occurrence of intraoperative complications. Concerning operation time, the relation between groups was significantly different. Group I (who underwent TAPP) showed significant decrease in operation time compared to group II (who underwent TEP). In contrast to our study, **Vinay and Balasubrahmanya**<sup>(7)</sup> reported that the mean operative time was elevated significantly in TAPP compared to TEP (p=0.001), the mean TAPP operative time was 68±5.46 minutes and was 54±6.63 minutes for TEP.

In the present study, the procedures were carried out under general anesthesia. **Hamza et al.**<sup>(9)</sup> reported that one case in each group in their study was converted

to open method in both TEP and TAPP groups. While, in a study by **Sreekanth**<sup>(10)</sup>, the study revealed that there was no potential intraoperative complications reported in both TEP and TAPP groups, but the previous reports showed organ and vessels damage, and mortality after laparoscopy.

The present findings showed remarkable increase in scrotal swelling frequency between TEP group and TAPP group, and also a significant elevation in subcutaneous emphysema frequency between TAPP group and TEP group, while concerning the operative complication there was not any remarkable difference between the groups. In agreement to our results, a study of inguinal hernia repair by **Sreekanth**<sup>(10)</sup>, compared post-laparoscopic complications in TEP, TAPP, and open hernioplasty, TEP showed the least complications. **Selvi and Manimegalai**<sup>(8)</sup> who compared post-laparoscopic complications in TEP, TAPP, and open hernioplasty found that TAPP had higher complications than TEP, and the study comparing open and post-laparoscopic complications of **Hamaza**<sup>(9)</sup>, showed that 8% of cases subjected to TEP had complications, and 25% cases underwent TAPP.

In our study, in both groups as expected pain scores were higher at the first 6 hours after surgery. There was no remarkable variance between groups as regard VAS at 1<sup>st</sup> 24 hours postoperatively, but the group I (TAPP) cases showed insignificant lower mean VAS compared to group II (TEP) cases. It appears that both procedures are well tolerated with satisfactory pain levels. Most of the patients are pain-free at the first postoperative visit after one week.

Also, **Murthy and Ravaliala**<sup>(12)</sup> in the present study, hospital stay was longer in Group I (TAPP) than Group II (TEP) and this was mainly related to postoperative complications and return of normal bowel movements, which took a long time in group I. All cases required more than two days to return to daily activity, and more than 13 days to return to works. In agreement to our study, in a study by **Sreekanth**<sup>(10)</sup> on inguinal hernia repair using TEP and TAPP repair, TEP showed shorter discharge time than TAPP. Laparoscopic hernia repair of **Hamaza**<sup>(9)</sup> demonstrated that the TEP and TAPP mean postoperative hospital stay was one day and this came in contact with our study.

The recurrence's results revealed that during follow-up (6 months), there was not any reported recurrent cases. In agreement to our study, **Prassas et al.**<sup>(11)</sup>, revealed that there was no significant variation regarding the rate of recurrence between TEP and TAPP groups (p=0.6). Also, **Vinay and Balasubrahmanya**<sup>(7)</sup> compared TAPP and TEP and did not show recurrent hernia in all cases and this agreed with our study.

#### CONCLUSION:

TEP showed increased safety and potential peritoneal repair. On the other side, TAPP revealed easier learning

curve and fine visualization. Both techniques are effective in inguinal hernia management and were associated with 0% recurrence. However, due to short follow up duration, and small sample size, longer-term studies are also recommended.

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**Conflict of interest:** Nil.

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