

**Transabdominal pre-peritoneal (TAPP) versus totally extraperitoneal (TEP) laparoscopic techniques for inguinal hernia repair**

Mohamed Mubark<sup>a</sup>, Hanaa Abdelraheem Mohammed<sup>a\*</sup>, Mohammed Abdelshafy Mohamed<sup>a</sup>, Mohamed Yousef A<sup>a</sup>

<sup>a</sup>General Surgery Department, Faculty of Medicine, South Valley University, Qena, Egypt.

**Abstract**

**Background:** Hernia repair is one of the most frequently performed surgeries worldwide. Surgical treatment is usually successful in the majority of cases. However, a recurrence rate of 10% is reported irrespective of the surgical approach. Postoperative pain and disability are frequent. Laparoscopic repair has largely replaced open surgery in the treatment of inguinal hernia.

**Objectives:** To evaluate TAPP and TEP laparoscopic techniques for treatment of inguinal hernia repair regarding safety and outcome.

**Patients and methods:** This prospective randomized clinical trial study was carried out on 40 patients with inguinal hernia who underwent laparoscopic repair. Patients were distributed into 2 groups, group A patients had transabdominal preperitoneal (TAPP) repair while group B patients underwent totally extraperitoneal (TEP) repair. Both groups were evaluated according to occurrence of intraoperative complications, operative time, bleeding amount, hospital stay, postoperative pain (visual analogue scale) and duration for return of bowel movements.

**Results:** There was no statistically significant difference between both groups in each studied parameter. However, there was significantly less postoperative pain in TAPP group (p-value= 0.008) and TEP group (p-value= 0.001).

**Conclusion:** In conclusion, both TAPP and TEP achieved similar results in the parameters evaluated during this study. Both approaches can be used in the treatment of inguinal hernia repair.

**Keywords:** Inguinal hernia repair; Laparoscopic approach, Minimally invasive surgery.

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**\*Correspondence:** [hanaabdelraheem@gmail.com](mailto:hanaabdelraheem@gmail.com)

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## Introduction

Hernia is one of the oldest disorders known to man and they are most frequently seen in the groin. In an inguinal hernia, the protrusion takes place through the inguinal canal. Groin hernias constitute a major portion of conditions for which primary care physicians refer patients for surgical management (**Kingsnorth & LeBlanc, 2003**).

Since its first description in the early '90s and due to the introduction of ground-breaking surgical platforms, the surgical technique advanced and the laparoscopic transabdominal preperitoneal (TAPP) repair and the totally extraperitoneal repair (TEP) were established as minimally invasive approaches for inguinal hernia repair (**Bittner et al., 2015**).

Compared to the Lichtenstein technique, minimally invasive approaches appear to be associated with a decreased risk of wound-related complications, earlier postoperative pain relief, return to work/activities, and less chronic pain compared to the open approach (**Aiolfi et al., 2021**).

Lately, laparoscopic repair has essentially displaced open surgery as the primary approach for the treatment of inguinal hernia. Laparoscopic techniques most widely used are transabdominal preperitoneal repair (TAPP) devised by **Arregui** in 1992 and totally extraperitoneal repair (TEP) created by **McKernan and Laws** in 1993. The advantages of laparoscopic repair compared to open techniques include not only less pain in the early postoperative period but also better cosmetic appearance and early return to work.

The transabdominal preperitoneal repair (TAPP) is relatively easier but carries the risk of bowel adhesions to the mesh. On the other hand, totally extraperitoneal repair (TEP) -despite being more difficult to perform- does not breach the peritoneum and has the advantage of direct access to posterior defects.

The goal of our research is to evaluate TAPP and TEP laparoscopic techniques for inguinal hernia repair regarding their safety and outcome.

## Patients and methods:

Forty patients were admitted with inguinal hernia to General Surgery Department from June 2021 to June 2022 and underwent laparoscopic repair.

Patients were categorized into two equal groups, TAPP technique was performed on 20 patients (group A) while TEP technique on the remaining 20 patients (group B).

**Inclusion criteria included:** All patients with uncomplicated primary inguinal hernia who are older than 18 years.

**Exclusion criteria included:** Patients with history of previous lower abdominal surgery, patients who are unfit for general anesthesia and patients younger than 18 years were all excluded.

Every patient selected for the study was subjected to complete history, general, local examination and Routine laboratory work-up including complete blood count, prothrombin time & concentration, liver function, renal functions, fasting and postprandial blood sugar, hepatitis B and C markers. In addition, pelvi-abdominal ultrasound was done to confirm the diagnosis and exclude the presence of any abnormality.

Laparoscopic TEP: placement of 3 trocars in the lower midline, one 10mm and two 5 mm trocars. A 1.5 cm curvilinear infra-umbilical incision is made and carried down sharply to the level of the fascia. The anterior rectus sheath is incised transversely off the midline to expose the rectus abdominis muscle. The rectus abdominis muscle is swept laterally exposing the posterior rectus sheath. The surgeon's index finger is inserted into the preperitoneal space and is swept from side to side to develop the space and accommodate the placement of the 5 mm trocars. The two 5 mm trocars are inserted in the midline: one at the pubic tubercle and the other mid-way between the two trocars guided by the index finger to prevent their placement in the intra-peritoneal position.

The pre-peritoneal space is insufflated to 10 mmHg with CO<sub>2</sub>. A 10 mm 30-degree laparoscope is then inserted and used to further develop the preperitoneal space down to the pubic symphysis using side to side motion. After dissection of the sac from the cord with the identification of the triangle of doom and pain, a 12x15 prolene mesh is placed through a 10 mm port in the preperitoneal space over the inguinal area. Release of the pneumoperitoneal gas was done, then closing the anterior rectal sheath of 10 mm port by prolene 2/0 followed by skin closure, (Fig.1).

Laparoscopic TAPP: pneumoperitoneum is created using Verres needle and 10 mm optical trocar is introduced through a horizontal supraumbilical incision. Under direct vision, two additional 5 mm operating trocars are placed in each flank, in a horizontal plane with the umbilicus. Peritoneal cut 2 cm above and 1 cm medial to the anterior superior iliac spine and continued horizontally in medial direction to the lateral umbilical ligament. Preperitoneal space dissection and identification of anatomical landmarks, triangle of doom and triangle of pain is done. The hernia sac is carefully dissected from the spermatic cord. Polypropylene mesh (12x15cm) is rolled about itself and inserted from the camera trocar. The peritoneum is closed using 2-0 vicryl sutures, (Fig.2).

#### **Outcome evaluation**

Patients of both groups were evaluated postoperatively on the following parameters: a) Occurrence of intraoperative complications. b) Bleeding amount was assessed by intraoperative visible blood loss (VBL) and measured according to the sum of total amount of blood in the suction chamber and the weight gained by the used gauze. The weight gained by gauze (due to blood) was calculated by subtracting the weight of the dry gauze from the weight of the gauze soaked with blood after completion of mesh fixation.

c) Operative time d) Postoperative pain according to visual analogue scale at 1 hour, 6 hours and 24 hours postoperative as well as at time of discharge from hospital. e) Hospital stay.

All patients signed a written informed consent prior to their inclusion in this study and the institutional ethical committee of the Faculty of Medicine, Qena, approved the study (IRB NO; SVUMED-SUR011-1-22-11-487).

#### **Statistical analysis**

Data was collected, coded then entered as a spread sheet using Microsoft Excel 2016 for Windows, of the Microsoft Office bundle; 2016 of Microsoft Corporation, United States. Data was analyzed using IBM Statistical Package for Social Sciences software (SPSS), 21st edition, IBM, United States. The Kolmogorov-Smirnov test was used to verify the normality of distribution. Continuous data was expressed as mean  $\pm$  standard deviation, median & IQR while categorical data as numbers and percentage. Data was presented as tables and graphs. Results was considered statistically significant at a p-value of less than or equal 0.05 and highly statistically significant at a p-value of less than or equal 0.001.

#### **Results**

Our study was conducted on 40 cases who were divided into two equal groups. Group A consisted of 20 patients who underwent TAPP technique and group B consisted of 20 patients who underwent TEP technique of laparoscopic hernia repair.

All patients in the study were men with a mean age of  $45.4 \pm 11.06$  years. The mean age in TAPP group and TEP groups was  $50.25 \pm 13.45$  years and  $42.17 \pm 8.95$  years respectively. No statistically significant difference was found between both groups regarding gender or age (p value = 0.28), (Table.1).

**Table .1. Distribution of patients regarding demographic data**

Variable		Group A TAPP group (N=20)		Group B TEP group (N=20)		P-value
		No.	%	No.	%	
Gender	Male	20	100.0%	20	100.0%	-
	Female	0	0.0%	0	0.0%	
Age (years)	Mean± SD	50.25± 13.45		42.17± 8.95		0.282
	Median (IQR)	51.5 (39.0-61.5)		40.0 (38.0-50.0)		
	Range	35.0 - 63.0		30.0 - 55.0		

Our study showed that most patients had hernia on the left side. There was no statistically significant difference between the two groups as 10 (50%) patients in TAPP group and 3 (15%) patients in TEP group had hernia on the right side while 10 (50%) patients in TAPP group and 5 (85%) patients in TEP group had hernia on the left side.

The mean operative time in TAPP group and TEP groups was 102.5± 12.58 min. and 105.83± 16.86 min. respectively. On comparison of operative time between TAPP group and TEP group, there was no statistically significant difference between the two groups (p value=0.74), (Table.2).

**Table 2. Distribution of patients regarding operative time.**

Variable		Group A TAPP group (N=20)	Group B TEP group (N=20)	P-value
Operative time (min.)	Mean± SD	102.5± 12.58	105.83± 16.86	0.746
	Median (IQR)	100.0 (95.0-110.0)	102.50 (90.0-120.0)	
	Range	90.0 - 120.0	90.0 - 130.0	

The mean bleeding amount in TAPP group was 140.0± 46.90 c.c it was 121.67± 20.41 c.c in TEP group. Comparing the bleeding amount between

TAPP group and TEP group, there was no statistically significant difference between the two groups (p value= 0.41), (Table.3)

**Table 3. Distribution of patients regarding bleeding amount.**

Variable		Group A TAPP group (N=20)	Group B TEP group (N=20)	P-value
Bleeding amount (c.c)	Mean± SD	140.0± 46.90	121.67± 20.41	0.414
	Median (IQR)	135.0 (105.0-175.0)	120.0 (100.0-140.0)	
	Range	90.0 - 200.0	100.0 - 150.0	

There was no statistically significant difference between the two groups regarding VAS at 1 hour, 6 hours, and 24 hours, as well as at discharge (p

value >0.05). Meanwhile, there was significant decline in visual analogue scale values in TAPP group (p-value= 0.008) and TEP group (p-value= 0.001).

**Table 4. Distribution of patients regarding Postoperative pain according to visual analogue scale (VAS).**

Variables			Group A TAPP group (N=20)	Group B TEP group (N=20)	P-value
VAS	1 hour.	Mean± SD	4.25± 0.96	4.5± 1.05	0.737
		Median (IQR)	4.5 (3.5- 5.0)	4.5 (4.0 - 5.0)	
		Range	3.0 - 5.0	3.0 - 6.0	
	6 hours.	Mean± SD	2.75± 0.96	3.17± 0.98	0.494
		Median (IQR)	2.5 (2.0- 3.5)	3.5 (2.0 - 4.0)	
		Range	2.0 -4.0	2.0 -4.0	
	24 hours.	Mean± SD	1.5± 0.85	1.83± 0.41	0.285
		Median (IQR)	1.5 (1.0- 2.0)	2.0 (2.0- 2.0)	
		Range	1.0 - 2.0	1.0 - 2.0	
	At discharge	Mean± SD	0.50± 0.58	1.0± 0.63	0.223
		Median (IQR)	0.5 (0.0- 1.0)	1.0 (1.0- 1.0)	
		Range	0.0 - 1.0	0.0 - 2.0	
<b>P- value (Fr.)</b>			<b>0.008</b>	<b>0.001</b>	

The mean hospital stay in TAPP group and TEP groups was 2.0± 0.82 days and 2.5± 0.55 days respectively. On comparison of hospital stay between TAPP

group and TEP group, there was no statistically significant difference between the two groups, (Table.4).

## Discussion

Inguinal hernia is the most common form of hernia in males and inguinal hernioplasty is one of the most often performed surgical procedures, with a lifetime risk for inguinal hernia of 27-43%

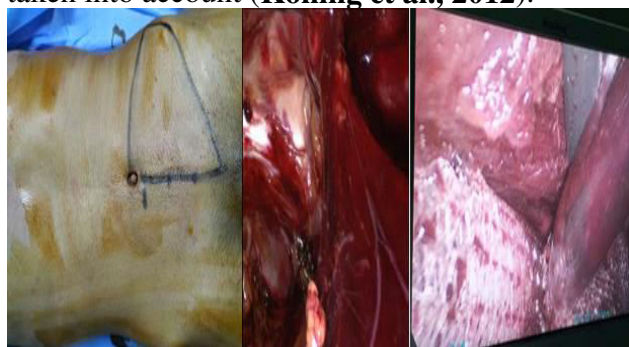
in men but it is only 3-6 % in women (Fitzgibbons Jr & Forse, 2015).

The definitive treatment for any type of hernia is essentially surgical and repairs can be performed using a wide variety of approaches including open, laparoscopic and robotic. Numerous



techniques have been employed in the treatment of inguinal hernia, most recently laparoscopic repair of inguinal hernia emerged as a good alternative to open surgery. The two main laparoscopic techniques are transabdominal preperitoneal (TAPP) repair and the totally extraperitoneal repair (TEP) emerged (Bittner et al., 2015).

Studies have shown that laparoscopic and endoscopic hernia repair have promising results concerning less chronic pain. However, considerable proportions of severe adverse events, learning curves, or added costs have to be taken into account (Koning et al., 2012).

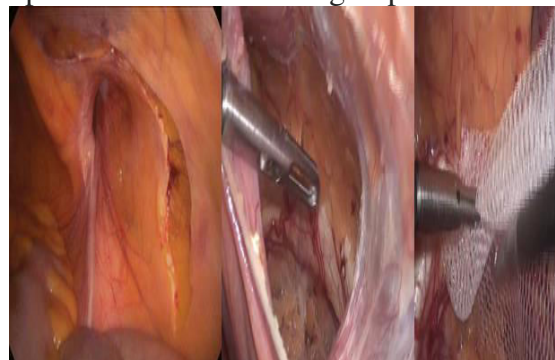


**Fig.1. TEPP approach.**

Our study showed that there is no statistically significant difference between the two groups regarding age and gender as the mean age in TAPP group and TEP groups was  $50.25 \pm 13.45$  years and  $42.17 \pm 8.95$  years respectively. All patients in both groups were males. In the same context, the study of Köckerling et al., 2015 showed similar ages between TAPP and TEP groups with a mean of  $50.04 \pm 15.95$  years in the TEP group and  $55.40 \pm 15.71$  years in the TAPP group.

The mean operative time for the TAPP group was  $102.5 \pm 12.58$  minutes, while the mean operative time for the TEP group was  $105.83 \pm 16.86$  minutes. There was no statistically significant difference between the two groups. This is supported by the study of Krishna et al., 2012 where they also found no statistical significance in operative time between TEP and TAPP groups. However, the study of Gangopadhyay & Ghosh, 2018 found

that TEP group had significantly longer operative time. In another study done by Goksoy et al., 2021 it was found that TAPP group had a significantly longer operative time than TEP group.



**Fig. 2. TAPP approach.**

There was no statistically significant difference between the two groups in operative bleeding as the mean bleeding amount in TAPP and TEP groups were  $140.0 \pm 46.90$  c.c and  $121.67 \pm 20.41$  c.c respectively, this was also the case in the study of Gong et al., 2011 and Tulin et al., 2019.

We also found no statistically significant difference between the two groups regarding visual analogue scale at 1 hour, 6 hours, and 24 hours, as well as at discharge ( $p > 0.05$ ). Meanwhile, there was significant decline in VAS values in TAPP group ( $p$ -value= 0.008) and TEP group ( $p$ -value= 0.001). These results are supported by the studies of Bansal et al., 2013 and Köckerling et al., 2015 in both studies there was no significant difference between TEP and TAPP groups regarding postoperative pain.

In our study, the mean hospital stay of TAPP group and TEP groups was  $2.0 \pm 0.82$  days and  $2.5 \pm 0.55$  days respectively. There was no statistically significant difference between the two groups. The study of Goksoy et al., 2021 showed similar results to our study regarding days of hospital stay. However, in the study of Ortenzi et al., 2020, it was significantly longer in the TAPP group.

## Conclusion

Considering the previous results, we can conclude that both TEP and TAPP approaches are safe, acceptable and effective in the treatment of primary inguinal hernia as they permit low rate of complications, lesser post-operative pain, shorter hospital stay, early toleration to feeds, early return to usual activities and less persisting pain.

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