

Comparison of Perioperative Complication Rates of Total Extraperitoneal and Transabdominal Preperitoneal Repairs in Primary Inguinal Hernia

Abstract

Background: Hernia may be defined as a protrusion of viscus through layers anatomically designed to contain that viscus. Most abdominal hernias occur at well-described sites of potential weakness. Repair of inguinal hernia is one of the most common operations in general surgery. **Objectives:** To compare the perioperative complication rates of total extraperitoneal (TEP) and transabdominal preperitoneal (TAPP) repairs of primary inguinal hernias. **Materials and Methods:** It is a randomised comparative study, conducted at the department of general surgery. A total of 50 patients were included and divided into two groups with 25 in each. Group A represents the laparoscopic TEP repair and group B represents the laparoscopic TAPP repair. Patients above 18 years with primary unilateral inguinal hernia were included. Patients having complicated inguinal hernia and history of previous abdominal surgery were excluded. **Results:** We observed that hernia occurrence is more common in the 31–50 years of age group and right-sided hernia is more common. Scrotal oedema and conversion to open surgery chances are similar in both TEP and TAPP groups. The duration of surgery in TEP is significantly higher as compared to TAPP. Patients who underwent TEP experienced less pain as compared to TAPP as per visual analogue scale. Postoperative hospital stay and time taken to resume the routine activity were significantly less in case of TEP. **Conclusion:** TEP is preferred over TAPP for laparoscopic hernia repair because it preserves the peritoneal integrity and has lesser postoperative pain. The early recovery and return to the routine work were seen with the patient treated with the TEP and also showed better visual analogue score than the TAPP repair group.

Keywords: Inguinal hernia, laparoscopy, totally extraperitoneal repair, transabdominal preperitoneal repair, VAS

Introduction

Inguinal hernias account for 75% of abdominal wall hernias, with a lifetime risk of 27% in men and 3% in women.^[1] Two third of these are indirect and the remainder are direct inguinal hernias.^[2]

There are numerous methods for inguinal hernia repair but tension-free repair is the procedure of choice. It can be done by both, an open or laparoscopic approach. The widely used laparoscopic hernia techniques are transabdominal preperitoneal (TAPP) and totally extraperitoneal (TEP) repairs. Laparoscopic repair of inguinal hernia is favourable in terms of a lower incidence of acute and chronic groin pain, better preservation of testicular functions, and significant improvement in quality of life compared to open mesh repair.^[3]

In TAPP, a peritoneal incision is made to reach the peritoneal cavity and then placement of a mesh is done. The mesh is placed in the preperitoneal space which covers all potential hernia sites in the inguinal region. After leaving mesh between the preperitoneal tissues and the abdominal wall the peritoneum is then closed above the mesh and later it becomes incorporated by fibrous tissue. In TEP, there is nonviolation of the peritoneal cavity as the preperitoneal space is created from outside. However, it is a technically difficult procedure with a long learning curve, because of space constraints and unfamiliar anatomy.^[4]

TAPP has the advantage of ease of learning, however, the major disadvantage is entry into the peritoneum, increasing risk of damaging the intra-abdominal organs and of adhesion formation leading to intestinal obstruction (which has been linked to TAPP).^[5]

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A frequent problem of the TEP technique is peritoneal leakage with consecutive carbon dioxide loss into the peritoneal cavity and subsequent compression of the preperitoneal dissection space. The incidence of such a peritoneal defect is as high as 50%. Questionnaires for patient-reported outcome measures, measuring quality of life after various interventions, have been developed and advocated for use in evaluation of treatment efficiency making it relatively objectivised.^[6] These patient-related outcomes, such as chronic groin pain and return to activity, have become the central issues in evaluation of any surgical intervention in groin hernia repair rather than recurrence or wound infection.

This study was done to compare the perioperative complication rates of TEP and TAPP repairs of primary inguinal hernias.

Materials and Methods

This randomised comparative study was conducted at the Department of General Surgery at ABVIMS & Dr RML Hospital for a period of 2 years. A total of 50 patients (divided into two groups with 25 in each) were enrolled on the study as per inclusion and exclusion criteria. Randomisation was done by block randomisation with sealed envelope system.

Group A represents the laparoscopic TEP repair.

Group B represents the laparoscopic TAPP repair.

Inclusion criteria

- Patients above 18 years
- Primary unilateral inguinal hernia

Exclusion criteria

- Complicated inguinal hernia
- History of previous abdominal surgery

Diagnosis of inguinal hernia was made on the basis of history and clinical examination. Patient underwent all routine investigations like complete blood count, fasting and postprandial blood sugar, liver function test, kidney function test, urine routine and microscopy, HIV/HBsAg/HCV, PT/INR, ECG, chest X-ray PA view, USG whole abdomen (PVR in elderly male). Pre-anaesthesia check-up was done. After the required preparations, written and informed consent was taken.

The following parameters were used for comparison of perioperative complications in two groups:

- Vascular injuries
- Visceral injuries
- Surgical emphysema
- Conversion to open
- Haematoma

- Postoperative pain
- Seroma
- Scrotal oedema
- Port site hernia
- Early recurrence
- Wound infection and mesh infection

Sample size calculation

Effects of TAPP and TEP inguinal hernia repair: an updated systematic review and meta-analysis of randomised controlled trials was performed by Li-Siou Chen *et al.*^[7] The study observed mean values of pain score at 1 d in TEP was 4.5 ± 0.9 and in TAPP was 5.7 ± 1.4 . Taking these values as reference, the minimum required sample size with 90% power of study and 5% level of significance is 21 patients in each study group. In 2016, Bansal *et al.*^[8] in their study concluded that for a surgeon with basic laparoscopic training, about 13–15 cases are required initially to become well-versed with both TEP and TAPP.

Formula used for comparing mean of two groups:

$$N \geq 2 (\text{standard deviation})^2 \times (Z\alpha + Z\beta)^2 (\text{mean difference})^2$$

where $Z\alpha$ is the value of Z at two-sided alpha error of 5% and $Z\beta$ is value of Z at power of 90% and mean difference is difference in mean values of two groups.

Calculations

$$\text{Pooled standard deviation} = \text{square root } ((.9 \times .9 + 1.4 \times 1.4)/2) = 1.18$$

$$n \geq (2 \times 1.18 \times 1.18 \times (1.96 + 1.28)^2) / (5.7 - 4.5)^2 = 20.30 = 21 \text{ (approx.)}$$

Statistical analysis

Categorical variables were presented in number and percentage (%) and continuous variables were presented as mean \pm SD and median. Normality of data was tested by Kolmogorov–Smirnov test. If the normality was rejected, then nonparametric test was used.

Quantitative variables were compared using unpaired t test/Mann–Whitney test (when the data sets were not normally distributed) between the two groups.

Qualitative variables were compared using Chi-square test/Fisher's exact test.

A P value of <0.05 was considered statistically significant. Statistical Package for Social Sciences (SPSS) version 21.0 was used.

Results

A total of 50 patients were enrolled in this study as per inclusion and exclusion criteria. Further, they were divided into two groups based on the type of the treatment option. All the patients included were male.

In our study, we observed that hernia occurrence is most common in the 31–50 years age group as 28 cases out of 50 cases were of the age group between 31 and 50 years (56%). The next most common occurrence was in the age group 51–60 years [Table 1]. It was also observed that right inguinal hernia is more common than left inguinal (right inguinal hernia cases: 28) [Table 2].

We compared the duration of surgery in both TEP and TAPP groups. The range in the TEP group was 80–130 min, whereas in TAPP, it was 70–110 min. The median duration of surgery in the TEP group was 90 min whereas in the TAPP group it was 85 min (*P* value: 0.046). TEP had a significantly longer duration of surgery as compared to TAPP [Table 3].

Risk of surgical emphysema was significantly higher in TEP. Three of twenty-five patients who underwent TEP developed surgical emphysema whereas none of the patients in the TAPP group developed surgical emphysema. There was no visceral or vascular injury noted during our study. In two patients, laparoscopic surgeries (2/50) were converted to open surgeries. In these two patients, one patient was undergoing TEP (1/25), whereas for the other patient we had started with TAPP (1/25) [Table 4].

We studied postoperative pain in patients undergoing TEP and TAPP using visual analogue scale (score 0–100). We compared pain at 6, 12, 24, and 48 h after surgery [Figure 1].

At 6 h, median pain score in TEP was 30 (range, 10–90) and in TAPP median pain score was 60 (range, 20–80) (*P* < 0.001), which showed a significant result. So patient experienced less pain at 6 h after TEP.

At 12 h, median pain score in TEP was 40 (range, 10–60), whereas in the case of TAPP it was 60 (range, 40–80) (*P* < 0.01), which implied the results were significant. So patients who underwent TEP had less pain at 12 h after surgery as compared to TAPP.

At 24 h, the median pain score in TEP was 30 (range, 10–50), whereas in TAPP it was 40 (range, 20–80) (*P* < 0.001), which implied results were significant. So patients who underwent TEP had less pain at 24 h after surgery as compared to TAPP.

At 48 h, median pain score in TEP was 30 (range, 0–70), whereas in TAPP it was 20 (range, 0–60) (*P* = 0.495). So although patients who underwent TEP had less pain at 48 h after surgery, it was insignificant.

There was no port site hernia, no recurrence and no any wound or mesh infection noted. Haematoma was observed in a single case of TEP (1/25) and no haematoma case was noted in the TAPP group (0/25). Seroma was observed in two patients in the TEP group (2/25) and four cases in the TAPP group (4/25). Scrotal oedema was noted in two

Table 1: Age-wise distribution of the patients

Age (years)	TEP (n = 25)	TAPP (n = 25)	Total
20–30	4 (16%)	3 (12%)	7 (14%)
31–40	6 (24%)	8 (32%)	14 (28%)
41–50	8 (32%)	6 (24%)	14 (28%)
51–60	4 (16%)	6 (24%)	10 (20%)
61–70	3 (12%)	2 (8%)	5 (10%)
Mean ± SD	45.16 ± 13.96	43.52 ± 11.12	44.34 ± 12.52
Median (IQR)	46 (37–55)	44 (34–54)	45 (35.25–54)
Range	20–70	25–65	20–70

TEP: total extraperitoneal, TAPP: transabdominal preperitoneal, SD: standard deviation, IQR: interquartile range

Table 2: Comparison of diagnosis between TEP and TAPP

Diagnosis	TEP (n = 25)	TAPP (n = 25)	Total
LDH	8 (32%)	4 (16%)	12 (24%)
LIH	3 (12%)	7 (28%)	10 (20%)
RDH	3 (12%)	6 (24%)	9 (18%)
RIH	11 (44%)	8 (32%)	19 (38%)
Total	25 (100%)	25 (100%)	50 (100%)

LDH: left direct hernia, LIH: left indirect inguinal hernia, RDH: right direct hernia, RIH: Right indirect inguinal hernia, TEP: total extraperitoneal, TAPP: transabdominal preperitoneal

Table 3: Comparison of duration of surgery (min) between TEP and TAPP

Duration of surgery (min)	TEP (n = 25)	TAPP (n = 25)	Total	<i>P</i> value	Test performed
Mean ± SD	94.72 ± 12.5	86.8 ± 11.63	90.76 ± 12.6	0.046	Mann–Whitney test; 211.5
Median (IQR)	90 (90–100)	85 (80–95)	90 (80–100)		
Range	80–130	70–110	70–130		

TEP: total extraperitoneal, TAPP: transabdominal preperitoneal, SD: standard deviation, IQR: interquartile range

Table 4: Comparison of intra-op complications between TEP and TAPP

Intra-op complications	TEP (n = 25)	TAPP (n = 25)	Total	P value	Test performed
Intra-op complications					
Surgical emphysema	3 (12%)	0 (0%)	3 (6%)	0.235	Fisher's exact test
Visceral injury	0 (0%)	0 (0%)	0 (0%)		
Vascular injury	0 (0%)	0 (0%)	0 (0%)		
Conversion to open					
No	24 (96%)	24 (96%)	48 (96%)	1	Fisher's exact test
Yes	1 (4%)	1 (4%)	2 (4%)		

TEP: total extraperitoneal, TAPP: transabdominal preperitoneal

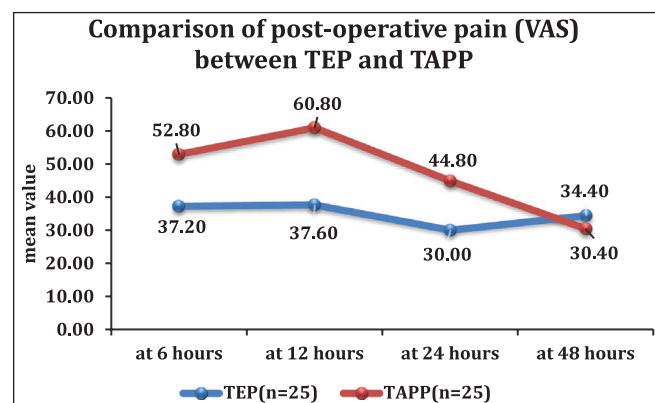


Figure 1: Comparison of trend of postoperative pain (VAS) at different time intervals between TEP and TAPP

patients in the TEP group (2/25) and in the TAPP group also it was noted in two patients (2/25). Shoulder tip pain was observed in a single patient in the TEP group (1/25) and there were two patients in TAPP group who experienced shoulder tip pain (2/25). Therefore, seroma formation, haematoma formation, development of scrotal oedema and shoulder tip pain chances are comparable when TEP is compared to TAPP since *P* value is insignificant [Table 5].

After surgery, postoperative hospital stay was studied individually for both groups. In TEP the median hospital stay was 3 days (range, 2–4 days), whereas in the case of TAPP it was 4 days (range, 2–5 days). Postoperative stay was significantly lower in TEP when compared to TAPP [Table 5].

We also compared time taken to resume normal activity in our study like doing morning walk or jogging, and going to work by driving. In TEP the median time to resume normal activity was 12 days (range, 10–15 days) and in case of TAPP the median time to resume normal activity was 14 days (range, 10–18 days).

Discussion

With advancement in laparoscopy, endoscopic repairs seem to offer better quality of life, decrease hospital stay and early return to work. Every possible attempt should be made for early repair of inguinal hernia if no added comorbidity is present.^[9,10] A large number of hernia repairs are still done with open technique as endoscopic repairs have a

steep learning curve and requires costlier infrastructure.^[11] Despite a few hurdles, laparoscopic repair is becoming a preferred approach, especially for bilateral and recurrent hernias.

In our study, we observed that inguinal hernia occurrence is more common in 31–50 years age group; that is 28 cases out of 50 cases were of age group between 31 and 50 years (56%). It was observed that right-sided inguinal hernia is more common than left side (right hernia cases = 28/50). The mean age of the participants included in this study was 45.16 years (SD = 13.95) in the TEP group and 43.52 (SD = 11.11) in the TAPP group, which was not statistically different. All the patients included were male, probably due to lower incidence of occurrence in females which is recorded in previous studies.^[12]

In a study by Verma *et al.*,^[13] 28 out of 60 cases were in the age group of 31–50 years with mean age was 35.77 years in TEP group and 41.70 years in the TAPP group. Right side hernia was more common than left 48% right inguinal hernia vs. 36% left inguinal hernia (16% bilateral).

There is no significant difference in the body mass index, duration of illness, pain, chronic cough, chronic constipation, and straining while micturition as the common symptoms associated with the hernia cases. These were similar to findings of many authors.^[14,15] The comorbidities associated with the patients included were six with COPD, four with hypertension and two with hypertension and diabetes mellitus.

Twenty-two patients presented with left-sided inguinal hernia and 28 patients with right-sided inguinal hernia, among which 21 had direct type of inguinal hernia and 29 patients with indirect type of inguinal hernia. Similar findings were previously recorded in other studies with more incidence of the right-sided hernia when compared to the left-sided inguinal hernia.^[16–18]

In this study, we compared the duration of surgery in both TEP and TAPP groups. The range in the TEP group was 80–130 min, whereas in the TAPP group it was 70–110 min. The median duration of surgery in the TEP group was 90 min, whereas in the TAPP group it was 85 min (*P* < 0.05). In a study by Verma *et al.*,^[13] the mean operative time in TEP group was 70.8 min as compared to TAPP group

Table 5: Comparison of postoperative complications between TEP and TAPP

Postoperative complications	TEP (n = 25)	TAPP (n = 25)	Total	P value	Test performed
Haematoma					
No	24 (96%)	25 (100%)	49 (98%)	1	Fisher's exact test
Yes	1 (4%)	0 (0%)	1 (2%)		
Seroma				0.667	Fisher's exact test
No	23 (92%)	21 (84%)	44 (88%)		
Yes	2 (8%)	4 (16%)	6 (12%)		
Scrotal oedema				1	Fisher's exact test
No	23 (92%)	23 (92%)	46 (92%)		
Yes	2 (8%)	2 (8%)	4 (8%)		
Port site hernia				No P value	-
No	25 (100%)	25 (100%)	50 (100%)		
Wound and mesh infection				No P value	-
No	25 (100%)	25 (100%)	50 (100%)		
Early recurrence				No P value	-
No	25 (100%)	25 (100%)	50 (100%)		
Shoulder tip pain				1	Fisher's exact test
No	24 (96%)	23 (92%)	47 (94%)		
Yes	1 (4%)	2 (8%)	3 (6%)		
Post-op hospital stay (days)				0.009	Mann-Whitney test; 187.5
Mean ± SD	3.12 ± 0.67	3.8 ± 0.91	3.46 ± 0.86		
Median (IQR)	3 (3-4)	4 (3-5)	3 (3-4)		
Range	2-4	2-5	2-5		
Time taken to resume normal activity (days)				0.328	Mann-Whitney test; 263.5
Mean ± SD	13.12 ± 1.79	13.72 ± 1.97	13.42 ± 1.89		
Median (IQR)	12 (12-15)	14 (13-15)	14 (12-15)		
Range	10-15	10-18	10-18		

TEP: total extraperitoneal, TAPP: transabdominal preperitoneal, SD: standard deviation, IQR: interquartile range

Table 6: Comparison of different studies

Parameters	Studies							
	Present study		Verma et al. ^[13]		Sharma et al. ^[25]		Gurung et al. ^[26]	
	TEP	TAPP	TEP	TAPP	TEP	TAPP	TEP	TAPP
No. of cases (N)	25	25	30	30	30	30	26	30
Mean age (years)	45.16	43.52	35.77	41.70	49	49.4	41.42	43.93
Side of hernia	Right: 28; left: 22		Right: 30; left: 22; bilateral: 8		All bilateral		Not mentioned	
Operative time (min)	90	85	70.8	88.0	120.89	108.16	56.5	65.5
Hospital stay (days)	3	4	2.27	2.53	2.2	2.3	1.1	1.2
Return to work (days)	12	14	6.4	7.2	12.4	11.8	5.6	6
Conversion to open	1	1	-	-	1	0	-	-
Recurrence	-	-	-	-	-	-	-	-

TEP: total extraperitoneal, TAPP: transabdominal preperitoneal

with 88 min as mean operative time. In some studies, the duration of TEP was more than TAPP^[19,20] but most studies recorded the time required for TEP repair to be lesser than the TAPP repair.^[21-24]

After surgery, postoperative hospital stay was studied individually for both groups. In TEP the median hospital stay was 3 days (range 2-4 days), whereas in TAPP, it was 4 days (range, 2-5 days) ($P < 0.05$). In a study by Verma et al.,^[13] the mean hospital stay in TEP group 2.27 was as compared to 2.53 in TAPP group.

The intra-operative complications related to the surgical procedures were noted in this study with the TEP repair resulting in more complications than the TAPP repair. Risk of surgical emphysema was insignificantly higher in TEP as 3 out of 25 patients who underwent TEP developed surgical emphysema, whereas none of the patients in the TAPP group developed surgical emphysema. Results were calculated using Fisher's exact test (surgical emphysema, visceral injury [no cases] and vascular injury [no cases]) and P value came out to be 0.235. Shoulder tip pain was observed in a single patient in the TEP group (1/25) and

there were two patients in TAPP group who experienced shoulder tip pain (2/25).

These findings in my study are comparable to Verma *et al.*^[13] who reported surgical emphysema in three patients (two in TEP, one in TAPP), port site infection in three patients (one in TEP, two in TAPP). Two cases of haematoma and seroma each was reported in TEP group. One patient in the TAPP group experienced shoulder pain and none of the patients in the TEP group experienced it. Hence statistically no significant difference was observed in TEP and TAPP in terms of shoulder tip pain. And overall complication results were insignificant that is $P \geq 0.05$.

In two patients, laparoscopic surgeries (2/50) were converted to open surgeries in our study. In these two patients, one patient we started with TEP but he developed some cardiac instability during surgery so it needed to be converted to open (1/25). While in the second patient we started with TAPP but due to difficult dissection, it needed to be converted to open method of repair (1/25). These results were calculated using Fisher's exact test and P value came out to be 1. It means these results are insignificant. These results in our study are comparable [Table 6] to study done by Sharma *et al.*,^[25] most procedures were completed laparoscopically 59/60 (98.33%). Thirty cases of TEP and 30 cases of TAPP were finally included in the study. There was no conversion in TAPP group. In TEP group, one case had to be converted to open surgery due to an unstable cardiac condition that developed during operation, and another very difficult case was converted to TAPP due to a large rent in the peritoneum during initial dissection.

Postoperative pain in patients undergoing TEP and TAPP by visual analogue scale (score 0–100). We compared pain at 6, 12, 24, and 48 h after surgery. Patient experienced less pain at 6, 12, and 24 h after TEP. Although patients who underwent TEP got more pain at 48 h after surgery, it was insignificant.

Scrotal oedema was noted in two patients in TEP group (2/25) and in TAPP group also it was noted in two patients (2/25). These results were also analysed by Fisher's exact test and P value came out to be 1. So it implied that scrotal oedema chances are similar in both groups. These results in our study matches with the study done by Gurung *et al.*,^[26] a total number of 56 patients with uncomplicated, primary and unilateral inguinal hernia were included in the study. Thirty patients were included in TAPP group and 26 patients were included in TEP group. They compared pain scores at 1 h, 6 h, 18 h, and 7 days after surgery for TAPP vs. TEP using visual analogue score (VAS). The pain score result was not statistically significant at 1 h after the operation in both the group (P value = 0.379). However, the pain scores were significantly higher in the TAPP patients at 6 h (P value = 0.002), 18 h (P value = 0.015), and 7 days (P value = 0.038) after the operation. In TEP group, three patients (3/26) whereas in TAPP six patients developed

scrotal oedema (6/30). Though this complication was higher in the TAPP group, it was not statistically significant ($P = 0.24$).

There were no visceral and vascular injuries noted during our study. Haematoma was observed in a single case of TEP (1/25) and no any haematoma case was noted in TAPP group (0/25). No drainage procedure was done for haematoma and it got resolved by conservative management. The postoperative complications are comparably lower than the previous studies.

In TEP median time to resume normal activity was 12 days (range 10–15 days) and in case of TAPP median time to resume normal activity was 14 days (range 10–18 days). When both these results were analysed by Mann–Whitney test, P value came out to be 0.328. So although patients who underwent TEP took less time to resume normal activity as compared to TAPP, it was not significant.

In this study, there was no mesh infection, post-site hernia, SSI and early recurrence were not found in all the 50 patients treated for inguinal hernia. Visceral injury and vascular injury were not present in all 50 patients treated for inguinal hernia. Recurrence in literature is almost attributed to less experience and occurs early in learning curve.^[27,28]

Conclusion

TEP is preferred over TAPP for laparoscopic hernia repair because it preserves the peritoneal integrity and also has lesser postoperative pain. However, TEP repair has been associated with a steep learning curve and is associated with longer operating times and higher conversion rates. It is a technically demanding procedure because of the unfamiliar anatomy and requires lot of training and laparoscopic experience. A gradual shift towards TEP has been observed worldwide because of its advantages such as reduced risk of bowel injury, bowel adhesions and incisional hernia formation. Still, TAPP repair holds good for huge hernia and in initial learning phase.

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Conflicts of interest

There are no conflicts of interest.

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