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Original Research Article

A COMPARATIVE OBSERVATIONAL STUDY OF ETEP VERSUS TEP IN INGUINAL HERNIA REPAIR IN A TERTIARY CARE HOSPITAL IN CENTRAL INDIA

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ABSTRACT

Background: Laparoscopic inguinal hernia repair has emerged as the preferred surgical approach due to reduced postoperative pain, shorter hospital stay, and early return to routine activities. Totally Extraperitoneal (TEP) repair is an established technique; however, limited working space and technical difficulty remain challenges. Extended Totally Extraperitoneal (ETEP) repair has been introduced to overcome these limitations by providing a larger operative field and improved ergonomics. Comparative evidence between ETEP and TEP remains limited, particularly in the Indian setting. The aim is to compare perioperative and postoperative outcomes of ETEP and TEP inguinal hernia repair among patients undergoing laparoscopic hernioplasty.

Materials and Methods: A prospective observational comparative study was conducted in the Department of General Surgery of a tertiary care hospital in Central India from January 2024 to December 2025. Fifty patients diagnosed with uncomplicated inguinal hernia and scheduled for elective laparoscopic repair were enrolled. Twenty-five patients underwent ETEP repair and twenty-five underwent TEP repair. Parameters assessed included operative time, intraoperative complications, postoperative pain, hospital stay, return to normal activities, and postoperative complications. Data were analyzed using SPSS version 26.0. A p-value <0.05 was considered statistically significant.

Results: The mean age is 46.92 ± 10.42 & 47.12 ± 9.00 years for the E-TEP & TEP group respectively. Both groups were comparable regarding demographic and clinical characteristics. Mean operative time was significantly shorter in the ETEP group (94.00 ± 11.18 minutes) compared to the TEP group (108.00± 15.0 minutes; p=0.009). Postoperative pain scores at 24 hours were lower in the ETEP group (1.40± 0.50) than in the TEP group (1.84 ± 0.37; p=0.004). No cases in either group (0 out of 25 in E-TEP and 0 out of 25 in TEP) required conversion to TAPP, resulting in 100.0% of cases in both groups remaining as planned. The mean hospital stay for the E-TEP group is 3.24 ± 0.83 days, compared to 3.44 ± 0.51 days for the TEP group. The p-value of 0.309 indicates no statistically significant difference in hospital stay duration between the groups. No cases in either group (0 out of 25 in E-TEP and 0 out of 25 in TEP) experienced recurrence, resulting in 100.0% of the total sample of 50 patients being free of recurrence.

Conclusion: ETEP repair demonstrated advantages over conventional TEP in terms of operative time, postoperative pain, and hospital stay while maintaining similar safety and complication profiles. ETEP appears to be an effective alternative for laparoscopic inguinal hernia repair.

Keywords: Inguinal hernia, ETEP, TEP, Laparoscopic hernioplasty, Postoperative pain.

INTRODUCTION

Inguinal hernia is a common clinical condition with a significant global health burden. It represents a protrusion of intra-abdominal contents through a weakened area in the lower abdominal wall, specifically within the inguinal canal. This condition is remarkably prevalent, with a reported lifetime risk of approximately 27% in men and 3% in women, making it a predominantly male health concern.[1] Among all types of abdominal wall hernias, inguinal hernias constitute nearly 75%, underscoring their predominance in clinical surgical practice.

Globally, surgical repair of inguinal hernias is one of the most frequently performed procedures in general surgery.[1] It is estimated that more than 20 million groin hernia repairs are conducted annually around the world, highlighting the widespread nature of this surgical challenge.[2] The evolving landscape of surgical techniques has led to the exploration and adoption of minimally invasive methods, particularly laparoscopic approaches, which offer several clinical benefits over traditional open surgery.

In 2009, the European Hernia Society issued a Grade A recommendation advocating for laparoscopic repair in the treatment of primary inguinal hernias.[3] This endorsement was based on accumulating evidence suggesting that laparoscopic approaches provide several key advantages, including enhanced anatomical visualization, reduced postoperative pain, quicker return to normal activities, and fewer wound-related complications.[4-7] These benefits have led to a growing interest in minimally invasive hernia repair among surgeons and patients alike.

Despite these clear advantages, the adoption of laparoscopic inguinal hernia repair has not been as widespread as anticipated. The penetration rate remains low in many parts of the world, owing to several inherent challenges associated with the laparoscopic techniques.[8] Among these are the relatively higher cost of equipment and consumables, extended operative time compared to open techniques, and the steep learning curve required to master the procedure. These factors continue to limit the universal acceptance and routine practice of laparoscopic hernia repair.

The totally extraperitoneal (TEP) approach has emerged as one of the most frequently utilized laparoscopic techniques for inguinal hernia repair. The TEP method avoids entering the peritoneal cavity, thereby reducing the risk of intra-abdominal complications. However, the TEP approach is not without limitations. It presents several technical challenges, including poor ergonomics, constrained trocar placement, limited operative workspace, and minimal tolerance for inadvertent pneumoperitoneum—all of which contribute to a demanding learning process for novice surgeons.[9]

To overcome some of the drawbacks associated with the TEP technique, Jorge Daes introduced the enhanced view totally extraperitoneal (eTEP) approach in 2012.[10] The eTEP technique offers improved ergonomics, a wider surgical field, and greater flexibility in port placement, which collectively contribute to a potentially safer and more effective surgical experience. So the present study is designed to compare the clinical outcomes of the Enhanced View Totally Extraperitoneal (eTEP) approach versus the Totally Extraperitoneal (TEP) approach in inguinal hernia repair.

MATERIALS AND METHODS

The Present Hospital based observational study was conducted among 50 Patients diagnosed with uncomplicated inguinal hernia at Tertiary Care Centre of Central India.

Sample Size:The total sample size for this study was 50 (25 in each group)

The sample size was calculated using the following formula:

$$N = \frac{2(Z_{\alpha/2}+Z_{\beta})^2\sigma^2}{d^2}$$

Where,

N = Sample size in each group

Zα/2 = 1.96 at the desired significance level of 5%

Zβ = 0.84 at the desired power of 80%

d = Mean difference in operating time = 40.0

σ = Standard deviation =50.0

Inclusion Criteria

1. Patients diagnosed with uncomplicated inguinal hernia.
2. Male and female patients aged 18-75 years.
3. Patients undergoing elective hernia repair.
4. Patients willing to participate in the study

Exclusion Criteria

1. Patients with recurrent inguinal hernia.
2. Patients with complicated inguinal hernias (e.g., strangulated or incarcerated hernia).
3. Patients with a history of previous lower abdominal surgery.
4. Patients with significant comorbidities contraindicating laparoscopic surgery.
5. Pregnant women.
6. Patients not willing to participate in the study

Methodology: After ethics committee approval and written informed consent from guardians and/or patients was obtained. All patients had a complete history obtained and undergo thorough physical examination.

Before surgery, the patients were instructed to empty their urinary bladders. TEP repair was accomplished with three midline ports. eTEP was performed in the standard fashion using three ports as described by Jorge Daes.10 Blunt dissection with a 0° telescope was used to create the pre-peritoneal space.

(A)Step-by-step breakdown of the TEP procedure:

Step	Description
Patient Prep	Supine, Trendelenburg; surgeon opposite hernia
Ports	Infra-umbilical 10 mm + two 5 mm (midline or triangulated)
Dissection	Retzius medially (pubic symphysis, Cooper's ligament); Bogros laterally up to ASIS
Sac Handling	Gentle dissection; ligate or invert; avoid "triangle of doom"
Mesh	Large mesh, unrolled to cover all defects; fix if needed
Closure	Desufflate under vision; close fascia and skin; optional analgesia

(B)Step-by-step breakdown of the e-TEP procedure:

Step	Action
Positioning & Marking	Supine, midline/semilunar/arcuate lines, flank-optic path
Port Access	12 mm optic flank port → blunt dissection
Working Ports & PRS Release	Lateral port, divide PRS, umbilical port insertion
Dissection	Expose Retzius medially → Bogros laterally
Sac Management	Reduce sac; use scrotal pressure if needed
Mesh Deployment	Large overlap, anchor selectively;
Final Steps	Optional intraperitoneal check, careful desufflation, port closure

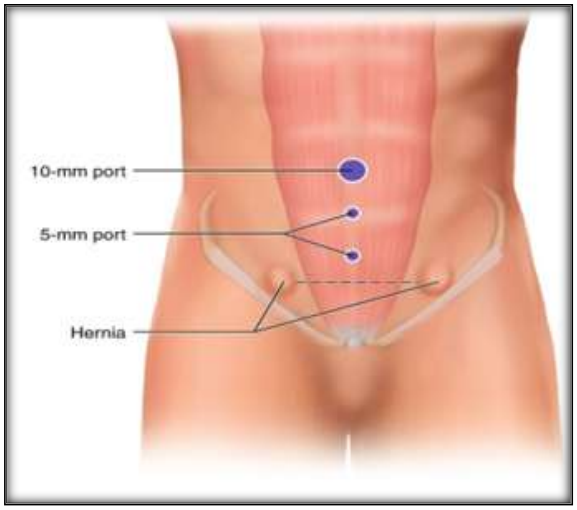

Figure 1: Port Placement

Data Collection: Various intraoperative and postoperative variables like operative time, morbidity, surgeon satisfaction score, pain, hospital stay, time to return to routine activities, and recurrence rates were noted. Operative time was defined as the time from the first skin incision to the closure of the last skin defect. Ergonomics evaluation was done using the surgeon's satisfaction score for the visualization of landmarks and the ease of mesh spreading.[7]

Postoperative pain was assessed using the visual analog scale. These scores were measured at 1, 2, 4, 6, 8, 12, and 24 hours postoperatively. If the pain score exceeded six, rescue analgesics were administered. The wound was examined for signs of infection or soakage. Follow-up data for one year were also analyzed, documenting the time to resume normal activities and any recurrence.

Statistical analysis: The data are tabulated in Microsoft excel and analysed with SPSS V.26.0 software. The continuous variables are presented with mean and standard deviation. The categorical variables are presented with frequency and percentage. Chi square test, Independent t test are used for the statistical analysis. The p value ≤0.05 is considered statistically significant.

RESULTS

In the E-TEP group, 96.0% (24 out of 25) are male, and 4.0% (1 out of 25) are female. In the TEP group, 92.0% (23 out of 25) are male, and 8.0% (2 out of 25) are female. The total sample of 50 patients consists of 94.0% males and 6.0% females. The p-value of 0.552 indicates that the difference in sex distribution between the groups is not statistically significant. In the E-TEP group, 24.0% (6 out of 25) had the procedure on the left side, and 76.0% (19 out of 25) on the right side. In the TEP group, 28.0% (7 out of 25) had the procedure on the left side, and 72.0% (18 out of 25) on the right side. Overall, 26.0% of procedures were on the left side, and 74.0% were on the right side across the total sample of 50 patients. The p-value of 0.747 indicates no statistically significant difference in the side of the procedure between the groups. The mean age for the E-TEP group is 46.92 ± 10.42 years, while for the TEP group, it is 47.12 ± 9.00 years. The p-value of 0.942 indicates no statistically significant difference in age between the two groups. [Table 1]

The mean operative time for the E-TEP group is 94.00 ± 11.18 minutes, significantly shorter than the TEP group's mean of 108.00 ± 15.00 minutes. The p-value of less than 0.001 confirms that the difference in operative time is statistically significant, indicating that the E-TEP procedure is associated with a shorter duration compared to the TEP procedure. Post-operative pain was assessed using the Visual Analog Scale (VAS), a validated tool for quantifying pain intensity. Patients rated their pain on a scale from 0 (no pain) to 10 (worst possible pain). Assessments were conducted through patient self-reporting during clinical visits or via standardized questionnaires. The mean post-operative pain for the E-TEP group is 1.40 ± 0.50, compared to 1.84 ± 0.37 for the TEP group. The p-value of 0.001 indicates a statistically significant difference, suggesting that patients in the E-TEP group experience a lesser post-operative pain compared to those in the TEP group. [Table 2]

No cases in either group (0 out of 25 in E-TEP and 0 out of 25 in TEP) required conversion to TAPP,

resulting in 100.0% of cases in both groups remaining as planned. The total sample of 50 patients shows no conversions, indicating that both procedures were completed as intended without the need for conversion. In the E-TEP group, 8.0% (2 out of 25) developed seroma, while in the TEP group, 4.0% (1 out of 25) did. Overall, 6.0% (3 out of 50) of the total sample had seroma. The p-value of 0.552 indicates that the difference in seroma incidence between the groups is not statistically significant. No cases in either group (0 out of 25 in E-TEP and 0 out of 25 in TEP) developed haematoma, resulting in 100.0% of the total sample of 50 patients being free of this complication. [Table 3]

The mean hospital stay for the E-TEP group is 3.24 ± 0.83 days, compared to 3.44 ± 0.51 days for the TEP group. The p-value of 0.309 indicates no statistically significant difference in hospital stay duration between the groups. [Table 4] No cases in either group (0 out of 25 in E-TEP and 0 out of 25 in TEP) experienced recurrence, resulting in 100.0% of the total sample of 50 patients being free of recurrence. [Table 5]

Table 1: Demographic distribution of study subject

Parameter			Group		Total	P value
			E-TEP	TEP		
Sex	Male	N	24	23	47	0.552(NS)
		%	96.0%	92.0%	94.0%	
	Female	N	1	2	3	
		%	4.0%	8.0%	6.0%	
Side	Left	N	6	7	13	0.747(NS)
		%	24.0%	28.0%	26.0%	
	Right	N	19	18	37	
		%	76.0%	72.0%	74.0%	
	Total	N	25	25	50	
		%	100.0%	100.0%	100.0%	
Age (Years)		Mean	46.92	47.12		0.942(NS)
		SD	10.42	9.00		

Table 2: Comparative evaluation of Operative time & Post Operative Pain between E-TEP & TEP groups.

Parameter	Group	Mean	SD	P value
Operative time (minutes)	E-TEP	94.00	11.18	<0.001
	TEP	108.00	15.00	
Post-operative pain (VAS)	E-TEP	1.40	0.50	<0.001
	TEP	1.84	0.37	

Table 3: Incidence of Conversion to TAPP (Transabdominal Preperitoneal), Seroma & Haematoma.

Parameter			Group		Total	P Value
			E-TEP	TEP		
Conversion to TAPP	No	N	25	25	50	NA
		%	100.0%	100.0%	100.0%	
	Yes	N	0	0	0	
		%	0.0%	0.0%	0.0%	
Seroma	No	N	23	24	47	0.552(NS)
		%	92.0%	96.0%	94.0%	
	Yes	N	2	1	3	
		%	8.0%	4.0%	6.0%	
Haematoma	No	N	25	25	50	NA
		%	100.0%	100.0%	100.0%	
	Yes	N	0	0	0	
		%	0.0%	0.0%	0.0%	
TOTAL		N	25	25	50	
		%	100.0%	100.0%	100.0%	

Table 4: Comparison of Hospital stay

Parameter	Group	Mean	SD	P value
Hospital stay (days)	E-TEP	3.24	0.83	0.309
	TEP	3.44	0.51	

Table 5: Comparison of Recurrence

Parameter			Group		Total
			E-TEP	TEP	
Recurrence	No	N	25	25	50
		%	100.0%	100.0%	100.0%
	Yes	N	0	0	0
		%	0.0%	0.0%	0.0%
Total		N	25	25	50
		%	100.0%	100.0%	100.0%

DISCUSSION

The comparative evaluation of the Enhanced View Totally Extraperitoneal (E-TEP) and the traditional Totally Extraperitoneal (TEP) approaches for inguinal hernia repair in this study provides important insights into the procedural nuances, intraoperative dynamics, and early postoperative outcomes. The inclusion of findings from recent literature further substantiates the present results and allows for a more integrated understanding of the clinical implications of both techniques.

In the current study, the mean age was 46.92 years for E-TEP and 47.12 years for TEP. In the study by Singh et al. (2022),[11] the mean age was 46.5 years for E-TEP and 47.8 years for TEP. Rashid et al. (2023),[12] reported a mean age of 47.0 years for E-TEP and 48.2 years for TEP. Yilmaz et al. (2025),[13] found lower values, with 31.5 years for E-TEP and 37 years for TEP. This demographic uniformity ensures that age-related confounding is minimized when interpreting outcomes such as operative time, postoperative recovery, and complication rates.

In the current study, the percentage of males was 96.0% in E-TEP and 92.0% in TEP. Singh et al. (2022),[11] reported 94.0% males in E-TEP and 93.0% in TEP. Rashid et al. (2023),[12] found 96.0% males in E-TEP and 94.0% in TEP. Yilmaz et al. (2025),[13] observed 100.0% males in both E-TEP and TEP groups. Despite this variation, the present data confirms that gender distribution was balanced across both groups and unlikely to have influenced the results.

In the current study, E-TEP cases were 24.0% left and 76.0% right, while TEP cases were 28.0% left and 72.0% right. Singh et al. (2022),[11] reported 27.0% left and 73.0% right for E-TEP, and 29.0% left and 71.0% right for TEP. Rashid et al. (2023),[12] reported 25.0% left and 75.0% right for E-TEP, and 28.0% left and 72.0% right for TEP.

In the current study, the mean operative time was 94.00 ± 11.18 minutes for E-TEP and 108.00 ± 15.00 minutes for TEP. Singh et al,[11] (2022) reported 58.2 ± 8.5 minutes for E-TEP and 72.4 ± 9.7 minutes for TEP. Rashid et al. (2023),[12] recorded 60.5 ± 9.0 minutes for E-TEP and 75.0 ± 10.2 minutes for TEP. Aggarwal et al. (2024),[14] reported higher values with 132.500 ± 16.825 minutes for E-TEP and 164.467 ± 11.802 minutes for TEP. Yilmaz et al. (2025),[13] found 55.3 ± 13.7 minutes for E-TEP and 54.0 ± 15.2 minutes for TEP.

In the current study, post-operative pain (VAS) was 1.40 ± 0.50 for E-TEP and 1.84 ± 0.37 for TEP. Singh et al. (2022),[11] reported 3.5 ± 0.6 for E-TEP and 4.8 ± 0.7 for TEP. Rashid et al (2023),[12] found 3.2 ± 0.5 for E-TEP and 4.5 ± 0.6 for TEP. Aggarwal et al. (2024),[14] reported 2.20 ± 0.76 for E-TEP and 5.13 ± 1.16 for TEP. The lower pain scores associated with E-TEP can be attributed to minimal trauma to neurovascular bundles and reduced tension in the preperitoneal space, allowing for quicker recovery and improved postoperative comfort.

In the current study, no conversions were observed in either E-TEP or TEP. Singh et al (2022),[11] reported no conversions in E-TEP and 4.0% in TEP. Rashid et al. (2023),[12] found no conversions in either group, and Yilmaz et al. (2025),[13] also reported no conversions in both E-TEP and TEP.

In the current study, seroma occurred in 8.0% of E-TEP cases and 4.0% of TEP cases. Singh et al. (2022) reported 10.0% in E-TEP and 5.0% in TEP. Yilmaz et al. (2025),[13] observed 10.0% in E-TEP and 12.5% in TEP. Nonetheless, the overall low incidence and lack of statistical difference between groups suggest that seroma remains a minor and self-limiting issue in both approaches when meticulous hemostasis and proper drainage are ensured.

In the current study, no hematomas were observed in either E-TEP or TEP. Singh et al. (2022) reported hematomas in 2.0% of E-TEP and 4.0% of TEP. Rashid et al. (2023),[12] reported none in both groups. Aggarwal et al. (2024),[14] observed 0% in E-TEP and 3.3% in TEP. Yilmaz et al (2025),[13] reported higher incidences, with 13.3% in E-TEP and 12.5% in TEP. The minimal use of electrocautery, combined with precise dissection under direct vision in E-TEP, may contribute to this favorable outcome.

In the current study, the mean hospital stay was 3.24 ± 0.83 days for E-TEP and 3.44 ± 0.51 days for TEP. Singh et al (2022),[11] reported 2.8 ± 0.6 days for E-TEP and 3.0 ± 0.7 days for TEP. Aggarwal et al. (2024),[14] reported 2.13 ± 0.86 days for E-TEP and 3.03 ± 1.44 days for TEP. These results indicate that early discharge is feasible with both techniques, provided perioperative complications are minimized.

In the current study, there was no recurrence in either E-TEP or TEP. Singh et al. (2022),[11] also reported no recurrence in both groups. Mandal et al (2023),[15] Rashid et al. (2023),[12] Aggarwal et al. (2024),[14] and Yilmaz et al. (2025),[13] similarly found no recurrences in both E-TEP and TEP. The absence of recurrence in both arms of the present study reinforces the long-term efficacy of mesh repair when anatomical landmarks are respected, and mesh placement is adequately secured in either technique.

The integrating findings of recent studies with the present data strengthens the evidence base supporting E-TEP as a viable, and in many respects advantageous, alternative to the traditional TEP approach. The cumulative evidence suggests that E-TEP is associated with shorter operative time, reduced postoperative pain, a comparable or better safety profile, and greater technical ease, especially for early-career surgeons.

CONCLUSION

In conclusion, this comparative study evaluating the E-TEP and TEP approaches for inguinal hernia repair demonstrates that both techniques are safe and effective, with no significant differences observed in patient demographics, side of hernia, incidence of postoperative complications, length of hospital stay,

or recurrence rates. However, the E-TEP approach was associated with a significantly shorter operative time and reduced duration of postoperative pain, highlighting its procedural efficiency and potential for enhanced patient comfort. These findings are supported by current literature, which also emphasizes the ergonomic advantages, surgeon satisfaction, and favorable learning curve associated with E-TEP. While both techniques offer comparable outcomes in experienced hands, E-TEP may serve as a more accessible and practical option, particularly for surgeons in the early stages of their laparoscopic training. Further large-scale, randomized controlled trials with longer follow-up are warranted to validate these findings and determine the long-term superiority of one technique over the other.

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