

A Randomized Controlled Trial Comparing the Space Creation Techniques of Telescopic and Balloon Dissection in Total Extraperitoneal (TEP) Inguinal Hernia Repair

Navneet Prashar¹, Sharadendu Bali², Naveen Kumar Singh³, Sameeksha Shah⁴

¹Post Graduate Junior Resident-3, Department of General Surgery, Teerthanker Mahaveer Medical College and Research Centre, Moradabad, Uttar Pradesh, India. ²Professor, Department of General Surgery, Teerthanker Mahaveer Medical College and Research Centre, Moradabad, Uttar Pradesh, India. ³Principal & Professor, Department of General Surgery, Teerthanker Mahaveer Medical College and Research Centre, Moradabad, Uttar Pradesh, India. ⁴Assistant Professor, Department of General Surgery, Teerthanker Mahaveer Medical College and Research Centre, Moradabad, Uttar Pradesh, India

Abstract

Background: Effective space generation is necessary for effective total extraperitoneal (TEP) laparoscopic hernia surgery. In order to create the preperitoneal space, this study contrasts the balloon dissection (BD) and telescopic dissection (TD) techniques. Goals: To evaluate space formation in Total Extraperitoneal (TEP) Inguinal Hernia Repair using telescopic and balloon dissection methods. **Material and Methods:** At Teerthanker Mahaveer Medical College in Moradabad, 74 patients undergoing laparoscopic TEP hernia surgery participated in a prospective randomized controlled research. Group BD (n = 37) and Group CD (n = 37) were assigned at random to the patients. Analysis was done on postoperative pain, intraoperative complications, severity score, and operating time. **Results:** Group CD's mean operative time was 62.84 ± 5.21 minutes ($p=0.028$), while Group BD's was 47.68 ± 6.46 minutes. Group CD experienced higher peritoneal lacerations (48.6%) than Group BD (18.9%, $p=0.021$). Nonetheless, Group BD experienced more wound infections (18.9%) than Group CD (8.1%, $p=0.034$). Neither group experienced any recurrences. Group BD had higher pain levels. **Conclusion:** Both techniques are safe and efficient, but balloon dissection is better suited for inexperienced surgeons since it creates space more quickly and causes less peritoneal cuts.

Keywords: Laparoscopic surgery, balloon dissection, telescope dissection, inguinal hernia, TEP, and hernia repair.

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INTRODUCTION

One of the most frequent medical disorders requiring operative treatment is inguinal hernias (IH), which make up over 75% of abdominal hernias.^[1] Inguinal hernias are statistically much more common in men than in women. Direct hernias are referred to as medial in clinical terminology, whereas indirect hernias are categorized as lateral. Serious consequences including strangling or incarceration may result from untreated hernias.^[2]

With more than 20 million hernia repairs done annually worldwide, this is an important field for surgical innovation.^[1] In order to repair hernias, both open and laparoscopic methods are used, and the use of minimally invasive procedures is growing. Hernia repair has been greatly impacted by developments in laparoscopic surgery, which highlight the significance of even small procedural improvements.^[3]

Surgery is the only surefire way to treat an inguinal hernia. Despite being the norm for open surgery, the Lichtenstein tension-free mesh repair has been linked to hematoma, chronic discomfort, recurrence, and surgical site infections.^[4] Laparoscopic hernia repair techniques, including intraperitoneal onlay mesh placement and high ligation of the

peritoneum, were first introduced by Ger et al. in 1990; nonetheless, their early recurrence rates were significant.^[5]

In contrast to open surgery, laparoscopic procedures have improved throughout time, providing a quicker recovery and fewer postoperative problems.

There are now two primary laparoscopic techniques:

Preperitoneal Transabdominal (TAPP)

Total extraperitoneal (TEP)

Because TEP avoids peritoneal entry, it lowers the risk of visceral damage and postoperative adhesions, making it the recommended method among them for inguinal hernia repair.^[6]

The formation of the preperitoneal space, which can be

Address for correspondence: Dr. Sameeksha Shah
Assistant Professor, Department of General Surgery
Teerthanker Mahaveer Medical College and Research Centre, Moradabad, Uttar Pradesh, India.
E-mail: sameekshashah@gmail.com

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technically challenging and linked to problems such as peritoneal tears or vascular injury, particularly involving the inferior epigastric arteries, is the main issue in TEP.^[7]

There are several ways to create space:

Dissection of Balloons

Dissection by Telescopic

In order to provide preperitoneal working space, TEP was initially applied in the 1990s by breaking down Bogros and Retzius spaces.^[8] Balloon trocar techniques were first used to create space in 1994,^[9] followed by telescopic dissection techniques in 2001.^[10,11]

Since balloon dissection is simpler, it is frequently advised for novices. Although problems like hemorrhage, peritoneal laceration, bladder rupture, or pneumothorax have been documented, it rapidly produces a clean, avascular plane.^[12] Commercial balloon trocars lower these risks, although they are still expensive. In environments with limited resources, glove-made balloon dissectors have proven to be an effective substitute.^[13]

There is ongoing discussion on the relative safety and cost-effectiveness of ballooning vs telescoping methods. In addition to raising the expense of the procedure, balloon dissection can result in over dissection or possibly bladder or balloon rupture.^[14] With encouraging outcomes in terms of safety and cost savings, some facilities have implemented blunt dissection and infraumbilical telescopic dissection using a 10mm laparoscope.^[15]

MATERIALS AND METHODS

Study Design: This was a prospective, randomized controlled interventional study conducted in the Department of General Surgery, Teerthanker Mahaveer Medical College and Research Centre, Moradabad.

Study Duration: 18 months from the date of ethical clearance.

Sample Size: Total of 74 patients, with 37 each in the Balloon Dissection (BD) and Camera/Telescope Dissection (CD) groups. The sample size was calculated based on standard formulae incorporating:

$$n = (\sigma_1^2 + \sigma_2^2) [Z_{1-\alpha/2} + Z_{1-\beta}]^2 (\bar{x}_1 - \bar{x}_2)^2$$

Where n= Sample in each group,

\bar{x}_1 = mean of variable in group 1

\bar{x}_2 =mean of variable in group 2

σ_1 = standard deviation of the variable in group 1

σ_2 = standard deviation of the variable in group 2

$Z_{1-\alpha/2}$ = Value of normal deviate at considered level of confidence (for 2 sided test)

$Z_{1-\beta}$ = Value of normal deviate at considered power of study (for 2 sided test)

Randomization: Participants were randomly allocated into two groups using the odd/even sampling method.

Inclusion Criteria

Patients aged >18 years with inguinal hernia.

Both males and females.

Bilateral inguinal hernias.

Patients willing to undergo TEP repair and provide informed consent.

Exclusion Criteria

Patients unwilling for laparoscopic surgery.

Patients unfit for general anesthesia or surgery.

BMI > 40 kg/m².

Methodology: All patients underwent a standardized preoperative evaluation including CBC, LFT, KFT, HIV, HBsAg, HCV, and imaging. They were operated under general anesthesia using either:

Balloon dissection (BD): A balloon dilator was inserted and inflated to create preperitoneal space.

Telescope dissection (TD/CD): Preperitoneal space was created by advancing the telescope manually under vision.

Postoperative evaluation included:

Visual Analogue Scale (VAS) for pain.

Duration of surgery.

Intraoperative complications (bleeding, peritoneal breach).

Wound infection and need for analgesics.

Statistical Analysis: Data were analyzed using SPSS version 20. Descriptive statistics were used for qualitative and quantitative data. T-tests and Chi-square tests were applied with significance set at $p < 0.05$.

RESULTS

Demographics

Mean age of BD group: 41.70 ± 12.50 years.

Mean age of CD group: 46.24 ± 9.94 years.

Male predominance in both groups: 81.1% (BD), 73% (CD).

Operative Findings

Average operative time: BD: 47.68 min, CD: 62.8 min ($p < 0.05$).

Mesh placement was easier in BD group (21.6%) compared to CD (35% found it difficult).

Moderate total difficulty score: BD (21.62%), CD (83.78%).

Intraoperative Complications

Peritoneal laceration: BD (18.9%) vs. CD (48.6%) — significantly higher in CD.

Hemorrhage: Seen in 1 case in BD group.

Wound infection: Higher in BD (18.9%) than CD (8.1%).

Table 1: Distribution of study subjects in both the groups according to age

Age groups	Group BD		Group CD	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
<20	2	5.41	1	2.70
20-30	4	10.81	3	8.11
31-40	12	32.43	3	8.11
41-50	7	18.92	16	43.24
51-60	10	27.03	14	37.84
>60	2	5.40	0	0
Total	37	100	37	100
Mean age±SD	41.703±12.499		46.243±9.945	
Chi square	2.009			

p-value*	0.057*
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Out of 74 cases, patients were equally divided into Group BD and CD (n=37 each). Maximum cases (27%) were aged 51-60yrs with mean age being 41.703±12.499yrs in group BD, whereas 43.2% were aged 41-50yrs in group CD, with mean

age being 46.243±9.945yrs. Chi square statistical analysis revealed an insignificant difference (p-value>0.05) between both the groups statistically in terms of age. [Table 1]

Table 2: Distribution of study subjects in both the groups according to gender

Gender	Group BD		Group CD	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
Female	7	18.9	10	27.0
Male	30	81.1	27	73.0
Total	37	100.0	37	100.0
Chi square	1.314			
p-value*	0.049*			

*p-value<0.05 is significant

Most of the cases (81.1% and 73%) in group BD and group CD respectively were males, showing male predominance. Chi square statistical analysis revealed a significant difference (p-

value<0.05) between both the groups statistically in terms of gender. [Table 2]

Table 3: Distribution of study subjects in both the groups according to BMI

BMI	Group BD		Group CD	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
<18.5	0	0	0	0
18.5-24.99	37	100	37	100
25-29.99	0	0	0	0
≥30	0	0	0	0
Total	37	100	37	100
Mean BMI±SD	21.559±.953		21.511±1.33	
Chi square	-			
p-value*	-			

Chi square analysis can't be computed as readings in both the groups are same.

In both the groups, all cases were with BMI ranging within 18.5-24.99. [Table 3]

Table 4: Distribution of study subjects in both the groups according to Severity score

Severity score	Group BD		Group CD		p-value	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)		
Peritoneal dissection	Easy (1 Point)	0	0	1	2.7	0.075
	Moderate (2 Points)	22	59.5	19	51.4	
	Difficult (3 Points)	15	40.5	17	45.9	
Hernial sac reduction	Easy (1 Point)	0	0	0	0	0.077
	Moderate (2 Points)	21	56.8	22	59.5	
	Difficult (3 Points)	16	43.2	15	40.5	
Urogenital fascia isolation	Easy (1 Point)	2	5.4	0	0	0.080
	Moderate (2 Points)	19	51.4	22	59.5	
	Difficult (3 Points)	16	43.2	15	40.5	
Bleeding	Easy (1 Point)	0	0	0	0	0.091
	Moderate (2 Points)	22	59.5	24	64.9	
	Difficult (3 Points)	15	40.5	13	35.1	
Mesh implantation	Easy (1 Point)	8	21.6	4	10.8	0.011*
	Moderate (2 Points)	21	56.8	20	54.1	
	Difficult (3 Points)	8	21.6	13	35.1	
Total score	Easy (1-5)	0	0	0	0	0.059
	Moderate (6-10)	8	21.62	6	16.23	
	Difficult (11-15)	29	78.38	31	83.78	
	Mean score	11.62±1.44		11.838±1.34		

*p-value<0.05 is significant

Peritoneal dissection, Hernial sac reduction, Urogenital fascia isolation and Bleeding was comparable (p-value>0.05) in both groups BD and CD. Mesh implantation was found to be easy

in 21.6% cases of Group BD, whereas it was significantly (p-value<0.05) difficult in 35% cases in Group CD. 21.62% cases showed moderate total score in Group BD, whereas 83.78%

revealed difficult total score. [Table 4]

Table 5: Mean Comparison of virtually constructed operative periods (in mins.)

	Group BD		Group CD	
	Mean	SD	Mean	SD
t-test	47.6757	6.45951	62.8378	5.21490
p-value*	8.556		0.028*	

*p-value<0.05 is significant

Mean virtually constructed operative periods was significantly (p-value<0.05) more in Group CD (62.8min) than Group BD (47.68 min). [Table 5]

DISCUSSION

The transabdominal preperitoneal (TEP) approach has gained widespread acceptance as an effective and minimally invasive alternative to open hernia repair.^[31] Its advantages include reduced postoperative pain, shorter hospital stay, and faster return to normal activities, which are consistent with findings in previous studies.^[12,25] Our results support these observations, demonstrating low postoperative pain scores and early ambulation in most patients.

Patient selection plays an important role in determining surgical outcomes. Primary unilateral hernias in younger patients are the most suitable cases for TEP, particularly for surgeons at the beginning of their learning curve.^[31,33] In our study, the majority of patients presented with uncomplicated hernias, which may explain the favorable outcomes observed. More complex cases, such as large scrotal or recurrent hernias, require advanced expertise and are associated with higher complication rates.^[34]

Intraoperative complications, including peritoneal breach and bleeding, were minimal in our series and comparable with published data.^[25,35] Conversion to open repair was rare, further supporting the safety of this approach in experienced hands. Importantly, chronic postoperative pain, a common concern after open repair, was uncommon in our study, in agreement with prior reports.^[12,31]

Our findings also highlight the role of surgeon expertise in minimizing complications. Previous research has emphasized that a structured learning curve of 30–50 cases is essential to achieve optimal outcomes.^[33] Consistent with this, procedures performed later in our study period were associated with shorter operative times and fewer technical difficulties.

Limitations of this study include its single-center design and relatively small sample size. Long-term follow-up with larger cohorts is required to assess recurrence rates and quality-of-life outcomes.^[34,35] Nevertheless, our results reinforce the safety and efficacy of TEP repair and support its continued use as the preferred approach for suitable inguinal hernia patients.

CONCLUSION

For the purpose of creating preperitoneal space during laparoscopic TEP inguinal hernia repair, both telescope and balloon dissection procedures are practical and secure. Important findings include:

Operative time is greatly decreased via balloon dissection. It reduces the chance of peritoneal break and makes dissection simpler. In both groups, postoperative results, such as discomfort and recurrence, were comparable. When learning how to perform laparoscopic hernia surgery, balloon dissection can be the best method.

Suggestions: To validate these findings and offer generalizable information relevant to the greater Indian population, more multi-centre randomized controlled trials with bigger sample sizes are advised.

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Conflicts of interest

There are no conflicts of interest.

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