Original Article
DOI: https://doi.org/10.70749/ijbr.v3i3.803

INDUS JOURNAL OF BIOSCIENCE RESEARCH
https://induspublishers.com/IJBR
ISSN: 2960-2793/ 2960-2807

Comparison of Laparoscopic Transabdominal Preperitoneal Mesh Repair and Open Inguinal Hernia Repair in Terms of Post-operative Pain and Hospital Stay

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ARTICLE INFO

Keywords

Lichtenstein Repair, Trans-abdominal Pre-peritoneal, Inguinal Hernia, TAPP, Post-Operative Pain.

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Declaration

Authors' Contribution: All authors equally contributed to the study and approved the final manuscript.

Conflict of Interest: No conflict of interest.

Funding: No funding received by the authors.

Article History

Received: 27-12-2024
Revised: 21-02-2025
Accepted: 07-03-2025

ABSTRACT

Background: Inguinal hernias occur in 0.5% to 15% of cases, with factors like location, type, and surgical technique influencing outcomes. This study compares postoperative pain (VAS) and hospital stay duration between laparoscopic trans-abdominal pre-peritoneal (TAPP) mesh repair and open mesh repair for inguinal hernia treatment. **Methods:** A six-month Randomised Controlled Trial, from January 2024 to June 2024 was conducted at Holy Family Hospital, Rawalpindi, involving 90 patients (45 in each group). This Randomised Controlled Trial, conducted at Holy Family Hospital, included patients aged 18-55 with inguinal hernias. It compared post-operative pain and hospital stay between two surgical approaches (open mesh repair for inguinal hernia versus laparoscopic trans-abdominal pre-peritoneal (TAPP) mesh repair) using VAS scores. **Results:** Results showed that the mean VAS pain scores at 12, 24, and 72 hours were significantly lower in the TAPP group compared to the open repair group. The mean hospital stay was also significantly shorter in the TAPP group (36.8 ± 5.1 hours) compared to the open repair group (42.7 ± 4.1 hours). Postoperative complications were more frequent in the open repair group, with seroma being the most common. **Conclusion:** While the TAPP technique had a longer operative time, it demonstrated reduced postoperative pain and shorter recovery times. These findings suggest that TAPP may be a preferable option for inguinal hernia repair, though further studies with longer follow-up are necessary to assess long-term outcomes.

INTRODUCTION

The incidence of inguinal hernia is estimated to range between 0.5% and 15%, influenced by various factors, such as the hernia's location (direct or indirect), the type of hernia (mesh or non-mesh), the surgical technique employed (open, laparoscopic, or robotic), and whether the clinical situation is elective or emergency [1]. Moreover, the risk of recurrence in patients with a recurrent inguinal hernia is higher than in those with a primary hernia [2], although there is limited evidence regarding the most effective treatment for recurrent hernias, particularly when mesh was used in the initial procedure [3].

The anterior mesh approach is the most commonly used; however, it may necessitate re-operation through scar tissue, which increases the risk of complications [4]. As a result, the open anterior approach can lead to failure rates as high as 36%. In contrast, the posterior pre-peritoneal approach offers superior outcomes compared to the anterior approach [5]. A comprehensive study by Campanelli et al. [6] classified recurrent hernias into three groups based on the size and location of the defect. This classification informed the selection of the most suitable surgical approach, which included plug repair, anterior approaches, open pre-peritoneal techniques (such as Nyhus, Stoppa, Wantz), and laparoscopic methods.

Nyhus (1960) initially introduced the posterior pre-peritoneal approach, emphasising its preference for the treatment of all inguinal hernias [7]. However, the question remains whether an open or laparoscopic approach should be employed. A recent study suggests that laparoscopic surgery is the preferred treatment for inguinal hernias, particularly in younger, active, and non-obese patients [8]. Despite the general consensus among surgeons favouring laparoscopic repair for hernias, this recommendation is not based on extensive data; the choice of technique often depends on local expertise, cost-effectiveness, and patient preference [9].

Furthermore, some clinicians argue that laparoscopic surgery is preferable for patients with prior open repair, while those with recurrences following laparoscopic surgery should undergo open mesh repair [10]. However, laparoscopic surgery for recurrences after initial laparoscopic repair has not demonstrated any statistical advantage over open techniques [9, 10]. Therefore, aim of this current study is to compare the mean postoperative Visual Analogue Scale (VAS) pain scores and hospital stay duration between laparoscopic trans-abdominal pre-peritoneal (TAPP) mesh repair and open mesh repair for inguinal hernia.

METHODS

The study was designed as a Randomized Controlled Trial and was conducted in the Department of General Surgery Unit-II at Holy Family Hospital, Rawalpindi from January 2024 to June 2024. The study duration was six months, following approval of the synopsis by the College of Physicians and Surgeons Pakistan (CPSP). Non-probability consecutive sampling was used to select participants. Based on the OpenEpi calculator, the required sample size was determined to be 90, with 45 patients in each group. The level of significance was set at 5%, and the power of the test was 80%. The hospital stay for patients in Group 1 was 1.9 ± 0.29 days, while in Group 2, it was 2.21 ± 0.41 days [11].

Inclusion criteria for the study were patients aged 18-55 years diagnosed with an inguinal hernia, who had undergone either closed or open Kirschner wire fixation. The exclusion criteria included patients requiring emergency surgery for complicated hernias, individuals with psychological issues, those with a history of major abdominal surgery, pregnant women, and patients unfit for spinal or general anaesthesia. Post-operative pain was defined as a discomforting sensation that impedes the daily activities of the patient post-surgery, measured using the Visual Analogue Scale (VAS) at 12, 24, and 72 hours. The post-operative hospital stay referred to the number of days a patient remained in the hospital following hernia repair surgery.

A comprehensive patient history, including personal history and complaints, was obtained, alongside a formal abdominal and hernia orifice examination. Routine pre-operative laboratory tests, including complete blood count, liver and kidney profiles, coagulation profile, blood sugar, and virology screen, were conducted. Radiological investigations, including pelvi-abdominal sonography, ECG, and echocardiography, were performed when requested by the anaesthesiologist.

The patient was thoroughly informed about the surgical options and potential postoperative complications the day before surgery. The risks, benefits, and expected outcomes of the procedure were explained. An informed consent was obtained, with any concerns addressed through discussions with the patient and, if requested, a first-degree relative. Pre-surgery instructions included a soft diet and mineral laxatives. All surgeries were conducted under general or regional anaesthesia by the same surgical team, with a single dose of 1g of a third-generation cephalosporin administered intravenously at anaesthesia induction.

In group I, a lower abdominal transverse incision was made, and the rectus muscle was reflected. The pre-peritoneal space was dissected to expose the myopectineal orifice. The hernias were reduced, and a 15 × 15 cm polypropylene mesh was placed in the pre-peritoneal space, fixed with non-absorbable sutures to the pubic tubercle and Cooper's ligament. The mesh was positioned behind the cord, overlapping the myopectineal orifice. No drains were used. In group II, three trocars were inserted one 10-mm trocar in the umbilical region and two 5-mm trocars in the left flank. The peritoneum was mobilized above the hernia defect, and adhesions were separated. The hernia sac was isolated from the cord structures. A new 15 × 10 cm polypropylene mesh was placed over the old mesh and fixed with tacks. The peritoneum was closed with a running suture, and trocar sites were closed. No drains were required.

Statistical Analysis

SPSS 26.0 (Statistical Package for the Social Sciences) was used for data entry and analysis. Quantitative variables, including patient age, pain assessed using the Visual Analogue Scale (VAS) score, operative time, and hospital stay, were presented as mean ± standard deviation (SD). Qualitative variables, such as gender and complications, were expressed as frequencies and percentages. An independent sample t-test was applied to compare pain scores and hospital stay between the two groups. The Chi-square test was utilised to compare qualitative data between the two groups. When the expected count in any cell was less than 5, the Fisher's exact test was applied as an alternative to ensure statistical validity. A p-value of ≤ 0.05 was considered statistically significant.

RESULTS

The study included a total of 90 patients with a mean age of 37.6 ± 5.9 years. The majority of the participants were male (81; 90.0%), while females accounted for 9 (10.0%). The mean operative time was 75.3 ± 14.2 minutes. Postoperative pain, assessed using the Visual Analogue Scale (VAS), was recorded at different time intervals, with mean scores of 5.8 ± 1.7 at 12 hours, 4.3 ± 1.1 at 24 hours, and 2.9 ± 0.8 at 72 hours. At follow-up, the mean VAS scores were 1.8 ± 0.6 at two weeks and 0.82 ± 0.17 at eight weeks. The mean duration of hospital stay was 39.4 ± 4.7 hours. Postoperative complications were observed in 8 patients (8.9%), while 82 patients (91.1%) had no complications. Among those with complications, seroma was the most common (4;

50.0%), followed by infection (2; 25.0%) and haematoma (2; 25.0%).

Table 1

Demographic and clinical and follow-up characteristics of all the patient's n (n = 90).

Variables	Categories	(n = 90)
Age		
	Mean ± SD*	37.6 ± 5.9
Sex		
	Male	81 (90.0)
	Female	9 (10.0)
Operation time (minutes)		
	Mean ± SD*	75.3 ± 14.2
Visual analogue scale (VAS)		
12-Hrs	Mean ± SD*	5.8 ± 1.7
24-Hrs	Mean ± SD*	4.3 ± 1.1
72-Hrs	Mean ± SD*	2.9 ± 0.8
Visual analogue scale (VAS) at follow-up		
2-weeks	Mean ± SD*	1.8 ± 0.6
8-weeks	Mean ± SD*	0.82 ± 0.17
26-weeks	Mean ± SD*	-
Hospital stay (Hrs)		
	Mean ± SD*	39.4 ± 4.7
Complications		
	Absent	82 (91.1)
	Present	8 (8.9)
	Seroma	4 (50.0)
	Infection	2 (25.0)
	Hematoma	2 (25.0)

SD (standard deviation)

The comparison of demographic, clinical, and follow-up characteristics between the two surgical modalities, Lichtenstein and Transabdominal Preperitoneal (TAPP) repair, revealed notable differences in several parameters. The mean age was slightly higher in the TAPP group (38.7 ± 6.4 years) compared to the Lichtenstein group (37.1 ± 5.1 years), though this difference was not statistically significant (p = 0.08). The gender distribution was comparable between the groups, with a male predominance in both (91.1% in Lichtenstein vs. 90.0% in TAPP; p = 0.23).

The mean operative time was significantly longer in the TAPP group (89.7 ± 12.5 minutes) compared to the Lichtenstein group (72.4 ± 18.2 minutes; p = 0.01). Pain assessment using the Visual Analogue Scale (VAS) showed significantly lower pain scores in the TAPP group at all measured intervals. At 12 hours postoperatively, the mean VAS score was 5.1 ± 1.2 in the TAPP group compared to 7.1 ± 1.8 in the Lichtenstein group (p = 0.04). Similarly, at 24 hours, the scores were 3.8 ± 1.0 vs. 4.9 ± 1.5 (p = 0.05), and at 72 hours, 1.2 ± 0.7 vs. 3.2 ± 1.0 (p = 0.03). During follow-up, the TAPP group continued to report lower pain levels, with a significant difference at two weeks (0.8 ± 0.1 vs. 1.9 ± 0.2, p = 0.03). Although the VAS score at eight weeks was lower in the TAPP group (0.2 ± 0.01) compared to the Lichtenstein group (0.9 ± 0.2), the difference did not reach statistical significance (p = 0.06).

The mean hospital stay was significantly shorter in the TAPP group (36.8 ± 5.1 hours) compared to the Lichtenstein group (42.7 ± 4.1 hours; p = 0.01). Postoperative complications were more frequent in the Lichtenstein group, with 13.3% of patients experiencing complications compared to 4.4% in the TAPP group (p = 0.001). Seroma was the most common complication in both groups, occurring in 50.0% of cases within the Lichtenstein group and 100.0% in the TAPP group. Infection (16.7%) and haematoma (33.3%) were observed exclusively in the Lichtenstein group.

Overall, the TAPP approach was associated with reduced postoperative pain, a shorter hospital stay, and fewer complications compared to the Lichtenstein technique, despite a longer operative time. These findings suggest that TAPP may offer a preferable alternative to open mesh repair for inguinal hernia management.

Table 2

Bifurcation of demographic and clinical and follow-up characteristics with respect to two surgical modalities.

Variables	Categories	Lichtenstein (n = 45)	TAPP (n = 45)	p-value
Age				0.08
	Mean ± SD*	37.1 ± 5.1	38.7 ± 6.4	
Sex				0.23
	Male	41 (91.1)	40 (90.0)	
	Female	4 (8.9)	5 (10.0)	
Operation time (minutes)				0.01
	Mean ± SD*	72.4 ± 18.2	89.7 ± 12.5	
Visual analogue scale (VAS)				
12-Hrs	Mean ± SD*	7.1 ± 1.8	5.1 ± 1.2	0.04
24-Hrs	Mean ± SD*	4.9 ± 1.5	3.8 ± 1.0	0.05
72-Hrs	Mean ± SD*	3.2 ± 1.0	1.2 ± 0.7	0.03
Visual analogue scale (VAS) at follow-up				
2-weeks	Mean ± SD*	1.9 ± 0.2	0.8 ± 0.1	0.03
8-weeks	Mean ± SD*	0.9 ± 0.2	0.2 ± 0.01	0.06
26-weeks	Mean ± SD*		-	
Hospital stay (Hrs)				0.01
	Mean ± SD*	42.7 ± 4.1	36.8 ± 5.1	
Complications				0.001
	Absent	39 (86.7)	43 (95.6)	
	Present	6 (13.3)	2 (4.4)	
	Seroma	3 (50.0)	2 (100.0)	
	Infection	1 (16.7)	-	
	hematoma	2 (33.3)	-	

SD (standard deviation).

DISCUSSION

Traditional surgical management of hernias involves ligation or reduction of the hernia sac and posterior wall reconstruction via an open incision. While this procedure can be performed as a day-care surgery under local anaesthesia in selected cases, it is often associated with increased postoperative pain, prolonged hospitalisation, higher recurrence rates, and delayed return to normal activities (four to six weeks). Recurrence rates following open repair are reported to be below 2% in specialised centres; however, regional studies indicate higher recurrence rates, averaging 5–10% for primary hernias and 5–30% for recurrent cases. Challenges associated

with conventional herniorrhaphy, coupled with the success of laparoscopic cholecystectomy, led to the development of laparoscopic hernia repair in the 1990s. The laparoscopic approach offers several advantages over open repair, including reduced postoperative pain, shorter hospital stays, and faster recovery [12-15].

Antoniou et al. [16] reported that inguinal hernia repair is among the most frequently performed surgical procedures worldwide. The Lichtenstein repair remains the most commonly utilised technique; however, in recent years, the laparoscopic approach, particularly the transabdominal preperitoneal (TAPP) technique, has gained popularity due to its minimally invasive nature. Claus et al. [17] highlighted that the TAPP approach offers advantages such as reduced postoperative pain and faster recovery. Regarding operative time, Simons et al. [18] demonstrated that the median operative time was slightly longer for the TAPP technique compared to the open Lichtenstein repair (110.3 vs. 97.1 minutes; $p = 0.23$). Additionally, the use of a partially absorbable mesh in laparoscopic TAPP repair has been associated with reduced postoperative pain and a faster return to daily activities, though it also resulted in a prolonged operative time [19]. In the present study, the mean operative time for TAPP was 89.7 ± 12.5 minutes, whereas it was shorter for the open Lichtenstein repair at 72.4 ± 18.2 minutes. This difference may be attributed to the relatively small sample size in this study.

Neumayer et al. [20] reported a higher incidence of intra-operative complications in laparoscopic procedures. The surgeon's proficiency in laparoscopic repair plays a crucial role in minimising complications. Additionally, the risk of injury to spermatic cord structures was lower in the TAPP approach compared to the open method, potentially due to the enhanced visualisation provided by laparoscopy. In the present study, no intra-operative complications were observed among the recruited patients. This absence of complications may be attributed to the small sample size.

Furthermore, Grant [21] reported a significantly lower incidence of wound infections and haematomas following laparoscopic repair, although an increased occurrence of seromas was noted. In the current study, no cases of wound infection (0%) or haematoma (0%) were recorded in the TAPP group, while two patients (4.4%) developed seromas. In contrast, the Lichtenstein group had four cases of seroma (6.7%), two cases of haematoma (4.4%), and one case of wound infection (2.2%). Therefore, a statistically significant differences were observed between the two groups in terms of overall complications rate.

In addition, Wennergren et al. [22] reported that laparoscopic inguinal hernia repair is associated with greater relief of early post-operative pain compared to the open Lichtenstein technique. Similarly, Wijerathne et al. [23] highlighted a significant correlation between post-operative pain and complications, suggesting that reduced pain in the laparoscopic approach may be attributable to a lower complication rate.

TAPP repair has been linked to earlier tolerance of oral intake, reduced post-operative pain, shorter hospital stays, faster return to normal activities, and lower incidence of persistent pain [24]. In the present study, patients who underwent TAPP repair experienced significantly less post-operative Visual analogue scale pain score (VAS) at 12-Hrs, 24-Hrs, 72-Hrs and at follow-up of 2-weeks and 8-weeks, with a significant p-value [11]. The primary limitations of this study include a relatively small sample size and a short follow-up period of six months, which may not capture the long-term cumulative benefits of the procedure.

CONCLUSION

Our study demonstrated that TAPP repair of inguinal hernia is associated with less early post-operative pain and fewer complications compared to the open approach. However, it was also associated with a significantly longer operative time. Despite the reduced post-operative pain, the length of hospital stay differed significantly between the two techniques. Given the limitations of laparoscopic repair, the decision to choose between laparoscopic and open approaches should be made on a case-by-case basis, taking into account factors such as patient preference, age, health status, work requirements, and cost. While laparoscopic repair appears to be a preferable option for inguinal hernia correction, further research with longer follow-up is needed to assess chronic discomfort and recurrence rates post-surgery.

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