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Original Article

Surgery Section

Comparison between Laparoscopic Transabdominal Preperitoneal Approach and Lichtenstein Repair for Unilateral Inguinal Hernia: A Prospective Interventional Study

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ABSTRACT

Introduction: Open and laparoscopic surgical methods are widely used for the treatment of inguinal hernias. Laparoscopic Transabdominal Preperitoneal (TAPP) repair is a minimally invasive approach and is one of the preferred methods for younger surgeons to treat inguinal hernias.

Aim: To compare the intraoperative and postoperative complications, chronic pain, length of hospital stay and return to normal work associated with laparoscopic TAPP surgery and Lichtenstein open mesh repair for unilateral inguinal hernia in males.

Materials and Methods: This prospective interventional study was conducted from January 2022 to December 2022 on 60 clinically diagnosed cases of primary unilateral direct and indirect inguinal hernias in the Department of Surgery, Uttar Pradesh University of Medical Sciences (UPUMS), Saifai, Etawah, Uttar Pradesh, India. Based on inclusion and exclusion criteria during, a total of 60 patients were included in the study and divided into two groups of 30 patients each using a random number table. In group A, patients underwent laparoscopic TAPP surgery, while in group B, Lichtenstein hernioplasty (open surgery) was performed. Patients were evaluated for intraoperative complications and postoperative pain using the Visual Analog Scale (VAS) for three consecutive days. They were followed-up one week postoperatively to monitor for common complications in both groups. Additionally, patients were followed-up at one month, three months and six months postoperatively for clinical recurrence of hernia and reports of pain in either group. The Chi-square test was used for comparison of categorical variables between the two groups and the Student's t-test was used for continuous variables.

Results: The overall mean age of the patients was 46.57±17.13 years, while the median age was 50 years. Vascular injury was present in one patient (2.33%) in group A (TAPP group). Intraoperative complications in group A and group B were statistically non significant for vas deferens injury, vascular injury, bladder injury and visceral injury. Postoperative complications during the first week of the postoperative period included stitch abscess and abdominal distension, which were statistically non significant. Seroma formation (χ^2=0.87, p-value=0.35), scrotal swelling (χ^2=0.27, p-value=0.61) and urinary symptoms (χ^2=0.00, p-value=1.00) were also non significant (p-value >0.05). Pain at one month, three months and six months follow-ups was not observed in group A, while in group B, pain was present in two patients (6.67%) at one month, one patient (3.33%) at three months and one patient (3.33%) at six months. Pain was statistically non significant in both groups. Recurrence of hernia at one month, three months and six months postoperatively was not observed in either group A or group B. The mean length of hospital stay in the TAPP group was 3±0.46 days, while in the Lichtenstein group it was 4±0.87 days. The mean time to return to normal work in the TAPP group was 6.6±1.22 days, while in the Lichtenstein group, the mean time was 14±3.37 days.

Conclusion: In unilateral inguinal hernia, laparoscopic TAPP repair is safer and comparable to Lichtenstein repair in terms of complications. In the TAPP group, pain, length of hospital stay and time to return to normal work were lower compared to the Lichtenstein repair. In both groups, no hernia recurrence was observed at the six-month follow-up.

Keywords: Hernial recurrence, Lichtenstein hernioplasty, Postoperative pain

INTRODUCTION

Inguinal hernia repair is one of the most common surgeries performed by surgeons, with significant variations in the surgical techniques used to address this condition [1]. Inguinal hernias account for approximately 85.4% of all abdominal wall hernias and for 97.2% of groin hernias [2]. The two most commonly employed methods for unilateral inguinal hernia repair are the laparoscopic TAPP approach and the Lichtenstein mesh repair. In open inguinal hernia repair, the Lichtenstein tension-free hernioplasty is considered the gold standard due to its low recurrence rates and relatively straightforward execution. This technique, first described in 1984, was performed through a groin incision, in which the mesh was placed over the defect to reinforce the abdominal wall [3]. The European Hernia Society recommends the Lichtenstein technique as the preferred approach for open inguinal hernia surgery [4].

The TAPP approach, first introduced by Ger R et al., in 1990, is a minimally invasive laparoscopic technique that involves the insertion of mesh into the preperitoneal space via a transabdominal approach [5]. This technique is associated with reduced postoperative pain, shorter recovery times and smaller incisions. Laparoscopic surgery has advantages over open surgery, including less postoperative pain, a shorter hospital stay and a faster return to normal activities [6,7].

Both the TAPP and Lichtenstein mesh repair techniques have demonstrated varying degrees of success in terms of postoperative outcomes, including recurrence rates, postoperative pain, recovery time and complications. However, a definitive comparison of the short-term and long-term outcomes of these two approaches remains limited in the existing literature. This study aims to compare the short-term and long-term outcomes between these two approaches in the management of unilateral inguinal

hernias. Specifically, the analysis will focus on parameters such as complication rates, pain scores, quality of life assessments and recurrence rates.

MATERIALS AND METHODS

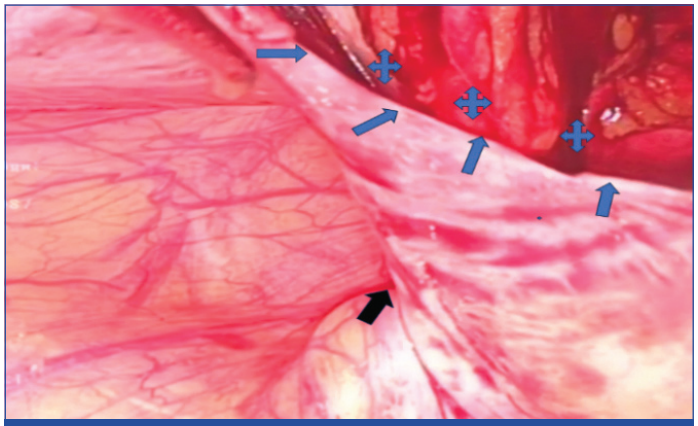
This prospective interventional time-bound study was conducted from January 2022 to December 2022 in the Department of Surgery, UPUMS, Saifai, Etawah, Uttar Pradesh, India. Ethical approval (202/2021) was obtained from the Institutional Ethics Committee (IEC).

Inclusion criteria: Male patients aged 18 to 70 years with unilateral direct and indirect inguinal hernias were included in the study.

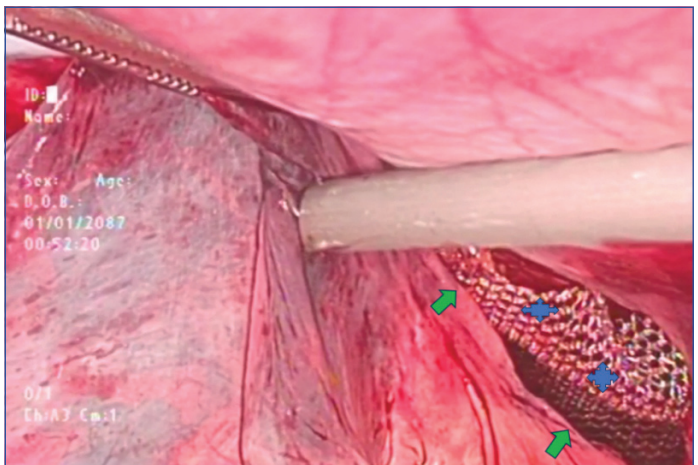
Exclusion criteria: Patients who required urgent inguinal surgery; those with recurrent unilateral or bilateral inguinal hernias; patients who had undergone pelvic radiation; those with intra-abdominal malignancies; patients unsuitable for general anaesthesia; those with coagulopathy; and patients converted from minimally invasive surgery to conventional surgery were excluded from the study.

Study Procedure

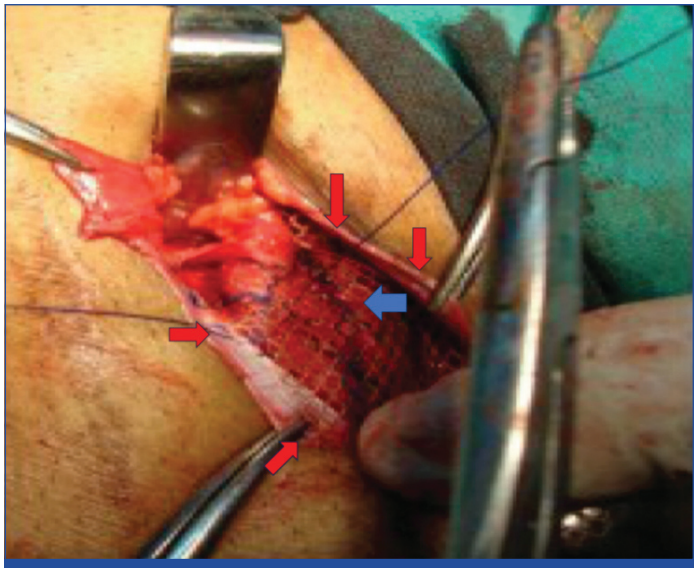
A total of 60 patients were included in the study and divided into two groups of 30 patients each using a random number table. In group A, patients underwent laparoscopic TAPP surgery, a minimally invasive technique, while in group B, Lichtenstein hernioplasty (the conventional open surgery approach) was performed. After a thorough history, clinical examination and investigations, patients with unilateral inguinal hernias underwent hernioplasty in our department using either the laparoscopic TAPP approach [Table/Fig-1,2] or Lichtenstein open surgery [Table/Fig-3]. All surgeries were performed by a single surgeon. Data were recorded for age,



[Table/Fig-1]: The left Transabdominal Preperitoneal (TAPP) hernioplasty is shown before mesh insertion (black arrow pointing to the left deep inguinal ring, blue arrow indicating the peritoneal flap and blue cross marking the preperitoneal space).



[Table/Fig-2]: The polypropylene mesh is shown in situ in the left Transabdominal Preperitoneal (TAPP) hernioplasty during the fixation of the peritoneum and mesh to the anterior abdominal musculature (green arrow pointing to the peritoneal flap, blue cross marking the polypropylene mesh inside the preperitoneal space).



[Table/Fig-3]: The polypropylene mesh is shown in situ over the hernia defect in Lichtenstein repair (blue arrow pointing to the polypropylene mesh, red arrow indicating the edge of the external oblique fascia).

intraoperative complications (e.g., vas deferens injury, vascular injury, bladder injury and visceral injury) and postoperative pain response on the VAS for three consecutive days.

Patients were followed-up during the first week postoperatively for complications such as stitch abscess, seroma formation, scrotal swelling, urinary symptoms and abdominal distension. Patients were also followed-up at one month, three months and six months postoperatively for pain and recurrence.

STATISTICAL ANALYSIS

Data were analysed using the Statistical Package for the Social Sciences (SPSS) version 21.0. The Chi-square test was used for comparison of categorical variables between the two groups, while the Student's t-test was used for continuous variables. A p-value <0.05 was considered significant.

RESULTS

The current study was limited to men to exclude anatomical differences that could affect the analysis of operative and postoperative parameters and outcomes without any sex differences. The minimum age of the study participants was 18 years and the maximum age was 70 years. In the TAPP group, the most common age range was 41 to 50 years. In the Lichtenstein repair group, the most common age range was 51 to 70 years. The overall mean age of the patients was 46.57±17.13 years, while the median age was 50 years [Table/Fig-4].

Age group (years)	TAPP group (n=30) n (%)	Lichtenstein group (n=30) n (%)
<20	4 (13.33)	3 (10)
21-30	3 (10)	6 (20)
31-40	1 (3.33)	3 (10)
41-50	9 (30)	4 (13.33)
51-60	5 (16.67)	7 (23.33)
61-70	8 (26.67)	7 (23.33)

[Table/Fig-4]: The distribution of patients according to age group in the TAPP group and the Lichtenstein repair group.

In the TAPP group, vascular injury was present in one patient (3.33%), while no vascular injury was observed in the Lichtenstein repair group [Table/Fig-5].

Early complications during the first week of the postoperative period were compared between the TAPP group and the Lichtenstein repair group. In the TAPP group, early complications included seroma

Complications		TAPP group (n=30) n (%)	Lichtenstein group (n=30) n (%)
VAS deferens injury	Present	0	0
	Absent	30 (100)	30 (100)
Vascular injury	Present	1 (3.33)	0
	Absent	29 (96.66)	30 (100)
Bladder injury	Present	0	0
	Absent	30 (100)	30 (100)
Visceral injury	Present	0	0
	Absent	30 (100)	30 (100)

[Table/Fig-5]: Comparison of intraoperative complications between the TAPP group and the Lichtenstein repair group.

formation in one patient (3.33%), scrotal swelling in one patient (3.33%) and urinary symptoms in one patient (3.33%), while stitch abscess and abdominal distension were absent. In the Lichtenstein group, early complications included stitch abscess formation in one patient (3.33%), seroma formation in four patients (13.33%), scrotal swelling in three patients (10%) and urinary symptoms in one patient (3.33%), while abdominal distension was absent [Table/Fig-6].

Complications		TAPP group (n=30) n (%)	Liechtenstein group (n=30) n (%)	p-value
Stitch abscess	Present	0	1 (3.33)	0.99
	Absent	30 (100)	29 (96.67)	
Seroma	Present	1 (3.33)	4 (13.33)	0.35
	Absent	29 (96.66)	26 (86.66)	
Scrotal swelling	Present	1 (3.33)	3 (10)	0.61
	Absent	29 (96.66)	27 (90)	
Urinary symptoms	Present	1 (3.33)	1 (3.33)	1.00
	Absent	29 (96.66)	29 (96.66)	
Abdominal distension	Present	0	0	0.99
	Absent	30 (100)	30 (100)	

[Table/Fig-6]: Comparison of complications within the first week of postoperative follow-up between the TAPP group and the Lichtenstein group.
Chi-square test was used

Postoperative follow-up at one month was conducted to assess pain and recurrence in both the TAPP and Lichtenstein groups. In the TAPP group, no pain was reported, whereas, in the Lichtenstein group, pain was present in two patients (6.67%) [Table/Fig-7].

		TAPP group (n=30) n (%)	Liechtenstein group (n=30) n (%)
Pain	Present	0	2 (6.66)
	Absent	30 (100)	28 (93.33)
Recurrence	Yes	0	0
	No	30 (100)	30 (100)

[Table/Fig-7]: Comparison of complications at one-month postoperative follow-up between the TAPP group and the Lichtenstein repair group.

Postoperative follow-up at three months was also conducted to assess pain and recurrence in both the TAPP and Lichtenstein groups. In the TAPP group, no pain was reported, while in the Lichtenstein group, pain was present in one patient (3.33%) [Table/Fig-8].

Postoperative follow-up at six months was performed to assess pain and recurrence in both the TAPP and Lichtenstein groups. In the TAPP group, no pain was reported, while in the Lichtenstein group, pain was present in one patient (3.33%) [Table/Fig-9].

The pain response was measured according to the VAS on Postoperative Day 1 (POD 1), POD 2 and POD 3. The maximum number of patients (n=11) in the TAPP group on POD 1 was equally distributed between VAS 3 and VAS 4. The maximum number of

		TAPP group (n=30) n (%)	Lichtenstein group (n=30) n (%)
Pain	Present	0	1 (3.33)
	Absent	30 (100)	29 (96.67)
Recurrence	Present	0	0
	Absent	30 (100)	30 (100)

[Table/Fig-8]: Comparison of complications at three months postoperative follow-up in the TAPP group and the Lichtenstein group.

		TAPP group (n=30) n (%)	Lichtenstein group (n=30) n (%)
Pain	Present	0	1 (3.33)
	Absent	30 (100)	29 (96.67)
Recurrence	Present	0	0
	Absent	30 (100)	30 (100)

[Table/Fig-9]: Comparison of complications at six months postoperative follow-up in the TAPP group and the Lichtenstein group.

patients (n=10) in the Lichtenstein group on POD 1 had a VAS of 4 [Table/Fig-10]. The mean VAS in the TAPP group on POD 1 was 3.63±0.96, on POD 2 was 2.4±0.72 and on POD 3 was 0.4±0.56. In the Lichtenstein group, the mean VAS on POD 1 was 4.37±1.19, on POD 2 was 2.7±0.88 and on POD 3 was 0.73±0.83.

Visual analog scale (VAS)	POD1		POD 2		OD 3	
	TAPP group (n=30)	Lichtenstein group (n=30)	TAPP group (n=30)	Lichtenstein group (n=30)	TAPP group (n=30)	Lichtenstein group (n=30)
1			3	1	19	15
2	3	1	13	13	10	8
3	11	6	13	11	1	7
4	11	10	1	4		
5	4	9		1		
6	1	2				
7		2				

[Table/Fig-10]: Pain response on the Visual Analog Scale (VAS) in the TAPP group and the Lichtenstein group for Postoperative Day 1 (POD-1), day 2 and day 3.

The mean length of hospital stay in the TAPP group was 3±0.46 days, while in the Lichtenstein group, it was 4±0.87 days [Table/Fig-11]. The mean time to return to normal work in the TAPP group was 6.6±1.22 days, while in the Lichtenstein group, it was 14±3.37 days [Table/Fig-11].

Intraoperative vascular injury was managed using a harmonic energy device. Postoperative stitch abscesses were managed by opening the stitch and performing saline irrigation. Seroma formation and scrotal wall oedema were managed with a wait-and-watch approach, along with scrotal support garments. Urinary symptoms, such as dysuria and burning micturition, were managed with hydration and antibiotic treatment.

DISCUSSION

In the literature, three minimally invasive procedures and techniques that have been used for many years are Intraperitoneal Onlay Mesh (IPOM) repair, Totally Extraperitoneal (TEP) hernia repair and TAPP repair. TEP is a completely extraperitoneal procedure that requires considerable training and cannot be performed in every situation [8]. TAPP repair is an abdominal technique that offers a clear view of the anatomy and the advantage of additional space in the abdominal cavity. For this reason, TAPP repair is more commonly used than TEP repair, especially by newcomers [9].

In present study, the intraoperative complication of vascular injury was found in one patient (3.33%) in the TAPP group, while it was absent in the Lichtenstein repair group. Vas deferens injury, bladder injury and visceral injury were absent in both the TAPP and Lichtenstein

	TAPP (n=30)			Lichtenstein (n=30)			p-value
	Minimum	Maximum	Mean	Minimum	Maximum	Mean	
Hospital stay (in days)	2	4	33±0.46	3	6	4±0.87	0.576
Return to normal work (in days)	5	9	6.6±1.22	8	21	14±3.37	0.850

[Table/Fig-11]: Minimum and maximum hospital stay and return to normal work in TAPP group and Lichtenstein group.
t-test was used

repair groups. Present study findings was comparable to the study by Saini V et al., in which 144 patients underwent laparoscopic hernia repair and vascular injury occurred in two patients (2.81%) in the TAPP group, while no cases of vas deferens injury, bladder injury, or visceral injury were observed in the TAPP group [10].

In the present study, the overall postoperative complication rate was higher in the Lichtenstein group (30%) compared to the TAPP group (10%), which was consistent with the findings of Jan Z et al., [11]. In the study by Jan Z et al., postoperative complications were more common in the Lichtenstein group (32%) compared to the TAPP group (4%). These complications included hematoma formation, seroma formation, scrotal oedema and urinary retention [11].

Complications such as seroma, haematoma and scrotal oedema are related to inguinal incisions, which are more likely to occur in the open approach than in the laparoscopic approach [12,13]. Seroma formation, scrotal swelling and urinary retention were found in one patient (3.33%) in each of the TAPP group cases, which was comparable to the study by Ahmad S et al., [14]. In Ahmad S et al.'s study, they found scrotal swelling in 11.6% of patients and urinary retention in 3.3% of patients [14].

Postoperative follow-up for pain in both the TAPP and Lichtenstein groups at one month, three months and six months showed that pain was absent in the TAPP group at all time points (one month, three months and six months). In the Lichtenstein group, pain was present in two patients (6.67%) at one month, one patient (3.33%) at three months and one patient (3.33%) at six months. This finding was similar to that of the study by Pereira C and Rai R, where no postoperative pain or neuralgia was detected in any of the patients at the 12-week or one-year follow-up [1]. In the study by Jan Z et al., it was observed that chronic pain was much higher in the Lichtenstein group (10%) compared to the TAPP group (2%), which aligns with present study's findings in the Lichtenstein group, while no pain was observed in the TAPP group [11]. In the study by Douek M et al., it was found that after a follow-up period of five years, paresthesia occurred in 12 out of 242 patients who underwent open surgery, whereas this was not the case in the laparoscopic group [15]. In the study by O'Reilly EA et al., up to 30% of individuals who underwent inguinal hernia surgery reported pain even after one year [16]. The primary explanation could be that the mesh is placed differently in space compared to the open approach. Other risk factors for chronic pain after inguinal hernia repair include the development of seromas, urinary symptoms and enlargement of the scrotum [12,17-19].

In present study, the mean VAS in the TAPP group on POD 1 was 3.63±0.96, on POD 2 was 2.4±0.72 and on POD 3 was 0.4±0.56, which was similar to the study by Picchio M et al., where the mean VAS in the TAPP group on POD 1 was 3.1 (range 1-7) and on POD 2 was 2.3 (range 1-6) [20]. In present study, the mean VAS in the Lichtenstein group on POD 1 was 4.37±1.19, on POD 2 was 2.7±0.88 and on POD 3 was 0.73±0.83, which was higher compared to the findings of Picchio M et al., the mean VAS in the Lichtenstein group on POD 1 was 2.7 (range 1-3) and on POD 2 was 1.8 (range 1-6) [20].

The mean length of stay in the present study for the Lichtenstein group was 4±0.87 days, while in the TAPP group, it was 3±0.46 days, which was similar to the results reported by Pereira C and Rai R, the mean duration of hospital stay for the Lichtenstein group was 5.2±0.41 days, while in the TAPP group, it was 3.07±0.36 days. The minimum time to return to normal work was five days in the TAPP group, while it was eight days in the Lichtenstein group. The maximum time to return to normal work was nine days in the TAPP group and 21 days in the Lichtenstein group. The mean time to return to normal work was shorter in the TAPP group (6.6±1.22 days) compared to the Lichtenstein group (14±3.37 days) in present study. Similarly, Pereira C and Rai R, and Neumayer L et al., reported that patients who underwent laparoscopic surgery returned to normal activity and work more quickly compared to those in the open group [1,21].

Patients were followed-up for six months postoperatively and no recurrences occurred in either group, which was contrary to the findings of the study by Jan Z et al., the recurrence rate was 2% and it was similar between both groups [11]. Other studies have indicated that the Lichtenstein procedure and laparoscopic surgery for primary inguinal hernia repair are equivalent in terms of recurrence rate [22,23]. Recurrence rates after laparoscopic inguinal hernia repair have been reported to range from 0-4% [24]. In this comparative study, patient feedback on the TAPP repair results was more favourable compared to the Lichtenstein repair.

Limitation(s)

It was a single-centre study; therefore, bias may occur. The sample size consists of only 60 patients, which was quite small.

CONCLUSION(S)

The TAPP repair is safer and comparable to Lichtenstein open repair in terms of complications. In the TAPP group, pain, length of hospital stay and time to return to normal work were less compared to the Lichtenstein open repair. More studies with larger sample sizes are needed to make any recommendations.

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