

A Comparative Study on Laparoscopic Transabdominal Preperitoneal versus Lichtenstein Repair for Inguinal Hernia Management: Assessing Effectiveness and Outcomes

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ABSTRACT

Background: Amongst the most frequent human inflections that a surgeon encounters, inguinal hernia is one of the most prevalent. While laparoscopic inguinal hernia repair has traditionally been preferred predominantly for bilateral and recurrent cases, it has become increasingly viable and proficient for primary and unilateral repair. In this study, we aimed to compare Laparoscopic Transabdominal Preperitoneal Repair (TAPP) with Open Lichtenstein tension free mesh Repair for inguinal hernia in terms of intraoperative and postoperative outcomes.

Materials and methods: This prospective comparative study was conducted over a span of 1.5 years from December 2022 - May 2024 including 76 participants. Two groups were formed by convenience sampling: TAPP and Open hernioplasty. Demographic data, intraoperative findings, duration of surgery, early postoperative complications such as acute pain was recorded at 12 hours, 24 hours, and 72 hours post-surgery using the Visual Analogue Scale noted. Occurrence of urinary retention and SSO was recorded. The postoperative discharge day was noted, and follow-up was done after 7 days, 14 days, 1 month, and 6 months. Data was analyzed critically.

Results: Among 76 patients, 98.7% were male and mean age 50 yr. No significant difference between the study groups was noted. Mean operative duration was more in Laparoscopic TAPP group for both unilateral and bilateral repair with p - value of 0.0131 and 0.0003 respectively. Visual analogue scale was more in Open hernioplasty group than Laparoscopic TAPP group with significant p – value at 12 hour of 0.003 and at 72 hour of 0.006. 15% and 22.9% developed urinary retention in post-operative period in Laparoscopic TAPP and Open hernioplasty group respectively. 21.05 % cases in laparoscopic TAPP group and 13.16 % cases in Open hernioplasty group developed seroma in post op period. At 6 months follow up, it was observed that 15.8 % and 26.3 % in TAPP and Open group respectively had persistent pain while, half of them had severe pain limiting daily activities.

Conclusion: Laparoscopic TAPP is now being accepted as a preferred procedure for inguinal hernioplasty because of its minimally invasive characteristic, while Lichtenstein Open

hernioplasty might be preferred in cases where laparoscopic expertise is limited or when dealing with certain anatomical variations. Overall, the choice between laparoscopic TAPP and Lichtenstein open inguinal hernioplasty should consider factors such as surgeon expertise, patient preference, and hernia characteristics.

Keywords: Inguinal hernia, Transabdominal preperitoneal approach, Lichtenstein repair, Open inguinal hernioplasty

INTRODUCTION

Amongst the most frequent human inflections that a surgeon encounters, inguinal hernia is one of the most prevalent [1]. Open mesh repair had been initiated by Usher late back in 1958, which was later modified by Irwing Lichtenstein in the 1980s. Further advancement in inguinal hernia repair saw the evolution of minimally invasive laparoscopic repair by Ger. Arregui and Dion later in 1990's, pioneered the groundbreaking laparoscopic transabdominal preperitoneal mesh repair (TAPP), which revolutionized the field of hernia repair [2]. The success of hernia repair rests on its capacity to reduce complications and avoid recurrence. Both open and laparoscopic mesh repairs have yielded favorable outcomes. However, from a mechanical perspective, it is tempting to repair and/or prevent all lateral, medial, and femoral hernias with a single mesh surgery by strengthening the whole Myo pectineal orifice (MPO), which is a weak, collagenous region devoid of muscles - divided by inguinal ligament with saphenous opening lying caudally and the deep and superficial inguinal rings present cranially [3]. While laparoscopic inguinal hernia repair has traditionally been preferred predominantly for bilateral and recurrent cases, it has become increasingly viable and proficient for primary and unilateral repairs due to advancements in laparoscopic techniques and its minimally invasive characteristic. In this study, we aimed to compare Laparoscopic Transabdominal Preperitoneal Repair with Open Lichtenstein tension free mesh Repair for inguinal hernia in terms of intraoperative and postoperative outcomes.

MATERIALS & METHODS

This prospective comparative study was conducted in the Department of General Surgery, of a tertiary care hospital of New Delhi over a span of 1.5 years. A total of 76 subjects with age more than 18 years and suffering from primary inguinal hernia were enrolled in this study. Patients with complicated hernia or not giving consent to participate in study were excluded. Two study groups (with n = 38 each) were defined - Inguinal hernia repair by Open hernioplasty: Lichtenstein technique (Group OH) and by Laparoscopic: Transabdominal preperitoneal (Group TAPP) technique. Patients were equally allocated to one of the two arms of the study by convenience sampling. Signed informed consent was obtained from each patient for the chosen method of treatment. Patients were completely evaluated, comorbidities noted and optimized. Laboratory and radiological findings were studied. Bladder emptying was done in pre op either by self-voiding or by Foley's catheterization. Skin preparation was done, and preoperative prophylactic Inj. Amoxicillin + Clavulanic acid was given to all patients. The procedure was performed by a single surgical team and surgeon with more than 5 years of experience in both methods of hernia repair and Polypropylene synthetic mesh was used for all patients, postoperatively three doses of antibiotic were administered. On the first postoperative day, Foley's catheter was withdrawn after the patient was ambulatory in cases in which it was inserted pre-operatively. ERAS protocol was followed for all patients. 8 hourly analgesic dose was given to all patients for at least 3 days and then as per the patient's needs. Demographic data, intraoperative findings and duration of

surgery was recorded. Early postoperative complications such as acute pain were recorded at 12 hours, 24 hours, and 72 hours post-surgery using the Visual Analogue Scale noted. Occurrence of urinary retention and SSO was recorded. The postoperative discharge day was noted, and follow-up was done after 7 days, 14 days, 1 month, and 6 months for assessing chronic pain and recurrence.

Statistical Analysis

Data were entered into a Microsoft Excel spreadsheet and analyzed using IBM SPSS Statistics version 25.0. Continuous variables were expressed as mean $\pm$ standard deviation (SD), while categorical variables were summarized as frequencies and percentages. Continuous variables between the TAPP and open hernioplasty groups were compared using the independent-samples (unpaired) t-test. Categorical variables were compared using the Pearson chi-square test, and Fisher's exact test was applied where the expected cell frequencies were small. A two-sided p-value <0.05 was considered statistically significant.

RESULT

A total of 76 patients with primary inguinal hernia were included in the study, with 38 patients in the laparoscopic transabdominal preperitoneal (TAPP) group and 38 patients in the open Lichtenstein hernioplasty (OH) group. The mean age was 48.97 ± 15.86 years in the TAPP group and 50.79 ± 15.42 years in the OH group, with no statistically significant difference between the groups ($p = 0.613$). The mean body mass index (BMI) was also comparable between the TAPP and OH groups (24.57 ± 3.24 vs. 24.51 ± 4.29 kg/m², respectively; $p = 0.945$). The study population was predominantly male, with 37 males and 1 female in the TAPP group and 38 males in the OH group (table 1).

The distribution of reported risk factors was broadly comparable between the two groups. The recorded risk factors included increased intra-abdominal pressure-related factors, such as constipation, prostatism, chronic cough and weight lifting, as well as factors associated with abdominal wall weakness, including obesity, age >60 years, previous abdominal surgery, diabetes, tobacco consumption and alcohol consumption.

Table 1. Baseline demographic characteristics of patients undergoing laparoscopic TAPP and open Lichtenstein hernioplasty.

Patient Variable	Group TAPP	Group OH	p - value
Mean Age (Years $\pm$ S.D)	48.97 ± 15.86	50.79 ± 15.42	0.613
Gender (n)	Male = 37 Female = 1	Male = 38 Female = 0	-
Mean BMI (BMI $\pm$ S.D)	24.57 ± 3.24	24.51 ± 4.29	0.945
Risk factors (n)			-
A) Increased intra-abdominal pressure			
1. Constipation	22	20	
2. Prostatism	7	11	
3. Chronic cough	4	4	
4. Weight lifting	11	10	
B) Weakness of abdominal wall			
1. Obesity	2	4	
2. Old age (> 60 yr)	10	14	
3. Previous abdominal surgery	7	2	
4. Diabetes	4	4	
5. Tobacco consumption	10	10	
6. Alcohol consumption	2	2	

The mean duration of symptoms was approximately 2 years 2 months in the

TAPP group and 3 years 6 months in the OH group. The mean size of the largest

dimension of the swelling was 6.9 cm in the TAPP group and 7.8 cm in the OH group (table 2).

Most hernias were reducible in both groups. Reducibility was documented in 35 (92.1%) patients in the TAPP group and 32 (84.2%) patients in the OH group, with no statistically significant difference between the groups ($p = 0.479$).

The distribution of hernia side and type was also recorded. In the TAPP group, 20 patients had right-sided, 11 had left-sided and 7 had bilateral hernias, compared with 21, 10 and 7 patients, respectively, in the OH group. Among unilateral hernias, indirect, direct and pantaloon hernias were documented, while bilateral cases included combinations of direct and indirect hernias.

Table 2. Clinical and hernia-related characteristics of patients in the TAPP and open hernioplasty groups.

Hernia Variable	Group TAPP	Group OH	p – value
Mean duration of complaints	2 years 2 months	3 years 6 months	-
Mean size of swelling (largest dimension in cm)	6.9	7.8	-
Reducibility [n (%)]	35 (92.1)	32 (84.2)	0.479
Side of hernia [n]			-
1. Right	20	21	
2. Left	11	10	
3. Bilateral	7	7	
Type of hernia [n]			-
A. Unilateral			
1. Indirect	23	15	
2. Direct	7	8	
3. Pantaloon	1	8	
B. Bilateral			
1. Both Indirect	1	1	
2. Both Direct	2	3	
3. Indirect and direct	1	2	
4. Direct and Pantaloon	3	1	
Hernia Content			-
1. Omentum	32	31	
2. Omentum + Gut loop	3	7	
3. Other			
a) Appendix	1	-	
b) Sigmoid colon	2	-	
c) Urinary bladder	1	-	

The majority of hernia sacs contained omentum. Omentum was reported as the hernia content in 32 patients in the TAPP group and 31 patients in the OH group. Other reported contents included omentum with a gut loop, appendix, sigmoid colon and urinary bladder.

Two patients initially planned for laparoscopic TAPP repair were converted to open repair. One conversion occurred because of dense adhesions between the intestine and anterior abdominal wall, while the second occurred because of an irreducible hernia sac. No major

intraoperative complications were reported in either group.

The mean operative duration was significantly longer in the TAPP group than in the OH group for both unilateral and bilateral hernia repair (table 3). For unilateral repair, the mean operative duration was 100.48 ± 39.44 minutes in the TAPP group compared with 79.35 ± 32.73 minutes in the OH group ($p = 0.0131$). For bilateral repair, the corresponding operative durations were 157.14 ± 27.52 and 131.43 ± 31.32 minutes, respectively ($p = 0.0003$).

Table 3. Comparison of operative duration between laparoscopic TAPP and open Lichtenstein hernioplasty according to unilateral and bilateral repair.

Duration of surgery (min.)	Mean $\pm$ SD	
	Unilateral	Bilateral
Group TAPP	100.48 $\pm$ 39.44	157.14 $\pm$ 27.52
Group OH	79.35 $\pm$ 32.73	131.43 $\pm$ 31.32
p - value	0.0131*	0.0003*

Postoperative pain was assessed using the Visual Analogue Scale (VAS) at 12, 24 and 72 hours after surgery (table 4). At 12 hours, the mean VAS score was significantly lower in the TAPP group than in the OH group (6.07 ± 1.08 vs. 6.84 ± 1.51 ; $p = 0.003$). At 24 hours, the mean VAS score remained lower in the TAPP group, although the difference was not statistically significant (5.34 ± 1.09 vs. 5.87 ± 1.28 ; $p = 0.057$). At

72 hours, the TAPP group again demonstrated a significantly lower mean VAS score than the OH group (4.08 ± 0.91 vs. 4.66 ± 0.88 ; $p = 0.006$).

The reported duration of analgesic requirement was 5.81 ± 1.18 days in the TAPP group and 6.26 ± 1.12 days in the OH group; the difference was not statistically significant ($p = 0.092$).

Table 4. Comparison of postoperative pain scores and duration of analgesic requirement between the TAPP and open hernioplasty groups.

Postoperative pain	Mean $\pm$ SD		p - value
	Group TAPP	Group OH	
At 12 hr	6.07 ± 1.08	6.84 ± 1.51	0.003*
At 24 hr	5.34 ± 1.09	5.87 ± 1.28	0.057
At 72 hr	4.08 ± 0.91	4.66 ± 0.88	0.006*
Need for analgesia (in days)	5.81 ± 1.18	6.26 ± 1.12	0.092

Postoperative complications included urinary retention, seroma, hematoma, surgical-site infection and orchitis. Urinary retention occurred in 15% of patients in the TAPP group compared with 22.9% in the OH group (figure 1). Seroma was reported in 21.05% of patients in the TAPP group and 13.16% in the OH group (figure 2).

No patient in either group developed postoperative hematoma or wound/mesh infection. One patient in the OH group developed left testicular pain and swelling following bilateral Lichtenstein repair for a direct inguinal hernia.

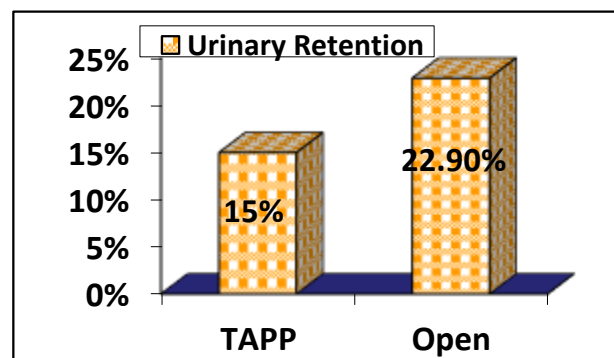


Figure 1. Frequency of postoperative urinary retention in the laparoscopic TAPP and open Lichtenstein hernioplasty groups.

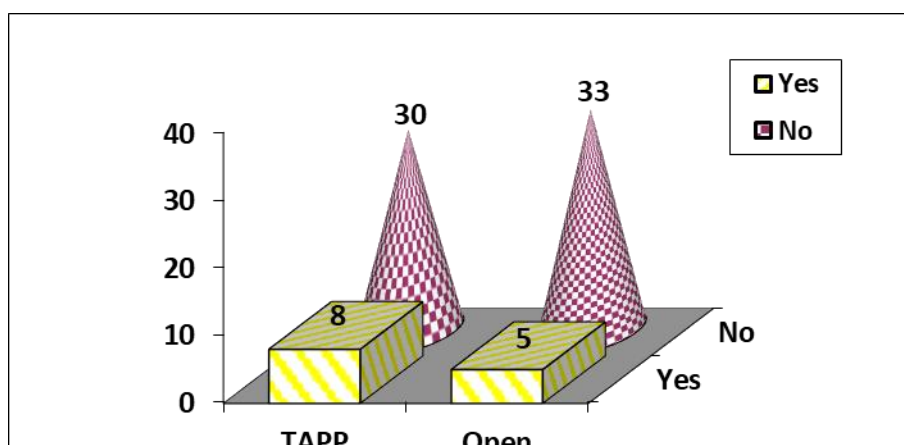


Figure 2. Frequency of postoperative seroma in the laparoscopic TAPP and open Lichtenstein hernioplasty groups.

The mean postoperative hospital stay was 2.55 ± 1.06 days in the TAPP group and 2.47 ± 0.95 days in the OH group (table 5).

The difference between the groups was not statistically significant ($p = 0.733$).

Table 5. Comparison of postoperative hospital stay between laparoscopic TAPP and open Lichtenstein hernioplasty groups.

Duration of stay (in days)	Mean $\pm$ SD	p – value
Group TAPP	2.55 ± 1.06	0.733
Group OH	2.47 ± 0.95	

Persistent pain at 3 months after surgery was reported in 15.8% of patients in the TAPP group and 26.3% in the OH group. The difference was not statistically significant ($p = 0.260$).

Pain limiting daily or leisure activities was reported in 7.9% of patients in the TAPP group and 13.2% in the OH group, with no statistically significant difference between the groups ($p = 0.711$).

During the reported 6-month follow-up period, no patient in either group developed recurrent inguinal hernia. Therefore, no between-group statistical comparison of recurrence could be performed.

Overall, the TAPP group demonstrated a significantly longer operative duration for both unilateral and bilateral repairs, while postoperative pain was significantly lower at 12 and 72 hours compared with open Lichtenstein hernioplasty. Hospital stay and the reported measures of chronic pain did not differ significantly between the two groups.

DISCUSSION

In India, inguinal hernia affects around 1.5 to 2 million people annually, making it a common surgical ailment [4]. Treatment for this prevalent disease has evolved over time, transitioning from pure tissue repairs to prosthetic repairs and, more recently, laparoscopic repairs. In today's era, laparoscopic repair is widely accepted as a method of repair [5]. It offers advantages such as an early return to activities and work, reduced postoperative pain and morbidity, fewer wound complications, less postoperative discomfort, and improved cosmetic outcomes. However, it is associated with some limitations, including a longer learning curve, longer operation times, higher hospital costs, a higher recurrence rate, particularly in the early postoperative period, and a greater risk of visceral injury. In our study, the mean age was 50 years, and 60% of cases were between the age groups of 40-70 years. The mean age of both study groups was comparable with p value not significant. Our study showed male preponderance, with

98.6% of patients being male and only 1.4% being female. The male-to-female ratio was 75:1. Similar to our study, other studies also found males suffering from inguinal hernia much more than females. In our study, patients with a BMI > 25 in the TAPP and open hernioplasty groups comprised 42.1% and 44.7% of the study population, respectively. Mean BMI is around 24.5 in our study similar to study by Jan Z et al [6]. De Goede B et al. (2015) concluded in their study that the overall incidence of inguinal hernia is lower in overweight and obese individuals due to the difficulty of its diagnosis [7]. Right-sided inguinal hernia is more common than the left side, attributed to the fact that the right testis descends later than the left, thus having greater chances of the right patent processes vaginalis. In the TAPP group, one patient presented with left-sided inguinal swelling, but intraoperatively, he was diagnosed with B/L inguinal hernia, thus highlighting the fact that laparoscopic approaches have an advantage over open repair in the diagnosis of occult cases. Van den Heuvel B et al. (2013), in their study, reported a 13% incidence of occult diagnosis of contralateral inguinal hernia during TAPP [8]. Balamaddaiah G et al. (2016) conducted an observational study with 212 cases and concluded heavy weight lifting as the most common risk factor among patients with inguinal hernia, which was seen in 27.6% of patients in our study, with the presence of other risk factors like alcohol consumption in 38.2% and old age (>60 yr.) in 29.7%, similar to our study [9]. In this study, indirect inguinal hernia is more common than direct hernia, similar to what was observed by El Sherpiny WY et al., but contrary to the results of Sofi J et al [10,11]. In our study, two cases (2.63%) of TAPP were converted to open procedures due to problems like dense adhesions and ill-defined anatomy. Sofi J et al. (2021) also reported in their study the conversion of one patient (3.3%) from TAPP to Open because of dense adhesions [11]. McCormack K et al. (2003) observed a 2.7% conversion rate

in their study with 3130 cases. In our study, we observed that the majority of cases had omentum as the hernia content [12]. Few cases had an appendix, sigmoid colon, and urinary bladder as content, which was found in TAPP group, highlighting the benefit of TAPP over open hernioplasty or totally extraperitoneal (TEP) laparoscopic approach. Sofi J et al and Sehgal et al observed in their study that the operative time for TAPP in unilateral repair was significantly higher than that of open hernia. Also reported that the operative time for bilateral cases was significantly lower than that for open cases. Similar to other studies, our study also showed significantly more operative time in TAPP group than in Open hernioplasty group [11,13].

In our study, correlating to other studies by Rayamajhi BB et al and Karim T et al, it was observed that significantly more pain was associated with open repair and the need for analgesics for a longer duration than in the laparoscopic repair group [14,15]. Chronic postoperative pain is generally defined as pain at the surgical site that persists for more than 3 months following surgery. The reported incidence of chronic pain after open inguinal hernia repair is approximately 25.6%, compared with 15.8% following laparoscopic repair, indicating a potentially lower risk of chronic postoperative pain with the laparoscopic approach. Scheuermann U et al. (2017) concluded in his meta-analysis that TAPP is associated with significantly less chronic inguinal pain as compared with Lichtenstein repair [16]. Urinary retention was seen in 22.9% of cases in the open hernioplasty group, while in 15% of the TAPP group similar to as stated by Jan Z. et al and Ahmed AE et al [6,17]. In our study, seroma was more common in the TAPP group, similar to studies reported by Xi S et al. and Sehgal K et al [13,18]. This is contradictory to the findings of study by Rayamajhi BB et al and Shah RU et al stating that the occurrence of seroma is more common after open hernioplasty repair [14,19]. None of the patients developed SSI or hematoma in

our study, which may be the result of good care for asepsis and better handling of tissues. Overall, it appears that the laparoscopic technique had fewer postoperative complications relative to the open technique. Whereas, Xi S et al. reported in their study a significant difference (p value = 0.01*) in hematoma development in the post-op period in TAPP = 10.33% vs. 1.7% in the open repair group [18]. One of the patients in the open hernioplasty group developed left-sided orchitis after a direct inguinal Lichtenstein hernia repair. None of the patients developed a recurrence at the 6-month follow-up. Jain V. et al. (2024) reported no significant difference in both procedures in preventing hernia recurrence, and they have similar safety profiles with regard to postoperative consequences [20]. Aiolfi A. et al. (2021) concluded that compared to Lichtenstein tension-free repair, TAPP group appears to be linked with significantly fewer cases of early postoperative discomfort, return to work or activities, chronic pain, hematoma, and wound infection. Seroma, hospital length of stay, and hernia recurrence appear to be comparable within both [21]. Shah RU et al. (2021), in their study, over 70 patients reported 14.3% in the open hernioplasty group versus 2.8% in the TAPP group, with a p value of 0.08, had wound infection, and similar to our study, none of the patients developed any intraoperative complications, hematomas, or recurrences for 1 year [19]. In our study, in both groups, on average, patients stayed for 2.5 days in the post-op period. In studies by Jain V et al, Rayamajhi BB et al and Ahmed AE et al reported significantly longer duration of hospital stay of patient with open hernia repair which was opposing to the conclusion of Sehgal K. et al [13,14,17,20]. According to an analysis by Arielle J. Perez et al. (2020), patients undergoing laparoscopic inguinal hernia repair had a lower risk of infection (OR: 0.34, 95% CI: 0.27–0.42), bleeding (OR: 0.72, 95% CI: 0.63–0.82), and postoperative wound complications (OR: 0.64, 95%

confidence interval [CI]: 0.41– 0.98). Additionally, this study involving 41,937 patients found that the laparoscopic technique decreased the duration of stay by 1.28 days (95% CI: –1.58 to –1.18), supporting the recommendation that the laparoscopic approach be promoted for the treatment of suitable patients with inguinal hernia [22].

During the 1.5 years of study, many conclusions and limitations were encountered. Hence, we would like to suggest the following recommendation like Recurrence rates after Laparoscopic and Open inguinal hernia repair requires study with longer follow up period, pre-operative assessment of quality of life to appropriately assess difference in quality of life after Open and Laparoscopic inguinal hernia repair, Inclusion of larger study participants to produce more significant results. Also, our study included single center thereby catering to a local population. Hence, our result was dependent on demographic profile in this particular study population. Therefore, we recommend a large multicentric study to eliminate this limitation as well as validate our study results.

CONCLUSION

Laparoscopic TAPP and Lichtenstein Open inguinal hernia repair are both effective surgical techniques. Laparoscopic TAPP is associated with smaller scar, less postoperative pain with decreased analgesic requirement, and quicker return to normal activities compared to Lichtenstein Open inguinal hernia. Laparoscopy helps in detection and management of occult hernia. It also provides better visualization of herniated content. However, it is important to weigh these benefits against potential drawbacks such as longer operating times and higher risk of seroma formation. Additionally, laparoscopic TAPP requires advanced skills and may have a longer learning curve. Laparoscopic TAPP is now being accepted as a preferred procedure for inguinal hernioplasty because of its

minimally invasive characteristic, while Lichtenstein Open hernioplasty might be preferred in cases where laparoscopic expertise is limited or when dealing with certain anatomical variations. Overall, the choice between laparoscopic TAPP and Lichtenstein open inguinal hernioplasty should consider factors such as surgeon expertise, patient preference, and hernia characteristics.

Declaration by Authors

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