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Original Research Article

To study the complication and outcomes of Liechtenstein versus Laparoscopic transabdominal peritoneal (TAPP) inguinal hernia repair

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ABSTRACT

Purpose: This study aims to compare the complications and outcomes associated with Liechtenstein and TAPP inguinal hernia repairs. **Methodology**: The study was conducted as a prospective study over two year. A total of 120 patients diagnosed with inguinal hernia were included, with 60 undergoing Liechtenstein repair and 60 undergoing TAPP repair. Preoperative assessments, including a thorough examination and pre-anaesthetic check-ups, were performed for all participants. Data on operative time, early postoperative complications, and recurrence rates at three months were collected and analyzed using SPSS 25.0. **Results**: The baseline characteristics of the two groups revealed a higher mean age in the TAPP group (50.37 years) with $p<0.0001$. The duration of surgery was also significantly longer for TAPP group (mean=1.31 hours) compared to Liechtenstein group (0.81 hours). At seven days post-surgery, the TAPP group exhibited significantly lower rates of pain (8.3% vs. 36.7%), cord edema (0% vs. 10%), surgical site infections (0% vs. 15%), and seroma formation (0% vs. 36.7%) compared to Liechtenstein group. However, at one month, TAPP group showed higher rates of persistent pain (15% vs. 0%) and surgical site infections (58.3% vs. 0%). By three months, most complications had resolved in both groups, although cord edema remained more prevalent in Liechtenstein group (18.3% vs. 0%). The recurrence rate at three months was lower in the TAPP group (8.3%) compared to the Liechtenstein group (20%), but this difference was not statistically significant ($p = 0.067$). **Conclusion**: Both TAPP and Liechtenstein techniques have their respective advantages and drawbacks. The choice of surgical method should be tailored to the individual patient's needs, the surgeon's experience, and the available resources.

Keywords: Inguinal hernia, Liechtenstein repair, TAPP, complications, operative time, recurrence, laparoscopic surgery, patient outcomes.

INTRODUCTION:

An inguinal hernia occurs when abdominal contents protrude through the inguinal canal, with types classified as direct or indirect based on their position relative to the inferior epigastric vessels. They can be congenital or acquired, and are caused by factors that increase intra-

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abdominal pressure or weaken the abdominal wall. (1) Inguinal hernia is a prevalent condition in India, affecting 15%-20% of the population, with an estimated prevalence of 1.5 to 2 million cases. It predominantly occurs in men, who account for 90% of repairs, and shows a bimodal distribution in males, peaking in the first year of life and again after age 40. (2) Inguinal hernia repair is one of the most common surgical procedures performed worldwide, with an estimated 20 million surgeries conducted annually, (3–5) and is also the most common elective surgery in India. (2) In 2022, the Global Burden of Disease 2021 report estimated that the all-age Disability-Adjusted Life Years (DALYs) for inguinal, femoral, and abdominal hernias amounted to approximately 2.34 million. (6) The surgical management of inguinal hernias has evolved significantly over the years, with various techniques developed to improve patient outcomes, reduce recurrence rates, and minimize complications. Out of over 100 repair techniques for inguinal and femoral hernias, the new International Guidelines of the Hernia-Surge Group recommend only three: Liechtenstein open tension-free mesh repair, Laparoscopic Transabdominal Preperitoneal (TAPP) approach and totally extraperitoneal patch plasty (TEP). (3) The Liechtenstein repair, introduced in the 1980s by Dr Irving Liechtenstein, has become the gold standard for open inguinal hernia repair. (7) This technique involves placing a synthetic mesh over the hernia defect, reinforcing the inguinal canal and providing a tension-free repair. (8) The Liechtenstein method is favoured for its simplicity, effectiveness, and relatively low complication rates. (8,9) It is particularly advantageous in settings where laparoscopic expertise and equipment are limited. Conversely, the TAPP repair represents a minimally invasive approach, gaining popularity due to advancements in laparoscopic surgery. (8,10) The TAPP technique involves placing a mesh through a laparoscope into the preperitoneal space, covering the hernia defect from within the abdominal cavity. (11) This method offers several benefits over open repair, including reduced postoperative pain, quicker recovery times, lower rates of chronic pain and lower surgical site complications. (8) However, it also presents challenges such as a steeper learning curve, longer operative times, and potentially higher costs. (12,13) Comparative studies between these two techniques have yielded varying results, with differences in patient demographics, surgeon expertise, and healthcare settings influencing outcomes. While some studies suggest the superiority of laparoscopic approaches in terms of postoperative recovery and pain, others highlight the reliability and accessibility of the Liechtenstein repair. This study aims to compare the complications and outcomes associated with Liechtenstein and TAPP inguinal hernia repairs.

METHODOLOGY:

The present prospective study was conducted in the Department of General Surgery, Sri Aurobindo Medical College and P.G. Institute, Indore over a period of two year (September 2022 to September 2024). The study participants included patients with inguinal hernia above the age of 18 years who were declared fit for surgery, and those with co-morbidities like hypertension, type-2 diabetes mellitus, joint pain, obstructive sleep apnoea or cardiac illness were excluded. On average, 12 patients with inguinal hernia visit our outpatient department each month, with around 10 meeting our inclusion criteria. Consequently, we manage an average of 120 cases annually. Therefore, we have established a sample size of 120 patients for this study. A well-informed verbal and written consent were taken from all the patients who were willing to participate in the study. The enrolled patients were thoroughly examined and investigated as per requirements. Pre-anaesthetic check-up was done. 60 patients underwent Liechtenstein repair while another 60 underwent TAPP repair of inguinal hernia. Complications and outcomes were observed. All data was recorded in a pre-designed semi-structured proforma.

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Statistical analysis was done using SPSS 25.0 (trial version). Continuous data was expressed in mean and standard deviation. The descriptive representation of data was done in the form of frequencies and percentages. Analytical part will be done using appropriate tests of association (Chi-square, Fischer's exact and t-test). The result was considered significant at 95% level of significance with $p<0.05$.

RESULT:

Table 1 presents the baseline characteristics of the study participants in both groups. In Group 1 (Laparoscopic TAPP), 91.7% of participants were male, compared to 66.7% in Group 2 (Liechtenstein repair), with the remaining participants being female. The mean age of participants in the TAPP group was 50.37 years (±16.23), significantly higher than the Liechtenstein group, which had a mean age of 40.13 years (±10.99), with a p-value of <0.0001. Additionally, the duration of surgery was longer in the TAPP group (1.31 hours ± 0.48) compared to the Liechtenstein group (0.81 hours ± 0.06), also with a highly significant p-value of <0.0001. Table 2 compares the complications observed at seven days, one month, and three months post-surgery between the two groups. At seven days, the TAPP group had significantly lower rates of complications, including pain (8.3% vs. 36.7%, $p < 0.0001$), cord edema (0% vs. 10.0%, $p = 0.027$), surgical site infection (0% vs. 15.0%, $p = 0.003$), and seroma formation (0% vs. 36.7%, $p < 0.0001$). At one month, the TAPP group had higher rates of persistent pain (15.0% vs. 0%, $p = 0.003$), while the Liechtenstein group had higher rates of cord edema (18.3% vs. 0%, p=0.001). By three months, most complications had resolved in both groups, except for cord edema, which was more prevalent in the Liechtenstein group (18.3% vs. 0%, $p = 0.001$). Table 3 focuses on the recurrence rates at three months between the two groups. The recurrence rate in the TAPP group was 8.3% compared to 20% in the Liechtenstein group. Although there is a noticeable difference in recurrence rates, the p-value of 0.067 suggests that this difference is not statistically significant.

Table-1: **Baseline characteristics of the study participants in both groups**

Characteristic	**Group 1 (Laparoscopic TAPP)**	**Group 2 (Liechtenstein repair)**	**p-value**
Gender			
Male *n (%)*	55 (91.7%)	40 (66.7%)	0.001
Female *n (%)*	5 (8.3%)	20 (33.3%)	
Age (in years)			
Age (*Mean±S.D)*	50.37±16.23	40.13±10.99	<0.0001
Duration of surgery (in hours)			
Duration of Surgery (*Mean±S.D)*	1.31±0.48	0.81±0.06	<0.0001

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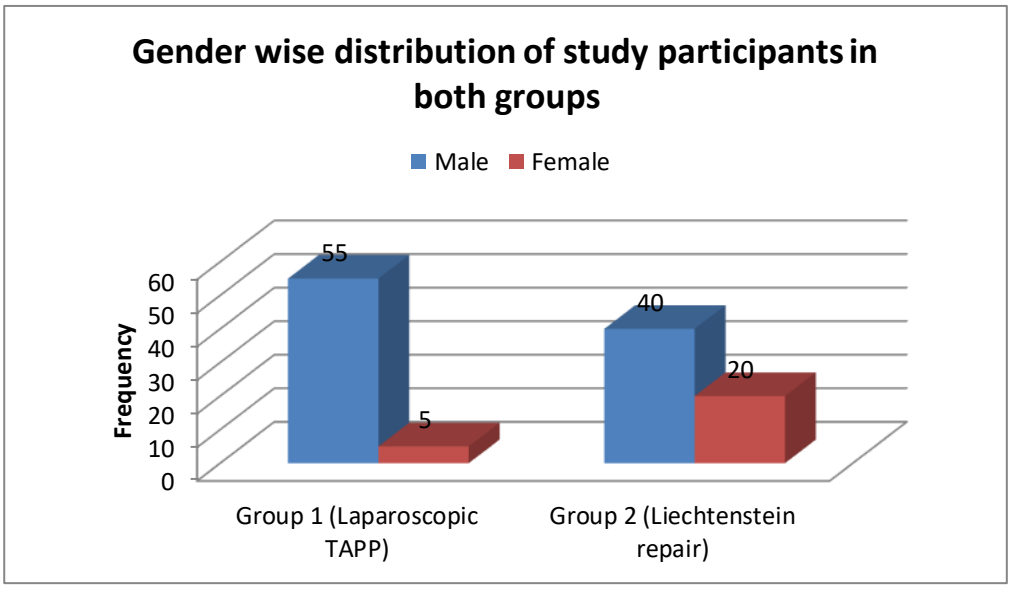

Figure 1: Gender wise distribution of study participants in both groups

Table-2: Comparison of complications at seven days, one month and three months between the two groups

Complications	Group 1 (Laparoscopic TAPP) *n (%)*	Group 2 (Liechtenstein repair) *n (%)*	Total *n (%)*	p-value
At seven days				
Pain	5 (8.3%)	22 (36.7%)	27	<0.0001
Cord edema	0 (0.0%)	6 (10.0%)	6	0.027
Surgical Site Infection	0 (0.0%)	9 (15.0%)	9	0.003
Seroma	0 (0.0%)	22 (36.7%)	22	<0.0001
At one month				
Pain	9 (15.0%)	0 (0.0%)	9	0.003
Cord edema	0 (0.0%)	11 (18.3%)	11	0.001
Surgical Site Infection	0 (0.0%)	35 (58.3%)	35	<0.0001
Seroma	0 (0.0%)	0 (0.0%)	0	-
At three months				
Pain	0 (0.0%)	0 (0.0%)	0	-
Cord edema	0 (0.0%)	11 (18.3%)	11	0.001
Surgical Site Infection	0 (0.0%)	0 (0.0%)	0	-
Seroma	0 (0.0%)	0 (0.0%)	0	-

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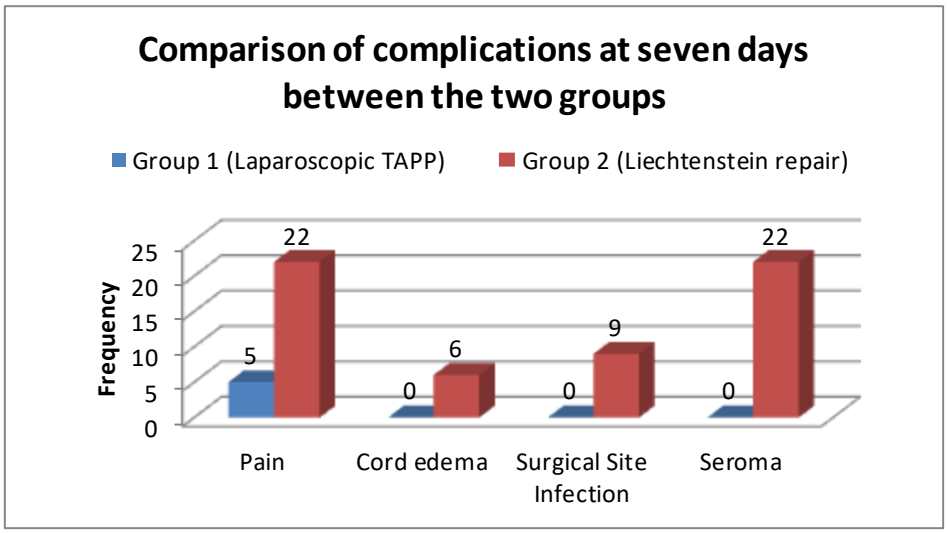

Figure 2: Comparison of complications at 7 days between the two groups

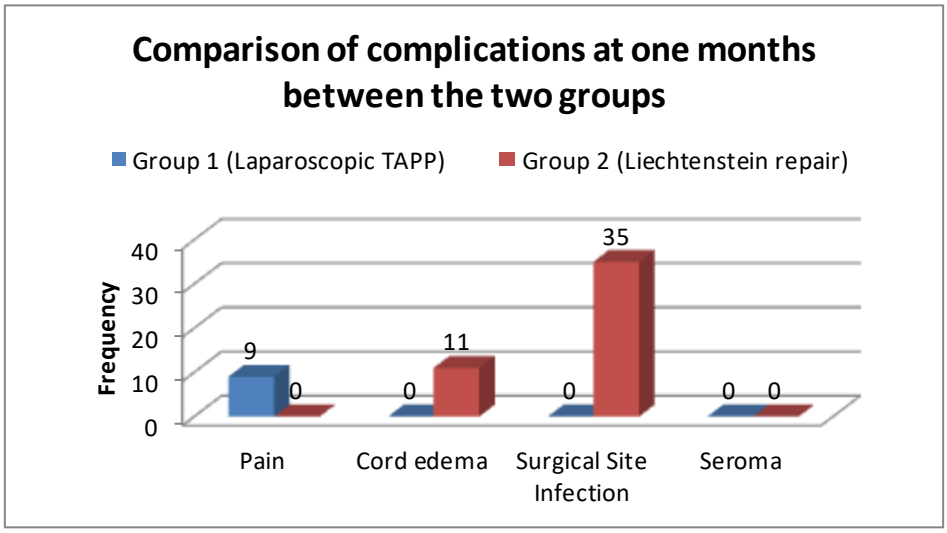

Figure 3: Comparison of complications at 1 month between the two groups

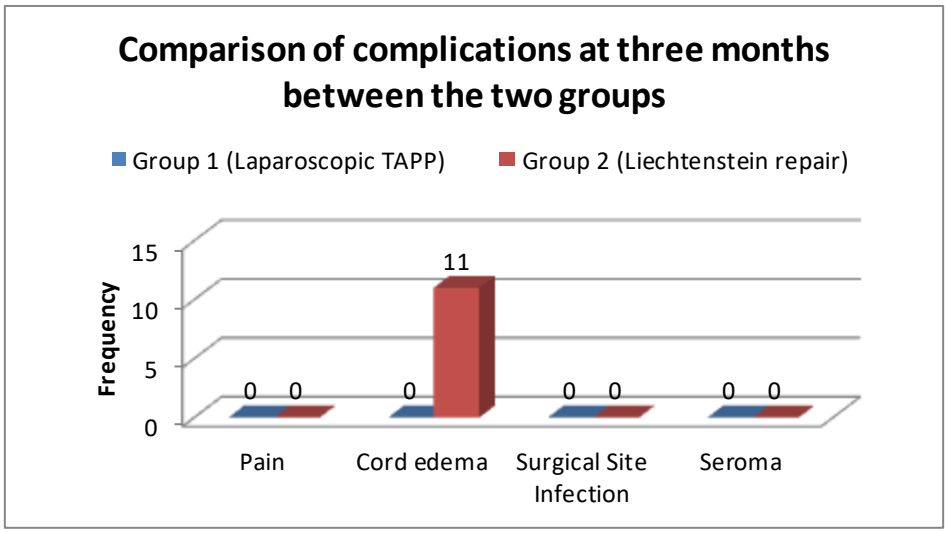

Figure 4: Comparison of complications at 3 months between the two groups

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Table-3: Comparison of recurrence at three months between the two groups

Characteristic	Group 1 (Laparoscopic TAPP)	Group 2 (Liechtenstein repair)	Total	p-value
Recurrence at 3 months	5 (8.3%)	12 (20%)	17	0.067

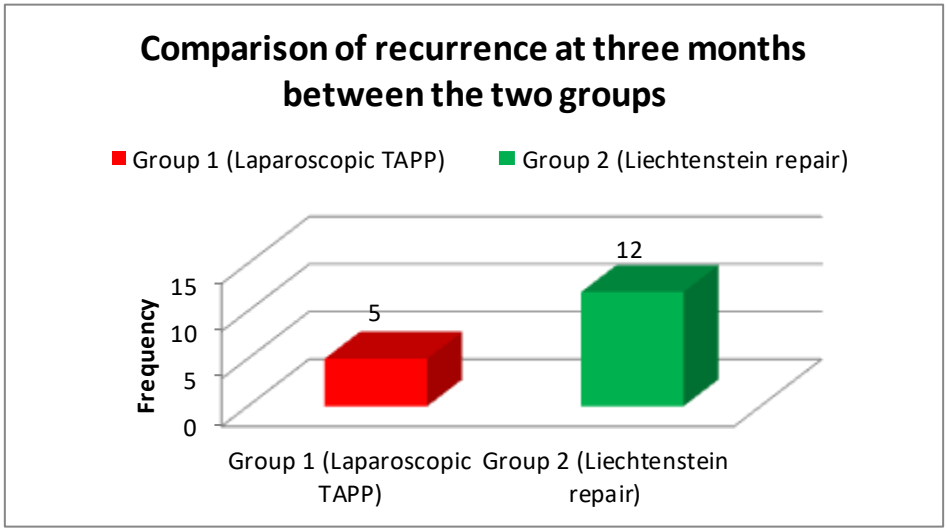

Figure 5: Comparison of recurrence at 3 months between the two groups

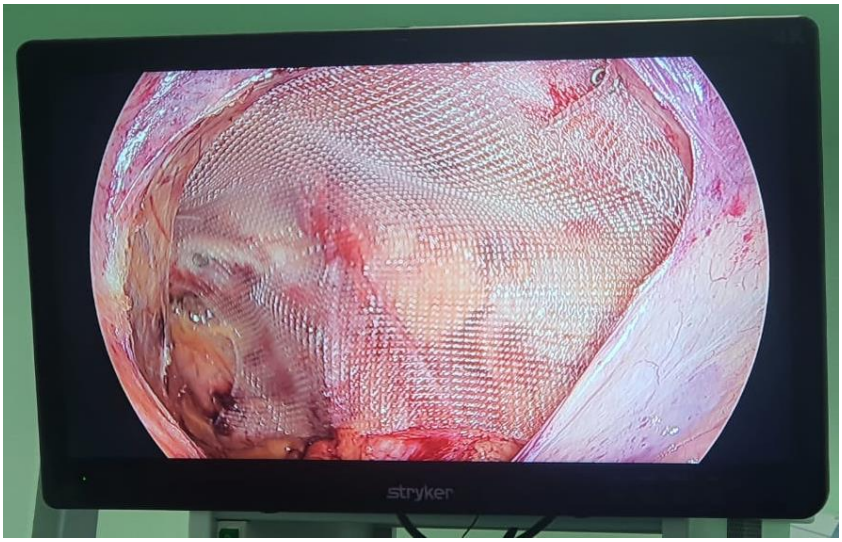

Image 1: Intra-operative image of a patient undergoing TAPP for bilateral inguinal hernia

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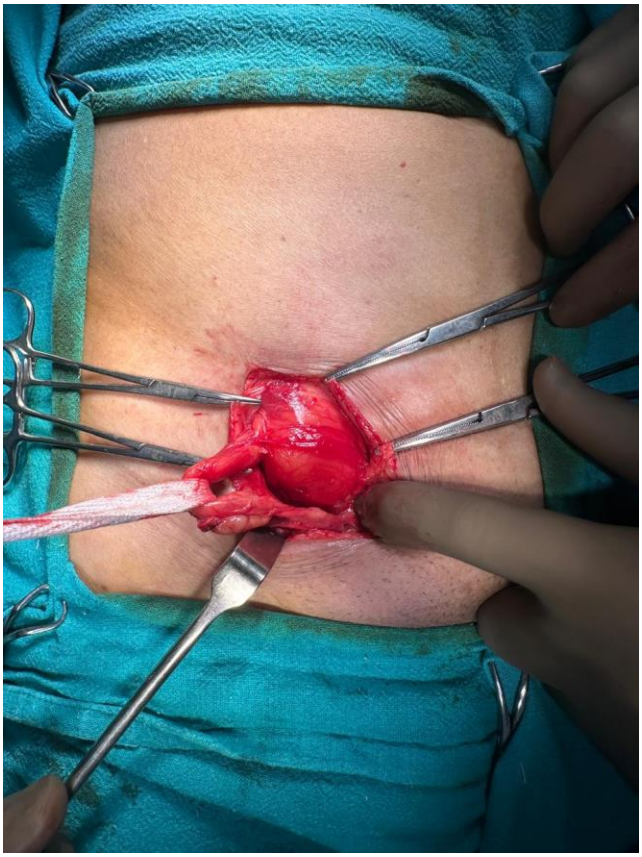

Image 2: Intra-operative image of a patient undergoing Liechtenstein hernioplasty for right direct inguinal hernia

DISCUSSION:

This study provides a comparative analysis of two widely used techniques for inguinal hernia repair: the Laparoscopic Transabdominal Preperitoneal (TAPP) approach and the Liechtenstein open mesh repair. The baseline characteristics of the study participants revealed significant differences between the two groups, particularly in terms of age and gender distribution. The TAPP group had a higher mean age (50.37 years) compared to the Liechtenstein group (40.13 years). Additionally, the predominance of male patients in both groups is consistent with the higher incidence of inguinal hernias in men, a trend well-documented in the literature. These findings are corroborated by Gomes et al. (8), who reported a mean age of 54.6±17 years and a male majority (82.6%), similar to our study. Butters et al. (14) also reported a median age of 53 years for TAPP patients and 56 years for Liechtenstein patients. Furthermore, Wellwood et al. (15) observed a median age of 52.5 years in the laparoscopic group and 51.5 years in the open repair group, with a male preponderance in both groups, aligning with our findings. Sofi et al. (16) reported a mean age of 54.4±13.95 years in the TAPP group and 54.2±11.24 years in the Liechtenstein group, with a majority of male patients in both cohorts.

The operative time was significantly longer ($p<0.0001$) for the TAPP approach (mean duration of 1.31 hours) compared to the Liechtenstein repair (0.81 hours). This difference can

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be attributed to the technical complexity of the TAPP procedure, which involves a laparoscopic approach requiring more meticulous dissection and mesh placement within the preperitoneal space. The longer operative time for TAPP is consistent with previous studies that highlight the steeper learning curve and the need for advanced laparoscopic skills. Gomes et al. (8) similarly reported that the operative time for the laparoscopic technique exceeded 90 minutes in the majority of patients (83.1%), with a significant p-value of 0.047, while the Liechtenstein technique was completed within 90 minutes. Hamza et al. (17) also documented a significantly longer operative time for TAPP (96.12±22.5 minutes) compared to the Liechtenstein repair (34.21±23.5 minutes). Elakkiya and Deepu (18) further reported a significantly longer mean operative time in the TAPP group (121.4±11.23 minutes vs. 89.66±8.03 minutes, $p<0.0001$). In contrast, Abbas et al. (19) found no significant difference in operative time between the two groups.

The analysis of postoperative complications revealed distinct patterns between the two techniques. At seven days post-surgery, the TAPP group exhibited significantly lower rates of pain, cord edema, surgical site infections, and seroma formation compared to the Liechtenstein group. These findings align with the benefits of minimally invasive surgery, which generally offers reduced postoperative pain and lower wound complications due to smaller incisions and less tissue disruption. At one month, while the TAPP group continued to show a lower incidence of most complications, it interestingly had a higher rate of persistent pain compared to the Liechtenstein group. The resolution of most complications by three months in both groups suggests that the initial postoperative period is critical for monitoring and managing complications, with long-term outcomes being relatively favourable for both techniques. Similarly, Gomes et al. (8) reported less pain and earlier mobility among patients who underwent laparoscopic repair compared to those who underwent Liechtenstein repair ($p=0.025$). However, they found no significant relationship between postoperative seroma or surgical site infection and the type of surgery. Abbas et al. (19) reported significantly better outcomes in terms of pain ($p\leq0.017$) in the laparoscopic surgery group, with a higher incidence of seroma in the Liechtenstein group. Anadol et al. (20) also observed that the mean pain score was significantly lower in the TAPP group ($p<0.05$) at 12 and 24 hours postoperatively compared to the open repair group. Hamza et al. (17) similarly reported higher postoperative pain scores in patients undergoing open repair compared to laparoscopic repairs. Köninger et al. (21) noted that 31% of Liechtenstein repair patients experienced chronic pain, compared to only 15% of TAPP surgery patients. Salma et al. (22) found that 53.33% of patients undergoing open hernioplasty experienced severe pain, whereas 63.34% of those undergoing laparoscopic repair experienced only moderate pain, with a mean VAS score of 6.23 in the former group and 4.43 in the latter. Wellwood et al. (15) reported wound infections in 11% of open repair patients and only 3% of TAPP patients within the first three months. Sofi et al. (16) also reported significantly lower pain scores in the TAPP group on days 0, 1, and 7 ($p<0.05$), while wound infection and seroma were the most common complications in the Liechtenstein group. Elakkiya and Deepu (18) reported a significantly higher mean pain score in the Liechtenstein group (2.16±0.62) compared to the TAPP group (1.52±0.59, $p<0.0001$), with surgical site infections and cord edema occurring more frequently in the Liechtenstein group.

Recurrence rates are a crucial outcome measure in hernia surgery, as they directly impact patient quality of life and the need for reoperation. In this study, the TAPP group had a lower recurrence rate at three months (8.3%) compared to the Liechtenstein group (20%), although this difference was not statistically significant ($p = 0.067$). The non-significance could be due to the limited sample size or the short follow-up period, as hernia recurrence may become

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more apparent over a longer duration. Previous studies have shown mixed results regarding recurrence rates between these two techniques, with some suggesting that the laparoscopic approach may offer better long-term outcomes in terms of recurrence. For example, Elakkiya and Deepu (18) reported a higher recurrence rate in the Liechtenstein group (8%). Anadol et al. (20) reported no recurrence in either group over a mean follow-up period of 13.5 months. Similarly, Wellwood et al. (15) observed no recurrence within the first three months in either group. Hamza et al. (17) found recurrence in only one patient who underwent TAPP. Butter et al. (14) reported comparable recurrence rates between the two techniques, while Pokorny et al. (23) documented a 0% recurrence rate in the Liechtenstein group and a 4.7% recurrence rate in the TAPP group.

In our experience, TAPP offers superior patient comfort and outcomes compared to the Liechtenstein method, with significantly lower rates of early postoperative pain, cord edema, surgical site infections, and seroma formation. Its minimally invasive approach results in reduced tissue trauma, faster recovery, and better cosmetic outcomes. Though recurrence rates within three months were slightly lower for TAPP, longer follow-up may further validate its efficacy. While requiring advanced skills and equipment, TAPP's reduced complications and quicker return to daily activities make it a preferable choice for inguinal hernia repair, especially for patients seeking improved postoperative comfort.

CONCLUSION: In conclusion, both the TAPP and Liechtenstein techniques have their respective advantages and drawbacks. The choice of surgical method should be tailored to the individual patient's needs, the surgeon's experience, and the available resources. However, the TAPP technique offers distinct advantages, including reduced postoperative pain, fewer complications such as surgical site infections and seroma formation, and a trend toward lower recurrence rates, making it a preferable option in appropriately selected patients. By considering these factors, surgeons can optimize outcome*s* and minimize the risk of complications and recurrence in patients undergoing inguinal hernia repair.

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