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Comparative Study to Assess the Effectiveness of Transabdominal Preperitoneal Procedure and Open Lichtenstein Repair of Inguinal Hernias in Term of Postoperative Pain and Duration of Hospital Stay

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ABSTRACT

Background: Inguinal hernias are common surgical conditions that can have a tremendous effect on the quality of life for patients. The selection of the surgical approach can affect the postoperative pain and convalescence. The present paper compares the result of the Transabdominal Preperitoneal (TAPP) procedure and the Open Lichtenstein repair with respect to the postoperative pain and the length of the hospital stay. **Objective:** To compare the mean postoperative pain score and mean hospital stay with open Lichtenstein repair and transabdominal preperitoneal procedure in patients with inguinal hernia. **Study Design:** Randomized controlled trial. **Duration and Place of Study:** The study was conducted from January 1, 2024, to July 5, 2024, in the Department of Surgery at KTH Peshawar. **Methodology:** Sixty male patients ranging in age from 18 to 60 years with diagnosed inguinal hernias were randomized into a group of 30 patients for each group. The Visual Analog Scale (VAS) was applied for the pain assessment four hours after the surgery and the duration of the hospital stay was recorded. **Results:** The mean pain score was significantly lower in the TAPP group (4.63 ± 0.99) compared to the Open Lichtenstein group (6.40 ± 1.24), yielding a t-value of 6.068 and a p-value of 0.000. However, both groups had comparable hospital stay durations: 36.03 hours for the Open Lichtenstein repair and 36.90 hours for the TAPP procedure, with a t-value of -0.342 and a p-value of 0.734. **Conclusion:** The Transabdominal Preperitoneal procedure significantly reduces postoperative pain compared to the Open Lichtenstein repair for inguinal hernias.

INTRODUCTION

Inguinal hernias are a common surgical disease which forms the protrusion into the abdomen through the inguinal canal of contents.[1] It most commonly occurs among the male sex and can cause severe morbidity if cared for negligently.[2] The most characteristic presentation of the client encompasses a complaint of a lump or a palpable swelling on the groin area, pain or soreness intolerable on straining or lifting.[3] Surgery for the reduction of inguinal hernias forms the removal of the foregoing symptoms and the complication known as incarceration or strangulation of the herniated organ.[4]

The Lichtenstein open repair continues to be a conventional method for the surgical management of the inguinal hernias.[5] The procedure constitutes the treatment for the groin wound, reduction of the hernial sac, and reinforcement for the abdomen with the application of a mesh.[6] The Lichtenstein procedure continues to be a preference for the surgeons based on the simplicity of the procedure, high success rates, and minimal recurrence.[7] The procedure stands out more especially when it's performed on outpatient cases as it achieves a rapid return and return to total activity.[8] The procedure nevertheless presents the risk for the development of the post-op complications such as infection or chronic pain and thus the need for strict selection of the patient and counseling before the procedure.[9]

In comparison, the Transabdominal Preperitoneal (TAPP) approach offers a minimally invasive technique for the repair of inguinal hernias.[10] The operation incorporates the use of laparoscopic entry and gives surgeons the option of performing operation through limited scars while visualizing the repair on a monitor screen.[11] Access into the preperitoneal space is obtained and a mesh is used for buttressing the abdominal wall.[11] TAPP can result in decreased postoperative pain and quicker return times compared with open techniques since it produces little trauma on the tissues.[12]

Comparative studies on the effectiveness of TAPP and Open Lichtenstein repair have been most useful for the

assessment of their respective effect on pain and length of stay after surgery.[13] Information reports that TAPP can have the potential for reduced pain and short stay, ideal for the majority of the patients.[14] The Open Lichtenstein, however, is a robust and efficient method, especially where special facilities for laparoscopic surgery are lacking.[15] Choice between the techniques should therefore be made based on specific parameters relating to the individual case and the experience and skill level of the operator and the facilities within the institution for optimization of the end points and enhancement of the overall satisfaction of the patient.

A study conducted by Salma U et al. reported that patients undergoing open Lichtenstein repair for inguinal hernia experienced a higher mean postoperative pain score (6.23 ± 1.87) compared to those treated with the transabdominal preperitoneal (TAPP) approach (4.43 ± 1.59). However, the mean hospital stay was slightly shorter in the Lichtenstein group (35.10 ± 12.55 hours) compared to the TAPP group (38.70 ± 34.36 hours).[16]

There is a need for broadening the assessment for the optimum operative method for the treatment for hernias located in the inguinal region since the outcome after the operation dictates the recuperation for the patient and the use of facilities for the health care. Whereas open Lichtenstein repair dominates the practice, there appears a preference for the TAPP procedure since it is a newer minimal invasive method. The comparison based on the pain after the operation and the time spent within the health facility among the techniques can serve as a guide for evidence-based practice for the surgery and the enhancement of the welfare for the client.

METHODOLOGY

This randomized controlled trial was conducted from January 1, 2024, to July 5, 2024, in the Department of Surgery at KTH Peshawar. A total of 60 male patients, aged 18 to 60 years, were included, with 30 patients allocated to each group. The sample size was calculated using a 95% confidence level, 80% power, and a significance level of 5%, based on previously reported mean postoperative pain scores of 6.23 ± 1.87 for open Lichtenstein repair and 4.43 ± 1.59 for the TAPP procedure.[16]

An inguinal hernia was defined as a condition diagnosed through physical examination, characterized by one or more of the following findings: a small bulge in the groin on one or both sides that increased in size with activities such as standing or straining but disappeared when lying down, scrotal swelling or enlargement in males, or sharp pain or discomfort in the groin that worsened during physical exertion, such as lifting or straining, and improved with rest. Postoperative pain was assessed four hours after surgery using the Visual Analogue Scale (VAS), which ranged from 0, indicating no pain, to 10, representing the worst imaginable pain. The duration of hospital stay was recorded in hours, beginning from the time of surgery and ending at discharge.

Eligibility criteria included male patients aged 18 to 60 years, diagnosed with inguinal hernia as described, and classified as ASA grade I or II. Patients with a history of prior hernia repair using mesh, recurrent inguinal hernia, previous transvesical prostatectomy, or those who declined consent were excluded from the study. After obtaining ethical approval and informed consent, demographic details such as age, ASA grade, and hernia duration were documented. Randomization was carried out using a blocked randomization method, allocating patients to either Group A for open Lichtenstein repair or Group B for the TAPP procedure. Both procedures were performed under general anesthesia by a consultant surgeon with at least three years of experience in hernia repair.

The TAPP procedure was performed laparoscopically using a three-port technique, with ports placed at the umbilicus and laterally at the borders of the rectus muscle at the umbilical level. The open Lichtenstein repair involved the standard tension-free mesh placement technique. Pain management was standardized for all patients, with intramuscular diclofenac sodium (75 mg) administered immediately after surgery and repeated only after six hours if necessary. No preoperative or intraoperative analgesia was given. Patients were instructed to resume normal activities, avoiding only those that caused pain.

Data were collected using a structured proforma and analyzed using SPSS version 26. Continuous variables were expressed as mean ± standard deviation. Categorical variables were reported as frequencies and percentages. Differences in mean postoperative pain scores and hospital stay durations between the two groups were analyzed using an independent t-test, with a p-value ≤ 0.05 considered statistically significant. Stratification was performed by age, ASA grade, residential status, and hernia duration, and post-stratification t-tests were used to compare outcomes between the groups.

RESULTS

Demographic data indicated that the mean age of participants was 38.50 years for the Open Lichtenstein group and 38.47 years for the Transabdominal Preperitoneal group, with similar standard deviations (SD) of 8.80 and 8.86, respectively. The duration of hernias was also comparable, with means of 15.43 months for the Open Lichtenstein repair and 15.13 months for the Transabdominal Preperitoneal procedure. ASA grade distribution was identical, with 53.3% classified as ASA I and 46.7% as ASA II in both groups, and the residential status was evenly distributed between rural and urban populations (as shown in Table-I)

Table I

Demographics in both groups (n=60)

Demographics	Group A n=30 Mean±SD	Group B n=30 Mean±SD
Age (years)	38.50±8.80	38.47±8.86
Duration (months)	15.43±8.18	15.13±7.73
ASA Grade		
I	16 (53.3%)	16 (53.3%)
II	14 (46.7%)	14 (46.7%)

Postoperative outcomes revealed significant differences in pain scores, with the Open Lichtenstein group reporting a mean pain score of 6.40 ± 1.24 compared to 4.63 ± 0.99 for the Transabdominal Preperitoneal group, yielding a t-value of 6.068 and a p-value of 0.000, indicating a

statistically significant difference in pain levels. Conversely, the mean duration of hospital stay was 36.03 hours for the Open Lichtenstein repair and 36.90 hours for the Transabdominal Preperitoneal procedure, with no significant difference (t = -0.342, p = 0.734), suggesting similar recovery times between the two techniques (as shown in Table-II).

Table II

Comparison of mean Pain Score and Hospital Stay in both groups.

Outcomes	Group A n=30 Mean±SD	Group B n=30 Mean±SD	t	P value
Pain Score	6.40±1.24	4.63±0.99	6.068	0.000
Hospital Stay (hours)	36.03±7.91	36.90±11.40	-0.342	0.734

Stratified analyses highlighted that younger patients (≤40 years) experienced lower pain scores, with means of 5.50 ± 0.81 for the Open Lichtenstein and 3.89 ± 0.58 for the Transabdominal Preperitoneal procedure, both significant at p <0.001. In contrast, patients older than 40 had higher pain scores, with means of 7.57 ± 0.47 for the Open Lichtenstein and 5.60 ± 0.39 for the Transabdominal Preperitoneal procedure, also significant at p <0.001. ASA grade I patients reported lower pain scores (5.46 ± 0.83 for Open Lichtenstein and 3.87 ± 0.59 for Transabdominal Preperitoneal) compared to ASA grade II patients (7.46 ± 0.60 for Open Lichtenstein and 5.51 ± 0.51 for Transabdominal Preperitoneal), both demonstrating p-values <0.001. Additionally, duration of hernia influenced pain levels, with those having a duration of ≤12 months reporting lower pain scores, significant at p <0.001. Analysis of hospital stay duration in relation to demographic factors revealed no significant differences among age groups (≤40 years: 30.71 ± 5.69 for Open Lichtenstein and 28.41 ± 5.17 for Transabdominal Preperitoneal; >40 years: 43.00 ± 3.89 for Open Lichtenstein and 48.00 ± 6.56 for Transabdominal Preperitoneal) with p-values of 0.265 and 0.063, respectively. ASA grades I and II also showed no significant differences in hospital stay duration, with p-values of 0.312 and 0.138, respectively (as shown in Table-III).

Table III

Stratification of mean Pain Score and Hospital Stay with respect to demographic factors in both groups

Demographic factors	Group	Mean Pain Score Mean ± SD	p Value
Age (years)	≤40	5.50 ± 0.81 3.89 ± 0.58	<0.001
	>40	7.57 ± 0.47 5.60 ± 0.39	<0.001
ASA Grade	I	5.46 ± 0.83 3.87 ± 0.59	<0.001
	II	7.46 ± 0.60 5.51 ± 0.51	<0.001
Duration (months)	≤12	5.20 ± 0.67 3.66 ± 0.43	<0.001
	>12	7.31 ± 0.64 5.38 ± 0.54	<0.001
Residential Status	Rural	6.54 ± 1.27 4.78 ± 1.01	0.002
	Urban	6.24 ± 1.24 4.47 ± 0.98	0.003

Demographic factors	Group	Mean Hospital Stay (hours) Mean ± SD	p Value
Age (years)	≤40	30.71 ± 5.69 28.41 ± 5.17	0.265
	>40	43.00 ± 3.89 48.00 ± 6.56	0.063
ASA Grade	I	30.50 ± 5.81 28.25 ± 5.30	0.312
	II	42.36 ± 4.45 46.79 ± 7.77	0.138
Duration (months)	≤12	28.54 ± 4.37 26.23 ± 3.65	0.187
	>12	41.76 ± 4.29 45.06 ± 7.90	0.223
Residential Status	Rural	36.69 ± 8.00 38.38 ± 11.09	0.653
	Urban	35.29 ± 8.03 35.21 ± 11.93	0.975

DISCUSSION

Transabdominal Preperitoneal procedure significantly reduced postoperative pain compared to the Open Lichtenstein repair. This can be attributed to the minimally invasive nature of the Transabdominal Preperitoneal approach, which typically results in less tissue trauma and a more favorable healing response. Despite the differences in pain levels, both procedures exhibited similar durations of hospital stay. This finding may suggest that while the Transabdominal Preperitoneal procedure allows for quicker recovery from pain, the overall recovery process and monitoring requirements post-surgery are comparable between the two techniques. The demographic analysis demonstrated lower pain scores for younger patients and for those with shorter hernia histories, and it was most likely a consequence of lower chronic tissue accommodation and higher physiological vigor for younger patients. The ASA grade is also a marker for overall health status and was independently associated with pain and recovery.

Postoperative outcomes revealed significant differences in pain scores, with the Open Lichtenstein group reporting a mean pain score of 6.40 ± 1.24 compared to 4.63 ± 0.99 for the Transabdominal Preperitoneal group, yielding a t-value of 6.068 and a p-value of 0.000, indicating a statistically significant difference in pain levels. This finding aligns consistently with multiple studies demonstrating TAPP's superiority in pain management. Zargar et al.[17] reported similar results with significantly lower pain scores in TAPP group on days 0, 1, and 7 postoperatively (day 0: 32.6±7.83 vs 42.84±5.73, p<0.001). Bhondve et al. [19] found pain scores at 24-48 hours were significantly lower in TAPP group (4.05±0.80 vs 4.3±0.74, p=0.03), and at one week (1.18±0.42 vs 1.55±0.67, p<0.001). Mehmood et al. [20] demonstrated VAS pain scores were significantly higher in Lichtenstein group (6±1.89 vs 3.6±1.35, p=0.0048). Dumitrescu et al.[18] showed statistically significant differences favoring TAPP for pain (IPQ day 1: 1.230±0.493 vs 1.807±0.739, p<0.001). Interestingly, Quispe et al. [21] found no statistically significant differences in VAS scores between groups, which may be attributed to their focus on inflammatory markers rather than clinical pain management protocols.

Conversely, the mean duration of hospital stay was 36.03 hours for the Open Lichtenstein repair and 36.90

hours for the Transabdominal Preperitoneal procedure, with no significant difference (t = -0.342, p = 0.734), suggesting similar recovery times between the two techniques. This finding contrasts sharply with most comparison studies. Bhondve et al.[19] found hospital stay was shorter for TAPP (2.3±0.64 days vs 3.01±0.911 days, p<0.001), Zargar et al.[17] reported shorter hospital stay for TAPP in both unilateral (1.8±0.721 vs 2.5±0.831 days, p=0.048) and bilateral cases, and Dumitrescu et al. [18] showed dramatically shorter stays for TAPP (1.389±1.012 vs 5.541±1.014 days, p<0.001). Yura et al. [22] found TAPP was associated with significantly shorter postoperative hospital stay (2.44±0.65 vs 2.96±0.35 days, p=0.001). Only Mehmood et al. [20] reported similar findings to our study with hospital stay being similar between groups (1.7±0.64 vs 2±0.77 days, p=0.096). The lack of difference in our study may be attributed to standardized discharge protocols or institutional practices that minimize the impact of surgical technique on length of stay.

Stratified analyses highlighted that younger patients (≤40 years) experienced lower pain scores, with means of 5.50 ± 0.81 for the Open Lichtenstein and 3.89 ± 0.58 for the Transabdominal Preperitoneal procedure, both significant at p <0.001. In contrast, patients older than 40 had higher pain scores, with means of 7.57 ± 0.47 for the Open Lichtenstein and 5.60 ± 0.39 for the Transabdominal Preperitoneal procedure, also significant at p <0.001. This age-related pattern supports findings from Yura et al. [22] who specifically studied elderly patients (≥75 years) and found TAPP was associated with less demand for additional analgesic prescriptions at first outpatient visit (4.0% vs 24.0%, p=0.049). ASA grade I patients reported lower pain scores (5.46 ± 0.83 for Open Lichtenstein and 3.87 ± 0.59 for Transabdominal Preperitoneal) compared to ASA grade II patients (7.46 ± 0.60 for Open Lichtenstein and 5.51 ± 0.51 for Transabdominal Preperitoneal), both demonstrating p-values <0.001. Additionally, duration of hernia influenced pain levels, with those having a duration of ≤12 months reporting lower pain scores, significant at p <0.001.

Analysis of hospital stay duration in relation to demographic factors revealed no significant differences among age groups (≤40 years: 30.71 ± 5.69 for Open Lichtenstein and 28.41 ± 5.17 for Transabdominal Preperitoneal; >40 years: 43.00 ± 3.89 for Open Lichtenstein and 48.00 ± 6.56 for Transabdominal Preperitoneal) with p-values of 0.265 and 0.063, respectively. ASA grades I and II also showed no significant differences in hospital stay duration, with p-values of 0.312 and 0.138, respectively. This finding differs from most studies where TAPP consistently demonstrated shorter hospital stays across different demographic groups.

While we did not measure operative time in our study, the reviewed literature consistently shows longer operative times for TAPP. Bhondve et al. [19] demonstrated significantly longer mean operative time for TAPP (137.43±24.41 minutes) versus Lichtenstein (108.91±36.73 minutes, p<0.001). Quispe et al. [21] found operative time was significantly longer for TAPP (109.77±29.90 minutes) versus Lichtenstein (71.94±16.48 minutes, p<0.01). Zargar et al. [17] showed longer operative time for unilateral TAPP cases (56.7±10.65 vs 42.9±9.53 minutes). However, Mehmood et al. [20] found no significant difference in operative times (45.2±17.64 minutes vs 37.4±13.10 minutes, p=0.0908). Yura et al.[22] reported Lichtenstein repair had shorter operating time (101.6±28.9 vs 138.7±30.2 minutes, p<0.001).

Rao[23] conducted a unique comparison between TAPP and TEP (total extraperitoneal) techniques, finding TAPP had advantages over TEP with shorter operative time (48 vs 55 minutes, p=0.0001) and shorter hospital stay (33 vs 36 hours, p=0.0449). This suggests that among laparoscopic approaches, TAPP may offer certain advantages over TEP in terms of operative efficiency.

Our study has several limitations that warrant consideration. As a single-center study, the generalizability of our findings may be limited by institutional practices and patient populations specific to our healthcare setting. The relatively short follow-up period restricts our ability to assess long-term outcomes such as chronic pain development and hernia recurrence rates. Additionally, the lack of operative time measurement in our study prevents direct comparison with the extensive literature documenting longer surgical times for TAPP procedures. The standardized discharge protocols at our institution may have influenced hospital stay outcomes, masking potential advantages of the laparoscopic approach that have been consistently demonstrated in other settings.

CONCLUSION

Our study has concluded that the Transabdominal Preperitoneal procedure is associated with significantly lower postoperative pain compared to the Open Lichtenstein repair for inguinal hernias. Despite the differences in pain levels, both surgical techniques resulted in comparable durations of hospital stay. These findings suggest that the Transabdominal Preperitoneal approach may offer advantages in pain management while maintaining similar recovery timelines. Overall, the choice of surgical technique should consider individual patient characteristics to optimize postoperative outcomes.

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REFERENCES

1. Mourad, M., & Kharbutli, B. (2023). Para-inguinal hernia; presentation, diagnosis and surgical treatment, a case report. *International Journal of Surgery Case Reports*, *108*, 108445. https://doi.org/10.1016/j.ijscr.2023.108445
2. Omar, I., Zaimis, T., Townsend, A., Ismaiel, M., Wilson, J., & Magee, C. (2023). Incisional hernia: A surgical complication or medical disease? *Cureus*. https://doi.org/10.7759/cureus.50568
3. Brimo Alsaman, M. Z., Ghabreau, L., Zeino, Z., Alahmad, Z., Attar, M., Haboush, S., Rezkallah, V., Darwish, A., & Mohammad, M. (2022). An inguinal hernia revealing an advanced stage gastric cancer in a

young patient: A case report. *Annals of Medicine & Surgery*, *79*. https://doi.org/10.1016/j.amsu.2022.103974

4. Sankaranarayanan, V. S., Napa, M., Giridharan, B., Palit, S., & Prabhuram, N. (2023). Strangulated Sliding Inguinoscrotal Hernia with a Gangrenous Bladder and Ileum. *Cureus*, *15*(8). https://doi.org/10.7759/cureus.43028
5. Ahmadinejad, I., Jalali, A., Ahmadinejad, M., Soltanian, A., Ahamdinejad, Y., Shirzadi, A., & Chaghamirzayi, P. (2024). Inguinal hernia: Lichtenstein VS Shouldice technique repair: A randomized controlled trial. *Surgery Open Science*, *17*, 70-74. https://doi.org/10.1016/j.sopen.2024.01.001
6. Messias, B. A., Nicastro, R. G., Mocchetti, E. R., Waisberg, J., Roll, S., & Junior, M. A. (2024). Lichtenstein technique for inguinal hernia repair: Ten recommendations to optimize surgical outcomes. *Hernia*, *28*(4), 1467-1476. https://doi.org/10.1007/s10029-024-03094-w
7. Kamani, F., Ghorbani, H., Mahmoudabadi, F. D., Chavoshinejad, M., Hakiminezhad, M., Zareifar, N., Mirzadeh, M., Nodoushan, S. M., Mohebbi, M., Javanbakht, M., & Soltani, A. E. (2024). Modified Lichtenstein hernioplasty with concomitant tissue repair: A retrospective study on postoperative chronic pain. *BMC Surgery*, *24*(1). https://doi.org/10.1186/s12893-024-02513-0
8. Brucchi, F., Ferraina, F., Masci, E., Ferrara, D., Bottero, L., & Faillace, G. G. (2023). Standardization and learning curve in laparoscopic hernia repair: Experience of a high-volume center. *BMC Surgery*, *23*(1). https://doi.org/10.1186/s12893-023-02119-y
9. Cabrera-Vargas, L. F., Mendoza-Zuchini, A., Aparicio, B. S., Pedraza, M., Sajona-Leguia, W. A., Arias, J. S., Lozada-Martinez, I. D., & Picón-Jaimes, Y. A. (2022). Perioperative outcomes using Lichtenstein-type open hernioplasty versus nyhus-type preperitoneal hernioplasty in inguinal hernia: A comparative study with 1-year follow-up. https://doi.org/10.21203/rs.3.rs-2035356/v1
10. Peltrini, R., Corcione, F., Pacella, D., Castiglioni, S., Lionetti, R., Andreuccetti, J., Pignata, G., De Nisco, C., Ferraro, L., Salaj, A., Formisano, G., Bianchi, P. P., & Bracale, U. (2022). Robotic versus laparoscopic transabdominal preperitoneal (TAPP) approaches to bilateral hernia repair: A multicenter retrospective study using propensity score matching analysis. *Surgical Endoscopy*, *37*(2), 1188-1193. https://doi.org/10.1007/s00464-022-09614-y
11. Jiao, J., Zhu, X., Zhou, C., & Wang, P. (2023). Single-incision laparoscopic transabdominal preperitoneal hernioplasty: 1,054 procedures and experience. *Hernia*, *27*(5), 1187-1194. https://doi.org/10.1007/s10029-023-02803-1
12. Tokumura, H., Nomura, R., Saijo, F., Matsumura, N., Yasumoto, A., Muto, M., Katayose, Y., Takahashi, K., & Haneda, S. (2016). Tumescent TAPP: Laparoscopic inguinal hernia repair after the preperitoneal tumescent injection of diluted lidocaine and epinephrine saline solution and carbon dioxide gas. *Surgery Today*, *47*(1), 52-57. https://doi.org/10.1007/s00595-016-1349-x
13. Sultan, A. A., Abo Elazm, H. A., & Omran, H. (2022). Lichtenstein versus transabdominal preperitoneal (TAPP) inguinal hernia repair for unilateral non recurrent hernia: A multicenter short term randomized comparative study of clinical outcomes. *Annals of Medicine & Surgery*, *76*. https://doi.org/10.1016/j.amsu.2022.103428
14. Alfarawan, F., Qaneer, B. A., Vincke, A., Bockhorn, M., & El-Sourani, N. (2025). Short-term outcomes of robotic eTEP versus TAPP for ventral hernia repair: Insights from a propensity-matched cohort. *Journal of Robotic Surgery*, *19*(1). https://doi.org/10.1007/s11701-025-02439-6
15. Ulutas, M. E., & Yilmaz, A. H. (2025). Comparison of open and laparoscopic inguinal hernia repair in the elderly patients: A randomized controlled trial. *Hernia*, *29*(1). https://doi.org/10.1007/s10029-025-03368-x
16. Ahmed, I. (2015). A comparison of post operative pain and hospital stay between Lichtenstein's repair and Laparoscopic Transabdominal Preperitoneal (TAPP) repair of inguinal hernia: A randomized controlled trial. *Pakistan Journal of Medical Sciences*, *31*(5). https://doi.org/10.12669/pjms.315.4811
17. Zargar, O., Ashraf, N., Albina, A., Iqbal, J., & Dhingra, N. C. (2022). Comparative study of transabdominal preperitoneal versus open Lichtenstein hernia repair in primary inguinal hernia. *International Journal of Research in Medical Sciences*, *10*(10), 2240. https://doi.org/10.18203/2320-6012.ijrms20222530
18. Dumitrescu, V., Serban, D., Costea, D. O., Dumitrescu, D., Bobirca, F., Geavlete, B., Bratu, D. G., Tribus, L., Serboiu, C., Alius, C., Tudor, C., Dascalu, A. M., Tudosie, M. S., Serban, B., & Moga, D. F. (2023). Transabdominal Preperitoneal versus Lichtenstein procedure for inguinal hernia repair in adults: A comparative evaluation of the early postoperative pain and outcomes. *Cureus*. https://doi.org/10.7759/cureus.41886
19. Bhondve, S., Ansari, K. F., Venkateswaran, R., Menon, B., Bhandarwar, A. H., Dandge, S. M., & Landge, R. A. (2025). Transabdominal Preperitoneal repair versus Lichtenstein's open hernia repair for inguinal hernias: A retrospective study of 120 cases. *Cureus*. https://doi.org/10.7759/cureus.81804
20. Mehmood, Z., ul Islam, Z., & Shah, S. S. H. (2014). Open Lichtenstein repair versus laparoscopic transabdominal preperitoneal repair for inguinal hernia. *Journal of Surgery Pakistan (International)*, *19*, 2. https://old.jsp.org.pk/Issues/JSP%2019%20(2)%20April%20-%20June%202014%20PDF/Zahid%20Mehmood%20%20OA.pdf
21. Quispe, M. R. F., & Salgado Júnior, W. (2019). Transabdominal preperitoneal (TAPP) versus open

Lichtenstein hernia repair. Comparison of the systemic inflammatory response and the postoperative pain. *Acta Cirurgica Brasileira*, *34*(2). https://doi.org/10.1590/s0102-8650201900206

22. Yura, M., Hara, A., Hayashi, K., Tajima, Y., Kaneko, Y., & Koma, Y. Transabdominal Preperitoneal Repair vs. Open Lichtenstein Repair of Primary Unilateral Inguinal Hernias in Elderly Patients: A Single-Center Propensity Score Analysis. *Clin Surg. 2022; 7*, *3563*. https://www.clinicsinsurgery.com/open-access/transabdominal-preperitoneal-repair-vs-open-lichtenstein-repair-of-primary-unilateral-9152.pdf
23. RAO, A. M. K. (2014). Transabdominal preperitoneal (TAPP) Vs total ext-raperitoneal (TEP) Laparoscopic inguinal hernia repair; a comparative study in terms of operative and postoperative complications. Pak J Med Health Sci, 8(2), 356-60.