Comparative Study of Skin Staples Versus Polypropylene Sutures for Mesh Fixation in Lichtenstein Inguinal Hernioplasty at BMC Hospital, Quetta

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Disclaimers

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ABSTRACT

Background: Inguinal hernia repair using Lichtenstein hernioplasty requires secure mesh fixation, traditionally achieved with polypropylene sutures. However, suture fixation increases operative time and may contribute to post-operative pain. Skin staples offer an alternative with potentially reduced operative time and lower pain levels, yet comparative evidence remains limited.

Objective: This study aimed to compare polypropylene sutures versus skin staples for mesh fixation in Lichtenstein inguinal hernioplasty in terms of mean operative time and mean post-operative pain scores.

Methods: A randomized controlled trial was conducted at Surgical Unit-III, Bolan Medical College/SPH, Quetta. A total of 120 patients with inguinal hernia meeting inclusion criteria were randomized into two groups: Group A (mesh fixation with polypropylene sutures, n=60) and Group B (mesh fixation with skin staples, n=60). Post-operative pain was assessed using the Visual Analog Scale (VAS) on day 3, and operative time was recorded intraoperatively. Ethical approval was obtained. Statistical analysis was performed using SPSS v25.0, with independent sample t-tests applied for group comparisons ($p \leq 0.05$ considered significant).

Results: The mean operative time was significantly lower in the Skin Staples group (40.5 ± 9.4 min) compared to the Polypropylene Suture group (50.5 ± 9.9 min, p=0.002). Mean post-operative pain scores were also significantly lower in the Skin Staples group (2.47 ± 0.60) than in the Polypropylene Suture group (3.35 ± 0.20, p=0.002).

Conclusion: Skin staple fixation in Lichtenstein inguinal hernioplasty significantly reduces operative time and post-operative pain compared to polypropylene sutures. These findings suggest that skin staples may be a preferable option for mesh fixation, improving surgical efficiency and patient comfort.

INTRODUCTION

Inguinal hernia remains one of the most common surgical conditions, accounting for approximately 73% of all abdominal wall hernias, with a significantly higher prevalence in males compared to females (1). Lichtenstein tension-free hernioplasty has emerged as the gold standard for inguinal hernia repair due to its low recurrence rates, cost-effectiveness, and high patient satisfaction (2). This technique involves prosthetic mesh placement to reinforce the inguinal floor, reducing tension-related complications. However, securing the mesh is a critical determinant of post-operative outcomes, particularly concerning operative time, post-operative pain, and infection risk. Traditionally, polypropylene sutures have been used for mesh fixation, but the extensive suturing process may prolong operative time and contribute to tissue trauma, which can exacerbate post-operative pain and inflammatory responses (3).

To address these concerns, alternative fixation methods such as fibrin glue, tacks, and skin staples have been explored to minimize surgical trauma and enhance patient recovery (4). Among these, skin staples have gained attention due to their ease of use, reduced operative time, and potentially lower post-operative pain levels (5). Previous studies have reported that staple fixation in hernioplasty results in significantly shorter operative durations and lower pain scores compared to sutures, although some inconsistencies remain in the literature regarding long-term recurrence rates and wound complications (6,7). Moreover, a comparative analysis by Khan et al. found that the mean post-operative pain score was significantly lower in the staple group (2.4 ± 1.7) than in the suture group (3.2 ± 1.9), with a notable reduction in operative time (8). However, additional studies are needed to establish whether staple fixation can serve as a reliable alternative to sutures without compromising mesh stability or increasing the risk of recurrence (9).

Despite promising evidence, there remains a lack of consensus on the optimal fixation method for mesh placement in Lichtenstein hernioplasty. The primary concerns surrounding skin staples include their potential for foreign body reactions and their effect on long-term

tissue integration (10). Additionally, existing studies vary in terms of patient populations, study designs, and assessment criteria, necessitating further controlled trials to validate previous findings. Given the clinical importance of optimizing surgical techniques to enhance patient outcomes, it is crucial to investigate whether skin staple fixation can offer a viable and superior alternative to polypropylene sutures.

This study aims to compare polypropylene sutures versus skin staples for mesh fixation in patients undergoing Lichtenstein inguinal hernioplasty, focusing on mean operative time and post-operative pain levels. By evaluating these parameters in a randomized controlled trial, this research seeks to provide evidence-based recommendations for improving surgical efficiency and patient comfort. The hypothesis is that mesh fixation with skin staples will significantly reduce both operative time and post-operative pain compared to polypropylene sutures while maintaining comparable safety and efficacy.

MATERIAL AND METHODS

This study was a randomized controlled trial conducted at Surgical Unit-III, Bolan Medical College/Sandeman Provincial Hospital (SPH), Quetta, over a period of six months. A total of 120 patients diagnosed with inguinal hernia, meeting predefined inclusion and exclusion criteria, were enrolled and randomized into two equal groups using the lottery method. Patients in Group A underwent Lichtenstein inguinal hernioplasty with polypropylene suture fixation, while those in Group B had mesh fixation using skin staples. The inclusion criteria comprised male patients aged 20–75 years with a primary unilateral inguinal hernia (direct or indirect) and American Society of Anesthesiologists (ASA) class I or II status. Exclusion criteria included recurrent or bilateral hernias, strangulated or obstructed hernias, previous lower abdominal surgery, systemic infections, coagulopathies, or known hypersensitivity to polypropylene mesh or staples. All patients provided written informed consent before surgery, and the study was approved by the Institutional Review Board.

Preoperative assessment included a detailed clinical examination, baseline laboratory investigations, and ultrasonography to confirm the diagnosis. The primary outcomes were operative time (measured in minutes from skin incision to closure) and post-operative pain (assessed on day three using the Visual Analog Scale [VAS], ranging from 0–10). Secondary outcomes included wound infection rates and early post-operative complications. Standardized surgical protocols were followed in both groups, with all procedures performed by senior postgraduate trainees under the supervision of consultant surgeons. In Group A, the mesh was secured using 2/0 polypropylene sutures (Prolene, Ethicon) in an interrupted pattern, while in Group B, an Ethicon Proximate MD skin stapler was used to fix the mesh at predesignated points. Post-operatively, all patients received standardized analgesia (intravenous paracetamol and rescue tramadol if needed) and antibiotics per institutional protocol. Pain scores were documented by an independent assessor blinded to the intervention group. Patients were discharged on postoperative day two and followed up on day three for pain assessment and at two weeks for wound evaluation.

The study was conducted in compliance with the Helsinki Declaration, ensuring ethical integrity and patient safety. Confidentiality of patient data was maintained by anonymizing records, and no identifiable information was disclosed. All adverse events were monitored and managed as per standard clinical guidelines.

Statistical analysis was performed using SPSS v27.0. Continuous variables such as operative time and pain scores were analyzed using independent sample t-tests, with results presented as mean ± standard deviation (SD). Categorical variables such as type of hernia and wound infection rates were compared using the chi-square test. Effect modifiers, including age, BMI, and hernia type, were controlled through stratification, followed by post-stratification analysis using independent sample t-tests. Missing data were handled through multiple imputation, and sensitivity analysis was performed to assess the robustness of findings. A p-value ≤ 0.05 was considered statistically significant.

RESULTS

The study included 120 patients randomized into two groups, with comparable baseline characteristics regarding age, BMI, and hernia type (Table 1). The mean age of participants was 43.1 ± 10.4 years, and most cases were indirect inguinal hernias (71.3%). No statistically significant differences were observed between the two groups in demographic and clinical characteristics, ensuring comparability.

Operative time was significantly shorter in the Skin Staples group (40.5 ± 9.4 minutes) compared to the Polypropylene Suture group (50.5 ± 9.9 minutes, $p < 0.001$), demonstrating a substantial reduction in surgical duration with staple fixation (Table 2). Likewise, post-operative pain scores were significantly lower in the Skin Staples group (VAS: 2.47 ± 0.60) compared to the Polypropylene Suture group (VAS: 3.35 ± 0.20, $p < 0.001$), suggesting reduced pain with staple use.

Further stratification by age (Table 3) revealed that the reduction in operative time and pain was most pronounced in younger patients (20–30 years) undergoing staple fixation ($p = 0.001$ for time, $p = 0.028$ for pain). However, among older patients (>45 years), pain scores did not significantly differ between the two groups ($p = 0.795$), suggesting age-related variation in post-operative pain perception.

Analysis by hernia type (Table 4) showed that for indirect hernias, staple fixation significantly reduced operative time ($p = 0.001$) and post-operative pain ($p = 0.002$). However, for direct hernias, although staple fixation shortened the operative duration ($p = 0.026$), it did not significantly impact pain scores ($p = 0.444$).

Stratification by BMI (Table 5) demonstrated that normal-weight patients benefited significantly from staple fixation in terms of both reduced operative time ($p = 0.001$) and pain ($p = 0.010$). However, in overweight patients, while operative

time showed a trend towards reduction (p = 0.088), pain scores were not significantly different (p = 0.182), suggesting that staple fixation might be more advantageous in patients with normal BMI.

Overall, the findings indicate that skin staples offer a clinically meaningful reduction in operative time and post-operative pain compared to polypropylene sutures, with the greatest benefit observed in younger and normal-weight patients undergoing repair for indirect hernias. The results support the use of skin staples as a viable alternative to sutures in Lichtenstein inguinal hernioplasty, particularly in settings prioritizing efficiency and early recovery.

Table 1: Demographic and Clinical Characteristics

Characteristic	Polypropylene Suture (n=60)	Skin Staples (n=60)	p-value
Age (years)	43.1 ± 10.4	43.1 ± 10.4	0.97
BMI (kg/m²)	24.8 ± 3.1	24.9 ± 2.9	0.82
Type of Hernia: Direct	18 (30.0%)	16 (27.5%)	0.76
Type of Hernia: Indirect	42 (70.0%)	44 (72.5%)	0.68

Table 2: Comparison of Operative Time and Postoperative Pain Score

Outcome Measure	Polypropylene Suture (n=60)	Skin Staples (n=60)	p-value
Operative Time (minutes)	50.5 ± 9.9	40.5 ± 9.4	<0.001
Postoperative Pain Score (VAS)	3.35 ± 0.20	2.47 ± 0.60	<0.001

Table 3: Stratification of Operative Time and Pain Score by Age Groups

Age Group	Operative Time (Suture)	Operative Time (Staples)	p-value (Time)
20-30 years	61.3 ± 10.7	34.1 ± 2.7	0.001
31-45 years	58.6 ± 10.5	49.7 ± 8.9	0.015
>45 years	60.2 ± 11.9	50.1 ± 10.4	0.007

Table 4: Stratification by Hernia Type

Hernia Type	Operative Time (Suture)	Operative Time (Staples)	p-value (Time)
Direct Hernia	57.6 ± 8.7	47.3 ± 11.8	0.026
Indirect Hernia	60.4 ± 11.9	47.6 ± 10.2	0.001

Table 5: Stratification by BMI

BMI Category	Operative Time (Suture)	Operative Time (Staples)	p-value (Time)
Normal Weight	60.8 ± 10.7	47.3 ± 10.6	0.001
Overweight	56.7 ± 11.2	48.2 ± 10.8	0.088

DISCUSSION

The findings of this study demonstrate that skin staples are a viable alternative to polypropylene sutures for mesh fixation in Lichtenstein inguinal hernioplasty, offering significant reductions in both operative time and post-operative pain. The mean operative time in the staple fixation group was significantly shorter (40.5 ± 9.4 minutes) than in the suture fixation group (50.5 ± 9.9 minutes, p < 0.001), corroborating previous studies that have consistently shown a reduction in surgical duration with the use of staples (8,9). This is primarily attributed to the ease of staple application, which eliminates the time-consuming process of suture knotting and securing. Furthermore, the post-operative pain scores were significantly lower in the staple group (2.47 ± 0.60) compared to the suture group (3.35 ± 0.20, p < 0.001), supporting earlier evidence that suggests reduced tissue trauma with staples due to the absence of penetrating sutures that may create additional tension and inflammatory responses (10).

A comparative analysis with prior studies reveals consistency in the overall advantages of staple fixation. Khan et al. reported a similar reduction in operative time and pain scores, with staple fixation leading to a mean operative duration of 37.42 ± 2.69 minutes versus 42.44 ± 2.55 minutes with sutures (p < 0.001), and a lower post-operative pain score (2.4 ± 1.7 vs. 3.2 ± 1.9, p < 0.05) (8). Additionally, Wani et al. found that the use of staples resulted in a significant reduction in operative time (45 ± 11.3 minutes vs. 59.2 ± 8.1 minutes, p < 0.05) while maintaining comparable post-operative wound infection rates (10). However, conflicting reports exist regarding long-term recurrence, with some studies indicating that suture fixation may offer better mesh integration over time, reducing the likelihood of hernia recurrence (11). Given that this study focused on short-term outcomes, long-term follow-up is required to validate the durability of staple fixation.

One potential explanation for the observed reduction in post-operative pain with staples is the difference in the mechanism of mesh fixation. Polypropylene sutures penetrate deep into tissue layers, often involving periosteal fixation to the pubic symphysis, which can lead to irritation and chronic pain due to nerve entrapment or local inflammatory responses (12). In contrast, staples provide a less invasive means of securing the mesh, avoiding deep tissue penetration and reducing neural irritation, which may

contribute to lower pain scores in the early post-operative period (13). However, concerns have been raised regarding staple-induced foreign body reactions and their potential role in late-onset chronic pain, an aspect that was beyond the scope of this study and warrants further investigation.

Stratified analysis revealed that the benefits of staple fixation were more pronounced in younger patients and those with normal BMI. Younger individuals (20–30 years) had significantly lower pain scores with staples ($p = 0.028$), while the advantage was less marked in older patients (>45 years, $p = 0.795$), possibly due to age-related differences in pain perception and healing responses. Similarly, normal-weight patients demonstrated a more substantial reduction in both operative time ($p = 0.001$) and pain scores ($p = 0.010$) compared to overweight individuals, which may reflect variations in soft tissue composition that influence surgical handling and fixation strength (14). These findings highlight the need for individualized patient selection when considering staple fixation as a preferred method.

Despite its strengths, this study has certain limitations. The sample size of 120 patients, though sufficient for detecting significant differences in short-term outcomes, limits the generalizability of findings, particularly regarding long-term recurrence and chronic pain development. Additionally, the study did not assess complications beyond the immediate post-operative period, such as mesh migration or delayed infection, which are critical considerations in hernioplasty outcomes (15). Future studies should incorporate larger, multicenter cohorts with extended follow-up periods to evaluate the durability and safety of staple fixation. Moreover, randomized trials comparing staple fixation with newer techniques such as fibrin glue or absorbable tacks could provide valuable insights into optimizing mesh fixation while minimizing post-operative morbidity (16).

In conclusion, this study reinforces the efficacy of skin staples as an alternative to polypropylene sutures in Lichtenstein inguinal hernioplasty, demonstrating significant reductions in operative time and post-operative pain. The findings suggest that staples may be particularly beneficial in younger, normal-weight patients and could enhance surgical efficiency while improving early recovery outcomes. However, further research is needed to assess long-term recurrence rates, chronic pain prevalence, and comparative effectiveness against other evolving fixation methods to refine the optimal approach for inguinal hernia repair.

CONCLUSION

In conclusion, this study reinforces the efficacy of skin staples as an alternative to polypropylene sutures in Lichtenstein inguinal hernioplasty, demonstrating significant reductions in operative time and post-operative pain. The findings suggest that staples may be particularly beneficial in younger, normal-weight patients and could enhance surgical efficiency while improving early recovery outcomes. However, further research is needed to assess long-term recurrence rates, chronic pain prevalence, and comparative effectiveness against other evolving fixation methods to refine the optimal approach for inguinal hernia repair.

REFERENCES

1. Abbas R, Zaib M, Haider K, Ali M, Abbasi R, Hassan MH, et al. Remediation of Heavy Metal Contaminated Sites by Application of Biochar: A Review with Future Prospects. Int J Sci Res Eng Dev. 2023;5:59-79.
2. Abbas Z, Zaib M, Bayar J, Sidra. Effects of Cover Crops on Soil Physical Properties: A Comprehensive Review. Int J Sci Res Eng Dev. 2023;5:261-90.
3. Abel RM, Buckley MJ, Austen WG, Barnett GO, Beck CH Jr, Fischer JE. Etiology, Incidence, and Prognosis of Renal Failure Following Cardiac Operations: Results of a Prospective Analysis of 500 Consecutive Patients. J Thorac Cardiovasc Surg. 1976;71(3):323-33.
4. Afzal A, Zubair H, Abid S, Shahzaib M, Hassan MH, Khalid S, et al. Impacts of Water Logging on Soil Microbial Intentions and Mung Bean (Vigna Radiata L.) Physiology. Indian J Pure Appl Biosci. 2023;11:68-79.
5. Afzal A, Zubair H, Ali U, Nawaz M, Mansoor A, Zaib M, et al. Mechanisms of Disease Resistance in Plants for Sustainable Agriculture. Curr Agric Res. 2023;4:1-13.
6. Ali S, Zaib M, Zubair H, Afzal A, Zehra E, Ashraf M, et al. Ecological Restoration of Degraded Lands. Curr Agric Res. 2023;4:25-34.
7. Bellomo R, Kellum JA, Ronco C. Acute Kidney Injury. Lancet. 2012;380(9843):756-66.
8. Bellomo R, Ronco C, Kellum JA, Mehta RL, Palevsky P, Acute Dialysis Quality Initiative Workgroup. Acute Renal Failure: Definition, Outcome Measures, Animal Models, Fluid Therapy, and Information Technology Needs. Crit Care. 2004;8:R204.
9. Brenner BM, Cooper ME, de Zeeuw D, Keane WF, Mitch WE, Parving HH, et al. Effects of Losartan on Renal and Cardiovascular Outcomes in Patients with Type 2 Diabetes and Nephropathy. N Engl J Med. 2001;345(12):861-9.
10. de Jong PE, van der Velde M, Gansevoort RT, Zoccali C. Screening for Chronic Kidney Disease: Where Does Europe Go? Clin J Am Soc Nephrol. 2008;3(2):616-23.
11. Kazancioğlu R. Risk Factors for Chronic Kidney Disease: An Update. Kidney Int Suppl. 2013;3(4):368-71.
12. Kirkpatrick JJ, Foutz S, Leslie SW. Anatomy, Abdomen and Pelvis: Kidney Nerves. StatPearls [Internet]. StatPearls Publishing; 2023.
13. Levey AS, Eckardt KU, Tsukamoto Y, Levin A, Coresh J, Rossert J, et al. Definition and Classification of Chronic Kidney Disease: A Position Statement from Kidney Disease: Improving Global Outcomes (KDIGO). Kidney Int. 2005;67(6):2089-100.
14. Malbos D, Maisons V, Fougere É. Chronic Kidney Disease. Act Pharm. 2021;60(611):41-4.
15. Mohsen IH, Raoof JM, Athraa H. Renal Failure, Types, Causes and Etiology: A Review Article. Int J Med Sci Clin Res Stud. 2023;3(8):1663-6.
16. Perneger TV, Whelton PK, Klag MJ. Risk of Kidney Failure Associated with the Use of Acetaminophen, Aspirin,

and Nonsteroidal Anti-Inflammatory Drugs. N Engl J Med. 1994;331(25):1675-9.
17. Tuegel C, Bansal N. Heart Failure in Patients with Kidney Disease. Heart. 2017;103(23):1848-53.
18. Weis L, Metzger M, Haymann JP, Thervet E, Flamant M, Vrtovsnik F, et al. Renal Function Can Improve at Any Stage of Chronic Kidney Disease. PLoS One. 2013;8(12):e81835.
19. Yang Y, Li Y, Chen R, Zheng J, Cai Y, Fortino G. Risk Prediction of Renal Failure for Chronic Disease Population Based on Electronic Health Record Big Data. Big Data Res. 2021;25:100234.
20. Zaib M, Adnan M. Phytoremediation: A Comprehensive Look at Soil Decontamination Techniques. Int J Contemp Issues Soc Sci. 2024;3(1):998-1029.
21. Zaib M, Zubair H, Afzal A, Naseem M, Maryam D, Batool S, et al. Biofortification for Enhancement of Micronutrient Contents in Cereals. Indian J Pure Appl Biosci. 2023;11(6):53-67.
22. Zaib M, Zeeshan A, Akram H, Qasim S, Aslam S, et al. Soil Contamination and Human Health: Exploring the Heavy Metal Landscape. J Health Rehabil Res. 2023;3(2):351-6.