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To Compare Outcomes of Stainless Steel Skin Staples and Polypropylene Sutures for Mesh Anchoring in Lichtenstein Tension Free Inguinal Hernia Repair

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ABSTRACT

OBJECTIVE: This study aimed to compare the outcome of Lichtenstein inguinal hernia repair using stainless steel staples versus polypropylene sutures for mesh anchorage.

METHODOLOGY: A Prospective analytical study was conducted at the Surgical Department Lady Reading Hospital, Peshawar, from June to December 2022. Consecutive non-probability sampling was used to assess a total of 100 cases (50 undergoing repair by each method). The study included primary unilateral inguinal hernia cases aged 20 to 70 years. Patients with complicated inguinal hernia, chronic ailments, BMI > 30, or immunocompromised state were excluded to avoid confounders. Outcome was assessed in terms of operative time, postoperative pain, and surgical site infection.

RESULTS: Surgical site infections (SSI) were noted in 6% cases of Group A and 16% cases of Group B (with p-value = 0.11). The only parameter that showed a statistically significant difference between the two groups was operative time (Group A: 36.63 ± 3.14 minutes, Group B: 45.68 ± 2.69 minutes, p-value <0.001)**.** The differences in postoperative pain between the two groups were not statistically significant (p-value of 0.47).

CONCLUSION: Both techniques provide excellent results. However, mesh anchoring using stainless steel staples takes less time than the polypropylene anchoring, which can have essential implications in postoperative recovery.

KEYWORDS: Abdominal hernia, direct inguinal hernia, indirect inguinal hernia, inguinal canal, suture, suture technique, polypropylene.

INTRODUCTION

When abdominal tissues push through a weak place in the abdominal wall, a hernia results. Inguinal hernias are the most prevalent kind among adults, making up 80% of all cases and affecting men around 20 times more frequently than women[1] ideally, surgery is employed as a preventative strategy. Although there are several surgical options, minimally invasive laparoscopic techniques are becoming more and more popular. The Lichtenstein method, which was first created in 1986, remains the most widely used open technique.[2,3] Because it utilizes a tension-free mesh placement, it minimizes postoperative issues such as hernia recurrence and pain caused by suture tension.[4]

Lichtenstein repair is less time-consuming and requires lower surgical skills. It can also be performed under local anesthesia, making it suitable for high-risk patients. However, this method has been associated with more chronic pain and a longer recovery time compared to other techniques. The procedure involves reducing the hernia sac contents and reinforcing the posterior wall of the inguinal canal using polypropylene sutures.[3,5] The leading cause of inguinal hernia recurrence is the tension along the suture line, caused by stitching tissues that are not generally in apposition.[6] This tension and the needle holes from sutures damage the tissues. Recent trials have explored using stainless steel skin staples instead of polypropylene sutures to secure the mesh, which has shown benefits such as reduced operating time and lower risk of wound infection.[7] Since both these materials and their respective techniques have their pros and cons, a detailed knowledge of each is necessary to help devise the best treatment options in individualized settings.

A study reported that the mean operative time was shorter in the stainless steel staples group compared to the polypropylene suture group. Additionally, the incidence of urinary retention and wound infection was lower in the staples group. Postoperative pain was also lower in the staples group compared to the sutures group.[8]

This study aimed to compare the outcome of Lichtenstein inguinal hernia repair using stainless steel staples versus polypropylene sutures for mesh anchorage. Hernia repair is a standard procedure, and finding the best strategy to minimize complications like chronic pain and wound infection is crucial. The results of this study will be shared with local surgeons. If the outcomes favor stainless steel staples, further large-scale trials will be recommended to evaluate their routine use in hernia repair.

METHODOLOGY

A prospective analytical study was conducted at the Surgical Department of the Lady Reading Hospital, Peshawar, following approval from the hospital's ethical committee. The study was conducted from June to December 2022. The WHO calculator was used to determine a sample size of 50 for each group, with 24% wound infection in the prolene suture group and 4% in the stainless-steel staples group.[8] The calculation applied a 95% confidence level and 80% power of the test.[8] Consecutive non-probability sampling was used to include patients with primary unilateral inguinal hernia, aged 20 to 70 years.

Patients with complicated inguinal hernia (obstructed, strangulated or recurrent hernia), chronic ailments (like chronic liver, renal or cardiac impairment), a Body Mass Index (BMI) > 30, or immunocompromised state (such as diabetes mellitus, malignancy, HIV/AIDS or taking immunosuppressant as steroids, etc.) were excluded to avoid confounders. Inguinal hernia was defined as a visible groin bulge, diagnosed by a senior consultant. Informed consent was obtained from all eligible patients, who then underwent Lichtenstein repair. The operating consultant surgeon decided to use stainless steel or polypropylene; both techniques were used, utilizing an open approach.

The Lichtenstein repair is a standard open surgical technique for inguinal hernia that involves placing a tension-free polypropylene mesh over the posterior wall of the inguinal canal after reduction or excision of the hernia sac. The mesh is slit laterally to accommodate the spermatic cord and then fixed either with Prolene sutures or surgical skin staples. Prolene sutures offer strong anchoring through non-absorbable fixation to the inguinal ligament and internal oblique aponeurosis, while skin staples provide a faster alternative with minimal tissue handling. The repairs were performed by an experienced general surgeon, with a single dose of antibiotic given one hour before surgery. Operative time was measured using a stopwatch: starting from the commencement of skin incision to the application of the last skin-stitch. Patients in whom stainless steel staples were applied constituted Group A, while those in whom polypropylene was used were put in Group B. Outcome was assessed in terms of operative time, postoperative pain, and surgical site infection. Pain was measured on a visual analogue scale on the 7th postoperative day, as it is the last day that signifies early postoperative pain (defined as pain caused by surgical trauma and it extends from 0 to the 7th postoperative day). Surgical site infection was monitored for 30 days post-surgery based on redness, swelling, discharge, and fever; supported by culture if needed. The 30th postoperative day was considered, as it signifies early SSI, i.e., the infection that appears within the first month and is caused by intraoperative contamination or early postoperative wound breakage.

Statistical analysis: The data were entered and analyzed using SPSS 23. Frequencies and percentages were calculated for categorical variables such as gender and outcomes (wound infection and pain). Mean ± SD was calculated for numerical variables like age and operative time. Categorical variables (wound infection and pain categories) were compared between the groups using the chi-square test, with a p-value of < 0.05 considered significant. Continuous variables like operative time were compared between the groups using an independent sample T-test, where a p-value of < 0.05 was considered significant. Age, BMI, and gender stratified outcomes in both groups to identify effect modifiers, using the chi-square test with a p-value of < 0.05 deemed significant.

RESULTS

The study compared two groups. Group A had an average age of 48.51 years (SD 9.97), and Group B had an average age of 49.92 years (SD 8.96), with no significant difference (p-value 0.45). Gender distribution was also similar: with Group A having 94% males and Group B having 96% males (p-value 1.00). Regarding BMI distribution, 74% of Group A and 62% of Group B had a BMI ≤ 25 kg/m², showing no significant difference (p-value 0.19): **Table I**.

Surgical site infections (SSIs) were slightly lower in the stainless steel group (group A). SSI on 1-month follow-up was noted in 6% cases of Group A and 16% cases of Group B (p-value 0.11). The only parameter that showed a statistically significant difference between the two groups was operative time. Group A had a significantly shorter operative time (36.63 minutes, SD 3.14) compared to Group B (45.68 minutes, SD 2.69) with a p-value < 0.001 **(Table II).**

The bar chart **(Figure 1)** compares postoperative pain in the two groups: Group A (Stainless Steel) and Group B (Polypropylene). Group A had 21 individuals with no pain, 15 with mild pain, 14 with moderate pain, and 3 with severe pain. Group B had 14 individuals with no pain, 21 with mild pain, 14 with moderate pain, and 3 with severe pain. The differences in postoperative pain between the two groups were not statistically significant, with a p-value of 0.47.

Table I: Comparison of the two study cohorts in terms of pre-operative variables

Variable	Group A	Group B	Chi-square/t-value*	p-value
Age (years)	48.51 ± 9.97	49.92 ± 8.96	-0.74	0.45
Gender (male: female)	47(94%): 03(6%)	48(96%): 02(4%)	0.21	1.00
BMI (≤ 25 kg/m^2: > 25 kg/m^2)	37(74%): 13(26%)	31(62%): 19(38%)	1.65	0.19

Table II: Comparison of outcomes of the two surgical cohorts

Variable	Group A	Group B	Chi-square/t-value*	p-value
Surgical site infection (no: yes)	47(94%): 03(06%)	42(84%): 08(16%)	2.55	0.11
Mean operative time (min)	36.63± 3.14	45.68± 2.69	-15.43	**<0.001**

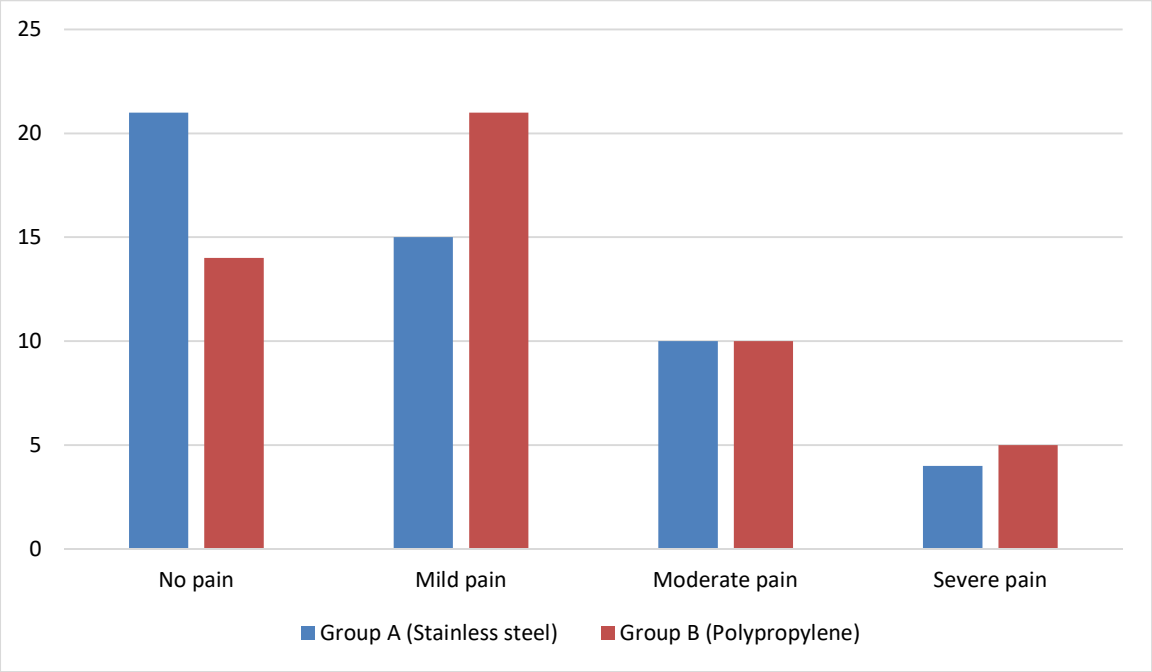

Figure I: Comparison of the two groups in terms of postoperative pain (p=0.47)

DISCUSSION

Surgical repair of hernia is one of the most commonly performed elective surgeries in general surgery and is among the procedures that have been done for decades. Hence, several techniques have been described, and an ongoing analysis of the pros and cons of each is being carried out worldwide. Among the inguinal hernia repair techniques, the Lichtenstein method is the most commonly performed one and has been performed using polypropylene and stainless steel fixation techniques.[6] Thus, we studied and compared both the surgical techniques.

The study compared two groups. Group A had an average age of 48.51 years (SD 9.97), and Group B had an average age of 49.92 years (SD 8.96), with no significant difference (p-value=0.45). Gender distribution was also similar, with Group A having 94% males and Group B having 96% males (p-value 1.00). For BMI, 74% of Group A and 62% of Group B had a BMI ≤ 25 kg/m², showing no significant difference (p-value 0.19). Surgical site infections (SSIs) were slightly lower in the stainless steel group (group A). SSI on 1-month follow-up was noted in 6% cases of Group A and 16% cases of Group B (p-value 0.11). The only parameter that showed a statistically significant difference between the two groups was operative time. Group A had a significantly shorter operative time (36.63 minutes, SD 3.14) compared to Group B (45.68 minutes, SD 2.69), with a p-value < 0.001. Group A in this study had 21 individuals with no pain, 15 with mild pain, 14 with moderate pain, and 3 with severe pain. Group B had 14 individuals with no pain, 21 with mild pain, 14 with moderate pain, and 3 with severe pain. The differences in postoperative pain between the two groups were not statistically significant: p-value was 0.47. The mean operative time in the staples group is lower, probably because it's easier to put in ready-to-use staples. However, since dissection and closure are the same irrespective of the technique, postoperative pain is comparable between the two groups.

A study by Munghate A 2014[8] found that the mean operative time was 74.0 (16.2) minutes for the polypropylene suture group, compared to 62.0 (14.4) minutes for the stainless steel staples group. Urinary retention rates were 8% and 12%, and wound infection rates were 24% and 4% for the suture and staples groups, respectively. Securing mesh with skin staples resulted in shorter operating time and less postoperative pain compared to polypropylene sutures in Lichtenstein inguinal hernioplasty.[8] These findings are similar to ours; that is mesh anchorage with stainless steel suture takes less time than the prolene anchorage. This would inadvertently result in a better postoperative outcome. Similarly, Khan AA et al.[9] studied 266 patients, examining age, operating time, and pain. The mean age was 48.99 ± 14.27 years in the polypropylene group and 46.37 ± 14.12 years in the staple group. The mean total operating time was 42.44 ± 2.55 minutes for the polypropylene group and 37.44 ± 2.69 minutes for the staple group ($p < 0.001$).[9] Hence, the board data is suggestive of lower operative time when stainless steel staples are used to anchor the hernia sac occlusive mesh. The lower operative time in mesh anchorage by stainless steel staples can be attributed to the ease of this technique. The resultant lesser operative time helps in multiple ways, such as less exposure of the open wound to a bacteria-laden environment and less bleeding. Both these decrease not only the postoperative infection rate but also lower morbidity rates by ensuring lesser anesthesia time and associated complications like deep venous thrombosis and pressure effects.

Damani SAR 2016[10] reported that on the 7th postoperative day, 37.5% of the stapled group had no pain, 46.8% had mild pain, 12.5% had moderate pain, and 3.1% had severe pain. For the polypropylene suture group, these figures were 31.25%, 43.7%, 15.6%, and 9.37%, respectively. These findings concur with our results, where the difference in perceived postoperative pain was not significantly different between the two groups. However, Khan AA et al. [9] inferred that on the 3rd postoperative day, pain levels in the polypropylene group were 23.3% with no pain, 51.1% with mild pain, 13.5% with moderate pain, and

12.0% with severe pain. In the staple group, 29.3% had no pain, 59.4% had mild pain, 6.8% had moderate pain, and 4.5% had severe pain (p = 0.026). Hence, variability exists among the inferences made regarding postoperative pain, and it could be because of the difference of the postoperative period when the readings were taken. However, the shorter operative time in stainless steel suture anchorage may be a cause of lower postoperative pain in this surgical cohort. But to confirm this association of operative time with postoperative outcome, further research is required, especially higher-level evidence, such as systematic reviews and meta-analyses.

Study limitations

The study analyzed a limited number of cases operated at a single setup. These limitations decrease the generalization of the inferences. However, uni-centric data collection reduces the bias caused by variability in surgical technique and postoperative rehabilitation protocols. Nonetheless, multicenter randomized controlled trials are required to guide the formulation of best practice guidelines.

CONCLUSION

Both surgical techniques provide excellent postoperative results. However, mesh anchorage with stainless steel staples takes less time than the polypropylene anchorage, which leads to faster postoperative recovery.

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Data Sharing Statement: The corresponding author can provide the data proving the findings of this study on request. Privacy or ethical restrictions bound us from sharing the data publicly.

AUTHOR CONTRIBUTION

Room B: Proposed the study, analyzed the data, and prepared the first draft
Shah S: Proposed the study, analyzed the data, and prepared the first draft
Junaid F: Proposed the study, analyzed the data, and prepared the first draft
Afridi NS: Data collection, design and interpretation of the project
Ullah R: Data collection, design and interpretation of the project
Hussain Y: Data collection, design and interpretation of the project

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