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Comparison of Skin Staples Versus Skin Sutures in Mesh Repair for Abdominal Wall Hernias in Terms of Outcome of Wound

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ABSTRACT

Background: Mesh based repair is widely performed in abdominal wall hernias to reduce recurrence. The final stage of surgery-skin closure-plays a crucial role influencing postoperative pain, surgical site infection (SSI), and cosmetic outcomes. Sutures are traditionally preferred for better tissue approximation and cosmesis, whereas staples offer faster application and reduced operative time. However, comparative evidence regarding their effectiveness in hernia repair remains limited.

Methodology: This prospective cohort study was carried out at a tertiary care facility over the course of a year from November 2024 to October 2025. Based on the closure method 124 patients undergoing elective abdominal wall hernia repair were divided into two groups: suture(n=62), and staple(n=62). The numeric rating scale was used to measure postoperative pain at 24hours. Using CDC criteria, SSI was assessed on postoperative days 3 and 7. The POSAS patient scale was used to evaluate cosmetic results at 6 months.

Results: The suture and staple groups had similar postoperative pain levels. There was no statistically significant difference between 4.8% of patients in the suture group and none in the staple group who experienced SSI. In both groups, the cosmetic results were consistently rated as good. The staples were linked to a substantial reduction in operating time but an increase in material costs.

Conclusion: Staples and sutures appear to provide similar outcomes in terms of postoperative pain, SSI, and cosmetic results. However, these findings should be interpreted cautiously given the study limitations. The choice of closure method may be guided by operative efficiency, cost, and clinical context.

Keywords: Abdominal Wall Hernia, Skin Closure, Sutures, Staples, Surgical Site Infection

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INTRODUCTION

One of the most common disorders in general surgery is abdominal wall hernias, which often call for mesh repair during surgery to ensure durability and prevent recurrence.[1] The final step of these procedures skin closure is critical, as it significantly influences postoperative pain, surgical site infection (SSI) rates, cosmetic outcomes, and overall patient satisfaction. Among the various techniques available, skin sutures and staples are the most commonly used methods for wound closure.

Following hernia repair, postoperative wound infection remains a major therapeutic problem that increases patient discomfort, morbidity, length of hospital stays, and healthcare expenses. Surgical site infections (SSIs) are classified as superficial, deep, or organ/space infections and are defined by the Centers for Disease Control and Prevention (CDC) as infections that develop at or near the surgical incision within 30 days of surgery (or within 90 days if an implant is present).[2]

Conventional skin suturing may offer improved tissue approximation and cosmetic benefits in some clinical situations, while outcomes may differ based on surgical approach and wound characteristics.[3,4] In contrast, skin staples are favored for their ease of use, reduced operative time, and consistency in wound closure.[5,6] However, concerns have been raised regarding their potential associations with increased postoperative discomfort and a higher risk of wound - related complications. Despite multiple studies comparing these techniques, the available evidence remains inconsistent, and a clear consensus regarding the optimal method of skin closure has not been established.[6,7]

Notably, there is limited procedure specific evidence comparing sutures and staples in abdominal wall hernia repair, particularly with respect to surgical site infection, postoperative pain, and overall patient related outcomes. This represents an important gap in the current literature and highlights the need for further focused evaluation.

In patients undergoing mesh repair of abdominal hernias, it is hypothesized that while skin staples shorten operating times, they are linked to greater incidence of surgical site infections, more pain following surgery, and worse scar results than skin sutures.

Given the high procedural volume of hernia surgeries, optimizing even minor technical aspects such as skin closure may have meaningful implications for patient outcomes and resource utilization. This study aims to compare skin staples and skin sutures in mesh repair of abdominal wall hernias with respect to surgical site infection rates, postoperative pain, operative duration, and overall patient outcomes.

MATERIALS AND METHODS

Study design and setting: This prospective cohort study was carried out from November 2024 to October 2025 in the Amala institute of Medical Sciences' Department of General Surgery. The recruitment of eligible patients was done using consecutive sampling. Participants were divided into two groups according to the type of skin closure used during the procedure: the staple group and the suture group. There were 124 patients in all, 62 in each group.

Sample size calculation: Based on previously published research comparing the incidence of surgical site infection (SSI) between sutures and staples, the sample size was determined. According to a study by Chandrashekar N et al.[8], the percentage of wound infection was 16% in the suture group and 38.09% in the staple group. The minimum necessary sample size was determined to be 62 patients in each group using these expected proportions, a significance level (α) of 5%, and power (1-β) of 80%.

Eligibility criteria: Adult patients (≥18 years) undergoing elective abdominal wall hernia repair were included. Exclusion criteria comprised patients on steroid therapy, immunocompromised individuals, those undergoing laparoscopic hernia repair, and patients with incisional hernia.

Ethical considerations: Written informed consent was obtained from all participants prior to their enrollment in the study. The study was conducted in accordance with ethical principles and was approved by the Institutional Ethics Committee. Ethical approval was obtained from the Institutional Ethics Committee, Ref. No. 34/EC/24/AIMS-08, dated 01/11/2024.

Outcome measures and follow-up: The incidence of surgical site infection served as the main outcome measure. Assessment of cosmetic scars and postoperative discomfort were secondary outcomes.

On the first postoperative day, postoperative pain was evaluated using the Numeric Rating Scale (NRS)- 0-10 scale, with 0 denoting no pain and 10 denoting the most severe discomfort [9]. Pain severity was categorized as no pain (NRS score = 0), mild pain (NRS score 1-3), moderate pain (NRS score 4-6), and severe pain (NRS score 7-10).

The Centers for Disease Control and Prevention (CDC) criteria [2] were used to classify surgical site infections, which were evaluated on postoperative day three before discharge and again on postoperative day seven during follow-up (at the time of suture removal).

- Superficial SSI: An infection that solely affects skin or subcutaneous tissue and manifests as purulent discharge, a positive culture, or localized indications of inflammation within 30 days.
- Deep SSI: Infection involving fascia or muscle layers, presenting with purulent discharge from deep incision, wound dehiscence, or abscess formation.

The Patient and Observer Scar Assessment Scale (POSAS) patient component was used to Assess cosmetic results six months after surgery [4]. Pain, itching,

color, rigidity, thickness, and irregularity are the six criteria that make up this with each given a score from 0 to 10. The total score (range: 6-60) was categorized as good (<19), moderate (19-36), or poor (>36).

Data collection and follow-up: All patients were followed up at postoperative day 3, day 7, and at 6 months. Clinical data were collected using a structured pro forma.

Statistical analysis: Microsoft Excel was used to enter the collected data, and the proper statistical software was used for analysis. The Chi-square test or Fischer's exact test were used to compare categorical data (such as SSI rates and scar grade) that were expressed as proportions. The independent t-test was used to compare continuous variables (such as pain scores) that were expressed as mean ± standard deviation. Statistical significance was defined as p-value of less than 0.05. For important outcome measures, confidence intervals (95%) were computed.

RESULTS

The mean age of the 124 participants in the study was 58.43 ± 4.37 years. 59.7% of participants were between the ages of 56 and 75. Males constituted 63.7% (n = 79), while females accounted for 36.3% (n = 45) (table 1). The most commonly performed procedure was inguinal hernioplasty (64.5%), followed by paraumbilical (21.8%) and umbilical hernioplasty (13.7%). Patients were equally distributed between suture and staple groups (62 each) (table 2).

With a mean difference of 170 INR (95% CI: 158-182; p <0.001), the mean cost of skin closure was substantially greater in the staple group (INR 350 ± 40) than in the suture group (INR 180 ± 25). With a mean difference of -12.8 minutes (95% CI: -16.1 to -9.5; p <0.001), the staple group had a considerably shorter mean operative time (54.6 ± 8.5 minutes) than the suture group (67.4 ± 10.2 minutes). Postoperative pain at 24 hours (Numeric Rating Scale) was comparable between the two groups. The mean pain score was 6.24 ± 1.60 in the staple group and 6.22 ± 1.99 in the suture group, with a mean difference of 0.02 (95% CI: -0.62 to 0.66; p = 0.277), indicating no statistically significant difference (table 3)

Comparison of mean postoperative pain scores at 24 hours between suture and staple groups (Numeric Rating Scale 0-10) (figure 1). At 24 hours postoperatively, the majority of participants in both groups experienced **moderate pain**, accounting for 80.6% of patients in the staple group and 77.4% in the suture group. Mild pain was reported by 16.1% and 11.3% of patients in the staple and suture groups, respectively. No pain was observed in a small proportion of patients, with a slightly higher frequency in the suture group (8.1%) than in the staple group (3.2%).

Table 1. Age and Gender Distribution of Study Participants (N = 124)

Variable	Cases (%)
Age (years)	
< 55 years	50 (40.3)
56-75 years	74 (59.7)
Mean ± SD	58.43 ± 4.37
Gender	
Male	79 (63.7)
Female	45 (36.3)

Values are presented as n (%) unless otherwise specified. SD = Standard Deviation

Table 2. Distribution of Participants by Type of Hernioplasty and Skin Closure Method (N = 124)

Variable	Cases (%)
Type of Hernioplasty	
Inguinal hernioplasty	80 (64.5)
Paraumbilical hernioplasty	27 (21.8)
Umbilical hernioplasty	17 (13.7)
Skin Closure Method	
Suture closure	62 (50.0)
Staple closure	62 (50.0)

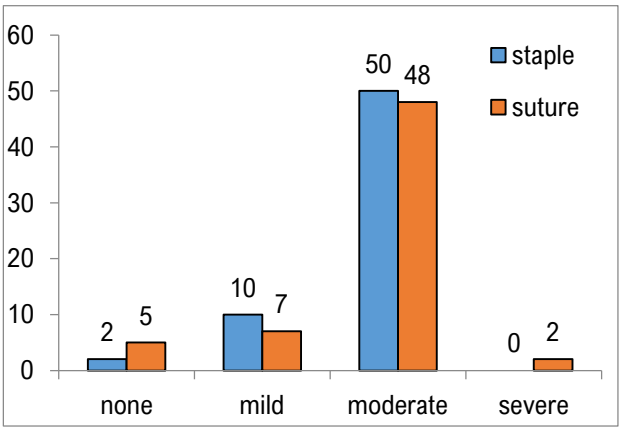

Figure 1: Pain severity post operatively

Table 3. Comparison of Clinical and Economic Outcomes Between Suture and Staple Groups

Outcome Variable	Suture Group (n=62) (Mean ± SD)	Staple Group (n=62) (Mean ± SD)	Mean Difference (95% CI)	p-value
Skin closure cost (INR)	180 ± 25	350 ± 40	170 (158 to 182)	<0.001
Operative time (minutes)	67.4 ± 10.2	54.6 ± 8.5	-12.8 (-16.1 to -9.5)	<0.001
Postoperative pain score at 24 hours (NRS)	6.22 ± 1.99	6.24 ± 1.60	0.02 (-0.62 to 0.66)	0.277

Values are expressed as mean ± SD. Mean difference was calculated as Staple group minus Suture group. CI = Confidence Interval; NRS = Numeric Rating Scale; INR = Indian Rupee. Independent-samples t-test was used for comparison. p < 0.05 was considered statistically significant.

Table 4: Comparison of post-operative suture site infection within 30 days in both the study groups

Group	Surgical site Infection (%)	No Surgical Site Infection (%)	Total	Relative Risk (95% CI)
Sutures	3 (4.8)	59 (95.2)	62	1(Reference)
Staples	0 (0)	62 (100)	62	0.14 (0.007-2.65)

Severe pain was uncommon and was reported only in the suture group (3.2%). Overall, the distribution of pain severity was comparable between the two groups, with most patients reporting moderate postoperative pain.

The incidence of SSI was 0% (0/62) in the staple group and 4.8% (3/62) in the suture group. 4.8% (95% CI: -0.4% to 10.0%) was the absolute risk difference. In comparison to the suture group, the staple group's relative risk (RR) of SSI was 0.14 (95% CI: 0.007-2.65), suggesting that there is no statistically significant difference (p = 0.25 in Fisher's exact test) (table 4).

At 6 months postoperatively, all patients in both groups were categorized as having good cosmetic outcomes based on POSAS scoring, with no cases of average or poor outcomes observed. Between the groups, there was no statistically significant difference (p = 1.000).

However, this uniformly favorable outcome may reflect limitations of subjective patient-reported assessment, potential observer bias, and limited discriminatory ability of the scoring system in detecting subtle differences in scar quality.

DISCUSSION

This study evaluated the impact of skin closure technique-staples versus sutures-on early postoperative pain, surgical site infection (SSI), and long-term cosmetic outcomes following abdominal wall hernioplasty. Postoperative pain assessed at 24 hours using the numeric rating scale demonstrated comparable mean scored between the two groups, suggesting that the method of skin closure does not substantially influence immediate postoperative pain perception.

With respect to surgical site infection, superficial SSI was observed in 4.8% of patients in the suture group, but the staple group showed no signs of infection. Despite the fact that this change was not statistically significant (p = 0.25), it is important to interpret this finding cautiously. No statistically significant difference in SSI rates was observed between groups; however, the study may be underpowered to detect small but clinically relevant differences. The observed absolute difference, although not statistically significant, may still hold clinical importance and warrants further evaluation in larger studies.

Cosmetic outcomes assessed at 6 months using the POSAS patient scale demonstrated that all patients were categorized as having good scar outcomes. Although there was no discernible statistically significant difference between the groups, this uniformly favorable result should be interpreted with caution. The findings may reflect limitations of subjective patient-reported assessment, potential observer or reporting bias, and limited discriminatory ability of the scoring system to detect subtle differences in scar quality.

The current results are generally in line with earlier research. According to Anyanwu SNC et al., there was no discernible difference between staple and suture closure in terms of infection rates or cosmetic results.[10] Similarly, systematic reviews by Qin C et al[11] and Feng J et al[7] demonstrated comparable SSI rates between staples and sutures. Malard O et al[6] reported non-inferior patient-reported outcomes with stapler-based closure compared to subcuticular sutures. Kawaguchi C et al[12] and Mastud K et al[13] also suggested that both techniques are safe and effective for elective wound closure.

Nonetheless, some research has revealed subtle variations. While postoperative discomfort and infection rates did not change, Pandey ND et al. found that using staples resulted in quicker wound closure.[14] Pragya et al[15] discovered no noteworthy difference in postoperative problems between sutures and staples in the treatment of inguinal hernias, while Ali M et al[3] similarly found comparable rates of surgical site infections. These discrepancies between studies could be explained by variances in the patient demographic, surgical technique, wound characteristics, and outcome evaluation techniques.

In comparison to sutures, staples shorten operating times without increasing surgical site infection or wound complications, according to recent research by Mishra AK et al[16] and a meta-analysis by Maheshwari et al[17]. Comparable postoperative results between the two methods are further supported by data from recent abdominal surgeries.[18]

Crucially, it is important to recognize the limitations of the current study. The use of consecutive sampling may introduce selection bias, as allocation to closure technique was not randomized and may have been influenced by surgeon preference. Additionally, outcome assessment particularly cosmetic evaluation relied on patient-reported measures, introducing potential measurement bias. The capacity to identify minor but clinically significant variations between group is further hampered by the very small sample size.

When combined, the study's results indicate that both skin closure methods produce generally comparable results in terms of postoperative discomfort, SSI, and cosmetic effects; nevertheless, the lack of statistically significant differences shouldn't be taken as evidence of equivalency. Larger, adequately powered randomized studies are required to establish definitive comparative effectiveness. In clinical practice, the choice of skin clo-

sure method may therefore be guided by surgeon experience, operative efficiency, cost considerations, and patient preference.

STRENGTH AND LIMITATION

This study's prospective cohort design and use of consecutive sampling are among its strong points in addition to the use of application of validated tools for assessing postoperative pain and long-term cosmetic outcomes. These features provide procedure-specific insights into outcomes following mesh repair of abdominal wall hernias.

But there are a few restrictions to be aware of. The study's moderate sample size and single location may have limited how broadly the results can be applied. Critically, the study might not have enough power to identify minute but clinically significant variations across groups, especially for outcomes like surgical site infection that are comparatively uncommon. Therefore, it is important to use caution when interpreting the lack of statistically significant differences.

Additionally, cosmetic assessment was based solely on the patient-reported component of the POSAS scale. As follow-up was conducted at six months postoperatively, in person evaluation by an observer was not feasible for many patients and therefore the observer component could not be included. This reliance on subjective patient-reported outcomes may introduce measurement bias and limit the comprehensiveness and objectivity of scar assessment.

CONCLUSION

This study suggests that both staples and sutures appear to provide satisfactory cosmetic outcomes and similar early postoperative pain control, no statistically significant difference observed in surgical site infection rates. However, staples were associated with a significantly shorter operative time, albeit at a higher material cost compared to sutures. While these findings indicate that both techniques are viable options for skin closure following mesh repair of abdominal wall hernias, the absence of statistically significant differences should be interpreted with caution. The results may be influenced by the limited sample size and potential biases inherent to the study design. Therefore, the choice of skin closure method may be guided by surgeon preference, operative efficiency, cost considerations, and individual patient factors, rather than clear evidence of superiority of one technique over the other. Further large scale, randomized studies are warranted to establish definitive comparative effectiveness.

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Availability of data: The data that support the findings of this study are available from the corresponding author on reasonable request.

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