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Original Research Article

Comparative study between skin staples and conventional sutures for skin closure in elective abdominal surgery

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ABSTRACT

Background: Skin closure is a crucial step in surgical procedures, as it directly affects wound healing, postoperative infection risk, and the aesthetic quality of the incision. The purpose of the study is to compare skin staples and conventional sutures for skin closure in elective abdominal surgery with respect to closure time, postoperative outcomes, and cosmetic results.
Methods: This prospective comparative study at the Department of General Surgery, Enam Medical College and Hospital, Dhaka, Bangladesh (March 2022–February 2023) included 60 elective abdominal surgery patients (30 staples, 30 sutures). Primary outcome was skin closure time; secondary outcomes were surgical site infection, pain, hospital stay, and cosmetic results. Data were analyzed using independent samples t-tests and chi-square tests ($p<0.05$).
Results: Sixty patients (30 per group) showed comparable baseline characteristics ($p>0.05$). Skin closure time was significantly shorter with staples than sutures (2.4±0.7 versus 9.8±2.5 minutes; $p<0.001$). Surgical site infection, postoperative pain, and hospital stay were similar between groups ($p>0.05$). Cosmetic outcome was significantly better with sutures (73.3% versus 40.0%; $p=0.030$).
Conclusions: Skin staples offer faster skin closure, whereas conventional sutures provide better cosmetic outcomes, with no significant difference in postoperative complications.

Keywords: Skin closure, Staplers, Sutures, Elective surgery

INTRODUCTION

Skin closure represents a vital component of surgical procedures, as it significantly influences the processes of wound healing, the likelihood of postoperative infection, and the aesthetic outcome of the incision. The primary aim of surgeries, including those in the neck region, is to ensure effective healing with minimal scarring, absence of discharge, limited edema, and prevention of infections.[1] Achieving proper skin closure is important not only for restoring function but also for attaining patient satisfaction with the cosmetic appearance of the scar, as the skin represents the final layer addressed in surgery, and creating a visually acceptable scar has consistently posed challenges.[2] Ideally, a surgical wound should possess the strength of normal tissue while remaining aesthetically pleasing. The optimal approach to skin closure should therefore be straightforward, safe, quick, cost-effective, minimally painful, and yield a cosmetically favorable result.[2] In addition, the surgical scar often serves as the sole visible indicator of a surgeon's expertise, and the final appearance of the wound frequently reflects the cumulative skill and precision of the surgical effort.[3]

Various approaches have been developed to optimize skin closure, each with distinct advantages and limitations. Techniques such as subcuticular sutures, adhesive tapes, and staplers have been devised to enhance cosmetic

outcomes. Among these, sutures and staples are the most widely implemented methods. Originally, staplers were designed to ensure patency, particularly in anastomoses, but their use has expanded, and it is now broadly recognized that both sutures and staples are capable of meeting the fundamental objectives of skin wound closure.[4] Both methods aim to realign skin edges in a watertight, tension-free, non-inverted manner, promoting rapid healing and a cosmetically satisfactory scar. The choice of closure technique and material can vary: sutures may be continuous or interrupted and can consist of natural or synthetic fibers, absorbable or nonabsorbable, single filament or braided, depending on the wound's length and location; staples, primarily made of stainless steel, can now also include absorbable materials as an option.[5,6] Sutures are valued for their favorable composition, minimal tissue reactivity, and postoperative comfort, whereas staples are thought to reduce local inflammatory responses, shorten the time required for closure, and minimize residual cross marks, making stapling the fastest method of skin closure.[7,8]

Despite a wealth of research, there remains ongoing debate over which method is superior for skin closure in elective abdominal surgery. Current evidence indicates that both sutures and staples are effective but demonstrate different strengths. For example, a meta-analysis by Wang et al. found that subcuticular sutures were associated with fewer postoperative complications, while staplers allowed shorter intraoperative closure times, although cosmetic results and pain scores were comparable between groups.[9] Additionally, multiple studies have reported conflicting outcomes regarding the efficacy, cost-effectiveness, complication rates, and aesthetic results of these two techniques.[10,11] Because the properties of skin differ across the body, including thickness, elasticity, healing speed, and scarring tendency, it is critical to determine which closure method is best suited for a given patient and wound.[12,13] This underscores the need for further comparative studies to establish which method offers the most favorable balance between efficiency, safety, and cosmetic result in elective abdominal surgery.

Although numerous studies have compared sutures and staples for skin closure, there is still no clear consensus regarding which method provides the optimal combination of efficiency, safety, and cosmetic outcome specifically in elective abdominal surgery. Some studies emphasize the faster closure time associated with staples, while others highlight the superior aesthetic results and patient satisfaction with sutures. Furthermore, variations in study populations, wound types, and surgical settings contribute to conflicting results, making it difficult to generalize findings. Given these inconsistencies and the limited data in certain clinical contexts, further research is warranted to clarify the comparative advantages of each method. The purpose of the study is to compare skin staples and conventional sutures for skin closure in elective abdominal surgery with respect to closure time, postoperative outcomes, and cosmetic results.

Objective

The objective of the study was to compare skin staples and conventional sutures for skin closure in elective abdominal surgery with respect to closure time, postoperative outcomes, and cosmetic results.

METHODS

This prospective comparative study was conducted at the Department of General Surgery, Enam Medical College and Hospital, Dhaka, Bangladesh, from March 2022 to February 2023. A total of 60 patients undergoing elective abdominal surgery were included and allocated into two groups based on the method of skin closure: skin staples (n=30) and conventional sutures (n=30). Patients were selected according to predefined inclusion and exclusion criteria to compare skin closure time, postoperative outcomes, and cosmetic results.

Inclusion criteria

Patients aged ≥18 years undergoing elective abdominal surgery, patients with clean or clean-contaminated surgical wounds, and patients who provided written informed consent were included.

Exclusion criteria

Patients with infected or contaminated wounds, emergency abdominal surgeries, patients with immunocompromised states or severe comorbid conditions, and patients unwilling to participate were excluded.

All surgeries were performed under standard aseptic conditions by experienced surgeons. Following completion of the abdominal procedure and fascial closure, skin closure was performed using either skin staples or conventional non-absorbable sutures according to group allocation. The time required for skin closure was recorded in minutes using a stopwatch from initial skin approximation to completion. The primary outcome was skin closure time. Secondary outcomes included surgical site infection (assessed clinically during hospital stay and follow-up), postoperative pain (measured on postoperative day 1 using the visual analog scale), length of hospital stay, and cosmetic outcome, evaluated during follow-up and graded as good, fair, or poor. Patient demographic data, clinical variables, operative details, and postoperative outcomes were recorded in a structured data collection form, and patients were followed up during hospitalization and at subsequent outpatient visits. Statistical analysis was performed using independent samples t-tests for continuous variables and chi-square tests for categorical variables. Continuous variables were expressed as mean±standard deviation, and categorical variables as frequency and percentage. A p value of <0.05 was considered statistically significant.

RESULTS

Table 1 summarizes the demographic and clinical characteristics of the study population. Both stapler (n=30) and suture (n=30) groups were comparable with respect to mean age, gender distribution, BMI, smoking status, and presence of diabetes (p>0.05).

Table 2 shows the mean skin closure time for the two groups. Patients in the stapler group had significantly shorter closure times (2.4±0.7 minutes) compared to the suture group (9.8±2.5 minutes), with the difference being statistically significant (p<0.001).

Postoperative outcomes including surgical site infection, postoperative pain (VAS score on POD 1), and length of hospital stay are presented. There were no statistically significant differences between the two groups (p>0.05).

Figure 1 compares cosmetic outcomes between the stapler and suture groups. A higher proportion of patients in the suture group achieved a good cosmetic outcome (73.3%) compared to the stapler group (40.0%), which was statistically significant (p=0.030).

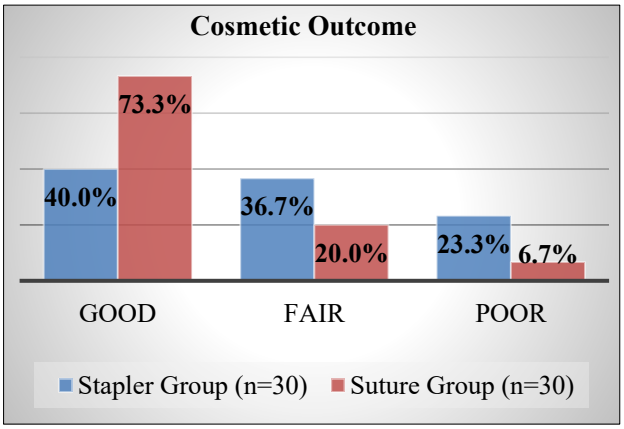

Figure 1: Cosmetic outcome following skin closure (n=60).

Table 1: Baseline demographic and clinical characteristics of patients (n=60).

Variable	Stapler group (n=30)	Suture group (n=30)	P value
Mean age (years±SD)	48.7±10.3	50.1±9.8	0.594
Gender, n (%)			0.600
Male	16 (53.3%)	14 (46.7%)	
Female	14 (46.7%)	16 (53.3%)	
Mean BMI (kg/m²±SD)	26.5±3.1	27.2±3.4	0.400
Smokers, n (%)	5 (16.7%)	4 (13.3%)	0.750
Diabetes, n (%)	3 (10.0%)	2 (6.7%)	0.650

Table 2: Comparison of skin closure time between stapler and suture groups (n=60).

Parameter	Stapler group (n=30)	Suture group (n=30)	P value
Mean closure time (minutes±SD)	2.4±0.7	9.8±2.5	<0.001

Table 3: Postoperative outcomes in stapler and suture groups (n=60).

Outcome	Stapler group (n=30)	Suture group (n=30)	P value
Surgical site infection, n (%)	3 (10.0)	2 (6.7)	0.650
Mean VAS pain score (POD 1±SD)	3.5±1.2	3.2±1.1	0.310
Mean hospital stay (days±SD)	3.1±0.9	3.0±0.8	0.650

DISCUSSION

Skin closure is a fundamental component of surgical procedures, particularly in elective abdominal surgery, as it directly influences wound healing, risk of postoperative complications, and the aesthetic outcome of the incision. The results of this study demonstrate that the choice of skin closure method impacts operative efficiency and cosmetic outcomes, with staples significantly reducing closure time, while conventional sutures provide superior aesthetic results. These findings highlight the clinical importance of selecting an appropriate skin closure technique to balance efficiency, safety, and patient satisfaction in elective abdominal surgeries.

The baseline demographic and clinical characteristics of patients in this study were comparable between the stapler and suture groups, with no statistically significant differences in mean age (48.7±10.3 versus 50.1±9.8 years; p=0.594), gender distribution (p=0.600), BMI (26.5±3.1 versus 27.2±3.4 kg/m²; p=0.400), smoking status (16.7% versus 13.3%; p=0.750), or prevalence of diabetes (10.0% versus 6.7%; p=0.650). These findings indicate that the two groups were well matched at baseline, reducing potential confounding when comparing outcomes. Similar results have been reported by Shah et al., who observed no significant differences in age, gender, BMI, smoking status, or comorbidities between staple and suture groups in a prospective cohort study.[14] Likewise, Imamura et al

reported comparable baseline characteristics in their RCT of 401 patients undergoing open abdominal surgery, with no significant differences in demographic or clinical parameters between groups.[4] Anyanwu et al also found similar age, BMI, and sociodemographic profiles in a study of 60 patients, further supporting the consistency of baseline matching in studies comparing skin closure methods.[15] The homogeneity observed in these fundamental parameters between our study groups strengthens the internal validity of our subsequent findings, as it minimizes the potential for confounding by these variables when comparing closure techniques.

The results of this study demonstrate that skin closure using staples is significantly faster than conventional sutures, with mean closure times of 2.4±0.7 minutes and 9.8±2.5 minutes, respectively ($p<0.001$). This finding is consistent with previous studies, such as Rabha et al, who reported a significant reduction in wound closure time with staples compared to sutures in elective abdominal surgeries ($p<0.001$).[16] Similarly, Kathare et al observed that stapler closure took approximately four times less time than suture closure in a cohort of 100 elective abdominal surgery patients ($p<0.0001$).[17] The significantly shorter closure time with staples observed in these studies, as well as in the present study, highlights the efficiency of staples in expediting skin closure without compromising other perioperative outcomes, supporting their practical advantage in elective abdominal surgery settings.

Postoperative outcomes in this study showed no significant differences between the stapler and suture groups, with surgical site infection rates of 10.0% and 6.7% ($p=0.650$), mean VAS pain scores on postoperative day 1 of 3.5±1.2 and 3.2±1.1 ($p=0.310$), and mean hospital stays of 3.1±0.9 and 3.0±0.8 days ($p=0.650$), respectively. These findings indicate that both skin closure methods provide comparable postoperative recovery in terms of infection risk, pain, and length of hospitalization. Similar observations have been reported by Feng et al, whose meta-analysis of randomized trials comparing staples and sutures after abdominal surgery found no significant difference in surgical site infection rates, supporting the equivalence of both techniques.[18] Likewise, Chavali et al reported that postoperative pain and recovery profiles were similar between staple and suture groups, aligning with the VAS pain scores and hospital stay durations observed in the present study.[19] Collectively, these results suggest that while staples offer a time-saving advantage, they do not compromise postoperative safety or patient comfort compared to conventional sutures.

The present study demonstrated that cosmetic outcomes were significantly better in the suture group compared to the stapler group, with 73.3% of patients achieving a good result versus 40.0% in the stapler group ($p=0.030$). This finding aligns with previous evidence indicating that while staples offer a time-saving advantage, suturing techniques, particularly non-absorbable subcuticular sutures, provide superior aesthetic outcomes. For instance, Feng et al. reported in a systematic review that suturing was consistently associated with better cosmesis and higher patient satisfaction compared to staples in abdominal skin closure.[18] Similarly, Agilinko et al observed in a double-blind randomized trial that patients with subcuticular suture closure experienced better cosmetic results and greater overall satisfaction than those with staple closure in elective open abdominal surgeries.[20] These findings suggest that although staples are efficient for rapid closure, conventional sutures may be preferable when optimal cosmetic outcome is a priority, supporting the results observed in the present study.

Limitations

This study had certain limitations, which are as follows. It was a single-center study. A larger, multi-center study is needed to reach more definitive conclusions. The sample size was relatively small.

CONCLUSION

Skin staples significantly reduce skin closure time in elective abdominal surgery compared to conventional sutures, while postoperative outcomes such as surgical site infection, pain, and hospital stay remain comparable between the two techniques. However, conventional sutures provide superior cosmetic outcomes, suggesting that the choice of skin closure method should be guided by operative time requirements and cosmetic considerations.

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