

Original Research Article

SKIN CLOSURE BY SUTURES AND STAPLERS IN VARIOUS SURGICAL INCISIONS – A COMPARATIVE STUDY

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ABSTRACT

Background: Skin closure plays a pivotal role in surgical wound management, as it directly affects healing outcomes, the risk of postoperative complications, cosmetic results, and overall patient satisfaction. Among the commonly employed techniques, sutures and staplers remain the most widely used, yet their relative effectiveness continues to be an area of ongoing clinical evaluation and debate.

Materials and Methods: The current comparative observational study was conducted in the Department of General Surgery at a tertiary care centre from 2024 to 2026. A total of 176 patients undergoing elective clean surgical procedures were included and divided into two groups: Group I (Sutures, n=88) and Group II (Staplers, n=88). Outcomes assessed included skin closure time, postoperative complications, pain during removal using the "Visual Analog Scale", patient comfort, scar quality, cosmetic outcome, and overall surgical outcome.

Results: The average time required for wound closure was markedly shorter in the stapler group compared to the suture group (7.01 ± 1.54 minutes) (15.25 ± 2.56 minutes) ($p < 0.0001$). Wound infection was observed in 12 patients in the suture group and 9 patients in the stapler group ($p = 0.049$). Good comfort, scar score, and cosmetic outcomes were significantly more common in the stapler group ($p < 0.0001$). Positive clinical outcomes were observed in 76 patients within the stapler group, compared to 70 patients in the suture group, with statistical significance noted ($p = 0.019$). Additionally, complications such as wound dehiscence and difficulties during removal occurred less frequently when staplers were used.

Conclusion: Skin staplers provide faster wound closure, better cosmetic outcomes, improved patient comfort, and superior overall postoperative results compared with conventional sutures, making them an effective substitute for closure of elective surgical incisions.

Keywords: Skin Closure, Sutures, Staplers, Cosmetic Outcome, Wound Healing.

INTRODUCTION

Skin closing of wounds is one of the key elements of surgical and emergency care, as it plays a direct role in determining the outcome of wound healing, occurrence of infections, cosmetic effects, and overall patient satisfaction. The main aim of skin

closure is ensuring accurate apposition of the wound edges, causing minimal trauma to the tissues, as well as ensuring proper healing. With the development of surgery and biomaterials, the methods used for skin closure have diversified from using sutures to surgical staples and even tissue adhesives.

Sutures remain the most widely used method of wound closure because of their versatility and ability to provide precise tissue approximation. They may be absorbable or non-absorbable and can be applied using various techniques, including interrupted, continuous, mattress, and subcuticular sutures, depending on the clinical situation. Proper suturing technique helps maintain wound strength, reduce tension, and improve cosmetic outcomes.^[1] Surgical staples have emerged as an effective alternative to sutures, particularly in procedures where rapid wound closure is desirable. Staples are easy to apply, reduce operative time, and are commonly used in scalp, orthopedic, and abdominal surgeries. Many research have reported comparable healing outcomes between staples and sutures, concerns remain regarding postoperative pain, scar appearance, and surgical site infections.^[2] Tissue adhesives and adhesive strips represent additional closure options, especially for superficial, low-tension wounds. These methods offer the advantages of faster application, minimal tissue handling, and improved patient comfort, particularly in pediatric populations.^[3,4] Regardless of the technique used, successful wound closure requires careful tissue handling, adequate hemostasis, and proper alignment of wound edges to facilitate healing and reduce complications.^[5,6] Studies comparing sutures and staples have demonstrated that staples significantly decrease closure time, thereby improving operative efficiency.^[7] However, evidence regarding infection rates, postoperative discomfort, cosmetic outcomes, and overall cost-effectiveness remains inconsistent. Several studies have indicated that the use of staples may be associated with a greater risk of surgical site infections, whereas sutures often yield better cosmetic outcomes and higher levels of patient satisfaction. Nonetheless, despite these observations, the choice of closure technique continues to differ considerably among surgeons and across institutions. Thus, the study aims, to compare different skin closure techniques and determine the superior method by evaluating closure time and patient outcomes, including postoperative pain, recovery time, and cosmetic results.

Need for the Study: The most suitable technique for skin closure remains a matter of continued discussion. Although both sutures and staples are routinely employed in surgical practice, clear differences in healing outcomes, infection rates, cosmetic appearance, operative duration, postoperative discomfort, and overall treatment costs have not been consistently demonstrated across various types of incisions. A thorough comparative evaluation of these methods is therefore warranted to determine the approach that offers the greatest clinical benefit. The present study seeks to assess and contrast the use of sutures and staples/staplers in different surgical incisions, with the aim of generating evidence based

recommendations to enhance surgical outcomes and patient care.

MATERIALS AND METHODS

This comparative observational study was carried out in the Department of General Surgery at a tertiary care center between 2024 and 2026. A total of 176 patients requiring skin closure for different surgical incisions were enrolled and allocated into two equal groups of 88 participants each. Eligible participants included adults aged 18 years or older undergoing elective clean or clean contaminated procedures, classified as American Society of Anesthesiologists (ASA) Class I or II, who provided informed consent. Exclusion criteria comprised patients on long term steroid or immunomodulatory therapy, individuals with documented hypersensitivity to sutures or staplers, contaminated or dirty surgical cases, those with bleeding disorders, and patients with medical conditions known to adversely affect wound healing.

All participants were provided with uniform preoperative care in accordance with standard protocols, including prophylactic antibiotics and strict antiseptic precautions. Skin preparation was carried out according to standard surgical protocols, using 10% povidone-iodine (betadine) solution and allowed to dry before surgery. Following closure of the deeper tissue layers, skin closure was performed using either sutures or staplers, with the method allocated through randomization. The time needed for skin closure was recorded in minutes, and sutures or staples were placed at approximately 1 cm intervals.

Following surgery, the initial wound dressing was applied after 48 hours, and patients were subsequently monitored for signs of infection, discharge, or fluid accumulation. Staples were removed between the 10th and 12th postoperative days using a specialized staple remover, whereas sutures were taken out with conventional techniques. Patient outcomes were evaluated based on postoperative pain, compliance, wound healing, and cosmetic appearance. Pain associated with the removal of sutures or staples was measured using the Visual Analog Scale (VAS). Cosmetic assessment was performed two weeks after surgery using standardized wound evaluation scores, with scar appearance categorized as good, acceptable, or poor.

All data collected were systematically entered into Microsoft Excel, appropriately coded, and analyzed using relevant statistical methods. The findings were displayed through tables and graphical representations, with statistical significance defined at a p value threshold of less than 0.05.

RESULTS

The present comparative observational study included 176 patients, with 88 patients each in the suture closure and stapler closure groups. Only elective clean surgical cases without evidence of infection or contamination were included to ensure uniformity and minimize factors affecting wound healing and postoperative infection rates.

Postoperative wound evaluation was conducted at regular intervals. Pain experienced during the removal of sutures or staples was measured using the "Visual Analog Scale" (VAS), while cosmetic outcomes were assessed two weeks after surgery. The collected data were organized into tables, subjected to statistical analysis, and the results are presented in the following section.

The distribution of age and gender was similar across both groups. The mean age was 45.22 ± 11.67 years in the suture group and 42.03 ± 10.67 years in the stapler group ($p = 0.47$). Males predominated in both groups, and no significant difference in gender distribution was observed ($p = 0.17$), indicating that the groups were demographically comparable. (Refer Table1)

The distribution of ASA grades was similar between the two groups, with ASA Grade I documented in 49

patients (55.7%) in the suture group and 52 patients (59.1%) in the stapler group. ASA Grade II was present in 39 (44.3%) and 36 (40.9%) patients, respectively ($p = 0.58$). (Refer Table1)

The types of surgeries performed were similarly distributed between the groups, including hernia repair (25 vs. 27), cholecystectomy (16 vs. 13), appendectomy (25 vs. 24), and thyroidectomy (22 vs. 24) in the suture and stapler groups, respectively ($p = 0.90$). Likewise, the distribution of incision types was comparable, with abdominal incisions (25 vs. 27), subcostal incisions (16 vs. 13), McBurney incisions (25 vs. 25), and neck incisions (22 vs. 23) in the two groups ($p = 0.98$). (Refer Table1)

With respect to comorbidities, 38 patients (43.2%) in the suture group and 48 patients (54.5%) in the stapler group had no associated medical illness. Diabetes mellitus was identified in 36 patients (40.9%) in the suture group and 23 patients (26.1%) in the stapler group, while hypertension was present in 14 patients (15.9%) and 17 patients (19.3%), respectively ($p = 0.066$). Smoking prevalence was significantly higher among patients in the suture group, affecting 35 individuals (39.8%), compared to 20 individuals (22.7%) in the stapler group ($p = 0.01$). (Refer Table1)

Table 1: Demographic and Clinical findings

Variable	Category	Group I (Sutures) n (%)	Group II (Staplers) n (%)	p-value
Age (years)	Mean $\pm$ SD	45.22 ± 11.67	42.03 ± 10.67	0.47
Gender	Male	57 (64.8)	46 (52.3)	0.17
	Female	31 (35.2)	42 (47.7)	
ASA Grade	I	49 (55.7)	52 (59.1)	0.58
	II	39 (44.3)	36 (40.9)	
Surgery Type	Hernia	25 (28.4)	27 (30.7)	0.9
	Cholecystectomy	16 (18.2)	13 (14.8)	
	Appendectomy	25 (28.4)	24 (27.3)	
	Thyroidectomy	22 (25.0)	24 (27.3)	
Incision Type	Abdominal	25 (28.4)	27 (30.7)	0.98
	Subcostal	16 (18.2)	13 (14.8)	
	McBurney	25 (28.4)	25 (28.4)	
	Neck	22 (25.0)	23 (26.1)	
Comorbidity	None	38 (43.2)	48 (54.5)	0.066
	Diabetes Mellitus	36 (40.9)	23 (26.1)	
	Hypertension	14 (15.9)	17 (19.3)	
Smoking Status	Yes	35 (39.8)	20 (22.7)	0.01*
	No	53 (60.2)	68 (77.3)	

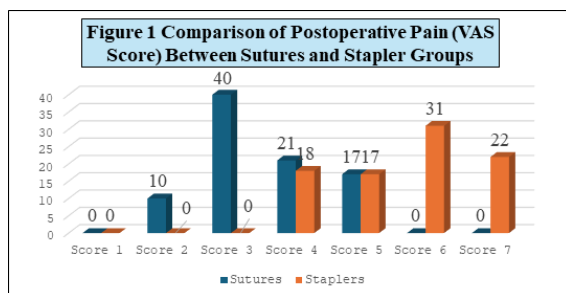
The mean duration of skin closure was significantly shorter in the stapler group (7.01 ± 1.54 minutes) compared with the suture group (15.25 ± 2.56 minutes) ($p < 0.0001$). Wound infection was noted in 12 patients (13.6%) in the suture group and 9 patients (10.2%) in the stapler group, a difference

that reached statistical significance ($p = 0.049$). Seroma formation occurred in 12 patients (13.6%) in the suture group and 18 patients (20.5%) in the stapler group, with the variation also proving significant ($p = 0.021$). (Refer Table 2)

Table 2

Variable	Category	Group I (Sutures) n (%) / Mean $\pm$ SD	Group II (Staplers) n (%) / Mean $\pm$ SD	p-value
Closure Time (min)	Mean $\pm$ SD	15.25 ± 2.56	7.01 ± 1.54	$<0.0001^*$
Wound Infection	Yes	12 (13.6)	9 (10.2)	0.049*
	No	76 (86.4)	79 (89.8)	
Seroma	Yes	12 (13.6)	18 (20.5)	0.021*
	No	76 (86.4)	70 (79.5)	

Pain assessment using the “Visual Analog Scale” (VAS) showed a significant finding between the two groups ($p < 0.0001$). In the suture group, most patients reported VAS scores of 3 (40 patients, 45.5%), followed by score 4 (21 patients, 23.9%) and score 5 (17 patients, 19.3%). In contrast, patients in the stapler group predominantly reported higher pain scores, with 31 (35.2%) patients having a VAS score of 6 and 22 (25.0%) patients a VAS score of 7. (Refer Fig.1)



Measures of patient comfort, scar quality, and cosmetic appearance were all significantly superior in the stapler group compared with the suture group ($p < 0.0001$ for each parameter). High comfort levels were reported by 86 patients (97.7%) in the stapler group versus 63 patients (71.6%) in the suture group. Likewise, a favorable scar score was documented in 86 stapler patients (97.7%) compared to 48 suture patients (54.5%). Cosmetic outcomes were also rated as good in 86 patients (97.7%) in the stapler group, whereas only 49 patients (55.7%) in the suture group achieved similar results, underscoring the enhanced satisfaction and scar appearance associated with stapler closure. (Refer Table 3)

Table 3: Comparison of Patient Comfort, Scar Score, and Cosmetic Outcome Between Study Groups

Variable	Category	Group I (Sutures) n (%)	Group II (Staplers) n (%)	p-value
Comfort	Good	63 (71.6)	86 (97.7)	<0.0001*
	Moderate	23 (26.1)	0 (0.0)	
	Poor	2 (2.3)	2 (2.3)	
Scar Score	Good	48 (54.5)	86 (97.7)	<0.0001*
	Acceptable	40 (45.5)	2 (2.3)	
Cosmesis	Good	49 (55.7)	86 (97.7)	<0.0001*
	Acceptable	37 (42.0)	0 (0.0)	
	Wide Scar	2 (2.3)	2 (2.3)	

Overall outcomes were significantly more favorable in the stapler group compared with the suture group ($p = 0.019$). A good outcome was achieved in 76 patients (86.4%) in the stapler group versus 70 patients (79.5%) in the suture group. Among the complications, scarring was observed equally in

both groups (10 patients each). However, difficulty during removal was reported more frequently in the suture group (6 patients) compared to only 1 patient in the stapler group. Wound dehiscence was uncommon, occurring in 2 patients in the suture group and 1 patient in the stapler group.

Table 4: Outcomes Between Suture Closure and Stapler Closure

Sr. No	Outcome Parameter	Sutures (Group I)	Staplers (Group II)	Interpretation	p-value
1	Mean Closure Time	15.25 ± 2.56 min	7.01 ± 1.54 min	Staplers required significantly lesser time for skin closure compared to sutures	<0.0001
2	Hospital Stay	Majority stayed 3–6 days	Majority stayed 3–6 days	Slightly shorter hospital stay observed with staplers	0.044
3	Good Cosmetic Outcome	49 patients	86 patients	Staplers showed markedly better cosmetic results	<0.0001
4	Acceptable Scar	37 patients	0 patients	Acceptable scars were predominantly seen in the suture group	—
5	Wide Scar	2 patients	2 patients	Similar incidence in both groups	—
6	Overall Good Outcome	70 patients	76 patients	Better overall outcome observed with staplers	0.019
7	Scarring Complication	10 patients	10 patients	Equal incidence in both groups	—
8	Difficult Removal	6 patients	1 patient	Difficult removal was more common with sutures	—
9	Wound Dehiscence	2 patients	1 patient	Slightly lower incidence with staplers	—

DISCUSSION

The present comparative observational study evaluated the effectiveness of sutures and staplers for skin closure in various elective clean surgical incisions. The 2 groups were similar with respect to age, gender, ASA grade, type of surgery, incision type, and comorbidities, as no statistically significant differences were observed. Similar baseline comparability was reported by Hamouda M et al. (2025), Rahbari H et al. (2025), and Ansari S et al. (2025), supporting the validity of outcome comparisons between the two closure techniques.^[10,11,12]

A major finding of the current study was the significantly shorter skin closure time with staplers (7.01 ± 1.54 min) compared with sutures (15.25 ± 2.56 min) ($p < 0.0001$). This finding is in agreement with studies by Rahbari H et al. (2025) and Ansari S et al. (2025), who also demonstrated substantially reduced closure times with staplers.^[10,12]

Postoperative wound infection was lower in the stapler group (9 cases) compared with the suture group (12 cases) ($p = 0.049$), consistent with the observations of Maske A et al. (2023) and Rajesh V et al. (2023).^[13,14] However, seroma formation was more frequent in the stapler group (18 vs. 12 cases; $p = 0.021$), which contrasts with the findings of Rajesh V et al. (2023) and Chandrasekaran M et al. (2024), who reported lower seroma rates with staplers.^[14,15]

The stapler group demonstrated markedly superior outcomes in terms of patient comfort, scar quality, and cosmetic appearance ($p < 0.0001$). Favorable cosmetic results were achieved in 86 patients within the stapler group, compared with 49 patients in the suture group. Similar superior cosmetic outcomes with staplers have been reported by Rajesh V et al. (2023), Chandrasekaran M et al. (2024), Karbhari et al. (2012), and dos Santos et al. (1995).^[14-17] Although postoperative pain scores were higher in the stapler group in the present study, this finding differs from those of Vikraman G et al. (2024) and Maske A et al. (2023), who reported lower pain scores with staplers.^[18,13]

Overall, good outcomes were achieved in 76 patients in the stapler group compared with 70 patients in the suture group ($p = 0.019$). Difficult removal and wound dehiscence were less frequent with staplers, while scarring rates were similar in both groups. These findings are supported by studies conducted by Rajesh V et al. (2023), Chandrasekaran M et al. (2024), and Maske A et al. (2023).^[14,15,13] Therefore, the present study suggests that staplers offer significant advantages over sutures in terms of operative efficiency, cosmetic appearance, patient comfort, and overall postoperative outcomes, making them an effective alternative for skin closure in elective surgical procedures.

CONCLUSION

The current study observed that skin staplers are a safe and effective alternative to conventional sutures for closure of various surgical incisions. Staplers significantly reduced skin closure time and were associated with better patient comfort, superior cosmetic outcomes, and improved scar quality. Although seroma formation was marginally greater in the stapler group, wound infection, difficult removal, and wound dehiscence were less frequent. Overall, staplers achieved a higher rate of good postoperative outcomes and patient satisfaction. Therefore, skin staplers may be preferred over sutures, particularly when rapid wound closure and favorable cosmetic results are important considerations.

Limitations of the Study:

1. The study was conducted at a single tertiary care center, which may limit the generalizability of the findings to other healthcare settings and populations.
2. The sample size was relatively small (176 patients), which may reduce the statistical power of the study.
3. Different types of surgeries and incision sites were included, which could have influenced wound healing and postoperative outcomes differently.

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