



STUDY TO COMPARE THE EFFICACY OF SKIN STAPLER VERSUS CONVENTIONAL SUTURING IN ELECTIVE ABDOMINAL SURGERIES

General Surgery

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ABSTRACT

Background: Efficient skin closure in elective abdominal surgeries is crucial to minimize complications and ensure favorable cosmetic outcomes. The choice between conventional sutures and skin staplers remains a topic of ongoing debate. This study aimed to compare the efficacy, safety, and cosmetic results of skin staplers versus traditional sutures in elective abdominal surgeries at RNT Medical College and Associated Hospitals, Udaipur. **Methods:** This hospital-based prospective observational study was conducted on 94 patients undergoing elective abdominal surgeries. Patients were randomly assigned to two groups: Group A (skin staplers) and Group B (conventional sutures), following inclusion and exclusion criteria. Data were collected using a structured proforma, and postoperative outcomes were evaluated using standardized scoring systems. Key parameters assessed included skin closure time, wound healing (Southampton score), time to suture removal, pain, and scar cosmesis at day 30. **Results:** Group A demonstrated significantly shorter skin closure time (53.51 ± 9.66 seconds vs. 328.93 ± 49.61 seconds; $p < 0.0001$) and earlier suture removal (10.97 ± 0.89 days vs. 12.85 ± 0.72 days; $p < 0.0001$). Better wound healing was observed in Group A, with 82.98% achieving Southampton score 1-A, compared to a higher rate of complications in Group B ($p = 0.0001$). Cosmetic outcomes at day 30 were superior in Group A (mean score 4.4 ± 0.68 vs. 3.44 ± 1.09 ; $p < 0.0001$). **Conclusion:** Skin staplers significantly reduced operative time, improved wound healing, and enhanced cosmetic results compared to conventional sutures. They represent a faster, safer, and more patient-friendly alternative for skin closure in elective abdominal surgeries.

KEYWORDS

Skin staplers, conventional sutures, wound healing, abdominal surgery, Southampton score, cosmetic outcome, skin closure techniques, postoperative recovery.

INTRODUCTION

In the dynamic field of modern surgery, achieving optimal outcomes, patient safety, and aesthetic satisfaction is a top priority, particularly in elective abdominal surgeries. These procedures demand meticulous wound closure to minimize complications such as infection, dehiscence, and hernia formation. A key debate in surgical wound management is the choice between conventional suturing techniques and skin staplers. An ideal closure method should be technically simple, reproducible, minimize complications, and provide a cosmetically acceptable scar.¹

Recently, skin staplers have gained popularity for their ability to reduce operative time, standardize closure, and potentially lower costs in high-volume settings. Meiring et al. found that staplers saved up to 80% of closure time with comparable aesthetic results.² Newman et al. reported higher complication rates with sutures compared to staples. However, staplers may also cause increased discomfort, inflammation, and inferior cosmetic outcomes in some regions.³

The evolution of wound closure spans from ancient use of plant fibers and horsehair to modern innovations. The goal remains the same: precise, tension-free approximation promoting rapid healing and minimal scarring. While subcuticular sutures are preferred aesthetically, staples—made of stainless steel—offer fast closure, especially for large incisions.⁴

Surgical scars reflect a surgeon's precision. Sutures provide patient-specific adaptability and precise edge approximation but may be time-intensive and risk hypertrophic scarring. Conversely, staplers offer rapid closure, comparable outcomes, and reduced fatigue. In elective abdominal procedures like hernia repairs or appendectomies, both techniques are frequently used.⁵

With increasing surgical load at tertiary centers like RNT Hospital, efficient closure techniques are essential. Skin staplers may reduce operating time, anesthesia exposure, and infection risk. However, factors like cost, availability, and patient-specific variables influence choice.⁶ This observational study compares conventional sutures and staplers in elective abdominal surgeries at RNT Hospital to guide clinical practice and improve outcomes.

MATERIALS AND METHODS

Study Overview: This hospital-based observational study was a prospective investigation conducted in the Department of Surgery at RNT Medical College and Associated Hospitals, Udaipur. It ran from the Ethics Committee's approval until Nov 2024 to March 2025. The study included patients undergoing elective abdominal surgeries with skin closure using either staplers or sutures, selected based on defined inclusion and exclusion criteria.

Inclusion Criteria: Patients included in the study were those undergoing elective abdominal surgeries.

Exclusion Criteria: Patients were excluded if they had traumatic wounds, incisions requiring closure under tension, were immunocompromised, below 18 years of age, or did not provide informed consent.

Sample: The sample size was calculated to be 94 with prevalence of healed Suture in stapler method as 92% and in conventional method as 60%, with 95% Confidence interval, 80% power and 5% alpha error. After considering 20% as non-response/attrition, final sample came out to be 118.

Methodology: After obtaining written informed consent, data were collected using a structured proforma. Patients were randomly assigned to sutures or staplers. Wound healing, infections, scar appearance, and pain were evaluated postoperatively using validated scoring systems on specified follow-up days.

Ethical Consideration: The study received ethical approval from the Ethical Review Committee and institutional clearance from RNT Medical College, Udaipur. Written informed consent was obtained after explaining the study's purpose, risks, benefits, confidentiality, and participants' rights. A printed handout with study details was also provided and explained.

RESULT AND OBSERVATIONS

Table No- 1 Distribution Of Patients According To Length Of Incision (In CMS).

Length of Incision	Group A		Group B	
	No. of Patients	Percentage	No. of Patients	Percentage

<5cms	25	53.19	18	38.30
<5cms	22	46.81	29	61.70
Total	47	100.00	47	100.00
Mean± SD	5.46±0.5		5.91±0.82	
P-Value	0.001			

*Students t-test, Significant <0.05

The length of incision in Group A was 5 cm in 25 patients (53.19%) and 6 cm in 22 patients (46.81%). In Group B, 18 patients (38.30%) had a 5 cm incision, while 29 patients (61.70%) had a 6 cm incision. The mean incision length was significantly shorter in Group A (5.46 ± 0.5 cm) compared to Group B (5.91 ± 0.82 cm), with the difference being statistically significant (p = 0.001).

Table No- 2 Distribution Of Patients According To Time.

Time	Group A		Group B		P- Value
	Mean	SD	Mean	SD	
For Skin Closure (in sec)	53.51	9.66	328.93	49.61	<0.0001

*Students t-test, Significant <0.05

The mean time taken for skin closure was significantly shorter in Group A, with an average of 53.51 ± 9.66 seconds, compared to Group B, which took 328.93 ± 49.61 seconds. This difference was highly statistically significant (p < 0.0001).

Table No- 3 Distribution Of Patients According To VAS Pain Score.

VAS Pain Score	Group A		Group B	
	No. of Patients	Percentage	No. of Patients	Percentage
One	21	44.68	6	12.77
Two	23	48.94	33	70.21
Three	3	6.38	8	17.02
Total	47	100.00	47	100.00
Mean ±SD	1.61±0.6		2.04±0.54	
P-Value	0.0004			

*Students t-test, Significant <0.05

In Group A, 21 patients (44.68%) reported a VAS pain score of one, 23 patients (48.94%) scored two, and 3 patients (6.38%) scored three. In Group B, pain scores were higher, with 6 patients (12.77%) reporting a score of one, 33 patients (70.21%) scoring two, and 8 patients (17.02%) scoring three. The mean VAS pain score was significantly lower in Group A (1.61 ± 0.6) compared to Group B (2.04 ± 0.54), indicating less pain, and this difference was statistically significant (p = 0.0004).

Table No- 4 Distribution Of Patients According To Southampton Score.

Southampton Score	Group A		Group B		P- Value
	No. of Patients	Percentage	No. of Patients	Percentage	
Normal Healing with some bruising or erythema	39	82.98	12	25.53	0.0001
Erythema plus other signs of inflammation at one point	5	10.64	15	31.91	
Erythema plus other signs of inflammation at around sutures	0	0.00	10	21.28	
Erythema plus other signs of inflammation around wound	0	0.00	5	10.64	
Clear or haemoserous discharge at one point (<2cm)	3	6.38	5	10.64	
Total	47	100.00	47	100.00	

*Chi-square test, Significant <0.05

The Group A showed significantly better wound healing, with 82.98% having a Southampton score of 1-A. In contrast, Group B had more wound complications, with higher proportions scoring 2-A, 2-B, and 2-D. The difference between groups was statistically significant (p = 0.0001), favoring improved outcomes in Group A.

Table No- 5 Distribution Of Patients According To Time For Suture Removal (in Days).

Time for Suture Removal (in days)	Group A		Group B	
	No. of Patients	Percentage	No. of Patients	Percentage
10-12	46	97.87	16	34.04
>12	1	2.13	31	65.96
Total	47	100.00	47	100.00
Mean ±SD	10.97±0.89		12.85±0.72	
P-Value	<0.0001			

*Students t-test, Significant <0.05

In Group A, the majority of patients (46, 97.87%) had their sutures removed within 10-12 days, while only 1 patient (2.13%) had removal after 12 days. In contrast, Group B had 16 patients (34.04%) with suture removal at 10-12 days and 31 patients (65.96%) after 12 days. The mean time for suture removal was significantly shorter in Group A (10.97 ± 0.89 days) compared to Group B (12.85 ± 0.72 days), with this difference being highly statistically significant (p < 0.0001).

Table No- 6 Distribution of Patients According to Wound Cosmesis Score (At Day 30).

Wound Cosmesis Score (at day 30)	Group A		Group B	
	No. of Patients	Percentage	No. of Patients	Percentage
One	0	0.00	4	8.51
Two	1	2.13	6	12.77
Three	2	4.26	6	12.77
Four	21	44.68	27	57.45
Five	23	48.94	4	8.51
Total	47	100.00	47	100.00
Mean ± SD	4.4±0.68		3.44±1.09	
P-Value	<0.0001			

*Students t-test, Significant <0.05

At day 30, Group A demonstrated significantly better cosmetic outcomes, with most patients scoring 4 or 5. Group B had lower scores and fewer excellent results. The mean cosmesis score was higher in Group A (4.4 ± 0.68) than Group B (3.44 ± 1.09), with a significant difference (p < 0.0001).

DISCUSSION

In terms of incision length, Group A had more patients with shorter incisions, as 25 individuals (53.19%) had 5 cm wounds and the remaining 22 (46.81%) had 6 cm incisions. Conversely, in Group B, a greater proportion—29 patients (61.70%)—had 6 cm incisions, while only 18 (38.30%) had 5 cm incisions. The mean incision length was notably shorter in Group A at 5.46 ± 0.5 cm compared to 5.91 ± 0.82 cm in Group B, and this difference reached statistical significance (p = 0.001). Likewise, Karthikeyan S et al⁷ reported nearly identical mean incision lengths between groups, with the stapler group averaging 15.58 ± 1.9 cm and the suture group 15.48 ± 2.4 cm, indicating no significant disparity and suggesting that incision size was unlikely to influence closure outcomes. Similarly, Batra J et al⁸ observed mean incision lengths of 54.0 ± 16.3 cm in the control group and 53.7 ± 15.4 cm in the study group, with a negligible difference (t = 0.06, p = 0.95), reinforcing the idea of comparable wound dimensions.

The Suture removal was completed earlier in Group A, with 46 patients (97.87%) undergoing removal between the 10th and 12th day post-surgery, and only 1 patient (2.13%) requiring removal beyond 12 days. In contrast, Group B showed a delayed pattern, where only 16 patients (34.04%) had sutures removed within 10–12 days, and a larger portion—31 patients (65.96%)—underwent removal after 12 days. The average duration until suture removal was notably shorter in Group A (10.97 ± 0.89 days) than in Group B (12.85 ± 0.72 days), with this difference being highly significant (p < 0.0001). Similarly, Gupta S K et al⁸ reported that the stapler group demonstrated faster suture removal, requiring only 10.36 seconds per centimeter, whereas the suture group took 48.46 seconds per centimeter, highlighting greater postoperative efficiency with staples. In a comparable study, Pandove P K et al⁹ also observed that the stapler group had a significantly quicker suture removal time (7.4 ± 1.1 seconds) in contrast to the suture group (22.3 ± 1.7 seconds), with a p-value of <0.001.

Pain perception assessed by the Visual Analog Scale (VAS) was

significantly lower in Group A (stapler group), with a mean score of 1.61 ± 0.6 compared to 2.04 ± 0.54 in Group B ($p = 0.0004$). In Group A, 44.68% reported VAS 1, 48.94% VAS 2, and 6.38% VAS 3, whereas in Group B, 12.77% reported VAS 1, 70.21% VAS 2, and 17.02% VAS 3. **Chavan DR et al.**¹⁰ reported higher VAS scores in the stapler group (7.1 ± 0.55) vs. suture group (6.4 ± 0.61) at one month ($p < 0.0001$). **In contrast, Pandya R et al.**¹¹ found no significant difference in VAS on Day 3 or 30 ($p = 0.64$, $p = 1.00$), though pain during staple removal was higher (mean 2.48 vs. 1.10; $p = 0.02$).

The average time required for skin closure was markedly less in Group A, averaging 53.51 ± 9.66 seconds, while Group B took considerably longer at 328.93 ± 49.61 seconds, a difference that was highly statistically significant ($p < 0.0001$). **Similarly, Liaquat A et al.**¹² observed that patients in the stapler group experienced significantly quicker closures (4.62 ± 1.10 minutes) than those in the conventional suturing group (11.57 ± 2.06 minutes), with a p -value of 0.001, reinforcing the time-saving advantage of staplers. **In a comparable study, Rabha P et al.**¹³ also reported that stapler closure required only 60 ± 15.3 seconds on average, whereas suturing took approximately 219.3 ± 47.72 seconds, almost four times longer ($p < 0.001$).

At the 30-day follow-up, wound cosmesis was notably better in Group A than in Group B. In Group A, a majority of patients achieved higher cosmetic scores—21 patients (44.68%) scored four, and 23 patients (48.94%) scored five—reflecting good to excellent healing. Conversely, in Group B, fewer patients attained the top score of five (4 patients, 8.51%), and a larger number were distributed among lower scores: one (4 patients, 8.51%), two (6 patients, 12.77%), and three (6 patients, 12.77%). The mean cosmesis score in Group A was 4.4 ± 0.68 , significantly higher than Group B's 3.44 ± 1.09 ($p < 0.0001$), highlighting the superior cosmetic outcome associated with stapler use. **Similarly, Ananda B B et al.**¹⁴ also assessed cosmetic outcomes over time; although initial cosmesis scores on day 7 were comparable across closure methods ($p = 0.770$), by one month, the glue group demonstrated significantly better results (mean 88.90) compared to staples (79.77) and sutures (72.03) ($p < 0.001$). At five months, while all groups showed improvement, glue maintained the highest score (96.13), though the statistical difference narrowed ($p = 0.057$), suggesting glue yielded the best long-term cosmetic results. **Likewise, Keng T M et al.**¹⁵ found that patients who underwent groin incisions had better wound appearance at four weeks when glue was used (mean score 4.71) compared to subcuticular sutures (mean 4.00), with the difference being statistically significant ($p < 0.05$).

On POD 2, complications were significantly higher in Group B (27.66%) than Group A (8.51%; $p = 0.01$). By POD 7, rates declined in both groups but remained higher in Group B (19.15% vs. 6.38%; $p = 0.06$). On POD 30, complications were rare and comparable. Overall, Group A showed consistently fewer early postoperative complications. **In a similar study, Singh H R et al.**¹⁶ also reported fewer complications in the stapler group, with only 5 of 25 patients (20%) experiencing issues, primarily clear (12%) and purulent discharge (8%). In contrast, the suture group had a complication rate of 36%, including 20% with clear and 16% with purulent discharge, indicating a higher burden of wound-related problems. **Likewise, Batra J et al.**⁵ found comparable complication rates between groups, with 20.5% in the control group and 23.7% in the study group. While wound dehiscence was slightly more frequent in the study group (18.4% vs. 10.3%), prolonged discharge was more common in the control group (10.3% vs. 5.3%). However, these differences were not statistically significant ($p = 0.73$), suggesting relatively similar safety profiles.

CONCLUSION

This comparative study found that skin staplers are more effective than conventional suturing for skin closure in elective abdominal surgeries. Both groups were comparable in baseline characteristics, ensuring fair comparison. The stapler group showed significantly shorter skin closure time and earlier suture removal, leading to faster recovery. Patients experienced less postoperative pain, better wound healing (as indicated by superior Southampton scores), and fewer early complications. Cosmetic outcomes at 30 days were also more favorable with staplers. Late complications were minimal and similar across groups. Overall, skin stapling proved to be a faster, safer, and more patient-friendly closure method.

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