

Original Research Article

Skin staples versus skin sutures for skin closure in elective and emergency abdominal surgeries: a prospective comparative study

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ABSTRACT

Background: Skin closure influences operative time, postoperative pain, wound healing, surgical site infection (SSI) and cosmetic outcome. This study compared skin staples with conventional skin sutures in elective and emergency abdominal surgeries.

Methods: In this prospective comparative study, 97 adults undergoing abdominal surgery were enrolled: 49 received metallic skin staples and 48 received conventional non-absorbable interrupted skin sutures. The primary outcome was skin closure time. Secondary outcomes were Visual Analog Scale (VAS) pain scores, SSI, wound dehiscence, Vancouver Scar Scale score at three months and time to removal of closure material.

Results: Skin closure time was shorter with staples than sutures (3.2 ± 0.8 vs. 9.6 ± 1.9 minutes; $p < 0.001$). Pain scores were lower with staples at 24 hours, postoperative day 3 and postoperative day 7. SSI occurred in 12.2% versus 20.8% and wound dehiscence in 4.1% versus 10.4%, in the staple and suture groups, respectively. Cosmetic scores were higher with staples (8.6 ± 1.1 vs. 7.8 ± 1.3 ; $p = 0.01$) and removal occurred earlier (8.1 ± 1.2 vs. 9.4 ± 1.5 days; $p = 0.004$).

Conclusions: Metallic skin staples reduced closure time and postoperative pain and produced better cosmetic outcomes without increasing wound-related complications. They are a safe and efficient alternative to conventional skin sutures for abdominal wound closure.

Keywords: Abdominal surgery, Cosmetic outcome, Skin staples, Skin sutures, Surgical site infection, Wound closure

INTRODUCTION

Appropriate closure of a surgical wound is essential for achieving satisfactory healing and minimizing postoperative complications. The quality of skin closure influences not only wound integrity but also patient comfort, scar formation and the risk of infection. Surgical site infections remain a major concern worldwide and continue to contribute to increased morbidity, prolonged hospitalization and additional healthcare expenditure.¹⁻³ Successful skin closure is a critical component of wound management following surgery. An ideal method of skin closure should provide secure wound approximation, minimize tissue trauma, reduce postoperative pain, lower the risk of infection and achieve satisfactory cosmetic

outcomes.^{4,5} Conventional skin sutures have long been the standard method for skin closure; however, alternative techniques have been developed to improve operative efficiency and patient outcomes.⁶ Recent advances in wound care and infection prevention strategies have emphasized the importance of meticulous surgical technique, appropriate wound management and evidence-based measures to reduce postoperative complications.⁷⁻¹¹ Among these advances, metallic skin staples have gained popularity because of their ease of application, rapid wound approximation and potential to decrease operative time. Basic principles of wound healing suggest that accurate approximation of skin edges with minimal tissue trauma may contribute to improved healing and scar quality.¹²⁻¹⁴ Previous investigations comparing staples and

sutures have reported varying results with regard to closure speed, postoperative discomfort, infection rates and cosmetic appearance. Consequently, further evaluation of these techniques remains clinically relevant.

The present study was designed to compare skin staples and conventional skin sutures in patients undergoing elective and emergency abdominal surgeries, focusing on wound closure time, postoperative pain, wound complications and cosmetic outcomes.

METHODS

Study design and setting

This prospective observational comparative study was performed in the Department of General Surgery at Great Eastern Medical School and Hospital, Ragolu, Srikakulam, Andhra Pradesh, India. The study period was March 2024 to February 2026.

Ethical approval

Institutional Ethics Committee approval was obtained before commencement of the study (IEC Reg. No. 01/IEC/GEMS&H/2024).

Study population

Adult patients undergoing elective or emergency abdominal surgery at our institution were considered eligible for participation. Patients older than 18 years who were willing to provide written informed consent were included in the study. Patients with severe immunocompromised states, known collagen vascular disorders or those unwilling to participate were excluded from the study.

Sample size

This investigation was designed as a prospective comparative observational study. Consecutive eligible patients who met the inclusion criteria and provided written informed consent were recruited. A total of 97 patients were enrolled, including 49 patients in the stapler group and 48 patients in the suture group.

Methodology

Eligible patients undergoing elective or emergency abdominal surgery during the study period were enrolled. The trial comprised 97 patients in total. Patients were divided into two groups: the stapler group (n=49) and the suture group (n=48), depending on the skin closure method employed by the operating surgeon.

In the stapler group, wound closure was performed using sterile disposable metallic skin staples. In the suture group, skin closure was achieved using conventional interrupted

non-absorbable skin sutures. The choice of closure method was left to the discretion of the operating surgeon.

The primary outcome assessed was the duration required for skin closure. Secondary outcomes included postoperative pain, surgical site infection, wound dehiscence, cosmetic appearance of the scar and time required for removal of the closure material.

Pain was assessed using the visual analog scale (VAS) at 24 hours, postoperative day 3 and postoperative day 7. Surgical wounds were evaluated during follow-up visits for signs of infection, discharge and wound separation. Cosmetic assessment was performed at three months using the Vancouver Scar Scale, a validated scar assessment instrument described by Sullivan et al.¹⁵

Statistical analysis

Microsoft Excel was used to enter the collected data and statistical software was used for analysis. Categorical data were expressed as frequencies and percentages and continuous variables as mean±standard deviation. The independent-samples Student's t-test was used for continuous variables and the chi-square test or Fisher's exact test was used for categorical variables. Statistical significance was defined as $p < 0.05$.

RESULTS

A total of 97 patients were included: 49 (50.5%) in the stapler group and 48 (49.5%) in the suture group.

Skin closure was completed significantly faster in patients who underwent stapled closure than in those who received conventional sutures (3.2 ± 0.8 vs. 9.6 ± 1.9 minutes; $p < 0.001$, Table 3 and Figure 1).

The stapler group had significantly lower Visual Analog Scale (VAS) scores at 24 hours (3.4 ± 1.1 vs. 4.6 ± 1.3 ; $p = 0.002$), postoperative day 3 (2.1 ± 0.9 vs. 3.0 ± 1.0 ; $p = 0.01$) and postoperative day 7 (1.2 ± 0.6 vs. 1.6 ± 0.7 ; $p = 0.04$, Figure 2).

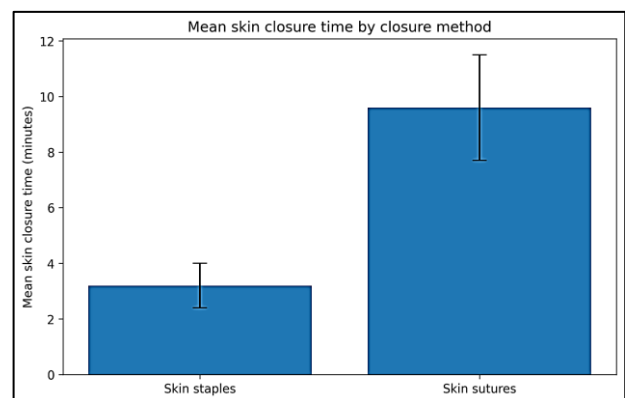


Figure 1: Mean skin closure time between stapler and suture groups.

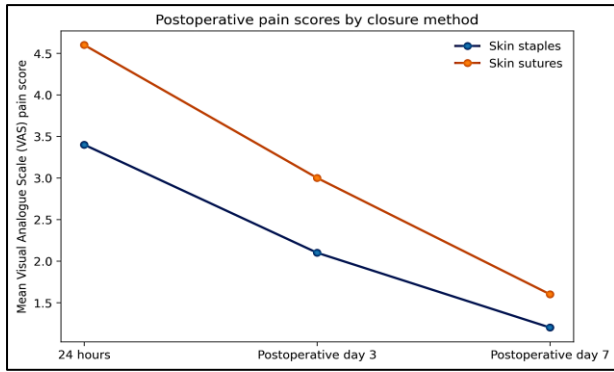


Figure 2: Comparison of postoperative pain scores.

Ten patients (20.8%) in the suture group and six patients (12.2%) in the stapler group experienced surgical site

infections. Two patients (4.1%) and five patients (10.4%) had wound dehiscence, respectively ($p=0.27$).

Cosmetic outcomes at three months were significantly better in the stapler group, with a higher mean cosmetic score (8.6 ± 1.1 vs. 7.8 ± 1.3 ; $p=0.01$; Table 3). Excellent cosmetic outcomes were observed in 59.2% of stapler patients compared with 41.7% of suture patients.

The average time required for removal of closure material was shorter among patients who underwent stapled closure (8.1 ± 1.2 days) compared with those who received sutures (9.4 ± 1.5 days; $p=0.004$). Overall, skin staples were associated with faster wound closure, lower postoperative pain, improved cosmetic outcomes and earlier removal, while maintaining comparable rates of wound complications.

Table 1: Demographic and procedural characteristics of the study population.

Characteristic	Staples (n=49)	Sutures (n=48)	Total (n=97)
Age, years, mean $\pm$ SD	44.6 $\pm$ 12.1	45.2 $\pm$ 11.8	—
Age 13–30 years	10 (20.4%)	9 (18.8%)	19 (19.6%)
Age 31–45 years	14 (28.6%)	15 (31.3%)	29 (29.9%)
Age 46–60 years	17 (34.7%)	16 (33.3%)	33 (34.0%)
Age >60 years	8 (16.3%)	8 (16.6%)	16 (16.5%)
Male	31 (63.3%)	30 (62.5%)	61 (62.9%)
Female	18 (36.7%)	18 (37.5%)	36 (37.1%)
Elective surgery	30 (61.2%)	29 (60.4%)	59 (60.8%)
Emergency surgery	19 (38.8%)	19 (39.6%)	38 (39.2%)

Table 2: Study group distribution.

Group	Patients, N	%
Stapler	49	50.5
Suture	48	49.5

Table 3: Comparison of skin closure time between study groups.

Group	N	Mean (minutes)	Standard deviation	Standard error mean	t-value	P value
Stapler	49	3.20	0.80	0.114	20.42	<0.001
Suture	48	9.60	1.90	0.274	20.42	<0.001

Table 4: Comparison of cosmetic outcome using the Vancouver Scar Scale.

Group	N	Mean score	Standard deviation	Standard error mean	t-value	P value
Stapler	49	8.60	1.10	0.157	3.32	0.01
Suture	48	7.80	1.30	0.188	3.32	0.01

DISCUSSION

The present study evaluated the effectiveness of metallic skin staples compared with conventional skin sutures for skin closure in elective and emergency abdominal surgeries. The findings demonstrated that skin staples significantly reduced wound closure time while providing favorable postoperative outcomes. One of the most notable

observations in the present study was the marked reduction in skin closure time among patients who underwent staple closure. The mean closure time in the stapler group was significantly lower than that in the suture group. Similar findings have been reported, with staples facilitating rapid wound approximation and improving operative efficiency.^{4,6} Reduced closure time may shorten operative duration and improve operating room utilization,

particularly in high-volume surgical settings. Postoperative pain scores were consistently lower in the stapler group at all assessed intervals. This finding may be attributed to reduced tissue manipulation and more uniform wound edge approximation achieved with staple application. Previous studies comparing staples and sutures have reported similar improvements in postoperative comfort among patients undergoing staple closure.^{4,6} Lower pain scores may contribute to improved patient satisfaction and earlier postoperative mobilization.

Although there was no statistically significant difference, the stapler group experienced fewer surgical site infections than the suture group. Prevention of surgical site infection remains a major objective in surgical practice because of its association with increased morbidity, prolonged hospitalization and healthcare costs.^{1,2,7} Current international guidelines emphasize meticulous wound management, atraumatic tissue handling and adherence to evidence-based infection prevention strategies to minimize wound complications.^{8,9} The lower infection rates observed in the stapler group may be related to reduced tissue trauma and shorter wound closure time.

Wound dehiscence rates were low in both groups, indicating that both closure methods provide adequate wound security. Similar observations have been reported in previous comparative studies, suggesting that staple closure does not compromise wound integrity when compared with conventional suturing techniques.^{4,6} Cosmetic outcomes assessed using the Vancouver Scar Scale were significantly better in the stapler group. Precise alignment of wound edges and minimal tissue distortion achieved with staples may contribute to improved scar formation. Previous studies have similarly demonstrated favorable cosmetic outcomes following staple closure.^{4,6} Furthermore, optimal wound care and postoperative dressing practices have been shown to positively influence scar quality and wound healing.¹⁰

The results of this study add to the increasing amount of data indicating that metallic skin staples are a workable substitute for traditional sutures in the closure of abdominal wounds. In addition to reducing closure time, staples were associated with lower postoperative pain and improved cosmetic outcomes while maintaining acceptable rates of infection and wound-related complications. These findings are consistent with broader surgical literature emphasizing the importance of efficient wound closure techniques and evidence-based wound care practices.^{7,8,11} Overall, the results of this study support the use of skin staples as a safe and efficient substitute for traditional skin sutures when closing abdominal wounds.

Limitations

This study has several limitations. First, it was carried out at a single tertiary care facility with a limited sample size, which may restrict generalizability. Second, patients were not randomly assigned to the stapler or suture group,

creating a risk of selection bias. Third, cosmetic outcomes were assessed only three months after surgery; longer follow-up could provide additional information on long-term scar quality. Multicenter studies with larger sample sizes and longer follow-up are needed to confirm these findings.

CONCLUSION

Skin staples represent a safe, effective and efficient method for skin closure in elective and emergency abdominal surgeries. Compared with conventional skin sutures, staples reduce closure time, improve patient comfort and provide superior cosmetic outcomes without increasing wound complications. Skin staplers may therefore be considered a valuable alternative for routine abdominal wound closure.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. World Health Organization. Global guidelines for the prevention of surgical site infection. World Health Organization. 2016.
2. Mangram AJ, Horan TC, Pearson ML, Silver LC, Jarvis WR: Guideline for prevention of surgical site infection. 1999, 1999:250-78.
3. Horan TC, Gaynes RP, Martone WJ, Jarvis WR, Emori TG: CDC definitions of nosocomial surgical site infections. 1992;2:606-8.
4. Mackeen AD, Berghella V, Larsen ML: Techniques and materials for skin closure in cesarean section . Cochrane Database Syst Rev. 2012;11, 003577-10.
5. Pillai CKS, Sharma CP: Review paper: absorbable polymeric surgical sutures. J Biomater Appl. 2010;5:291-366.
6. Meiring L, Cilliers K, Barry R, Nel CJ. A comparison of a disposable skin stapler and nylon sutures for wound closure. S Afr Med J. 1982;62(11): 371-2.
7. Owens CD, Stoessel K: Surgical site infections: epidemiology, microbiology and prevention. J Hosp Infect. 2008;2:3-10.
8. Anderson DJ, Podgorny K, Berríos-Torres SI. Strategies to prevent surgical site infections in acute care hospitals. Infect Control Hosp Epidemiol. 2014;35:605-27.
9. Berríos-Torres SI, Umscheid CA, Bratzler DW. Centers for Disease Control and Prevention guideline for the prevention of surgical site infection. 2017;152:784-91.
10. Dumville JC, Gray TA, Walter CJ. Dressings for the prevention of surgical site infection . Cochrane Database Syst Rev. 2016;3091:10.
11. Leaper DJ, van Goor H, Reilly J. Surgical site infection - a European perspective of incidence and economic burden. Int Wound J. 2004;3:247-73.

12. O'Connell PR, McCaskie AW, Sayers RD, editors. Bailey & Love's short practice of surgery. 2023.
13. Kaleem A, Ab Hamid Wani GS, Rayoo S, Parihar S. Comparison of fenyo lindberg scoring system with modified alvarado scoring system for diagnosis of acute appendicitis. *IP J Surg Allied Sci.* 2025;7(4):128-33.
14. Grady ZJ, Gallo LK, Lin HK, Magod BL, Coulthard SL, Flink BJ, Knauer EM, Winer JH, Papandria D, Pettitt BJ. From the operating room to online: medical student surgery education in the time of COVID-19. *J Surg Res.* 2022;270:145-50.
15. Sullivan T, Smith J, Kermode J, McIver E, Courtemanche DJ: Rating the burn scar. *J Burn Care Rehabil.* 1990,11:256-60.

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