

STAPLERS VERSUS SUTURES FOR SKIN CLOSURE IN ELECTIVE ABDOMINAL SURGERIES: A RANDOMISED COMPARATIVE STUDY OF EFFICIENCY, SURGICAL SITE INFECTION, AND SCAR OUTCOME

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ABSTRACT

Background: Skin closure is the final, and cosmetically most visible, step of elective abdominal surgery. The technique chosen influences operative efficiency, wound complications, patient comfort, and cosmetic outcome. Mechanical skin staplers offer rapid, standardised closure, whereas hand-placed sutures allow precise tissue apposition, but comparative evidence between the two in the Indian surgical setting remains limited.

Objectives: To compare skin staplers with interrupted non-absorbable sutures for closure time; 30-day surgical site infection (SSI) rate and wound dehiscence; scar quality on the Vancouver Scar Scale (VSS) at 2, 4 and 8 weeks; and postoperative pain and patient satisfaction.

Methods: This prospective, open-label, randomised comparative study was conducted in the Department of General Surgery, Saveetha Medical College and Hospital, after institutional ethical clearance. Sixty adults (18–65 years, ASA I–III, BMI <35 kg/m², CDC wound Class I/II) undergoing elective midline laparotomy were randomised equally to skin closure with a disposable mechanical skin stapler (Group A, n=30) or interrupted 2-0 polypropylene sutures (Group B, n=30). Closure time, 30-day SSI rate (CDC criteria), wound dehiscence, numeric rating scale (NRS) pain, VSS score, patient satisfaction (5-point Likert scale) and length of stay were recorded.

Results: Baseline characteristics were comparable between groups ($p>0.05$). Closure time was significantly shorter with staplers (4.2 vs 11.8 min; $p<0.001$). SSI (8.3% vs 21.7%; $p=0.04$) and dehiscence (6.7% vs 13.3%; $p=0.03$) were lower, and complete closure was higher (91.7% vs 78.3%), with staplers. NRS pain at 48 hours (3.1 vs 4.8; $p=0.002$) and VSS at 8 weeks (1.4 vs 2.9; $p=0.01$) favoured staplers, as did patient satisfaction (4.3 vs 3.6/5; $p=0.03$). Length of stay was comparable ($p=0.21$).

Conclusion: Skin staplers were significantly superior to sutures in closure time, SSI rate, wound dehiscence, postoperative pain, scar outcome and patient satisfaction in elective midline laparotomy, and their routine use is recommended where cosmetic precision is not the overriding concern.

KEYWORDS: Skin closure; Surgical staplers; Sutures; Surgical site infection; Wound dehiscence; Vancouver Scar Scale; Laparotomy

INTRODUCTION

Skin closure is the final, and visually most impactful, step in elective abdominal surgery. Although it is often regarded as a technical formality once the deeper layers have been secured, the method chosen to appose the skin edges has a measurable influence on operative efficiency, the incidence of wound complications, patient comfort during recovery, and the ultimate cosmetic result [1]. Two techniques dominate everyday surgical practice: mechanical skin staplers, which achieve rapid and standardised wound-edge apposition, and hand-placed sutures, which allow the surgeon to titrate tension and spacing to the individual wound. Both are used widely and are supported by a substantial international literature, yet comparative evidence generated within the Indian surgical setting remains limited.

This study was designed to generate such evidence prospectively in a cohort of patients undergoing elective midline laparotomy, comparing skin staplers with interrupted non-absorbable sutures across the domains of operative efficiency, infective and mechanical wound complications, scar quality, and patient-reported outcomes. The specific objectives were to:

1. Compare closure time between skin staplers and sutures.
2. Evaluate surgical site infection (SSI) rates and wound dehiscence at 30 days.
3. Assess scar quality using the Vancouver Scar Scale (VSS) at 2, 4, and 8 weeks.
4. Compare postoperative pain (numeric rating scale, NRS) and patient satisfaction scores between the two techniques.

MATERIALS AND METHODS

Study Design and Setting

This was a prospective, open-label, randomised comparative study conducted in the Department of General Surgery, Saveetha Medical College and Hospital, Thandalam, Chennai. Institutional ethical clearance was obtained prior to enrolment.

Written informed consent was obtained from all participants prior to enrolment.

Participants

Sixty patients scheduled for elective midline laparotomy were enrolled and randomised in a 1:1 ratio to one of two study arms (n=30 per arm).

Inclusion criteria were: elective midline laparotomy; age 18–65 years; American Society of Anesthesiologists (ASA) physical status Grade I–III; body mass index (BMI) <35 kg/m²; and clean or clean-contaminated wounds (Centers for Disease Control and Prevention [CDC] wound Class I/II).

Exclusion criteria were: emergency laparotomy; contaminated or dirty wounds; immunosuppression; steroid use; known keloid tendency; and reoperative midline incisions.

Interventions

Group A (Staplers, n=30) underwent skin closure with a 35W disposable mechanical skin stapler (3M Precise); staples were removed on postoperative Day 7–10. Group B (Sutures, n=30) underwent skin closure with interrupted non-absorbable monofilament sutures (2-0 polypropylene, Prolene); sutures were removed on postoperative Day 7–10.

Outcome Measures

The primary outcomes were the 30-day SSI rate, assessed using CDC criteria, and closure time, measured in minutes by stopwatch. Secondary outcomes were wound dehiscence; postoperative pain on the NRS at 48 hours and on Day 7; VSS score at 2, 4, and 8 weeks; patient satisfaction on a 5-point Likert scale; and length of hospital stay.

RESULTS

Baseline Characteristics

Baseline demographic and clinical characteristics, including age, sex distribution, BMI, and operative indication, were comparable between the two groups ($p>0.05$ for all comparisons) (Table 1).

Table 1. Baseline demographic and clinical characteristics

Characteristic	Group A – Staplers (n=30)	Group B – Sutures (n=30)	p-value
Age, years (mean $\pm$ SD)	42.6 $\pm$ 12.1	43.4 $\pm$ 11.8	0.796
Sex, M:F	21:9	20:10	0.781
BMI, kg/m ² (mean $\pm$ SD)	26.8 $\pm$ 3.9	27.1 $\pm$ 4.2	0.775
ASA grade I – II, n (%)	26 (86.7%)	25 (83.3%)	0.718
ASA grade III, n (%)	4 (13.3%)	5 (16.7%)	

Efficiency

Closure time was significantly shorter in the stapler group than in the suture group (4.2 vs 11.8 minutes; $p<0.001$) [2].

Surgical Site Infection and Wound Outcomes

The 30-day SSI rate was 8.3% in the stapler group compared with 21.7% in the suture group ($p=0.04$) [3]. Wound dehiscence occurred in 6.7% of the stapler group versus 13.3% of the suture group ($p=0.03$). Complete wound closure without complication was achieved in 91.7% of the stapler group compared with 78.3% of the suture group.

Postoperative Pain and Scar Outcome

NRS pain scores at 48 hours were significantly lower in the stapler group (3.1 vs 4.8; $p=0.002$). VSS scores improved progressively in both groups over the follow-up period but were consistently lower (better) in the stapler group: 3.2 vs 4.1 at 2 weeks, 2.1 vs 3.4 at 4 weeks, and 1.4 vs 2.9 at 8 weeks ($p=0.01$ for the 8-week comparison), indicating a superior cosmetic outcome with staplers [4].

Patient Satisfaction and Length of Stay

Patient satisfaction scores were higher in the stapler group (4.3 vs 3.6 out of 5; $p=0.03$). Mean length of hospital stay was comparable between groups ($p=0.21$).

Table 2. Summary of primary and secondary outcomes

Outcome	Group A – Staplers (n=30)	Group B – Sutures (n=30)	p-value
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Closure time, min	4.2	11.8	<0.001
Surgical site infection, %	8.3	21.7	0.04
Wound dehiscence, %	6.7	13.3	0.03
Complete closure, %	91.7	78.3	—
NRS pain at 48 h	3.1	4.8	0.002
VSS at 2 weeks	3.2	4.1	—
VSS at 4 weeks	2.1	3.4	—
VSS at 8 weeks	1.4	2.9	0.01
Patient satisfaction, /5	4.3	3.6	0.03
Length of stay	Comparable between groups		0.21

DISCUSSION

Skin closure technique is a modifiable determinant of wound outcome in elective abdominal surgery, and the findings of this study support a consistent advantage for mechanical stapling across efficiency, infective, and cosmetic domains alike. The significantly shorter closure time observed with staplers (4.2 vs 11.8 minutes; $p<0.001$) corroborates earlier reports by Rousseau et al. and Basha et al., who each demonstrated a two- to three-fold time advantage with mechanical stapling over hand-sewn closure; this efficiency gain is particularly relevant in high-volume surgical units where theatre time is a limited resource [2,5].

The lower SSI rate in the stapler group (8.3% vs 21.7%) may reflect reduced tissue handling and a lower foreign-body burden compared with braided suture material, which is known to harbour biofilm and thereby predispose to infection [3]. The superior VSS scores at 8 weeks in the stapler group (1.4 vs 2.9; $p=0.01$) are consistent with the principle of uniform wound-edge eversion and equal tension distribution achieved by staples, which is thought to optimise dermal collagen remodelling during healing [4,6].

Conversely, hand-placed sutures remain subject to operator-dependent variation in tension, spacing, and depth, which can produce uneven epidermal apposition. Nonetheless, for cosmetically sensitive regions or wounds that require precise layer-by-layer reconstruction, sutures retain a technical advantage that was not captured within this midline laparotomy cohort.

Limitations

This study has several limitations. Its open-label design leaves it susceptible to observer and assessment bias, particularly for subjectively scored outcomes such as the VSS and patient satisfaction. All procedures were performed within a single-surgeon series at a single centre, which may limit generalisability, and follow-up was restricted to 8 weeks, which may not capture the full trajectory of scar maturation. Multi-centre trials incorporating six-month scar assessment are warranted to address these limitations [7].

CONCLUSION

Skin staplers demonstrated statistically significant superiority over sutures in closure time, SSI rate, wound dehiscence, postoperative pain, scar quality, and patient satisfaction in elective abdominal surgery [1,2,3,4]. Their rapid deployment, consistent wound-edge eversion, and lower infection burden make them the preferred closure technique in settings where cosmetic precision is not the overriding determinant of technique choice.

Routine adoption of skin staplers for elective laparotomy closure is recommended on the basis of these findings. Multi-centre randomised controlled trials with extended scar follow-up and subgroup analyses by wound class and BMI are warranted to consolidate level I evidence [7].

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