

“A Comparative Study Between Conventional Suturing and Skin Stapler in Surgical Skin Closure”

Dr. Triloki Nath Mishra

Postgraduate Resident (M.S. General Surgery)
Department of General Surgery
Venkateshwara Institute of Medical Sciences,
Shri Venkateshwara University, Gajraula, Amroha, Uttar Pradesh, India

Dr. Nitin Kumar Rastogi

Professor
Department of General Surgery
Venkateshwara Institute of Medical Sciences,
Shri Venkateshwara University, Gajraula, Amroha, Uttar Pradesh, India

Dr. Abhaya Bhatnagar

Professor & Head
Department of General Surgery
Venkateshwara Institute of Medical Sciences,
Shri Venkateshwara University, Gajraula, Amroha, Uttar Pradesh, India

Corresponding Author

Dr. Varsha Kumari

Assistant Professor
Department of General Surgery
Venkateshwara Institute of Medical Sciences,
Shri Venkateshwara University, Gajraula, Amroha, Uttar Pradesh, India

ABSTRACT

Background

Skin closure is a crucial component of surgical wound management that significantly influences postoperative wound healing, infection rates, cosmetic outcomes, operative duration, and patient satisfaction. Conventional suturing has long been the standard method of skin approximation; however, skin staplers have emerged as an effective alternative owing to their rapid application and reduced operative time. Despite increasing adoption, controversies persist regarding their cost-effectiveness, wound complications, and cosmetic superiority.

Objective

To compare conventional suturing and skin stapler techniques in terms of operative time, postoperative pain, wound infection, cosmetic outcome, and patient satisfaction in elective surgical procedures.

Methods

A prospective comparative observational study was conducted in the Department of General Surgery at Venkateshwara Institute of Medical Sciences, Gajraula, over a period of 18 months. A total of 120 patients undergoing elective surgical procedures requiring linear skin closure were included and divided equally into two groups: conventional suturing group (n=60) and skin stapler group (n=60). Parameters assessed included skin closure time, postoperative pain using Visual Analogue Scale (VAS), surgical site infection, scar assessment, duration of hospital stay, and patient satisfaction. Statistical analysis was performed using SPSS version 26.0.

Results

The mean skin closure time was significantly lower in the stapler group (3.8 ± 1.1 minutes) compared to the suture group (9.6 ± 2.4 minutes; $p < 0.001$). Postoperative wound infection rates were slightly lower in the stapler group (6.7%) than in the suturing group (10%), though statistically insignificant. Cosmetic outcomes assessed at 6 weeks showed superior scar appearance in the stapler group. Patients in the stapler group also reported lower postoperative pain scores and higher satisfaction rates.

Conclusion

Skin staplers provide faster wound closure with comparable complication rates and improved cosmetic outcomes when compared with conventional suturing. Skin stapling may therefore be considered an effective alternative for elective surgical skin closure, particularly in procedures where operative efficiency is essential.

KEYWORDS: Skin Stapler; Conventional Suturing; Surgical Site Infection; Wound Closure; Cosmetic Outcome; Postoperative Pain; General Surgery

INTRODUCTION

Surgical wound closure is one of the most fundamental and critical steps in operative procedures. An ideal skin closure technique should ensure accurate tissue approximation, minimize wound tension, reduce infection risk, promote optimal cosmetic healing, and improve patient comfort. Over the years, multiple techniques and materials have evolved for skin closure, among which conventional suturing remains the most widely practiced method worldwide (1).

Conventional suturing techniques involve the use of nonabsorbable or absorbable materials for precise tissue approximation. These methods provide good tensile strength and allow meticulous closure of wounds. However, suturing requires technical expertise, consumes significant operative

time, and may increase tissue handling and trauma, thereby potentially influencing postoperative inflammation and scar formation (2).

The introduction of metallic skin staplers revolutionized surgical wound closure by offering a rapid and standardized alternative. Surgical staplers were initially developed to reduce operative duration and minimize tissue manipulation. Their application has expanded significantly in modern surgical practice due to ease of use, consistency, and reduced closure time (3). Skin staplers are especially advantageous in lengthy surgical procedures, trauma cases, orthopedic surgeries, and high-volume operative settings.

Globally, surgical site infections (SSIs) remain among the leading causes of postoperative morbidity and prolonged hospitalization. According to the World Health Organization, SSI accounts for approximately one-third of healthcare-associated infections in low- and middle-income countries (4). In India, the burden of SSI is considerably high because of increased patient load, resource limitations, poor nutritional status, and delayed presentation of surgical cases (5). Therefore, selecting an appropriate skin closure method has significant implications for postoperative outcomes and healthcare costs.

Wound healing is a highly coordinated biological process involving hemostasis, inflammation, proliferation, and remodeling phases (6). Excessive tissue trauma during closure can impair vascularity and predispose to infection and delayed healing. Conventional suturing often requires repeated needle penetration and knotting, which may contribute to tissue ischemia and local inflammatory response. In contrast, skin staplers provide rapid mechanical approximation with minimal tissue handling, potentially reducing tissue edema and bacterial contamination (7).

Several studies have compared suturing and stapling techniques with variable conclusions. Some researchers have demonstrated significantly reduced operative time with staplers while maintaining acceptable cosmetic outcomes (8). Others have reported higher costs and occasional increased discomfort during staple removal (9). Certain meta-analyses have shown no significant difference in infection rates between the two techniques, whereas cosmetic outcomes may favor staplers in selected procedures (10).

Cosmetic appearance of surgical scars is another important determinant of patient satisfaction, particularly in younger individuals and surgeries involving exposed body areas. Modern healthcare increasingly emphasizes patient-centered outcomes, including pain perception, scar quality, and quality of life after surgery (11). Therefore, evaluating cosmetic outcomes alongside clinical effectiveness is essential.

In resource-constrained healthcare systems such as India, the economic implications of wound closure methods also deserve consideration. Although staplers are initially more expensive than

sutures, reduced operative time and shorter anesthesia exposure may offset the additional cost (12). Faster closure may additionally improve operation theater efficiency and reduce surgeon fatigue.

Despite extensive research, no universal consensus exists regarding the superiority of one method over another. Differences in surgical specialty, wound characteristics, patient comorbidities, and surgeon preference contribute to variability in outcomes reported across studies. Furthermore, limited data are available from tertiary care teaching hospitals in northern India regarding comparative outcomes between conventional suturing and skin staplers.

The present study was therefore undertaken to compare conventional suturing and skin stapler techniques in elective surgical skin closure with respect to operative time, postoperative pain, wound infection, cosmetic outcome, and patient satisfaction.

The primary objective of this study was to evaluate the effectiveness and safety of skin staplers compared with conventional suturing methods in general surgical procedures.

MATERIALS AND METHODS

This prospective comparative observational study was conducted in the Department of General Surgery at Venkateshwara Institute of Medical Sciences, Gajraula, Uttar Pradesh, over a duration of 18 months from January 2024 to June 2025. The study included patients undergoing elective surgical procedures requiring linear skin closure.

A total sample size of 120 patients was determined based on previous literature and institutional surgical workload. Patients were divided into two groups comprising 60 participants each. Group A underwent skin closure using conventional nonabsorbable nylon sutures, whereas Group B underwent skin closure using disposable stainless-steel skin staplers.

Patients aged between 18 and 65 years undergoing elective clean and clean-contaminated surgeries were included in the study. Patients with uncontrolled diabetes mellitus, immunocompromised status, chronic steroid therapy, keloidal tendency, severe anemia, or infected wounds were excluded.

Detailed demographic data, medical history, type of surgery, and operative findings were recorded using a predesigned proforma. All surgeries were performed under standard aseptic precautions by experienced surgeons. In both groups, deep fascial layers were closed uniformly before skin approximation.

The duration of skin closure was recorded using a stopwatch from initiation of skin approximation to complete wound closure. Postoperative pain was assessed using the Visual Analogue Scale

(VAS) at 24 and 72 hours. Wounds were examined for surgical site infection according to CDC criteria. Cosmetic outcome was assessed at 6 weeks using the modified Hollander wound evaluation scale.

Patients were followed until suture or staple removal and subsequently reviewed during outpatient visits. Ethical approval for the study was obtained from the Institutional Ethics Committee prior to commencement of the study. Written informed consent was obtained from all participants.

Data were entered into Microsoft Excel and analyzed using SPSS version 26.0. Continuous variables were expressed as mean $\pm$ standard deviation, while categorical variables were represented as frequencies and percentages. Student's t-test and Chi-square test were applied as appropriate. A p-value <0.05 was considered statistically significant.

RESULTS

A total of 120 patients participated in the study, with 60 patients in each group. The mean age in the suturing group was 42.6 ± 11.4 years, while in the stapler group it was 41.9 ± 10.8 years.

Table 1: Comparison of Operative and Clinical Outcomes

Parameter	Conventional Suturing	Skin Stapler	p-value
Mean Closure Time (min)	9.6 ± 2.4	3.8 ± 1.1	<0.001
Mean VAS Pain Score	5.8 ± 1.3	4.2 ± 1.1	0.002
Surgical Site Infection (%)	10%	6.7%	0.48
Mean Hospital Stay (days)	6.1 ± 1.5	5.2 ± 1.2	0.01
Patient Satisfaction (%)	76.7%	90%	0.03

Interpretation

The stapler group demonstrated significantly reduced wound closure time and lower postoperative pain scores compared with conventional suturing. Patient satisfaction was also significantly higher in the stapler group.

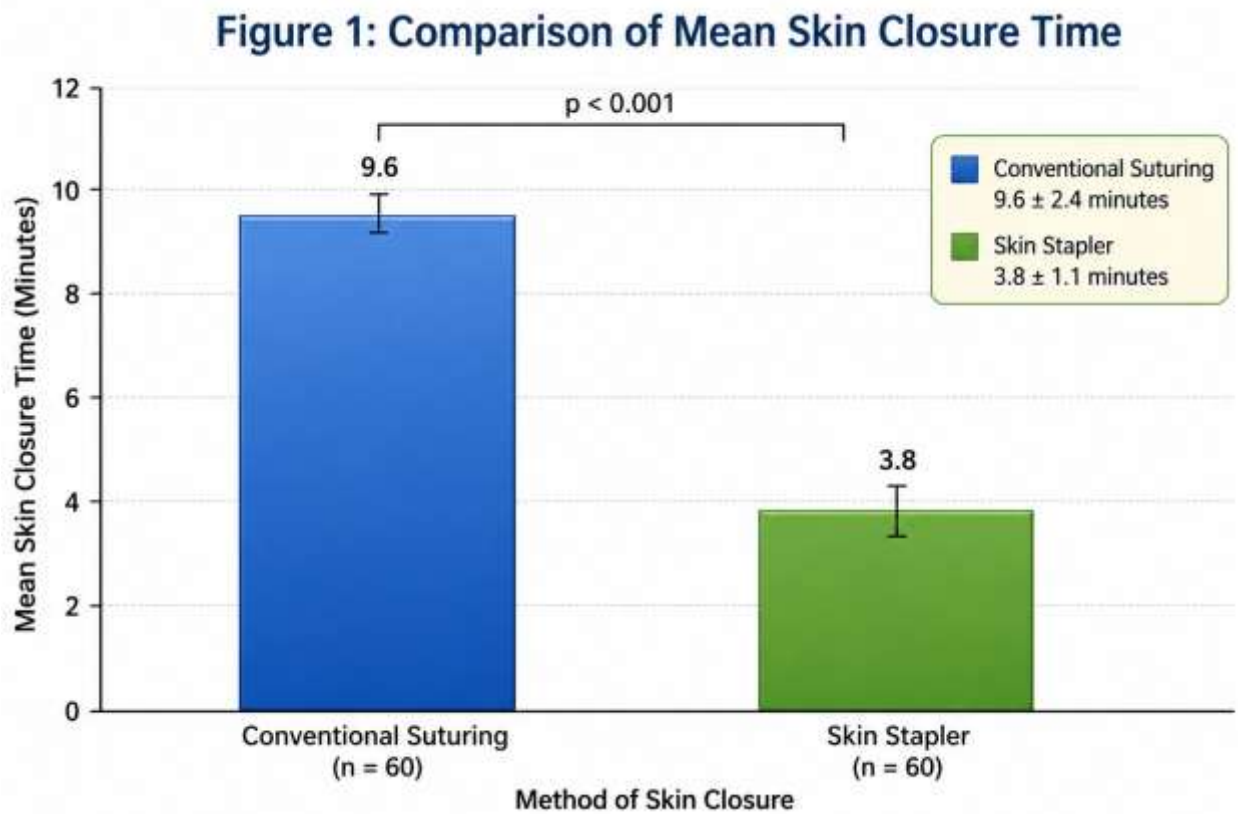


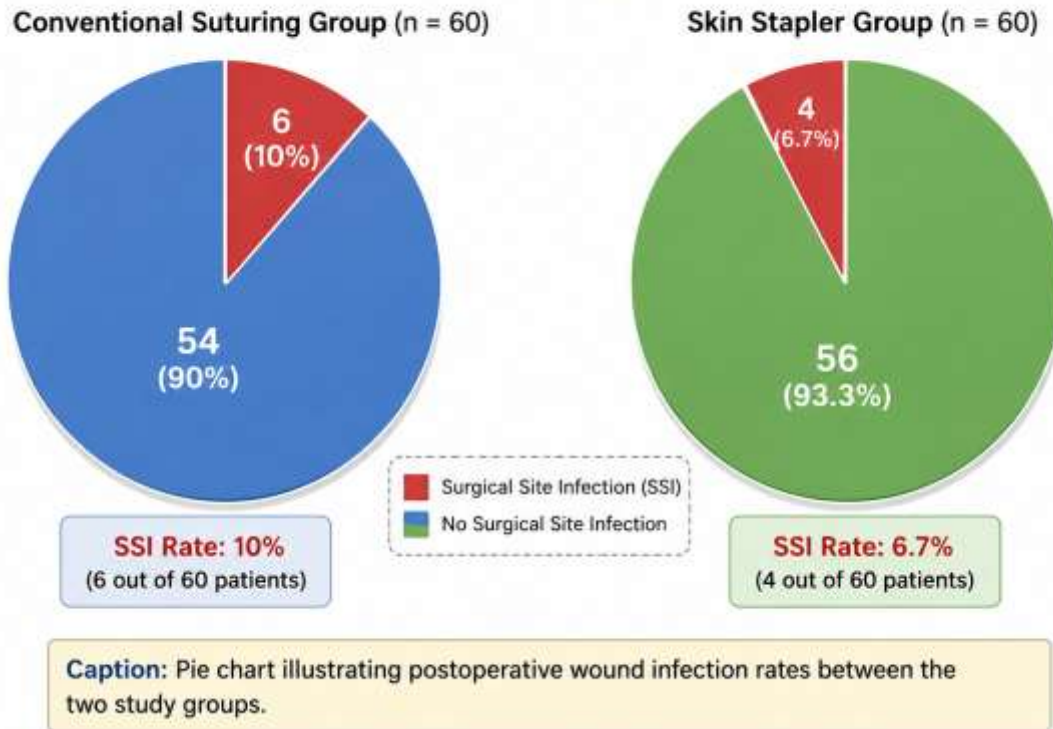
Table 2: Cosmetic Outcome Assessment at 6 Weeks

Cosmetic Grade	Suturing Group	Stapler Group
Excellent	18 (30%)	32 (53.3%)
Good	24 (40%)	20 (33.3%)
Fair	12 (20%)	6 (10%)
Poor	6 (10%)	2 (3.3%)

Interpretation

Cosmetic outcomes were superior among patients undergoing skin stapling, with a higher proportion achieving excellent scar grades.

Figure 2: Comparison of Surgical Site Infection Rates



DISCUSSION

The present study evaluated the comparative effectiveness of conventional suturing and skin stapling techniques in elective surgical wound closure. Surgical wound management remains an essential determinant of postoperative recovery, cosmetic outcome, and patient satisfaction. The findings of this study suggest that skin staplers offer significant advantages in terms of operative efficiency and cosmetic outcomes while maintaining acceptable safety profiles.

One of the most important observations in the current study was the significantly reduced skin closure time associated with stapler use. The mean closure time in the stapler group was less than half that observed in the conventional suturing group. This finding is consistent with studies conducted by Khan et al. and Stockley et al., who similarly reported substantial reductions in operative duration with staplers (13,14). Reduced operative time may contribute to shorter anesthesia exposure, decreased surgeon fatigue, and improved operation theater turnover.

Postoperative pain scores were also significantly lower among patients receiving staple closure. Reduced tissue handling and minimal skin penetration associated with staplers may account for lower inflammatory response and pain perception. Similar observations were reported in

orthopedic and abdominal surgical studies comparing staples and sutures (15). However, some investigators have noted transient discomfort during staple removal, particularly in sensitive anatomical areas.

Surgical site infection remains a major concern in postoperative wound management. In the present study, wound infection rates were slightly lower in the stapler group, although the difference was not statistically significant. This observation supports previous meta-analyses demonstrating comparable infection rates between the two techniques (16). The lower tissue manipulation and rapid closure associated with staplers may reduce bacterial contamination, but factors such as patient immunity, operative environment, and wound contamination level also play critical roles.

Cosmetic outcome is increasingly recognized as an important component of postoperative quality of life. The stapler group demonstrated superior cosmetic scores at 6 weeks follow-up. Accurate wound edge eversion and uniform tension distribution provided by staples may contribute to improved scar formation. Similar findings were reported by Johnson et al., who observed superior scar appearance following stapled closure in abdominal surgeries (17). However, cosmetic outcomes can vary depending on wound location, patient skin characteristics, and postoperative wound care.

Patient satisfaction rates were higher in the stapler group in the current study. Faster procedures, reduced postoperative discomfort, and favorable cosmetic appearance likely influenced overall satisfaction. Modern surgical practice emphasizes patient-centered outcomes, and closure techniques contributing to enhanced patient experience may improve treatment compliance and healthcare perception.

The economic aspect of wound closure techniques remains controversial. Although staplers are more expensive than conventional sutures in terms of material cost, reduced operative duration may offset expenses by lowering operation theater occupancy and anesthesia costs. In high-volume surgical centers, staplers may therefore be economically advantageous. However, cost-effectiveness varies according to healthcare infrastructure and institutional resource availability.

The present study possesses several strengths, including prospective design, uniform surgical protocols, and assessment of multiple clinically relevant outcomes. Nonetheless, certain limitations should be acknowledged. The study was conducted at a single tertiary care center with a relatively moderate sample size. Long-term cosmetic assessment beyond 6 weeks was not performed. Additionally, subgroup analysis according to specific surgical procedures was not included.

Future multicentric randomized controlled trials with larger sample sizes and long-term follow-up are required to establish definitive recommendations regarding optimal skin closure techniques.

Comparative assessment involving absorbable subcuticular sutures, tissue adhesives, and newer stapling technologies may further enrich surgical practice guidelines.

Overall, the findings of this study support the growing role of skin staplers as a safe, efficient, and cosmetically favorable alternative to conventional suturing in elective surgical procedures.

CONCLUSION

Skin staplers provide significantly faster wound closure compared with conventional suturing while maintaining comparable rates of postoperative wound infection. Stapler closure is associated with reduced postoperative pain, improved cosmetic outcomes, and higher patient satisfaction. Skin staplers therefore represent an effective and reliable alternative for surgical skin closure, particularly in elective procedures requiring rapid and standardized wound approximation.

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