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Original article

Randomized Clinical Trials to Assess the Outcome of Skin Stapler and Conventional Suture for Abdomen Skin Wound Closure in Planned Surgeries at a Tertiary Care Hospital

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Abstract

Background: Optimal skin closure technique is critical for postoperative healing, pain management, infection prevention, and cosmetic outcomes. Conventional sutures and skin staplers are commonly used methods, each with distinct advantages and limitations. This study aimed to compare the clinical outcomes of skin stapler versus conventional suture techniques in abdominal wound closure during planned surgeries.

Methods: A randomized clinical trial was conducted involving 50 patients undergoing elective abdominal surgeries at a tertiary care hospital. Participants were randomly assigned to receive either skin staplers (n=25) or conventional sutures (n=25) for skin closure. Parameters analysed included wound closure time, healing time, postoperative pain (assessed by VAS on days 3, 7, and 14), wound infection rate, and cosmetic appearance at 30 days. Statistical analysis was performed using SPSS version 27.

Results: Stapler group showed significantly shorter closure time (4.60 vs. 10.64 min; p<0.001) and faster healing (17.84 vs. 20.60 days; p=0.035). VAS scores were significantly lower in the stapler group on all days. Cosmetic appearance was rated significantly better in the stapler group (p=0.001). No significant difference was observed in infection rates.

Conclusion: Skin staplers demonstrated superior outcomes in terms of time efficiency, pain reduction, healing, and cosmetic results, supporting their use in elective abdominal surgeries.

Keywords: Skin stapler, abdominal wound closure, conventional sutures

Introduction:

Wound closure is a critical step in surgical procedures, significantly impacting postoperative healing, infection rates, cosmesis, and patient satisfaction. (1) Traditionally, conventional sutures have been widely used for skin closure due to their affordability and surgeon familiarity. (2) However, skin staplers have gained popularity in recent years as an alternative closure technique, offering potential advantages such as reduced operative time, consistent approximation of skin edges, and improved aesthetic outcomes.(3) Despite these perceived benefits, the choice between skin staplers and conventional sutures remains a topic of debate, especially in resource-constrained settings where cost-effectiveness is a major concern.(4)

Several studies have explored the efficacy of skin staplers versus sutures, but there remains a lack of consensus regarding their comparative outcomes in terms of wound healing, complication rates, scar appearance, and patient comfort. (5,6) Most available literature is heterogeneous, with variations in surgical sites, patient populations, and evaluation criteria. This randomized clinical trial aims to assess and compare the outcomes of skin stapler and conventional suture techniques for abdominal skin wound closure in planned surgeries at a tertiary care hospital. The study focuses on postoperative wound healing, time efficiency, cost analysis, and cosmetic results to provide evidence-based recommendations for optimal skin closure methods in routine surgical practice.

Study Methodology

The present study was conducted as a randomized clinical trial involving 50 patients admitted for planned abdominal surgeries in the Department of Surgery at a tertiary care hospital. The study was carried out over a duration of 18 months, which included time for patient enrolment, interventions, and follow-up. Patients were randomly allocated into two groups of 25 each: one group received skin closure using staples, while the other group underwent conventional suture closure. Randomization was performed using a computer-generated random table to ensure unbiased group assignment.

Inclusion criteria for the study comprised patients aged between 18 and 60 years, undergoing clean, planned, and elective open abdominal surgeries. Only healthy male and female patients without comorbidities such as diabetes mellitus, thyroid disorders, or anaemia were included. Patients were excluded if they had lacerated wounds with skin loss, were outside the age criteria, had prior surgeries, suffered from skin infections or post-burn scars, or refused to participate in the study.

Data were collected intraoperatively from the operating surgeon and postoperatively from the patients during their recovery period. Additionally, information regarding the types of sutures and staplers used was obtained from the hospital pharmacy and pharmaceutical suppliers. Standardized postoperative assessment included evaluation of wound healing, cosmetic outcomes, and patient satisfaction using validated tools.

All patients underwent routine preoperative investigations such as complete hemogram, urine routine examination, bleeding time, clotting time, platelet count, and ultrasonography of the abdomen when indicated. The sample size was determined using OPEN EPI version 3 software, based on a mean VAS score of 74.97 (SD = 4.555) for sutures and 65.15 (SD = 18.057) for staples, with a 95% confidence interval and 80% study power, arriving at a minimum required sample size of 46, considered 50 .

Results

Table 1: Comparison of Mean Closure Time and Healing Time

Parameter	Conventional Suture (n=25)	Stapler Suture (n=25)	*P* Value
Mean Closure Time (min)	10.64 ± 1.91	4.60 ± 1.12	<0.001
Mean Healing Time (days)	20.60 ± 3.81	17.84 ± 4.29	0.035

Table 2: Visual Analogue Scale (VAS) Scores

Post-Operative Day	Conventional Suture (Mean ± SD)	Stapler Suture (Mean ± SD)	*P* Value
Day 3	6.84 ± 0.89	5.88 ± 0.78	0.007
Day 7	4.48 ± 1.23	3.40 ± 1.04	0.005
Day 14	1.52 ± 1.08	0.60 ± 1.22	0.008

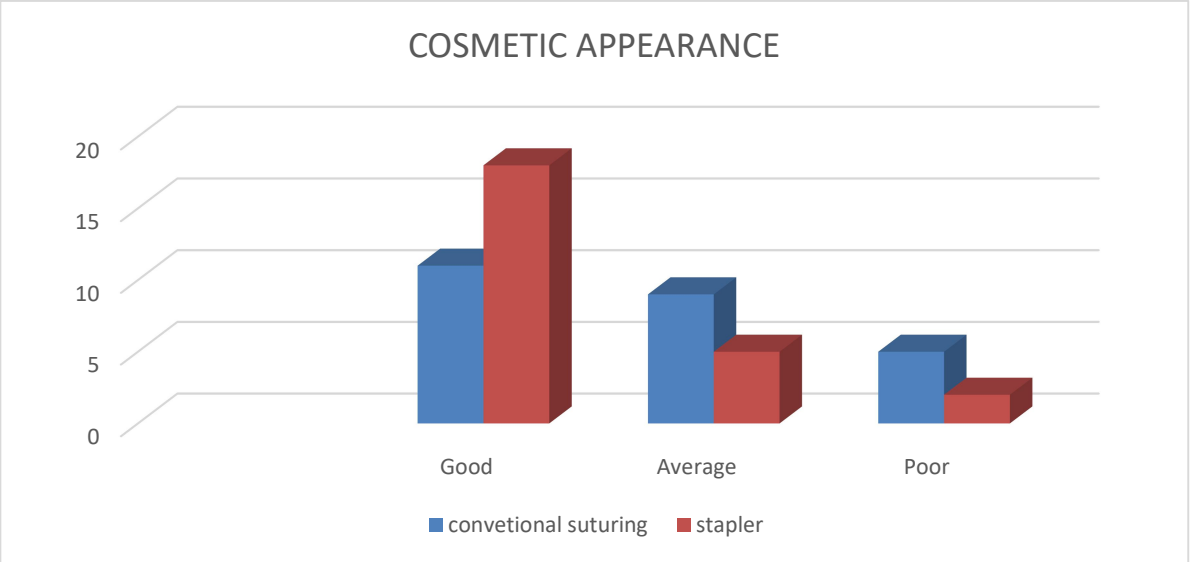
Table 3: Clinical Outcomes and Complications

Outcome	Conventional Suture (n=25)	Stapler Suture (n=25)	*P* Value
Normal Healing	18	16	0.544
Wound Infection	7	9	

Wound Infection Grade	Conventional	Stapler	*P* Value
Erythema + signs of inflammation	2	3	0.885
Mild bruising/erythema	4	4	
Pus formation	1	2	
Normal healing	18	16	

Table 4: Cosmetic Outcome Assessment

Cosmetic Appearance	Conventional Suture (n=25)	Stapler Suture (n=25)	*P* Value
Good	11	18	0.001
Average	9	5	
Poor	5	2	



Graph 1) Cosmetic appearance

Discussion:

The present randomized clinical trial aimed to compare the outcomes of skin staplers and conventional sutures for abdominal wound closure in planned surgeries at a tertiary care hospital. The findings from this study revealed several significant differences in parameters, including closure time, healing time, pain scores, and cosmetic outcomes. In contrast, other parameters, such as wound infection rates and clinical outcomes, showed no statistically significant variation between the two groups.

One of the most notable findings of the study was the significantly reduced closure time in the stapler group (mean 4.60 minutes) compared to the conventional suture group (mean 10.64 minutes, $p<0.001$). This result aligns with previous studies conducted by Batra et al. and Kathare et al., which emphasized the time efficiency of skin staplers. The shorter closure time offers a distinct advantage in high-volume surgical settings and emergencies, as it reduces operative duration and potentially minimizes the risk of infection. (7)

Healing time was also significantly lower in the stapler group (mean 17.84 days) as compared to the suture group (mean 20.60 days, $p=0.035$). Faster wound healing in the stapler group could be attributed to reduced tissue manipulation and uniform wound edge approximation, which promotes quicker epithelialization and tissue recovery.

Pain assessment using the Visual Analogue Scale (VAS) demonstrated consistently lower scores in the stapler group across all postoperative days evaluated. On day 3, the stapler group reported a mean VAS of 5.88 versus 6.84 in the suture group ($p=0.007$). Similar trends were observed on day 7 (3.40 vs. 4.48, $p=0.005$) and day 14 (0.60 vs. 1.52, $p=0.008$). These findings support the hypothesis that reduced tissue trauma and more uniform closure with staples contribute to decreased postoperative discomfort.

Although wound infections were slightly more frequent in the stapler group (9 vs. 7), the difference was not statistically significant ($p=0.544$). The grades of infection, including erythema and pus formation, also showed no significant disparity between groups ($p=0.885$). These results are comparable with those from Muthukumar et al. and Naireen et al., who found no significant differences in infection rates between the two closure methods. However, consistent aseptic technique and patient-related factors such as nutrition, immunity, and

comorbidities play a vital role in infection risk, possibly outweighing the impact of closure technique alone. (8,9)

The most pronounced difference in favor of the stapler group was observed in cosmetic outcomes. A significantly higher number of patients in the stapler group were rated to have a good scar appearance (18 vs. 11; p = 0.001). This finding is critical, especially in modern surgical practice where patient satisfaction and aesthetic outcomes are increasingly valued. Better cosmetics with staples may be attributed to minimal cross-hatching, precise approximation, and eversion of wound edges. (10,11)

Conclusion:

In conclusion, this study demonstrated that skin staplers are associated with shorter closure time, faster healing, reduced postoperative pain, and superior cosmetic results compared to conventional sutures. While infection rates and overall clinical outcomes were comparable, the practical benefits of staplers make them a viable alternative in elective abdominal surgeries, especially where time efficiency and aesthetics are prioritized. Further large-scale multicentric studies may strengthen these findings and help formulate definitive surgical guidelines.

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