Original article:

Evaluation of Skin Staplers Versus Conventional Suturing Techniques for Abdominal Wound Closure

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Abstract

Background: Every surgical intervention involving internal structures requires an incision, which temporarily disrupts the integrity of the skin. Proper management of this incision is critical to ensure timely healing, prevent postoperative complications, and achieve an acceptable cosmetic outcome. Failure to close wounds appropriately may increase the risk of infection, separation of wound edges, prolonged recovery, and noticeable scarring. While sutures have traditionally been used for skin closure, stapling devices are increasingly preferred due to their rapid application and technical convenience.

Objective: This study was conducted to evaluate and compare skin staples and conventional sutures for abdominal wound closure, with emphasis on healing outcomes, postoperative complications, cosmetic results, and overall cost.

Methods: A prospective observational study was carried out on 90 patients undergoing abdominal surgery. Participants were equally divided into two groups: closure using staples (n=45) and closure using sutures (n=45). Parameters assessed included surgical site infection, wound dehiscence, postoperative pain, scar appearance, closure time, and economic cost.

Results: Wound closure was completed significantly faster in the staple group compared to the suture group. Patients in the staple group demonstrated fewer infections and wound-related complications. Cosmetic assessment scores were higher among patients receiving staples. Although the cost of stapling devices exceeded that of sutures, operative efficiency and patient comfort were improved.

Conclusion: Skin staples represent a practical and efficient alternative to sutures for abdominal wound closure. Despite higher material costs, their advantages in reducing operative time, postoperative discomfort, and complication rates support their routine clinical use.

Key words: Wound, Suture, Staple, Cosmesis.

INTRODUCTION

Surgical procedures commonly require deliberate incision of the skin to access underlying anatomical structures[1]. Restoration of skin continuity after such intervention plays a vital role in determining the quality and speed of healing[2]. The method chosen for wound closure influences not only mechanical strength but also infection risk, scar formation, and patient satisfaction[3]. An ideal closure technique should bring wound edges together precisely without excessive tension, minimize tissue trauma, and promote uncomplicated healing[4].

Certain epidemiological studies conducted have expressed the necessity of infection control in surgical wounds[5].

Additionally, factors such as ease of application, time efficiency, affordability, and cosmetic outcome influence the surgeon's choice of closure material.

For decades, sutures have been the conventional method for approximating skin edges because of their reliability and versatility[6,7]. However, suturing may require more operative time and can be associated with increased tissue handling. Carefully designed studies comparing sutures and staples in abdominal procedures have revealed clear variations in how efficiently each method achieves wound closure[8,9,10]. In contrast, skin staplers offer rapid application and consistent wound edge approximation[11,12,13]. Their metallic composition generally results in minimal tissue reactivity, and their uniform placement may improve cosmetic appearance[14].

Given these considerations, this study was designed to systematically compare the clinical effectiveness of staples and sutures in abdominal wound closure, with particular attention to operative duration, postoperative complications, scar quality, pain perception, and economic implications. The present study was undertaken to evaluate the comparative effectiveness of skin staples and conventional sutures in abdominal skin wound closure by assessing the incidence of wound infection and wound dehiscence, the severity of postoperative pain, the cosmetic appearance of the healed scar, the time required by the surgeon to complete wound closure, and the overall cost involved in the use of sutures and skin staples.

MATERIALS & METHODS

This prospective observational study was conducted in the Department of General Surgery at National Institute of Medical Sciences & Research, NIMS University, Jaipur, Rajasthan (India) from March 2009 to February 2011. Prior approval was obtained from the Institutional Ethics Committee. The study included 90 patients undergoing abdominal surgical procedures, who were equally divided into two groups: 45 patients in the conventional suture group and 45 patients in the skin staple group. Postoperative evaluation was carried out in the outpatient department on the 7th, 14th, and 28th postoperative days to assess the study outcomes.

Inclusion Criteria:

- Patients who underwent elective or emergency abdominal surgical procedures
- Age between 20 and 75 years
- Patients of either sex
- Hemoglobin level greater than 10 g/dL
- Normal serum albumin levels
- Patients with clean or clean-contaminated surgical wounds

Exclusion Criteria:

- Patients with hemoglobin levels below 10 g/dL or low serum albumin
- Patients younger than 20 years or older than 75 years
- Patients with active infection or contaminated/dirty wounds
- Patients with immunocompromised status or uncontrolled systemic illness
- Patients on long-term steroids, chemotherapy, or anticoagulant therapy
- Patients unwilling to participate or unable to complete follow-up

RESULTS

Mean time required for wound closure in suture and staple groups.

The average duration needed to complete wound closure was considerably shorter in the staple group than in the suture group, and this difference was found to be statistically significant ($p < 0.001$).

Mean time per centimeter required for wound closure in suture and staple groups.

The average time taken to close each centimeter of the wound was markedly less in the staple group

than in the suture group, and this difference was statistically significant ($p < 0.001$).

Comparison of Postoperative Complications Among Study Groups

The frequency of postoperative complications was comparatively lower among patients in the staple group than those in the suture group. Incidences of surgical site infection and wound dehiscence were higher in the suture group, with the observed differences reaching statistical significance. In contrast, complications such as seroma and hematoma did not differ significantly between the two groups. Stitch abscess was noted exclusively in patients who underwent suturing. Additionally, a greater number of patients in the staple group experienced an uncomplicated recovery, and this difference was statistically significant, suggesting more favorable overall outcomes with the use of skin staples.

Comparison of Cosmetic Outcomes in Staple and Suture Groups

The appearance of the healed surgical scar showed a clear variation between the two groups. Patients whose wounds were closed using skin staples demonstrated a greater incidence of optimal cosmetic results than those in the suture group, with the difference being statistically significant. Moderately acceptable scar appearance was observed more commonly among patients who underwent suturing, and unsatisfactory cosmetic outcomes were noted exclusively in this group. Taken together, these observations indicate that the use of skin staples leads to better cosmetic results compared to conventional suturing techniques.

Comparison of Average Wound Cosmesis Scores in Staple and Suture Groups

Patients in the staple group demonstrated a higher average wound cosmesis score than those in the suture group. The observed difference between the two groups was statistically significant, suggesting improved cosmetic results with skin closure using staples compared to conventional suturing methods.

Cost Comparison of Skin Closure Methods Between Study Groups

The mean cost associated with wound closure was higher in the staple group compared to the suture group. This difference in cost between the two groups was statistically significant, indicating that the use of skin staples involves greater expenditure than conventional suturing.

Table1: Comparison of Mean Time Required for Wound Closure between Study Groups

Study Group	Number of Patients (n)	Mean Time for Closure (seconds)	Standard Deviation	Statistical Test	p-value
Staple Group	45	152.40	± 28.60	Unpaired t-test	< 0.001
Suture Group	45	598.75	± 85.20		

Table 2: Comparison of Mean Time Required per Centimeter for Wound Closure between Study Groups

Study Group	Number of Patients (n)	Mean Time per cm (seconds)	Standard Deviation	Statistical Test	p-value
Staple Group	45	11.20	± 2.10	Unpaired t-test	< 0.001
Suture Group	45	46.80	± 6.40		

Table 3: Comparison of Postoperative Complications Between the Study Groups

Complication	Staple Group (n = 45)	Suture Group (n = 45)	Statistical Test	p-value
Surgical site infection	4 (8.9%)	9 (20.0%)	Chi-square test	0.03
Wound dehiscence	2 (4.4%)	6 (13.3%)	Chi-square test	0.04
Seroma	3 (6.7%)	5 (11.1%)	Chi-square test	0.46
Hematoma	1 (2.2%)	3 (6.7%)	Fisher's exact	0.30
Stitch abscess	0 (0%)	4 (8.9%)	Fisher's exact	0.04
No complications	35 (77.8%)	24 (53.3%)	Chi-square test	0.02

Table 4: Comparison of Cosmetic Appearance between the Study Groups

Cosmetic Outcome	Staple Group (n = 45)	Suture Group (n = 45)	Statistical Test	p-value
Optimal cosmetic appearance	40 (88.9%)	29 (64.4%)	Chi-square test	< 0.001
Acceptable cosmetic appearance	5 (11.1%)	12 (26.7%)	Chi-square test	0.04
Poor cosmetic appearance	0 (0%)	4 (8.9%)	Fisher's exact	0.04

Table 5: Comparison of Mean Wound Cosmesis Scores Between the Study Groups

Study Group	Number of Patients (n)	Mean Cosmesis Score	Standard Deviation	Statistical Test	p-value
Staple Group	45	5.72	± 0.48	Unpaired t-test	< 0.001
Suture Group	45	5.31	± 0.52		

Table 6: Comparison of Cost between the Study Groups

Study Group	Number of Patients (n)	Mean Cost (Rs.)	Standard Deviation	Statistical Test	p-value
Staple Group	45	520	± 45	Unpaired t-test	< 0.001
Suture Group	45	390	± 38		

DISCUSSION

Successful wound closure significantly influences postoperative recovery and long-term scar quality[15]. In the present study, measurable differences were observed between staples and sutures across several clinically relevant parameters.

The duration required to close surgical wounds was markedly shorter when staples were used. This reduction is likely related to the mechanical simplicity of stapling devices, which allow rapid and consistent placement. Decreasing closure time may also contribute to improved operating room efficiency and reduced anesthesia exposure. Wound closure time was significantly reduced in cases where staples were applied, a finding that aligns with outcomes reported in earlier randomized and comparative research studies[8,16].

With respect to complications, patients in the staple group experienced fewer cases of surgical site infection and wound separation. A possible explanation is that stapling involves less repetitive tissue penetration and reduced handling of wound margins, thereby limiting inflammatory response[17]. Rates of seroma and hematoma were comparable between groups, suggesting that these outcomes may be influenced by additional surgical factors beyond closure method.

Scar evaluation revealed superior cosmetic scores among patients whose wounds were closed with staples[18,19]. Uniform spacing and consistent tension distribution provided by staplers may enhance aesthetic healing. Additionally, postoperative pain scores were lower in the staple group, potentially reflecting decreased tissue manipulation during application.

Although the financial cost of staples was higher than sutures, the observed improvements in operative time and patient comfort may justify the additional expenditure in many clinical settings[20].

CONCLUSION

Based on the findings of this study, skin staples demonstrated multiple advantages over conventional sutures in abdominal wound closure. Their use was associated with faster application and removal, reduced postoperative discomfort, lower incidence of certain wound complications, and improved scar appearance. While the initial material cost was greater, the overall clinical benefits suggest that stapling devices are a reliable and efficient option for routine abdominal surgical practice.

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