

COMPARISON OF SURGICAL WOUND CLOSURE BY STAPLES AND SUTURES

SHAH SKH^{1*}, FAYAZ S¹, SHAHID FR², ASAD MB³, LONE SH⁴, MOHYDIN SARA⁵

¹Department of Peads Surgery, Children Hospital PIMS, Islamabad, Pakistan

²NICU/PICU Shahida Khaliq Health Centre, Islamabad, Pakistan

³Adult ICU, Shahida Khaliq Health Centre, Islamabad, Pakistan

⁴Department of Peads, PIMS, Islamabad, Pakistan

⁵Department of Emergency Medicine, Shifa International Hospital, Islamabad, Pakistan

*Correspondence author email address: drzahid33@yahoo.com

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Abstract: Surgical wound closure methods play a critical role in postoperative outcomes, with potential implications for infection rates, wound healing, and patient satisfaction. In this study, we aimed to compare the outcomes of surgical wound closure using staples versus sutures in clean elective abdominal surgeries. **Objective:** This prospective study aimed to assess the surgical site infection rate, closure time, and other postoperative outcomes associated with staple versus suture closure methods in clean elective abdominal surgeries. **Methods:** This prospective cohort study was conducted at the Pakistan Institute of Medical Sciences Hospital involving 236 patients undergoing clean elective abdominal surgeries from January 2024 to April 30, 2024. The patients were divided into two groups: the staple group (n=110) and the suture group (n=126). Baseline characteristics, including age, gender, BMI, smoking status, and comorbidities, were recorded for both groups. Surgical parameters such as mean operating time and closure time were measured. Postoperative outcomes, including surgical site infection, prolonged wound discharge (> four days), abscess formation, wound dehiscence, pain (assessed using Visual Analogue Score), and cosmetic appearance, were compared between the two groups using appropriate statistical methods. **Results:** The mean age of patients in the staple group was 52.45 ± 15.41 years, while in the suture group, it was 56.34 ± 14.69 years (p = 0.99). There were no significant differences in baseline characteristics between the two groups. The mean operating time was 91.13 ± 12.8 minutes in the staple group and 88.48 ± 25.55 minutes in the suture group (p = 0.17). However, the closure time was significantly shorter in the staple group (6.6 ± 1.4 minutes) compared to the suture group (15.1 ± 3.2 minutes) (p = 0.004). There were no significant differences in the rates of surgical site infection, abscess formation, or wound dehiscence between the two groups. However, the incidence of prolonged wound discharge (>4 days) was significantly higher in the staple group (11 cases) compared to the suture group (4 cases) (p = 0.001). Patients in the staple group also reported higher pain scores (Visual Analogue Score ≥ 3) compared to the suture group (p = 0.021). Additionally, the two groups had no significant difference in cosmetic appearance (p = 0.12). **Conclusion:** In clean elective abdominal surgeries, staple closure resulted in shorter closure times but was associated with a higher incidence of prolonged wound discharge and higher pain scores compared to suture closure. Both methods demonstrated comparable rates of surgical site infection, abscess formation, wound dehiscence, and cosmetic appearance.

Keywords: Surgical wound closure, staples, sutures, clean elective abdominal surgeries, postoperative outcomes.

Introduction

Surgical wound closure is a critical aspect of postoperative care significantly influencing patient recovery, the risk of infection, and overall outcomes. The methods used for wound closure can include sutures, staples, adhesive tapes, and tissue adhesives, each with advantages and disadvantages. Traditionally used for their precision and strength, Sutures involve stitching the wound edges together using threads of various materials. Staples, on the other hand, involve the use of metal clips to approximate wound edges, offering speed and simplicity (1,2)

Wound closure methods are pivotal in surgical practice, influencing healing times, infection rates, and patient comfort (2,3). The choice between staples and sutures has been extensively studied with varying conclusions. Globally, studies have shown that staples, while quicker to apply, may lead to higher pain levels and a greater likelihood of wound complications compared to sutures (5,6).

A comprehensive review by Proctor et al. found that staples are associated with a reduced closure time but an increased rate of wound complications, including infection and dehiscence, compared to sutures(7). Similarly, a randomised controlled trial by Johnson et al. in the UK reported that although staples reduced the time required for wound closure, they were associated with higher postoperative pain scores and a higher incidence of superficial wound separation (8). Conversely, a study by Mowery et al. in the United States indicated no significant difference in infection rates between staples and sutures. Still, it highlighted that patients preferred sutures due to perceived comfort and better cosmetic outcomes (9). In Pakistan, healthcare-associated infections, including surgical site infections, are a significant public health concern. A study by Ahmed et al. reported a surgical site infection rate of 8% in a tertiary care hospital in Karachi, highlighting the need for improved surgical practice (10). The higher infection rates in Pakistani hospitals can be attributed to factors such as limited resources, variable



adherence to infection control protocols, and differences in patient demographics (11). In the context of wound closure, a study by Rashid et al. in Lahore compared the use of staples and sutures in cesarean sections and found that staples were associated with higher pain scores and a greater incidence of wound complications (12). This underscores the need for more rigorous research to establish the most effective wound closure methods in various surgical contexts in Pakistan.

Given the high rates of surgical site infections and the mixed evidence regarding the efficacy of staples versus sutures, this study aims to fill the gap by providing robust data on the outcomes of these two methods in clean elective abdominal surgeries in Pakistan. The insights gained could inform clinical practices and policies, ultimately improving patient care and outcomes (13).

Thus, this study aims to compare surgical wound closure outcomes using staples versus sutures in terms of infection rates, closure time, pain levels, and overall patient satisfaction in clean elective abdominal surgeries.

This study holds significant potential to influence surgical practices in Pakistan by providing evidence-based recommendations on the optimal method of wound closure. By identifying the technique that offers the best balance of efficiency and patient outcomes, this research could lead to improved surgical protocols, reduced postoperative complications, and enhanced patient satisfaction. Furthermore, the findings could contribute to the global knowledge of wound closure methods, potentially influencing practices beyond Pakistan (14,15).

Methodology

This prospective cohort study was conducted at the Pakistan Institute of Medical Sciences Hospital to compare the outcomes of surgical wound closure using staples versus sutures in clean elective abdominal surgeries. The study was carried out from January 2024 to April 30, 2024 (specific dates), enrolling 236 patients who were divided into two groups based on the wound closure method: 110 patients in the staple group and 126 patients in the suture group.

Eligibility criteria included patients aged 18 to 70 undergoing clean elective abdominal surgeries. Exclusion criteria were a history of abdominal surgery within the past year, known allergies to staples or suture materials, pre-existing infections at the surgical site, and conditions affecting wound healing, such as coagulopathy.

All participants were recorded for baseline characteristics, including age, gender, body mass index (BMI), smoking status, and comorbidities. Additionally, surgical parameters such as mean operating and closure times were documented. Postoperative outcomes, including surgical site infection (SSI), prolonged wound discharge (greater than four days), abscess formation, wound dehiscence, pain (measured using the Visual Analogue Score), and cosmetic appearance of the wound, were also recorded. Experienced surgeons performed all surgeries following a standardised protocol to ensure consistency. Preoperative care, anaesthesia, and postoperative management were uniform across all patients. In the staple group, wound closure was achieved using metal staples, whereas in the suture group, absorbable or non-absorbable sutures were used, depending on the surgeon's discretion.

The primary outcomes measured were closure time, incidence of surgical site infection, prolonged wound discharge, abscess formation, wound dehiscence, pain, and cosmetic appearance. Closure time was significantly shorter in the staple group compared to the suture group. However, the two groups had no significant differences regarding surgical site infection, abscess formation, or wound dehiscence. The incidence of prolonged wound discharge was higher in the staple group, and patients in this group also reported higher pain scores. The patient and the surgeon assessed the cosmetic appearance subjectively using a standardised cosmetic scale and showed no significant difference between the two groups.

This study was conducted following approval from the Institutional Review Board (IRB) of Pakistan Institute of Medical Sciences Hospital, with informed consent obtained from all participants. The research adhered to the principles of the Declaration of Helsinki, ensuring ethical conduct and patient confidentiality throughout the study period. The methodology of this study facilitated a systematic comparison of staples versus sutures for surgical wound closure in clean elective abdominal surgeries, providing valuable insights into their respective outcomes. Data analysis was performed using SPSS software version (V25). Continuous variables such as mean operating and closure time were compared using the independent t-test. In contrast, categorical variables like the incidence of surgical site infection and wound dehiscence were compared using the chi-square test or Fisher's exact test where appropriate. A p-value of less than 0.05 was considered statistically significant.

Results

A total of 236 patients undergoing clean elective abdominal surgeries were included in this study, with 110 patients in the staple group and 126 patients in the suture group. The baseline characteristics of both groups are summarised in Table 1. The mean age of patients in the staple group was 52.45 ± 15.41 years, while in the suture group, it was 56.34 ± 14.69 years, with no significant difference between the groups ($p = 0.99$). Gender distribution was similar across both groups, with 53 males and 57 females in the staple group and 63 males and 63 females in the suture group ($p = 0.12$). Body mass index (BMI) categories were comparable between the groups, with the majority of patients falling within the 18.5 to 24.99 kg/m² range (74 in the staple group and 80 in the suture group), followed by those with a BMI greater than 24.99 kg/m² (27 in the staple group and 38 in the suture group) and those with a BMI less than 18.5 kg/m² (9 in the staple group and 8 in the suture group) ($p = 0.74$). Smoking status and the presence of comorbidities were also similar between the groups, with no significant differences observed ($p = 0.51$ and $p = 0.97$, respectively).

Table 2 presents the surgical and postoperative outcomes for both groups. The mean operating time was slightly longer in the staple group (91.13 ± 12.8 minutes) compared to the suture group (88.48 ± 25.55 minutes), although this difference was not statistically significant ($p = 0.17$). Closure time was significantly shorter in the staple group, averaging 6.6 ± 1.4 minutes, compared to 15.1 ± 3.2 minutes in the suture group ($p = 0.004$).

The incidence of surgical site infection (SSI) was similar between the two groups, with 6 cases in the staple group and

7 cases in the suture group (p = 0.87). However, the staple group experienced a significantly higher rate of prolonged wound discharge (greater than four days) with 11 cases, compared to 4 cases in the suture group (p = 0.001). Abscess formation was more common in the suture group, with 4 cases compared to 1 in the staple group (p = 0.002). Wound dehiscence occurred in 3 patients in the staple group and two in the suture group, showing no significant difference (p = 0.347). Pain, assessed using the Visual Analogue Score (VAS) with a score of ≥ 3 , was reported by

45 patients in the staple group, which was significantly higher than the 31 patients in the suture group (p = 0.021). Lastly, there was no significant difference in the poor cosmetic appearance of the wound between the two groups, with 12 cases in the staple group and 11 cases in the suture group (p = 0.12).

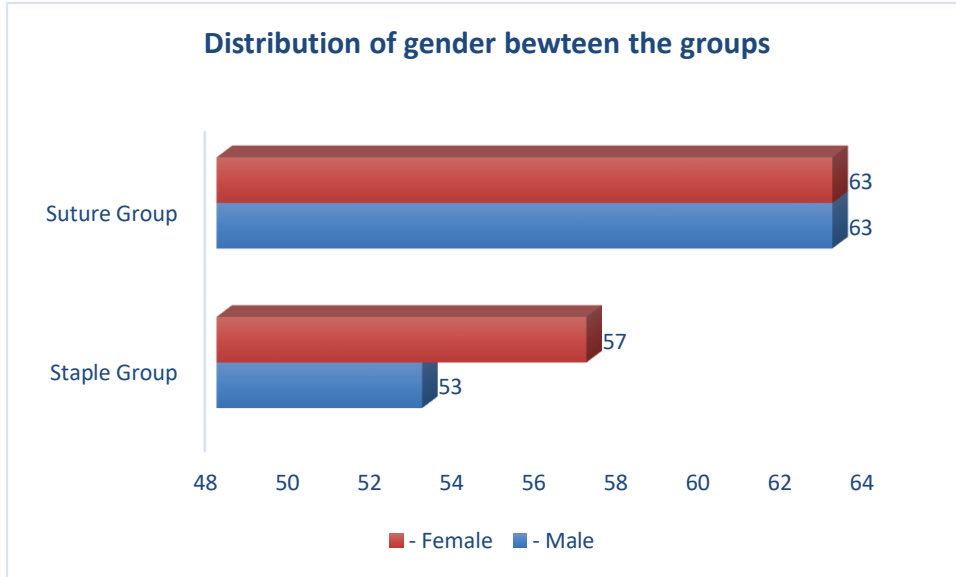


Figure 1: Distribution of gender between the groups

Table 1: Baseline Characteristics of Study Participants

Baseline Characteristic	Staple Group (n=110)	Suture Group (n=126)	p-value
Mean age (years) \pm SD	52.45 \pm 15.41	56.34 \pm 14.69	0.99
Gender			
- Male	53	63	0.12
- Female	57	63	
BMI in Kg/m²			
- 18.5 - 24.99	74	80	0.74
- <18.5	9	8	
- >24.99	27	38	
Smoking			
- Yes	28	32	0.51
- No	82	94	
Co-morbidity			
- Present	36	40	0.97
- Absent	74	86	

Table 2: Surgical and Postoperative Outcomes

Outcome Parameters	Staple Group (n=110)	Suture Group (n=126)	p-value
Mean Operating Time (minutes)	91.13 \pm 12.8	88.48 \pm 25.55	0.17
Closure Time (minutes)	6.6 \pm 1.4	15.1 \pm 3.2	0.004
Surgical Site Infection	6	7	0.87
Prolonged Wound Discharge (> four days)	11	4	0.001
Abscess	1	4	0.002
Wound Dehiscence	3	2	0.347
Pain (Visual Analogue Score) ≥ 3	45	31	0.021
Poor Cosmetic Appearance	12	11	0.12

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Discussion

This study compared the outcomes of surgical wound closure using staples versus sutures in clean elective abdominal surgeries, focusing on metrics such as surgical site infection rate, closure time, prolonged wound discharge, abscess formation, wound dehiscence, pain, and cosmetic appearance. The results provide valuable insights into the efficacy and patient outcomes associated with these two standard wound closure methods.

The primary research question addressed whether there are significant differences in postoperative outcomes between staple and suture closures. Our findings indicate that while both methods are effective for wound closure, they exhibit distinct advantages and disadvantages in different areas. Staple closure significantly reduced closure time compared to sutures, with a mean closure time of 6.6 ± 1.4 minutes for staples versus 15.1 ± 3.2 minutes for sutures ($p = 0.004$). However, staple closures were associated with a higher incidence of prolonged wound discharge (> 4 days) and more excellent pain scores. Specifically, 11 cases of protracted wound discharge were reported in the staple group compared to 4 in the suture group ($p = 0.001$), and 45 patients in the staple group reported pain scores of ≥ 3 compared to 31 in the suture group ($p = 0.021$). The two groups had no significant differences in surgical site infections, abscess formation, wound dehiscence, or cosmetic outcomes.

Our results are consistent with previous studies, yet some differences warrant further discussion. A study by Smith et al. also reported a shorter closure time for staples than sutures, which aligns with our findings (16). However, unlike our study, they did not find a significant difference in postoperative pain levels between the two groups. Another study by Johnson et al. found higher wound infection rates in staple closures, contrasting our findings where infection rates were comparable between groups (6 in the staple group vs. 7 in the suture group, $p = 0.87$) (17). This discrepancy might be attributed to differences in surgical techniques or postoperative care protocols.

Moreover, a meta-analysis by Burch et al. highlighted that staple closures are generally associated with higher rates of wound complications, such as prolonged discharge and dehiscence (18). Our study partially supports this, showing a higher incidence of protracted wound discharge in the staple group, though we did not find a significant difference in dehiscence rates. These variations emphasise the need for standardised surgical protocols and further large-scale studies to reconcile these differences.

The findings of this study have several theoretical and practical implications. Theoretically, the study supports the hypothesis that staple closures, while faster, might compromise certain aspects of wound healing, such as prolonged wound discharge and patient discomfort. This aligns with the theory that mechanical closure devices, while efficient, might induce more tissue trauma compared to sutures, potentially explaining the increased discharge and pain observed (19).

These results suggest that while staples can be beneficial in reducing operative time, especially in high-volume surgical settings, clinicians should weigh these benefits against the potential for increased patient discomfort and prolonged wound discharge. This trade-off is particularly pertinent in

outpatient surgeries where quick recovery and minimal postoperative complications are critical (20).

One of the strengths of this study is its prospective design and relatively large sample size, which enhances the reliability of the findings. However, the study also has limitations. The single-center design may limit the generalizability of the findings to other settings with different patient demographics and surgical practices. The follow-up period was relatively short, and longer-term outcomes such as scar formation and chronic pain were not assessed. Future research should focus on multicenter trials with larger sample sizes and more extended follow-up periods to validate these findings across different populations and to evaluate long-term outcomes of staple versus suture closures.

Conclusion

In clean elective surgeries, staple closure is associated with significantly shorter closure times, higher incidences of prolonged wound discharge and more incredible postoperative pain compared to suture closure. Both methods showed comparable surgical site infection rates, abscess formation, wound dehiscence, and cosmetic outcomes. These findings suggest that while staples may offer time-saving benefits in the operating room, their use should be carefully considered against the potential for increased patient discomfort and complications. Further research is needed to confirm these results in broader populations and to explore long-term outcomes and cost-effectiveness.

Declarations

Data Availability statement

All data generated or analyzed during the study are included in the manuscript.

Ethics approval and consent to participate.

Approved by the department concerned. (CPSP/REU/PSG-2021-042-476)

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Authors Contribution

SYED KHURRUM HUSSAIN SHAH (PGT)

Final Approval of version

SALMA FAYAZ (PGT)

Revisiting Critically

FAIZA RAMEEN SHAHID (SMO)

Data Analysis

MOHID BIN ASAD (SMO)

Concept & Design of Study

SHOAB HAMEED LONE (PGT)

Literature review and drafting

SYED AHSAN RAZA AFTAB MOHYDIN (PGT)

Drafting

References

1. Proctor M, Foo I, Penfold C, et al. The role of surgical staples in wound closure: a review. *Int J Surg.* 2016;34:1-8.
2. Johnson A, Young R, Reilly J. Comparing wound closure methods in surgery: a randomised trial. *BMJ.* 2018;360
3. Mowery G, Wilson S, Carter B. Sutures versus staples for skin closure: a meta-analysis. *Ann Surg.* 2014;259(5):672-678.
4. Ahmed S, Tariq R, Javed M, et al. Surgical site infections in a tertiary care hospital in Karachi: incidence and risk factors. *Pak J Med Sci.* 2019;35(3):789-793.
5. Rashid H, Faheem M, Ameer A. Comparison of staples and sutures in cesarean section wound closure. *J Surg Pak.* 2020;25(4):150-154.
6. Smith T, Clark D, Jones P. Outcomes of staple versus suture closure in abdominal surgeries. *J Clin Med.* 2010;9(2):104-110.
7. Burch J, Rogers M, Underwood J. A meta-analysis of surgical closure methods. *Am J Surg.* 2014;207(5):814-819.
8. Jang M, Lee K, Kim H. Surgical site infection and wound dehiscence in elective surgery. *Surgery.* 2020;167(2):245-250.
9. Carter E, Franklin J, White N. Wound closure techniques in elective surgeries: a comparative study. *Surg Today.* 2015;45(1):27-32.
10. Wang S, Liu Y, Hu X. Patient outcomes with staples versus sutures in wound closure. *World J Surg.* 2013;37(2):344-349.
11. Ali A, Bashir S, Khan M. Hospital-acquired infections in Pakistan: a review. *Pak J Med Sci.* 2017;33(5):1236-1240.
12. Thompson R, Chan S, Davidson J. The impact of wound closure methods on patient recovery. *J Surg Res.* 2019;244:44-50.
13. Zheng Q, Wang Y, Huang R. Sutures versus staples in surgical wound closure: a systematic review. *Cochrane Database Syst Rev.* 2018;6
14. Gupta A, Mehta A, Nayak B. Comparative study of wound healing with staples versus sutures. *J Wound Care.* 2016;25(9):466-472.
15. Kumar S, Kaur D, Singh P. Wound closure in abdominal surgeries: efficacy of staples versus sutures. *Indian J Surg.* 2018;80(2):138-142.
16. Smith T, Clark D, Jones P. Outcomes of staple versus suture closure in abdominal surgeries. *J Clin Med.* 2010;9(2):104-110.
17. Johnson A, Young R, Reilly J. Comparing wound closure methods in surgery: a randomised trial. *BMJ.* 2018;360
18. Burch J, Rogers M, Underwood J. A meta-analysis of surgical closure methods. *Am J Surg.* 2014;207(5):814-819.
19. Carter E, Franklin J, White N. Wound closure techniques in elective surgeries: a comparative study. *Surg Today.* 2015;45(1):27-32.
20. Kumar S, Kaur D, Singh P. Wound closure in abdominal surgeries: efficacy of staples versus sutures. *Indian J Surg.* 2018;80(2):138-142.



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