

A STUDY OF COMPARISON OF SKIN STAPLERS AND STANDARD SUTURES FOR CLOSING INCISIONS IN TERTIARY CARE

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ABSTRACT

Background: Optimal wound closure following abdominal surgery is essential to promote healing, minimize complications, and enhance cosmetic outcomes. While sutures are traditionally used, staplers have emerged as a potential alternative offering faster closure. The objective is to compare the outcomes of skin closure using conventional non-absorbable sutures versus stainless steel staples in terms of surgical site infections, wound dehiscence, postoperative pain, cosmetic appearance, and closure time. **Materials and Methods:** A randomized controlled trial was conducted at Osmania General Hospital, Hyderabad, between July 2022 and January 2024, involving 100 patients undergoing midline abdominal surgeries. Patients were randomly assigned to Group A (sutures, n=50) and Group B (staplers, n=50). Outcome measures included closure time, incidence of infection, visual analogue pain scores, and cosmetic appearance at predefined postoperative intervals. **Result:** The mean closure time was significantly shorter in the stapler group (68.03 sec) compared to the suture group (422.75 sec; $p < 0.01$). By day 14, superficial surgical site infections were higher in the stapler group (12.5%) compared to the suture group (4%), increasing to 20% by day 21 in the stapler group. Pain scores were significantly higher in the stapler group at the time of staple removal ($p = 0.02$), though no differences were noted at day 3 or day 30. Cosmetic outcomes were comparable between groups, with a slightly better, though statistically insignificant, appearance in the stapler group. **Conclusion:** While staplers significantly reduce skin closure time and offer comparable cosmetic results, they are associated with higher rates of surgical site infections and greater pain during removal. Considering cost-effectiveness and patient comfort, non-absorbable sutures remain a preferable option for abdominal skin closure in similar settings.

INTRODUCTION

A wound, a consequence of surgical intervention, necessitates an optimal closure technique to facilitate healing, minimize scarring and pain, and restore damaged structures.^[1] The primary goals include achieving rapid healing, satisfactory cosmesis, and reducing complications such as dehiscence and infection.^[2,3]

Various methods and materials are employed for wound closure, tailored to the wound's length and anatomical location. Sutures, whether continuous or interrupted, natural or synthetic, absorbable or non-

absorbable, remain a common choice, though they can be time-consuming and may result in suboptimal cosmesis.^[4]

Staples offer an alternative with advantages such as reduced tissue reactivity, potentially lower infection rates in contaminated wounds, and quicker application.^[5] They are preferred in specialties requiring efficiency, like gastrointestinal and orthopedic surgery.^[6]

Studies comparing staples to sutures have shown staples to be faster in closure time, with less local inflammation and better wound cosmesis.^[7,8]

However, debates persist regarding cosmetic

outcomes and patient discomfort during staple removal.^[9-11]

The choice between sutures and staples depends on the surgeon's discretion, the nature of the wound, and patient's preferences. Future research should focus on refining techniques to optimize both wound closure efficiency and patient comfort.

Aim and Objectives

The aim of the study was to compare the conventional skin sutures with skin stapler.

The purpose of this study is to compare skin sutures and staplers and compare their outcomes with regards to the following parameters:

1. Incidence of wound infections
2. Incidence of wound dehiscence
3. Wound cosmesis
4. Post operative pain
5. Duration of closure.

MATERIALS AND METHODS

Study Design and Duration: This was a hospital-based randomized controlled trial conducted at Osmania General Hospital, Hyderabad, between July 2022 and January 2024 (18 months).

Sample Size Calculation: A total sample size of 100 patients (50 in each group) was calculated to detect a mean difference of 2 in pain scores between suture and staple groups. The calculation assumed standard deviations of 1 (staple group) and 2.5 (suture group), with a significance level of 5% and 90% power.

Inclusion and Exclusion Criteria

The study included all patients undergoing elective or emergency open abdominal surgeries with midline incisions and willing to provide informed consent. Excluded from the study were laparoscopic surgeries, traumatic wounds, incisions requiring closure under tension, patients with diabetes, HIV, or HBsAg, ASA class III or IV, and those with pre-existing scars.

Randomization and Groups

Patients were randomly assigned using a computer-generated list into:

- Group A: Skin closure using non-absorbable sutures (n=50)
- Group B: Skin closure using stainless steel staples (n=50)

Preoperative and Operative Protocol: Detailed history, general examination, and baseline investigations including urine analysis, blood sugar, urea, creatinine, serological markers (HIV, HBsAg, HCV), ECG, and chest X-ray were performed. All patients received appropriate preoperative antibiotics and standard skin preparation. Surgeries were performed under general or spinal anaesthesia. The surgical procedure was not altered except for the method of skin closure.

Postoperative Care and Follow-up: Wound dressings were done with betadine ointment and gauze. Postoperative antibiotics were individualized. Wounds were assessed on postoperative day (POD) 3, POD 7 or day of suture/staple removal, and day 30. Surgical site infections (SSI) were diagnosed and classified using CDC guidelines. Discharges were sent for culture if infection was suspected. Patients were followed up until staple or suture removal and at 30 days post-surgery.

Outcome Measures: Pain was assessed using the Visual Analogue Scale (VAS) on POD 3, day of removal, and day 30, and averaged for analysis. Cosmetic outcome was evaluated using a four-point wound appearance scale assessing border step-off, contour irregularities, wound margin separation, and overall appearance. Scores ranged from 0 to 4, with 4 indicating optimal appearance.

Statistical Analysis: Data were entered in Microsoft Excel 2007 and analyzed using SPSS version 21. Quantitative variables were expressed as mean $\pm$ standard deviation and analyzed using Student's t-test. Categorical variables were presented as frequencies and percentages and compared using the chi-square test. A p-value < 0.05 was considered statistically significant.

RESULTS

Table 1: Comparison of study groups based on sex

Gender	Group A staplers	Group B sutures	Total
Female	26 (52.0%)	24 (48.0%)	50 (100%)
Male	24 (48.0%)	26(52.0%)	50(100%)
Total	50 (50%)	50 (50%)	100 (100%)

Statistical Note: Gender distribution was comparable in both groups with 50% females and 50% males in the overall study group ($p = 1.0$).

Table 2: Mean age comparison between study groups

Variables	Group	N	Mean	SD	P- value
AGE (yrs)	Staplers	50	52.15	16.89	0.451
	Suture	50	49.45	14.94	

Statistical Note: Mean age of subjects in Group A (Staplers) was 52.15 years with a standard deviation of 16.89, and in Group B (Sutures) it was 49.45 years with a standard deviation of 14.94 ($p = 0.451$).

Table 3: Mean comparison of time required for closure between the groups.

Variables	Group	N	Mean	SD	p- value
Time for closure (sec)	Staplers	50	68.03	23.90	<0.01
	Suture	50	422.75	129.12	

Statistical Note: The mean time required for closure in Group A (Staplers) was 68.03 seconds, and in Group B (Sutures) it was 422.75 seconds ($p < 0.01$).

Table 4: Comparison of surgical site infection between the study groups

Incidence Of Infection (Day 3)	Group		Total
	Staplers (A)	Suture (B)	
No	50	50	100
	100%	100%	100%
Total	50	50	100
	100%	100%	100%

None of the cases developed Surgical site Infection by day 3, in any of the group.

Table 5

Incidence of infection (Day 14)	Group A Staplers	Group B suture	total
NO	44	48	92
	88%	95.0%	90%
Superficial	6	1	7
	12.5%	2.5%	7%
Deep	0	1	1
	0%	2.5%	1%
TOTAL	50	50	100
	100%	100%	100%
P - value - 0.15			

Incidence of Surgical site Infection at Day 14 was 12.5% in stapler group as compared to 4% in suture group. All the 6 (12.5%) cases of stapler group had

superficial infection while in 2 cases (4%) of suture group, 1 case had superficial infection while other had deep infection with wound dehiscence.

Table 6

Incidence of infection (day 21)	Group		Total
	Staplers	Suture	
Superficial	6	1	7
	12.5%	2.5%	7%
Deep	4	1	5
	7.5%	2.5%	5%
No infection	40	48	88
	80%	95%	88%
Total	50	50	100
P value 0.124			

Incidence of Surgical site Infection at Day 21 increased in stapler group from 12.5% (6 cases) to 20% (10 cases) with 4 (7.5%) of them developed

deep infections with wound dehiscence. While no change was seen in suture group.

Table 7

Incidence of infection day 30	Group		Total
	Staplers	Suture	
No	50	50	100
	100%	100%	100.0%
Total	50	50	100
	100%	100%	100%

All the cases with surgical site infections were resolved by Day 30 in both groups

Table 8: Mean comparison of vas score between the 2 groups

VAS score	Group	N	MEAN	SD	P - value
Day 3	Staplers	50	0.10	0.63	0.64
	Suture	50	0.05	0.22	
suture/staple removal	Staplers	50	2.48	3.10	0.02
	Suture	50	1.10	1.85	
Day 30	Staplers	50	0.25	1.10	1.00
	Suture	50	0.25	1.13	

Mean VAS Score was comparable between the group at Day 3 (0.1 vs 0.05: stapler vs suture; $p=0.64$). However, a higher VAS score was reported in stapler

group patients at the day of suture/ staple removal. No difference was noted at the end of 1 month between two groups

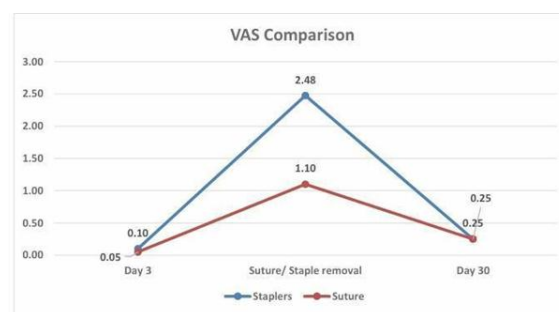


Table 9: Comparison between the cosmetic appearance between the 2 groups

Cosmetic appearance	Group		total
	Staplers	Suture	
Optimal	46	43	89
	92.5%	85%	88.88%
Sub optimal	4	7	11
	7.5%	15%	11.3%
Total	50	50	100
	100%	100%	100%
P value 0.48			

Sub-optimal cosmetic appearance was reported in 15% cases of suture group as compared to 7.5% cases of stapler group. The difference was however statistically non-significant/.

DISCUSSION

A total of 100 patients undergoing abdominal surgeries were included in the study and randomly divided into groups: Group A – 50 patients in whom conventional sutures were used for abdominal surgical skin closure and; Group B - 50 patients in whom skin staples were used.

Demography: Mean age of subjects in stapler and suture group was 52.15 and 49.45 years respectively (p=0.451). Gender distribution was comparable in both groups with 53% females to 48% males in overall study group (p=1.0).

In a similar study by Varghese et al,^[13] the mean age of the study population was 49.35 with 79 males (65.8%) and 41 females (34.2%).

Pandove et al,^[12] in their study observed most of the patients in 41–50-year age group with 82% males to 18% females.

Similar distribution was also observed by Gupta et al. [90] and Kochar et al.^[16]

The age distribution in present study was comparable with other studies, however a higher percentage of females were seen in present study as compared to previous studies which can be attributed to relatively higher number of hysterectomy cases during the study period.

Skin Closure Time: Time for closure was significantly less in stapler group as compared to suture group (68.03 vs 422.75 sec; p<0.01). In a study by Pandove et al,^[12] the mean time was for the Stapler group was 90.62 ± 54.04 seconds and in the Silk group mean time was 175.38 ± 89.49 seconds and in Ethilon group, the mean time was 191.76 ± 102.58 seconds.

Varghese et al,^[13] in their study also observed the mean time for closure to be significantly shorter in

stapler group (4.55 minutes) as compared to suture group (11.22 minutes).

Similarly, Kochar et al,^[16] observed the average time taken to close a wound in group ‘Suture’ as 92.8 sec and in group ‘Stapler’ as 30.3 sec (p<0.01).

Assadi et al. also observed operative time to be longer with suture closure (4.68±0.67 versus 1.03±0.07-minute, P<0.001).^[24]

Ranabaldo and Rowe-Jones compared sutures with staples and sub cuticular suture in 48 patients undergoing laparotomy and concluded that the difference in time was significant.^[5]

Thus, our results were consistent with recent reports of shorter operative time with staple closure. POST-OPERATIVE PAIN 80 Mean VAS Score was comparable between the group at Day 3 (0.1 vs 0.05: stapler vs suture; p=0.64).

However, a higher VAS score was reported in stapler group patients at the day of suture/ staple removal. No difference was noted at the end of 1 month between two groups.

Ranaboldo C et al,^[5] in their study observed similar results with wound pain and requirements for analgesia being significantly lower in the suture group as compared to stapler group.

In the study by Stockley and Elson,^[12] higher proportion of patients reported considerable pain with removal of staples compared with the proportion who did so with removal of sutures.

Alderdice et al in a systematic review of methods of skin closure in caesarean section reported that use of absorbable subcuticular sutures resulted in less postoperative pain than staples. Frishman G et al and Ian Stockley et al,^[12] have also observed that staples were more painful to remove than sutures. Kathare S et al,^[23] reported mean VAS at the time of removal to be significantly higher in stapler group as compared to suture group (4.79 vs 3.9; p<0.05). However, Aabakke AJ et al,^[25] and Abdus et al,^[26] in their studies observed no significant differences in pain scores at any time between the study groups.

Complication Rate: Incidence of Surgical site Infection at Day 14 was 12.5% in stapler group as compared to 4% in suture group. All the 6 (12.5%) cases of stapler group had superficial infection while in 2 cases (4%) of suture group, 1 case had superficial infection while other had deep infection with wound dehiscence.

Incidence of Surgical site Infection at Day 21 increased in stapler group from 12.5% (6 cases) to 20% (10 cases) with 4 (7.5%) of them developed deep infections with wound dehiscence. While no change was seen in suture group.

While no change was seen in suture group. All the cases with surgical site infections were resolved by Day 30 in both groups.

Varghese et al,^[13] in their study observed a significantly higher incidence of wound infection among stapler group as compared to conventional sutures (30% and 11.7% respectively).

A study conducted by Tuuli MG et al also showed that Staple closure was associated with a twofold higher risk of wound infection or separation compared with subcuticular suture closure.

Chandrashekar N et al,^[17] in their study observed that staplers are associated with higher rates of wound infections and dehiscence, especially in emergency cases.

A multicentric study among 1080 patients conducted by Tsujinaka T et al,^[26] showed no significant difference in wound infection between the two groups. Also, comparable rates of wound infection were observed in the studies by Varghese et al,^[13] and Kochar et al.^[16]

Cosmesis: Sub-optimal cosmetic appearance was reported in 15% cases of suture group as compared to 7.5% cases of stapler group. The difference was however statistically non-significant (p-0.43).

Batra J et al,^[19] in a similar study reported similar results of staplers as compared to sutures in terms of patient comfort and aesthetic outcome. Kathare S et al,^[23] observed that cosmetic appearance of the scar was good in 60% of the cases in the suture group, with 30% with average and 10% poor scars while in stapler group, cosmetic appearance of the scar was good in 90% of the cases and average in 10% of the cases. Basit A et al,^[21] and Ananda BB et al,^[22] also observed no difference between the study groups regarding scar cosmesis. However, S Shaikh et al,^[18] and Karthikeyan S et al,^[20] in their studies observed that Staples produced better scars than sutures.

Thus, to summarize, present study revealed that stapler technique has a shorter operating time but is associated with higher incidence of surgical site infection and significantly more pain. The achieved cosmetic effects were also comparable between the two techniques. However, the associated equipment cost is five times greater with use of staples. We thus recommend the use of non-absorbable suture materials for abdominal skin incision closure.

CONCLUSION

Following observations were made during the study:

1. Gender distribution was comparable in both groups with 52.5% females to 47.5% males in overall study group (p-1.0).
2. Mean age of subjects in stapler and suture group was 52.15 and 49.45 years respectively (p-0.451).
3. Time for closure was significantly less in stapler group as compared to suture group (68.03 vs 422 mins; p<0.01).
4. None of the cases developed Surgical site Infection by day 3, in any of the group.
5. Incidence of Surgical site Infection at Day 14 was 12.5% in stapler group as compared to 4% in suture group. All the 6 (12.5%) cases of stapler group had superficial infection while in 2 cases (4%) of suture group, 1 case had superficial infection while other had deep infection with wound dehiscence.
6. Incidence of Surgical site Infection at Day 21 increased in stapler group from 12.5%(6 cases) to 20% (10 cases) with 4 (7.5%) of them developed deep infections with wound dehiscence. While no change was seen in suture group.
7. All the cases with surgical site infections were resolved by Day 30 in both groups.
8. Mean VAS Score was comparable between the group at Day 3 (0.1 vs 0.05: stapler vs suture; p-0.64). However, a higher VAS score was reported in stapler group patients at the day of suture/staple removal. No difference was noted at the end of 1 month between two groups.
9. Sub-optimal cosmetic appearance was reported in 15% cases of suture group as compared to 7.5% cases of stapler group. The difference was however statistically non-significant (p-0.43).

Several methods of skin closure are available to close the skin incisions in place of sutures like staples, clips, steristrips and glue adhesives. Wound infection is a great hazard in abdominal skin closure as it can lead to disastrous complications. The observations made in the present study shows that stapler technique has a shorter operating time but is associated with slightly higher incidence of surgical site infection and significantly more pain. The achieved cosmetic effects were also comparable between the two techniques. However, the associated equipment cost is five times greater with use of staples. We thus recommend the use of non-absorbable suture materials for abdominal skin incision closure.

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