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Comparing Wound Complication Rate Between Stappled Closure Vs Sutured Closure for Clean Abdominal Wounds

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ABSTRACT

Objective: To compare the wound complication rate between stappled closure vs sutured closure for clean abdominal wounds.

Study Design: Quasi experimental study.

Place and Duration of study: Department of General Surgery Combined Military Hospital Rawalpindi, Pakistan from Feb to July 24.

Methodology: A total of 256 patients who fulfilled the selection criteria were enrolled in the study after taking written informed consent. The patients were divided into two groups i.e. 128 each by odd and even number. Patients in Group-A underwent stappled closure and in Group-B underwent suture closure of the abdominal wounds and the outcome measures were assessed till the patients were discharged. Findings were noted down and were subjected to statistical analysis.

Results: A total of 256 patients were assessed and were randomized into two groups of equal number i.e. 128 in each group. The mean age of patients was 39.7±8.2 years in Group-A and 40.7±8.3 years in Group-B. SSI was seen in 10(7.8%) patients in Group-A and 23 (18%) patients in Group-B (p=0.015). Wound dehiscence was seen in 2(1.6%) patients in Group-A and 11(8.6%) patients in Group-B (p=0.010). Cosmetic appearance was reported good by 116(90.6%) patients in Group-A and 79(61.7%) patients in Group-B (p< 0.001).

Conclusion: Stappled closure of clean abdominal wounds is significantly associated with lesser wound complication as compared to sutured closure.

Keywords: Clean wounds, infection suturing, Surgical wound, Wound healing.

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INTRODUCTION

The treatment of wounds is essential to the surgical profession.[1] Surgeons have used a variety of materials and devices in the modern era to approximate tissues, such as sutures, staples or clips, glues, steritapes but the key to achieving a good wound healing is careful tissue dissection, which is followed by suture material selection, wound closure techniques and postoperative complications.[2] A variety of suture materials have been used with variable results. However, surgical site infections continue to be the main problem.[3,4] The degree of accuracy and kind of tissue approximation affect the rate of tissue healing, the early and late complications that arise from surgical wounds after surgery and the financial strain on the hospital.[5]

The advent of staples has revolutionized skin closure. Staples enable approximation without penetration of the skin.[6] Although staplers were first designed to solve the perceived issue of patency that is, security against blood or bowel leakage during anastomosis. It is now generally acknowledged that both sutures and staples can accomplish the fundamental objectives of skin wound closure.[7,8] Regarding the effectiveness, cost, frequency of problems and aesthetic results obtained when comparing these two closure techniques for a range of applications, numerous research have shown contradictory findings.[9,10]

The surgeon's ability is only evident in the surgical scar, and often his entire endeavor is evaluated based on how it turns out. It is now essential to understand which type of closure is best for a certain patient and wound. Keeping this in view, the rationale of our study was to compare the wound complication rate between stappled closure versus sutured closure for clean abdominal wounds. The

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study aimed to guide about a better closure approach which is associated with lesser wound related complications, better cosmetic outlook and improved patients' satisfaction with the procedure.

METHODOLOGY

This quasi-experimental study was carried out after taking approval from the Ethical review committee/IRB committee (ERC/IERB approval certificate number 666) in the General Surgical Department of Combined Military Hospital, Rawalpindi for a period of 6 months i.e. from February 2024 to July 2024. The sample size of 256 patients (Figure) was calculated keeping expected percentage of wound complications in the stapled group as 8% and in the suture group as 16%, with 95% confidence interval and 80% power of test.[11]

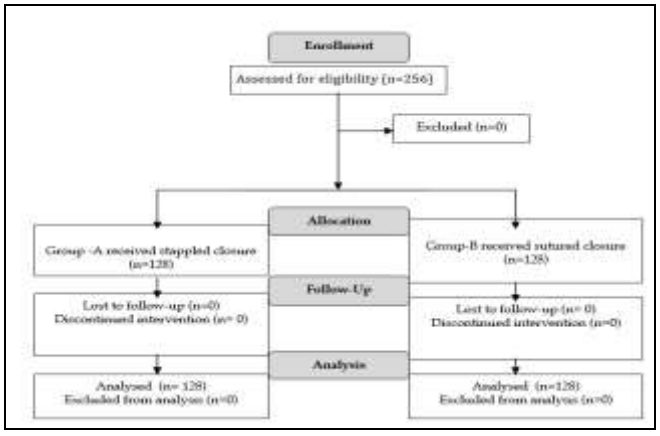

Figure: Patient Flow Diagram (n=256)

Inclusion Criteria: Patients of age 18 to 60 years, of both genders, with ASA grade I and II, with clean abdominal wounds who underwent elective abdominal surgical interventions were included in the study.

Exclusion Criteria: Patients with ASA grade III or more, with contaminated or dirty wounds, patients who were immunocompromised such as with malignancies, uremia and AIDS were excluded from the study.

Clean wounds of the abdomen were classified as those abdominal wounds which were not infectious, showed no indications of inflammation and were closed. If drainage was required, a closed draining method was preferred and the wounds did not affect the respiratory, digestive, vaginal, or urinary tract.[12] The primary outcome assessed included the occurrence of surgical site infection (SSI), the incidence of wound dehiscence, closure time of the wound and cosmetic outlook as the secondary outcomes.

SSI was defined as infection that arose up to 30 days after surgery and affected either the incision or deep tissue at the surgical site.[13] Wound dehiscence was defined as the partial or complete separation of previously approximated wound margins as a result of inadequate healing of wound.[14] Closure time of the wound was calculated in seconds, starting from the end of surgery till the wound was completely closed with either staples or suture. Cosmetic outlook was assessed using Stony Brook Scar Evaluation Scale (SBSES) and a score of >3 was considered a good cosmetic outlook.

All patients were enrolled after taking written informed consent. A full history, physical examination and local inspection, as well as documentation of the operation conducted of all patients was done and findings were noted down. Patients were divided into two equal groups by odd and even numbers i.e. 128 patients in each group. Patients with odd numbers were placed in Group-A and those with even numbers were placed in Group-B. In Group-A patients, stappled closure of the abdominal wounds was done and in Group-B suture closure of the wounds was carried out. A doctor who was blinded to the group allocation, timed the process of closure of wound with either method in seconds. The investigator measured the wound's length in centimeters and recorded the number of staples or suture packs utilized. Staples or sutures were inserted at 2.0 cm apart. At the time of surgery and again on the second, eighth and thirty postoperative days afterward, the success of closure was evaluated. Wounds were examined on alternating days, beginning with the second day postoperatively. Both groups received prophylactic antibiotics (intravenous third-generation Cephalosporin and Metronidazole) at the time of anesthesia induction. Patients were instructed to report immediately if they experienced any prolonged pain, soreness, discharge, bleeding, seroma, hyperemia or the formation of an abscess at the site of incision which were indicators of a SSI. In most cases, the wound closure materials were taken out after eight days, and the ease or difficulty of removal was noted. At the time of suture/staple removal and on day thirty, the cosmetic appearance was evaluated. Findings were noted down and were subjected to statistical analysis.

Data was analyzed using Statistical Package for Social Sciences version (SPSS) 25.0. Shapiro-wilk test

was performed to check for normality of data. Quantitative variables such as age, length of hospital stay and wound closure time were presented as mean and standard deviation. Qualitative data such as gender, ASA grade, SSI, wound dehiscence and cosmetic outlook was presented as frequency and percentage..As wound closure time was not normally distributed that's why Mann-Whitney U test was used. Comparison of both groups in terms of SSI, wound dehiscence and cosmetic outlook was done by using Chi square test and a p-value of ≤0.05 was considered significant.

RESULTS

A total of 256 patients were enrolled. The mean age of the patients was 39.71±8.29 years in Group-A and 40.71±8.31 years in Group-B, the mean duration of hospital stay was 3.82±0.69 days in Group-A and 4.00±0.66 days in Group-B, the median (IQR) closure time of the wound was 169 (208) seconds in Group-A and 385 (20) seconds in Group-B (p=0.000) (Table-I).

Table-I: Comparative Mean of Quantitative Variables (n=256)

Variables	Group		*p*-value
	A (Stappled closure) n=128	B (Sutured closure) n=128	
Age (in years)	39.7±8.2	40.7±8.3	-
Duration of hospital stay (in days)	3.8±0.6	4.0±0.6	-
Closure time of wound (in seconds)	169(208)	385(20)	< 0.001*

**As the data was non-normal in distribution in terms of closure time of wound so Mann-Whitney U test was applied*

In terms of age group, in Group-A, there were 21(16.4%) patients of age group 18 to 30 years, 70(54.7%) patients of age group 31 to 45 years and 37(28.9%) patients of age group 46 to 60 years, and in Group-B, there were 14(10.9%) patients of age group 18 to 30 years, 74(57.8%) patients of age group 31 to 45 years and 40(31.3%) patients of age group 46 to 60 years. With respect to gender, there were 82(64.1%) males and 46(35.9%) females in Group-A and 78(60.9%) males and 50(39.1%) females in Group-B. In terms of ASA grade, in Group-A, there were 83(64.8%) patients with ASA grade I and 45 (35.2%) patients with ASA grade II, whereas, in Group-B, there were 80(62.5%) patients with ASA grade I and 48(37.5%) patients with ASA grade II (Table-II).

Table-II: Comparison of Qualitative Variables Among Groups (n=256)

Variables	GROUP	
	Stappled closure (n=128)	Sutured closure (n=128)
Age group		
18 to 30 years	21(16.4%)	14(10.9%)
31 to 45 years	70(54.7%)	74(57.8%)
46 to 60 years	37(28.9%)	40(31.3%)
Gender		
Male	82(64.1%)	78(60.9%)
Female	46(35.9%)	50(39.1%)
ASA Grade		
Grade I	83(64.8%)	80(62.5%)
Grade II	45(35.2%)	48(37.5%)

In terms of SSI, it was found that 10(7.8%) patients in Group-A and 23(18%) patients in Group-B (p=0.015). Wound dehiscence was seen in 2(1.6%) patients in Group-A and 11(8.6%) patients in Group-B (p=0.010). Cosmetic appearance was reported to be good by 116(90.6%) patients in Group-A and 79(61.7%) patients in Group-B (p=0.000) (Table-III) as assessed by SBSES (Table-IV).

Table-III: Frequency of Surgical site Infection in Stappled Closure Versus Suture Closure of Clean Abdominal Wounds (n=256)

VARIABLES	GROUP		*p*-value
	Stappled closure (n=128)	Sutured closure (n=128)	
Surgical Site Infection			
Yes	10(7.8%)	23(18%)	
No	118(92.2%)	105(82%)	0.015
Wound Dehiscence			
Yes	2(1.6%)	11(8.6%)	
No	126(98.4%)	117(91.4%)	0.010
Cosmetic Appearance			
Good	116(90.6%)	79(61.7%)	
Not good	12(9.4%)	49(38.3%)	<0.001

Table-IV: Stony Brook Scar Evaluation Scale (SBSES)

Variables	Scar Category	Points
Width	>2 mm	0
	≤2 mm	1
Height	Elevated/depressed in relation to surrounding skin	0
	Flat	1
Color	Darker than surrounding skin	0
	Same color or lighter than surrounding skin	1
Hatch marks/suture mark	Present	0
	Absent	1
Overall appearance	Poor	0
	Good	1

DISCUSSION

The current study results revealed that in patients with clean abdominal wounds, there was a significant

difference between stappled versus sutured closure of clean abdominal wounds and stappled closure was associated with lesser wound complication rate. The majority of the patients in our study were males, of age group 31 to 45 years and had ASA grade I.

The use of conventional skin sutures has some intrinsic drawbacks.[11] On either side of the wound, the needle must penetrate the skin that is still intact. The epidermis and dermis are ruptured during suturing and wound infection risk is raised which results in localized symptoms such as edema, drainage, redness and ultimately wound disintegration.[15] The wick effect increases the risk of infection in materials used for braided sutures, such as silk.[16] Once infection takes hold, there's a very high likelihood of a nasty scar, resulting in an unsatisfactory cosmetic outcome.[17] A novel technique for skin approximation is skin staples. Since the substance is inert, it causes the least amount of tissue reaction. Because there is no skin penetration, there is a significant decrease in the likelihood of wound infection, which results in a tiny scar.[18] The available evidence regarding the role of skin closure technique in literature is controversial. Furthermore, locally there is paucity of data which could guide a surgeon about a better closure technique. Keeping this in view, our study was conducted to compare the rate of wound complications in stappled versus sutured closure of clean abdominal wounds.

In our study, following wound closure, SSI occurred in 7.8% patients who had closure with staples compared to 18% patients who had closure with sutures and this difference was statistically significant (p=0.015). In a study conducted in Abbottabad, Khan *et al*., revealed that SSI occurred in 10.8% patients who had stappled closure of wound compared to 24.8% who had sutured closure of wound and the difference was statistically significant (p=0.001).[16] Vagholker *et al*., revealed that none of the patients in the stappled closure group had wound infection compared to 8% patients in the sutured group (p=0.028).[19] Similarly, Singh *et al*., revealed that purulent discharge was witnessed in 8% patients in the stappled closure versus 16% patients in the sutured closure group (p<0.05).[11] These findings are consistent with our study findings.

Our study results showed that wound dehiscence occurred in 1.6% patient who had stappled closure compared to 8.6% patients who had sutured closure and this difference was statistically significant (p=0.010). Vagholker *et al*., revealed that 0% patients in the stappled closure group had dehiscence compared to 8% patients in the sutured group (p=0.028).[19] These findings are consistent with our study findings.

In terms of cosmetic appearance, our study results showed that stappled closure resulted in good appearance in 90.6% patients compared to 61.7% in the sutured closure and this difference reached statistical significance (p=0.000). Vagholker *et al*., revealed that the appearance of scar was reported to be good by 89.3% patients who had stappled closure versus 52% patients who had sutured closure (p<0.01).[19] Singh *et al*., similarly revealed better cosmetic appearance with stappled closure as compared to sutured closure i.e. 80% of cases in the stappled group had good appearance compared to 64% cases in the sutured group (p<0.05),[11] thus supporting our results.

The wound closure time was significantly shorter in the stappled closure group compared to sutured closure (p=0.000) as shown by our results. Vagholker et al. similarly revealed that wound closure time was significantly shorter with the use of staples compared to sutures i.e. 68 seconds compared to 422.7 seconds (p<0.01), respectively.[19] This supports our study findings that stappled closure is faster than the sutured closure.

Our study results revealed that the use of staplers for skin closure can be favored over traditional skin sutures due to their ease of application, reduced application time, lesser wound complication, improved aesthetic results and affordability.

LIMITATIONS OF STUDY

The current study had few limitations. Firstly, the sample size was small and the study was carried out at a single center so there is an issue of generalizability of the results. Secondly, patients were followed up over a short period of time, so long-term complications were not assessed. Furthermore, Stapler availability and cost might be challenging at times which was not assessed in our study.

CONCLUSION

The current study concluded that stappled closure of clean abdominal wounds was significantly associated with lesser wound complication rate in terms of lesser frequency of SSI, wound dehiscence, early wound closure time and a good cosmetic appear. Hence, our results proposed that the use of staplers for skin closure can be favored over traditional skin sutures due to their ease of application, reduced application time, lesser wound complication, improved aesthetic results and affordability.

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Authors Contribution

Following authors have made substantial contributions to the manuscript as under:

SA & BS: Conception, study design, drafting the manuscript, approval of the final version to be published.

SI & AS: Data acquisition, data analysis, data interpretation, critical review, approval of the final version to be published.

LHA & TMQ: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

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