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Original Article

Comparison of Postoperative Wound Infection Between Staple and Prolene Suture Closure Techniques in Elective Surgeries at a Tertiary Care Hospital

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ABSTRACT

Objective: To compare the frequency of postoperative wound infection with staple wound closure and Prolene suture in clean elective surgery.
Study Design: Quasi-experimental study.
Place and Duration of Study: Department of General Surgery, Combined Military Hospital, Multan Pakistan, from Feb 2021 to Aug 2022.
Methodology: A total of 156 patients were divided into two equal groups. Group-A (Staple wound closure) and Group-B (Prolene suture closure). All wounds in both groups were inspected on 3rd, 7th, 14th and 30th postoperative day for presence or absence of wound infection in both groups and compared by applying Chi square test at 0.05 level of significance.
Results: Mean age of patients in Group-A was 53.24±7.08 years vs 54.57±5.74 years in Group-B. Majority of the patients in both groups were male. The most common operation performed was skin and soft tissue surgery. Prevalence of infection in this study was 7.69% (n=12). Wound infection in Group-A was 3.8% (n=3), whereas in Group-B it was 11.5% (n=9) (p=0.037).
Conclusion: Our study results support the use of skin staples for skin closure in elective cases as compared with Prolene sutures, as it is less time-consuming and has a decreased incidence of postoperative infection.

Keywords: Prolene, Skin Closure, Skin Stapler, Wound Infection.

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INTRODUCTION

The term surgery originated from the ancient word "chirurgery," which specifically refers to hand work. It involves understanding all manual operations needed to heal or as much as possible, using all available medications.[1] Recent advances and automation in the field of surgery, along with instrument handling, have led to a better understanding of operative procedures. Demonstrating modern surgical methods is considered the ability to recognize what to practice, when to apply it, and for how long.[2] To access specific underlying pathologies, any surgical technique will create wounds, and the main goal is to achieve wound healing as quickly as possible, with minimal damage to surrounding tissues and a cosmetically acceptable scar.[3] This scar should be aesthetically suitable for the patient, while the critical factor remains the precise alignment of the dermal edges.[4]

Surgical site infection (SSI) is one of the most common postoperative complications associated with different kinds of surgeries, and its burden has declined significantly in recent years due to the latest inventions and the evolution of new techniques.[5] SSI is the most common nosocomial infection encountered among hospitalized patients. It has been reported that approximately 2.5% of patients who undergo non-infected extra-abdominal surgeries and around 20% of patients undergoing intra-abdominal surgeries usually develop surgical site infections in various settings.[6] Infections remain a major contributing factor that affects wound healing characteristics, and techniques for skin closure that penetrate the epidermis and dermis may lead to auto-inoculation of wounds, potentially driving superficial bacterial species deep into subcutaneous tissues.[7] Percutaneous suture closures may also create additional sources of infection through suture pathways, which can give rise to a slim peri-sutural cuff of dead epidermis, dermis, and subcutaneous fat. Suture closing remains an important cause of foreign body reactions in the susceptible subcutaneous tissues.[8]

For decades, it was possible to approximate the skin edges by employing various suturing techniques.[9] Furthermore, these suturing techniques are also

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associated with certain other disadvantages, like more time consumption while applying, along with aesthetically inferior scars.[10] Recent use of automatic stapling devices for skin closure has gained more popularity these days to address such issues.

This study aims to address the existing conflicting evidence regarding the efficiency and safety of Prolene versus Staple closure by providing data from a controlled clinical setting. The findings will help clarify whether significant differences exist in wound closure time and infection rates, thereby guiding junior surgeons in selecting the most appropriate closure method for clean elective surgical procedures.

METHODOLOGY

This Quasi-experimental study was conducted at Combined Military Hospital, Multan Pakistan, from Feb 2021 till August 2022. Permission was granted by the institutional ethical review committee (file no. 14/trg/2021). A total of 156 patients, with 78 cases in each group, were included in the study. The sample size was calculated by OpenEpi, keeping the expected proportion of postoperative wound infection in Staple wound closure as 38.8% and the expected proportion in Prolene suture Group-A as 61.2%. The study subjects were selected using a Non-probability purposive sampling approach.

Inclusion Criteria: Patients aged 18–60 years of both genders, planned for clean elective surgery, were included in the study.

Exclusion Criteria: Patients with lacerated wounds, skin loss on physical examination, co-morbidities like diabetes, hypertension, and obesity, and known allergy to the suture materials were excluded from this study.

Informed written consent was sought from every patient. The 156 patients were randomly divided into two groups, "A" and "B". Seventy-eight patients for the Staple Wound Closure as Group-A, and 78 patients for Prolene Suture as Group-B. In Group-A, skin staples were used to approximate the wounded skin, while in Group-B, skin was closed with subcuticular polypropylene suture (Prolene 2/0). First dressing was removed after 48 hours, and the wound was inspected for infection on 3rd, 7th, 14th and 30th postoperative day. The presence or absence of post-operative wound infection in both groups was recorded on the proforma (Figure).

Data was analyzed through frequencies and percentages for categorical variables like gender, type of surgery, and post-operative wound infection. Mean and standard deviation were calculated for age, duration of procedure, height, weight, and BMI. Both groups were compared for postoperative wound infection by applying the chi–square test, taking $p \leq 0.05$ as significant.

RESULTS

The average age of patients in this study was 53.91±6.46 years. In Group-A mean age was 53.24±7.08, whereas in Group-B mean age was 54.57±5.74 years, and the difference between the groups was found to be insignificant (p=0.44). The gender distribution in our study showed a male dominance. The males were 60.3% (n=94), whereas females were 39.7% (n=62). In Group-A, males were 50(64 %) and 28(36 %) were females, while in Group-B, there were 44(56.4%) males, whereas 34(43.6 %) were females. The statistical difference between the two groups was not significant (p-0.326). The mean BMI of the study population was 26.9±2.91 kg/m2. Mean BMI in Group-A was 26.91±2.9 kg/m2, whereas in Group-B it was 27.02±2.9 kg/m2.

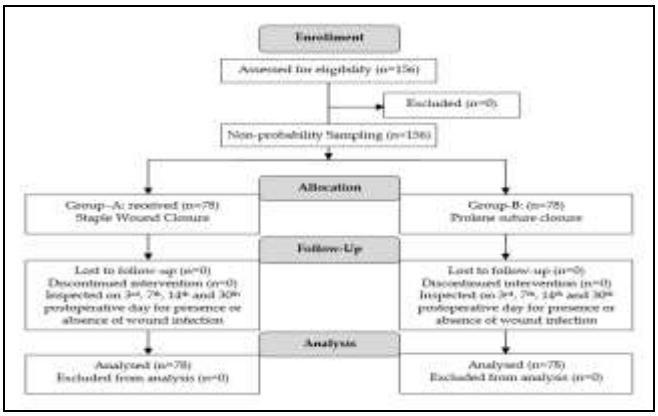

Figure: Patient Flow Diagram (n=156)

In Group-A, the cases of Hernia repair were 16(20.5%), Skin and Soft tissue surgery 24(30.7%), hydrocele & varicocele 15(19.2%), and breast surgery cases 23(29.4%). In Group-B, the cases of Hernia repair were 14(17.94%), Skin and Soft tissue surgery 26(33.3%), hydrocele & varicocele 13(16.6%) and breast surgery cases 25(32.05 %). Mean duration of procedure in this study was 68.99±19.86 minutes. In Group-A, it was 56.82±11.8 minutes versus in Group-B it was 81.16±18.8 minutes (p=0.009). Prevalence of infection in this study was 7.69% (n=12), wound infection in Group-A was 3.8% (n=3), whereas in Group-B it was 11.5% (n=9) (p=0.037). The results are tabulated in Table.

Table: Distribution of Wound Infection in Both Groups (n=156)

Gender	Study Groups	Wound Infection		*p*-Value
		Yes	No	
Male	Group-A	2(2.5%)	48(61.5%)	0.003
	Group-B	5(6.4%)	39(50%)	
Female	Group-A	1(1.2%)	27(34.6%)	0.407
	Group-B	4(5.1%)	30(38.4%)	
Type of Surgery				
Hernia Repairs	Group-A	6(37.5%)	10(94.0%)	0.019
	Group-B	0(0%)	14(100%)	
Soft Tissue Surgery	Group-A	0(0%)	24(100%)	0.236
	Group-B	3(11.5%)	23(88.5%)	
Hydrocele & Varicocele	Group-A	0(0%)	15(100%)	0.001
	Group-B	8(57.1%)	6(42.9%)	
Breast Surgery	Group-A	0(0%)	23(100%)	0.109
	Group-B	4(8.5%)	43(91.5%)	
Duration of Surgery				
<60 minutes	Group-A	5(10.4%)	43(89.6%)	0.169
	Group-B	2(33.3%)	4(66.7%)	
>60 minutes	Group-A	1(3.3%)	29(96.7%)	0.041
	Group-B	13(18.1%)	59(81.9%)	
Body Mass Index (BMI)				
20-25	Group-A	1(4.5%)	21(95.5%)	0.17
	Group-B	4(18.2%)	18(81.8%)	
25.1-30	Group-A	4(8.7%)	42(91.3%)	0.107
	Group-B	9(20%)	36(80%)	
>30	Group-A	1(10%)	9(90%)	0.538
	Group-B	2(18.2%)	9(81.8%)	

DISCUSSION

The results of this study were evidently in favor of using staples for wound closure as compared to traditional suture closure. Wound closure remains one of the major duties performed by Surgeons in healthcare settings and apart from yielding a healthy and acceptable scar, Surgeons are required to ensure an aesthetically favorable physical appearance.[11] Skin stappling technique offers an alternative management technique to offer these advantages, and this study was done to ascertain the outcome of stapling in terms of surgical site infection and duration of surgery.[12]

The difference between the mean ages of the two groups was found to be insignificant (p=0.234). The results of our study contrasted with the study conducted by Basit *et al*.[13] The mean age in their study was 31.54±10.51 years. However, Batra *et al.*, from India also reported an insignificant effect of age on suture technique selection, which was similar to our study results.[14]

The gender distribution in our study showed a male dominance. The males were 60.3% (n=94), whereas females were 39.7% (n=62). The difference between the two groups was not significant (p=0.326), but the overall male dominance in this study was similar to the study conducted by Kathatre *et al.*, in India.[15]

In category of type of surgery, most of the surgeries in this study were conducted in the Skin & Soft tissue area, in which the second most common site was Hernia repair. Regarding the age and gender distribution, BMI, and the type of surgery, the study groups were found to have no statistically significant difference, and hence they were comparable. Cochetti *et al.*, has provided similar results.[16]

The duration of wound closure was significantly shorter in the group treated with staples compared to the suture group. This difference is attributed to the expedited application process of staples, which requires less manual dexterity and coordination than suturing. Suturing necessitates precise hand-eye coordination and the repetitive handling of the needle with the needle holder, which prolongs the procedure time.[17]

The most important finding in this study was the incidence of post-operative wound infection; the overall incidence of infection in our study was 7.69% (n=12). The result of our study clearly shows that the infection rate is much lower in Group-A compared to the traditional Suture Group. The difference between the two groups is because there is a breach in the skin while using the suture, whereas there is no apparent skin breach when using a stapler for skin closure. The results of this study are comparable to the study conducted by Bashir *et al*.[18] It reported 7 % wound infection versus 15%, similar to our results. Hence, through comparison between evidence provided by literature and the findings of the study, the use of Stapler for wound closure has been proven to be more beneficial in numerous ways.

LIMITATION OF STUDY

The study, initially conducted on a small scale based on average patient data, is being recommended for expansion to a larger scale. This suggests that while the initial findings were promising, a more comprehensive study with a larger sample size is needed to confirm and generalize the results.

CONCLUSION

The findings of our study strongly endorse the utilization of skin staples for wound closure in elective surgical procedures when compared to Prolene sutures. The evidence demonstrated that skin stapling significantly reduces the total duration of the closure process, thereby enhancing operative efficiency. Furthermore, the incidence of postoperative infections was notably lower in the staple

group, suggesting that skin staples may contribute to improved wound healing outcomes and decreased risk of infectious complications. Collectively, these results indicate that skin staples represent a more time-efficient and clinically advantageous method for skin closure in elective surgical cases, supporting their preferential use in appropriate clinical settings

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Authors' Contribution

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

AI & RA: Data acquisition, data analysis, critical review, approval of the final version to be published.

SAA & MZF: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

MT & GF: 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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