

## A Comparative Study of Wound Closure by Skin Sutures versus Skin Staplers.

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### Abstract

**Background:** Wound closure holds equal importance alongside other surgical procedures. Beyond the necessity of creating a robust and healthy scar, the surgeon must guarantee its visually pleasing appearance. Skin staples provide an alternative to traditional sutures, and this study has contributed to underscoring the advantages they offer in achieving this goal.

**Methods:** Among the 100 participants, half (50) underwent skin closure using stainless steel skin staples, while the other half (50) received non-absorbable Polyamide mattress sutures in a randomized manner. All participants received a single mandatory pre-operative parenteral antibiotic dose one hour before the incision. On the third day following the surgery, the wounds were assessed for signs of inflammation, infection, and any opening. Subsequently, participants were re-evaluated for infection, wound gap, and inflammation during a follow-up examination on the seventh day. The wounds were once again evaluated for cosmetic appearance using the Visual Analog Score at the one-month follow-up.

**Results:** In the suture group, the majority of cases, constituting 88%, exhibited normal healing. A small percentage, 2%, displayed normal healing but with mild bruising or erythema. Additionally, 2% of cases in this group showed erythema along with other signs of inflammation, and 6% developed pus at the site of the wound. In contrast, in the stapler group, 76% of cases achieved normal healing. A slightly higher proportion, 6%, demonstrated normal healing but with mild bruising or erythema. Moreover, 4% of cases in this group displayed erythema along with other signs of inflammation.

**Conclusion:** In this study, we compared the use of skin staplers and sutures in various wound closures. We found that the incidence of postoperative wound infection was higher with skin staplers than with sutures. Sutures also provided better cosmesis than skin staplers. Additionally, skin staplers saved operative time, but sutures took longer to apply.

**Keywords:** Wound closure, Wound healing, Wound Infection, Sutures, Skin staples

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### Introduction

When suturing any incision or wound, it's crucial to consider the location, and tissue involved, and select the appropriate closure technique accordingly. While the right choice of suture technique and material is essential, it can't compensate for an inadequate operative technique. To ensure proper wound healing, it's vital to maintain a good blood supply and minimize tension during closure. [1, 2] Choosing the right incision, suture material, and closure technique plays a significant role in supporting the patient's natural healing processes

and restoring normal anatomical structures post-surgery. Attention to these details also helps prevent complications such as wound dehiscence and infection, ensuring a favorable cosmetic outcome. [3]

To achieve rapid and cosmetically pleasing healing of skin incisions, it's essential to precisely bring together the edges of the wound. [4] While no technique can surpass the standard suturing methods for the most precise wound closure, staples offer advantages for most linear lacerations outside of the

facial region. They are known to be quicker, less disruptive to the body's natural defenses, and useful in managing potentially contaminated wounds. [5] Given the increasing use of staples in closing incisions in head and neck cancer surgery, there's a necessity to confirm their effectiveness in this specialized field. Therefore, a prospective trial was conducted to assess the benefits and drawbacks of using staples for skin closure in comparison to traditional sutures.

Surgical site infections (SSIs) are serious complications that can occur in approximately 2% of surgical procedures, accounting for about 20% of healthcare-associated infections. [6] These infections can be categorized as incisional or organ/space infections, with incisional ones further classified as superficial (limited to skin and subcutaneous tissue) or deep. The choice of suture material for skin closure has also been reported to impact postoperative wound complications. However, some studies have not found significant differences between various suture materials. [7, 8] It's important to note that the surgical scar remains the only visible indicator of a surgeon's skill, and often, their work is judged based on its final appearance. This study aimed to compare the incidence of post-operative wound infections between skin staples and conventional sutures in abdominal skin closures, as well as to evaluate the cosmetic outcomes of stapled closures compared to conventional sutures.

### Material and Methods

This cross-sectional study was conducted in the Department of General Surgery. Written permission was obtained from all the participants of the study.

### Inclusion Criteria

1. The patients included in this study were randomly selected from those who underwent various surgical procedures including.
2. Elective and Emergency procedures with various incisions.
3. Willing to join the study voluntarily.

### Exclusion Criteria

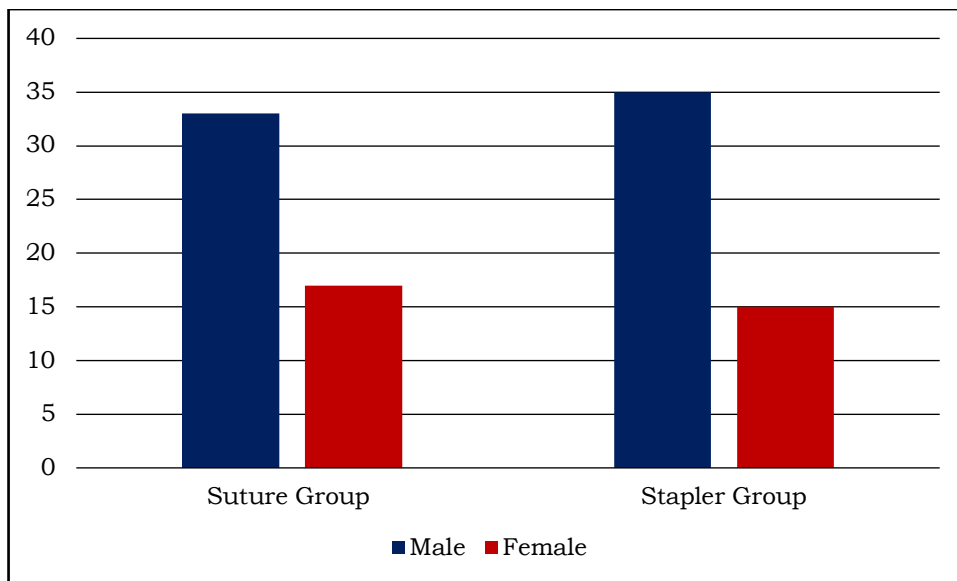
1. Accident cases with extensive lacerations
2. Cases with a history of significant medical conditions
3. Cases with dermatological diseases
4. Not willing to participate in the study.

The patient data was gathered in the following manner: patient age, gender, occupation, incision type, incision length, the device employed for skin closure, duration of skin closure, and the presence of postoperative complications, including wound infections, seroma formation, stitch abscess, stitch granuloma, wound separation, and the development of adverse scars. This information was meticulously observed and recorded in the designated Proforma. A comprehensive medical history was obtained from each patient, beginning with an account of their current symptoms and the identification of any existing co-morbid conditions, such as diabetes (DM) or hypertension (HTN), which were ruled out. A thorough general physical examination was conducted. Before the surgery, all patients underwent a series of tests including complete blood count, urine analysis, blood sugar assessment, blood urea measurement, serum creatinine level determination, liver function tests, chest x-ray, and electrocardiogram. Abdominal shaving was performed before the surgical procedure.

Skin closure was performed utilizing various suture materials such as silk, Prolene, and nylon, and then compared with the use of staplers, with the subsequent outcomes carefully observed and documented. The techniques employed for skin closure with suture materials included simple, mattress, and subcuticular sutures, and the choice of suture material was based on the availability of these materials in the operating room. We also noted the postoperative day on which sutures were removed. Additionally, during the follow-up period, we observed and recorded the ultimate appearance of the scar, categorizing it as either good, fair, or unsightly. The collected data was organized, coded, and entered into Microsoft Excel, and subsequently, statistical software SPSS was used for analysis

### Results

A total of 100 cases divided equally into two groups were included in the study. The average age of the individuals in the study population was 42.5, with a standard deviation of 8.5. The youngest participant was 18 years old, while the oldest was 56, resulting in a range of 38 years. The mean age in the suture group was  $38.25 \pm 6.5$ , whereas in the stapler group, it was  $41.5 \pm 7.0$ . However, this difference was not statistically significant, with a p-value of 0.575. Therefore, we can conclude that the two study groups were comparable in terms of age.



**Figure 1: Sex-wise distribution of cases in the study**

A critical analysis of Table 1 showed for Midline Laparotomy incision, sutures were used in 45 cases (90%), while staplers were used in 50 cases (100%). The total number of cases for this type of incision is 95 (95%). For Subcostal incisions, sutures were used in 5 cases (10%), while staplers were not used (0.00%). The total number of cases for this type of incision is 5 (5%).

**Table 1: Distribution of cases based on the type of incision and wound closure**

		<i>Suture</i>	<i>Stapler</i>	<i>Total</i>
<i>Type of incision</i>	Midline Laparotomy incision	45 (90%)	50 (100%)	95 (95%)
	Subcostal incision	5 (10%)	0 (0.00%)	5 (5%)
<i>Total</i>		50(100%)	50(100%)	100(100%)

Table 2 shows that in Suture Closure: Out of 50 cases, 44(88%) exhibited normal healing, while 6(12%) resulted in wound infection. Stapler Closure: Among 50 cases, 38(76%) showed normal healing, while 12(24%) experienced wound infections. In total, out of 100 cases, 82(82%) achieved normal healing, while 18 (18%) developed wound infections.

**Table 2: Showing the wound closure and healing in the cases of the study**

		<i>Normal Healing</i>	<i>Wound Infection</i>	<i>Total</i>
<i>Closure</i>	Suture	44(88%)	6(12%)	50 (50%)
	Stapler	38 (76%)	12(24%)	50 (50%)
<i>Total</i>		82(82%)	18(18%)	100(100%)

In the suture group, the majority of cases, constituting 88%, exhibited normal healing. A small percentage, 2%, displayed normal healing but with mild bruising or erythema. Additionally, 2% of cases in this group showed erythema along with other signs of inflammation, and 6% developed pus at the site of the wound. In contrast, in the stapler group, 76% of cases achieved normal healing. A

slightly higher proportion, 6%, demonstrated normal healing but with mild bruising or erythema. Moreover, 4% of cases in this group displayed erythema along with other signs of inflammation, and a comparatively larger percentage, 14%, experienced the development of pus at the wound site depicted in Table 3.

**Table 3: Distribution of study population based on type of wound closure and wound infection**

		<i>Normal Healing</i>	<i>Normal healing with mild bruising/erythema</i>	<i>Erythema + Other signs of inflammation</i>	<i>Pus</i>	<i>Total</i>
<i>Closure</i>	Suture	44(88%)	1(2%)	2(4%)	3(6%)	50 (50%)
	Stapler	38 (76%)	3(6%)	2(4%)	7(14%)	50 (50%)
<i>Total</i>		82(82%)	4(4%)	4(4%)	10(10%)	100(100%)

Diabetic Status and Wound Infection: Among the 100 patients, 89 did not have diabetes mellitus, and among them, 7 patients developed wound infections. The remaining 4 patients had diabetes and were under treatment, with 4 of them experiencing post-operative wound infections. Hypertension and Wound Infection: Out of the 100 patients, 22 did not have hypertension, and among them, 6 patients had wound infections. Closure Technique and Mean Closure Time: The average time required for suture closure was 11.58 minutes, with a standard deviation

(SD) of 2.05. In contrast, stapler closure took an average of 5.15 minutes, with an SD of 2.0. This difference was statistically significant, as indicated by a t-value of 22.069 and a P-value of <0.001. Closure Technique and Visual Analogue Score: The mean visual analog score for wounds closed with sutures was 7.5, with an SD of 1.5. For wounds closed with a stapler, the mean score was 38.34, with an SD of 16.057. This difference was found to be statistically significant a P-value of <0.0217.

**Table 4: Distribution of cases based on the meantime of wound closure and VAS scores in the cases of the study.**

	Frequency	Meantime in minutes	SD	T	P value
Mean time required for closure of the wound					
Suture	50	11.58	2.05	21.335	0.0128*
Stapler	50	5.15	1.71		
Distribution of cases based on VAS scores					
	Frequency	Mean VAS Scores	SD	T	P value
Suture	50	7.5	1.5	24.120	0.0217*
Stapler	50	6.5	2.0		

**Discussion**

The current research demonstrates a notably higher rate of wound infections in the stapler group compared to traditional sutures, with rates of 30% and 11.7%, respectively. In a study carried out by Tuuli MG et al. [9] staple closure was found to be associated with a twofold increased risk of wound infection or separation in comparison to subcuticular suture closure. On the other hand, a multicenter study involving 1080 patients, conducted by Tsujinaka T et al. [10] did not reveal a significant difference in wound infection rates between the two groups. The current study reveals that stapler closure significantly reduces the time required for wound closure compared to conventional sutures. Additionally, it indicates that conventional suture closure offers a superior cosmetic appearance. Kanagaye JT et al. [11] conducted a study showing that staple closure is not only safe but also a swift and cost-effective method. Staples were found to be six times faster than standard sutures, with no observed complications. Patients experienced less pain during staple removal, and the resulting scars were cosmetically satisfactory. [12, 13]

Eldrup et al. [14] in an analysis of 137 patients undergoing abdominal or thoracic surgery, concluded that the primary advantage of using staples was the time saved, as closure with mechanical sutures took only one-third of the time required by the conventional method. However, staples were associated with the major drawback of higher expenses, with costs being forty-seven times greater than those of sutures with Dermalon. Meiring et al. [15] reported slightly better cosmetic outcomes in a group of 40 patients undergoing laparotomy, with an impressive 80% reduction in

closure time. They also emphasized that the ultimate cost of the stapler played a pivotal role in selecting the closure method. Harvey et al. [16] conducted a study involving 20 patients undergoing surgery for varicose veins in both lower limbs, using different closure methods for each leg. They reported a 66.6% reduction in closure time and similar cosmetic results with the use of staples. They considered staples a valid choice for patients with numerous wounds, although the additional cost might not be justified for smaller sutures.

Ranabaldo et al. [16] conducted a comparison between sutures, staples, and subcuticular sutures in a group of 48 patients undergoing laparotomy. They concluded that the time difference between these methods was statistically significant. However, they also noted that the cost associated with staples was five times greater, making subcuticular sutures the preferred choice. In a study by dos Santos LR et al. [17] involving 20 consecutive patients, it was found that the use of skin staplers accelerated closure by 80% and yielded a superior cosmetic outcome. Importantly, this approach did not increase the incidence of complications, although it did involve slightly higher costs. Basha et al. [18] observed that staples were linked to an elevated risk of wound infection. While wound complications did lead to a reduction in patient satisfaction, this decrease in satisfaction was not statistically significant when associating it directly with the use of staples. Cromi et al's [19] research revealed equivalent cosmetic outcomes among different closure methods, indicating that there was no significant difference in the cosmetic appearance of wounds.

**Conclusion**

There are several methods of skin closure available, including staples, clips, steristrips, and glue adhesives. Wound infection is a major risk factor for abdominal skin closure, as it can lead to serious complications. Cosmesis is also an important consideration in modern surgical practice, as a good-looking scar can provide satisfaction to both the patient and the surgeon. Preventing wound infection is essential, as it can not only lead to an unsightly scar but also to hernias. In this study, we compared the use of skin staplers and sutures in various wound closures. We found that the incidence of postoperative wound infection was higher with skin staplers than with sutures. Sutures also provided better cosmesis than skin staplers. Additionally, skin staplers saved operative time, but sutures took longer to apply.

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