

# Outcome on Surgical Site Infections for the Closure of Abdominal Incisions in General Surgery

SHIRAZ SHAIKH<sup>1</sup>, ZAMEER HUSSAIN LAGHARI<sup>2</sup>, QAMBER ALI LAGHARI<sup>3</sup>, AISHA MEMON<sup>4</sup>, SAHRISH<sup>5</sup>, ARIF HUSSAIN<sup>6</sup>

<sup>1,3</sup>Assistant Professor, Department of General Surgery, LUMHS Jamshoro

<sup>2</sup>Associate Professor, Department of General Surgery, LUMHS Jamshoro

<sup>4,6</sup>Post graduate Trainee of Surgery, LUMHS Jamshoro

<sup>5</sup>Consultant Surgeon, Shah Bhattai Hospital, Hyderabad

Corresponding author: Shiraz Shaikh, Email: [shiraz\\_shaikh2003@hotmail.com](mailto:shiraz_shaikh2003@hotmail.com)

## ABSTRACT

**Objective:** To determine the frequency of surgical site infections according to the closure of abdominal incisions (skin staplers versus suture stitches) in General Surgery at Liaquat University of Medical and Health Sciences (LUMHS).

**Material and Method:** This cross-section comparative study was conducted at the Department of General Surgery at LUMHS. The study was conducted for one year from January 2021 to December 2021. All the patients aged more than 12 years, both genders and who had undergone abdominal surgeries were included. Patients were divided into two groups group A and group B as per closure of the abdominal incisions. Patients in group A underwent staplers wound closure and patients in group B underwent wound closure by suture stitches. Patients were assessed for postoperative surgical site infection during hospital stay. All the data were collected via self-made study proforma. SPSS version 26 was used for the purpose of data analysis. Stratification with respect to the effect modifiers was done and a p-value < 0.05 was taken as significant.

**Results:** In this study, a total of 41 cases were comparatively studied regarding surgical site infections as to the type of wound closure. The average age of the stapler's patients' group was 36.70+6.22 years and the average age of the suture patients' group was 42.47+5.09 years. Males were most common in both groups without a significant difference (p-0.929), while average duration of closure was significantly lower in stapler group as compared to suture group (p-0.001). Of all, 12 cases had wound infection, particularly as 4 cases had infection grade I, 5 cases had grade II infection and 2 cases had grade III infection. Although frequency of surgical site infection was statistically insignificant (p-0.223).

**Conclusion:** The wound closure skin stapler's method was observed to be effective in terms of short duration, while the frequency of surgical site infection was higher in stapler closure but statistically insignificant as per both techniques.

**Keywords:** Wound infection, stapler, suture, effectiveness

## INTRODUCTION

Surgical site infections are the most prevalent bacteremia infections, and they cause significant mortality and the morbidity, along with increasing prolonged hospital stay and treatment costs.<sup>1</sup> When compared to participants without SSIs, the individuals with SSIs are up to five times more likely to be re-admitted in the hospital, 60% more likely to be placed in the intensive care unit and 2 times more risk of mortality.<sup>1,2</sup> SSIs are said to be responsible for more than a third of postoperative mortality throughout the world it is also the risk of the health of millions of the cases each year and lead to antibiotic resistance spreading.<sup>3,4</sup> Recent research suggests that the SSI risk factors are complex and diverse.<sup>3</sup> Pre-existing illness, lack of the prophylactic antibiotics uses, contamination of the wound, hypovolemia presence, long operative duration, prolonged hospital stay, smoking and alcohol consumption, advanced age, previous surgical history, use of iodine alone in skin preparation, drain, lack of the proper care of the wound and hair removal in operating room, all the factors linked to surgical site infection.<sup>3,5,6</sup> Although wound closure procedures and materials vary greatly depending on the type of surgery, the length, and the anatomical location of the wound. In routine surgeries, a number of sutures and staples are employed.<sup>7</sup> Sutures are commonly used to close surgical incisions on the skin. It has been reported that the sutures have been shown to have improved results in terms of the incidence of wound infections in clean surgical procedures compared to staples.<sup>7</sup> Sutures have several advantages, including strength, flexibility, non-toxicity, and in-vivo disintegration. Alternatively, it is stated that the Staples are a good substitute for sutures and are typically constructed of stainless steel, though easily absorbable staples are also available.<sup>8,9</sup> Sutures are a common method of wound closure; however, they may raise the risk of infection. In fact, the sutures may promote ischemia of the wound flaps, which obstructs normal healing. Staples have a potential benefit in surgical wound closure because of their minimal tissue reactivity.<sup>8,10</sup> After considering above controversies in the literature and lack of the local data, this study has conducted to

observe the frequency of surgical site infections in terms of the types of closure of abdominal incisions in general surgery.

## MATERIAL AND METHODS

This cross-section comparative study was conducted at the Department of General Surgery of Liaquat University of Medical and Health Sciences. Study was conducted during one year from January 2021 to December 2021. All the patients aged more than 12 years, both genders and undergone abdominal surgeries at Department of General Surgery were included. All the cases having comorbidities like diabetes, chronic liver disease, hematological abnormalities, history of chemotherapy, pre-operative contaminated wound, tuberculosis, obesity and those who were not agree to participate in the study were excluded. Patients were divided in two groups group A and group B as per closure of the incisions. Patients of group A underwent staplers wound closure and patients of group B underwent wound closure by suture stitches. All the surgeries were done by senior surgeon having minimum experience of more than five years. Patients were assessed for postoperative surgical site infection during hospital stay. Wound infection was graded as clean (grade I), clean/contaminated (grade II), contaminated (grade III) and dirty (grade IV). All the data regarding age, gender, type of incision, time of wound closure, postoperative scar status and grade of wound infection were collected via self-made study proforma. SPSS version 26 was used for the purpose of data analysis. Stratification with respect to the effect modifiers was done by the applying the chi-square test and a p-value < 0.05 was taken as significant.

## RESULTS

In this study a total of 41 cases comparatively studied regarding surgical site infection as per types of wound closure. The average age of the stapler's patients' group was 36.70+6.22 years and average age of the suture patients' group was 42.47+5.09 years. Males were most common in both groups without significant difference (p-0.929), while average duration of closure was

significantly lower in stapler group (6.8+1.32minutes) as compared to suture group (16.8+1.74 minutes) (p-0.001). Table.1

Out of all 41 cases, 12 had wound infection, particularly as 4 cases had infection grade I, 5 cases had grade II infection and 2 cases had grade III infection. Surgical site infection was found higher in stapler group, while frequency of surgical site infection was statistically insignificant (p-0.223). Table.2

Table 1: Descriptive statistics age, gender and duration of wound closure n=41

Variables	Study Group	N	Statistics	p-value
Age (years)	Group A		36.70+6.22	0.002
	Group B		42.47+5.09	
Closure Duration (Minutes)	Group A		6.8+1.32	0.001
	Group B		16.8+1.74	
Gender	Group A	Male	15(75.0%)	0.929
		Female	5(25.0%)	
	Group B	Male	16(76.2%)	
		Female	5(23.8%)	

Group A= wound closure skin staplers

Group B= wound closure suture stitches

Table 2: Wound infections grading and comparison as per wound closure n=41

Grades of Wound Infection	Study Groups		Total	p-value
	Group A	Group B		
No wound infection	12	18	30	0.223
	60.0%	85.7%	73.2%	
Grade I	3	1	4	0.223
	15.0%	4.8%	9.8%	
Grade II	3	2	5	0.223
	15.0%	9.5%	12.2%	
Grade III	2	0	2	0.223
	10.0%	0.0%	4.9%	
Total	20	21	41	0.223
	100.0%	100.0%	100.0%	

Group A= wound closure skin staplers

Group B= wound closure suture stitches

## DISCUSSION

Surgical site infections (SSIs) are the commonest prevalent healthcare-linked infection involving surgical cases, and they're linked to a higher risk of hospital re-admissions, ICU admissions, long-term consequences, and even mortality.<sup>11</sup> In this study The average age of the stapler's patients' group was 36.70+6.22 years and average age of the suture patients' group was 42.47+5.09 years. Males were most common in both groups without significant difference (p-0.929). Consistently Malik ZI et al<sup>12</sup> reported that the patient's median age was 42.7 years and most of the participants 74% were under 50 years old and males made up the majority of their study population 61%. In another study of Ansari S et al<sup>13</sup> reported that the average age of their study participants was 58.2± 15.9 years and males were in majority 55.8%. On other hand Sattar F et al<sup>14</sup> conducted the study to assess the frequency of surgical site infection and inconsistently, they reported that females were in majority 56.8% and males were 43.2%, while they found average age of the patients was 35.73 ± 19.73 years.

In this study the average duration of closure was significantly lower in stapler group (6.8+1.32minutes) as compared to suture group (16.8+1.74 minutes) (p-0.001). Consistently in a study demonstrated that the staples are widely used to close wounds on the skin since they shorten operating duration.<sup>15</sup> Nevertheless, when it comes to wound healing, it's uncertain whether staples or sutures should be used.<sup>15</sup> In the study of Abdul kareem ZB et al<sup>16</sup> reported that in light of their prospective study, which was conducted to examine the outcomes of clip and suture closure in terms of duration of closure, economic viability, and postoperative wound dehiscence, as well as scar acceptance and they observed that the silk has been discovered to provide speedier wound closure and better results when used in surgical wound closure.

In this study, the surgical site infection was seen high in stapler group, while frequency of surgical site infection was statistically insignificant (p-0.223). Consistently van de Kuit A et al<sup>17</sup> in their systematic review and meta-analysis demonstrated that patients who had staples had a considerably higher risk of surgical site infection than those who had sutures, according to a review of studies with a low risk of bias, while there was no significant difference in the probability of SSI between patients who had staples and those who had sutures. In the study of Cochetti G et al<sup>8</sup> reported that the overall, sutures group cases had 4.90% less rate of wound infections than staples 6.75%, however it is unclear whether there is a significant difference between the two groups. Further they reported that the wound closure stapler technique may raise the risk of adverse outcomes when contrasted to sutures (7.3% versus 3.5% respectively), but the evidence was not conclusive. Additionally, patients who had sutures were more likely than those who had staples to be satisfied with the cosmetic consequences of their operation, but there was no significant difference observed between the interventions, and the quality of evidence was low. Furthermore, sutures may cause less post-operative pain than staples.<sup>8</sup> In the study of Ando Met al<sup>18</sup> demonstrated that the patients who received 2-octyl-cyanoacrylate exhibited more SSI risk factors than those who received metal staples. Despite this, eight participants in the metal-staple group developed SSIs compared to none in the 2-octyl-cyanoacrylate group (p 0.01).<sup>18</sup> In the study of Shani A et al<sup>19</sup> reported that the staples group had a combined superficial and deep infection rate of 11.8 percent, while the nylon suture group seemed to have a rate of 4.2% (p-0.017). In the study of Maurer E et al<sup>20</sup> also observed that the intracutaneous suturing was not observed to be related with a less rate of superficial wound infections in contrast to skin stapling in elective gastrointestinal surgeries, but it did result in fewer wound dehiscences. While Feng Jet al<sup>7</sup> stated that in patients undergoing abdominal surgery, in their study, they found that subcuticular sutures and staples for skin closure had similar SSI rates. There are several controversies in the literature about such wound closure procedures, and the results of this study were not guaranteed to be significant due to the small sample size. However, further multicenter large-scale studies are needed to evaluate the significant difference in the outcome of stapler wound closure technique in terms of surgical site infection rate.

## CONCLUSION

The wound closure skin stapler's method was observed to be the effective in terms of short duration, whereas frequency of surgical site infection was higher in stapler wound closure, while findings observed insignificant as per both techniques. In keeping with limitation of very sample size, further large-scale studies are recommended on this subject.

## REFERENCES

- Laloto TL, Gameda DH, Abdella SH. Incidence and predictors of surgical site infection in Ethiopia: prospective cohort. BMC infectious diseases. 2017;17(1):1-9.
- Gagliardi AR, Fenech D, Eskicioglu C, Nathens AB, Mcleod R. Factors influencing antibiotic prophylaxis for surgical site infection prevention in general surgery: a review of the literature. Can J Surg. 2009;52(6):481-9.
- Shiferaw WS, Aynalem YA, Akalu TY, Petrucka PM. Surgical site infection and its associated factors in Ethiopia: a systematic review and meta-analysis. BMC surgery. 2020 Dec;20(1):1-5.
- World Health Organization. Preventing surgical site infections: implementation approaches for evidence-based recommendations.2018;1-69
- Mawalla B, Mshana SE, Chalya PL, Imirzalioglu C, Mahalu W. Predictors of surgical site infections among patients undergoing major surgery at Bugando medical Centre in Northwestern Tanzania. BMC Surg. 2011;11(1):21.
- Afenigus A, Shbabawu A, Melese T. Surgical site infection and associated factors among adult patients admitted in west and east Gojjam zone hospitals, Amhara region. Ethiopia Nu Care Open Acces J. 2019;6(3):107-12

- 7 Feng J, Jiang X, Zhi Z. Subcuticular sutures versus staples for skin closure in patients undergoing abdominal surgery: A meta-analysis of randomized controlled trials. *PloS one*. 2021 May 4;16(5):e0251022.
- 8 Cochetti G, Abraha I, Randolph J, Montedori A, Boni A, Arezzo A, Mazza E, De Vermandois JA, Cirocchi R, Mearini E. Surgical wound closure by staples or sutures?: Systematic review. *Medicine*. 2020 Jun 19;99(25).
- 9 Hochberg J, Meyer KM, Marion MD. Suture choice and other methods of skin closure. *Surg Clin North Am* 2009;89:627–41.
- 10 Edlich RF, Rodeheaver GT, Thacker JG, et al. Revolutionary advances in the management of traumatic wounds in the emergency department during the last 40 years: part II. *J Emerg Med* 2010;38:201–7
- 11 Manian FA. The role of postoperative factors in surgical site infections: time to take notice. *Clinical Infectious Diseases*. 2014 Nov 1;59(9):1272-6.
- 12 Malik ZI, Nawaz T, Abdullah MT, Waqar SH, Zahid MA. Surgical site infections in general surgical wards at a tertiary care hospital. *Pakistan Journal of Medical Research*. 2013 Oct 1;52(4):116.
- 13 Ansari S, Hassan M, Barry HD, Bhatti TA, Hussain SZ, Jabeen S, Fareed S. Risk factors associated with surgical site infections: a retrospective report from a developing country. *Cureus*. 2019;2:11(6).
- 14 Sattar F, Sattar Z, Zaman M, Akbar S. Frequency of post-operative surgical site infections in a Tertiary care hospital in Abbottabad, Pakistan. *Cureus*. 2019 Mar 12;11(3).
- 15 Cochetti G, Abraha I, Randolph J, Montedori A, Boni A, Arezzo A, Mazza E, De Vermandois JA, Cirocchi R, Mearini E. Surgical wound closure by staples or sutures?: Systematic review. *Medicine*. 2020 Jun 19;99(25).
- 16 Abdulkareem ZB, Naeem LA, Jassim MM. Comparative study between silk suture and metallic Staplers in skin wound closure in Rabbits. *InIOP Conference Series: Materials Science and Engineering* 2019;1:571;p. 012059.
- 17 van de Kuit A, Krishnan RJ, Mallee WH, Goedhart LM, Lambert B, Doornberg JN, Vervest TM, Martin J. Surgical site infection after wound closure with staples versus sutures in elective knee and hip arthroplasty: a systematic review and meta-analysis. *Arthroplasty*. 2022 Dec;4(1):1-9.
- 18 Ando M, Tamaki T, Yoshida M, Sasaki S, Toge Y, Matsumoto T, Maio K, Sakata R, Fukui D, Kanno S, Nakagawa Y. Surgical site infection in spinal surgery: a comparative study between 2-octyl-cyanoacrylate and staples for wound closure. *European Spine Journal*. 2014 Apr;23(4):854-62.
- 19 Shani A, Poliansky V, Mulla H, Rahamimov N. Nylon skin sutures carry a lower risk of post-operative infection than metal Staples in open posterior spine surgery: a retrospective case-control study of 270 patients. *Surgical Infections*. 2020 Jun 1;21(5):440-4.
- 20 Maurer E, Reuss A, Maschuw K, Aminossadati B, Neubert T, Schade-Brittinger C, Bartsch DK. Superficial Surgical Site Infection Following the Use of Intracutaneous Sutures Versus Staples: A Randomized Single-Center Trial in an Elective Gastrointestinal Surgery Setting. *DeutschesÄrzteblatt International*. 2019 May;116(21):365.