



## INCIDENCE OF SURGICAL SITE INFECTION/ WOUND GAPING IN SUTURED VS STAPLED CLOSURE OF ABDOMINAL INCISION: A COMPARATIVE STUDY

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### ABSTRACT

**Background** Surgical wound is any wound inflicted during surgical process and infection of surgical wound is a relevant complication with an incidence of 1% to 3%. Many factors are responsible for the occurrence of surgical site infections, like age, presence of comorbidities, type of procedure, wound closure method, level of contamination etc. Surgical Site Infection or SSI is associated with a significant economic burden in terms of extended length of stay and increased costs of treatment. **Objectives-** To determine whether the incidence of surgical site infections differed after wound closure with non-absorbable suture material vs skin stapler, in elective abdominal surgeries. **Methods-** A comparative study to determine the incidence of surgical site infections after elective abdominal surgery was conducted in a tertiary care setup for a duration of one year. The study population was divided by random computer method in two arms, consisting of 30 patients each. In one arm the abdominal wound after elective surgery was closed with non-absorbable sutures while in the other with skin staplers. Outcomes were noted in terms of Surgical site infection, i.e, presence of wound gape, burst abdomen, closure duration, duration of hospital stay and interventions like secondary suturing, daily cleaning and dressing (CnD) **Results-** A total of 60 patients who underwent elective abdominal surgeries were divided into two arms of 30 patients each. Wound closure in one group done by non-absorbable suture material while in the other group with skin stapler. The groups were comparable in demographics, ASA (American society of Anaesthesiologist) grading and CDC (Centre for disease control) class of surgical wound. In our study, Surgical site infections were detected in 33.3% (10 patients) in the sutured arm of closure of abdominal incision, while SSI were detected in 26.6% (8 patients) of stapled arm of closure of abdominal incision. No significant difference encountered in the incidence of SSI in sutured and stapled closure of abdominal wound. 76.7% (23 patients) underwent wound closure within 10 minutes in the stapled arm, while only 20% (6 patients) in the sutured arm had surgical time duration of wound closure less than 10 minutes (p value < 0.001), the wound closure duration in the stapled arm was significantly less compared to the sutured arm. **Conclusions-** There was no significant difference in the incidence of surgical site infections in both the groups, but the surgical time duration of wound closure was significantly lower in the stapled group.

### KEYWORDS :

#### INTRODUCTION

Our skin is a natural barrier against infection. Even with many precautions and protocols to prevent infection in place, any surgery that causes a break in the skin may lead to an infection. These infections are called surgical site infections (SSIs). Criterion Surgical Site Infection (SSI) is divided into Superficial, Deep and Organ level deep SSI, with date of event occurring within 30 to 90 days (3)

Surgical wound closure aims to move close the skin flaps to favour rapid healing and a good cosmetic outcome with low risk of complications. Infection of surgical wound is a relevant complication with an incidence of 1% to 3% (1); it is favoured by age, underlying illness (American Society of Anaesthesiologists score of three or more, diabetes, malnutrition, low serum albumin, radiotherapy, and steroid use), obesity, host immune status, smoking, site, level of wound contamination. Further significant risk factors are related to type and complexity of the surgical procedure, duration of operation, type of surgical approach (laparotomic or laparoscopic or robotic) and closure material.(4)

Closure of the surgical wound over the skin can be carried out with an array of different methods – like absorbable sutures, nonabsorbable sutures, skin staplers, surgical glue, antibiotic coated sutures. The principal advantages of sutures are their flexibility, strength, non-toxicity, and in vivo degradation properties. Staplers are a valid alternative to sutures and are mainly made of stainless steel. Although the sutures are the most common technique of closure, they could increase the risk of wound infection, cause the ischemia of the wound flaps and this hinders a regular healing. The potential advantage of staples in surgical wound closure is related to their low level of tissue reactivity. However, in literature, it is unclear which is the best skin closure technique between sutures and staplers.

While some RCTs report that there is no difference between two methods in terms of overall wounds infections, others report higher rates of wound complications following the use of staplers. Furthermore, evidence has begun to be synthesized within different surgery types, but often it is not conclusive due to small sample size and low quality of studies; then, it is important for the clinicians to evaluate the issue through the broad field of different surgical specialties. A systematic review of RCTs is required to compare sutures with respect to staples in terms of wound infections, length of hospital stay, rates of readmission, adverse events, pain, in order to provide surgeons the optimal method for skin closure in different surgical specialties.(4)

#### MATERIALS AND METHODS

60 patients were evaluated at a tertiary care institute to document the incidence surgical site infections after wound closure in open abdominal elective surgeries from January 2021 to January 2022. The patients who satisfied the inclusion criteria of age above 18 years of age, non-pregnant females, who underwent clean and clean contaminated elective planned surgeries and who consented to be a part of the study were included in the study. The patients were matched for the age, gender, ASA grade, the type of procedure, the duration of surgery, and were distributed in sutured vs stapled arms by random computer method. Closure of abdominal skin incision was done with skin staplers in 30 patients, and with non-absorbable suture material in 30 patients.

Data were collected from prospectively maintained database. Demographic data included age, sex, and medical comorbidities. Perioperative parameters included in the study were American society of anaesthesiologist (ASA) score, the Centre for Disease Control (CDC) surgical wound classification grade, skin incision type, length of skin incision,

duration of surgery and use of surgical drains, use of skin stapler or non-absorbable suture material for skin closure, number of skin staplers/ sutures and average time for skin closure. Postoperative parameters included the postoperative day of check dress if done, presence of fever, local suture site pain/erythema/induration/tenderness, serous/purulent discharge from the suture site, postoperative day on which surgical site infection was detected, level of surgical site infection, wound swab culture sensitivity report, duration of antibiotics, total duration the surgical drains were left in situ, secondary suturing, the duration of hospital stay. The patients were followed up for a minimum duration of 30 days post operatively, to detect presence of any signs/symptoms of SSI. The means were compared using t test or Mann-Whitney U test when appropriate. The proportions were compared by Fisher's exact test or Chi-square test when appropriate. All tests were two tailed, and p value ≤ .05, differences were deemed statistically significant. Data were analysed using the IBM-SPSS statistics application, version 25.

**RESULTS**

Out of total 60 patients, 30 patients were in the sutured arm where the abdominal incision was closed by non-absorbable suture material, while 30 patients were in the stapled arm where the abdominal incision was closed by skin staplers.

Patients in both the arms were comparable with respect to demographic data such as age and gender as shown in table 1

**Table 1 - demographic data**

Demographic Parameter	N- number of patient ( % of patients)		P value
Age	Sutured	Stapled	0.331
<20 years	0(0%)	4(13.3%)	
20-50	19(63.3%)	20(66.7%)	
>50 years	11(36.7%)	6(20%)	
Gender			0.603
Female	17(56.7%)	14(46.7%)	
Male	13(43.3%)	16(53.3%)	

Perioperative parameters including ASA grade, CDC wound class, the length of incision, number of sutures/ skin staplers used, insertion of subcutaneous drains, removal of sutures/staplers, secondary suturing, duration of hospital stay was comparable in both the groups as mentioned in table 2.

**Table 2 - perioperative data**

Parameters	N – number of patient (% of patients )		P value
Duration for skin Closure	Sutured	Stapled	≤0.001
< 10 minutes	6(20%)	23(76.7%)	
10-15 minutes	15(50%)	7(23.3%)	
> 15 minutes	9(30%)	0(0%)	
Duration of Surgery(min)			0.864
< 100	5(16.7%)	4(13.3%)	
100-300	19(63.3%)	21(70%)	
>300	6(20%)	5(16.7%)	

In the stapled arm, duration for skin closure was significantly less (P value < 0.001) However, this did not have any effect on the over-all duration of surgery, which was comparable for both the groups, as enlisted in table 3.

**Table 3**

Perioperative Parameter	N– number of patient ( % of patients)		P value
ASA grade	Sutured	Stapled	0.777
1	21(70%)	19(63.3%)	
2	9(30%)	11(36.7%)	

CDC wound class			0.603
1 – clean surgery	16(53.3%)	13(43.3%)	
2 – clean contaminated surgery	14(46.7%)	17(56.7%)	
Length of incision(cm)			0.577
<10	11(36.7%)	8(26.7%)	
>10	19(63.3%)	22(73.3%)	
Number of Sutures/Staplers used			0.285
<10	11(36.7%)	6(20%)	
10-15	13(43.3%)	14(46.7%)	
>15	6(20%)	10(33.3%)	
Insertion of subcutaneous drain			0.287
No	16(53.3%)	21(70%)	
Yes	14(46.7%)	9(30%)	
Suture/ skin stapler removal done on Postoperative day		Stapled	0.226
<10	0(0%)	2(6.7%)	
10-15	29(96.7%)	25(83.3%)	
>15	1(3.3%)	3(10%)	
Secondary suturing			0.491
Yes	3(10%)	4(13.4%)	
No	27	26	
Duration of Hospital stay (days)			0.937
<20	15(50%)	15(50%)	
20-30	7(23.3%)	8(26.7%)	
>30	8(26.7%)	7(23.3%)	

Surgical site infections were detected in 33.3 % i.e 10 patients in the sutured arm of closure of abdominal incision, while SSI were detected in 26.6 % i.e 8 patients of stapled arm of closure of abdominal incision. The incidence of SSI was comparable in both the arms (P value 1.000) Levels of SSI are mentioned in table 4

**Table 4**

Parameters	N – no of patients (% of patients )		P value
Level of SSI	Sutured	Stapled	
Organ level	0(0%)	1(12.5%)	
Deep	0(0%)	1(12.5%)	
Superficial	10 (100 %)	6(75%)	
Total	10(100%)	8(100%)	0.183

**DISCUSSION**

Surgical wound is any wound inflicted during surgical process. Surgical site infections (SSIs) are serious operative complications that occur in approximately 2% of surgical procedures and account for some 20% of health care-associated infections. SSI is associated with a significant economic burden in terms of extended length of stay and increased costs of treatment.(2). There are various methods of surgical wound closure including but not limited to with absorbable sutures, non-absorbable sutures, and skin staplers. In literature, it is unclear which is the best skin closure technique between sutures and staplers. While some RCTs report that there is no difference between two methods in terms of overall wounds infections, others report higher rates of wound complications following the use of staplers, as summarised in the table below.

Maurer et al, in their prospective, randomized, single-center study concluded that – In elective gastrointestinal surgery, intracutaneous suturing was not found to be associated with a lower rate of superficial wound infections than skin stapling, but fewer wound dehiscences occurred in the intracutaneous suturing group(7). Kobayashi et al also concluded that compared with skin stapling, subcuticular sutures did not reduce the risk of incisional SSI after colorectal surgery. Wound problems, and postoperative duration of hospital stay did not differ between the groups i.e subcuticular sutures and

skin stapler; subcuticular sutures took 5 min longer than staples ( $P < 0.001$ ) (10). In another study done by Tsujinaka et al, a multicentre, open-label, randomised controlled trial was carried out at 24 institutions between June 1, 2009, and Feb 28, 2012. They concluded that the efficacy of subcuticular sutures was not validated as an improvement over a standard procedure for skin closure to reduce the incidence of wound complications after open gastrointestinal surgery(9). Joshua et al did a double-blinded randomized controlled trial in all patients undergoing elective open surgeries in a single unit, from May 2007 to May 2010. Their results showed that patients with non-absorbable subcuticular skin closure compared to staples had reduced infection rates and were more satisfied with their scar and the cosmesis outcome(11).

Study/Country	Average age years Sutures /staplers	Population s/staplers	Closure materials	Main relevant outcome
Elisabeth Maurer 2019/Germany	66/61	280 (141/139)	4-0 absorbable sutures, staples	In elective gastrointestinal surgery, intracutaneous suturing was not found to be associated with a lower rate of superficial wound infections than skin stapling, but fewer wound dehiscences occurred in the intracutaneous suturing group.
S.Kobayashi 2015/Japan	65/67	1232 (620/612)	4-0 or 5-0 absorbable sutures, staples	Wound problems, and postoperative duration of hospital stay did not differ between the groups i.e subcuticular sutures and skin stapler;subcuticular sutures took 5 min longer than staples ( $P < 0.001$ ) in colorectal surgery.
Toshimasa Tsujinaka 2013/Japan	68/68	1072 (562/518)	3-0 or 4-0 polydioxanone sutures, staples	The rate of wound complications did not differ significantly between the subcuticular sutures and staples groups after open gastrointestinal surgery.
Joshua Agilinko 2019/United Kingdom	67/69	218 (134/84)	non-absorbable sutures, staples	Patients with non-absorbable subcuticular skin closure compared to staples had reduced infection rates in elective surgeries.

Ranaboldo et al in their study concluded that the mean time saved per patient with skin staples was 77 s, compared to sutured closure. The mean cost per patient was 1.41 pounds

for subcuticular closure and 7.72 pounds for stapling; the latter also incurred an additional cost of 6.27 pounds for staple removal (5).

The Proximate stapler was compared with usual skin closure in a randomized trial, done by Eldrup et al. who concluded that the median duration of skin closure with the Proximate stapler was significantly shorter than with conventional closure. No difference was found with regard to wound infection, but pain was more frequent after stapling(6).

In the meta-analysis done by Feng et al, it was demonstrated that- There were similar outcomes in SSI rate between subcuticular sutures and staples for skin closure in patients undergoing abdominal surgery(8).

The incidence of surgical site infections after sutured vs stapled closure of abdominal incision in elective abdominal surgeries was comparable in our study, although the duration of skin closure after stapled closure was significantly less compared with sutured closure of skin incision. The duration of total surgery was, however, comparable with no significant difference in sutured vs stapled closure.

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