

## Evaluation of Surgical Site Infection in Abdominal Surgeries in the Department of General Surgery in a Tertiary Care Centre: An Observational Study

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### Abstract

**Background:** Surgical site infection is increasingly recognized as a measure of the quality of patient care by surgeons, the incidence of SSI in our environment is still high when compared to the developed world.

**Objectives:** This study was conducted to evaluate the incidence, risk factors and the types of Surgical Site Infection (SSI) in postoperative abdominal surgeries.

**Methods:** Immediate postoperative period of the patients was followed up. Wound was examined on day 2, then everyday till the day of discharge. Signs of SSI were looked for. If the Patient developed SSI in this period, then type of SSI was classified and swab culture was performed to identify the microorganism and antibiotic sensitivity pattern. CDC (Centre for disease Prevention and Control) criterion was used for diagnosis and classification of SSI. Patient was treated and discharged. All the details were recorded in the proforma. The patients were followed up every week till 30 days.

**Results:** The SSI rate in our study was 14% and risk factors Associated with SSI in our study are smoking (p=0.001), preoperative stay of > 3days (p=0.000), ASA score (p=0.001), contaminated and dirty wound (p=0.000), duration of surgery (p=0.010) and duration of drain placement (p=0.000).

**Conclusion:** Our study prompts us to look at the gaps in our surgical and infection control protocols which will enable policy formulation that will foster a reduction in wound infection rate. SSI can be reduced by decreasing the preoperative hospital stay, appropriate antibiotic administration policies, adequate preoperative patient preparation, reducing the duration of surgery to minimum, judicious use of drains and intraoperative maintenance of a sepsis and following operation theatre discipline properly.

**Keywords:** Abdominal Surgeries, ASA Score, Glycemic Control, Surgical Site Infection (SSI)

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## Introduction

Surgical site infections (SSIs) are infections of the incision or organ or Space that occur after surgery. The term 'surgical site infection' (SSI) was introduced in 1992 to replace the previous term 'surgical wound infection'. Surgical site infection (SSI) has always been a major complication of surgery and trauma and has been documented for 4000–5000 years. SSI Is both the most frequently studied and the leading HAI reported hospital wide in LMICs. World Health Organization (WHO) Clean Care is Safer Care programme shows that surgical site infection (SSI) affects upto one third of patients who have undergone a surgical procedure in LMICs and The pooled incidence of SSI was 11.8 per 100 surgical patients undergoing the procedure (range 1.2 to 23.6). [1,2]

Although SSI incidence is much lower in high- income countries, it remains this frequent type of HAI in Europe and the United States of America (USA). In some European countries, it even represents the most frequent type of HAI. SSIs are among the most preventable HAIs, but they still represent a significant burden in terms of patient morbidity and mortality and additional costs to health systems and service payers worldwide. [3] Each SSI is Associated with approximately additional postoperative hospital days and patients with an SSI have a 2-11 times higher risk of death, compared with operative patients without an SSI. [4] Surgical patients initially seen with more complex comorbidities and the emergence of antimicrobial- resistant pathogens increase the cost and challenge of treating SSIs. [5]

For these reasons, the prevention of SSI has received considerable attention from surgeons, infection control professionals and health care authorities, the media and the public. This study was conducted to evaluate the incidence, risk factors and the

types of Surgical Site Infection (SSI) in postoperative abdominal surgeries.

## Methodology

This prospective study was performed in ESIC Medical College and PGIMSR, Chennai, in the period 18 months from April 2018 to September 2019. 100 adult patients undergoing elective and emergency abdominal surgeries were selected. The ethical standards for human experimentation were followed during the study and permission from the institutional ethical committee was taken.

Patients with HIV, HBV or HCV infection, patients on chemotherapy and radiotherapy, patients on oral steroids and other immuno suppressant drugs, patients with hepatic, cardiac and renal failure, and ASA (American Society of Anaesthesiologists) score IV or V were excluded from the study.

**Study procedure:** Informed written consent was obtained. Appropriate history was taken; Clinical examination and relevant investigations were carried out. Intravenous antibiotic was given 30–60 minutes before the procedure. Appropriate surgical management was carried out under strict aseptic precautions.

Immediate postoperative period of the patients was followed up. Wound was examined on day 2, then everyday till the day of discharge. Signs of SSI were looked for. If the Patient developed SSI in this period, then type of SSI was classified and swab culture was performed to identify the microorganism and antibiotic sensitivity pattern. CDC (Centre for disease Prevention and Control) criterion was used for diagnosis and classification of SSI. Patient was treated and discharged. All the details were recorded in the proforma. The patients were followed up every week till 30 days. If the patient developed any features of SSI during follow up period after discharge, then

Patient was treated accordingly as described above. All details were recorded in the proforma.

Data was collected and calculated data were arranged in systemic manner, presented in various table and figures and statistical analysis was made to evaluate the objectives of this Study with the help of SPSS. The Chi square calculation was done.

## Results

In our study maximum numbers of patients were 35 to 65 years of age and predominantly male. 12 patients were known diabetic, 14 patients were smokers. In our study 95 patients had preoperative stay less than 3 days. In our study 3 patients had elevated blood sugar level > 200 mg/dl. There were more emergency surgeries (64) than elective surgeries (36). Out of 58 male patients 26 were anaemic. None of the patients required blood transfusion. Majority of patients were of the age group 13 to 35 years. All the male patients above 65 years of age were with low hemoglobin. In our study 64 patients came under ASA score I.

Majority of surgical wound were clean contaminated. Duration of surgery was > 2 hrs for 71 procedures. Drainage tube was placed in 31 surgeries. 74 patients had post-operative stay period of 3-7days. 23 patients had prolonged hospital stay. All patients were under glycemic control during the post-operative period. 71 patients were started on oral feeds between 24 and 48 hours. Out of 14 patients who developed SSI, 13 had superficial SSI. 1 had organ Space SSI. No patients had deep incisional SSI.

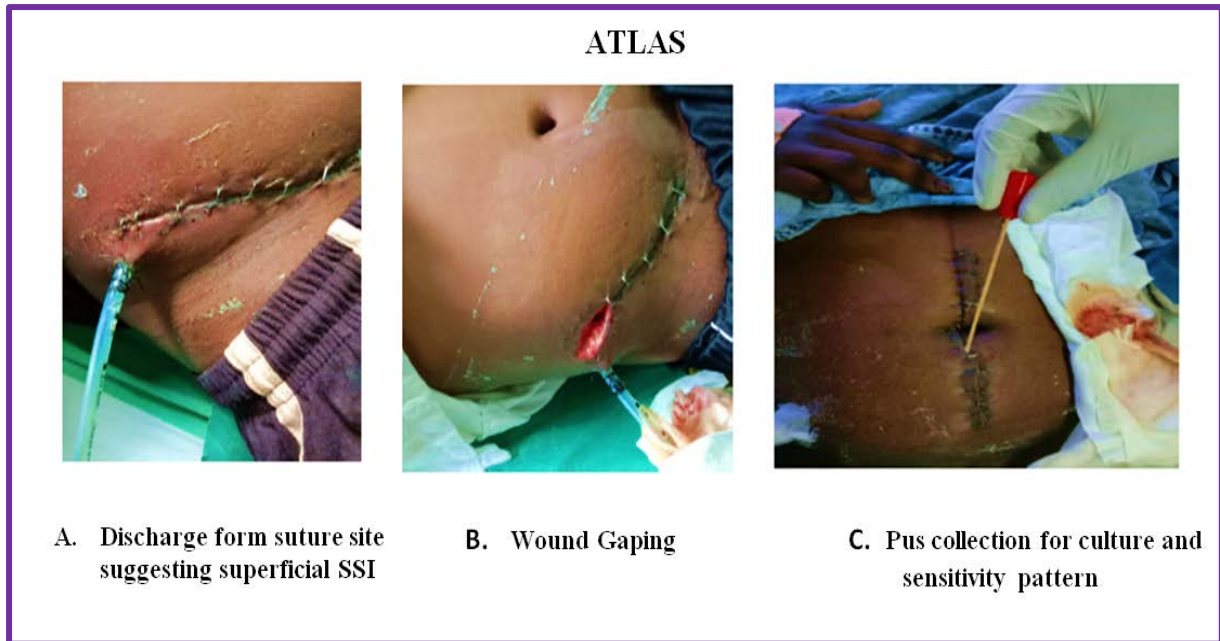
Out 14 patients 9 were 35-65 years of age. The infection rate was 18.4% (9/49). In this age group while that in age >65 years is 25% (1/4). 10 out of 14 patients were males. Both age and sex were found not corelated with SSI. 3 patients who had diabetes mellitus developed SSI. The infection rate was 25 % (3/12). Diabetes mellitus was not a risk factor for SSI in our study. 6 patients

were smokers. The infection rate among smokers was 42.9%. Smoking was found to be associated with SSI (P=0.001). 12 patients were having normal BMI. Patients under nutrition and obesity were not found to be associated with SSI in our study. All patients who developed SSI were under glycemic control both during preoperative and postoperative period. So we could not establish any association between SSI and perioperative Hyperglycemia in our study. Out of 4 female patients who developed SSI, 3 were found to have anaemia with infection rate is 10.3% (3/26).

Seven patients with SSI had low serum albumin level. The infection rate is 20% (7/35) in patients with hypoalbuminemia, which is not statistically significant. 4 patients had preoperative stay period of >3 days. The infection rate was 80% (4/5), which was significantly associated with SSI (P=0.000). The infection rate in patients with ASA class II is 28.1% (9/32) and class III was 50% (2/4). Higher ASA score is significantly associated with SSI in our study (p=0.001). Out of 14 patients, 10 patients have undergone emergency procedure. The infection rate in patients who underwent emergency procedure was 12% (10/83) as compared to that elective is 23.5% (4/17).

Contaminated and dirty wounds were significantly associated with SSI (p=0.000). 11 cases out of 14 were found to have contaminated wound. All patients with SSI had drain placed for >4 days. This is significantly associated with SSI (p=0.0). More than 1 organism was isolated in the swab culture of 5 patients. The most organisms isolated were Escherichia coli.

The SSI rate in our study was 14% and risk factors associated with SSI were smoking (p=0.001), preoperative stay of > 3days (p=0.000), ASA score (p=0.001), contaminated and dirty wound (p=0.000), duration of surgery (p=0.010) and duration of drain placement (p=0.000). All the details are tabulated in the table and images in atlas.



**Table: Relationship between clinical parameters and incidence of SSI**

Parameters	Subgroup	SSI present frequency (%)	SSI absent frequency (%)	X <sup>2</sup>	DF	'P' value
Age group	13-35	4(8.5)	43(91.5)	2.355	2	0.308
	36-65	9(18.4)	40(81.6)			
	>65	1(25.0)	3(75.0)			
Gender	Male	10(17.5)	47(82.5)	1.383		0.240
	Female	4(9.3)	39(90.7)			
DM	Yes	3(25.0)	9(75.0)	1.370	1	0.242
	No	11(12.5)	77(87.5)			
Smoking	Yes	6(42.9)	8(57.1)	11.259	1	0.001
	No	8(9.3)	78(90.7)			
BMI	<18.5	2(18.2)	9(81.8)	0.332	2	0.847
	18.5-25	12(13.6)	76(86.4)			
	>25	0	1(100)			
Random blood sugar	<200	14(14.4)	83(85.6)	0.503	1	0.478
	≥200	0	3(100)			
Hb male	<13	5(19.2)	21(80.8)	0.131	1	0.718
	≥13	5(15.6)	27(84.4)			
Hb female	<12	3(10.3)	26(89.7)	0.073	1	0.787
	≥12	1(7.7)	12(92.3)			
Albumin	<3.5	7(20.0)	28(80.0)	1.610	1	0.204
	≥3.5	7(10.8)	58(89.2)			
Pre op- Stay duration (days)	≥3	10(10.5)	85(89.5)	19.042	1	0.00
	<3	4(80.0)	1(20.0)			
ASA	I	3(4.7)	61(95.3)	14.218	2	0.001
	II	9(28.1)	23(71.9)			
	III	2(50.0)	2(50.0)			
Type of procedure	Emergency	10(12.0)	73(88.0)	1.545	1	0.214
	Elective	4(23.5)	13(76.5)			
Type of wound	Clean	0	1(100)	72.013	3	0.00
	Clean contaminated	2(2.4)	83(97.6)			

	Contaminated	11(91.7)	1(8.3)			
	Dirty	1(50.0)	1(50.0)			
<b>Duration of surgery</b>	≤2	0	29(100)	6.649	1	0.0
	>2	14(19.7)	57(80.3)			
<b>Post-op- Stay duration (days)</b>	<3	0	3(100)	54.499	2	0.0
	3-7	0	74(100)			
	>7	14(60.9)	9(39.1)			
<b>Drain placement (days)</b>	<4	0	8(100)	8.879	1	0.0
	>4	14(60.9)	9(39.1)			
p<0.001; NS–Not Significant						

## Discussion

Large number of studies reported surgical site infection in abdominal surgeries between 3.4% and 36.1% [96]. In our study out of 100 patients who underwent abdominal surgeries, 14 patients developed SSI. The rate of SSI in our study is 14%. This is comparable to many studies in India and is higher compared to developed countries and less as compared to few Indian studies. This is due to the fact that in developed countries they have a systematic feedback of SSI rate and surveillance bodies such as Hospitals in Europe Link for Infection Control through Surveillance (HELICS) in Europe and National Nosocomial Infection Surveillance System (NNIS) in United States of America whereas in our country were mainly on sporadic surveys. [6]

In our study most of patients were of middle age group (35-65 years) and there was male preponderance. The risk factors associated with SSI in our study are smoking (p=0.001), preoperative stay of >3 days (p=0.000), ASA score (p=0.001), contaminated and dirty wound (p=0.000), duration of surgery (p=0.010) and duration drain placement (p=0.000).

Our study did not find association between SSI and BMI grading, anaemia as well as hypoalbuminemia. In our study Smoking was found to be associated with SSI like previous studies. [7] The infection rate among smokers is 42.9% (6/14) while that in Non-smokers is 9.3% (8/86). Preoperative stay duration of >3 days is significantly associated with SSI. The infection rate is

80% in patients with Preoperative stay of >3 days as compared to 10.5% in patients with <3 Days duration. Similar finding is observed in many studies. [8,9,10]

Patients with ASA class of 2 and 3 are associated with SSI. This is comparable to previous studies. [11,12] The infection rate in class II Patients is 28.1% and in class III are 50%. In our study Contaminated and dirty Wound were associated with SSI as observed in previous studies. The infection rate in contaminated wound is 91.7% (11/12) while in dirty Wound it is 50% (1/2). Duration of surgery > 2 hours duration is significantly associated with SSI. Reports from other studies were in agreement with our findings. [8,10,11] The infection rate was 19.7% (14/71) inpatients When the duration of surgery was >2 hours. No patient with surgery Duration < 2 hours developed SSI in our study (0/29). Duration of drain placement for > 4 days is associated with SSI in our study. Similar finding was observed in many studies. [8,10,12] The infection rate was 60.9% in patients with drain placed for > 4 days. The most common disease condition encountered in our study is acute appendicitis with or without abscess and surgical procedure observed is emergency open appendectomy. SSI was most commonly observed in appendicular abscess and duodenal perforation. SSI was noted on 4th post-operative day for 9 patients and 5th postoperative day for 5 patients. None of the patients developed SSI after discharge from hospital. The Endogenous flora is responsible for infection in most cases. The opening of the gastrointestinal tract

increases the likelihood of Gram-negative bacilli that was our finding in this study. The most common organism isolated was *E. coli*. It was isolated in 50% of swab culture. This is similar to the finding observed by Satyanarayana V et al and Raka L et al. [13,14]

*Pseudomonas* and *proteus mirabilis* were next most common organisms isolated. More than 1 organism was isolated in the swab culture of 5 patients. *E. coli* was found sensitive to piperacillin and Tazobactam, Imipenam, Colistin. The other organisms observed in swab culture were *klebsella*, *staph aureus*, MRSA. Swab culture was sterile in 3 patients in our study. [15] In patients who developed SSI, 13 patients had superficial SSI. 1 patient had organ space SSI. None of the patients developed deep incisional SSI. Secondary wound closure was done for 9 (64.3%) patients who had SSI With residual wound dehiscence with healthy granulation tissue in whom Spontaneous closure did not occur. All patients with SSI had prolonged Post-operative stay duration of more than 7 days.

### Conclusion

Our study prompts us to look at the gaps in our surgical and infection control protocols which will enable policy formulation that will foster a reduction in wound infection rate. SSI can be reduced by decreasing the preoperative hospital stay, appropriate antibiotic administration policies, adequate preoperative patient preparation, reducing the duration of surgery to minimum, judicious use of drains and intraoperative maintenance of a sepsis and following operation theatre discipline properly.

Although surgical site infections cannot be completely eliminated, a reduction in the infection rate to a minimal level could have significant benefits, by reducing postoperative morbidity and mortality, and wastage of health care resources. A dedicated system of infection surveillance has to be established to identify the gaps in our infection control protocols and therefore

identify areas of focus to reduce the burden of SSIs. It will also help to individualize policies regarding infection control in different setups.

Appropriate precautionary measure has to be taken to reduce the incidences of SSI that originate primarily from the care procedures provided during hospitalization. A sound antibiotic policy, reducing the length of procedures by adequate training of the staff on proper surgical techniques, proper intraoperative infection control measures and feedback of appropriate data to surgeons regarding SSIs would be desirable to reduce the surgical site infection.

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