



SURGICAL SITE INFECTIONS: INCIDENCE AND ASSOCIATED RISK FACTORS, A ONE YEAR PROSPECTIVE STUDY IN A TERTIARY CARE CENTER.

Microbiology

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ABSTRACT

SSI is defined as the infection occurring within 30 days of surgery or within a year in the case of implants left in the place of surgery.¹ SSIs are responsible for the increasing costs and the morbidity and mortality which are related to surgical infections.⁴ The organisms which cause surgical infections vary from time to time and from place to place. **Objectives:** To estimate the rate of SSI among patients operated in General surgery department., To identify the risk factors and etiological agents associated with SSI. **Method:** 2 Swabs were collected from the depth of the wound using sterile cotton swabs under aseptic conditions, one for the preparation of smear for microscopy and the other for culture. **Result:** A Total of 500 Patients were enrolled in the study, out of these 54 patients were found to have SSI. The overall incidence of SSI in this study was found to be 10.8%. It was observed that, contaminated wound, prolonged duration of surgery, use of drains and prolonged hospital stay are associated with increased incidence of SSI. Escherichia coli 24 (42.80%), Klebsiella pneumonia 15 (26.78%) and Staphylococcus aureus 08 (14.28%) were the most common organisms isolated. **Conclusion:** Overall most of the surgical site infections can be prevented by taking proper infection care control measures and antibiotic policies. A range of precautions taken before, during and after surgery will definitely reduce the risk of SSIs.

KEYWORDS

Surgical site infections, post operative wound, incidence, risk factors, general surgery.

INTRODUCTION:

SSI is defined as the infection occurring within 30 days of surgery or within a year in the case of implants left in the place of surgery.¹ Based on the National Nosocomial Infections Surveillance, SSIs are the third most frequently reported nosocomial infections, accounting for 14-16% of all the nosocomial infections. SSIs are responsible for the increasing costs and the morbidity and mortality which are related to surgical infections.² The organisms which cause SSI vary from time to time and from place to place. The pathogens that infect surgical wounds can be a part of the patient's normal flora or they may be acquired from the hospital environment.² A complex interplay between host, microbial and surgical factors ultimately determines the prevention or establishment of a wound infection. A working knowledge of the prevalent organism, virulence and resistance profile will help the infection control practitioner and surgeon to treat the infection effectively at the earliest and also decreases economic burden due to SSI.¹ This study was done to determine the SSI rate, associated perioperative risk factors and etiological agent in both elective and emergency operated patients of general surgery units of Gandhi Hospital.

MATERIAL AND METHODS:

Post operative cases of Elective and Emergency surgeries in General surgery department were enrolled in this study (Jan 2018 to Dec 2018), patients were informed about the procedure and Informed consent was obtained. The surgical sites were examined for suggestive signs/symptoms of infection in the post-operative period, during wound dressing, until the patient was discharged from the hospital and also in the out-patient department up to 30 days after discharge. When infection was clinically suspected, the area around the surgical wound was cleaned with 70% ethyl alcohol. 2 swabs were collected from the depth of the wound using sterile cotton swabs under aseptic conditions, one for the preparation of smear for microscopy and the other for culture.

Sample Processing:

Samples were inoculated on to 5% Sheep Blood agar, MacConkey's agar and incubated aerobically at 37°C for 24hrs. The specific identification of bacterial pathogen was done based on Microscopic Morphology, Staining Characteristics, Colony Morphology and Biochemical Properties using standard laboratory technique.

RESULTS:

A Total of 500 Patients were enrolled in the study, out of these 54 patients were found to have SSI. The overall incidence of SSI in this study was found to be 10.8%, as depicted in table-1 and figure 1

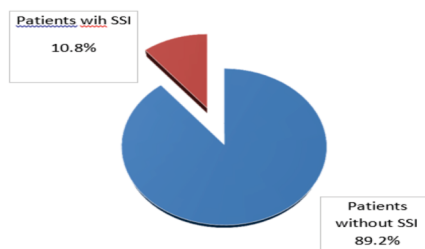


Figure 1: Incidence of Surgical Site Infection.

Table 1: Risk Factors: 1. incidence In Relation To Wound Class:

SSI +/-	NO. OF PATIENTS	PERCENT(%)
Patients without SSI	446	89.2
Patients with SSI	54	10.8
Total	500	100.

Out of total surgeries performed, 3.79% of 211 clean surgeries; 5.35% of 112 clean contaminated; 15.38% of 91 contaminated; 30.23% of 86 dirty wound type were infected. When surgeries of clean (3.79%) and other than clean (15.91%) wound type were compared, the difference of 12.12% was found to be highly significant statistically. ($p < 0.001$, highly significant), as depicted in table 2.

Table 2 :

WOUND CLASS	PATIENTS WITH SSI	PATIENTS WITHOUT SSI	TOTAL
Clean	8(3.79%)	203	211
Clean Contaminated	6(5.35%)	106	112
Contaminated	14(15.38%)	77	91
Dirty	26(30.23%)	60	86
Total	54	386	500

Chisquare=49.9; $p < 0.001$, highly significant.

2. Incidence In Relation To Type of Surgery:

Out of 295 elective surgeries 5.42% had SSI, and 18.53% of total 205 emergency surgeries had SSI. The difference of 13.11% was found to be highly significant statistically.,depicted in table 3.

Table No: 3

TYPE OF SURGERY	PATIENTS WITH SSI	PATIENTS WITHOUT SSI	TOTAL
Elective	16(5.42%)	279	295
Emergency	38(18.53%)	167	205
Total	54	446	500

Chi square=21.59;p<0.001,highly significant

3. Incidence In Relation To Duration of Surgery.

Out of total 500 surgeries, 2.92% of 239 surgeries of <1 hour duration, 14.14% of 99 surgeries of 1-2 hours duration, 20.37% of total 162 surgeries of >2 hours duration developed SSI. As the duration of surgery increased, SSI rate increased proportionately. The difference between surgery of <1 hour and >1 hour duration was 14.55%;which was highly significant.,depicted in table 4.

Table No:4

DURATION OF SURGERY	PATIENTS WITH SSI	PATIENTS WITHOUT SSI	TOTAL
<1 hour	07(2.92%)	232	239
1-2 hours	14(14.14%)	85	99
>2 hours	33(20.37%)	129	162
Total	54	446	500

Chi square=31.92;p<0.001;Highly Significant

4.Incidence In Relation To Diabetes.

Out of 98 diabetic patients,12.24 % had SSI and 10.44% of 402 non diabetic patients had SSI. The difference of 1.8 % was not statistically significant. Other chronic illnesses (HTN,anaemia) were also not statistically significant(p>0.05%)

5. Incidence In Relation To Presnce of Drain:

Out of 340 total operated patients who had drain 13.23% showed SSI, and out of 160 patients with no drain, 5.62% had SSI. The difference was found to be statistically significant.,depicted in table 5.

Table No: 5

DRAIN	PATIENTS WITH SSI	PATIENTS WITHOUT SSI	TOTAL
Drain present	45(13.23%)	295	340
Drain absent	09(5.62%)	151	160
Total	54	446	500

6. Incidence In Relation To Site:

12.36% of total 380 abdominal surgeries and 5.83% of total 120 extra abdominal surgeries had SSI. It was found to be highly significant. **P<0.001;Highly significant.** Depicted in table 6.

Table :6

SITE OF SURGERY	PATIENTS WITH SSI	PATIENTS WITHOUT SSI	TOTAL
Abdominal	47(12.36%)	333	380
Extra Abdominal	07(05.83%)	113	120
Total	54	446	500

7. Incidence In Relation To open And Laparoscopic Surgeries:

2.75% of total 109 laparoscopic abdominal surgeries, 16.23% of total 271 open abdominal surgeries had SSI. The difference of 13.48% was found to be statistically significant(**P<0.05,Significant.**) Depicted in table 7.

Table No:7

TYPE OF SURGERY	PATIENTS WITH SSI	PATIENTS WITHOUT SSI	TOTAL
Laparoscopic abdominal surgeries	03(2.75%)	106	109
Open abdominal surgeries	44(16.23%)	227	271
Total	47	333	380

8. Incidence In Relation To Type Of Ssi.;

Out of total 54 SSI cases, 24 were superficial incisional SSI, 19 Deep

incisional SSI, 11 were organ space SSI(table 9)TABLE NO:8

Table 8

TYPE OF SSI	FREQUENCY	%
Superficial incisional SSI	24	44.44
Deep incisional SSI	19	35.18
Organ space SSI	11	20.37
Total	54	100

9. Incidence In Relation To Duration of Hospital Stay.

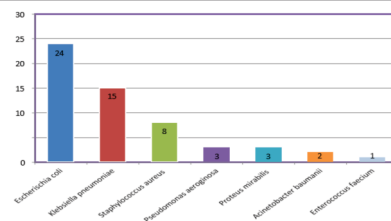
it was found that 6.6% of total patients with pre-operative stay >10 days showed SSI.this was not statistically significant(p>0.05).The mean post operative stay for patients who had SSI infections was 11.04 days and the mean post operative stay for non infected patients was 5.87 days. It was found that patients with SSI infections had 1.96 times longer hospital stay than non infected patients

Clinical Isolates.

56 isolates were isolated from 54 SSI patients. Gram negative bacterial isolates were 83.94% and gram positive were 16.06%. The predominant isolate from the SSI was *Escherichia coli* 24 (42.80%), followed by *Klebsiella pneumoniae* 15 (26.78%), Table 9 ,fig2.

Table 9

NAME OF THE ORGANISM	NUMBER OF ISOLATES OBTAINED	%
<i>Escherichia coli</i>	24	42.80%
<i>Klebsiella pneumoniae</i>	15	26.78%
<i>Staphylococcus aureus</i>	08	14.28%
<i>Pseudomonas aeruginosa</i>	03	05.35%
<i>Proteus mirabilis</i>	03	05.35%
<i>Acinetobacter baumannii</i>	02	03.57%
<i>Enterococcus faecium</i>	01	01.78%
Total	56	100%

**Figure 2:**

DISCUSSION.

The global data suggests the SSI incidence rate varies from 0.5 to 20% depending upon the type of operation and underlying patient status.^{3,4}

Table 10

STUDY	PLACE/YEAR	INCIDENCE
Jafri HS, et al. ⁵	U.S.A/2013	3.7%
Rochak G et al. ⁶	Punjab /2015	12.6%
Walelign et al. ⁷	Ethiopia /2016	9.8%
Ayesiga M et al. ⁸	Tanzania /2017	21.3%
Amrutham R et al. ⁹	Sangareddy /2017	5.51%
Pujar PS et al. ¹⁰	Raichur /2018	18.33%
Present study	Hyderabad/2018	10.8%

The incidence of SSI was more in present study when compared to Jafri HS, et al.,⁵U.S.A(3.7%) and Walelign et al.⁷,ethiopia(9.8%).

The infection rate in indian hospitals is much higher than that other countries. the higher infection rate in indian hospitals may be due to the poor setup of hospitals and also due to the lack of attention towards the basic infection control measures.

However, Similar study in northern Tanzania by Ayesiga et al.⁸ 2017 showed higher incidence of 21.3%. Where as, when compared to other studies in our country, the incidence in this study is high when compared to amrutham R et al.⁹,sangareddy/2017 (5.51%) and it was low when compared to Pujar PS et al.¹⁰,raichur/2018 (18.33%), Rochak et al.⁶,punjab/2015(12.6%). A study conducted by Ashish Pathak et al.¹¹ at Ujjain in 2011 had reported that 15.7% SSI in contaminated and dirty wounds where as 3.5% SSI in clean and contaminated wounds and a statistical significant association

found between wound class and surgical site infections ($p < 0.05$) which was similar to the present study.

A study conducted by Ashish Pathak et al¹¹ at Ujjain in 2011 had reported that 10.7% SSI in emergency surgery whereas 4.8% SSI in elective surgeries but no statistical significant association found between type of surgery and surgical site infections but the higher percentages in emergency when compared to elective was similar to the present study.

A study conducted by Ashish Pathak et al¹¹ at Ujjain in 2011 had reported that 10.8% SSI cases if the duration of surgery was more than one hour and 3.5% SSI if duration was less than one hour and a statistical significant association found between duration of surgery and surgical site infections with increase in duration of surgery which was similar to the present study.

A study conducted by Ashish Pathak et al at Ujjain¹¹ in 2011 had reported that 7.7% of diabetics had surgical site infection when compared to 5% in non-diabetics and no statistical significant association found between diabetes mellitus and surgical site infections which was similar to the present study.

Varsha Shahane et al¹² study on surgical site infections at Pune in 2012 had also reported that 13.6% had surgical site infections and in patients without drain 4.7% had surgical site infection which was similar to the present study.

Rajanikanth Amrutham et al⁹ study on surgical site infections and related risk factors had reported 47.17% SSI was from abdominal surgeries.

Exploratory laparotomy (34%) was the procedure most commonly associated with SSI in a study conducted by Ansul Kumar et al.¹³ Ansul Kumar et al¹³ study on the prevalence of surgical site infection out of total patients 2.9% were organ space surgical site infections, 4.4% were deep incisional site infections and the rest 5.6% were superficial incisional infections which was in contrast to the present study where organ space surgical sites was common in the present study.

An increase in SSI incidence was observed when the duration of surgery was > 2 hours (19.4%) in a study conducted by Ansul Kumar et al.¹³ Gram negative bacilli, namely members of enterobacteriaceae, are the predominant pathogens reported in the study conducted by Varsha Shahane et al¹². *S. aureus* species were the leading cause of SSI accounting for 52% of SSIs followed by *E. coli* 11%, *Pseudomonas* species 10%, *Proteus* species 9% and *Klebsiella* species 7% according to Ayesiga et al study.⁸

CONCLUSIONS:

In the present study it was observed that, contaminated wound, prolonged duration of surgery, use of drains and prolonged hospital stay are associated with increased incidence of SSI. As significant association found between duration of surgery and surgical site infections with increase in duration of surgery there was increase in surgical site infections therefore efforts to decrease the duration of surgery without compromising the patients safety and the beneficial outcome.

Escherichia coli 24 (42.80%), *Klebsiella pneumoniae* 15 (26.78%) and *Staphylococcus aureus* 08 (14.28%) were the most common organisms in SSI. Overall most of the surgical site infections can be prevented by taking proper infection care control measures and antibiotic policies. A range of precautions taken before, during and after surgery will definitely reduce the risk of SSIs.

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