International Journal of Biomedical Research

ISSN: 0976-9633 (Online)
Journal DOI:10.7439/ijbr
CODEN:IJBRFA

Research Article

Study of Surgical site infection in clean and clean contaminated surgeries in a tertiary care hospital

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Abstract

Background & objectives: Infection is an important cause of morbidity and mortality in surgical patients. Surgical site infections (SSI) can occur anytime from zero to thirty days and affect either the incision or deep tissue at the operation site. Rapidly emerging nosocomial pathogens and the problem of multi-drug resistance necessitates periodic review of isolation patterns and sensitivity in surgical practice. This study aimed at evaluating the incidence of SSI in our hospital and the preventive measures which are already practised for reducing the SSI rate in our hospital.

Materials & methods: A hospital based descriptive study conducted in a public tertiary care hospital in Puducherry. Data from 242 surgical patients were collected using a predesigned proforma and the patients were followed up for a period of 30 days following surgery to assess the occurrence of any infection at wound site.

Results: During the study period data from 242 patients were collected. Out of these, 29 patients [12%] developed the surgical site infection. The incidence of SSI in clean surgeries was 11.1% and in clean-contaminated surgeries was 12.9%. The most common isolates were *Staphylococcus aureus* and MRSA [2 cases each]. All other isolates were obtained from single cases of SSI.

Interpretation & conclusions: The incidence of SSI in our institute was found to be around 12% in clean & clean-contaminated surgeries. The pathogenic isolates from our institute were same as pathogens associated with SSI from other studies.

Keywords: surgical site infection, clean surgery, clean contaminated surgery

1. Introduction

Surgical site infection (SSI) is one of the most common healthcare-associated infections (HAIs).SSIs are infections of the tissues, organs or spaces exposed by surgeons during performance of an invasive procedure.[1] SSIs accounts for about 38% of nosocomial infections, and are a significant source of post-operative morbidity.[2] They can occur anytime from zero to thirty days and affect either the incision or deep tissue at the operation site.[2]

Data from the National Nosocomial Infection Surveillance [NNIS] system of CDC shows that of all SSIs, 47% are superficial, 23% are deep and 30% are organ/space.[3]The incidence of SSI in India ranges from 4.04 to 30%.[4]

SSIs remain a significant clinical problem as they are associated with enhanced mortality and morbidity and impose socio economic burden on patients as well as health care resources.[5] SSI surveillance is integral to hospital infection control and quality improvement programs, with feedback of SSI rates being an important component of SSI reduction strategies.

This study aimed at evaluating the incidence of SSI in our hospital and the preventive measures which are already practised for reducing the SSI rate in our hospital. The study was aimed to assess the patient related and procedure related risk factors influencing development of SSI and pathogens associated with SSI and their drug resistance in a tertiary care centre. The SSI incidence rate and other information derived from this study can be used for further strengthening of the hospital infection control programmes and thus effectively reducing the morbidity and mortality caused by SSIs.

2. Materials & methods

A descriptive study was conducted at a public tertiary care hospital in Puducherry after the approval of Institute Ethics Committee. All Patients aged 18 years or above, who underwent either clean or clean-contaminated surgeries [1, 2, 3] in the departments of Surgery / Obstetrics & Gynecology / Orthopaedics, were enrolled for the study. Patients aged less than 18 years / patients with implants / patients who refused to give consent were excluded. Data from 242 patients was obtained using a structured proforma. Patients were followed up for 30 days after the surgery to identify any infection at the surgical site. Inpatient follow up was done in the ward & those who got discharged were followed up over the phone to identify the presence of any infection. Diagnosis of infection was made according to the criteria established by the Centers for Disease Control (Atlanta)[6].

Pus swabs or aspirate from incision wound discharge was sent to Microbiology department and samples were processed as per standard guidelines in the microbiology laboratory. Antibiotic sensitivity testing was done according to CLSI guidelines[7]. Microbiological investigations results were collected from the laboratory. A record of all samples received was maintained in the register that carries identification details and details of organism isolated along with its antibiotic sensitivity pattern for selected first line and second line agents.

Data entry was done using Microsoft Excel 2007 version and data analysis was done using Microsoft Excel 2007 version and SPSS 17 version.

3. Results & observations

The study population consisted of 77[31.8%] males and 165[68.2%] females. Of these, 126[52.1%] cases were clean surgeries and 116[47.9%] cases were clean-contaminated surgeries.

Out of these, 29 patients [12%] developed the surgical site infection. Of this, 9 patients [3.7%] had a positive culture, 6 patients [2.5%] had no growth and for 14 patients [5.8%] no sample was sent.

3.1 Age distribution of patients

Table 1: Age distribution of sample group

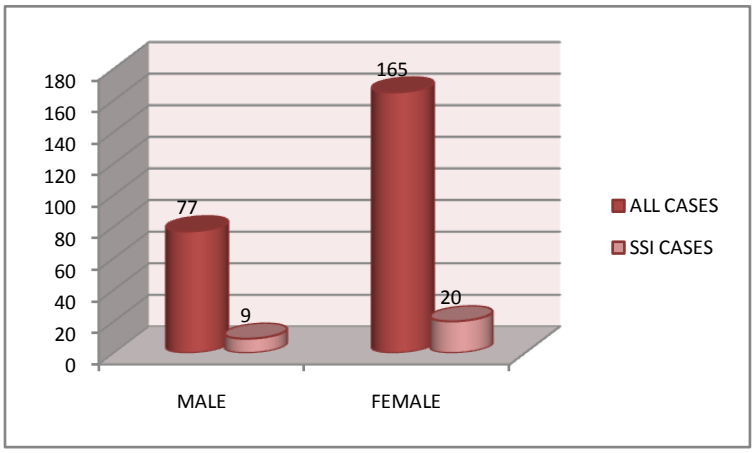
Age groups	Total number of patients (%)	Number of SSI (%)	Incidence of SSI
18-29 years	90 (37.2%)	11 (37.9%)	12.22%
30-39 years	46 (19.0%)	05 (17.2%)	10.87%
40-49 years	46(19.0%)	05 (17.2%)	10.87%
50-59 years	33(13.7%)	03 (10.4%)	9.09%
60-69 years	22(09.1%)	04 (13.8%)	18.18%
70-79 years	03(01.2%)	01 (03.5%)	33.33%
80-89 years	02(00.8%)	0	0.00%
TOTAL	242	29	11.98%

Majority of the SSI patients belong to younger age group.

3.2 Gender distribution & the incidence of SSI

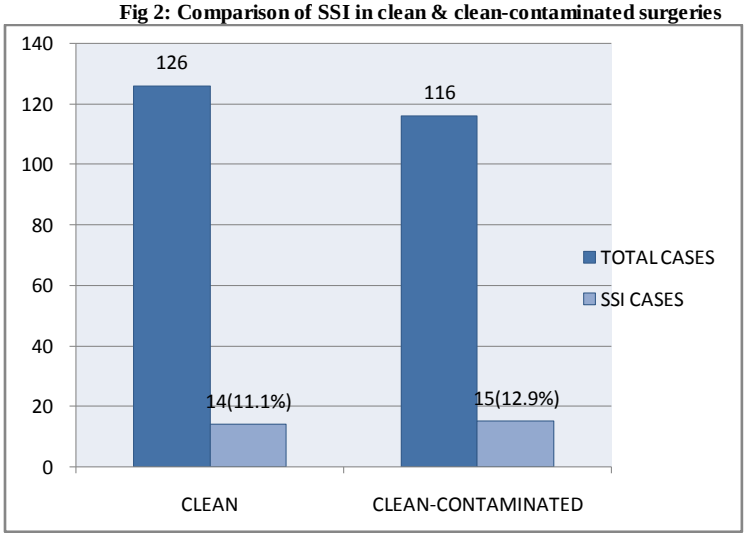
Of the 29 patients who developed SSI, 9 cases [31%] were males and 20 cases [69%] were females.

Fig 1: Bar diagram representing the gender distribution of study population



3.3 Incidence of SSI in clean & clean-contaminated surgeries

Fig 2: Comparison of SSI in clean & clean-contaminated surgeries



3.4 Pathogens associated with SSI

Table 2: Pathogens isolated from SSI wound swab

Pathogens	Number of cases
Staphylococcus aureus	2
MRSA	2
Pseudomonas aeruginosa	1
Proteus vulgaris	1
Coagulase Negative *Staphylococcus*(CONS)	1
Escherichia coli	1
Klebsiella oxytoca	1
Enterobacter spp	1
Klebsiella pneumoniae	1

3.5 Incidence of SSI in different surgeries

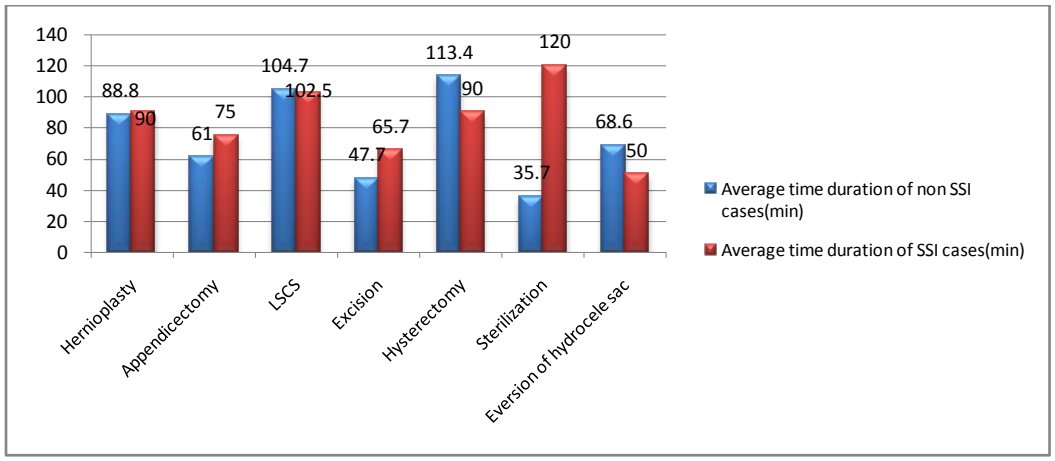
Table 3: Surgical site infection in different surgeries

Name of surgery	Total no. of cases (%) (n = 242)	No. of SSI cases (%) (n=29)
Hernioplasty	59(24.4%)	06(20.7%)
LSCS	51(21.1%)	04(13.8%)
Hysterectomy	35(14.5%)	06(20.7%)
Appendicectomy	14(05.8%)	04(13.8%)
Excision	27(11.2%)	07(24.2%)
Sterilization	08(3.3%)	01(3.4%)
Thyroidectomy	11(4.5%)	0
Mastectomy	07(2.9%)	0
Eversion of Hydrocele sac	12(5.0%)	01(3.4%)
Gastrojejunostomy	03(1.2%)	0
Cholecystectomy	02(0.8%)	0
Trendelenburg procedure for varicose veins	03(1.2%)	0
ORIF	03(1.2%)	0
Dilatation & Evacuation	01(0.4%)	0
Circumcision	01(0.4%)	0
Haemorrhoidectomy	02(0.8%)	0
ACL reconstruction	01(0.4%)	0
Raw area SSD	01(0.4%)	0
Sarcocalpopexy	01(0.4%)	0
Palomo's procedure	01(0.4%)	0
TOTAL	242(100%)	29(100%)

Majority of surgical wound infections were reported in excision cases followed by hernioplasty and hysterectomy. Sterilization procedures & hydrocele sac surgeries had the least incidence of SSI. No cases of SSIs were reported from other surgeries.

3.6 Duration of surgery & the incidence of SSI

Fig 3: Average time duration of SSI cases of each surgery is compared with that of non SSI cases



There is no much difference in the average duration of surgery when SSI cases are compared against non SSI cases of all hernioplasty, appendicectomy & LSCS cases.

The SSI cases of excision & sterilization procedures have an average duration of surgery which is much prolonged than that of non SSI cases.

The average duration of surgery of SSI cases of hysterectomy & eversion of sac procedures are much lesser than that of non SSI cases.

3.7 Preoperative antibiotic prophylaxis & the incidence of SSI

For majority of cases, cephazolin was used for preoperative antibiotic prophylaxis [181 cases, 74.8%]. Other antibiotics used for pre-operative prophylaxis were Ciprofloxacin – 2 cases [0.8%], Cefotaxime – 5 cases [2.1%], Cephazolin/Ciprofloxacin/Cefotaxime + Metronidazole – 29 cases [12%], Ampicillin – 17 cases [7%], Amikacin – 1 case [0.4%]. No pre-operative antibiotic prophylaxis was given for 7 cases [2.9%].

Among the 29 patients who developed wound infection following surgery, 21 patients [72.4%] were given Cephazolin , 5 patients [17.3%] were given metronidazole in combination with cephazolin/ciprofloxacin, 2 patients [6.9%] were given ampicillin as prophylactic antibiotic. No pre-operative prophylactic antibiotic was given for 1 patient [3.4%].

3.8 Metabolic disorders & incidence of SSI

In the study population 10.7% [26] cases was diabetic and 11.6% [28 cases] was hypertensives. Of these 13 [5.4%] individuals had both DM and hypertension.

Among the diabetics, 1 patient, who was a case of gestational diabetes, developed SSI.

Among the hypertensives, 2 patients developed SSI.

3.9 Addiction & incidence of SSI

The percentage of smokers in the study population was 9.5% [23 cases] and the percentage of alcoholics was 14% [34 cases]. Majority of the individuals [18 cases, 7.4%] were addicted to both alcohol and tobacco.

The incidence of wound infection following surgery among alcoholics was 2 cases and among smokers were 2 cases. Of these 1 patient was a smoker and alcoholic.

3.10 Post-discharge SSI

Among the 29 cases of wound infection following surgery, 8 cases [27.6%] developed SSI after discharge from the hospital. Of these 5 patients were readmitted for treatment of SSI and the other 3 patients were managed on OPD basis.

4. Discussion

The incidence of SSI in India ranges from 4.04% to 30%.[4]The accepted range of infection rates has been 1% to 5% for clean and 3% to 11% for clean-contaminated surgeries.[2]

In our study, the SSI incidence in our institute was found to be 12% from all cases of clean & clean-contaminated surgeries. The incidence of SSI in clean surgeries was 11.1% and in clean-contaminated surgeries was 12.9%. The incidence of SSI among clean contaminated surgeries is 2% more than clean surgeries. According to a study conducted in Mumbai, surgical site infection rate was found to be 3.03% in clean surgeries and 22.41% in clean-contaminated surgeries.[8]

Out of the 29 cases of post operative wound infection, 9 cases had positive cultures with pathogenic isolates. The rest were either culture negative or their wound swab was not sent, but they were treated with empirical antibiotics based on clinical symptoms of SSI like wound erythema, discharge or wound dehiscence since these cases were associated with at least one of the risk factors .

The isolates from the surgical wound infections were common known pathogens associated with SSI. The most common isolates were *Staphylococcus aureus* and MRSA [2 cases each] and all other isolates were obtained from single cases of SSI. From 2 patients who developed SSI, 2 different pathogens were isolated from two different wound swab culture done at an interval of 2-3 weeks. Both the patients were hospitalized during this time period and they acquired both organisms most probably from the hospital environment itself.

Since the number of isolates was very less in number no conclusion could be drawn regarding the antibiotic susceptibility pattern.

We assessed the risk factors for SSI as patient related risk factors and procedure related risk factors.[5,9,10,11] The Dutch PREZIES (Preventie van Ziekenhuisinfecties door Surveillance [Prevention of Nosocomial Infections Through Surveillance]) Project found age, pre-operative length of stay, wound class, anesthesia score, and duration of surgery to be independently important risk factors for SSIs when all procedures were pooled together for analysis.[12]

The patient related risk factors were identified as age, obesity, hypertension, diabetes mellitus, addictions i.e. smoking and alcoholism. The procedure related risk factors for SSI were the type of surgical wound, duration of surgery, length of stay in hospital and preoperative antibiotic prophylaxis.

We found a decreasing incidence of SSI as age advances. There was a decrease by around 1.5% in the incidence of SSI from 18- 29 yr to 30 to 39 and 39 to 40 year age groups. This matches with previous study which states a decreased risk of SSI at age 65 years or more.[5]Metabolic disorders have its role in SSI by delaying the wound healing and making the individual more susceptible for infections. Alcoholism and tobacco addiction also makes the individual weak and more prone for infections.

The surgical wound is a risk factor for SSI since with increase in contamination there is an increased risk for infection. In our study, the incidences of SSI in clean and clean-contaminated surgeries slightly differed (1.8%).

The duration of surgery of SSI cases were much prolonged in some surgeries where as in most of the surgeries, there was no much difference in the average duration of SSI and non SSI cases of surgery.

In our institute cephazolin is most commonly used for preoperative antibiotic prophylaxis. Other antibiotics like ciprofloxacin, cefotaxime, ampicillin, amikacin and combination of drugs were also used for pre-operative antibiotic prophylaxis of some cases. For some surgeries like excision, no antibiotic prophylaxis was given. The incidence of SSI was higher in surgeries were combination of drugs were used as antibiotic prophylaxis, probably because these were clean contaminated surgeries, followed by the surgeries where no antibiotic prophylaxis was given.

5. Conclusions

The incidence of SSI in our Institute was found to be 11.1% in clean surgeries and in clean-contaminated surgeries was 12.9%. The pathogens isolated were *Staphylococcus aureus*, MRSA, *Pseudomonas aeruginosa*, *Proteus vulgaris*, CONS, *E. coli*, *K. pneumoniae*, *K. oxytoca*, *Enterobacter* spp. The patient related risk factors were identified as age, obesity, metabolic disorders and addictions. The procedure related risk factors were identified as type of surgical wound, duration of surgery and pre-operative antibiotic prophylaxis.

Acknowledgement

Authors sincerely thank Indian Council of Medical Research , New Delhi for granting the Short Term Student scholarship 2013 for the second author.

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