

## Assessment of Spectrum of Surgical Site Infections: A Prospective Observational Study

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### Abstract

**Aim:** The present study was aimed to determine the incidence of SSIs and the prevalence of aerobic bacterial pathogens involved with their antibiogram at tertiary care hospital.

**Methods:** This prospective study was done in the Department of Microbiology, Narayan Medical College and Hospital, Sasaram, Rohtas, Bihar, India. The study period of the study was one year. The patient details were recorded including type of surgery, type of wound infection, wound class including clean, clean contaminated and contaminated wound and total days of stay in the hospital.

**Results:** The patients included 10 males 5 females; the age of the patients were in a range of 17 years to 70 years. 5 patients were in age group 17-34, 5 patients in age group of 35-51, and 5 patients in an age group of 52-70 years with mean age of 43.7 years. The duration of the surgery lasting less than 2 hours has been noticed in 12 cases and in remaining three cases the duration of surgery was more than 2 hours. Few cases are with the comorbidities such as 3 hypertension cases, 1 case of chronic kidney disease, 1 case of coronary artery disease and 1 case has been admitted with road traffic accident. A total of 9 cases (60%) of SSI were culture positive out of 15 cases. The organisms isolated were Staphylococcus species which includes 3 MSSA (Methicillin sensitive Staphylococcus aureus), 1 MRSA (methicillin resistant Staphylococcus aureus) and 1 Staphylococcus hemolyticus, two Enterococcus species which includes one Enterococcus durans and another Enterococcus faecalis. Among gram negative bacteria that were isolated which are specific to SSI included Pseudomonas aeruginosa and the other showed growth of Acinetobacter baumannii.

**Conclusion:** Management of SSIs remains a significant concern for surgeons and physicians in a health care facility, which carries a load with high morbidity and mortality. Due to the proper hospital infection control management we report the occurrence of low SSI in our hospital with the absence of multidrug resistance. We emphasized on the importance of hospital infection control monitoring with proper precautions during surgeries to reduce the load of SSI and better outcome of the treatment.

**Keywords:** Bacterial Drug Resistance, Surgical Site Infections.

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## Introduction

Surgical site infections (SSI) are the third most commonly reported nosocomial infection and they account for approximately a quarter of all nosocomial infections. It has an adverse impact on the hospital as well as on the patient. It is responsible for increasing length of stay of patient which results in social and economic loss to the patients and family. Host factors, wound factors and surgery related factors are implicated in the causation of SSI. [1] Surgical Site infections (SSI) is considered as a significant problem in clinical aspects associated with the high morbidity and mortality. It has been associated with greater economic burden, prolonged hospitalization and high mortality rate. 1 CDC clearly defined SSI as an infection that occurs after surgery in the part of the body where the surgery took place and classified the SSI into superficial, deep and organ specific. [2]

The pathogenesis of SSI has been associated both with the endogenous contamination such as skin flora and exogenous contamination by healthcare personnel or contaminated surgical instruments. Other factors such as burden of organism and virulence factors of pathogens also play a major role in occurrence of SSI. The risk factors associated with the SSI were classified as intrinsic associated with age, obesity, nutrition, preoperative hospitalization. The perioperative factors such as preparation of patient, hair removal, skin preparation, antimicrobial prophylaxis and duration of surgery impact the outcome of surgery and ill preparation favours the SSI. [3] Literature revealed several microorganisms are associated with SSI and etiological pathogen has been associated with the type of surgery. Owen et al. found that the common organisms associated with SSI are mostly gram positive bacteria such as *Staphylococcus aureus*, coagulase negative

*Staphylococcus*, *Enterococcus* species. [4] Survey of literature found that Indian studies have also contributed and found different pathogenic microorganisms associated with SSI. A study from Raj Kumari and co-workers found 4.4% of orthopaedic cases were confirmed as SSI and etiological agents included predominantly *Acinetobacter baumannii* and *Staphylococcus aureus*. [5] A study from Uttarakhand has found the predominantly SSI has been associated with *Staphylococcus aureus* at the rural healthcare unit. [6] Patak et al. in their detail study found statistically significant risk factors such as severity of the disease, presence of drains, history of previous hospitalization, preoperative stay and surgical duration associated with SSI. [7] A study from Mumbai pointed out the serious concern of presence of multidrug resistant gram negative bacteria associated with SSI. [8]

The aim of the study is to evaluate the occurrence of SSI, associated comorbidities, the etiological microorganisms and their drug sensitivity pattern at the tertiary care centre.

## Materials and Methods

This prospective study was done in the Department of Microbiology, Narayan Medical College and Hospital, Sasaram, Rohtas, Bihar, India. The study period of the study was one year. The patient details were recorded including type of surgery, type of wound infection, wound class including clean, clean contaminated and contaminated wound and total days of stay in the hospital.

## Inclusion criteria

All the patients admitted from different surgical wards of the hospitals during the tenure of study period for elective or emergency surgeries associated with clean, clean contaminated and contaminated were included.

The demographic data, associated comorbidities, risk factors, duration of surgery and clinical evaluation of wound were collected and analysed.

### Specimen collection

Cases categorised as SSI, specimens were collected from different surgical infected sites as mentioned in table 1. Pre-existing morbidities such as hypertension, chronic kidney disease (CKD), coronary artery disease (CAD) and various signs of SSI were noted.

### Microbiological evaluation

All the samples were cultured on blood

agar, MacConkey Agar media and Chromogenic agar media, and culture plates were incubated at 37°C overnight, the identification of culture and sensitivity to various antibiotics was carried out using VITEK-2 system.

Statistical analysis is done using Microsoft excel.

### Results

In this period in our hospital a total number of 1500 surgeries were carried out. Out of 1500 cases the present study found the occurrence of 15 cases (1%) developed SSI.

**Table 1: Patient characteristics**

Variables	N
<b>Gender</b>	
Male	10
Female	5
<b>Age groups</b>	
17-34	5
35-51	5
52-70	5
<b>Duration of surgery</b>	
<2 hours	12
>2 hours	3
<b>Co-morbidities</b>	
Hypertension	3
Chronic kidney disease	1
CAD	1
RTA	1

The patients included 10 males 5 females, the age of the patients were in a range of 17 years to 70 years. 5 patients were in age group 17-34, 5 patients in age group of 35-51, and 5 patients in an age group of 52-70 years with mean age of 43.7 years. The duration of the surgery lasting less than 2 hours has been noticed in 12 cases and in remaining three cases the duration of

surgery was more than 2 hours. Few cases are with the comorbidities such as 3 hypertension cases, 1 case of chronic kidney disease, 1 case of coronary artery disease and 1 case has been admitted with road traffic accident. The cases taken up for the surgery were included as elective in 10 cases, and 5 cases were taken up on emergency basis.

**Table 2: The spectrum of bacterial isolated from SSI cases**

Bacteria isolated	N
MSSA	3
MRSA	1
Staphylococcus hemolyticus	1

Enterococcus species	1
Enterococcus faecalis	1
Pseudomonas aeruginosa	1
Acinetobacter baumannii	1

A total of 9 cases (60%) of SSI were culture positive out of 15 cases. The organisms isolated were Staphylococcus species which includes 3 MSSA (Methicillin sensitive Staphylococcus aureus), 1 MRSA (methicillin resistant Staphylococcus aureus) and 1 Staphylococcus hemolyticus, two Enterococcus species which includes one Enterococcus durans and another Enterococcus faecalis. Among gram negative bacteria that were isolated which are specific to SSI included Pseudomonas aeruginosa and the other showed growth of Acinetobacter baumannii.

### Discussion

SSI is the index of the health care system of any hospital. With the increase in incidence of nosocomial infections and multi drug resistance, a meticulous and periodic surveillance of various hospital acquired infections is called for. With an active Infection Control team operating in the hospital, SSI is naturally one of the topmost priorities on the agenda. Several studies all over the world has reported surgical site infection as one of the causative agent for the long stay in hospital, leading to spread of bacterial drug resistance as well as the psychological and monetary effect on the patients. The overall infection rate in the present study was less than 1%, a very less occurrence of SSI compared to the other studies which reported rates ranging from 2.5 to 41.9%. [9,10]

In the present study we report the occurrence of SSI at very low percentage which emphasize the continuity of strict adherence of standard operating procedure and effective work of hospital infection control committee. In the present study the overall average stay in the hospital on

average was 13.6 days (min-5 days- max-50 days). Similar to other studies the present study also found the most common bacterial isolates were Staphylococcus species with varying antibiotic sensitivity pattern.<sup>2</sup> Contrast to a study conducted by Lilani et al., which found occurrence of more gram negative bacteria isolated from clean-contaminated wounds, the present study isolated a single Pseudomonas aeruginosa and a single Acinetobacter baumannii complex. [11] Prolonged duration of operation results in increased exposure of operation site to air, prolonged trauma, stress of prolonged anaesthesia and sometimes blood loss. [12] Our study reveals a clear cut increased number of SSI cases i.e.20% cases, where surgery has been prolonged  $\geq 2$  hours.

The present study also emphasized the importance of duration of surgery. Emergency surgery is one of the key factors, and have more than 50% risk of developing SSI compared to elective procedures, [13] the present study also support and shown the 100% bacterial growth in SSI cases taken up on emergency basis. Comorbidities including hypertension, CKD and CAD also play a major and independent risk factors in SSI. A study from Mejía et al. has found the patients with comorbidities acts as risk factors favouring SSI and our results echo with similar results where we found 100% growth in SSI in cases having comorbidities as a one of the important factor. [14] Age is one of the factors, which might increase the chances of having SSI. A cohort study conducted by Kaye et al has found that age is an independent factor which favours the occurrence of SSI, similar to our results which found high occurrence of culture positive cases in patients with age ranging

from 52-70 compared to lower age group. [15]

The present study has found low SSI cases along with the organisms which were sensitive to most of the antibiotics except for *Acinetobacter baumannii* complex. The organisms were found sensitive to the several classes of antibiotics such as macrolides, cephalosporin's, beta lactamases, aminoglycosides, glycopeptides and carbapenems. [16] This study also emphasise the importance of isolation of newer organisms in relation with the SSI. We first time report to our knowledge- the isolation of *Staphylococcus hemolyticus*, *Enterococcus durans* from the surgical site infection which are sensitive to most of the antibiotics. We isolated multidrug resistant *Acinetobacter baumannii* which has been associated with long stay in the hospital.

### Conclusion

Management of SSIs remains a significant concern for surgeons and physicians in a health care facility, which carries a load with high morbidity and mortality. Due to the proper hospital infection control management we report the occurrence of low SSI in our hospital with the absence of multidrug resistance. We emphasized on the importance of hospital infection control monitoring with proper precautions during surgeries to reduce the load of SSI and better outcome of the treatment.

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