

Assessment of Incidence of SSIs and the Prevalence of Aerobic Bacterial Pathogens Involved with their Antibiogram: An Observational Study**Anubhuti****Assistant Professor, Department of Microbiology Netaji Subhas Medical College and Hospital, Bihta, Patna, Bihar, India****Received: 10-06-2023 Revised: 20-07-2023 / Accepted: 25-08-2023****Corresponding author: Dr. Anubhuti****Conflict of interest: Nil****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, Netaji Subhas Medical College and Hospital, Bihta, Patna, Bihar. 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 14 (70%) males 6 (30%) females; the age of the patients were in a range of 17 years to 70 years. 7 (35%) patients were in age group 17-34, 8 (40) patients in age group of 35-51, and 5 (25) patients in an age group of 52-70 years with mean age of 44.6 years. The duration of the surgery lasting less than 2 hours has been noticed in 16 (80%) cases and in remaining 4 (20%) cases the duration of surgery was more than 2 hours. Few cases are with the comorbidities such as 4 hypertension cases, 2 cases of chronic kidney disease, 1 case of coronary artery disease and 1 case has been admitted with road traffic accident. A total of 11 cases (55%) of SSI were culture positive out of 20 cases. The organisms isolated were Staphylococcus species which includes 4 MSSA (Methicillin sensitive Staphylococcus aureus), 2 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:** 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

Post-operative surgical wound infection refers to infection of a wound following surgery. These infections occur at varying frequencies from facility to facility, and their extent can range from the suture line to the whole operating site. Nosocomial infections include infections of surgical wounds. [1] Infections contracted in healthcare settings are called nosocomial infections. Nosocomial infections can only occur when a patient is admitted to a healthcare institution for reasons unrelated to the illness, and when the patient shows no outward symptoms of the infection. [2]

Urinary tract infections, pneumonia, and surgical site infections are all examples of nosocomial infections. After UTIs, surgical wound infections are the most prevalent nosocomial infections. [3,4] Twenty percent to thirty-nine percent of all hospital-acquired illnesses are caused by these

bugs. [5] Infection of a surgical incision can happen any time after surgery, even years later. However, it is most frequent between day 5 and day 10. [6] Most wounds are delayed by infection, which is both frequent and difficult to treat. A wound is considered infected when both the local and systemic defences of the host fail, allowing microorganisms to invade the wound's tissues. A severe wound infection is defined as one that results in pus drainage or necessitates a subsequent operation to ensure proper drainage. Serous fluid or pus may drain from a wound during a small wound infection, but there won't be any systemic symptoms or severe pain. [7]

In 1992, the Surgical Wound Infection Task Force renamed this type of infection from "surgical wound infection" to "surgical-site infection" since it also applies to infections that occur deep into the skin and soft tissues. [8] The CDC in the United

States categorizes surgical-site infections (SSIs) as either (a) superficial incisional SSI, (b) deep incisional SSI, or (c) organ/space SSI. [9] Klebsiella pneumonia (26.31%), Pseudomonas aeruginosa (15.79%), Escherichia coli (10.53%), Acinetobacter (10.53%), and Proteus mirabilis (5.26%) are the next most prevalent bacteria after Staphylococcus aureus (31.58%). Most of these germs are multi-drug resistant, making them a serious concern for surgeons. [10]

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, Netaji Subhas Medical College and Hospital, Bihta, Patna, Bihar. The study period of the study was one year.

Inclusion Criteria

All patients who were admitted to various surgical wards of the hospitals during the study period for elective or emergency surgeries involving clean, clean contaminated, and contaminated conditions were included in the study.

Data Collection

The patient information was documented, encompassing the surgical procedure type, wound infection type, wound classification (including

clean, clean contaminated, and contaminated wounds), and the total duration of hospitalization.

The researchers collected and analyzed demographic data, comorbidities, risk factors, duration of surgery, and clinical evaluation of the wound.

Specimen Collection

In the cases classified as SSI, specimens were obtained from various surgical sites that are specified in table 1. Pre-existing comorbidities, including hypertension, chronic kidney disease (CKD), coronary artery disease (CAD), and various indications of surgical site infection (SSI), were observed.

Microbiological Evaluation

The samples were subjected to culturing on blood agar, MacConkey Agar media, and Chromogenic agar media. The culture plates were then incubated at a temperature of 37°C for a duration of one night. Subsequently, the identification of the culture and the assessment of its sensitivity to different antibiotics were conducted utilising the VITEK-2 system.

Statistical analysis is done using Microsoft excel.

Results

In this period in our hospital a total number of 1876 surgeries were carried out. Out of 1876 cases the present study found the occurrence of 20 cases (1.06%) developed SSI.

Table 1: Patient characteristics

Variables	N%
Gender	
Male	14 (70)
Female	6 (30)
Age groups	
17-34	7 (35)
35-51	8 (40)
52-70	5 (25)
Duration of surgery	
<2 hours	16 (80)
>2 hours	4 (20)
Co-morbidities	
Hypertension	4 (20)
Chronic kidney disease	2 (10)
CAD	1 (5)
RTA	1 (5)

The study sample consisted of 14 male participants, accounting for 70% of the total, and 6 female participants, accounting for 30% of the total. The age range of the participants spanned from 17 to 70 years. Out of the total number of patients, 7 individuals (35%) belonged to the age group of 17-34, 8 individuals (40%) were in the age group of 35-51, and 5 individuals (25%) fell into the age group of 52-70 years. The average age of the patients was calculated to be 44.6 years. It has been

observed that in 16 cases, which accounts for 80% of the total, the duration of the surgery was less than 2 hours. Conversely, in the remaining 4 cases, constituting 20% of the total, the duration of the surgery exceeded 2 hours. There are a limited number of cases involving comorbidities, specifically four cases of hypertension, two cases of chronic kidney disease, one case of coronary artery disease, and one case resulting from a road traffic accident.

Table 2: The spectrum of bacterial isolated from SSI cases

Bacteria isolated	N
MSSA	4
MRSA	2
Staphylococcus hemolyticus	1
Enterococcus species	1
Enterococcus faecalis	1
Pseudomonas aeruginosa	1
Acinetobacter baumannii	1

Out of a sample size of 20 cases, a total of 11 cases, accounting for 55% of the sample, were found to be culture positive for Surgical Site Infections (SSI). The isolated organisms consisted of Staphylococcus species, comprising 4 Methicillin-sensitive Staphylococcus aureus (MSSA), 2 Methicillin-resistant Staphylococcus aureus (MRSA), and 1 Staphylococcus hemolyticus. Additionally, two Enterococcus species were identified, specifically Enterococcus durans and Enterococcus faecalis. The isolated gram-negative bacteria that were found to be associated with surgical site infections (SSI) included Pseudomonas aeruginosa, as well as another strain that exhibited growth of Acinetobacter baumannii.

Discussion

The SSI serves as a metric for evaluating the effectiveness and efficiency of a hospital's health care system. Given the rising prevalence of nosocomial infections and the emergence of multi-drug resistance, it is imperative to implement a systematic and regular monitoring of diverse hospital-acquired infections. The presence of an active Infection Control team within the hospital naturally places Surgical Site Infections (SSI) as a primary concern on the agenda. Numerous studies conducted globally have consistently identified surgical site infection as a significant contributing factor to prolonged hospital stays, resulting in the dissemination of bacterial drug resistance and imposing psychological and financial burdens on patients. The current study observed an overall infection rate of 1.06%, which is significantly lower than the rates reported in other studies, ranging from 2.5% to 41.9%, indicating a relatively low occurrence of surgical site infections (SSI). [11,12] The study sample consisted of 14 male participants, accounting for 70% of the total, and 6 female participants, accounting for 30% of the total. The age range of the participants spanned from 17 years to 70 years. Out of the total number of patients, 7 individuals (35%) belonged to the age group of 17-34, 8 individuals (40%) belonged to the age group of 35-51, and 5 individuals (25%) belonged to the age group of 52-70 years. The average age of the patients was calculated to be 44.6 years. It has been observed that in 16 cases, accounting for 80% of the total, the duration of the surgery was less than 2 hours. Conversely, in the remaining 4 cases, constituting 20% of the total, the

duration of the surgery exceeded 2 hours. There are a limited number of cases that exhibit comorbidities, including four cases of hypertension, two cases of chronic kidney disease, one case of coronary artery disease, and one case resulting from a road traffic accident.

Out of a sample size of 20 cases, a total of 11 cases (55%) were found to be culture positive for surgical site infections (SSI). The isolated organisms consisted of Staphylococcus species, comprising 4 Methicillin-Sensitive Staphylococcus aureus (MSSA), 2 Methicillin-Resistant Staphylococcus aureus (MRSA), and 1 Staphylococcus hemolyticus. Additionally, two Enterococcus species were identified, namely Enterococcus durans and Enterococcus faecalis. The gram-negative bacteria that were isolated included Pseudomonas aeruginosa, which demonstrated specificity to SSI, and another strain that exhibited growth of Acinetobacter baumannii. This study presents findings on the incidence of Surgical Site Infections (SSI) at a remarkably low rate. These results underscore the importance of consistently following standard operating procedures and the effective efforts of the hospital's infection control committee. In the current investigation, the mean duration of hospitalization was found to be 13.6 days, with a range spanning from a minimum of 5 days to a maximum of 50 days. Consistent with previous research, the current study also observed that the predominant bacterial isolates were species of Staphylococcus, exhibiting diverse patterns of antibiotic sensitivity. [13] In contrast to a previous study conducted by Lilani et al., which reported a higher occurrence of gram-negative bacteria in clean-contaminated wounds, the current study identified only one instance of Pseudomonas aeruginosa and one instance of Acinetobacter baumannii complex. [14] The extended duration of a surgical procedure leads to an augmented level of exposure of the surgical site to ambient air, prolonged physical trauma, the stress associated with prolonged anaesthesia, and occasionally, blood loss. [15] Our study demonstrates a significant rise in the incidence of surgical site infections (SSI) by 20% in cases where the duration of surgery exceeds 2 hours.

The current study also underscored the significance of surgical duration. Emergency surgery is considered a significant contributing factor, with a

risk of developing surgical site infections (SSI) exceeding 50% when compared to elective procedures. The findings of this study further corroborate this notion, as it demonstrates a 100% occurrence of bacterial growth in SSI cases that were performed on an emergency basis. Comorbidities such as hypertension, chronic kidney disease (CKD), and coronary artery disease (CAD) are significant and autonomous risk factors in the development of surgical site infections (SSI). [16] According to a study conducted by Mejía et al., patients with comorbidities have been identified as risk factors that contribute to the occurrence of surgical site infections (SSI). [17] Our findings align with similar results, as we observed a 100% increase in SSI cases specifically associated with the presence of comorbidities, highlighting its significance as a contributing factor. [14] Age is considered to be a contributing factor that may heighten the likelihood of experiencing SSI. A cohort study conducted by Kaye et al has identified age as an independent variable that contributes to the occurrence of surgical site infections (SSI). Our own findings align with this, as we observed a higher prevalence of culture positive cases among patients aged 52-70 compared to those in younger age groups. [18]

Conclusion

The management of surgical site infections (SSIs) remains a significant challenge for surgeons and physicians practicing in a hospital setting characterized by a high incidence of morbidity and mortality. In this study, we present findings regarding the prevalence of surgical site infections (SSI) at our hospital, as well as the absence of multidrug resistance, which can be attributed to the effective implementation of hospital infection control measures. The importance of closely monitoring hospital infection control through appropriate measures during surgical procedures was underscored in order to reduce the incidence of surgical site infections (SSI) and enhance treatment outcomes.

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