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SURGICAL SITE INFECTIONS IN A TERTIARY CARE HOSPITAL - BACTERIOLOGY AND RISK FACTOR ANALYSIS

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ABSTRACT

Introduction: Surgical site infections (SSIs) are the third most commonly reported nosocomial infection and they account for approximately a quarter of all nosocomial infections. **Aims & objectives:** To study the prevalence of SSIs, bacteriological profile along with the antibiotic resistance pattern and analyze the risk factors in a tertiary care hospital. **Materials & methods:** All the patients undergoing general surgery, orthopedic surgery, cardiothoracic surgery and obstetric & gynecological surgery for a period of six months were prospectively followed after surgery. Samples and appropriate history were collected from patients with symptoms of SSI. The swabs were cultured and the bacterial colonies were identified and antimicrobial susceptibility tests were done. Risk factors were analysed. **Results:** The overall prevalence of SSIs was found to be 4.62% with highest incidence following general surgeries 10.34%. The commonest organism isolated was Enterococcus species followed by Escherichia coli, Pseudomonas species, etc. Most of the isolates were multidrug resistant. Contaminated wounds, high ASA score (American Society of Anaesthesiologists), prolonged surgeries and emergency surgeries were more prone for infection. **Conclusion:** Surgical site infection is an important nosocomial infection which can be adequately controlled by adopting good infection control practices and risk factor analysis.

Keywords: Surgical site infections, risk factors, nosocomial infections

INTRODUCTION

Infection has always been a feature of human life and sepsis in modern surgery continues to be a significant problem for healthcare practitioners across the globe. Surgical site infections (SSIs) are one of the most common nosocomial infections besides pneumonia, urinary tract infections, and blood-stream infections.

A surgical site infection is an infection that occurs after surgery in the part of the body where the surgery took place. SSIs are classified as being either incisional or organ/space. Incisional SSIs are further divided into superficial incisional SSI and deep incisional SSI. CDC provides guidelines and tools to the healthcare community to help end surgical site infections and resources to help the public understand these infections and take measures to safeguard their own health when possible[1].

Until the middle of the 19th century, when Ignaz Semmelweis and Joseph Lister became the pioneers of infection control by introducing antiseptic surgery, most wounds became infected. In cases of deep or extensive infection this resulted in a mortality rate of 70-80% [2]. Since then a number of significant developments, particularly in the field of microbiology, have made surgery safer. However, the overall incidence of healthcare associated infections (HAIs) remains high and represents a substantial burden of disease.

This study was carried out over a period of six months, in a tertiary care hospital in Chennai to study the prevalence of SSIs in the hospital, common etiology of SSIs, antibiotic sensitivity pattern of the bacteria isolated and identify risk factors associated with them.

MATERIALS & METHODS

A study was carried out in Chennai in a tertiary care hospital following general surgery, orthopedic surgery, cardiothoracic surgery and obstetric & gynecological surgery over a period of six months. Samples were collected from patients with symptoms surgical site infection. The patients were followed prospectively for 30 days after surgery. Risk factors like ASA score, wound class, duration of surgery, type of surgery were analysed applying Chi square test. Signs of surgical site infection considered were fever, wound discharge, redness, etc.

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The samples were collected using structured proforma and informed consent. Ethical clearance was obtained.

Two swabs were collected from the patients from the infected surgical site with suitable precautions. The swabs were brought to the microbiology lab within one hour and the samples were processed. One swab was used for Gram's Staining and another one was inoculated onto routine culture media such as Nutrient agar, Blood agar and Mac Conkey agar & incubated overnight. The colonies were then identified and subjected to biochemical tests and antibiotic susceptibility testing by Kirby Bauer disc diffusion technique using CLSI guidelines[3].

RESULTS

The following table (Table 1) gives the total number of surgeries performed by the various surgical departments over a period of six months and the respective surgical site infection rates.

Table 1: Total number of different types of surgeries performed and their infection rates

Department	Total number of surgeries	No. of infections	Infection rate %
Obstetrics & Gynaecology	671	12	1.79
Orthopaedic Surgery	490	30	6.12
General Surgery	609	63	10.34
Cardiac Surgery	655	7	1.07
Total	2425	112	4.62

The overall incidence rate of surgical site infections (SSI) was found to be 4.62%. Incidence of SSIs was found to be high following general surgery (10.34%), followed by orthopaedic surgery (6.12%), obstetric & gynecological surgery (1.79%) and cardiothoracic surgery (1.07%)(Figure 1)

The commonest organism from SSIs was found to be Enterococcus species. E.coli and Pseudomonas species were the next most frequently isolated organisms followed by Staphylococcus aureus and the others. 60% of the organisms isolated were Gram negative bacilli and 40% were Gram positive cocci. Table 2 lists the organisms in the decreasing order of their incidence.

Table 2: Bacteriology of Surgical site infections

ORGANISM	INCIDENCE %
Enterococcus species	18
Escherichia coli	16
Pseudomonas species	16
Staphylococcus aureus	13
Proteus species	10
Citrobacter species	10
Coagulase negative Staphylococcus species (CoNS)	9
Acinetobacter species	5
Klebsiella species	3

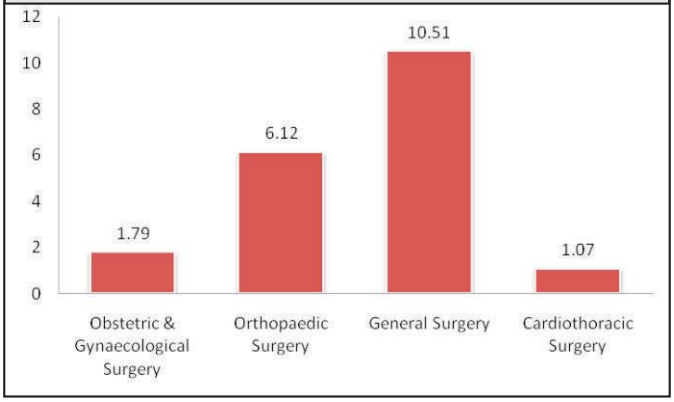
Several risk factors like wound class, type of surgery, duration of surgery and ASA score were analysed. Contaminated wounds(class II & class III), emergency surgeries, prolonged duration of surgeries (> 1 hour) and presence of systemic disease indicated by high ASA scores were considered as risk factors for the development of SSIs. The various risk factors associated with the infections are shown in Table 3.

Table 3: Risk factor analysis

Risk factor		No. of infections associated with each risk factor (Total 112)	Percen -tage	P- Value (Chi-Square)
Wound Class	Class I (clean)	22	20	0.000
	Class II (clean contaminated)	43	38	
	Class III (contaminated)	47	42	
Type of Surgery	Emergency	74	66	0.000
	Elective	38	34	
Duration of Surgery	< 1 hour	31	28	0.000
	> 1 hour	81	72	
ASA	ASA I	10	9	0.000
	ASA II	44	39	
	ASA II	58	52	

*American Society of Anaesthesiologists[2]

Figure 1: Surgical site infection rates among different surgeries



Contaminated wounds (class III) had higher infection rates compared to clean (class I) & clean contaminated (class II) wounds. High ASA score, emergency surgeries and prolonged surgeries carried greater risk of infection compared to elective surgeries and minor surgeries. There is a significant association between the risk factors and the SSIs as shown by the p value.

Figure 2 shows the antibiotic resistance pattern of the top four commonest Gram negative bacilli isolated from the surgical site infection. This clearly shows that most of them are multi drug resistant. 38% of the Gram negative bacilli isolated were extended spectrum β-lactamase (ESBL) producers. Moreover 22% of the Gram negative bacilli were imipenem resistant , 68% of them showed resistance to meropenem and 16% were resistant to both. Figure 3 shows the antibiotic resistance pattern of the commonest Gram positive cocci. 13% of Staphylococcus aureus isolated were methicillin resistant.

Figure 2: Antibiotic resistance pattern of the Gram negative bacilli isolated from the SSIs:

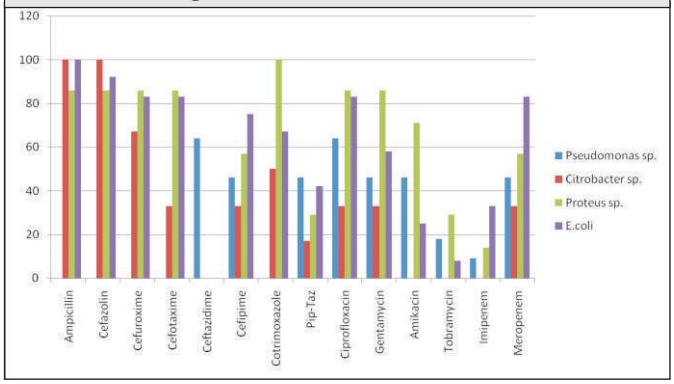
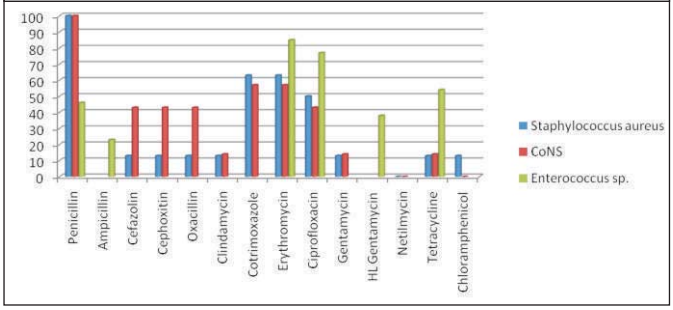


Figure 3: Antibiotic resistance pattern of the Gram positive cocci isolated from the SSIs:



DISCUSSION

The reports of incidence of SSIs in India differ considerably in different studies. The overall infection rate in the present study was 4.62% and compares favorably with other reported rates ranging from 2.5 to 41.9%. [4,5,6]. A prolonged preoperative stay with exposure to hospital environment and its diagnostic procedures, therapies and microflora have been shown to increase the rate of surgical site infection [7]. Kowli *et al* found an infection rate of 17.4% when preoperative stay was 0-7 days and an infection rate of 71.4% with a preoperative stay of more than 21 days.[5] In a study carried out in Nigeria[8] the prevalence of SSI following Obstetric surgeries was 9.1% while in this study the prevalence is very low 1.79%. In a tertiary care hospital in Serbia [9] the overall incidence rate of surgical site infections following orthopaedic surgeries was 22.7% which is very high compared to prevalence rate in this study 6.12%.

Lilani et al [11] and other studies [2,10] have most commonly reported Staphylococcus aureus as the cause of surgical site infections while in this study it was Enterococcus species, followed by Escherichia coli. Staphylococcus aureus was the fourth commonest isolate. Most of the organisms isolated were multidrug resistant which is a common finding in many of the studies[5,6]. Based on the type of surgical procedure, the pathogens that are isolated from surgical site infection vary.[13]A greater number of persons in the operating room can increase the rates of surgical site infections from 1.5 to 3.8 [12]. Air is an important route for the spread of infection, routine use of an ultra clean air system and exhaust-ventilated clothing is frequently recommended. However, other less

costly measures, including the reduction of the number of persons in the operating room, probably may insure similar preventive effect.

Many studies [4,5,6] have shown that SSIs are influenced by many factors like duration of surgery, wound class, nature of surgery, etc. The findings of the present study are in agreement with the reported literature. With increase in duration of surgery, the rate of infection increased in direct proportion. The results were found to be significant.

CONCLUSION

Surgical site infection is an important nosocomial infection which can be adequately controlled by adopting good infection control practices and risk factor analysis. Surveillance of surgical site infection with feedback of appropriate data to surgeons would be desirable to reduce the rate of surgical site infection. Hospital infection control committees should meet regularly and identify the SSIs and devise a system to track, analyze, monitor and prevent such incidents. Otherwise it will be impossible to overcome the serious issues of economic loss and high hospital morbidity and mortality caused by SSIs.

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