Research Paper

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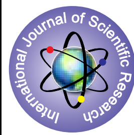
Epidemiology and Microbiology of Surgical Site Infections in A Tertiary Care Hospital



MEDICAL SCIENCE

KEYWORDS : Surgical Site Infection (SSI), Microbiological profile, Risk factors, Antimicrobial sensitivity pattern

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ABSTRACT

Surgical site infection (SSI) is the most common complication following surgical procedures. The aim of this study was to assess Epidemiological characteristics, Risk factors, Microbiological profile and Antimicrobial sensitivity pattern of surgical site infection in a tertiary care hospital. Two hundred patients who underwent surgery in the male and female surgical wards, gynaecology and maternity wards were enrolled in the study. Data was collected in a predesigned questionnaire forms. Out of 200 surgeries conducted during this period of 4 months, 30 patients presented with the complaints of surgical site infections and were taken for the studies based on the inclusion criteria and the exclusion criteria. Out of these 30 patients, 25 were males and the remaining were females. Of the total surgical wound infection, 4% were those of superficial incisional surgical site infection. Deep incisional surgical site infections accounted for 60% of all cases. The remaining 24% were organ space surgical site infection. Among these 30 patients, bacterial growth was found in 25 samples. The results indicate that 12.5% of patients undergoing surgeries developed SSI. Klebsiella Spp. was the most common etiological agent (48%) followed by Staphylococcus aureus, E. coli, Streptococcus pyogenes and Pseudomonas group. Meticulous surgical technique, proper sterilization, judicious use of antibiotics, improvement of operation theatre and ward environments, control of malnutrition and obesity, treatment of infective foci and diseases like Diabetes, and avoidance of smoking helps control the morbidity of surgical wound infections.

Introduction

Surgical site infections (SSIs) are the most common nosocomial infections. Potential complications of SSIs include tissue destruction, failure or prolongation of proper wound healing, incisional hernias, and occasionally bacteraemia. Additionally, recurrent pain and disfiguring scars may also result. SSIs result in increased use of antibiotics, and increased length of hospital stay, all of which have a significant impact on patients and the cost of health care. Such intraoperative factors as proper skin preparation, adherence to sterile technique, surgical duration, and traffic in the operating room contribute more to SSIs than do patient-related risk factors such as diabetes mellitus, obesity, and pre-existing colonization with methicillin-resistant Staphylococcus aureus. Surgeons have a responsibility to understand the current evidence regarding the factors that affect the rates of SSIs so as to provide the highest level of patient care.

Minimizing SSIs is a top priority for surgeons and hospitals to ensure the safest environment for patients undergoing surgery. The major underlying cause for all infections is trauma which may be accidental or intentionally induced. Latter category includes hospital-acquired wounds, which can be grouped according to how they are acquired, such as surgically and by use of intravenous medical devices. Although not intentionally induced, hospital-acquired wounds can be the pressure sores caused by local ischemia, too. They are also referred as decubitus ulcers, and when such wounds become infected, they are often colonized by multiple bacterial species.[(1)]The About 25-36% of these infections are preventable through the adherence to strict guidelines by health care workers when caring for patients.[(2,3)]An active surveillance program of such infections plays a vital role in obtaining knowledge of the epidemiological characteristics of the infections and through such data, most suitable preventive and control measures can be applied.[4,5]These actions may contribute to reduction in infection rates.

The objective of this study was to determine the rate of SSIs and risk factors for development of infections observed after surgical operations by using surveillance data form. In Tirunelveli, we implemented a pilot surveillance of Surgical Site Infections (SSI) in a tertiary care hospital, to study the Epidemiology and Microbiology of surgical wound infections in patients.

Material and Methods

This descriptive observational study was carried out prospectively in Surgical Units in Tirunelveli Medical College Hospital, TamilNadu, India from July and October 2013. The study protocol was approved by the ethical committee of the institution. The patients gave written informed consent to participate in the study.

Study population:

All patients undergoing surgeries in the male and female surgical wards, gynaecology and maternity wards were enrolled in the study after informed consent of patients. Patients having complaints of post surgical infections were identified and included in the study. Patients from paediatrics and medicine wards are excluded. The relevant information of all the patients were entered on a Proforma especially designed for the study which contains details about bio data, clinical features, diagnosis, type of surgery performed, duration of surgery, prophylactic antibiotics, postoperative antibiotics, possible risk factors and complications including wound infection, organisms isolated, hospital stay and outcome and the data was analyzed. All patients were followed up for 30 days for development of surgical site infection. Infected cases were identified using CDC, USA definition for surgical site infections.

Exclusion criteria:

1. Refusal to participate in the study.
2. Patients already receiving antibiotics for >1 week.
3. Patients undergoing re-operation.
4. Patients failing to come for follow-up of up to 30 days since the day of operation.
5. Refusal to give consent for participating in the study.

Inclusion criteria:

1. Age >14 years.
2. Patients of either sex.
3. Patients undergoing clean and clean-contaminated surgery electively.
4. Giving informed consent to participate.

Sample collection:

After obtaining approval from the ethical committee, the samples were collected from the patients of surgical units who have undergone surgery and developed the signs and symptoms of

post operative wound infections for the period of six months. The specimens were collected aseptically on the first day when patients presented with clinical evidence of infection (purulent drainage from incision or drain) before the wound was cleaned with antiseptic. Using sterile cotton wool, swabs were obtained from surgical site without contaminating with skin commensals and transported to the laboratory immediately.

Laboratory procedures:

Swab specimens were processed and tested in the Central Microbiology Laboratory and immediately were cultured upon arrival in the laboratory. Culturing for colony characteristics followed by Gram stain and biochemical tests were used to identify pathogenic bacteria. Culture media used were Blood agar, MacConkey agar and Nutrient agar. Antimicrobial susceptibility pattern of isolated bacterial pathogens were performed by Kirby Bauer disc diffusion method according to the guidelines of the Clinical and Laboratory Standards Institute.[3]

Results:

Out of 200 surgeries, 30 patients developed the complaints of surgical site infections. Samples were collected from 30 patients and cultured by using Differential and selective media. Out of 30 samples 25 were found to have growth and 5 samples did not produce any growth in culture. Thus among 30 patients, 25 were found to be having SSI. Hence the incidence of SSI is 12.5%

Demographic status:

Out of 30 patients, 25 were males and 5 were females. Among them 46.5% (n=14) were below the age of 45 and 53.5 %(n=16) were above the age of 45 years.

Nature of surgical wound:

The criteria employed for classifying surgical wound infections were those established by Centre for Disease Control (CDC) and National nosocomial Infection Surveillance (NNIS). According to it surgical wound infections are divided into following categories based on site of infections.

1. Superficial incisional surgical wound infection
2. Deep incisional surgical wound infection
3. Organ space surgical wound infection

Of the total surgical wound infection, 4% were those of superficial incisional surgical site infection. Deep incisional surgical site infections accounted for 60% of all cases. The remaining 24% were organ space surgical site infection. (Table-1)

Nature of surgery:

Also the surgeries performed are classified according to CDC and NNIS as

1. Clean
2. Clean contaminated
3. Contaminated
4. Dirty

In those 25 cases of SSI, 36% of the surgeries were clean, 16% of the surgeries were clean contaminated and 8% were contaminated surgeries. The majority of the surgeries causing SSI were dirty accounting for 40% of all the surgeries.(Figure-1)

Nutritional status:

Majority of the patients were well nourished (60%). Only a few were mildly malnourished (32%) and very few were moderately malnourished (8%). 24% of the patients (n=8) suffered from moderate anaemia with the haemoglobin levels varying between 8-10 gm%. The remaining had the normal haemoglobin levels of >12 gm%

Pre operative hospital stay:

40% of the surgeries causing the SSIs were emergency surgeries (n=10). The rest were elective surgeries. Among them 54% (n=8) involved pre operative hospitalizations of > 7 days.

Others:

28% of the patients (n=7) were diabetic. Also the use of drain was mostly associated with SSIs with the incidence of 52 %(n=13)

Organism isolated:

Out of the 25 samples collected, the most predominant organisms were Klebsiella Spp., E.Coli, Pseudomonas aeruginosa, Staph aureus and Acinetobacter Sp. The most common among them were Klebsiella Spp. Accounting for 48% (n=12) of all the cases. They are followed E.Coli (24%), Pseudomonas aeruginosa (12%), Staph aureus (12%) and Acinetobacter Sp. (4%)

Antibiotic susceptibility pattern:

Klebsiella spp. is sensitive to ceftazidime (62.5%), Imipenem (30%) and Amikacin (50%).Almost all the Klebsiella Spp. is resistant to Cotrimoxazole followed by resistance to Gentamicin(87.5%), Ceftriaxone (87.5%) and 75% of them are resistant to ciprofloxacin. Similarly in case of E.Coli, 75% of them are sensitive to Amikacin, Cotrimoxazole, Gentamicin, and Ceftriaxone. Similarly almost all the strains of Pseudomonas aeruginosa and Staphylococcus aureus are resistant to Cotrimoxazole and Ceftriaxone. 70% of them are sensitive to Imipenem and ceftazidime and 33% of them are sensitive to Amikacin.(Figure-2) ESBL production was detected in 4 strains of Klebsiella Spp. and 2 strains of Escherichia coli and MRSA was detected in one strain of Staphylococcus aureus.

Discussion

Observations during the past 30 years revealed that surgical site infections (SSIs) are responsible for a quarter of overall hospital infections. SSIs are the most significant and preventable causes of morbidity and mortality in surgical patients. Duration of hospital stay is extended and treatment costs are increased in patients with SSIs; hence, SSIs lead to substantial economic losses. An efficient surveillance system was shown to provide an approximately one third decrease in the rate of SSIs.Various factors associated with microorganisms, surgical procedures, and patients play a role in the development of SSIs. It is well known that defining the risk factors has a significant influence on prevention of disease.

The prevalence rate of surgical site infections, though preventable is still high. In the present study, the prevalence of SSIs is 12.5%. This is consistent with studies by Agarwal, Rao and Harsha, Kowli et al. and Anvikar which shows that incidence of SSIs in India is between 4-30 %.[4-7]

The use of drains has significantly contributed as a risk factor in causing SSI in this study i.e. 52%. This is due to the fact that they are more likely to be used in contaminated or dirty wounds and in emergencies and prolonged operations which increases the probability of the wound getting infected.[8]

The rate of infection was highest in dirty type of wounds-40% followed by clean cases accounting for 36% and the least were the contaminated cases which were 8% of the total cases.

Certain conditions like anaemia and diabetes alter or decrease the immune status thus significantly increasing the risk of SSI. They are also an important cause of increasing the pre operative stay of the patient which steeply increases the risk of SSI.In this study 24%of the patients with SSI had some underlying conditions, anaemia and diabetes mellitus(25%) being the commonest. Each day of extra hospitalization adds to the risk of acquiring SSI. Also diabetes mellitus itself is a risk factor for acquiring infections and increased level of HbA1C will promote infection by attenuation of host defence mechanism.

SSI have occurred more in elective surgeries than in emergency surgeries. This observation may seem very surprising, as emergency cases have known to land up in SSI more than elective ones.[8-12] This may be because , the presence of underlying conditions like anaemia, diabetes mellitus etc was more in patients who had undergone elective surgeries than in those who had emergency operations done.

Also there is a marginal preponderance of male patients developing SSI over female patients with SSI which is not statistically significant. However; it has been known that sex is not a pre determinant of the risk of SSI.

Gram negative bacilli, namely members of enterobactericeae, are the predominant pathogens in the current study. The most

common etiological agent is *Klebsiella Spp.* This is followed by *E.Coli, Pseudomonas auregenosa, Staph aureus* and *Actinobacter Sp*. However in some studies *Staphylococcus aureus* has dominated the scene.(13-14)

Almost all the strains of Klebsiella Spp. were resistant to Cotrimoxazole by resistance to Ciprofloxacin. Most of them were sensitive to Ceftazidime .Similarly most of the strains of Pseudomonas aeruginosa and E.Coli were resistant to Cotrimoxazole and Ceftriaxone. But they were sensitive to other antibiotics like Amikacin and Imipenem. Similarly Staphylococcus aureus and Acinetobacter Spp were mostly sensitive to Imipenem.Multi drug resistance is a dreaded problem in nosocomial infections. This study reveals that most of the organisms were sensitive to Amikacin but very low sensitivity with cephalosporins and Fluoroquinolones. This could be due to the over use of these drugs and the high prevalence of ESBLs among these organisms.

One of the complications of Diabetes mellitus and Hypertension is Nephropathy. All gram negative isolates were sensitive to Amikacin which is a potent nephrotoxic agent. Thus the use of this easily available and cheap drug is restricted in the clinical setting compelling the treating physicians to go for a higher antibiotic. This will lead to selection pressure among the organisms and in due course, an ESBL (Extended Spectrum Beta Lactamases) becoming sensitive only to Imipenem. This in turn will increase the economic loss to the patient unnecessarily.

To avoid the above said problem anti microbial prophylaxis has to be adopted, which should be safe, inexpensive, bactericidal and with a good spectrum of activity. The drug should be infused preoperatively so that optimum serum concentration is achieved intraoperatively. Thus, the incidence of infection varies from surgeon to surgeon, from hospital to hospital, from one surgical procedure to other and most importantly from one patient to another.

Conclusion

Surveillance for SSIs is recommended for each centre to determine the rate of SSIs, distribution of microorganisms and antimicrobial sensitivities of microorganisms. Empirical treatment of SSIs should be conducted using these relevant data. To emphasize precise empiric therapy, policies on prescription patterns should be reviewed, which will ensure reduced patient stay, morbidity and cost per day in the hospital.

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Table-1 Distribution of infections according to surgical site

Surgical site	Infection rate
Deep	60%
Organ Space	24%
Superficial	4%

Figure -1 Classification of wound according to contamination

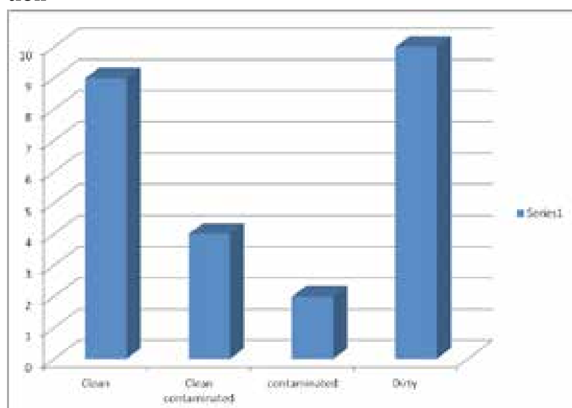
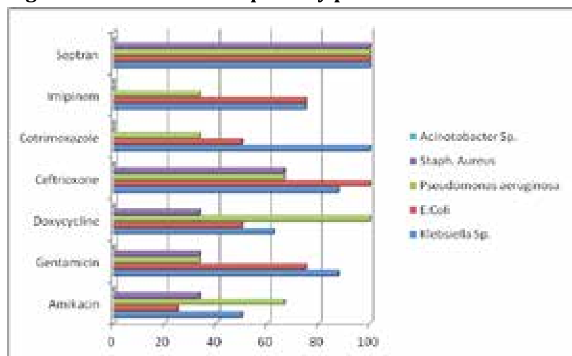


Figure-2 Antibiotic susceptibility pattern



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