BACTERIOLOGICAL PROFILE OF SURGICAL SITE INFECTIONS AND THEIR ANTIMICROBIAL SUSCEPTIBILITY PATTERN AT TERTIARY CARE CENTRE IN KANPUR

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ABSTRACT

BACKGROUND

Healthcare-Associated Infections (HAI) are considered to be the most common and deadliest events menacing the health of patients. Surgical Site Infection (SSI) events are one of the noteworthy healthcare-associated infections and common complication associated with surgery.

The aim of this study was to find the incidence of postoperative surgical wound infections in clean, clean-contaminated and contaminated surgeries and to determine bacteriological profile with antimicrobial susceptibility patterns of the isolates.

MATERIALS AND METHODS

During one year of study, total 833 operated cases were included from different departments like orthopaedics, surgery and obstetrics and gynaecology and all the clinical details of the patients were recorded. For microbiological study, swabs were collected from infected surgical sites and processed according to standard procedure.

RESULTS

The incidence of SSIs in our setting was 1.8 per 100 patients and the rates of infection were highest in contaminated type of surgeries (60%) followed by clean contaminated (33.3%) and clean surgeries (6.6%). *Klebsiella pneumoniae* (46.6%) was the most common pathogen followed by *Staphylococcus aureus* (26.6%), *Pseudomonas* species (20%) and *Escherichia coli* (6.6%) isolated from SSIs. Antibigram of these isolates showed that gram negative bacilli as well as gram positive cocci were resistant to penicillin and cephalosporins. But piperacillin-tazobactam, cefoperazone-sulbactam, imipenem, meropenem, tigecycline and polymyxin drugs were found to be effective. Antimicrobial profile of *Staphylococcus aureus* showed 75% and 100% sensitivity for cotrimoxazole and clindamycin respectively.

CONCLUSION

The rate of SSIs observed in this study was comparatively lower, but there is higher degree of antimicrobial resistance. It is very important to adhere to strict infection control measures and maintenance of proper hand hygiene.

KEYWORDS

Antibiogram, Surgical Site Infections.

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BACKGROUND

Surgical Site Infections (SSIs) constitute a major public health problem worldwide and several studies have shown that SSIs are one of the most common Healthcare-Associated Infections, (HAIs) among hospitalised patients. They are responsible for increasing the cost of treatment, length of hospital stay and significant increase in morbidity and mortality.^[1,2]

The CDC's Healthcare-Associated Infection (HAI) prevalence survey found that there were an estimated more than one lakh surgical site infections associated with inpatient surgeries in 2011.^[3]

Surgery has made great advances in last few decades, but postoperative wound infection is the most common complication faced by surgeons since the advent of surgery. Infection causes delayed recovery and may leave permanent disability. Despite efforts to have a better understanding of sepsis, wound infection is still a clinical problem and some infections in clean wounds remain unexplained. Wound access to bacteria can be prevented by aseptic surgical techniques.^[4] The main objective of the present study was to find the incidence of surgical site infections in clean, clean-contaminated and contaminated surgeries in our setting along with the factors related to patient and surgical procedures influencing the rate of postoperative surgical wound infections and to determine bacteriological profile with antimicrobial susceptibility patterns of the isolates.

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MATERIALS AND METHODS

This was a prospective study conducted in the Department of Microbiology at Rama Medical College Hospital and Research Centre, Kanpur. The study period was from January 2015 to December 2015. Ethical approval was taken from the Institute's Ethical Committee. A total of 833 patients undergoing surgery were taken from different departments like orthopaedics, surgery and obstetrics and gynaecology. All the clinical details of the patients were recorded. Each patient was followed from the time of admission till discharge from the hospital (CDC, 1999).^[5]

Inclusion Criteria

All the patients undergoing any type of surgery, clean surgeries (Class I Operative Wounds), clean-contaminated surgeries (Class II Operative Wounds), contaminated surgeries (Class III Operative Wounds) according to CDC classification were included in this study.

Exclusion Criteria

All type of eye surgeries was excluded. Dirty surgeries (Class IV operative wounds) and contaminated samples were also excluded from the study.

Sample Collection

Serous or non-purulent or pus discharge was collected aseptically in sterile syringe or in two sterile swab sticks (one for microscopy and another for culture) from the wound.

Processing

A smear was prepared from direct sample and stained by Gram-staining method for early presumptive diagnosis and sample inoculated on blood agar and MacConkey's agar. The plates were incubated at 37°C overnight for 18-24 hours. After incubation culture plates were observed and isolated organism was identified by colony characteristics and appropriate biochemical reactions. Antimicrobial susceptibility testing was done using disk diffusion tests according to CLSI guidelines.^[6]

RESULTS

Among 833 operated cases, 15 suffered from surgical site infection. The incidence of infection was 1.8 per 100 patients. Male and female ratio was 1.5:1. Among 15 infected cases most of postoperative infectious cases were >50 years (66.6%). [Fig-1] The rate of infection was highest in contaminated type of wounds 60.0% followed by clean-contaminated wounds 33.3% and least in clean wounds 6.6% [Fig-2].

Fig 1: Agewise distribution

Fig 2: Type of wounds

Klebsiella pneumoniae (46.6%) was most common pathogen isolated from SSIs followed by *Staphylococcus aureus* (26.6%), *Pseudomonas* species (20%) and *Escherichia coli* (6.6%) [Fig-3].

Fig 3: Distribution of bacteria in SSIs

Antibiotic susceptibility testing showed that maximum isolated strains of gram negative bacilli as well as gram positive cocci were resistant to penicillin and cephalosporins. But combination with inhibitors like piperacillin-tazobactam and cefoperazone-sulbactam increased the sensitivity for *Klebsiella pneumoniae* (71.4%), *Pseudomonas* species (100%) and *Escherichia coli* (100%). Only *Klebsiella pneumoniae* showed sensitivity to aminoglycosides: gentamycin (42.8%) and amikacin (28.5%) while other gram negative bacilli; *Pseudomonas* species and *Escherichia coli* were resistant to aminoglycosides. Carbapenems and polymyxins also showed excellent sensitivity against gram negative bacilli [Fig-4]. Fifty percent of *Staphylococcus aureus* (2 out of 4) were methicillin resistant, but sensitive to co-trimoxazole (75%) and clindamycin (100%).

Fig 4: Antimicrobial sensitivity pattern of Gram Negative Bacilli

DISCUSSION

The problem of surgical site infections is seen in both developed and developing countries, despite introduction of strict antiseptic regimes in surgical practices. In this study, 15 patients suffered from surgical site infections. This is comparable with the rates reported by various authors; Lilani et al Wondemagegn Mulu, Ahmed MI and Mundhada AS found SSIs 8.95%, 10.9%, 25.23% and 32% respectively.^[4,7,8,9] It can occur from either an endogenous or an exogenous source. As compared to these studies, in the present study infection rate was low which may be due to differences in working conditions or septic conditions or preoperative antibiotic prophylaxis.

There was no significant relation of SSIs with gender as has been reported by other authors also, but age was found to be a significant risk factor for SSIs. In this study patients more than 50 years of age got infected, which was in contrast to other studies.^[10]

In the present study surgical site infection was significantly associated with contaminated class of wounds, being the highest (60%) for contaminated surgery, 33.3% for clean-contaminated surgery and 6.6% for clean surgery. While Mundhada AS^[4] documented 17.65% clean and 39.39% clean contaminated wound were infected and Lilani et al^[7] found 3.03% clean and 22.41% were clean-contaminated surgeries. This rate of infection would be probably because of profound influence of endogenous contamination during surgery.

Gram negative bacilli were the most frequent pathogen isolated from SSIs in this study and *Klebsiella pneumoniae* (46.6%) was the commonest pathogen followed by Gram positive cocci; *Staphylococcus aureus* (26.6%). Masaadeh HA et al^[11] and Lilani SP^[7] found *Pseudomonas* sp. as commonest isolate, while Vikrant Negi et al^[1] reported *E. coli* which remains a third and fourth most isolated strain in this study. Fahad A Al-Mulhim^[12] and Mundhada AS^[4] found *S. aureus* as the predominant pathogen. *Klebsiella*, *Escherichia coli* or any other enteric microorganism infection at a surgical site indicates poor hospital hygiene.

Antimicrobial susceptibility pattern of isolated microorganisms revealed a high degree of resistance. All gram negative bacilli were resistant to penicillin and cephalosporins. Other studies have also shown approximately the same results.^[1,11]

On the other hand aminoglycosides, amikacin and gentamycin showed moderate sensitivity against *Klebsiella pneumoniae* only, other gram negative bacilli were resistant while another study revealed Enterobacteriaceae showing highest sensitivity to amikacin and gentamycin.^[13]

Similar to other studies^[8,9,11] in the present study *Klebsiella pneumoniae*, *Pseudomonas* sp. and *Escherichia coli* showed good sensitivity to piperacillin-sulbactam (71.4%, 100% and 100%, respectively), Imipenem (85.7%, 100% and 100% respectively), meropenem (71.4%, 100% and 100%) and polymyxin and tigecycline (100% for all). This could be because these antibiotics are not commonly used and limited in practice because of their higher cost.

In this study, *S. aureus* was the single gram positive organism isolated. Special interest in *S. aureus* SSI is mainly due to emergence of Methicillin Resistant *Staphylococcus aureus* (MRSA) strains, which is difficult to treat. In the present study 50% of *Staphylococcus aureus* were Methicillin resistant; this was in contrast to other studies who have

reported 10%^[13] and 15%^[14] resistance only. *Staphylococcus aureus* showed higher sensitivity to co-trimoxazole (75%) and clindamycin (100%) only.

Limitation of Study

This study was limited to isolate aerobic bacteria only.

CONCLUSION

The study gives us insight into the bacterial isolates and their resistance pattern in SSIs in our tertiary care hospital. The rate of SSIs in our setting was lower, but there is tremendous resistance of antimicrobial agents. Hence, it is very important to adhere to strict infection control measures, maintenance of proper hand hygiene and judicious use of antibiotics along with evidence-based medicine practice.

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