Original Article

Post operative wound infections: pattern of bacterial pathogens and their antibiotic sensitivity in a tertiary care hospital of north India

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Abstract

Background: Surgical site infection (SSI) is defined as an infection that occurs at an incision site within 30 days after surgery. Postoperative wound infections have been an important cause of morbidity and cost burden for the patients. **Aim and Objectives:** To isolate and identify the bacteria causing postoperative wound infections and to determine the antimicrobial susceptibility pattern. **Materials and Methods:** One hundred and twenty pus samples and wound swabs were collected from clinically suspected post-operative wound infection in Maharishi Markendeshwar Institute of Medical Sciences and Research, Mullana, Ambala from January 2014 to December 2014. The samples were processed as per standard guidelines. Antimicrobial susceptibility testing was performed as per CLSI guidelines. **Results:** Out of 120 pus samples and wound swabs, 44 samples (36.7%) were culture positive. 76 samples (63.3%) were culture negative. The common organisms isolated were Staphylococcus aureus 16 (36.3%), Escherichia coli 09 (20.4%), Klebsiella pneumoniae 8 (18.1%) and Pseudomonas aeruginosa 7(16%). Most of the Staphylococcus aureus exhibited resistance to penicillin, cefoxitin and aminoglycosides, and 100% sensitivity to vancomycin and gram negative bacilli showed resistance commonly to first and second line antibiotics. **Conclusion:** Staphylococcus aureus was the most frequently isolated pathogen from post- operative wound infections. Antibiotic susceptibility pattern of various isolates help to assist the clinician in appropriate selection of empirical antibiotics especially against hospital acquired infections.

Key Words: Post-Operative wound infections, Antimicrobial susceptibility pattern, Gram negative organisms, Gram positive organisms.

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INTRODUCTION

Besides skin and soft tissue infections that occur primarily as a result of a break in the skin surface, wound infections can occur as complications of surgery, trauma and bites or diseases that interrupt a mucosal or skin surface. Post operative wound infections can be caused through two major sources: exogenous and endogenous. Surgical site infection (SSI) is the most common nosocomial infections in surgical patients and defined as infections occurring within 30 days after surgical operations and affecting either the incision or deep tissue at operation site.[1] Despite advances in operative techniques and a better understanding of the pathogenesis of wound infection and wound healing, SSI's continue to be a major source of morbidity and mortality for patients undergoing operative procedures. The overall incidence of wound sepsis in India is from 10%-33%. However, the incidence of wound complications in the obstetric population varies with rates ranging from 2.8% to 26.6%.[2-4] The CDC's Healthcare-Associated Infection

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(HAI) prevalence survey found that there were an estimated more than one lakh surgical site infections associated with inpatient surgeries in 2011.[5] SSI's delays recovery, increase hospital stay and may produce long lasting sequelae.[6] As a result of indiscriminate use of antimicrobial agents, significant changes occur in microbial genetic etiology, so spread of antimicrobial resistance is now a global problem. [1] The aim of the study was to isolate and identify the bacteria causing postoperative wound infections, to determine their antimicrobial susceptibility pattern.

MATERIAL AND METHODS

The present study was conducted in the Dept. of Microbiology, MMIMSR, Mullana from a study period of January 2014 to December 2014. 120 operated cases in Surgery and Obstetrics and Gynaecology were included in this study. The 80 pus samples and 40 wound swabs were obtained under aseptic precautions and were transported to laboratory without delay. Certain risk factors like – type of surgical wound, elective or emergency surgery, antibiotic prophylaxis, duration of surgery, presence or absence of drain and any underlying or predisposing conditions were noted. Samples obtained were processed by the conventional microbiological methods.[7] Antimicrobial susceptibility testing was done by Kirby-Bauer disc diffusion method[8] and interpretation was done according to CLSI guidelines.[9]

RESULTS

A total of 44 culture positive isolates (36.7%) were obtained from 120 pus samples and wound swabs which were collected from clinically suspected postoperative wound infections. Female patients (59.1%) were more than male patients (40.9%) in culture positive cases. *Staphylococcus aureus* (36.3%) was the predominant organism among gram positive isolates. Among gram negative organisms, *Escherichia coli* (20.4%) was the commonest, followed by *Klebsiella pneumoniae* (18.1%) and *Pseudomonas aeruginosa* (16%) [Table1]

Table 1: Distribution of pathogens causing Post operative wound infections

Sr. No	Microorganism	Frequency n=44 (%)
1	*Staphylococcus aureus*	16 (36.3%)
2	*Escherichia coli*	9 (20.4%)
3	*Klebsiella pneumonia*	8 (18.1%)
4	*Pseudomonas aeruginosa*	7 (16%)
5	CONS	2 (4.6%)
6	Enterococcus sp.	2 (4.6%)

Antimicrobial susceptibility pattern of gram positive and gram negative isolates have been shown in Table 2 and Table 3.

Table 2: Percentage of antibiotic senstivity in Gram-positive isolates causing Post operative wound infections

Antibiotic	S.aureus (n=16)	*CONS (n=2)*	*Enterococcus sp (n=2.*	No (%) (n=20)
Penicillin	0	0	0	0
Cefoxitin	0	0	01	01 (05%)
Aminoglycosides	12	02	02	16 (80%)
Quinolones	11	02	02	15 (75%)
Linezolid	16	02	02	20(100%)
Vancomycin	16	02	02	20 (100%)

Table 3: Percentage of antibiotic senstivity in Gram-negative isolates causing Post operative wound infections

Antibiotic	E.coli (n=9)	*Klebsiella sp (n=8)*	*Pseudomonas sp (n=7)*	No (%) (n=24)
Ampicillin	0	0	0	0
Gentamycin	03	03	02	08(33%)
Amikacin	03	02	01	06 (25%)
Ceftazidime	06	05	06	17 (71%)
Imipenem	08	08	06	22(92%)
Meropenem	07	07	07	21 (87.5%)
Tigecycline	09	08	07	24 (100%)

DISCUSSION

Unrestrained and rapidly spreading anti-microbial resistance among bacterial populations has made the management and treatment of post-operative wound infections a serious challenge in clinical and surgical practice. Patients with post-operative wound infections face additional exposure to microbial populations circulating in a hospital set up as the hospital environment is always charged with microbial pathogens. Most post-operative wound infections are hospital acquired, and vary from one hospital to the other and are associated with complications, increased morbidity and mortality.[6,10] The condition is serious in developing countries owing to irrational prescriptions of antimicrobial agents, complications, increased morbidity and mortality. The emergence of bacterial anti microbial resistance (AMR) has made the choice of empirical therapy more difficult and expensive. Wound infections by resistant bacteria have further deteriorated the condition in this regard. Several reports have illustrated the etiologic agents involved in SSIs and their AMR patterns in India.[11] As the AMR patterns of the bacterial isolates keep changing and evolving with time and place, this study was conducted to assess the current status of bacterial pathogens involved in postoperative wound infection cases and their antimicrobial sensitivity pattern. This study observed that 36.7% samples showed growth on culture and it was comparable with J. Lalithambigai *et al*

and Anbumani *et al* where 37.27% and 47% of samples were culture positive respectively for wound infections. However, infection rates varying frim 20% to as high as 76.9% have also been reported.[12-16] This difference in prevalence of post-operative infection may be due to variation in common nosocomial pathogen inhabitant, difference in policy of infection control and prevention between countries and hospitals and study design used in the researches. The predominance of females (59.1%) in culture positive cases is probably due to the fact that subjects have been chosen from Obstetrics and Gynaecology department. In another study done by Khan MA *et al*, females showed preponderance of SSI's than males.[12] However, it has been known that sex is not a pre determinant of the risk of SSI.[17] When causative agents of post operative wounds were identified by culture, it was found that most frequently isolated pathogen was *Staphylococcus aureus* (36.3%) which was similar to other studies.[1,6,18] The predominance of *Staphylococcus aureus* is obvious as it forms the bulk of normal flora of the skin and nails.[6] Another reason for the prevalence of S. aureus in surgical wound infection has been attributed to high rate of nasal carriage of this organism in patients and healthcare workers in the treatment of the patients. [19]In another study [20] gram negative organisms were predominantly the causative agents of SSI's. This difference in pattern of distribution of pathogens in different setups can be explained by the fact that distribution of pathogens involved in infection process is usually dependent on the study population and local antimicrobial use pattern which results in emergence of pathogens that have the potential to resist currently used antibiotics.[20] *Escherichia coli* was the next common organism causing wound infections followed by *Klebsiella pneumonia*, *Pseudomonas aeruginosa* and the same pattern has been studied by other researchers.[1,21] The antimicrobial agents are of great value for devising curative measures against bacterial infections. Indiscriminate prescription coupled with improper use of antimicrobials, the development of resistance inducing mutations and horizontal transfer of genes coding for antimicrobial resistance among bacteria has remained a major cause for development of resistance among microorganisms to previously sensitive antimicrobial agents. The widespread use of antimicrobials, together with the length of time over which they have been available have led to major problems of resistant organisms, contributing to morbidity and mortality.[22] Hence there is a requirement for regular screening of organisms causing various infections and to characterize their antimicrobial susceptibility pattern to commonly used antibiotics at the hospital, regional, national and global levels to guide the clinicians to select a relevant antimicrobial for empirical treatment of infections. In our study, *Staphylococcus aureus* showed 100% sensitivity to Vancomycin and Linezolid, followed by Aminoglycosides (80%) and Fluoroquinolones (75%) with all the strains being Methicillin Resistant (MRSA). Rapidly increasing rates of MRSA causing Surgical Site Infections are being reported in other studies as well.[23] In other studies done by Shriyan *et al*[18] and J. Lalithambigai *et al* [1] same pattern of susceptibility to antibiotics have been showen. In a study done by Kurhade A *et al* in 2015[24], 91% resiatnce to penicillin has been described which is comparable to the present study in which all the gram positive isolates were resistant to penicillin. Antimicrobial sensitivity testing of gram negative isolates showed higher rate of multi drug resistance. All the isolates were resistant to penicillin and a very high degree of resistance has been showen to gentamycin and amikacin. Sainin S *et al* from India has also described high level of resiatance in gram negative pathogens to aminoglycosides.[25] Pseudomonas aeruginosa strains showed increased resistance to various commonly used antibiotics like aminoglycosides and ceftazidime as showen by Safia Bibi *et al* in 2012.[20] The high level resistance against these antibiotics may be due to the result of increased use of these antibiotics in the selected ward for prophylaxis as well as postoperatively to prevent infections and an empirical treatment for infected cases. On the other hand, *pseudomonas aeruginosa* strains were susceptible to Imipenem (100%) which is similar to other studies.[1,21] Post operative wound infection in any hospital depends on the hospital environment and irrational use of antibiotics. Antibiotic resistance can be controlled by appropriate antimicrobial prescription, prudent infection control, new treatment alternatives and continued surveillance.

CONCLUSION

Although nosocomial infections are usually associated with resistant organisms due to selective use of antibiotics in the hospital environment but the present study revealed much higher rates of resistance among organisms commonly associated with wound infections which is quite alarming. A proper infection control system should be established to continuously monitor the pattern of different pathogens and their source. It is also mandatory to establish guidelines for antibiotic use so as to control the emerging antibiotic resistance problems in hospitals.

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