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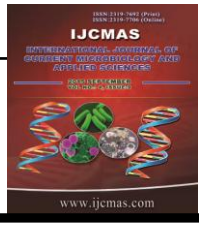

Original Research Article

Aerobic bacteriology of surgical site infection in a tertiary care centre

Sunilkumar Biradar[1*] and C.Roopa[2]

[1]Department of Microbiology, Mahadevappa Rampure Medical College, Gulbarga, India
[2]Department of Microbiology, Navodaya Medical College Hospital and Research Centre, Raichur, India

**Corresponding author*

Keywords

Surgical site infection, SSI, Nosocomial infection

A B S T R A C T

Surgical Site Infection (SSI) is the third most frequent nosocomial infection, associated with increased hospital stay, pain, reintervention, use of antimicrobial agents and costs. Various nonmicrobiological causes can add to burden of SSI making this as commonest cause of death in postoperative patients. Total 400 surgical wounds were studied.SSI was commonly found in patients aged more than 40 years. Daibetes, presence of drain & extended hospital stay favoured the development of SSI. Most common bacteria causing SSI is *Staphylococcus aureus* followed by *Pseudomonas aeruginosa*, *E. coli* & *Klebsiella*. Gram negative bacteria are more common than Gram positive bacteria. Vancomycin and linezolid in gram positive and carbapenems in gram negative bacteria can be used confidently to treat SSI till complete reports of antibiotic sensitivity are available. Hospital infection control practices and antibiotic policy plays a crucial role in controlling the SSI.

Introduction

Surgical site infection (SSI) is a serious hazard to patients, with incidence according to CDC is 15.45%, and according to the UK nosocomial infection surveillance is 11.32%, and according to ASEPSIS is 8.79% (Ashby *et al.,* 2010). SSI are the third most frequent nosocomial infections, associated with increased hospital stay, pain, reintervention, use of antimicrobial agents and costs (Ducel *et al.,* 2002; Schwulst and Mazuski, 2012).

When death in these surgical patients with nosocomial SSI occurred, 77% of the these deaths were reported as related to the infection and the majority (93%) were serious infections involving organs or spaces accessed during the operation (Mangram *et al.,* 1999). The emergence of resistant strains has increased the morbidity and mortality associated with these wound infections (Chastre and Trouillet, 2000). Risk factors other than microbiology can be due to systemic factors affecting the patient's healing response, local wound characteristics, or operative characteristics. The risk also depends on bleeding, the amount of devitalized tissue created, and the need for drains within the wound, obesity

and diabetes mellitus (Rubin, 2006).

The present study was conducted to know the prevalence of microorganisms causing surgical site infection and their antibiogram.

Materials and Methods

A total of 400 clean and clean-contaminated surgeries conducted in various surgical departments like surgery, orthopaedics, OBG etc. in M.R. Medical College from May 2013 to July 2014 were included in the study. Details that were recorded include the type of surgery by wound class, clean surgeries (Class I-operative wound) / clean-contaminated surgeries (Class II-operative wound), type and duration of operation, antimicrobial prophylaxis, drain used, total hospital stay and associated factors like diabetes or any.

Samples for wound infections were collected from the patients with complaints of discharge, pain, swelling, foul smelling, delayed and non healing wound by using a sterile swab, taking care to avoid contamination of the specimen with commensals from the skin, and were immediately transported to the laboratory (Koneman *et al.*, 1997). Preliminary Gram's stain was done to know the type of organism and presence of pus cells. The sample was streaked on Blood agar, MacConkeys agar and incubated for 24–48 hours at 37^{o}C. Further identification was done depending on colony morphology, Gram's stain and various biochemical tests for identification & speciation. Antibiotic susceptibility testing was performed by employing Kirby Bauer disc diffusion technique according to CLSI guidelines (CLSI, 2011).

Results and Discussion

Out of 400 cases of postoperative surgical wounds studied, 53 (13.25%) cases developed postoperative wound infections. Maximum number of patients (71.6%) was from 5th, 6th, and 7th decade of age groups (Table 1). Infection rate was more in males 30 (56.6%) as compared to females 23(43.4%) (Table 2).

Postoperative wound infection rate was 33.9% in clean wound and 65.1% in clean contaminated wounds (Table 3).

Associated factors studied in all these SSI cases were found to be diabetes, length of hospital stay, presence of drain, immunocompromised state & others. Diabetes was the single most common risk factor in 28(52.8%) cases followed by presence of drain in 19(35.8%) cases, length of hospital stay more than 15days in 16(30%) cases, while 9(16.9%) cases were immunocompromised (Table 4). Most patients had multiple associated factors.

10 cases of these SSI were polymicrobial in origin, so 63 isolates were identified & speciated. The most common bacteria causing the SSI was found to be *Staphylococcus aureus* 21(33.36%) followed by *Pseudomonas aeruginosa* 16(25.3%), *Escherichia coli* 11(17.4%), *Klebsiella pneumoniae* 09(14.2%), *CONS* 4(6.3%), *Enterococcus* and *Acinetobacter* in 1(1.6%) each (Table 5). Considering the Gram reaction, Gram negative bacteria 37(58.8%) isolates were more common than Gram positive bacteria 26(41.2%).

All the gram positive bacteria (*S. aureus*, CONS, *Enterococcus* 26 isolates) were 100% sensitive to vancomycin and linezolid. These showed varied resistance to other antibiotics like gentamicin 46%, amikacin 65%, ciprofloxacin 54%, ofloxacin 62%, amox-clav 69%, cotrimoxazole 50%, cefotaxime 65% and ampicillin 8%.

The gram negative bacteria (total 37

isolates) showed highest sensitivity to meropenem & imipenem (100%). Sensitivity to other antibiotics in GNB was ampicillin (3%), piperacillin/tazobactum (39%), ceftriaxone (54%), ceftazidime (56%), cefepime (65%), aztreonam (72%), amikacin (51%), gentamicin (27%) and ciprofloxacin (24%).

In present study, rate of surgical site infection was 13.25%, that is similar to the other studies conducted in India (Suchitra and Lakshmidevi, 2009). The age group 40 years and above has the incidence of 70% of total SSI. This is attributed to poor immune response, existing co-morbid conditions and reduced compliance to treatment. The sex distribution of SSI was not statistically significant.

Table.1 Showing the age-wise distribution of SSI

Age group	No. of cases	Percentage
10-20	03	05.6%
20-30	07	13.2%
30-40	06	11.3%
40-50	10	18.8%
50-60	15	28.3%
60 & above	13	24.5%

Table.2 Showing sex variation

No. of cases	Males	Females
53	30(56.6%)	23(43.4%)

Table.3 Incidence of SSI in different type of surgical wound

Type of wound	No of cases	percentage
clean	18	33.9%
Clean contaminated	35	65.1%

Table.4 various associated factors seen in Patients of SSI

Associated factors	No. of cases	Percentage
Diabetes	28	52.8%
Presence of drain	19	35.8%
Length of hospital stay>15days	16	30.1%
Immunocompromised state	09	16.9%
Others(Malnitrition,IV line etc)	11	20.7%

Table.5 List of organisms causing SSI

Organisms	No of isolates	Percentage
Staphylococcus aureus	21	33.3%
Pseudomonas aeruginosa	16	25.3%
Escherichia coli	11	17.4%
Klebsiella pneumoniae	09	14.2%
CONS	04	6.3%
Enterococcus	01	1.5%
Acinetobacter	01	1.5%

Table.6 Antibiogram of Gram positive bacteria

Antibiotic	Sensitivity (total-26 isolates)
Ampicillin	02(8%)
Amox-clav	18(69%)
Gentamicin	12(46%)
Amikacin	17(65%)
cotrimoxazole	13(50%)
cefotaxime	17(65%)
Ciprofloxacin	14(54%)
Ofloxacin	16(62%)
Vancomycin	26(100%)
Linezolid	26(100%)

Table.7 Antibiogram of Gram negative bacteria

Antibiotic	Sensitivity (total 37 isolates)
Ampicillin	01(3%)
Piperacillin/TZM	14(39%)
Gentamicin	10(27%)
Amikacin	19(51%)
Ciprofloxacin	09(24%)
Ceftriaxone	20(54%)
Ceftazidime	21(56%)
Cefepime	24(65%)
Aztreonam	27(72%)
Imipenem	37(100%)
Meropenem	37(100%)

Diabetes was found to be a major risk factor in developing SSI. Several other studies done have the same inference (Malone *et al.*, 2002; National Academy of Science/ National Research Council, 1964). Presence of drain and postoperative hospital stay were other major associated factors. Higher surgical site infection rates have been noted

for drained wounds as compared to nondrained wounds by Moro *et al.* (2005). Prolonged postoperative hospitalization was also a major concern in patients developing surgical site infection in study done by Cruse Peter *et al.* (1980).

Staphylococcus aureus was the predominant organism isolated from the surgical sites followed by *Pseudomonas*, *E. coli* and *Klebsiella* in the present study. CONS, *Enterococcus* and *Acinetobacter* are the other organisms isolated. The gram positive *Staphylococcus aureus* could be due to its commensal nature in skin, also a common carrier in hands & nares of healthcare workers. *Pseudomonas* is also a highly resistant and hardier organism having the capabilities to grow even in hospital disinfectants. *E. coli* & *Klebsiella* are commensals in GIT. Many studies have reported *Staphylococcus aureus* as the commonest isolate from the postoperative wound infection (Malik *et al.*, 2011). Also the high incidence of gram-negative organisms in the postoperative wound infections can be attributed to be acquired from patient's normal endogenous micro flora (Malik *et al.*, 2011).

Gram positive bacteria have shown sensitive range from 8% to 68% with 100% sensitive to vancomycin & linezolid. Gram negative bacteria have shown varied sensitivity 3% to ampicillin, 25–60% sensitive to commonly used drugs like fluoroquinolones & cephalosporins. Carbapenems like imipenem & meropenem were 100% sensitive.

In conclusion, surgical site infections are one of the common form of nosocomial infections. Elderly above 40 years were most commonly affected. The most common associated factors are diabetes, presence of drain and long hospital stay postoperatively. *Staphylococcus aureus* is the most common bacteria isolated followed by *Pseudomonas*, *E. coli* & *Klebsiella*. Vancomycin & linezolid are the most sensitive antibiotics to treat SSI due to gram positive bacteria, while carbapenems are totally effective against gram negative organisms. However testing for sensitivity is the best measure to reduce the development of resistance. Strict hospital infection control measures and antibiotic policy can reduce the incidence of SSI.

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