

Original Research Article

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Prevalence of *Pseudomonas aeruginosa* in Surgical Site Infection in a Tertiary Care Centre

Sapana Mundhada, Anu Sharma, Kishor Ingole and Sadiya Shaikh

Department of Microbiology, Dr. V.M. Government Medical College Solapur-413003,
Maharashtra India

*Corresponding author

ABSTRACT

Pseudomonas aeruginosa is a leading cause of nosocomial infections. Infections caused by it are often severe and life threatening and difficult to treat because the organism is inherently resistant to many drug classes (MDR) and is able to acquire resistance to all effective antimicrobial drugs. Over the years, *P. aeruginosa* contributes substantially to morbidity and mortality related to surgical site infection (SSI) worldwide, the third most commonly reported nosocomial infection. People infected with drug-resistant organisms like *P. aeruginosa* are more likely to have longer and more expensive hospital stays, and may be more likely to die as a result of the infection. The study was aimed to determine the prevalence and drug resistance pattern of *P. aeruginosa* in SSI. Over a 2-year period, specimens were received as postoperative wound swabs in Microbiology department and processed for isolation and identification of bacterial pathogens, according to the standard microbiological techniques. Antibiotic Sensitivity test was performed on Mueller Hinton agar by Kirby Bauer's disc diffusion method. Out of 360 bacterial organism isolated, 68 (18.89 %) were *P. aeruginosa*. A total of 11 (16.18%) isolates were resistant to three or more antibiotic classes (multidrug resistance). Imipenem and piperacillin/tazobactam showed high sensitivity, with 88.24% and 89.71% respectively. Continued monitoring of susceptibility pattern of *P. aeruginosa* from SSI need to be carried out in individual settings so as to detect the true burden of multidrug resistance in organisms and prevent their further emergence by judicious use of drugs.

Keywords

Surgical site infection (SSI), *P. aeruginosa*, Antimicrobial susceptibility testing.

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Introduction

Among Surgical patients, surgical site infection (SSI) is an important cause of health care associated infection (Ranjan *et al.*, 2010). They account for approximately a quarter of nosocomial infection.

SSI have been responsible for increasing cost of treatment due to prolong hospital stay as well as high morbidity and mortality related to surgical operation and continue to be major problem even in hospital with most modern facility and standard protocols of preoperative

preparation and antibiotic prophylaxis (Lilani *et al.*, 2005). Incidence of SSI in India ranges from 4.04% to 30% (More *et al.*, 2015).

The virulence factor and invasive property of the microorganisms are the important risk factor for development of infection, but the physiological state of the tissue in the wound and immunological integrity of the host also shows equal importance in determining whether infection occurs or not (Ranjan *et al.*, 2010). The common pathogenic bacteria

isolated from SSI include *Staphylococci*, *Pseudomonas*, *Streptococci*, *Enterococci*, *E.coli*, *Klebsiella*, *Enterobacter*, *Citrobacter*, *Acinetobacter*, *Proteus*, etc (Naik *et al.*, 2011).

In the recent years, increasing incidence of *P. aeruginosa* in SSI is a serious problem in developing countries as infections caused by it are often severe and life threatening and difficult to treat because the organism is inherently resistant to many drug classes (MDR) either intrinsically or following acquisition of resistant gene thus reducing treatment options for patients. Also *P. aeruginosa* shows variety of virulence factors like lipopolysaccharides (LPSs), exotoxin A, leucocidin, extracellular slime, proteases, phospholipase, and several other enzymes which make it the most clinically significant pathogen among non-fermenting bacteria. *Pseudomonas aeruginosa* is a leading cause of nosocomial infection, ranking second among gram-negative pathogens as reported by the United States national nosocomial infection surveillance system. *P. aeruginosa* contributes substantially to SSI-related morbidity and mortality worldwide. So the present study was aimed to determine the prevalence of *P. aeruginosa* in the isolates of postoperative wounds infection in our setting and its antimicrobial susceptibility pattern.

Materials and Methods

The present study was carried out at a tertiary care centre in the Microbiology department from January 2015 to December 2016. Two wound swabs were collected aseptically from all clinically suspected cases of SSI from all surgical wards, one swab was used for Gram stain and the other for culture. All the collected swabs were processed for detection of aerobic bacteria without delay in the following manner (Collee *et al.*, 2006; Forbes *et al.*, 2007).

- a. Gram stain microscopy by 1st swab.
- b. Inoculation on culture media by using 2nd swab (Blood agar, MacConkey agar).
- c. Preliminary identification of the growth (Gram stain, catalase test, oxidase test, motility, etc.).
- d. Routine standard biochemical tests for confirm identification.
- e. Antimicrobial susceptibility testing by Kirby Bauer disk diffusion method (Performance Standards for Antimicrobial Susceptibility Testing, 2015).

Antibiotic testing was not done of other bacterial isolates in this study since our focus was on the prevalence of *P. aeruginosa*. Antibiotics used in our study were piperacillin (100 µg), ceftazidime (30 µg), imipenem (10 µg), piperacillin/tazobactam (100/10 µg), gentamicin (10µg), cefepime (30µg) and ciprofloxacin (5 µg).

Results and Discussion

Total 360 specimen were obtained from post-operative wound infection patients admitted in surgery, orthopaedics, Obstetrics and gynaecology ward. Among them 278 (77.22%) sample revealed growth while 82(22.78%) showed no growth. *Pseudomonas aeruginosa* 68(18.89%) was the most common isolate followed by *E. coli* 58 (16.11%), *Klebsiella spp.* 53 (14.72%), *Staphylococcus aureus* 46(12.78%), *Proteus spp.* 32 (8.89%) and *Acinetobacter spp* 21(5.84%). *Pseudomonas aeruginosa* had showed maximum susceptibility to Piperacillin-Tazobactam (89.71%) and Imipenem (88.24%) (Table 1).

Out of 68 *P. aeruginosa* 11(16.18%) were resistant to three or more class of drug

(MDR). Frequency of isolation of *P. aeruginosa* was maximum in patients who underwent caesarean section followed by abscess drainage and Diabetic foot (Table 2). We found that *P. aeruginosa* infection was more common in age group 21-40 years and males (54.41%) were more affected than female (45.59%).

Surgical site infection (SSI) is an important cause of health care associated infection among surgical patients. Patients who developed SSI have longer hospital stay, more expensive hospitalization and increased morbidity and mortality. In present study 77.22% sample had shown growth of aerobic bacteria. Similar finding were observed in other studies by Insan *et al.*, (2013) and More

et al., (2015). *Pseudomonas aeruginosa* 68(18.89%) was the most common bacteria isolated in our study followed by *E. coli* 58 (16.11%), *Klebsiella spp.* 53 (14.72%), *Staphylococcus aureus* 46(12.78%) which can be correlated well with the findings of other studies by Ranjan *et al.*, (2010) and Lilani *et al.*, (2005) while Negi *et al.*, (2015) found *E. coli* as common isolate and Mundhada *et al.*, (2015) reported *S. aureus* as predominant organism in their studies. When factors such as age and sex of the patient were considered, *P. aeruginosa* was found to be more common in males than female and highest in the age group 21–40 years which can be correlates with results recorded by Ranjan *et al.*, (2010) and More *et al.*, (2015).

Table.1 The susceptibility pattern of *P. aeruginosa* isolated from post-operative wound swab (n=68)

Antibiotic	Percentage of susceptibility (%)
piperacillin/tazobactam	61(89.71%)
Imipenem	60(88.24%)
Piperacillin	47(69.12%)
Ceftazidime	42(61.76%)
Gentamicin	21(30.88%)
Cefepime	18(26.47%)
Ciprofloxacin	12(17.64%)

Table.2 Prevalence of *P. aeruginosa* isolated from different type of surgeries

Type of Surgery	Total no. of specimens	Total no of <i>P. aeruginosa</i> isolated	Percentage (%)
Cesarean section	91	26	38.25%
Abscess drainage	77	19	27.68%
Diabetic foot	66	10	14.70%
Abdominal abscess	27	8	11.76%
Bone excision	17	5	7.35%

Fig.1 Pigment production of *P. aeruginosa* on Nutrient Agar



Antimicrobial susceptibility pattern of *P. aeruginosa* shows highest sensitivity to Pipracillin-Tazobactam followed by imipenem while maximum resistance to ciprofloxacin, cefepime and Gentamicin. Similar results were recorded by Ranjan *et al*, Navneet *et al.*, and Mohamad *et al.*, (Ranjan *et al.*, 2010; Navaneeth *et al.*, 2002; Mahmoud *et al.*, 2013). In present study, out of 68 *P. aeruginosa* 11(16.18%) were resistant to three or more class of drug (MDR). Similar finding were recorded in study by Mohamad *et al.*, (2013) (10.60%) while in contrast Srinivas *et al.*, (2012) reported 86.90% MDR *P. aeruginosa* in their study. In our study, *P. aeruginosa* isolation rate was highest from patients who underwent caesarean section followed by abscess drainage and Diabetic foot. In contrast to this Ranjan *et al.*, (2010) isolated *P. aeruginosa* mainly from patients of abscess drainage followed by Diabetic foot and caesarean section.

In conclusion, SSI is major risk in surgeries in spite of use of modern surgical and sterilization technique and use of prophylactic antibiotic during surgery. SSI represent substantial burden of disease not only on patient but also on health care services in terms of morbidity, mortality and the economic costs. According to our study, continued monitoring of susceptibility pattern of *P. aeruginosa* from SSI need to be carried out in individual settings so as to detect the

true burden of multidrug resistance in organisms and prevent their further emergence by judicious use of drugs.

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