

Original Research Article

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Pseudomonas aeruginosa in Nosocomial Infection: Burden in Surgical Site of Tertiary Care Unit

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ABSTRACT

Pseudomonas aeruginosa is a major cause of nosocomial infections. It has natural resistance as well as acquired multidrug resistance to various antibiotics leading to increased morbidity and mortality which lead to problematic condition. The main aim is to study the resistance pattern of *Pseudomonas aeruginosa* isolates from surgical site. Retrospective study was conducted in Department of Microbiology, M.P. Shah Govt. Medical College, Jamnagar, from January-2017 to October-2017. A total of 170 isolates of *Pseudomonas aeruginosa* from indoor patients from surgical department who were having surgical wound infections, were included in the study. They were identified by routine standards and operative procedures, antimicrobial susceptibility testing was done using Kirby-Bauer disc diffusion method, and the results were interpreted according to the CLSI guidelines. Resistance pattern were Ceftazidime (69.4%), Aztreonam (60%), Gentamicin (55.9%), Levofloxacin (49.4%), Piperacillin-Tazobactam (17.64%), Imipenam (8.82%) of the isolates. *Pseudomonas aeruginosa* is an important cause of nosocomial wound infections. A regular screening of surgical site can help to combat the emergence of MDR strains of *P. aeruginosa* and reducing the spread of drug resistance in pathogen.

Keywords

Surgical site infection,
Pseudomonas aeruginosa,
Antibiotyping,
Resistance, Jamnagar

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Introduction

Antibiotic when first introduced was considered as a magic bullet. A single injection of penicillin could eradicate a life threatening infection. Unfortunately with time due to malpractices of natural causes, most of the cheaper antibiotics have lost their efficacy and more and more expensive and complicated antibiotics were introduced and marketed to combat simple infection (Betty *et al.*, 2007). The microbial pathogens, as well as, their antibiotic sensitivity pattern, may

change from time to time and place to place. Therefore knowledge of current drug resistance pattern of the common pathogenic bacteria in a particular region is useful in clinical practice.

Pseudomonas aeruginosa (*Ps.aeruginosa*) is one of the important bacterial pathogens isolated from various samples. Despite advances in medical and surgical care and introduction of wide variety of antimicrobial agents against having anti-pseudomonal activities, life threatening infection caused by

Ps. aeruginosa continues to cause complications in hospital acquired infections. *Ps. aeruginosa* is increasingly recognized as an emerging opportunistic pathogen of clinical relevance that causes infections in hospitalized patient particularly in burn patients, orthopedic related infections, respiratory diseases, immunosuppressed and catheterized patients.

Several different epidemiological studies indicate that antibiotic resistance is increasing in clinical isolates (Koneman, 2006). Being gram-negative bacteria, most pseudomonas spp. are naturally resistant to penicillin and majority of related beta-lactum antibiotics, but a number are sensitive to Piperacillin-Tazobactam, Imipenam and Colistin. Nowadays more and more resistance of *Ps.aeruginosa* are encountered in routine clinical practice, a serious problem, increase morbidity and mortality and also cost of treatment.

Materials and Methods

This study was a retrospective study done in Department of Microbiology, Shri M.P. Shah Govt. Medical College and Guru Gobindsingh Government Hospital Jamnagar, Gujarat (India) from January 2017 to October 2017. In this study, antimicrobial susceptibility testing of isolates was done by Kirby-Bauer disc diffusion method and the results were interpreted according to the CLSI guidelines. A total of 170 isolates of *Pseudomonas aeruginosa* from indoor patients from surgical department who were having surgical wound infections, were included in the study. The samples included were pus/ pus swabs/ aspirations from the wounds.

Sample processing

All the samples were inoculated on MacConkey agar, Blood agar and Nutrient agar

plates. The culture plates were incubated aerobically for 24 hrs at 37°C. Growth and cultural characteristics were observed next day. Bacterial pathogens were identified by conventional biochemical methods according to standard microbiological techniques.

Confirmation of *Pseudomonas* spp.

After obtaining the pure strains, the strains were subjected to biochemical identification tests to identify *Pseudomonas* spp. For this purpose strains were inoculated in Triple Sugar Iron media (TSI), Citrate media, Peptone water, Urease media and kept in an incubator for 18hrs at 37°C. Next day the results were noted on TSI, Citrate media and Urease media. Part of growth on Peptone water was subjected to Indole test with Kovac's Reagent and part for motility test by 'Hanging drop' method. A strain of *Pseudomonas* in the TSI medium showed alkaline slant, no reaction in butt. It showed negative reaction for Indole test, negative urease test and positive citrate test. Glucose is utilized oxidatively, forming acid only (RajatRakesh *et al.*, 2012).

The organism was identified by its culture characteristics, gram staining and various biochemical reactions performed by standard bacteriological methods. Each isolate was evaluated for antibiotics susceptibility to six different antibiotics i.e. Ceftazidime (30µg), Aztreonam (30µg), Gentamicin (10µg), Levofloxacin (5µg), Piperacillin-Tazobactam (100/10µg) and Imipenam (10µg). The results were interpreted according to Clinical Laboratory Standard Institute (CLSI) guidelines (CLSI, 2018).

Results and Discussion

Out of 170 isolates, 125(73.53 %) were from male patients and 45(26.47 %) were from female patients (Table 1).

Maximum resistance was seen to third generation cephalosporins-69.4% to Ceftazidime, 60% to Aztreonam, Gentamicin showed resistance in 55.9% and Levofloxacin in 49.4% of the isolates. Piperacillin-Tazobactum resistance was seen in 17.64% of the isolates. Minimum resistance was seen to Imipenam 8.82% (Table 2).

Pseudomonas aeruginosa emerged as an important pathogen and responsible for the nosocomial infections. It is one of the important causes of morbidity among hospital patients. The pre-eminent of *pseudomonas aeruginosa* in hospital infections is due to its resistance to common antibiotics and antiseptics, and its ability to establish itself widely in hospitals.

Being an extremely adaptable organism, it can survive and multiply even with minimum nutrients, if moisture is available. As

pseudomonas aeruginosa causes serious infections, and is one of the leading causes of hospital acquired infections, several studies were carried out to detect antibiotic resistance pattern for the various drugs available. Such study helps clinicians for the better management of patients.

So the present study was conducted to determine the antibiotic resistance pattern of *Pseudomonas aeruginosa* isolated from surgical site samples. In present study the isolation rate of *Pseudomonas aeruginosa* was comparable with other studies.

In the present study sex wise prevalence of clinical isolates shows that infections caused by *Pseudomonas aeruginosa* are more common in males (73.53%) compared to females (26.47%). This is comparable with study of Rakesh Kumar *et al.*, (2014), which show males (71%) and Females (29%).

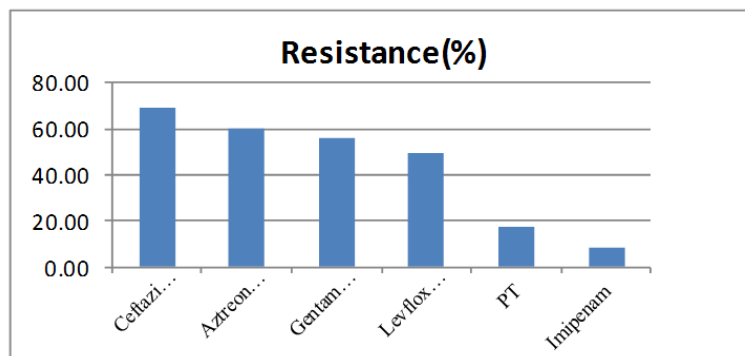
Table.1 Sex wise distribution of cases

Sex	Total No.	Percentage (%)
Male	125	73.53%
Female	45	26.47%
Total	170	100

Table.2 Percentage of resistance towards various antibiotics

Antibiotics	Resistance (%)
Ceftazidime(CAZ)	69.4%
Aztreonam(AZ)	60%
Gentamicin(GM)	55.9%
Levofloxacin(LV)	49.4%
Piperacillin-Tazobactum (PT)	17.64%
Imipenam(IPM)	8.82%

Chart.1 Graphical presentation of resistance (%) towards various antibiotics



In our study resistance to third generation Cephalosporins (ceftazidime) was seen to be 69.4 %. Similar rate were observed by Javiya *et al.*, (2008), 67.86% and Senthamarai *et al.*, (2014), 65.38% and higher rates of resistance 75% were observed in Rajput *et al.*, (2015). We found that 60% isolates were resistance to Aztreonam in our study, similar to other studies by Yadav *et al.*, (2017), 63.7%. We found that 55.9% isolates were resistance to Gentamicin in our study, similar to other studies by Senthamarai *et al.*, (2014), 51.92%.

Resistance to Imipenam was seen in 8.82% isolates in our study, similar rate were observed in the study of Yadav *et al.*, (2017), 8.6% and Sapana Mundhada *et al.*, (2017), 11.76%.

Surgical site infection (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.

Pseudomonas aeruginosa is an important cause of nosocomial wound infections. A regular screening of surgical site can help to combat the emergence of MDR strains of *P. aeruginosa* and reducing the spread of drug resistance in pathogen. Newer antibiotics such as Colistin and Polymixin-B have good *in vitro* anti-pseudomonal activity. Although their clinical use may be limited due to adverse effect.

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