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Disease burden and antimicrobial profile of Pseudomonas species in high risk areas at a tertiary care centre

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ABSTRACT:
Pseudomonas aeruginosa is a Gram negative bacilli and responsible for various infections particularly pneumonia and wound infections. In majority of pneumonia cases by Pseudomonas spp.,the patient has cystic fibrosis. The pathogen is notorious to develop resistance quickly. Multi drug resistant isolates lead to increase morbidity and mortality. The aim of our study was to determine the prevalence of Pseudomonas species in various samples and determine their antimicrobial susceptibility pattern. Among 13480 culture samples received in Department of Microbiology, Pseudomonas species was isolated from 267 samples. The isolates were resistant to cephalosporins and quinolones but mostly sensitive to carbapenems and colistin. To prevent infections with multi drug resistant organism stringent infection control procedures should be followed.

I. INTRODUCTION:

Infections in ICU are not uncommon and are associated with higher antimicrobial resistance and increased mortality. ICUs play as the high risk areas, as critically ill patients play an active host for any microorganism due to immunocompromise,use of prolonged drug therapy and use of invasive devices. Any breach in infection control protocols would easily disseminate and amplify these multidrug resistant organisms. Pseudomonas aeruginosa acts as an alarming pathogen because it has minimal nutritional needs and is well tolerant of disinfectants and many antimicrobial agents. Pseudomonas aeruginosa has been identified as an ESCAPE organism and along with multidrug resistant organisms like E.coli, Klebsiella spp., Acinetobacter baumannii,is responsible for spectrum of infections in the ICU. It can cause various life-threatening infection like septicaemia, surgical wound infections, pneumonia UTI etc. In specific settings, such as in intensive care units (ICU), the rate of Pseudomonas spp. isolation as pathogens causing BSIs is even higher. For example, in a study about ICU-acquired BSI Pseudomonas aeruginosa was the second most common cause of BSI among gram-negative pathogens [(1)]. Pseudomonas aeruginosa is of major relevance as antibiotic resistance is common and the frequency of multidrug resistance is increasing.[(2,3)]

The present study was undertaken to find out the prevalence of Pseudomonas in ICUs and wards and their antimicrobial profile which would help in effective treatment protocols for better patient outcome.

II. MATERIAL AND METHOD:

The present cross-sectional prospective study was carried in the Department of Microbiology, Santosh Medical College and Hospital, Ghaziabad, Uttar Pradesh, India. The study was carried out for a period of six months from January 2023 to June 2023. Written informed consent was taken from all participants of the study.Demographic data was collected through the software. All clinical samples like ET aspirates, blood, pus,urine(catheter),BAL fluid samples from admitted patients were collected aseptically and sub-cultured on Mac Conkey agar and Blood Agar. Culture was incubated at 37 °C and identification was done on the basis of culture characteristics and biochemical reactions by following standard microbiological procedures. Morphological assessment using microscopy, oxidase test, catalase test,pigment production, indole, MR, VP,citrate uyilisation test,urease hydrolysis test and nitrate reduction test were done and findings were

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recorded.[3]Pseudomonas aeruginosa were selectively grown on cetrimide agar medium, cetrimide inhibits bacterial growth except P. aeruginosa and enhances fluorescein and pyocyanin pigment production.[4, 5]The confirmed Pseudomonas species were inoculated on Muller Hinton Agar for antimicrobial susceptibility testing by Kirby Bauer Disc diffusion method. For detection of Colistin sensitivity Broth microdilution method was used.[6] The results were interpreted according to CLSI guidelines 2023.[6]

III. RESULT:

The study was cross sectional prospective study conducted in the Department of Microbiology, Santosh Medical College, Ghaziabad for a period of six months from Jan 2023 to June 2023. Out of the total 13480 bacteriological samples collected 267(19.8%) were positive for Pseudomonas Spp. From the confirmed isolates 161(60.2%)were ward samples followed by 106(39.7%)which were from ICUs. Pseudomonas species were mostly isolated from respiratory samples 96(36%),pus samples 79(29.6%),urine samples 67(25.1%),blood samples 14(5.2%) and other samples 11(4.1%)etc. The common age group affected was 41-50 years with a total of 69(25.9%) isolates followed by 51-60 which showed 65(24.3%)isolates,57(21.3%) isolates in elderly patients >60years. The incidence of Pseudomonas infection was highest in respiratory department 71(26.6%), followed by surgery and orthopaedics department68(25.5%), gynae department65(24.3%),ENT department29(10.8%), medicine department 20(7.5%)and paediatrics department 14(5.2%). Most of the patients were immunocompromised with diabetes (56%) being the most common comorbidity followed by other factors like cystic fibrosis (31%),COPD(30%), renal insufficiency (16%) etc. Out of the 267 samples 141 were Pseudomonas aeruginosa and rest were Pseudomonas species.

Table 1: Clinical samples of isolated Pseudomonas species.

Sl. No.	SAMPLE	NUMBER(n=267)
1.	RESPIRATORY SAMPLES	96
2.	PUS SAMPLES	79
3.	URINE SAMPLES	67
4.	BLOOD	14
5.	OTHER SAMPLES	11
TOTAL		267

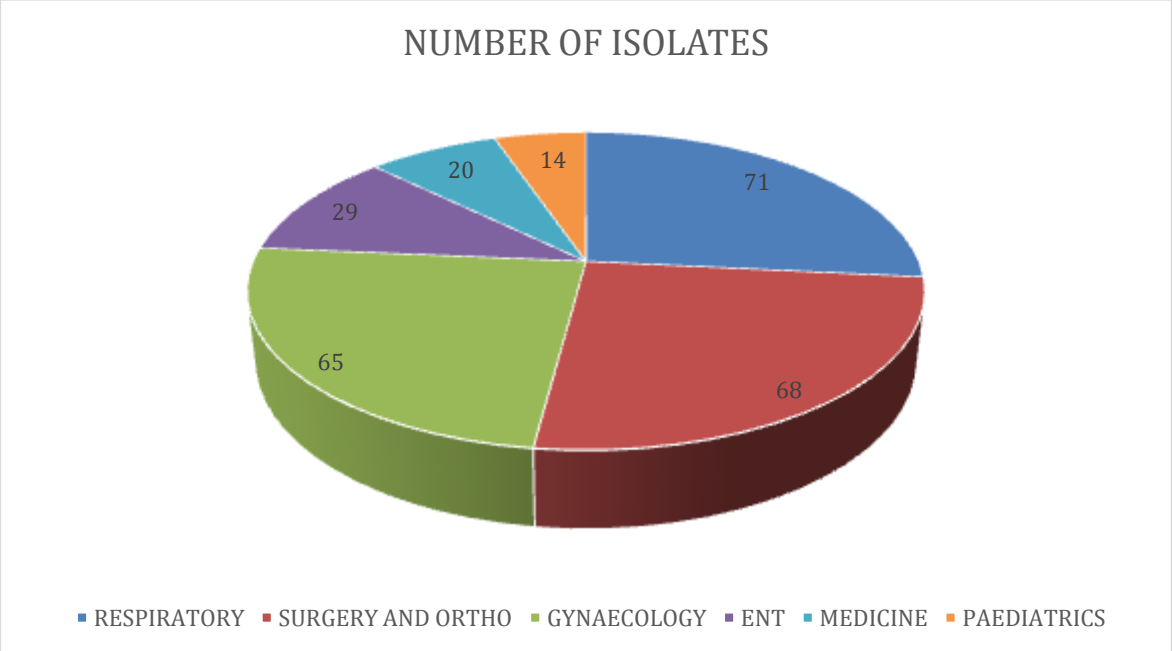

Fig 1:Unit wise distribution of samples

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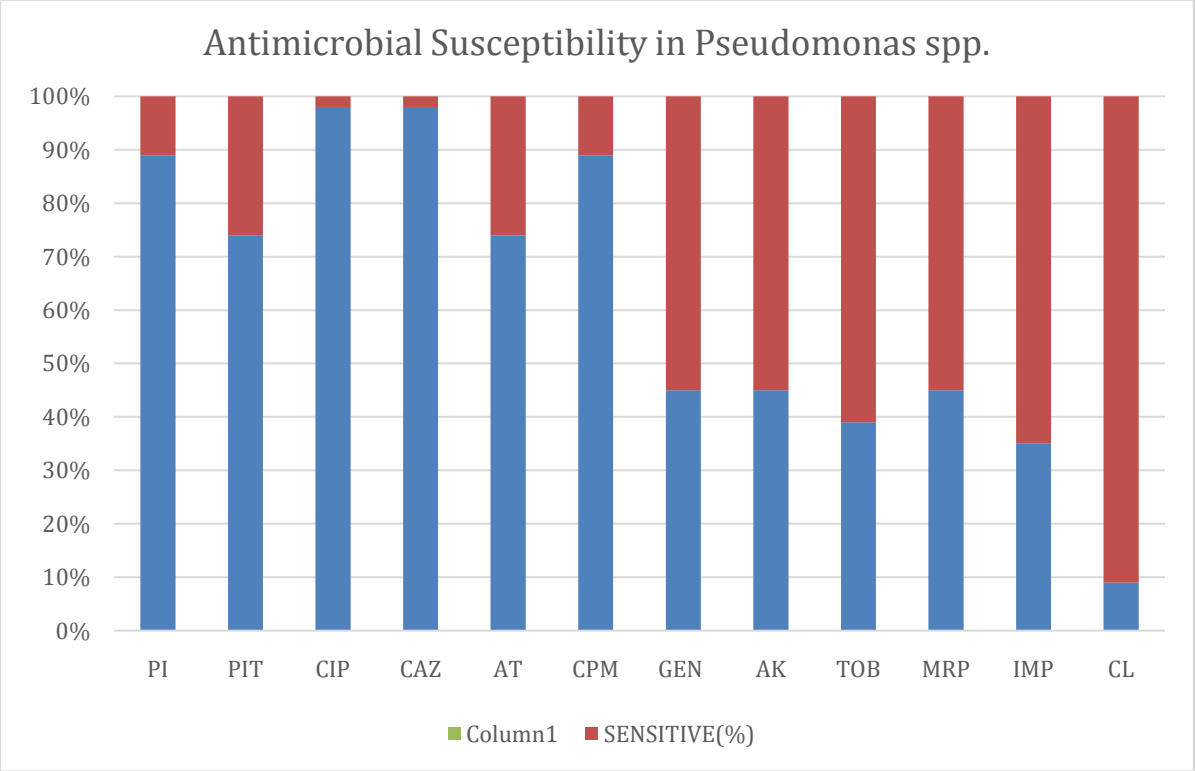

Fig 2:Drug resistance in Pseudomonas spp.

PI-Piperacillin,PiT-Piperacillin/Tazobactum,CIP-Ciprofloxacin,CAZ-Ceftazidime,AT-Aztreonam,CPM-Cefepime,GEN-Gentamicin,AK-Amikacin,TOB-Tobramycin,MRP-Meropenem,IPM-Imipenem and CL-Colistin.

The species were multi drug resistant with piperacillin 89% resistant, Piperacillin Tazobactum was resistant in 74% of isolates,Ciprofloxacin was resistant in 98 %, Ceftazidime was 98% and Cefepime was 89% resistant, Amikacin 45%, Gentamicin was 45% and Tobramycin was 39% resistant. 35% isolates were resistant to Imipenem and 45 % were resistant to meropenem. However, most of the isolates 92% were sensitive to Colistin.

IV. DISCUSSION:

Pseudomonas spp. is a common multidrug resistant bacterium specially in hospital set ups. It is an obligate aerobe, Gram negative bacilli, motile and oxidase positive. Once settled in hospital environment it can easily lead to outbreaks as it is resistant to several disinfectants routinely used. It has been implicated in a spectrum of diseases specially pneumonia and wound infections in burn patients. In our study we could isolate pure growth of Pseudomonas species with 267(19%) isolates which was in concordance to similar articles.[7,8,9]The most common sample were respiratory samples which was also seen in other studies. [7,10]In our study the isolates were resistant to Cephalosporins and Quinolones like Ciprofloxacin. This was in concordance to studies by Biswal et al, [11]Gupta et al[12] and Naseer et al.[13] In the present study the isolates were mostly sensitive to Carbapenems(55-65%) and Colistin(92%).Similar findings were seen by study done by Prasad et al. [14]

The major limitation of our study was that we could not speciate the Pseudomonas species by conventional microbiological procedures and follow up of some patients were not possible as they left against medical advice.

V. CONCLUSION:

Pseudomonas aeruginosa is associated with several complications and emergence of multi drug resistance. Early diagnosis, isolation and antimicrobial susceptibility can help in suitable therapy for the isolate decreasing mortality and morbidity in patients.

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