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Original Research Article

Prevalence of *Pseudomonas aeruginosa* isolates and it's antibiogram in the rural tertiary care hospital

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Abstract

The emergence of *Pseudomonas aeruginosa* as a multidrug resistant strain through mutations in the chromosomal genes which regulate the resistance genes has resulted in making the existing antibiotics obsolete and hence is considered as the most challenging bacteria to treat there by leading to worldwide increase in rate of morbidity and mortality. The clinical samples received to the department of microbiology from different ward, ICU's and OPD's for culture and sensitivity are subjected to standard microbiological procedures including Gram staining, Oxidase and various other biochemical tests and clinical samples are then streaked on MacConkey agar and Blood agar and are then incubated at 37ºc for 18-24 hours and are then subjected to antibiotic sensitivity testing. In our study Pseudomonas aeruginosa was highly resistant to Gentamicin-15 (36.5%), followed by Ciprofloxacin-12 (29.2%), Amikacin-10 (24.3%), Piperacillin-9 (21.9%). Pseudomonas aeruginosa was least resistant to Ceftazidime-8 (19.5%), Imipenem-8 (19.5%) which can be considered as sensitive.

Keywords: Pseudomonas aeruginosa isolates, antibiogram, gram staining

Introduction

Pseudomonas aeruginosa is a aerobic, motile, gram negative rod that belongs to the family, pseudomonadaceae opportunistic pathogen which is now emerging as a multidrug resistant organism which is mainly known to cause wide range of severe infections including Bacteremia, Pneumonia, Meningitis, Urinary Tract Infections, Wound infections [1], Severe burns cases and in infections in immunocompromised individuals and several other Community acquired and 10% of Nosocomial infections [2, 3]. The emergence of *Pseudomonas aeruginosa* as a multidrug resistant strain through mutations in the chromosomal genes which regulate the resistance genes has resulted in making the existing antibiotics obsolete [3] and hence is considered as the most challenging bacteria to treat there by leading to worldwide increase in rate of morbidity and mortality [4, 5]. It can acquire additional resistance genes also from other organisms via plasmids, transposons and bacteriophages other than acquiring through mutations [6, 7, 8]. Thus, the emergence of multidrug resistant *Pseudomonas aeruginosa* is of clinical concern and present study is undertaken to study the prevalence of *Pseudomonas aeruginosa* isolates and its antibiogram

in this geographical area.

Aims and Objectives of the study

1. To estimate the prevalence of *Pseudomonas aeruginosa* isolates in clinical samples.
2. To assess the antibiotic susceptibility pattern among the *Pseudomonas aeruginosa* isolates.

Material and Methods

Study design: Observational study.
Study area: The study was carried out in the microbiology department of the PES Institute of Medical Sciences and Research, Kuppam.
Duration of study: 1-June-2018 to 31-July-2018.

Ethical clearance

The study has been conducted after the approval of the Institutional ethical committee.

Sample collection

Inclusion criteria: All the clinical samples received to the department of microbiology from different wards, ICU's and OPD'S of the hospital.
Exclusion criteria: Samples of patients who are on prior administration of antibiotics.
Sampling method: Convenience sampling.

Sample processing and Antibiogram

The clinical samples received to the department of microbiology from different ward, ICU's and OPD's for culture and sensitivity are subjected to standard microbiological procedures including Gram staining, Oxidase and various other biochemical tests and clinical samples are then streaked on MacConkey agar and Blood agar and are then incubated at 37 ºC for 18-24 hours and are then subjected to antibiotic sensitivity testing. The antibiotic sensitivity test are performed by Kirby Bauer disc diffusion method on Muller-Hinton agar with commercially available antibiotic discs (procured from Hi-Media Mumbai) and then the diameter of zone of inhibition for each antibiotic was measured and interpreted according to CLSI guidelines [4] and the frequency of resistance pattern is noted.

Statistical analysis of data

The data will be entered into MS Excel 2007 version and further analyzed using SPSS 20. For descriptive analysis, the categorical variables will be analyzed by using percentages and the continuous variables will be analyzed by calculating mean ± standard deviation. For inferential analysis the numerical data were analyzed using 't' test, the categorical data were analyzed using Chi square test, will be applied and "p" <0.05 will be considered as statistically significant.

Observations and Results

Among the 511 total clinical samples, 41(8%) isolates of *Pseudomonas aeruginosa* were isolated [Figure-1].

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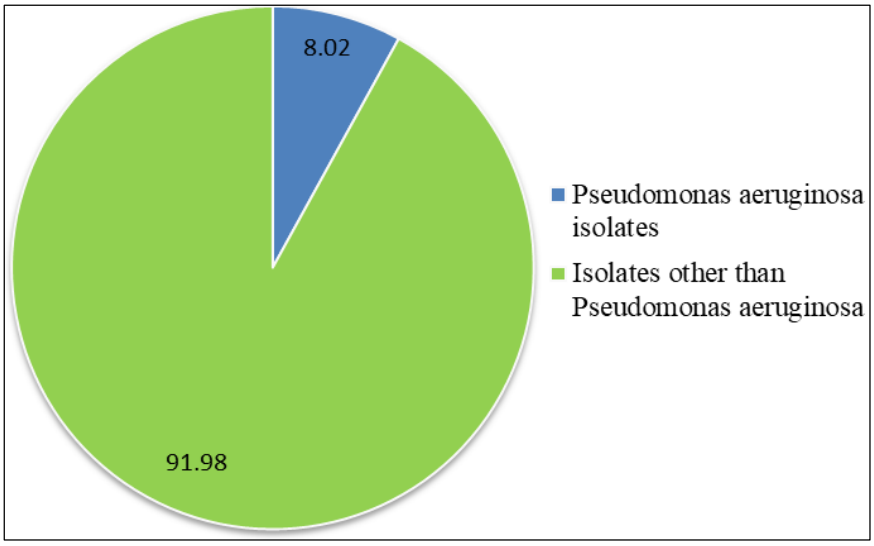

Fig 1: Prevalence of Pseudomonas aeruginosa isolates in clinical samples (n=511)

Table 1: Distribution of age and gender among study participants (n=41)

Age group (in years)	Gender		Total (%)
	Male (%)	Female (%)	
0-10	2	2	4 (9.7%)
11-20	0	0	0 (0%)
21-30	1	2	3 (7.3%)
31-40	4	5	9 (21.9%)
41-50	2	2	4 (9.7%)
51-60	5	3	8 (19.5%)
>60	13	0	13 (31.7%)
Total	21 (65.8%)	14 (34.1%)	41 (100%)

Among the isolated samples males were predominant and mostly belong to age group of above 60 years [Table-1/ Figure-2].

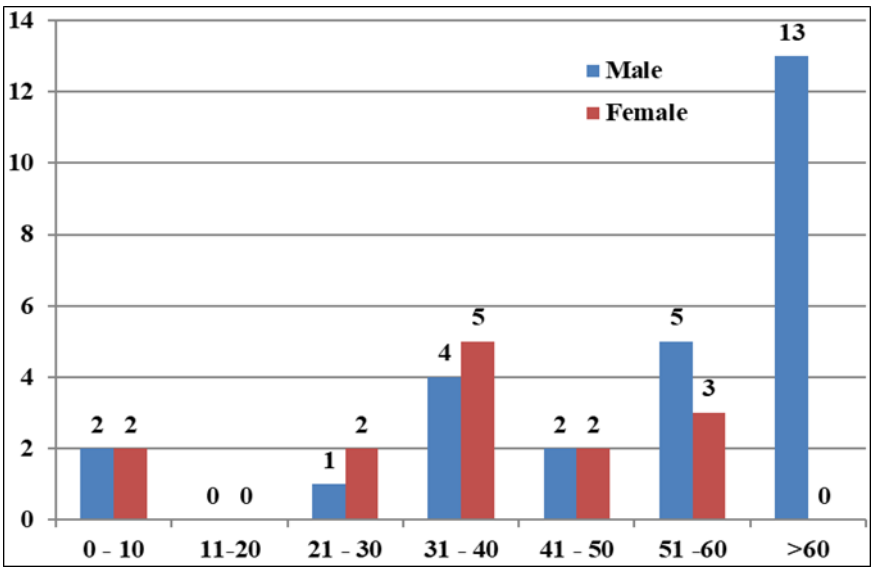

Fig 2: Distribution of age and gender among study participants (n=41)

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Table 2: Distribution of Pseudomonas aeruginosa in relation to clinical samples (n=41)

Clinical sample	Frequency of Pseudomonas aeruginosa Isolates	%
Pus	20	48.7
Blood	7	17.0
Sputum	7	17.0
Urine	3	7.3
ET Tube secretions	3	7.3
Vagina swabs	1	2.4
Total	41	100.0

Of all the samples Pus isolates were 20 (48.7%) being the predominant sample of isolation, which was followed by Blood-7 (17%), Sputum-7 (17%), Urine-3 (7.3%), Endotracheal tube secretions-3 (7.3%) and Vaginal swabs-1 (2.4%) [Table-2/ Figure-3].

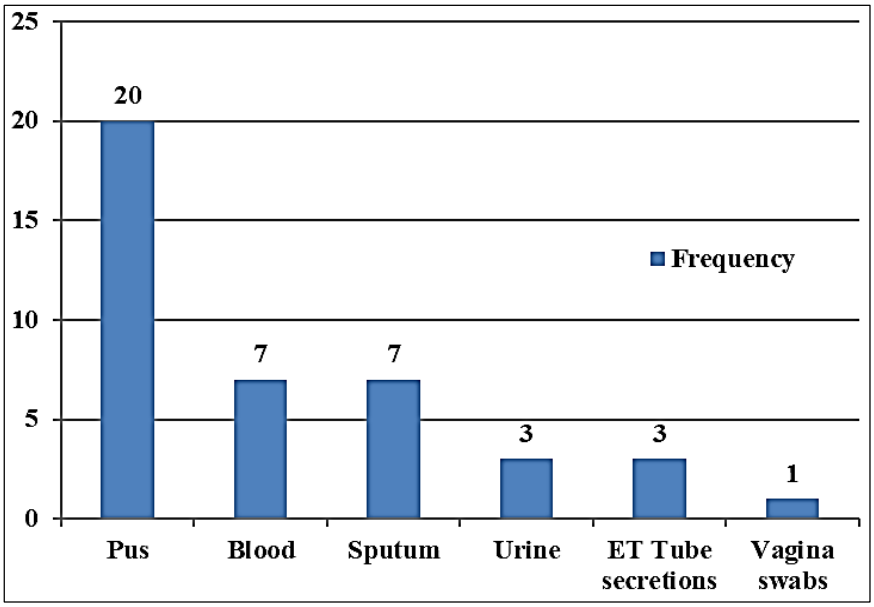

Fig 3: Distribution of Pseudomonas aeruginosa in relation to clinical samples (n=41)

Table 3: Spectrum of Antibiotic Resistance among Pseudomonas aeruginosa isolates (n=41)

Antibiotic	Frequency of Resistant Pseudomonas aeruginosa	%
Gentamicin	15	36.5
Ciprofloxacin	12	29.2
Amikacin	10	24.3
Piperacillin	9	21.9
Ceftazidime	8	19.5
Imipenem	8	19.5

In our study Pseudomonas aeruginosa was highly resistant to Gentamicin-15 (36.5%), followed by Ciprofloxacin-12 (29.2%), Amikacin-10 (24.3%), Piperacillin-9 (21.9%). Pseudomonas aeruginosa was least resistant to Ceftazidime-8 (19.5%), Imipenem-8 (19.5%) which can be considered as sensitive [Table-3/Figure-4].

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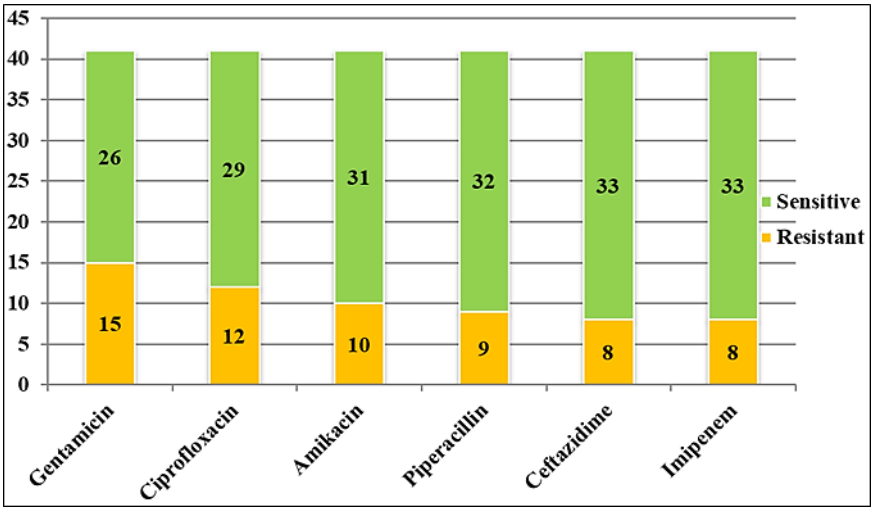

Fig 4: Spectrum of Antibiotic Resistance of Pseudomonas aeruginosa isolates (n=41)

Discussion

Pseudomonas aeruginosa causes life threatening conditions and ranks one of the top five opportunistic nosocomial infections [7]. Resistance to most of anti-pseudomonal agents has increased in the past five years [8]. As *Pseudomonas aeruginosa* demonstrates resistance to multiple antibiotics, it leads to jeopardizing the selection of appropriate treatment and in turn leading to morbidity and mortality amongst the patients. The heightened level of drug resistance is a result of emergence of resistance in specific organism after exposure to antimicrobials as well as of patient-to-patient spread of resistant organisms.

In our survey *Pseudomonas aeruginosa* was predominantly isolated from Pus-20 (48.70%) similar to that has been reported with Senthamarai S *et al.* (47.11%) [5] & Dash M *et al.* (67.6%) [2]. In our study, patients with Diabetes and Urinary tract infections were found to be commonly affected by *Pseudomonas aeruginosa* [Table-4].

Table 4: Different studies on *Pseudomonas aeruginosa*, with pus as predominant sample

Authors and Reference	Region of study	Most predominant sample in the survey
Senthamarai S *et al.* [5]	Kanchipuram, Tamil Nadu	Pus
Dash M *et al.* [2]	South Odisha, India	Pus
Present study	Kuppam, Andhra Pradesh	Pus

Male preponderance with 21 (65.8%) participants was noted in this study similar to that has been reported with Senthamarai S *et al.* 58 (55.76%) [5] & Dash M *et al.* 189 (57.7%) [2] & Anupurba *et al.* 208 (60%) [6]. More outdoor exposure to contaminated areas may be a reason for male preponderance. More number of cases 13 (31.7%) were seen in patients of age group >60 years similar to which has been noted in Dash M *et al.* whereas more number of cases were seen among 20-40 years in case of Senthamarai S *et al.* [5] & Anupurba *et al.* [6].

Table 5: Different studies on *Pseudomonas aeruginosa*, with Male preponderance

Authors and Reference	Region of study	Male Preponderance (%)
Senthamarai S *et al.* [5]	Kanchipuram, Tamil Nadu	58 (55.8%)
Dash M *et al.* [2]	South Odisha, India	189 (57.7%)
Anupurba *et al.* [6]	Varanasi, India	208 (60%)
Present study	Kuppam, Andhra Pradesh	21 (65.8%)

In our present study the highest resistance was showed by Gentamicin (36.5%), Ciprofloxacin

(29.2%), Amikacin (24.3%), Piperacillin (21.9%) similar to which was reported in Dash M *et al*. [2] and the lowest resistance was noted with Ceftazidime (19.5%), Imipenem (19.5%) which can be considered to be sensitive compared to other drugs. The establishment of resistance to above drugs is may be due to inappropriate and irrational usage of anti-pseudomonal agents and patient to patient spread. With prior knowledge of susceptibility pattern in this geographical area, it becomes easy to choose appropriate antimicrobial against these resistant strains and treat efficiently [9, 10].

Conclusion

Our study has revealed that 33 (80.5%) *Pseudomonas aeruginosa* isolates were susceptible to Ceftazidime (19.5%), Imipenem (19.5%) which can be considered as effective drugs as per present review. As the prevalence and antibiotic sensitivity of *Pseudomonas aeruginosa* varies between communities, hospitals present in same community and among different patient populations in same hospital, thus this study has been conducted to institute a system of surveillance about the antimicrobial resistance that is prevailing in this geographical area so that clinicians will have an access to recent data on prevalence of antimicrobial resistance and make an appropriate and rational usage of antibiotics thereby decreasing the development of Multidrug resistant strains of *Pseudomonas aeruginosa* and also useful in providing the effective and accurate treatment for the patients and there by leading to decreasing the rate of morbidity and mortality.

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