

Occurrence of *Pseudomonas aeruginosa* infections in a Tertiary care Hospital

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Abstract: *Pseudomonas* has been recognized as an important nosocomial, health care associated pathogen, selected out due to indiscriminate use of antibiotics. They are multidrug resistant, contributing to treatment problems. The present study was undertaken to determine the occurrence of *Pseudomonas* as a hospital pathogen from various clinical samples and to ascertain its sensitivity pattern along with a clinico-bacteriological correlation. Cultural analysis was undertaken on solid and liquid media. Antimicrobial susceptibility was done using CLSI Guidelines. The occurrence as a hospital pathogen was 3.1%. The male female ratio 1.2: 1. Patients belonged to age groups above 51 years (55.4%). Pus samples yielded the maximum isolates of *Pseudomonas* (40.2%), followed by endo tracheal tubes (24.5%). Patients with *Pseudomonas* infection were predominantly from ICU (31.8%), Surgical wards (23.8%) and Burns unit (16.4%). Clinically, patients presented with wound infections (41.2%) and Pneumonia (25.5%). Risk factors identified were patients on ventilator (25.1%), prolonged antibiotic use (16.8%) and urinary catheter (12.9%). Periodic surveillance with knowledge of *Pseudomonas* isolation rate and susceptibility pattern is essential to guide physicians to choose appropriate antibiotics. This will reduce mortality and morbidity associated with these infections.

Key words: *Pseudomonas*, Non fermentors, Nosocomial pathogen

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I. Introduction

Pseudomonas aeruginosa belonging to the family Pseudomonadaceae, are motile oxidase positive, pigment producing, non fermenting gram negative bacilli. These organisms are aerobic and do not utilise glucose as an energy source. They are ubiquitous in nature and occur as saprophytes in the environment.

This group of bacteria have been associated with infections in hospitalised patients and immunocompromised. They are considered as notorious health care associated pathogens. They have been incriminated as causative agents of various pyogenic infections, including surgical wound infections, burn wounds, urinary, respiratory and orthopaedic infections amongst others.¹

A rapid increase in drug resistance among clinical isolates of *Pseudomonas aeruginosa* has posed a serious threat to the treating physician and surgeon, limiting their treatment options. These organisms are known to be intrinsically resistant to many antibiotics and are potent metallo beta lactamase producers; an important factor interfering with optimum patient management.²

The serious problem of its association as a nosocomial pathogen in critical care wards and ICU and as well as other hospital areas, merits their isolation and need for determination of the antibiogram pattern. This will serve as a useful guide to the treating doctor.

The present study was therefore undertaken to determine the frequency of isolation of *Pseudomonas aeruginosa* from various clinical samples, to evaluate their antibiogram pattern, to obtain a clinico-bacteriological correlation and to elucidate the risk factors involved.

II. Material And Methods

The present study was undertaken in the Department of Microbiology, Goa Medical College, Bambolim Goa, over a period of one year extending from January to December 2017.

All samples were subjected to primary Gram staining for presence of organisms as well as pus cells. Culture of these samples was then done on Blood agar and MacConkey agar along with liquid media ie. Glucose Broth. These media were incubated at 37° C for 18 to 24 hours. The inoculated plates were examined subsequently for bacterial growth. Suspected colonies of *Pseudomonas* were identified using standard microbiological techniques; which include colony morphology, gram staining and biochemical reactions.³ The glucose broth was subcultured on to solid media, whenever primary culture yielded no positive result.

Antimicrobial susceptibility was performed by using Kirby Bauer's disc diffusion method as per CLSI guidelines, using the recommended anti pseudomonal antimicrobials.⁴

III. Results

A total of 27700 samples were processed during the study period for bacterial pathogens. Non fermenting gram negative bacilli (NFGNB) were isolated from 1990 cases i.e. 7.2%. Among the NFGNB, *Pseudomonas aeruginosa* accounted for 850 cases (42.7%). The overall isolation rate for *Pseudomonas* among all samples processed was 3.1% (Table no 1).

Table no 1: Culture result of NFGNB and *Pseudomonas aeruginosa* during the study period

| Number of samples processed | Number yielding NFGNB | Number yielding <i>Pseudomonas aeruginosa</i> |
|-----------------------------|-----------------------|---|
| 27700 | 1990 (97.2%) | 850 (3.1%) |

Males accounted for 54.1% (n=460), while females with *Pseudomonas* infection were 45.9% (n=390). The male female ratio was 1.2:1. Age wise distribution of the patients is depicted in Table no.2. A large number of cases of *Pseudomonas* infection were seen in age groups 51-60 years (23.9%) and > 61 years (31.5%). Occurrence of *Pseudomonas* was low in the younger age group i.e. 0-10 years (3.1%), 11-20 years (5.8%) and 21-30 years (7.6%).

Table no 2: Age wise distribution of Patients

| Age in years | Number | Percentage |
|--------------|--------|------------|
| 0-10 | 26 | 3.1 |
| 11-20 | 49 | 5.8 |
| 21-30 | 65 | 7.6 |
| 31-40 | 92 | 10.8 |
| 41-50 | 147 | 17.3 |
| 51-60 | 203 | 23.9 |
| >61 | 268 | 31.5 |
| Total | 850 | 100 |

Distribution of samples yielding *Pseudomonas* on culture is seen in Table no. 3. Isolation of *Pseudomonas* was predominantly from pus (40.2%), endo tracheal tube (24.5%) and urine (19.9%). Sputum, blood and body fluids yielded a low number i.e. 2.4%, 4.9% and 7.5% respectively.

Table no 3: Samples yielding *Pseudomonas aeruginosa*

| Sample | Number | Percentage |
|--------------------|--------|------------|
| Pus | 342 | 40.2 |
| Sputum | 20 | 2.4 |
| Endo tracheal tube | 208 | 24.5 |
| Urine | 169 | 19.9 |
| Blood | 42 | 4.9 |
| Body fluids | 64 | 7.5 |
| Suction tip | 0 | 0.6 |
| Total | 850 | 100 |

A large number of patients whose samples yielded *Pseudomonas aeruginosa* on culture, were those admitted in the ICU (31.8%), Surgical wounds (23.8%) and burns unit (16.4%) (Table no 4).

Table no 4: Ward wise distribution of patients yielding *Pseudomonas aeruginosa*

| Ward | Number | Percentage |
|--------------------|--------|------------|
| ICU | 270 | 31.8 |
| Medical wards | 97 | 11.4 |
| Paediatric wards | 26 | 3.1 |
| Pulmonary Medicine | 32 | 3.7 |
| Skin ward | 16 | 1.9 |
| Surgical wards | 202 | 23.6 |
| Burns unit | 140 | 16.4 |
| Orthopaedic wards | 13 | 1.5 |
| OBG wards | 45 | 5.3 |
| ENT wards | 9 | 1.1 |
| Total | 850 | 100 |

Analysis of clinical diagnosis of the patients whose samples grew *Pseudomonas* on culture showed that a large number of them had wound infections (n=350; 41.2%), followed by Pneumonia (n=217; 25.5%) and UTI (n=169; 19.9%). Meningitis and septicaemia were seen in 60 (7.1%) and 54 (6.3%) cases respectively.

Risk factors associated with *Pseudomonas* infections included patients on ventilators (n=213; 25.1%), prolonged antibiotic therapy (n=143; 16.8%) and presence of urinary catheter (n=110; 12.9%), among others ie. corticosteroid use (n=94; 11.1%) and immunocompromised state (n=100; 11.8%).

The antimicrobial susceptibility of *Pseudomonas* isolates in the study can be analysed in Table no.5. Colistin sensitivity was highest ie. 83.4%, followed by Imipenem, Meropenem and Piperacillin+ tazobactam (59.3% each). Aztreonam sensitivity was found to be 57.7%. Aminoglycosides ie. Amikacin, Gentamicin and Netilmicin showed a sensitivity of 48.45, 47.1% and 48.4 % respectively. Sensitivity to Quinolones was 48.4%. Among the Cephalosporins, Cefepime sensitivity was low ie 24.9%.

Table no 5: Antibiotic Sensitivity pattern of *Pseudomonas aeruginosa*

| Antibiotic | Number | Percentage |
|-------------------------|--------|------------|
| Imipenem | 515 | 59.3 |
| Meropenem | 515 | 59.3 |
| Amikacin | 420 | 48.4 |
| Gentamicin | 409 | 47.1 |
| Netilmycin | 420 | 48.4 |
| Ciprofloxacin | 420 | 48.4 |
| Levofloxacin | 420 | 48.4 |
| Aztreonam | 501 | 57.7 |
| Colistin | 724 | 83.4 |
| Ceftazidime | 390 | 44.9 |
| Cefepime | 216 | 24.9 |
| Piperacillin+Tazobactam | 515 | 59.3 |

IV. Discussion

Pseudomonas aeruginosa has emerged as an important troublesome agent of community acquired and health care associated infections. *Pseudomonas* contributed to 3.1% of total isolates in the present study. Pathi et al encountered 8.43% of *Pseudomonas* in their study in Odisha, India.⁵ A higher isolation rate of 16.9% was observed by Bhargava et al.⁶

Male female ratio as was 1.2:1 in the present study. Similar male predominance was seen in the study of Pathi et al⁵ and Raman et al.⁷ Elderly individuals above 51 years of age were affected in the present study (55.4%). Similar predominance among the elderly was observed in the study of Mayank et al.⁸ This is probably related to presence of co morbid conditions in the elderly, predisposing them to *pseudomonas* infections.

In the present study *Pseudomonas aeruginosa* was isolated predominantly from pus (40.2%), Endotracheal tubes (24.5%) and urine (19.9%). Similarly, Pathi et al had highest recovery rate of *Pseudomonas* from pus / wound swabs, followed by urine and sputum.⁵ Ramana et observed a higher isolation rate from urinary catheters (52%).⁷ The clinical samples yielding *Pseudomonas* may vary from place to place and is a reflection of the types of clinical conditions attributable to *Pseudomonas*.

Analysis of Unit wise distribution of patients yielding *Pseudomonas* revealed that 31.8% of patients were admitted to the ICU, 23.8% in surgical wards and Burns Unit (16.4%). Renuga et al encountered their isolation of *Pseudomonas* from surgical and orthopaedic wards and ICU.⁹ *Pseudomonas* exhibits resistance to commonly used antiseptics and tend to colonise various surfaces, giving them survival advantage in ICU and Burns wards.

Patients yielding *Pseudomonas* predominantly had clinical diagnosis of wound infection (41.2%), Pneumonia (25.5%) and UTI (19.9%). Similar high isolation of *Pseudomonas* from wounds was seen in the study of Renuga et al.⁹ This organism has been frequently associated with chronic non healing ulcers and Ventilator associated Pneumonia.¹

Risk factors identified in the present study were patients on ventilator (25.1%), prolonged antibiotic therapy (16.8%) and presence of Urinary catheter (12.9%). These risk factors can probably serve as predictors of outcome and are responsible indirectly for lowering the individual's immune status.

Antimicrobial susceptibility pattern of isolates fortunately showed 83.4% sensitivity to Colistin and 59.3% sensitivity to Carbapenems. However, susceptibility to other antimicrobials was low. Similar findings were observed in the study of Upadhyay et al.¹⁰ Resistance of *Pseudomonas* to carbapenems is predominantly due to production of various metallo beta lactamases. Documentation of Carbapenem resistance is therefore essential to create awareness amongst clinicians, so as to select appropriate antibiotic therapy.

In order to curtail survival of *Pseudomonas* in hospital environment, infection control measures need to be in place, with special attention to be given to hand washing and isolation in high risk areas.

V. Conclusion

The occurrence and sensitivity profile of *Pseudomonas* varies geographically and within units of a hospital. It is therefore essential to have knowledge of the prevalence of *Pseudomonas* and its antibiotic sensitivity pattern, so as to select appropriate empiric therapy and minimize mortality. Further, judicious use of antimicrobials will go a long way to control drug resistance, which is at its high, at this point of time.

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