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Antibiotic Sensitivity Pattern *In Pseudomonas Aeruginosa* Among Various Samples: A Study From National Medical College, Birgunj, Nepal

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Abstract:

Introduction: *Pseudomonas aeruginosa* is a Gram-negative bacterium with resistance to manyantibiotics, causing severe infections in immunocompromised individuals. Resistance patternsvary geographically and over time, with beta-lactams showing high resistance to penicillins and cephalosporins, carbapenems increasing resistance, aminoglycosides having variable susceptibility, fluoroquinolones being common, and polymyxins reserved for multidrug- resistant cases. Management involves prevention, culture, prompt antimicrobial therapy, and combination therapy. In our present study, we will study the antibiotic sensitivity pattern *in P.aeruginosa.* **Aim & Objectives:** The aim and objectives of present study is to isolate *Pseudomonas aeruginosa* among various samples and estimate its antibiotic sensitivity pattern.

Material & Methods: The study analysed antibiotic sensitivity patterns in *Pseudomonas aeruginosa* from clinical samples, using 50 non-repetitive isolates from outpatient and inpatientdepartments. The modified Kirby-Bauer disc diffusion method was used for antimicrobial susceptibility testing in the Department of Microbiology, National Medical College, Birgunj, Nepal, between 1 st July 2022 and 30 th June 2023. **Results:** *Pseudomonas aeruginosa* was found to be most abundant in pus samples, followed by ear swabs, urine, sputum, E.T. secretion, and blood. Out of 50 isolates, the most sensitive were Polymyxin-B (98%), Colistin (98), Imipenem (89%), Cefeparazone/Salbactum (86%), Meropenem (84%), Pipercillin/Tazobactum (82%),
ciprofloxacin (72%), and cefepime (38%).

Conclusion: The study identifies a drug for *Pseudomonas aeruginosa* infection, focusing on species-level identification and resistance mechanisms, promoting judicious use of chemotherapeutic agents

Keywords: Pseudomonas aeruginosa, Polymyxin-B, Colistin, Infection

Introduction:

Pseudomonas aeruginosa is a Gram-negative bacterium with resistance to manyantibiotics due to efflux pumps, low outer membrane permeability, and β-lactamases. It can cause severe infections in immunocompromised individuals, including pneumonia, urinary tract infections, sepsis, and skin infections. Resistance patterns vary geographically and over time, with beta-lactams showing high

resistance to penicillins and cephalosporins, carbapenems increasing resistance, aminoglycosides having variable susceptibility, fluoroquinolones being common, and polymyxins reserved for multidrug-resistant cases.

Pseudomonas aeruginosa is a common cause of nosocomial infections, particularly pneumonia in immunocompromised hosts and individuals with structural lung diseases like cystic fibrosis.(1) The pathogen is causing increasing antimicrobial resistance, including multi-drug resistant (MDR) isolates. Its virulence mechanisms include secreted toxins, quorum sensing, and biofilm formation. Management of *P. aeruginosa* involves prevention, culture, prompt antimicrobial therapy, and combination therapy. Newer antibiotics are increasingly used against *MDR P. aeruginosa*.(1)

Recent studies in the Arabian Gulf region reveal a high resistance to meropenem and colistin, with increased resistance in Kuwait and Qatar. In Saudi Arabia, a rise in resistance toazoleonam, imipenem, and meropenem was observed. (2) *P. aeruginosa* showed higher sensitivity to meropenem, piperacillin-tazobactam, and amikacin, with resistance more pronounced against cefixime, netilmicin, ceftriaxone, and aztreonam.(3) Polymyxin-B and colistin were highly effective compared to other antibiotics.(4)

The present study was undertaken with an objective to antibiotic sensitivity pattern in *Pseudomonas aeruginosa* among various samples at a tertiary care Hospital in Birgunj, Nepal.

Aims & Objectives:

Aims:

- To estimate the antibiotic sensitivity pattern in *P.aeruginosa* in various samples.Objectives:
- To isolate *P.aeruginosa* in various samples.
- To estimate antibiotics sensitivity pattern.

Material & Methods:

The study aimed to detect antibiotics sensitivity pattern in *Pseudomonas aeruginosa* among various samples in Department of Microbiology, National Medical College, Birgunj, Nepal. The research was conducted from 1 st July 2022 to 30 th June 2023 using 50 non-repetitive clinical isolates from outpatient and inpatient departments.The study was a descriptive observational with cross-sectional design, involving urine, body fluids, pus, sputum, swabs, ET secretion, and ear swabs. Patients were informed about the research and confidentiality of their personal information.

Ethical- Ethical clearance has been issued from IRC National Medical college and Teaching Hospital, Birgunj, Nepal on 20 th February, 2022. (Ref. F-NMC/652/079-080).

The organism that grew as non-lactose fermenter on MacConkey agar and produce alkaline reaction in TSI was provisionally considered as *Pseudomonas aeruginosa*. All clinical samples were processed immediately and routine culture as per standard protocol:

- Culture characteristic: Nutrient agar, 5% Blood agar and MacConkey agar
- Pigment production: Blood agar and Nutrient agar

- Morphology and Gram's stain
- Motility: Hanging drop preparation.
- Catalase test
- Oxidase test
- Indole, Methyl red, Voges Proskauer, Citrate utilization test, Urease test, and Triplesugar iron reaction.

Antibiotic Sensitivity Test:

The modified Kirby-Bauer disc diffusion method was used for antimicrobial susceptibility testing. Inoculums with a turbidity equivalent to a 0.5 McFarland standard and Muller Hintonagar plates with commercially available antibiotic discs were used. The plates were inoculated within 15 minutes of suspension preparation, and antibiotic discs were applied andkept in an incubator overnight. The zone of inhibition wasmeasured and recorded, comparing it to manufacturer interpretation charts.

Table 1: Following antibiotics discs from (Hi media), Mumbai.

Antibiotic	Potency(µg)	Abbreviation
Ampicillin	**30 µg**	**AMP**
Ceftazidine	**30 µg**	**CAZ**
Cefotaxime	**30 µg**	**CX**
Ceftriaxone	**30 µg**	**CTR**
Aztreonam	**30 µg**	**AT**
Amikacin	**30 µg**	**AK**
Tobramycin	**10 µg**	**TB**
Pipercillin/Tazobactum	**75 µg /10 µg**	**PIT**
Cefepime	**30 µg**	**CPM**
Cefoperazone/Salbactum	**75 µg /30 µg**	**CFS**
Ceftazidine/Clavulanic acid	**30 µg /10 µg**	**CTX/CA**
Ciprofloxacin	**5 µg**	**CIP**
Imipenem	**10 µg**	**I**

Meropenem	**10 µg**	**MR**
Polymyxin B	**300 unit**	**PB**
Colistin	**10 µg**	**CL**

Results:

Table 2: Types of Clinical Samples from which *Pseudomonas aeruginosa* isolated

Clinical specimens	No. of isolates (n=50)	%
Foley's tip	1	2
Catheter tip	1	2
Blood	2	4
ET secretion	2	4
Sputum	7	14
Urine	9	18
Ear swab	13	26
Pus	15	30

Above the table 2 show that *Pseudomonas aeruginosa* isolated maximum from pus samples i.e. 15 followed from ear swab 13, 9 from urine, 7 from sputum, 2each from E.T. secretion andblood, least from Foley's tip and catheter tip 1each.

Table 3: Antibiotic Sensitivity pattern in *P.aeruginosa*

Antibiotic Sensitivity pattern	***Pseudomonas aeruginosa*(n=50)** **No.**	**(%)**
Ampicillin	**0**	**00**
Amikacin	**31**	**62**
Cefotaxime	**19**	**38**
Ceftazidime	**21**	**42**
Ceftriaxone	**20**	**40**
Pipercillin/Tazobactum	**45**	**90**
Polymyxin -B	**49**	**98**
Colistin	**49**	**98**
Aztreonam	**20**	**40**
Tobramycin	**30**	**60**
Ciprofloxacin	**28**	**56**
Cefepime	**39**	**68**
Cefeparazone/Salbactum	**43**	**86**
Meropenem	**42**	**84**
Imipenem	**46**	**89**

As shown in table 3, Out of 50 isolates of *Pseudomonas aeruginosa*, maximum sensitivity against Polymyxin- B 98%, Colistin 98%, Imipenem 89% , Cefeparazone/ Salbactum 86%, Meropenem 84%, Pipercillin / Tazobactum 82%, ciprofloxacin 72%, Cefepime 80%, amikacin, colistin 62% each, tobramycin 60%, ceftazidime 42%, Ceftriaxone and aztreonam40% each, least cefotaxime 38% and Ampicillin show no sensitivity.

Discussion:

Pseudomonas aeruginosa is a major cause of nosocomial infections, despitesanitationimprovements and antimicrobial agents. A study was conducted in Department of Microbiology, National Medical College, Birgunj, Nepal.

The study found that out of 50 *Pseudomonas aeruginosa* isolated from clinical samples, the maximum was found in pus (30%) and ear swab (26%), consistent with previous studies (69, 55.1%, Sharma A et al, 2012).[5]

The study analyzed the sensitivity of *Pseudomonas aeruginosa* isolates to various antibiotics. It found that the isolates showed no sensitivity to Ampicillin, Amikacin, Cefotaxime, Ceftazidime, Ceftriaxone, Pipercillin/Tazobactum, Polymyxin-B, Aztreonam, Tobramycin, Ciprofloxacin, Cefepime, Cefeparazone/Salbactum, Meropenem, and Imipenem. The sensitivity of *Pseudomonas aeruginosa* was comparable to other studies, with lower sensitivityreported by Farida et al.[6], Goel et al.[7]and others.

The sensitivity of *Pseudomonas aeruginosa* to Cefepime was lower than other studies, with lower sensitivity reported by Juyal D et al.[8], and lower sensitivity reported by D' Souza et al.[9], respectively. The sensitivity of *Pseudomonas aeruginosa* to Imipenem was also lower than other studies, with a sensitivity of 89%. The study highlights the importance of understanding the sensitivity of *Pseudomonas aeruginosa* isolates to antibiotics.

Summary:

The study aimed to detect antibiotic sensitivity pattern in *Pseudomonas aeruginosa* among various samples in Department of Microbiology, National Medical College, Birgunj, Nepal. It tested 50 isolates from non-repetitive samples, identifying and their antimicrobial susceptibility patterns.

- Maximum number of samples were obtained from Pus sample (30%) followed by samples from Ear swab (26%).
- Polymyxin-B and Colistin showed maximum sensitivity (98%) followed by Imipenem 89% against *Pseudomonas aeruginosa*.

Conclusion:

The study aims to identify the drug for *Pseudomonas aeruginosa* infection, focusing on species-level identification and resistance mechanisms. This helps in judicious use of chemotherapeutic agents against resistant bacteria, reducing selection pressure and reducing survival advantage. Proper drug sensitivity pattern administration is recommended for effectivetreatment, reducing patient burden and treatment costs. This approach will improve patient careand reduce treatment costs.

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