



# Clinical Impact and Emerging Multi Drug Resistance of *Acinetobacter Baumannii* and *Pseudomonas Aeruginosa* Isolates

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## ABSTRACT

**Background:** *Acinetobacter* and *Pseudomonas* are the two most important member of the Non fermenter group. They cause serious life threatening infections. They are mainly nosocomial causing infection in deprived immunity. Multi drug resistance is the major problem which may be intrinsic, or extrinsic.

**Methods:** It was a prospective study done in tertiary care hospital, Surat. All clinical samples were included. Processing of samples, identification of isolates and antibiotic susceptibility were done using standard guidelines. Clinical correlation of the patients was done.

**Result:** Total 151 samples showed growth of *Acinetobacter* and *Pseudomonas*. *A. Baumannii* was the most common isolated followed by *P. aeruginosa*. Only Polymyxins showed complete sensitivity. Most of the isolates were from surgical and orthopedic wards with trauma as predominant infectious cause. Monomicrobial infections and male preponderance were observed. Most of the patients got discharged within 10 days of admission. Clinical outcome showed 72 % of discharge rate followed by death.

**Conclusion:** The only group having complete sensitivity towards organisms was the Polymyxin group. The most common cause being trauma, strict infection control practices with emphasis on hand hygiene should be followed to prevent emergence of pan drug resistant bacteria.

**Keywords:** *A. Baumannii*, *P.aeruginosa*, Multi Drug Resistance, Clinical Impact

## Introduction

*Acinetobacter* and *Pseudomonas* are the two most important member of the Non fermenter group. Current literature review shows that these organisms are now associated with life threatening infections such as septicemia, pneumonia, urinary tract infections, meningitis, surgical site infections, ventilator associated pneumonia, wound infections, osteomyelitis, peritonitis, cirrhosis of liver etc [1]. They cause infections in patients with deprived immunity. They are mainly nosocomial. They are isolated from different samples like pus, swabs from wound/ discharge, urine, body fluids, respiratory samples including sputum, endotracheal tube tips etc. These gram negative bacilli have also been isolated from the blood culture of patients admitted to high risk units like oncology, nephrology, burns, neonatal intensive care unit and cardiology irrespective of their age group. With specific references to intensive care units and major superficial and systemic infections, *Pseudomonas aeruginosa* is the most common isolate followed by *Acinetobacter* and *Alcaligenes*. Bacteremia due to *Pseudomonas* and *Acinetobacter* has become an important cause of morbidity and mortality in hospital acquired infections [2]. In addition to that, they are prone to cause lower respiratory tract infection (LRTI), mainly

in intensive care unit patients in the form of ventilator associated pneumonia (VAP). This LRTI is the fastest leading cause of the morbidity and mortality in the world. The main organism causing VAP is *Acinetobacter*.

Today drug resistance to these organisms is a matter of concern. One reason is intrinsic resistance and over as well as inappropriate use of the antibiotics. The another major reasons of multi drug resistance is due to mutations in their outer membrane porins resulting in reduced permeability to antimicrobials and over expression of multi drug efflux pumps. Commonly used drugs for non fermenters are mainly Carbapenems and they are often the agents of last resort. Imipenem and Meropenem are very good choice of drugs with good potency and efficacy as well as economical to the patients having good outcomes. Thus, the emergence of Carbapenem resistance in *Pseudomonas aeruginosa* and *Acinetobacter baumannii* is of particular concern [3]. The rapid emergence of a wide variety of antibiotic resistance genes, as well as their ability to survive in various harsh environmental conditions has caused difficulties in the control and eradication of the pathogen. Accurate identification of non fermenters is therefore important for proper patient management in terms of selection of appropriate antimicrobials and early cure of the patients.



**Materials and Methods**

It was a prospective analytical study done in tertiary care hospital, Surat. All clinical samples received by Microbiology Department were included in the study. The processing of sample was done as per routine protocol, using standard guidelines. Isolates were identified by gram stain, motility, colony characteristics, colony smear, growth at 42°C, different biochemical reactions like citrate utilization tests, triple sugar iron test, arginine dehydrolase test, lysine decarboxylase test, sugar fermentation test etc. the antibiotic susceptibility was done using Kirby bauer disc diffusion method and results interpreted as per CLSI guidelines 2017 [4]. The follow up of the patients was done with the help of case paper review from medical record office. All necessary details like demographic data, clinical history, diagnosis, treatment, outcome etc were noted in Microsoft excel sheet and data analyzed.

**Result**

Total of 4089 samples were received in laboratory in 3 months. Out of which 151 samples showed growth of non fermenters. *Acinetobacter baumannii* (85/157) was the most common organism isolated in the study followed by *Pseudomonas aeruginosa* (66/157). Swab from wound discharge or pus was the most common sample from which

these organisms were isolated. Pleural fluid showed 80 % isolation rate of *P. aeruginosa* whereas urine and drain showed 100 % isolation rate. *A. baumannii* showed 80 % isolation rate from endotracheal tube tips and blood culture whereas 100 % isolation rate from cerebrospinal fluid and sputum. Total body fluids account for 7 % with isolation rate from cerebrospinal fluid accounting for 2%. Sensitivity of *P. aeruginosa* and *A. baumannii* is shown in Figure 1 & 2.

The most common ward of isolation was surgical followed by orthopedic, medicine, paediatric and medical as well as neonatal ICU. Neonatal ICU showed 100 % *A. baumannii* isolates whereas medical ICU 80 %. *P. aeruginosa* and *A. baumannii* both were more common in elderly age group that is >60 and >75 years of age respectively. The male:female and mono:polymicrobial infection isolation rate was 2:1. Most common polymicrobial infection was associated with orthopedic and surgery with most common organism isolated *S. aureus* and *K. pneumoniae* respectively. In almost 50% of patients, WBC showed higher values. Apart from this, around 60-70 % patients showed low albumin, low total protein and low serum sodium in biochemical report as well as low hemoglobin levels in pathological report.

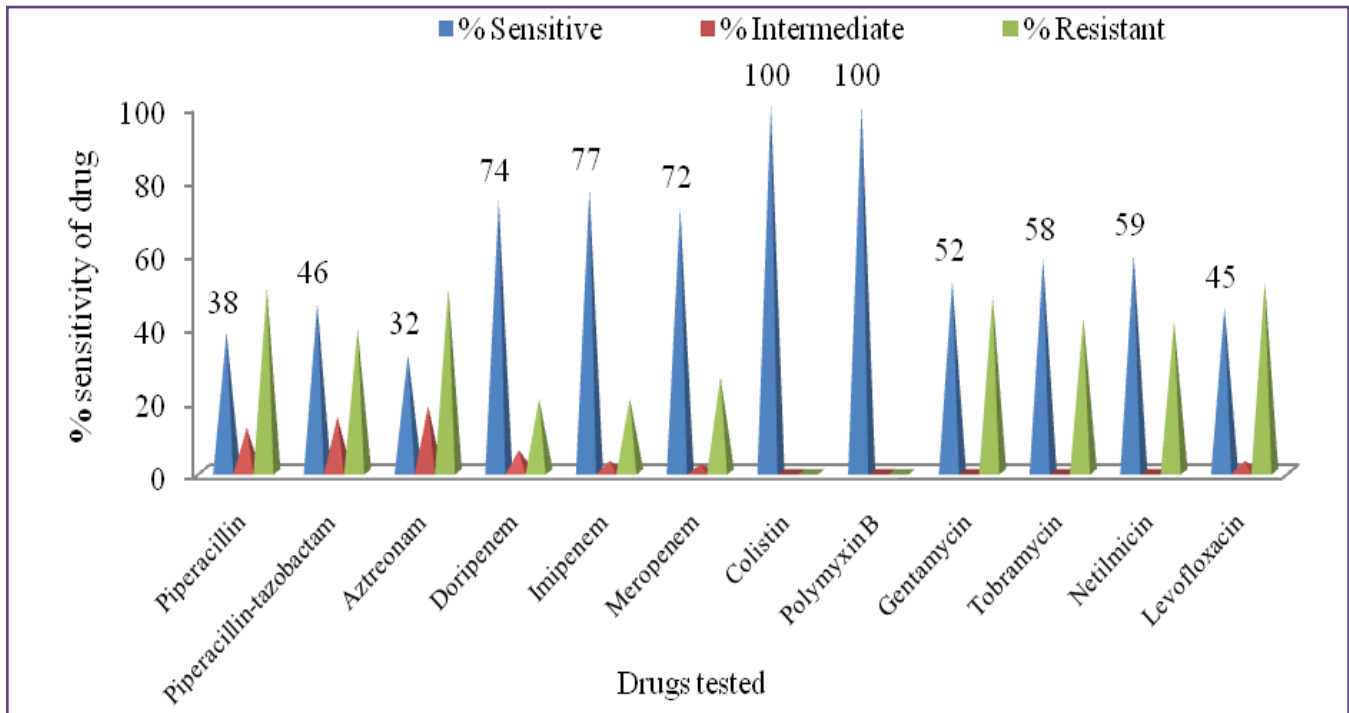


Fig. 1: Antibiotic susceptibility of *P.aeruginosa*.

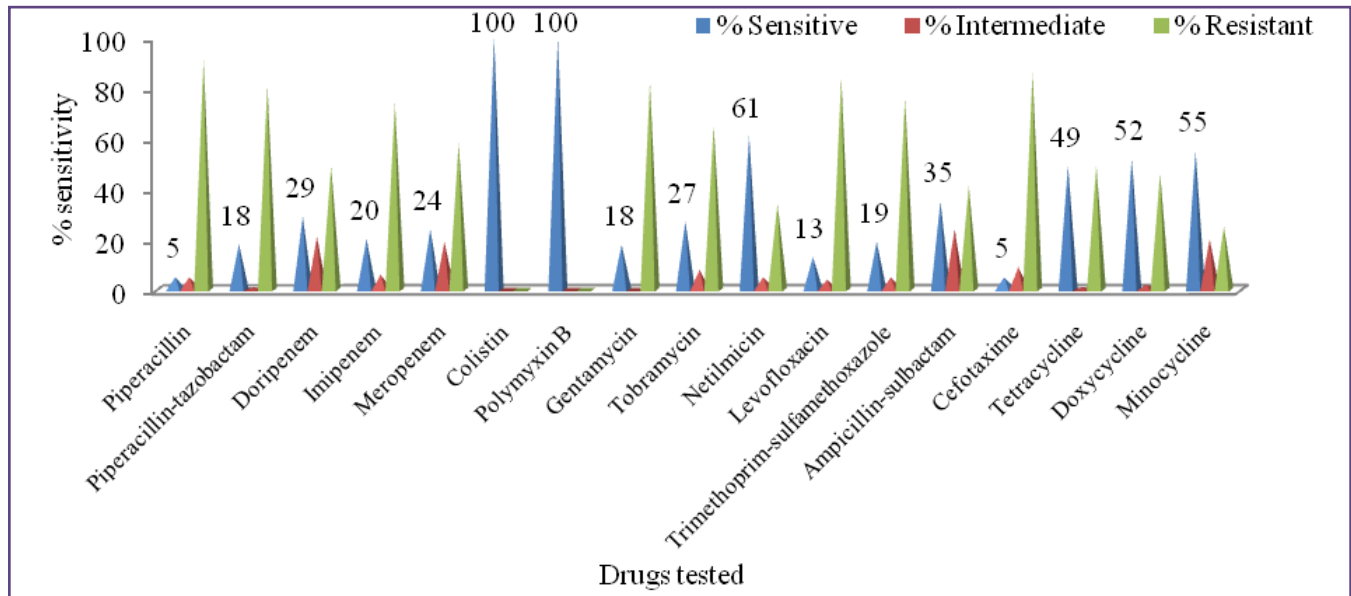


Fig. 2: Antibiotic susceptibility of *A. baumannii*.

## Discussion

*A. baumannii* isolates showed resistance towards Piperacillin and Piperacillin-tazobactam combination for around 70-80% [5]. Rit, *et al* [6] and Shete, *et al* [7] study show good sensitivity towards Imipenem (90%) and Meropenem (100%) respectively, while present study shows only 20-25 % sensitivity towards Carbapenems. Sensitivity of Aminoglycosides and Cefotaxime is also similar in these studies showing only 5-20 % sensitivity [8, 9], whereas tetracycline shows around 50% sensitivity.

Result of sensitivity of Piperacillin for *P.aeruginosa* matched with the Benachinmardi *et al* [10], whereas that of Piperacillin-tazobactam matched with Rit *et al* [6]. Results of Imipenem sensitivity also matched accounting for almost 80-90 % of sensitivity with both above studies [6, 10]. Sensitivity of Meropenem and Doripenem was 70 % showing that Carbapenems and Polymyxins are the only two groups having good remarkable sensitivity towards *P. aeruginosa*.

Most common cause of infection may be surgical intervention which leads to a stitch site, which if not taken proper care, can get opened and nosocomial organisms can enter the wound site resulting in delayed cure and longer hospitalization followed by burns and sepsis. This shows similar results with Thipperudramswamy, *et al* [11].

The most common empirical treatment given to patients in present study was Inj. Ceftriaxone 1 gm iv 12 hrly with Inj Metronidazole 500 mg iv 8 hrly. This is the ideal combination as 3<sup>rd</sup> generation cephalosporin has good activity against both gram positive and gram negative

bacteria, whereas Metronidazole acts on anaerobes, so Mono or Polymicrobial infections are treated most of the time. But problem occurs when there is resistance to Ceftriaxone develops.

Cure rate was more in first 10 days of admission. Chawla, *et al* [12] study also documented the median of duration of stay in hospital as 9.00 (7.00-18.00). This may be due to empirical treatment given to the patient, or sensitive strain of the organism. 26% showed > 30 days stay in a hospital. Most common cause for longer stay in study showed, trauma, wound, cellulitis or fracture which accounted for around 46%. Most common organism isolated from these patients which was responsible for this much long duration of stay was *P. aeruginosa* followed by *A. baumannii* accounting for 54 % and 44 % isolation rate respectively.

Clinical outcome of the patients showed that most of them got discharged (72 %), 12% expired and 9 % got DAMA. This shows similar results with Chawla *et al* [12] and Bala, *et al* [3] study. Another finding that was found in study was 60-70% of patients had low hemoglobin, low serum sodium, low albumin and low total protein in biochemical and pathological findings which is similar to Cunha, D.F. Da *et al* study [13].

## Conclusion

Antibiotic susceptibility of isolates showed higher resistance towards routinely used drugs like broad spectrum  $\beta$ -lactams - Piperacillin, Piperacillin-tazobactam combination, Cefotaxime- 3<sup>rd</sup> generation Cephalosporin, Aminoglycosides and to some extent Carbapenems also. So the only group having complete sensitivity towards

organisms was the Polymyxin group. The most common cause being trauma, strict infection control practices with emphasis on hand hygiene should be followed to prevent emergence of pan drug resistant bacteria. More such studies in future are needed to study periodic epidemiological pattern of a region and to change antibiotic policy of a health care.

Limitations: Antibiotics given to the patients were given by same route and of same dosage, so dose dependent effectiveness and better route of administration of drug could not be analyzed.

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**Financial or other Competing Interests:** None.