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(CASE REPORT)

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# Management of community-acquired pneumonia because of multidrug-resistant *Pseudomonas aeruginosa* with Supime: A case study

Vijay Shankar Upadhyay * and Ayush Upadhyay

*General Medicine, MCH Udaipur*

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## Abstract

Community-acquired pneumonia (CAP), particularly in patients infected with multidrug resistance (MDR) Gram-negative bacilli, is a common and potential serious associated illness leading to considerable morbidity and mortality. *Pseudomonas aeruginosa* is the second most common pneumonia-causing pathogen, followed by K. pneumonia and S. aureus in India. This resistance is one of the most barriers to bacterial eradication and clinical cure of Pseudomonas infection. This delay in the management of MDR *Pseudomonas aeruginosa* with antibiotics can lead to increased mortality and morbidity. Here we discuss a case of a CAP caused by pathogen *Pseudomonas aeruginosa* which was resistant to the first line of antibiotics, piperacillin-tazobactam & cefoperazone sulbactam but sensitive to Supime (cefepime + sulbactam). Supime 3gm BD with 30 minutes of infusions for 7 days was effective in treating and discharging the patient from the hospital. Supime was safe and efficacious to treat hospitalized CAP patient infected with MDR *Pseudomonas aeruginosa.*

**Keywords:** Cefepime + Sulbactam; SUPIME; CAP; MDR; *Pseudomonas aeruginosa*; CAP

## 1. Introduction

Worldwide the challenge of treating community-acquired pneumonia (CAP) is increasing because of the multidrug resistance of microorganisms. CAP is defined as a pulmonary parenchymal infection with symptom onset either in the community or diagnosed in hospital settings within 48h of hospital admission. Patients with co-morbidities are at higher risk of morbidity and mortality. The bacteriological profile of CAP differs according to the geographical and seasonal variations in the same country, examples the streptococcus pneumoniae infection is predominantly found in Shimla and Delhi, whereas *Pseudomonas aeruginosa* is more dominant in Northern and Southern regions of India like Ludhiana, Srinagar and Karnataka.[1,2] It is that in Asia alone, over a million-adult death per year will be attributed to MDR CAP caused by gram-negative bacterial infections.[3]

The prevalence of *Pseudomonas aeruginosa* was once thought to be restricted in the hospital setups, but now it is being commonly observed in community-acquired pneumonia. As *Pseudomonas aeruginosa* is an opportunistic infection-causing pathogen, it presents a serious therapeutic challenge with its ability to develop resistance to multiple classes of antibiotics.[4] With growing resistance to *Pseudomonas aeruginosa*, especially to beta-lactams, beta-lactam inhibitor combinations (piperacillin-tazobactam and cefoperazone sulbactam) and carbapenem present a serious therapeutic challenge for clinicians. Delayed and improper management for MDR ESBL producing *Pseudomonas aeruginosa*, could lead to complications of bacteremia and sepsis with high mortality.[5,6]

Pneumonia is common in patients with co-morbidities such as diabetes mellitus, COPD, renal failure, etc. We are discussing a case CAP infected with MDR *Pseudomonas aeruginosa* of a 55-year male patient who was treated with Supime (cefepime + sulbactam).

* Corresponding author: Vijay Shankar Upadhyay
General Medicine, MCH Udaipur.

## 2. Case Presentation

A 55 years male patient was brought to our hospital with a medical history of smoking for 20 years, diabetes and hypertension. Chief complaints of fever, severe breathlessness, cough and weakness from the last 8 days. The patient had taken oral antibiotic treatment from the local general practitioner, but the symptoms got exaggerated. The vital presentations of the patients were; blood pressure 108/64 mmHg, pulse 84/minutes, body temperature: $101^0$ F. The respiratory rate was 28/minutes with an SPO2 of 84. Systemic examination of respiratory system showed right infra-scapular bronchial breathing sound, the cardiovascular system had normal S1 S2, per abdomen was soft and non-tender, central nervous system examination showed the patient to be conscious and oriented. A chest X-ray was advised, and the report showed pneumonia of the right middle and lower lobe. The patient was further investigated for routine blood tests for hemogram, ESR, sputum, acid-fast bacilli (AFB). Bronchoalveolar (BAL) and sputum samples sent for routine microscopy culture and sensitivity. They put the patient on oxygen. Based on the laboratory reports and hospital antibiogram, we empirically put the patient on Supime 3 g B.I. D with 30 minutes intravenous infusion with other supportive medications.

Laboratory reports showed haemoglobin 9.5 g/dL (low), white blood cells 15000 per mm3, polymorphs: 82%, lymphocytes: 18%, Monocytes: 0%, Eosinophils: 02%, platelet count 2.6 lakhs/cumm, erythrocyte sedimentation rate (ESR)- 22 mm/hr, liver function test (LFT) and renal function test (RFT) were within normal limits. Tuberculin test (T. T), sputum acid-fast bacilli (AFB) and blot test were negative. Based on chest x-ray, blood counts, culture and susceptibility reports, we diagnosed the patient with CAP. BAL samples identified *Pseudomonas aeruginosa*, which was resistant to cefepime, ceftazidime, piperacillin-tazobactam, cefoperazone sulbactam, but sensitive to Supime, meropenem, aminoglycoside (amikacin). Considering the positive response to Supime and aminoglycoside, we continued the therapy further to 10 days. On the 10th day, the patient was feeling well and had no signs and symptoms of infection, WBS counts settled (6400/cumm) and the patient and advised for follow-up after a week.

## 3. Discussion

The CAP is an acute infection of the lower tract occurring during a patient who has not lived during a hospital or medical building within the previous 14 days, thus the occurrence of MDR *Pseudomonas aeruginosa* infection is an alarm of the extent of resistance bugs spread in the community. With the increasing indiscriminate use of antibiotics, bacteria have developed novel methods of resistance. The gram-negative bacteria, which make most of the cephalosporins ineffective, produced the extended-spectrum beta-lactamases and Metallo - beta-lactamases enzymes. Bacteria also show resistance to antibiotics through membrane impermeability, efflux pump hyperactivity, penicillin-binding site alteration (PBP), biofilm formation, etc which makes most of the antibiotics ineffective, especially the first line of antibiotics.[7,8,9]

Mostly S. pneumoniae pathogens cause CAP, but the prevalence of community gram-negative pathogens like K. pneumoniae and *Pseudomonas aeruginosa* is on a rise. Incidence of the rise of Pseudomonas infection causing severe CAP is now a serious concern.[10.]

The current study presents the case of a 55 year male patient with CAP because of MDR *Pseudomonas aeruginosa* with co-morbidities. The causative pathogen, in this case, was MDR *Pseudomonas aeruginosa* isolated from sputum and BAL samples, with resistance to cefepime, ceftazidime, piperacillin-tazobactam, cefoperazone sulbactam but sensitive to Supime, carbapenem and aminoglycoside. Over the past three decades, many studies have reported a higher incidence of Gram-negative organisms, especially K. pneumoniae and *Pseudomonas aeruginosa*, which are considered the most common pathogens for CAP.[2]

*Pseudomonas aeruginosa* has a high tendency to exhibit rapid progression with high severity and poor prognosis, as compared to pneumonia caused by other pathogens. The CURB-65 score, and Pneumonia severity index score is significantly higher in Pseu*domonas aeruginosa* CAP, with 18-16% mortality[11,12]. In severe *Pseudomonas aeruginosa*, patients have a high tendency to develop complications of septic shock multiorgan dysfunctions, the mortality reaching up to 50-100%. Elderly Patients with a history of smoking, chronic liver disease, acute renal failure, the requirement of ICU admission, and improper initial antibiotic use might be risk factors for poor prognosis[13]. Guidelines recommend the administrations of proper antibiotics to improve the outcomes for patients undergoing treatment for *Pseudomonas aeruginosa*.[14]

For critically ill patients admitted to the ICU, guidelines recommend the use of a piperacillin-tazobactam, cefepime, imipenem, or meropenem which are antipseudomonal β-lactam drugs plus an antipseudomonal fluoroquinolone; or the

above β-lactam plus an aminoglycoside and azithromycin; or the above β-lactam plus an aminoglycoside and a fluoroquinolone. Once *Pseudomonas aeruginosa* is confirmed to be the pathogenic agent, we should adjust the antibiotic regimen to be more targeted. Targeted therapy recommended by guidelines includes an antipseudomonal β-lactam plus an aminoglycoside or a fluoroquinolone, with the choice being an aminoglycoside plus a fluoroquinolone.[15]

Based on the presentation of the patient, signs and symptoms, history, and hospital antibiogram we empirically put our patient on Supime (a fourth-generation cephalosporine with sulbactam) and aminoglycoside. Post culture and sensitivity report, which identified ESBL producing *Pseudomonas aeruginosa* , we continued the patient on the same therapy for 10 days. The patient responded well to the treatment, and it completely covered the patient after 10 days of therapy. The empiric choice of using Supime in treating MDR *Pseudomonas aeruginosa* CAP was justified in our case, as the patient responded well to the therapy with no side effects.

## 4. Conclusion

With increasing MDR CAP infections, the risk of morbidity and mortality also rises in patients with comorbidities. MDR *Pseudomonas aeruginosa* creates immense challenges because of limited treatment options. In our case, Supime successfully treated MDR *Pseudomonas aeruginosa* CAP patient and thus can be considered as a safe and effective empirical treatment option.

## Compliance with ethical standards

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Conceptualization, writing -original draft and preparation by Dr Vijay and Dr Ayush, writing review and editing by Dr Pankaj Mandale. All authors have read and agreed to the published version of the manuscript.

### *Disclosure of conflict of interest*

There is no conflict of interest between the authors.

### *Statement of ethical approval*

since the current case is a retrospective study data with no identifying patient information disclosed the ethics approval was waived off.

### *Statement of informed consent*

Informed consent from the patient was taken to publish his case without disclosing his personal information.

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