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Case Report

Successful Management of Severe Community-Acquired Pneumonia Using Combination Antibiotic Therapy: A Case Report

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Abstract

Antibiotics remain the cornerstone of bacterial infection management; however, their use must be guided carefully to ensure therapeutic effectiveness while limiting the development of antimicrobial resistance. We present the case of a 68-year-old male diagnosed with severe community-acquired pneumonia (CAP) caused by multidrug-resistant Streptococcus pneumoniae. Initial management involved empiric broad-spectrum antibiotic therapy, which was subsequently tailored according to culture and antimicrobial susceptibility testing results. The patient demonstrated significant clinical improvement following targeted treatment and supportive care. This case highlights the importance of timely antibiotic initiation, adherence to evidence-based clinical guidelines, microbiological confirmation, and antimicrobial stewardship in achieving favorable patient outcomes.

Keywords: Community-acquired pneumonia, Severe pneumonia, Streptococcus pneumoniae, Multidrug resistance, antibiotic therapy, Antimicrobial stewardship

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Introduction

The introduction of antibiotics revolutionized modern medicine by significantly reducing morbidity and mortality associated with bacterial infections. Despite their effectiveness, inappropriate or delayed antibiotic use has contributed to the emergence of multidrug-resistant (MDR) organisms, creating substantial therapeutic challenges and increasing healthcare costs worldwide.

Community-acquired pneumonia (CAP) remains one of the most common infectious diseases requiring prompt diagnosis and treatment. Early initiation of empiric antibiotic therapy is particularly important in elderly individuals and patients with underlying comorbidities, who are at increased risk of severe disease and complications [**Figures 1, 2]**.

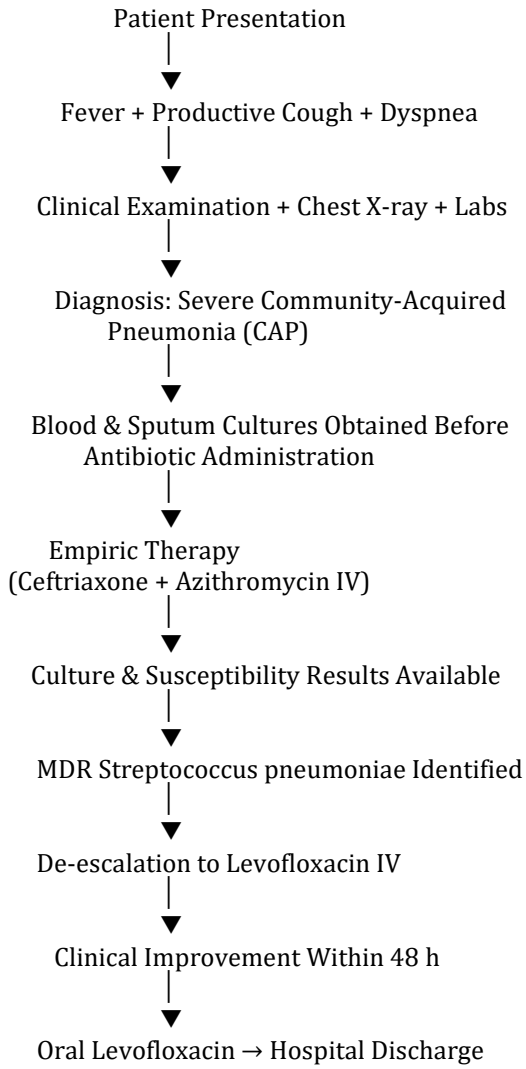
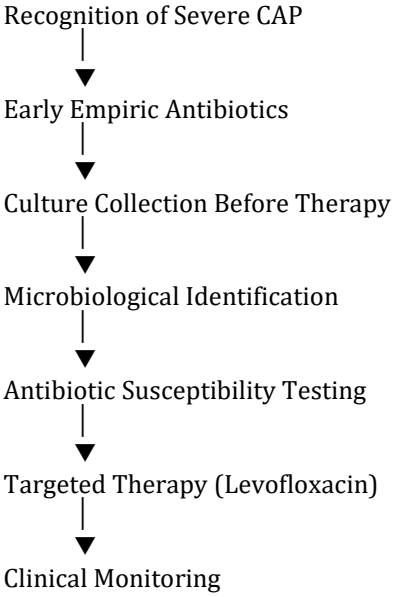


Figure 1: Clinical management flowchart.



Step-down to Oral Therapy

Hospital Discharge

This case report describes the management of severe CAP caused by multidrug-resistant Streptococcus pneumoniae, emphasizing the role of appropriate antibiotic selection, microbiological evaluation, susceptibility-guided therapy, and antimicrobial stewardship principles.

Figure 2: Antimicrobial stewardship pathway.

Case presentation

Patient history

A 68-year-old male with a medical history of hypertension and type 2 diabetes mellitus presented to the emergency department with a three-day history of fever, productive cough, dyspnea, and pleuritic chest pain. The patient also reported chills, generalized malaise, and fatigue. He denied recent hospitalization, antibiotic use, or known exposure to individuals with respiratory infections.

Upon admission, the patient's vital signs were as follows:

- Temperature: 39.2°C
- Blood pressure: 110/68 mmHg
- Heart rate: 112 beats/min
- Respiratory rate: 28 breaths/min
- Oxygen saturation: 88% on room air

Physical examination revealed inspiratory crackles over the right lower lung field and diminished breath sounds at the right lung base. No evidence of sepsis-related organ dysfunction was observed at presentation.

Laboratory and radiological findings

Initial laboratory investigations demonstrated:

- White blood cell count: 18,500/μL (85% neutrophils)
- C-reactive protein (CRP): 190 mg/L
- Procalcitonin: 5.8 ng/mL
- Blood urea nitrogen: 28 mg/dL
- Serum creatinine: 1.2 mg/dL

Chest radiography revealed consolidation of the right lower lobe with air bronchograms, findings consistent with bacterial pneumonia. Blood cultures and sputum samples were collected before initiating antimicrobial therapy.

Initial management

Considering the severity of the illness and the possibility of infection with resistant pathogens, empiric intravenous antibiotic therapy was initiated according to Infectious Diseases Society of America (IDSA) and American Thoracic Society (ATS) guidelines for severe CAP.

The patient received:

- Ceftriaxone 2 g intravenously once daily
- Azithromycin 500 mg intravenously once daily

Supportive management included supplemental oxygen delivered via nasal cannula, intravenous fluid administration, and close

monitoring in a step-down care unit.

Microbiological findings

Sputum culture demonstrated heavy growth of Streptococcus pneumoniae. Antimicrobial susceptibility testing revealed: **[Table 1].**

- Resistance to penicillin (MIC 2 µg/mL)
- Resistance to erythromycin
- Susceptibility to levofloxacin
- Susceptibility to vancomycin

Organism	Test	Result
Streptococcus pneumoniae	Sputum Culture	Heavy Growth
Penicillin	MIC	2 µg/mL (Resistant)
Erythromycin	Susceptibility	Resistant
Levofloxacin	Susceptibility	Susceptible
Vancomycin	Susceptibility	Susceptible
Blood Culture	Growth	Negative

Table 1: Microbiological findings and antibiotic susceptibility.

Blood cultures remained negative after 48 hours of incubation.

Modification of antibiotic therapy

Following receipt of susceptibility results, empiric therapy was de-escalated to targeted treatment with levofloxacin 750 mg intravenously once daily. This strategy ensured effective pathogen-specific therapy while minimizing unnecessary exposure to broader-spectrum antimicrobial agents.

Clinical improvement became evident within 48 hours of treatment modification, as demonstrated by resolution of fever and improvement in respiratory status.

Clinical course and outcome

By the fifth day of hospitalization, the patient showed substantial clinical improvement:

- Oxygen saturation increased to 95% on room air
- White blood cell count decreased to 9,800/µL
- CRP level decreased to 65 mg/L

No adverse drug reactions were observed during treatment. Renal and hepatic function were monitored daily and remained within acceptable limits.

Hospital Day	Treatment	Clinical Response
Day 1	Ceftriaxone + Azithromycin (IV)	Empiric therapy initiated
Day 3	Culture results available	MDR *S. pneumoniae* identified
Day 3	Switched to Levofloxacin (IV)	Targeted therapy
Day 5	Continued Levofloxacin	Marked clinical improvement
Day 7	Oral Levofloxacin	Discharged

Table 2: Antibiotic therapy timeline.

On hospital day seven, the patient was transitioned to oral levofloxacin 750 mg once daily to complete a total 10-day antibiotic course. A follow-up chest radiograph obtained before discharge demonstrated marked resolution of the right lower lobe consolidation **[Table 2].**

The patient was discharged in stable condition with instructions for outpatient follow-up.

Discussion

Antibiotic Selection in severe community-acquired pneumonia

This case highlights the critical role of empiric antibiotic therapy guided by disease severity and local antimicrobial resistance patterns. Current IDSA/ATS guidelines recommend either a combination of a beta-lactam and macrolide or monotherapy with a respiratory fluoroquinolone for severe CAP in patients without risk factors for methicillin-resistant Staphylococcus aureus (MRSA) or Pseudomonas aeruginosa.

Appropriate empiric therapy must achieve adequate pathogen coverage while minimizing the risk of promoting antimicrobial resistance. In this case, the initial combination of ceftriaxone and azithromycin provided broad coverage against typical and atypical respiratory pathogens until definitive microbiological data became available.

Multidrug resistance considerations

Penicillin-resistant Streptococcus pneumoniae remains an important global public health concern, particularly among elderly individuals and patients with chronic comorbidities. Resistance is commonly mediated through alterations in penicillin-binding proteins and mechanisms such as macrolide efflux pumps or ribosomal target modifications.

Accurate pathogen identification and susceptibility testing are therefore essential for selecting effective therapy and preventing treatment failure.

Role of microbiological diagnostics

Microbiological investigations, including sputum cultures, blood cultures, and antimicrobial susceptibility testing, play a pivotal role in the management of severe bacterial infections. These diagnostic tools help to:

- Confirm the causative pathogen
- Identify antimicrobial resistance patterns
- Facilitate de-escalation to targeted therapy
- Reduce unnecessary exposure to broad-spectrum antibiotics

Emerging molecular diagnostic techniques, including polymerase chain reaction (PCR)-based assays, may further reduce the time required to identify pathogens and resistance determinants, thereby enabling earlier optimization of antimicrobial therapy.

Antimicrobial stewardship

The management of this patient exemplifies several key principles of antimicrobial stewardship:

- Prompt initiation of empiric therapy based on established clinical guidelines
- Collection of microbiological specimens before antibiotic administration
- Adjustment of treatment according to culture and susceptibility results
- Use of the narrowest effective antimicrobial regimen
- Limitation of therapy duration to an appropriate clinical course

Implementation of these principles helps reduce resistance development, minimize adverse drug effects, and improve patient outcomes.

Monitoring and supportive care

Successful management of severe CAP extends beyond antibiotic therapy. Supportive interventions such as oxygen

supplementation, adequate hydration, and continuous clinical monitoring are crucial components of patient care. Serial laboratory investigations and follow-up imaging provide objective evidence of therapeutic response and assist clinicians in determining readiness for discharge.

Clinical lessons learned

Several important lessons can be derived from this case:

- Early empiric antibiotic therapy is essential for improving outcomes in severe CAP.
- Antimicrobial susceptibility testing is critical for identifying multidrug-resistant pathogens and guiding targeted treatment.
- De-escalation of therapy based on microbiological results supports antimicrobial stewardship efforts.
- Ongoing surveillance of local resistance trends is necessary to inform empiric treatment decisions.
- Education regarding appropriate antibiotic use remains fundamental in combating antimicrobial resistance.

Conclusion

Antibiotic therapy remains the foundation of treatment for severe bacterial infections such as community-acquired pneumonia. This case demonstrates the importance of prompt empiric treatment, microbiological confirmation, susceptibility-guided de-escalation, and adherence to antimicrobial stewardship principles. The favorable clinical outcome achieved in this patient underscores the value of integrating clinical assessment, laboratory diagnostics, and evidence-based treatment guidelines to optimize patient care while minimizing the emergence of antimicrobial resistance.

References

1) Sh Paik MJ. Metabolome changes in cerebral ischemia. Cells. 2022, 9:1630.

2) Sylvestrea DA, Otoki Y, Metherel AH, Bazinet RP, Slupsky CM, et al. Effects of hypercapnia / ischemia and dissection on the rat brain metabolome. Neurochem Int. 2022, 156:105294.

3) Zhao Y, Zhang X, Wei Y. Neuronal injuries in cerebral infarction and ischemic stroke: From mechanisms to treatment (Review). Int Mol Med. 2022, 49:15.

4) Feduto MA, Maksimovich N Ye, Bon EI, Zimatkin SM. Modeling of cerebral anoxia of respiratory genesis in rats. Arch Urol Nephrol. 2023, 2:1-4.

5) Feduto MA, Maksimovich N Ye, Bon EI, Zimatkin SM. Comparative characteristics of morphological changes in neurons of the parietal cortex of rats with anoxia of ischemic and respiratory genesis. Arch Repr Med. 2023, 1-4.

6) Feduto MA, Maksimovich N Ye, Bon EI, Zimatkin SM. Histological disorders of the neurons of the occipital cortex of the brain of rats with mechanical asphyxia in dynamics. News of Biomed Sci. 2022, 22:93-94.

7) Maksimovich NE, Bon E, Zimatkin SM. The rat brain and its response to ischemia: monograph. Grodno: GrGMU. 2020, 1:240.

8) Paxinos G. The rat brain in stereotaxis coordinates. Academic Press. 1998, 9: 242.

9) Maksimovich N Ye, Bon EI, Zimatkin SM. Central nervous system of the rat: textbook. GrSMU. 2022, 226.

10) Brown BM, Newcombe RG. Non-null semi-parametric inference for the Mann-Whitney measure. J Nonpar Stat. 2009, 743.