Research & Reviews: Journal of Microbiology and Biotechnology

e-ISSN: 2347-2286

Hospital-Acquired Pneumonia: A Case Report

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Case Report

Received: 01-Sep-2025, Manuscript No. JMB-25-187556; **Editor assigned:** 03-Sep-2025, Pre-QC No. JMB-25-187556 (PQ); **Reviewed:** 17-Sep-2025, QC No JMB-25-187556; **Revised:** 22-Sep-2025, Manuscript No. JMB-25-187556 (R); **Published:** 29-Sep-2025, DOI: 10.4172/2320-3528.14.011

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Citation: Kiran Patel, Hospital-Acquired Pneumonia: A Case Report. Rep Cancer Treat. 2025.14.011.

ABSTRACT

Hospital-acquired pneumonia (HAP) is a prevalent and serious nosocomial infection associated with significant morbidity, mortality, and healthcare costs. It occurs 48 hours or more after hospital admission and is not incubating at the time of admission. Patients undergoing surgery, particularly those with comorbidities, are at increased risk. Early diagnosis and appropriate antimicrobial therapy are critical for improving outcomes. We present a case of a 68-year-old male who developed HAP following elective abdominal surgery. The report emphasizes clinical presentation, diagnostic evaluation, microbiological findings, therapeutic interventions, and preventive strategies. This case highlights the importance of antimicrobial stewardship, infection control practices, and multidisciplinary management in mitigating the impact of HAP.

Keywords

Hospital-acquired pneumonia (HAP), Nosocomial infections, Postoperative pneumonia, Healthcare-associated infections (HAIs), Pseudomonas aeruginosa, Gram-negative bacterial infections

INTRODUCTION

Hospital-acquired pneumonia (HAP) is one of the most common and severe healthcare-associated infections worldwide, second only to urinary tract infections in hospitalized patients. Defined as pneumonia occurring 48 hours or more after hospital admission, it contributes to increased length of stay, healthcare costs, and mortality. The reported mortality ranges from 20% to 50%, particularly in patients requiring intensive care or mechanical ventilation.

HAP occurs when pathogenic microorganisms colonize the lower respiratory tract in a hospital environment. Risk factors include advanced age, chronic illnesses (such as diabetes mellitus or chronic obstructive pulmonary disease), immunosuppression, prolonged hospitalization, prior antibiotic therapy, and invasive procedures. Common causative organisms include gram-negative bacteria (Pseudomonas aeruginosa, Klebsiella pneumoniae, Escherichia coli) and gram-positive bacteria (Staphylococcus aureus, including MRSA). The increasing prevalence of multidrug-resistant pathogens further complicates management.

Early recognition of HAP is crucial because delays in appropriate antimicrobial therapy are associated with worse outcomes. This case report illustrates the clinical course, diagnostic challenges, management strategies, and preventive considerations for HAP in a postoperative patient.

Case Presentation

Patient Information

A 68-year-old male was admitted to the surgical ward for elective colectomy due to diverticulosis. His medical history included type 2 diabetes mellitus, hypertension, and mild chronic kidney disease. He had no history of chronic lung disease, smoking, or prior episodes of pneumonia. Preoperative evaluation, including chest radiograph and routine blood tests, was unremarkable.

Clinical Course

The patient underwent an uncomplicated colectomy. On postoperative day 3, he was recovering well, mobilizing, and tolerating

oral intake. However, on postoperative day 5, he developed acute respiratory symptoms:

Fever of 38.5°C

Tachypnea: 28 breaths per minute

Oxygen saturation: 88% on room air

Productive cough with purulent sputum

Mild hypotension: 95/60 mmHg

Physical examination revealed coarse crackles over the right lower lung field, with dullness to percussion. No wheezing or pleural rub was noted.

Diagnostic Evaluation

Laboratory Findings:

Leukocytosis: 15,500/μL (normal: 4,000–11,000/μL)

Neutrophilia: 82%

C-reactive protein (CRP): 120 mg/L

Procalcitonin: 2.5 ng/mL

Serum creatinine: 1.4 mg/dL (baseline: 1.2 mg/dL)

Arterial blood gas: PaO_2 68 mmHg on room air, $PaCO_2$ 35 mmHg

Radiology:

Chest X-ray: New right lower lobe consolidation with air bronchograms

CT thorax (performed due to poor resolution on X-ray): Confirmed right lower lobe consolidation, no pleural effusion, no abscess formation

Microbiological Evaluation:

Sputum Gram stain: Gram-negative rods

Sputum culture: Pseudomonas aeruginosa, susceptible to piperacillin-tazobactam, ceftazidime, and meropenem

Blood cultures: Negative

Nasopharyngeal swab: Negative for viral pathogens

Diagnosis:

Based on clinical features, radiologic evidence, and positive sputum culture, the patient was diagnosed with hospital-acquired pneumonia (HAP), occurring on postoperative day 5.

Management

Initial Empirical Therapy

Given the high risk of multidrug-resistant organisms in a postoperative patient with comorbidities, empirical intravenous therapy was initiated:

Piperacillin-tazobactam 4.5 g IV every 8 hours

Oxygen supplementation via nasal cannula to maintain SpO_2 > 92%

Supportive care: Intravenous fluids, glucose control, pulmonary physiotherapy, and frequent monitoring

Targeted Therapy

After 48 hours, culture and sensitivity results guided therapy adjustment. Piperacillin-tazobactam was continued, as the isolate was fully susceptible. Duration of therapy was planned for 10–14 days, depending on clinical response and radiographic improvement.

Supportive Measures

Pulmonary hygiene with incentive spirometry

Early ambulation to prevent atelectasis

Strict hand hygiene and isolation precautions to prevent nosocomial spread

Outcome and Follow-Up

The patient showed clinical improvement within 5 days: fever subsided, oxygen requirements decreased, and sputum production became minimal. Laboratory parameters normalized: WBC decreased to 8,500/μL, CRP to 20 mg/L, and procalcitonin to 0.5 ng/mL. Repeat chest X-ray showed near-complete resolution of right lower lobe infiltrates.

He was discharged on postoperative day 14 in stable condition, with instructions for outpatient follow-up and monitoring for recurrent infections. At one-month follow-up, he remained asymptomatic, with no residual radiographic abnormalities.

DISCUSSION

Pathophysiology and Risk Factors

HAP occurs when pathogenic microorganisms overcome host defenses in the hospital environment. Mechanisms include aspiration of oropharyngeal secretions, colonization of the upper respiratory tract, and direct inoculation via medical devices. Risk factors in this patient included advanced age, diabetes mellitus, recent surgery, and hospitalization.

Microbiological Considerations

Pseudomonas aeruginosa is a frequent cause of HAP, particularly in patients with prolonged hospitalization or prior antibiotic exposure. Its intrinsic resistance to multiple antibiotics and ability to acquire additional resistance determinants makes empirical therapy challenging. Early identification and targeted therapy are crucial for reducing morbidity and mortality.

Diagnostic Approach

HAP diagnosis relies on clinical suspicion, supported by laboratory and radiological findings. Key features include new-onset fever, leukocytosis, purulent sputum, and new or progressive infiltrates on imaging. Microbiological confirmation via sputum or tracheal aspirates guides targeted therapy. Molecular diagnostics, such as PCR assays for resistance genes, can further optimize antimicrobial selection.

Management Principles

Management of HAP requires a combination of:

Empirical Antimicrobial Therapy: Should cover common gram-negative and gram-positive pathogens, including MRSA when risk factors are present.

Targeted Therapy: Adjusted based on culture and sensitivity results to prevent resistance and reduce adverse effects.

Supportive Care: Oxygen therapy, fluid balance, pulmonary physiotherapy, and glycemic control in diabetic patients.

Infection Control Measures: Hand hygiene, isolation protocols, and environmental cleaning to prevent cross-infection.

Duration of therapy typically ranges from 7 to 14 days, tailored to the patient's clinical response and severity of infection.

Prevention

Preventive strategies are crucial for reducing HAP incidence:

Hand hygiene and standard precautions in healthcare settings

Minimizing invasive devices such as endotracheal tubes and central lines

Early mobilization and pulmonary physiotherapy to prevent atelectasis

Vaccination against influenza and pneumococcus for at-risk populations

Antimicrobial stewardship programs to limit unnecessary antibiotic exposure

Prognosis and Outcome

The prognosis of HAP depends on the patient's baseline health, pathogen virulence, presence of multidrug resistance, and timeliness of therapy. In this case, prompt recognition and targeted antimicrobial therapy led to favorable outcomes, with complete clinical and radiographic recovery.

Challenges and Future Directions

HAP remains a therapeutic challenge due to:

Increasing prevalence of multidrug-resistant organisms

Limited availability of new antibiotics

Difficulty in rapid pathogen identification

Emerging strategies include rapid molecular diagnostics, novel antimicrobial agents, and AI-based predictive tools for early detec-

tion and antimicrobial selection.

CONCLUSION

Hospital-acquired pneumonia is a common and serious nosocomial infection, particularly in postoperative patients with comorbidities. Early recognition, empirical broad-spectrum antimicrobial therapy followed by targeted treatment, and strict adherence to infection control practices are essential for favorable outcomes. Multidisciplinary management and preventive measures, including antimicrobial stewardship and patient mobilization, play a critical role in reducing HAP incidence and improving patient care. This case underscores the importance of timely intervention, evidence-based therapy, and ongoing surveillance to mitigate the burden of HAP in hospitalized patients.

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