

Case Series on Clinical and Radiological Findings in Pneumonia Due to *Klebsiella Aerogenes*

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Abstract

Background: Pneumonia due to *Klebsiella aerogenes* is an increasing concern in healthcare settings. Therefore, early identification of the threatened risk factors to initiate appropriate therapy for limiting the disease & progression of symptoms is urgently required. Hence, this study was designed to report 4 case series of pneumonia due to *K. aerogenes*.

Methods: Gram staining of sputum was performed to identify the presence of Gram-negative bacilli. A sputum culture was conducted to confirm the presence of *K. aerogenes* bacteria. Radiological imaging, including chest X-ray and CT-scan, was used to assess lung manifestations, such as ground glass opacities, consolidation, and necrosis. Treatment options for pneumonia due to *K. aerogenes* were considered based on the susceptibility of the bacteria to specific antibiotics. Bronchoscopy and bronchoalveolar lavage (BAL) were performed in some cases to obtain samples for further analysis.

Results: Clinical findings included fever, chest pain, cough with expectoration, chest auscultation encompassed a range of findings from harsh vesicular breath sounds to coarse crackles in the respective areas. Radiological imaging showed a spectrum of lesions from ground glass opacities, multilobar consolidation, cavitation, necrosis and multiple fibrotic strands in respective lung fields. Treatment options for pneumonia depend on factors such as the severity of the infection, the patient's medical history and the presence of any drug allergies.

Conclusion: *K. aerogenes*, a gram-negative opportunistic anaerobe, causes aggressive pneumonia with high fatality rates. Early active sputum culture and selective antibiotic use are crucial for effective management.

Keywords: *Klebsiella aerogenes*, pneumonia, case series, radiological and clinical findings.

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Introduction

Klebsiella aerogenes, originally known as *Enterobacter aerogenes*, is a Gram-negative anaerobe that belongs to the family Enterobacteriaceae [1]. It is extensively spread in the environment and is present in the human gastrointestinal system, where it is also a frequent opportunistic pathogen. When the host immune system is weakened or the intestinal mucosa is injured, infection of the respiratory, circulatory, or urogenital systems can occur [2]. Despite rising publications on the pathogenicity and drug resistance of *E. coli* and *Klebsiella pneumoniae* in recent years, there have only been a few reports on *K. aerogenes* [3, 4]. During numerous hospital outbreaks, *K. aerogenes* was shown to have an MDR phenotype [5,6]. When compared to other Enterobacteriaceae species, *K.*

aerogenes is more likely to induce septic shock or even mortality in patients [7,8]. *K. pneumoniae* and *E. aerogenes* have a strong genetic link, as evidenced by the intergeneric recombination of chromosomal genes between the two species [9].

Pneumonia is an acute infection of the lung's parenchyma accompanied by symptoms of acute illness. It can be difficult to identify the infectious agents responsible for respiratory infections in the elderly, especially in frail patients [10]. Lower respiratory infections, including pneumonia, are a leading cause of death globally, with pneumococcal pneumonia being a major contributor [11]. Pneumonia can be classified as community-acquired, hospital-acquired, or ventilator-acquired,

depending on the patient's *location at the time of infection* [12]. Pneumonia due to *K. aerogenes* is an increasing concern in healthcare settings responsible for high morbidity and mortality. Therefore, there is a need for early identification of the threatened risk factors to initiate appropriate therapy for limiting the disease & progression of symptoms. Keeping in view of this, the present study reported the clinical and radiological findings of 4 case series in pneumonia due to *K. aerogenes*.

Case Presentations

Case 1

A 36-year-old male smoker presented with fever, chest pain, and cough with expectoration. Clinical features showed that, on auscultation, he had harsh vesicular breath sounds on the right side and coarse crepitations in bilateral basal regions. His oxygen saturation was 86% on room air. The results of laboratory parameters conducted on the patient showed leucocytosis and raised D-dimer. The hematological assessment of the blood specimen demonstrated that the patient's hemoglobin was 12

g/dl, white blood cell count was 18,000, with 71.8% neutrophils, 23% lymphocytes, and 1.3% immature granulocytes, platelet count was 3.11 L, C-reactive protein level was 169 mg/dl, erythrocyte sedimentation rate was 130 mm/hr and lactate dehydrogenase level was 664 U/L. Sputum acid-fast bacilli (AFB) and Cartridge-Based Nucleic Acid Amplification Test (CBNAAT) for tuberculosis were negative. Gram staining of sputum was performed, which showed the presence of Gram-negative bacilli. Furthermore, sputum culture revealed the presence of *Klebsiella aerogenes* (Figure 1). The radiological findings included ground-glass opacities (GGO), consolidation, and necrosis in the right middle and lower zones of the lungs (Figure 2). The treatment options were Piperacillin-Tazobactam, Meropenem, and Clindamycin. These medications are commonly used to treat bacterial infections, including pneumonia. It is important to note that the choice of treatment may vary depending on factors such as the severity of the infection, the patient's medical history, and the presence of any drug allergies.

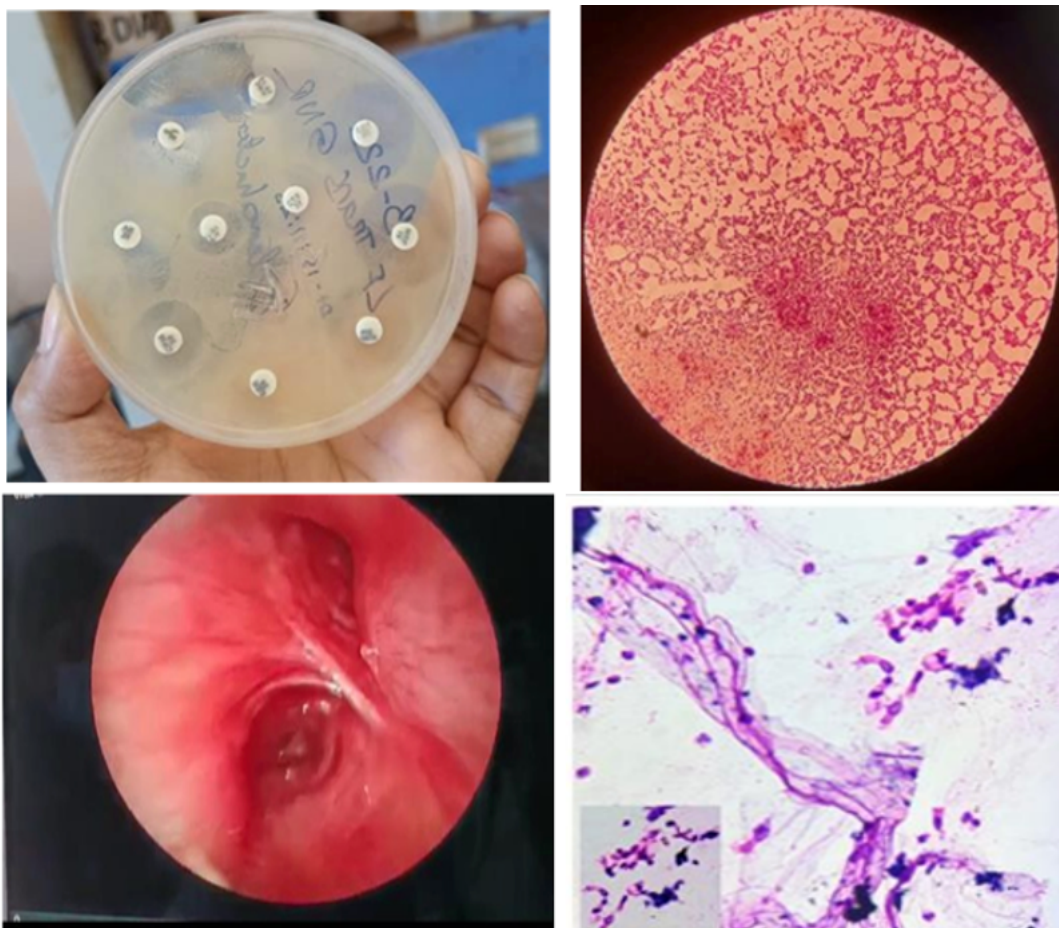


Figure 1: Bronchoscopy and BAL (C/S) in relation to *Klebsiella aerogenes* pneumonia.

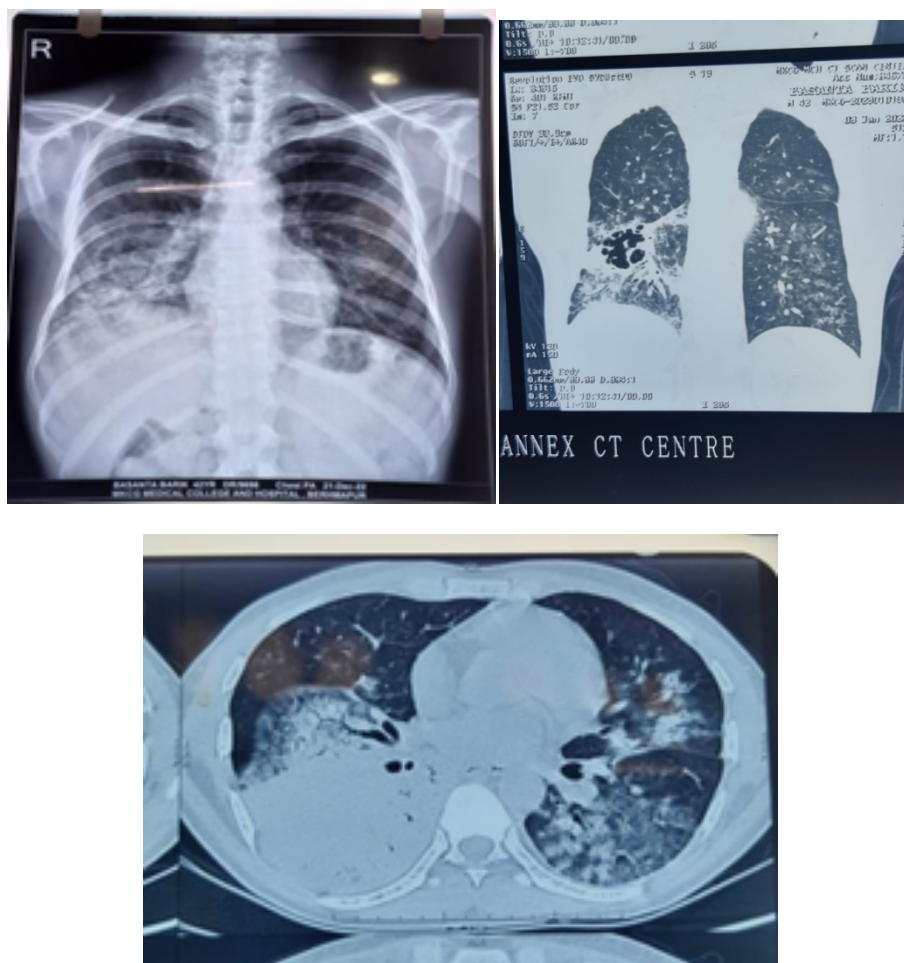


Figure 2: Chest X-rays and CT-scan of the patient showing bilateral ground glass opacities (B/L GGO) and consolidation with necrosis in the right lower lobe.

Case 2

A 55-year-old female with a history of diabetes and biomass exposure presented with fever, cough with expectoration, and breathlessness. On auscultation, bronchial breath sounds were heard in the right infraclavicular and mammary regions, along with bilateral coarse crepitations. Her oxygen saturation was 84% on room air, and she exhibited hypotension and pallor. The results of laboratory parameters conducted on the patient showed anaemia, leucocytosis, increase in neutrophils, dyselectremia and hypoalbuminemia. The hematological assessment of the blood specimen demonstrated that the patient's hemoglobin was 8 g/dl, white blood cell count was 24,590, with 87% neutrophils, 9.4% lymphocytes, 2.5% monocytes, and 2.1% immature granulocytes, platelet count was 4.06L, C-reactive protein level was 129 U/1, fasting blood sugar level

was 230 mg/dl, serum albumin level was 2.7 g/dl, serum sodium and potassium levels were 135meq/L and 2.5meq/L, respectively. Sputum acid-fast bacilli and Cartridge-Based Nucleic Acid Amplification Test results were negative. Gram staining of sputum was performed, which showed the presence of Gram-negative bacilli. Furthermore, sputum culture revealed the presence of *Klebsiella aerogenes* (Figure 3). The radiological findings included a thick-walled cavitory lesion in the apico-posterior segment of the left upper lobe, suggesting the formation of a cavity or hollow space within the lung tissue, which may be filled with fluid or pus. Additionally, there were ground-glass opacities (GGO) with consolidation in this area, indicating the presence of abnormal lung tissue that appears hazy or cloudy, possibly due to inflammation or infection (Figure 4). The treatment options were Piperacillin-Tazobactam, Meropenem, and Clindamycin.

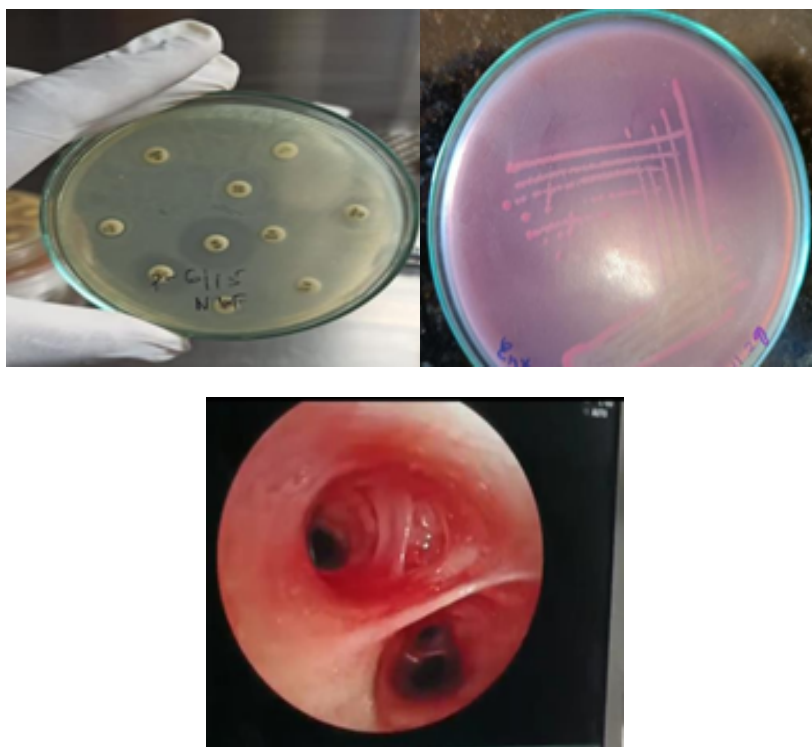


Figure 3: Bronchoscopy and BAL (C/S) in relation to *Klebsiella aerogenes* pneumonia.



Figure 4: Chest X-ray of the patient showing consolidation and cavitation in the left upper lobe.

Case 3

A 50-year-old female patient presented with fever, cough with expectoration, and breathlessness. On examination, she had a Spo₂ of 92% on room air and bronchial breath sounds in the right infraclavicular mammary region, with bilateral coarse crepitations. The results of laboratory parameters conducted on the patient showed anaemia, neutrophilia and leucocytosis. The hematological assessment of the blood specimen demonstrated that the patient's hemoglobin was 8.6 g/dl, white blood cell count was 24600, with a differential count of N38% (neutrophils), L23% (lymphocytes), and

IG2% (immature granulocytes), platelet count was 222L, indicating a normal level and an elevated C-reactive protein level was 47.11 mg/L. Sputum acid-fast bacilli culture and nucleic acid amplification test was negative. Gram staining of sputum was performed, which showed the presence of Gram-negative bacilli. Furthermore, sputum culture revealed the presence of *Klebsiella aerogenes* (Figure 5). The radiological manifestation showed right multi-lobar consolidation (middle zone and lower zone) with right side pleural effusion (Figure 6). The treatment options were linezolid, meropenem and clindamycin.

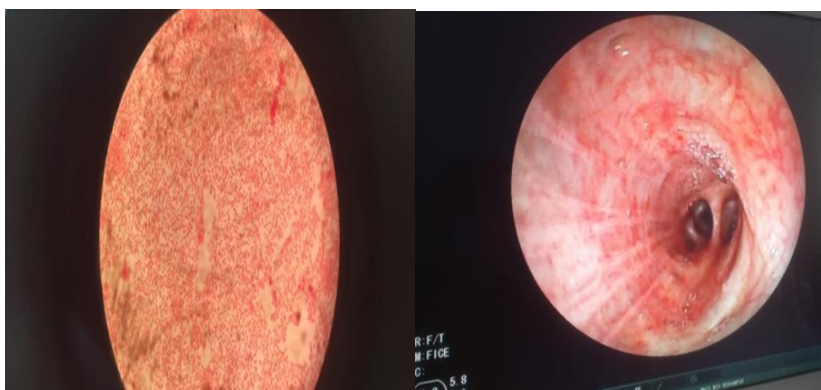


Figure 5:Bronchoscopy and BAL (C/S) in relation to *Klebsiella aerogenes* pneumonia.

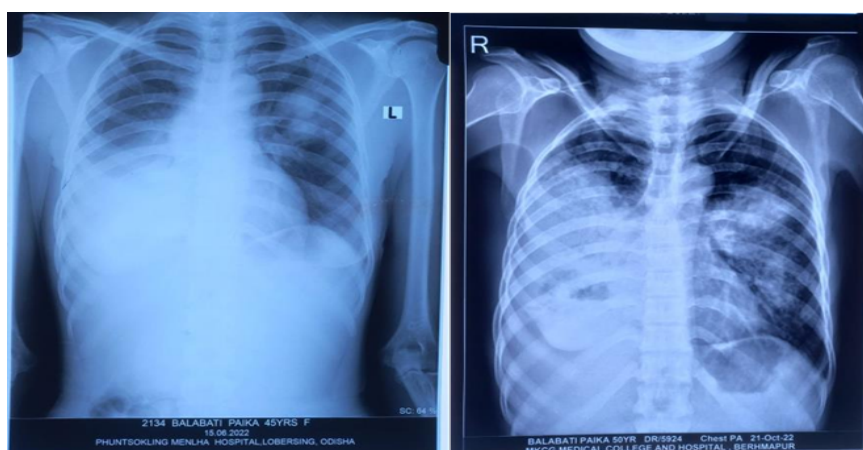


Figure 6:Chest X-ray of the patient showing multilobar consolidation with effusion

Case 4

A 36-year-old diabetic male presented with fever, hemoptysis, and cough with scanty expectoration. The patient had no past history of tuberculosis and any respiratory disease or no history of ATT intake. However, a known case of insulin dependent Type 1 diabetes mellitus was observed. On examination, he had a Spo₂ of 90% on room air and bilateral harsh vesicular sound with coarse crepitations. The patient was thin built, pallor, tachypneic, had tachycardia and hypotensive. The results of laboratory parameters conducted on the patient showed leukocytosis with neutrophilia. The hematological assessment of the blood specimen demonstrated that the patient's hemoglobin was 9.4 g/dl, fasting blood sugar level was 171 mg/dL and postprandial blood sugar level was 190 mg/dL, indicating elevated blood sugar levels, total leukocyte count was 17,000 per microliter, with differential counts of 85% neutrophils, 10% lymphocytes, 5% eosinophils, and

1.4% immature granulocytes, platelet count was 32,000 per microliter, indicating thrombocytopenia, complete blood count showed bicytopenia, which means there was a decrease in the number of both red blood cells and platelets, NS1 antigen test for dengue fever was negative, C-reactive protein level was 381 mg/L, indicating inflammation, scrub typhus test was negative. Urine routine and microscopy showed the presence of ketones and glucose in the urine, without the presence of pus cells. The examination of the patient's sputum revealed the presence of gram-positive cocci with rod-shaped, along with a large number of pus cells. The culture of the sputum identified the presence of *Klebsiella aerogenes* bacteria, which was found to be susceptible to specific antibiotics. The radiological imaging showed bilateral moderate pleural effusion with multilobar consolidation with cavitation seen diffusely with multiple fibrotic strands in both lung fields (Figure 7).

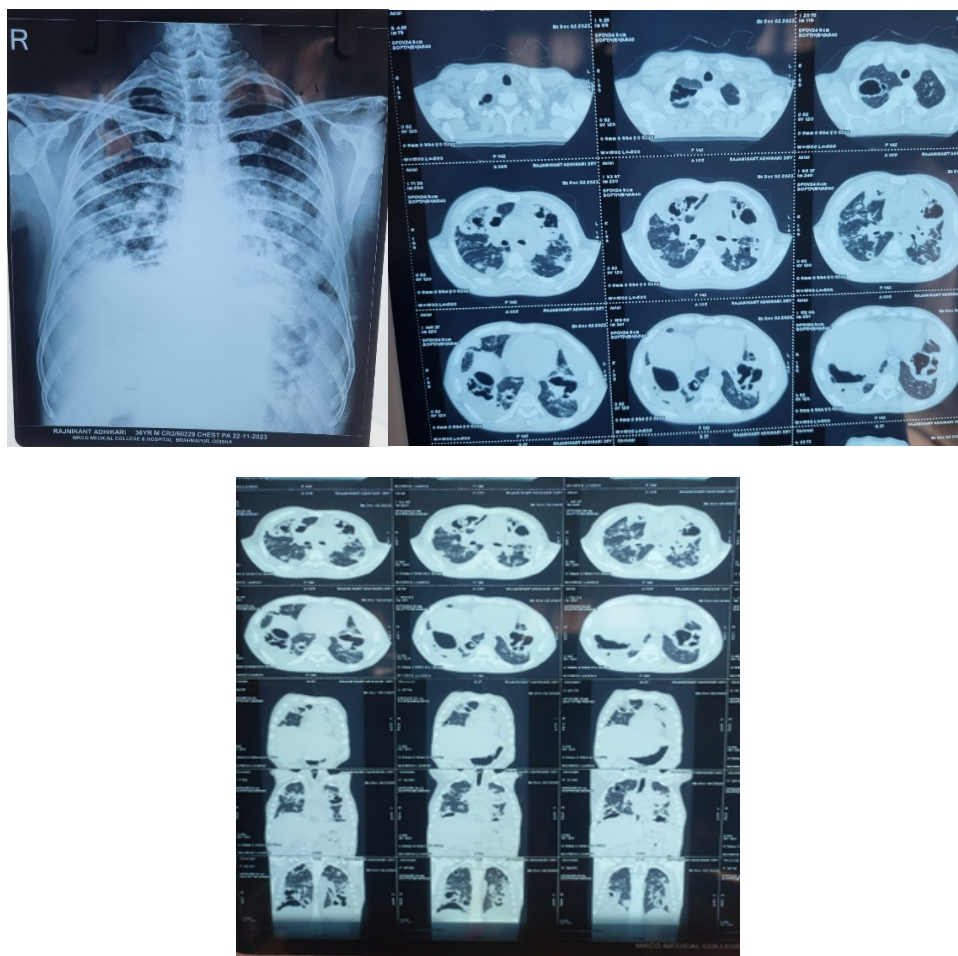


Figure 7: Chest X-ray and CT-scan of the patient showing bilateral moderate pleural effusion with multilobe consolidation with cavitation

Conclusion

Present case series concludes that *Klebsiella aerogenes*, a gram-negative opportunistic anaerobe, is a significant cause of aggressive pneumonia with high fatality rates compared to other Enterobacteriaceae. It is commonly found in the human gastrointestinal tract, as well as in soil, water, and vegetable waste. The clinical characteristics, radiological manifestations, and virulence impact of *K. aerogenes* pneumonia vary, making it distinct from pneumococcal pneumonia. Cavitation is a common feature in *Klebsiella pneumoniae*, unlike in pneumococcal pneumonia. The study emphasizes the importance of early active sputum culture and cautious use of selective antibiotics for effective management of the disease. Treatment of *K. aerogenes* pneumonia can be challenging due to antibiotic resistance. Clear guidelines for management are needed to address this issue.

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