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The fulminant course of sepsis caused by Klebsiella pneumoniae and Influenza A – a case study

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Abstract

Introduction. Combined bacterial and viral infections are rare and could lead to fatal events. ***Background.*** We would like to present a fatal combined Klebsiella pneumoniae and Influenza A infection. A 55-year-old patient reported to the Hospital Emergency Department due to symptoms of a respiratory tract infection for 3 days. He had a cough, fever, and chills. He has not been chronically ill, denied hospitalizations, didn't take medications permanently, and wasn't allergic. ***Case study.*** Within the next 3 hours, acute respiratory failure occurred, the patient was intubated and transferred to the Intensive Care Unit (ICU). Over the next 12 hours, critical circulatory failure progressed, and therefore, the patient was treated by current sepsis guidelines. Despite the intensification of treatment, the patient died within 60 hours of admission. ***Conclusions.*** The coincidence of these two infections is a serious threat and requires quick and decisive action. *Anestezjologia i Ratownictwo 2025; 19: 85-88. doi:10.53139/AIR.20251910*

Keywords: Klebsiella pneumoniae, Influenza A, infection, sepsis

Introduction

Combined bacterial and viral infections are rare and could lead to fatal events. We would like to present a combined Klebsiella pneumoniae and Influenza A infection.

Klebsiella pneumoniae is a ubiquitous gram-negative, lactose-fermenting bacillus and a representative of the Enterobacteriaceae family. It constitutes commensal flora and causes opportunistic infections in people – i.e., pneumonia (characterized by necrotic lesions promoting cavities in lung tissue and blood-tinged phlegm), bacteriemia, meningitis, wound and soft tissue infections, and urinary tract infections [1]. These infections are particularly common in critically ill and immunocompromised patients, and could be both community- and hospital-acquired; the latter being most likely present in the intensive care units (ICUs) [2].

Upon entering the host, Klebsiella triggers the immune response by attracting immune cells (mainly neutrophils) to the site of infection. Consequently, the immune system produces pro-inflammatory cytokines that favor granulopoiesis. K. pneumoniae virulence is associated with its prominent capsule, pili, lipopolysaccharide (LPS), and iron carriers as well as an ability to produce a biofilm that has protective properties for these pathogens [3]. Some of the K. pneumoniae variant forms are well recognized for their multi--drug (or even extreme) resistance and hypervirulence (which could facilitate a community-acquired infection among young and relatively healthy individuals) [4]. Extraordinary antibiotic resistance of K. pneumoniae refers to strains producing beta-lactamases (i.e., ESβL, NDM-1), carbapenemases (i.e., KPC, OXA-48), and even those resistant to the drug of last resort - colistin

[5]. In the ICU setting, drug-resistant K. pneumoniae strains account for significantly higher mortality, substantial hospitalization costs, prolonged ICU stay, and other detrimental outcomes [6]. It is also believed that K. pneumoniae plays a major role in transmitting drug-resistance genes (as plasmids) to other bacterial species [7]. This should be of major concern as this bacterium poses a threat to international health due to its rapid evolution and limited treatment options.

Influenza is a viral pathogen of worldwide occurrence, a member of the Orthomyxoviridae family. There are four types of Influenza virus – A, B, C, and D. Type A Influenza is the most widespread, infecting humans, other mammals, and birds. Structurally, it is equipped with an RNA genome, RNA polymerase, membrane protein, and an envelope with clinically significant glycoproteins – neuraminidase (NA) and hemagglutinin (HA) [1]. As it possesses rapid mutation and replication rates, Influenza can easily adapt to changes in the environment. Two unique properties of the Influenza virus – mutation and reassortment – account for virus genome instability [8]. The minor mutations involving NA or HA genes cause antigenic drift and are responsible for periodic Influenza epidemics, which happen every 2-3 years. The genome reassortment might take place between two Influenza strains (even those infecting different animals) and is known to promote antigenic shift, which could lead to the pandemic. Pathogenicity of Influenza relates to upper and lower respiratory tract infections with acute symptoms, incl. high fever, malaise, myalgia, dry cough, and sore throat [9]. Influenza virus might lead to complicated disease – i.e., severe viral pneumonia, secondary bacterial pneumonia, cardiac involvement, and neurologic syndromes (such as encephalitis) [1,10]. It is most likely in immunocompromised patients and those affected by multimorbidity. Moreover, immunosuppressive properties of the Influenza virus were reported, as it facilitated bacterial pneumonia in mouse models [11,12]. Currently available antiviral therapy targets proteins necessary for viral infection and replication, i.e., NA inhibitors - Oseltamivir, Zanamivir. These agents – if administered early (36-48 hours from the onset of the infection) – might alleviate symptoms, shorten disease duration, and prevent some of its complications [9]. Annual prophylaxis (vaccinations) is recommended for every person above six months of age to reduce individual risk of severe infection, boost herd immunity, and prevent genetic reassortment [10].

Case report

A 55-year-old patient reported to the Hospital Emergency Department around 6:00 a.m. due to symptoms of a respiratory tract infection for 3 days: cough, fever, and chills. The patient was taking over-the-counter non-steroidal anti-inflammatory drugs. He has not been chronically ill, denied hospitalizations, didn't take medications permanently, and wasn't allergic. He was working as a professional driver. At the time of admission, the patient was logical, and the neurological examination showed no abnormalities. On auscultation, a normal symmetrical murmur and numerous whirrs were present. Over the next 2 hours, the patient's condition deteriorated due to increasing hypotension, and the patient required the supply of fluid boluses and norepinephrine in constant infusion. Within the next 3 hours, acute respiratory failure occurred, and the patient was intubated.

The patient's condition deteriorated over time, as presented in Figure 1.

The patient was transferred to the Intensive Care Unit. At that time, Multiplex PCR test results were obtained, indicating Klebsiella pneumoniae infection and influenza A virus (IAV). The following X-ray ordered after intubation of the patient showed progression of changes: decreased transparency of the middle and lower right lung, pleural effusion, and accompanying parenchymal densities. The patient required mechanical ventilation with an increasing concentration of oxygen in the breathing mixture (100%). Over the next 12 hours, critical circulatory failure progressed and therefore the patient was treated in accordance with current sepsis guidelines: early microbiological tests were done, empiric antibiotic therapy (meropenem) and antiviral therapy (oseltamivir) included, steroid therapy administered, fluid boluses and vasopressin was added to treat resistant hypotension [13]. Due to increasing renal failure, it was decided to start continuous renal replacement therapy. The echocardiographic examinations were performed, which showed generalized cardiac hypokinesis, so dobutamine infusion was introduced. Lung USG showed signs of developing ARDS in both lungs. The performed bronchoscopy showed congestion of the respiratory tract mucosa, a tendency to bleeding, and a large amount of purulent secretion clogging the bronchioles. Despite the intensification of treatment, the patient died within 60 hours of admission. The

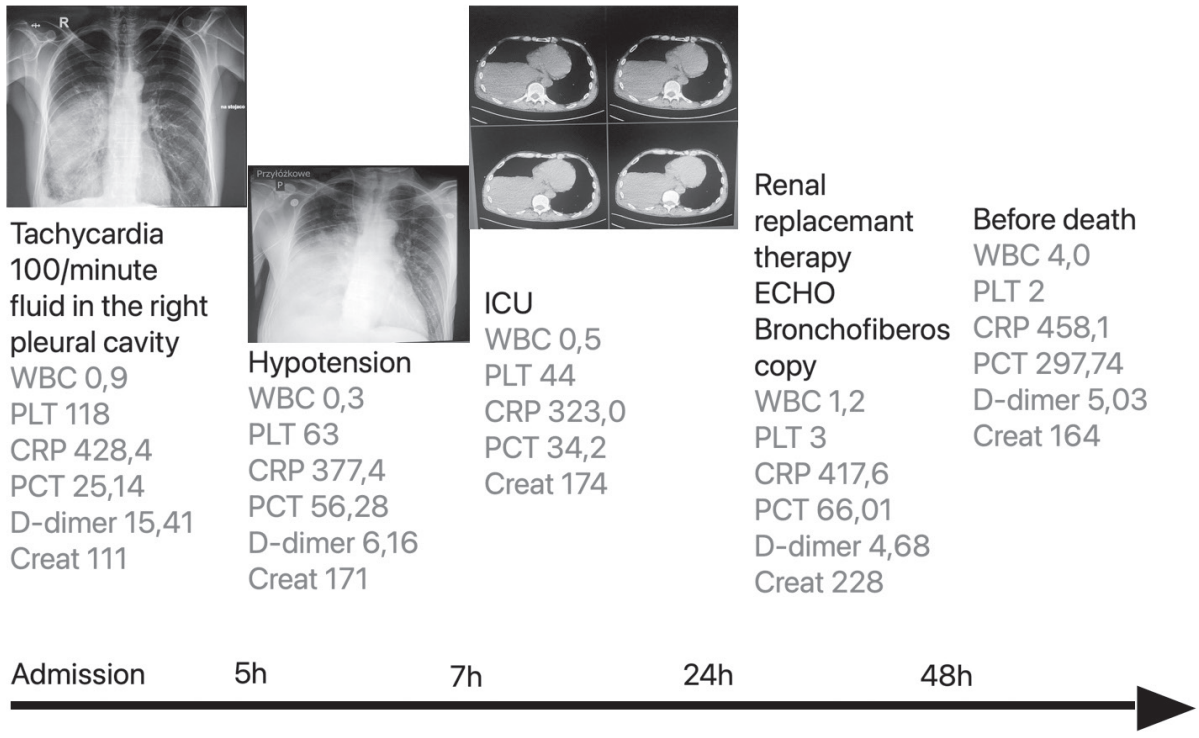

Figure 1. Timeline of the fulminant course of sepsis caused by K. pneumoniae and Influenza A in a 55-year-old male. From Authors' private archives

obtained cultures confirmed infection with Klebsiella pneumoniae, which was sensitive to all tested antibiotics, including meropenem. HIV immunodeficiency virus was not identified, and the panel of tumor markers used also turned out to be negative. Based on the interview and the tests used, no causes of reduced immunity were found.

Discussion and conclusion

In mice, findings showed that H9N2 IAV infection facilitated secondary infection of K. pneumoniae, causing severe illness. K. pneumoniae infection after H9N2 IAV infection compared to isolated K. pneumoniae infection increased histopathological changes in the lungs and apoptosis, resulting in a more severe course of the disease. The lung index of mice co-infected with H9N2 IAV and K. pneumoniae was significantly higher than in the other groups. Pre-infection with H9N2 IAV has been shown to contribute to K. pneumoniae proliferation and delayed bacterial clearance in mice. [14] One of the most common bacteria co-detected with a virus is K. pneumoniae. Statistically, in these cases, WBC are higher, PLT are higher or normal [15], but in the presented patient, WBC and PLT were decreasing dramatically (to 0.3 and 3, respectively).

The patient we describe did not have a chronic disease and did not stay in health centers before hospitalization, which ended in death. The tested strain of K. pneumoniae did not show resistance typical of strains responsible for hospital infections. Based on the interview and results, we can conclude that the patient was not exposed to any particular factors and had no risk factors himself. The coincidence of two infections is a serious threat and requires quick and decisive action.

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Conflict of interest
None

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