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CASE REPORT

Respiratory Syncytial Virus and *Streptococcus pneumoniae* Co-infection in an Elderly Individual within a Familial Cluster

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Respiratory syncytial virus (RSV) is a common pathogen that causes respiratory tract infection and has been found to co-infect with other bacteria. Although the virus can cause morbidity and mortality in the elderly, RSV-bacteria co-infection had rarely been reported. In this paper, we reported the case of an elderly woman with RSV and *Streptococcus pneumoniae* co-infection in a familial cluster during the COVID-19 pandemic era. The patient was treated appropriately and showed complete recovery.

Key words: Co-infection, familial cluster, respiratory syncytial virus, *Streptococcus pneumoniae*

INTRODUCTION

In the United States, respiratory syncytial virus (RSV), a common pathogen causing respiratory tract infection,[1] accounts for approximately one-fourth of hospitalizations among infants and young children due to lower respiratory tract infections.[2] Apart from infants and children, RSV can also cause morbidity and mortality in adults, especially in older adults, those with severe lung disease, and immunocompromised patients.[3] RSV is attributable for 1%–10% of acute respiratory infections in adults and 2%–14% of acute respiratory infections in patients with chronic diseases or organ transplantation.[3]

CASE REPORT

In December 2020, a healthy 70-year-old woman presented with a 1-day duration of fever, productive cough, and malaise occurring after taking care of her husband during illness. Her husband was admitted for pneumonia [Figure 1a] 2 days earlier after taking care of their granddaughter. Two weeks prior to that, her 1-year-old granddaughter was admitted for RSV bronchiolitis. On admission, the patient's physical examination showed that she was febrile (37.6°C) and had crackles over bilateral lungs. Laboratory results were notable for a white blood cell count of 10,660/mm^3 with neutrophil predominance (86.6%) and a high level of C-reactive protein (16.2 mg/dL). The chest plain film showed increased interstitial infiltration in the bilateral lung fields [Figure 1b]. Computed tomography of the chest revealed multiple ill-defined patchy ground-glass opacities and mild bronchial wall thickening with minimal centrilobular opacities in the bilateral lung fields [Figure 1c]. A familial cluster of pneumonia was created for her and her husband during the COVID-19 pandemic. Therefore, both were transferred to the isolation ward for pathogen identification and management.

Gram staining of the sputum specimen showed few Gram-positive cocci. The cultures of blood and sputum specimens yielded no pathogens. Both rapid antigen testing for influenza and polymerase chain reaction (PCR) for severe acute respiratory syndrome coronavirus 2 in nasopharyngeal swabs showed negative results. The patient's urine antigen test was positive for *Streptococcus pneumoniae* (her husband's test

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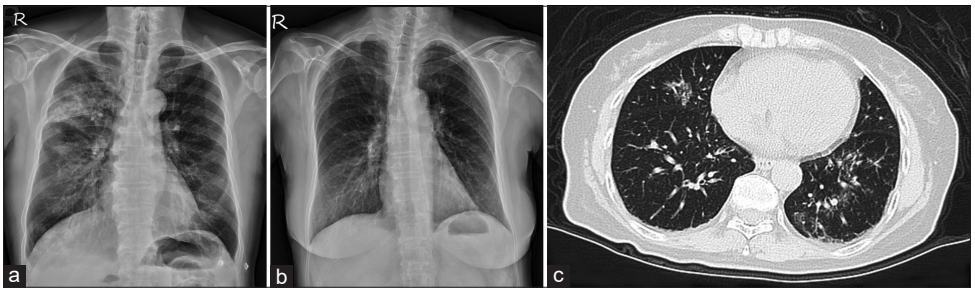

Figure 1: (a) The chest film showed increased interstitial infiltrations, patchy, and ground-glass opacity in the right upper lung field. **(**b) The chest film showed increased interstitial infiltrations in the bilateral lung fields. **(**c) Computed tomography of the chest revealed multiple ill-defined patchy ground-glass opacities and mild bronchial wall thickening with minimal centrilobular opacities in the bilateral lung fields

was negative). Multiplex PCR testing (BioFire® FilmArray® Respiratory Panels) on nasopharyngeal specimens of the patient and her husband showed positive results for RSV. Thus, a familial cluster of RSV infection was confirmed. In addition, a diagnosis of RSV and *S. pneumoniae* co-infection was made. She was treated with levofloxacin (750 mg/day) and was discharged after 5 days of treatment.

DISCUSSION

RSV was initially noted as a common cause of severe respiratory illness in young children. Subsequently, the pathogen was found to cause serious illnesses among healthy community-dwelling older adults.[4] RSV infection in adults may cause tracheobronchitis or other types of lower respiratory tract diseases, including pneumonia, bronchitis, exacerbation of asthma, or chronic obstructive pulmonary disease, particularly in older adults and patients in long-term care facilities.[5] RSV should be considered in patients hospitalized with acute lower respiratory tract disease if they are immunocompromised or ≥50 years of age. Compared with influenza in adults ≥65 years of age, RSV appears to be associated with an increased risk of hospitalization >7 days, exacerbation of chronic obstructive pulmonary disease, and increased mortality within 1 year.[4] A systemic review revealed that the mortality rate among adults ≥50 years of age hospitalized with RSV was 6%–8%.[6] Therapy for RSV infection of the lower respiratory tract is supportive care, including frequent monitoring of clinical status, providing fluids, and respiratory support, if necessary.

RSV-bacterial co-infection in children has been reported previously.[1] Infants with RSV-bacterial co-infection have been found to have prolonged hospitalizations, are admitted to the intensive care unit (ICU) more frequently, and require prolonged ventilator support in the ICU.[1] However, few studies have described superinfection or co-infection with bacteria among adults with RSV pneumonia.[7] The burden and epidemiology of bacterial superinfections are poorly understood. A recent study found that 31.9% of RSV-infected adult cases presented with radiologically confirmed pneumonia, and 9.7% had an RSV-bacterial co-infection.[7] In addition, a higher prevalence of RSV-bacterial co-infection was noted in older adults, those who are immunosuppressed, and patients with comorbidities.[7] Adults with RSV-bacterial co-infection were associated with longer hospitalizations and more frequent ICU hospitalizations.[7] These findings indicate that patients with RSV-bacteria-associated pneumonia have worse clinical outcomes than those with RSV pneumonia alone.

Among RSV-infected children, *S. pneumoniae*, *Haemophilus influenzae*, and *Moraxella catarrhalis* were detected more frequently in both outpatients and inpatients.[8] It is known that *S. pneumoniae* colonization enhances RSV replication in human bronchial epithelial cells.[9] In addition, *S. pneumoniae* or *H. influenzae*-dominated microbiome profiles in children have been associated with enhanced mucosal pro-inflammatory responses.[10] Detection of *S. pneumoniae* and *H. influenzae* was associated with fever, more frequent antibiotic treatment, poor radiologic findings, and higher neutrophil counts.[8] Patients with *S. pneumoniae* and *H. influenzae* co-detection had longer hospitalizations, prolonged oxygen administration, and increased disease severity.[8] In contrast, *Staphylococcus aureus* detection was not common in children with RSV infection and was not associated with worse clinical outcomes.[8] For most patients hospitalized with pneumococcal pneumonia, empirical treatment with ceftriaxone or fluoroquinolones, such as levofloxacin or moxifloxacin, was advised.

CONCLUSION

Here, we report an unusual case of RSV-*S. pneumoniae* co-infection in an older adult with an RSV familial cluster. The patient was treated with levofloxacin and recovered well. Although the incidence of RSV infection in adults is low, RSV infection should not be ignored in adults with pneumonia.

Early recognition of RSV-bacterial co-infection is crucial for administering appropriate treatment. While this report focuses on the importance of RSV, other pathogens that cause acute respiratory tract disease should also be considered during the COVID-19 pandemic era.

Ethical approval

The study was conducted in accordance with the Declaration of Helsinki and was approved by the local ethics committee of the institute(IRB institution name: Tri-Service General Hospital, Approval number: A202105033, Approval date: 2021/3/9). Informed written consent was obtained from all patients prior to their enrollment in this study.

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Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient had given her consent for her images and other clinical information to be reported in the journal. The patient understands that name and initials will not be published and due efforts will be made to conceal identity, but anonymity cannot be guaranteed.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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