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CHANGING DYNAMIS AND EMERGENCE OF NEW EVIDENCE IN VARIOUS SEVERE RESPIRATORY INFECTIONS

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Abstract:

Respiratory tract infection can be characterized as upper respiratory tract infection and lower respiratory tract infection. Respiratory tract infection is fatal. Influenza a virus plays a vital role in causing severe respiratory tract infection. Rhinovirus, human adenovirus (HAdV), respiratory syncytial virus (RSV), and human metapneumovirus (hMPV) are noninfluenza viruses which couldn't be ignored in severe respiratory infections.

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INTRODUCTION:

Lower respiratory tract infection (LRTI) is a leading cause of death worldwide and the most common infection identified in patients admitted to the intensive care unit. [1,2] This infection effects group of aged persons the most.The diagnosis and treatment of lower respiratory tract infections includes community-acquired pneumonia has focused traditionally on bacterial pathogens. [3] The study of respiratory viral pathogens in severe respiratory illness has been increased in the past because of the limited pharmacologic therapies and diagnostic techniques. Evolution in the diagnostic platforms and pneumonia epidemiology occurred, which leads to change. The success of childhood vaccination programs and the aging have changed the scenario of severe respiratory infection. Viral pathogens and invasive pneumococcal disease has declined dramatically that particularly impact the elderly are now recognized as common causal pathogens in severe disease. [4,5] Nowadays the widespread use of nucleic acid amplification testing improved the detection of viral pathogens.The current studies increased the importance of respiratory viral pathogens in the pathogenesis of severe respiratory infections with a particular emphasis on community-acquired infections. Influenza virus plays an important role in severe respiratory infections, however the noninfluenza viruses like rhinovirus, human adenovirus (HAdV), respiratory syncytial virus (RSV), and human metapneumovirus (hMPV) couldn't be ignored in severe respiratory infections.

The Evolving Epidemiology of Severe Respiratory Infections:

In some study, the hospitalizations for pneumonia in patients 65 years of age or older increased by 20% over a 15-year period with an 11% increase in the number of patients with chronic cardiac or pulmonary disease. [6] Functionally limited adults and elderly are particularly prone to severe viral infection. [7] The rhinovirus infection is 10 times higher in patients 65 years of age or older than in younger adults and the majority of deaths occurred to respiratory syncytial virus infection occur in patients older than 65 years of age. [8,9] The number of adults susceptible to severe viral infections has increased, the incidence of invasive bacterial pneumonia has decreased by decreased rates of cigarette smoking, pneumococcal vaccination and increased awareness of the importance of early antimicrobial therapy. In one study, the incidence of invasive pneumococcal disease decreased by almost 30% over a 5 year period in adults greater than 50 years of age. [10] Nowadays the ability of diagnosis of viral infections is increased and become more accurate. Diagnostic tests for respiratory viral pathogens include acute and convalescent phase viral serologies, direct fluorescence antibody staining and viral culture. These methods are limited by slow turnaround time and limited sensitivity. [11] Nucleic acid amplification testing with the use of polymerase chain reaction (PCR) platforms has greatly improved the diagnosis of respiratory viral infections. The sensitivity of polymerase chain reaction testing is up to 5 times higher than conventional diagnostic methods, which may be particularly important in elderly patients. [12-15] Polymerase chain reaction can also aid with viral subtyping and quantification of viral burden. Multiplex assays are now available, which allow for the testing of up to 19 viruses simultaneously.[11]Numerous clinical samples can be used for polymerase chain reaction testing including pleural fluid, nasopharyngeal swabs, bronchoalveolar lavage fluid and tracheal aspirates. Viral pathogens are also frequently isolated in patients requiring intensive care unit admission and patients with severe community-acquired pneumonia. In a study, viral pathogens were isolated by reverse transcription polymerase chain reaction (RT-PCR) from nasopharyngeal swabs or lavage fluid in 72 of 198 (36%) patients with health care-associated pneumonia or patients with severe community-acquired pneumonia. [16] Some studies have also found respiratory viral pathogens present in over 20% of patients with hospital-acquired pneumonia (HAP)[17,18] For the understanding of the importance of respiratory viral pathogens in the pathogenesis of severe respiratory infection continues to evolve, it is important for clinicians to be familiar with the unique characteristics of the most commonly identified pathogens.

Rhinovirus:

Rhinoviruses are singe-stranded negative-sense RNA viruses that are divided into 3 species (rhinovirus-A, -B, -C) and more than 160 distinct serotypes. [19] Rhinovirus infections occur throughout the year with increased prevalence noted in the late spring and early fall. [20] Transmission occurs most commonly through autoinoculation after contact with contaminated objects, like aerosolization that majorly contributes to viral spread. [21]Nosocomial outbreaks of rhinovirus have been reported and highlight the importance of infection when caring for infected patients. [22] The clinical importance of rhinovirus in children where it may be responsible for more than 70% of asthma exacerbations in children greater than 2 years of age. [23] Infection with rhinovirus early in childhood has been linked to asthma pathogenesis, particularly in children with a genetic predisposition to the disease. [24] Rhinovirus is also recognized as

an important cause of pediatric community-acquired pneumonia.

Rhinovirus Infection in Adults:
In some adults, rhinovirus most commonly causes a self-limited upper respiratory tract infection (URI) and may be responsible for more than 80% of common colds during the fall and spring. [25] The frequent association with the start of upper respiratory tract infection has led many clinicians to question its resemblence to pneumonia. Rhinovirus can itself be an important pathogen rather than simply a precursor to more serious infections. Immunocompromised patients are particularly prone to severe rhinovirus infection. Infection after lung transplantation is common and may contribute to graft dysfunction. [26] In patients with chronic obstructive pulmonary disease (COPD), rhinovirus is an important cause of exacerbations. In a study of 77 patients with chronic obstructive pulmonary disease and frequent exacerbations, rhinovirus prevalence and viral load, measured in sputum by quantitative reverse transcription polymerase chain reaction, were significantly higher in patients during acute exacerbations. Patients with rhino viral infection, 73% were found to have bacteria in their sputum. [27] This type of association between bacterial coinfection and rhinovirus may be due to changes in the host microbiome. Recent study of healthy controls and rhinovirus infection in patients with chronic obstructive pulmonary disease found that rhinovirus altered the microbiome of chronic obstructive pulmonary disease patients allowing them for an increase in pathogenic bacterial species such as Haemophilus influenzae. [28] Rhinovirus may also degrade antimicrobial peptides in the lung, predisposing susceptible patients to bacterial coinfection. [29]

In adult patients with community-acquired pneumonia rhinovirus is isolated frequently. In some study rhinovirus was the most common pathogen identified and was found in 9% of all patients. Importantly, rhinovirus was rarely isolated in the study's healthy controls. In a single-center prospective study of 304 hospitalized patients with community-acquired pneumonia, rhinovirus was also the most frequently identified pathogen and was isolated in 10% of patients. [30]

Clinical Presentation and Diagnosis
Rhinorrhea and sore throat are typical early symptoms of rhinovirus infection. [31] Common presenting symptoms in patients with community-acquired pneumonia secondary to rhinovirus are not known. In a study of 304 hospitalized patients with community-acquired pneumonia, the most common symptoms in 31 patients with documented rhinovirus infection were sputum production (74%), anorexia (77%), lethargy (87%), pleuritic pain (58%) and cough (94%). [30] Reverse transcription polymerase chain reaction is the preferred diagnostic test for severely ill patients with rhinovirus and more rapid turnaround time than conventional culture based diagnostic methods and improve the sensitivity. In future studies the identification of specific host transcriptional changes may help to differentiate between asymptomatic carriage and true infection. [32]

Treatment:
Treatment of even severe rhinoviral infection is supportive. The reported cases have described the use of pegylated interferon-α2A and ribavirin in immunosuppressed patients with evidence of persistent infection, but this strategy has not been tested in randomized trials. [33]

Human Adenoviruses:
Human adenoviruses are nonenveloped double-stranded DNA viruses that have long been recognized as an important cause of respiratory tract infections in children. [34] Human adenoviruses are divided into seven species (HAdV-A through HAdV-G) with species B, C, and E most commonly associated with respiratory infections. [35] Based on serotypes and genomic analysis, 67 subtypes of adenovirus have been identified. Unlike other respiratory viruses, human adenoviruses infections do not demonstrate clear seasonal variation.[36] Transmission can occur via fecal–oral spread, inhalation of aerosolized droplets, contact with infected environmental surfaces and direct conjunctival inoculation. Human adenoviruses are resistant to many common disinfectants, so rigorous infection control policies, including the use of 95% ethanol for decontamination, are essential to prevent nosocomial spread of infection. [37]

Respiratory Syncytial Virus:
Respiratory syncytial virus is an enveloped, single-stranded RNA ,negative-sense virus first identified more than 50 years ago. [38] The 2 serotypes, respiratory syncytial virus -A and respiratory syncytial virus -B, are discriminated by reactivity to monoclonal antibodies. Respiratory syncytial virus is highly infectious and can spread via contact with infected secretions or aerosolized droplets. [39] The clinical and economic burden of respiratory syncytial virus infection in children is substantial. Respiratory syncytial virus is the most common cause of lower respiratory tract infections in children, with more

than 3 million hospitalizations and up to 200,000 deaths in children less than 5 years of age per year. [40] Respiratory bronchiolitis, characterized by obstruction and inflammation of the small airways, is one of the most common manifestations of respiratory syncytial virus infection and is a significant cause of pediatric morbidity and mortality. [41] Children with Down syndrome seem to be at particular risk of severe infection. [42] Respiratory syncytial virus infection early in life has also been associated with the development of asthma. [43] Respiratory syncytial virus can cause numerous extra pulmonary diseases in children, including hepatitis, seizures and myocarditis. [44]

Human Metapneumovirus:

Human metapneumovirus is a negative-sense, single-stranded RNA virus first isolated in 2001 from children with respiratory tract infections in the Netherlands. [45] Modes of transmission are not well-described, but outbreaks of human metapneumovirus at long-term care facilities and hospital wards highlight the importance of infection control protocols when caring for infected patients. [46] The clinical importance of human metapneumovirus is well-documented in children. In a recent study the human metapneumovirus was identified in 6% of all children hospitalized with increased ICU duration of stay and an acute respiratory illness. [47] Human metapneumovirus may be responsible for more than 10% of all lower respiratory tract infections in children and 5% to 7% of all pediatric respiratory tract infections worldwide. Disease manifestations in children range from bronchiolitis and croup to exacerbations of severe pneumonia and asthma requiring mechanical ventilation. [48]

Challenges and Future Directions:

With the improved sensitivity of polymerase chain reaction -based testing, a major challenge in the diagnosis and treatment of viral pneumonia is distinguishing true infection from isolated upper respiratory infection or asymptomatic carriage. This is especially true for samples obtained from the upper respiratory tract in patients with suspected lower respiratory tract infection. The specificity of polymerase chain reaction testing likely depends on both the age of the patient and the pathogenic identification. Measuring convalescent phase serum antibodies may help to improve the diagnostic yield and specificity of polymerase chain reaction-based testing. Transcriptional profiling of the host response to infection may also aid the diagnosis of viral pneumonia. Recently, an 11-gene influenza virus specific host response signature was identified in human blood that accurately diagnosed influenza infection, predicted outcomes in patients with influenza pneumonia and identified bacterial coinfection. [49]

CONCLUSION:

Nowadays recent studies shows that respiratory tract infections can be cured through proper diagnostic testing, vaccinations, medications and through proper caring of patient. In older ages the respiratory tract infection is the most common cause of death in elderly and children because of no vaccination and medicines are available. Due to advancement in research studies and proper availability it can be cured nowadays. Lungs transplant is also better option for patients with the severe respiratory tract infection.

REFERENCES:

1. Vincent JL, Rello J, Marshall J, et al. International study of the prevalence and outcomes of infection in intensive care units. JAMA 2009;302(21):2323–9.
2. Xu J, Murphy SL, Kochanek KD, et al. Deaths: final data for 2013. Natl Vital Stat Rep 2016;64(2):1–119.
3. Bartlett JG, Mundy LM. Community-acquired pneumonia. N Engl J Med 1995; 333(24):1618–24.
4. Griffin MR, Zhu Y, Moore MR, et al. U.S. hospitalizations for pneumonia after a decade of pneumococcal vaccination. N Engl J Med 2013;369(2):155–63.
5. Ruuskanen O, Lahti E, Jennings LC, et al. Viral pneumonia. Lancet 2011; 377(9773):1264–75.
6. Fry AM, Shay DK, Holman RC, et al. Trends in hospitalizations for pneumonia among persons aged 65 years or older in the United States, 1988–2002. JAMA 2005;294(21):2712–9.
7. Falsey AR, Walsh EE. Viral pneumonia in older adults. Clin Infect Dis 2006;42(4): 518–24.
8. Jain S, Self WH, Wunderink RG, et al. Community-acquired pneumonia Requiring hospitalization among U.S. adults. N Engl J Med 2015;373(5):415–27.
9. Falsey AR, Hennessey PA, Formica MA, et al. Respiratory syncytial virus infection in elderly and high-risk adults. N Engl J Med 2005;352(17):1749–59.
10. Lexau CA, Lynfield R, Danila R, et al. Changing epidemiology of invasive pneumococcal disease among older adults in the era of pediatric pneumococcal conjugate vaccine. JAMA 2005;294(16):2043–5.
11. Mahony JB, Petrich A, Smieja M. Molecular diagnosis of respiratory virus infections. Crit Rev Clin Lab Sci 2011;48(5–6):217–49.

12. Diederen BM, Van Der Eerden MM, Vlaspolder F, et al. Detection of respiratory viruses and Legionella spp. by real-time polymerase chain reaction in patients with community acquired pneumonia. Scand J Infect Dis 2009;41(1):45–50.
13. Templeton KE, Scheltinga SA, van den Eeden WC, et al. Improved diagnosis of the etiology of community-acquired pneumonia with real-time polymerase chain reaction. Clin Infect Dis 2005;41(3):345–51.
14. Garbino J, Gerbase MW, Wunderli W, et al. Lower respiratory viral illnesses: improved diagnosis by molecular methods and clinical impact. Am J Respir Crit Care Med 2004;170(11):1197–203.
15. She RC, Polage CR, Caram LB, et al. Performance of diagnostic tests to detect respiratory viruses in older adults. Diagn Microbiol Infect Dis 2010;67(3): 246–50.
16. Choi SH, Hong SB, Ko GB, et al. Viral infection in patients with severe pneumonia requiring intensive care unit admission. Am J Respir Crit Care Med 2012;186(4):325–32.
17. Hong HL, Hong SB, Ko GB, et al. Viral infection is not uncommon in adult patients with severe hospital-acquired pneumonia. PLoS One 2014;9(4):e95865.
18. Shorr AF, Zilberberg MD, Micek ST, et al. Viruses are prevalent in non-ventilated hospitalacquired pneumonia. Respir Med 2017;122:76–80.
19. 19.Greenberg SB. Update on Human Rhinovirus and Coronavirus Infections. Semin Respir Crit Care Med 2016;37(4):555–71.
20. 20.Turner RB. Rhinovirus: more than just a common cold virus. J Infect Dis 2007; 195(6):765–6.
21. Musher DM. How contagious are common respiratory tract infections? N Engl J Med 2003;348(13):1256–66.
22. Reese SM, Thompson M, Price CS, et al. Evidence of nosocomial transmission of human rhinovirus in a neonatal intensive care unit. Am J Infect Control 2016; 44(3):355–7.
23. Rakes GP, Arruda E, Ingram JM, et al. Rhinovirus and respiratory syncytial virus in wheezing children requiring emergency care. IgE and eosinophil analyses. Am J Respir Crit Care Med 1999;159(3):785–90.
24. Camargo CA Jr. Human rhinovirus, wheezing illness, and the primary prevention of childhood asthma. Am J Respir Crit Care Med 2013;188(11):1281–2.
25. 25.Arruda E, Pitkaranta A, Witek TJ Jr, et al. Frequency and natural history of rhinovirus infections in adults during autumn. J Clin Microbiol 1997;35(11):2864–8.
26. Kaiser L, Aubert JD, Pache JC, et al. Chronic rhinoviral infection in lung transplant recipients. Am J Respir Crit Care Med 2006;174(12):1392–9
27. 27.George SN, Garcha DS, Mackay AJ, et al. Human rhinovirus infection during naturally occurring COPD exacerbations. Eur Respir J 2014;44(1):87–96.
28. Molyneaux PL, Mallia P, Cox MJ, et al. Outgrowth of the bacterial airway microbiome after rhinovirus exacerbation of chronic obstructive pulmonary disease. Am J Respir Crit Care Med 2013;188(10):1224–3.
29. Mallia P, Footitt J, Sotero R, et al. Rhinovirus infection induces degradation of antimicrobial peptides and secondary bacterial infection in chronic obstructive pulmonary disease. Am J Respir Crit Care Med 2012;186(11):1117–24.
30. 30.Jennings LC, Anderson TP, Beynon KA, et al. Incidence and characteristics of viral communityacquired pneumonia in adults. Thorax 2008;63(1):42–8.
31. Harris JM 2nd, Gwaltney JM Jr. Incubation periods of experimental rhinovirus infection and illness. Clin Infect Dis 1996;23(6):1287–90.
32. Heinonen S, Jartti T, Garcia C, et al. Rhinovirus detection in symptomatic and asymptomatic children: value of host transcriptome analysis. Am J Respir Crit Care Med 2016;193(7):772–82.
33. Ruuskanen O, Waris M, Kainulainen L. Treatment of persistent rhinovirus infection with pegylated interferon alpha2a and ribavirin in patients with hypogammaglobulinemia. Clin Infect Dis 2014;58(12):1784–6.
34. Gardner PS. Virus infections and respiratory disease of childhood. Arch Dis Child 1968;43(232):629–45.
35. Lion T Adenovirus infections in immunocompetent and immunocompromised patients. Clin Microbiol Rev 2014;27(3):441–62.
36. Ison MG, Hayden RT. Adenovirus. Microbiol Spectr 2016;4(4).
37. Sandrock C, Stollenwerk N. Acute febrile respiratory illness in the ICU: reducing disease transmission. Chest 2008;133(5):1221–31.
38. Griffiths C, Drews SJ, Marchant DJ. Respiratory syncytial virus: infection, detection, and new options for prevention and treatment. Clin Microbiol Rev 2017; 30(1):277–319.
39. Drysdale SB, Green CA, Sande CJ. Best practice in the prevention and management of paediatric respiratory syncytial virus infection. Ther Adv Infect Dis 2016;3(2):63–71.

40. Nair H, Nokes DJ, Gessner BD, et al. Global burden of acute lower respiratory infections due to respiratory syncytial virus in young children: a systematic review and meta-analysis. Lancet 2010;375(9725):1545–55.
41. Hall CB, Weinberg GA, Iwane MK, et al. The burden of respiratory syncytial virus infection in young children. N Engl J Med 2009;360(6):588–98.
42. Stagliano DR, Nylund CM, Eide MB, et al. Children with down syndrome are high-risk for severe respiratory syncytial virus disease. J Pediatr 2015;166(3): 703–9.e2.
43. Sigurs N, Aljassim F, Kjellman B, et al. Asthma and allergy patterns over 18 years after severe RSV bronchiolitis in the first year of life. Thorax 2010; 65(12):1045–52.
44. Bohmwald K, Espinoza JA, Rey-Jurado E, et al. Human respiratory syncytial virus: infection and pathology. Semin Respir Crit Care Med 2016;37(4):522–37.
45. van den Hoogen BG, de Jong JC, Groen J, et al. A newly discovered human pneumovirus isolated from young children with respiratory tract disease. Nat Med 2001;7(6):719–24.
46. Kim S, Sung H, Im HJ, et al. Molecular epidemiological investigation of a nosocomial outbreak of human metapneumovirus infection in a pediatric hematooncology patient population. J Clin Microbiol 2009;47(4):1221–4. [PubMed: 19213698]
47. Edwards KM, Zhu Y, Griffin MR, et al. Burden of human metapneumovirus infection in young children. N Engl J Med 2013;368(7):633–43. [PubMed: 23406028]
48. Williams JV, Harris PA, Tollefson SJ, et al. Human metapneumovirus and lower respiratory tract disease in otherwise healthy infants and children. N Engl J Med 2004;350(5):443–50.
49. Andres-Terre M, McGuire HM, Pouliot Y, et al. Integrated, multi-cohort analysis identifies conserved transcriptional signatures across multiple respiratory viruses. Immunity 2015;43(6):1199–211.