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Associated bacterial infections with covid 19 infection

A graduation project

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Abstract

Associated bacterial infections with viral respiratory infections are common and it's important cause of morbidity and mortality . The prevalence of bacterial infection in patients infected with SARS-CoV-2 is not well understood. One reason for this bacterial co-infection is due to many hospital-associated bacteria being adapted to develop an infection in individuals with a weakened immune system .

While antibiotics are ineffective for treatment of COVID-19, they are prescribed for a variety of reasons. This includes difficulty in ruling out bacterial co-infection on presentation but also the possibility of bacterial secondary infection during the course of illness

Introduction

Current study shows that secondary bacterial infections, although less frequent than in previous influenza pandemics, affect COVID-19 patient . Bacterial co infection rates increase in patients admitted in the intensive careunits, and those diseases can be due to superinfections by nosocomial antibiotic-resistant bacteria. This highlights the urgency to revise frequent and empiric prescription of broad-spectrum antibiotics in COVID-19 patients, with more attention to evidence-based studies and respect for the antimicrobial stewardship principles.[1]

Some studies have shown that viral agents such as influenza viruses can be associated with secondary bacterial pneumonia that might occur throughout hospitalization and lead to the death of individuals with or without preexisting respiratory diseases [2] .The damage of ciliated cells can also be observed in association with respiratory syncytial virus infection; it can result in deterioration of mucociliary clearance, increased adhesion of bacteria to mucins and, enhanced colonization of the bacteria in the airway. Moreover, new receptors for bacterial adherence can emerge following the virus-induced death of the airway epithelial cells[3]. In addition, after an acute inflammatory reaction and pulmonary tissue

damage induced by viral infections, a resolving/repair phase of the lung tissue takes place. Due to varied immune responses in different individuals, this phase may cause an enhanced susceptibility to respiratory bacterial

infections. Thus, bacterial superinfection can occur after a viral infection, which in turn might lead to increased morbidity and mmortality[4] . some reports showed that secondary infections significantly decreased survival of COVID-19 patients .Of nineteen COVID-19 patients, 11 (58%) patients were male and 8 (42%) were female, with a mean age of ~ 67 years old. The average ICU length of stay was ~ 15 days .all patients were found positive for bacterial infections, including seventeen Acinetobacter baumannii (90%) and two Staphylococcus aureus (10%) strains

Literature review

Cornoavirus

The coronavirus disease 2019 (COVID-19) was first recognized in Wuhan, China, in December 2019. It rapidly spread across mainland China and became a global threat. As of May 7, 2020, the causative pathogen, namely severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has infected 3,672,238 people and caused 254,045 deaths globally.A striking aspect of COVID-19 is that the disease became a pandemic in less than 3 months. Advances in modern medicine facilitated the early recognition of SARS- CoV-2, previously known as 2019 novel coronavirus, and identification of potential treatments, such as lopinavir/ ritonavir, chloroquine/hydroxychloroquine, and remdesivir for SARS-CoV-2. However, several issues, such as a useful strategy to prevent disease spread, collection of appropriate clinical specimens, transmission route, viral dynamics, and effective drug treatments, remain unclear. In addition, the possibility of co-infection with other respiratory pathogens remains unknown. However, this should be an important concern for clinicians in the management of COVID-19. [5] [6]

Co-infection in influenza, SARS, and Middle East respiratory syndrome

The recent community-acquired pneumonia (CAP) guidelines by the American Thoracic Society (ATS) and Infectious Diseases Society of America (IDSA) recommended initial antibacterial treatment for adults with CAP who test positive for influenza, because bacterial co-infections are a common and serious complication of influenza and it is difficult to exclude the presence of bacterial co-infection in a patient with CAP who tested positive for influenza virus. Based on previous studies on severe coronavirus infections ,serological evidence among SARS patients indicated incidences of acute or recent Chlamydophila pneumoniae (30%) or Mycoplasma pneumoniae (9%) infection, respectively. Furthermore, SARS and human metapneumovirus co-infection were reported during a major nosocomial SARS outbreak in Hong Kong.Moreover, co-infection of the Middle East respiratory syndrome coronavirus (MERS-CoV) with influenza and tuberculosis has been reported. A multicenter retrospective cohort study of critically ill patients with MERS-CoV demonstrated that 18% and 5% had bacterial and viral co-infections, respectively. These findings indicate the possibility of co-infection with coronaviruses and other respiratory pathogens. However, there are limited studies reporting this clinical phenomenon.[7] [8] [9]

Co-infection in COVID-19

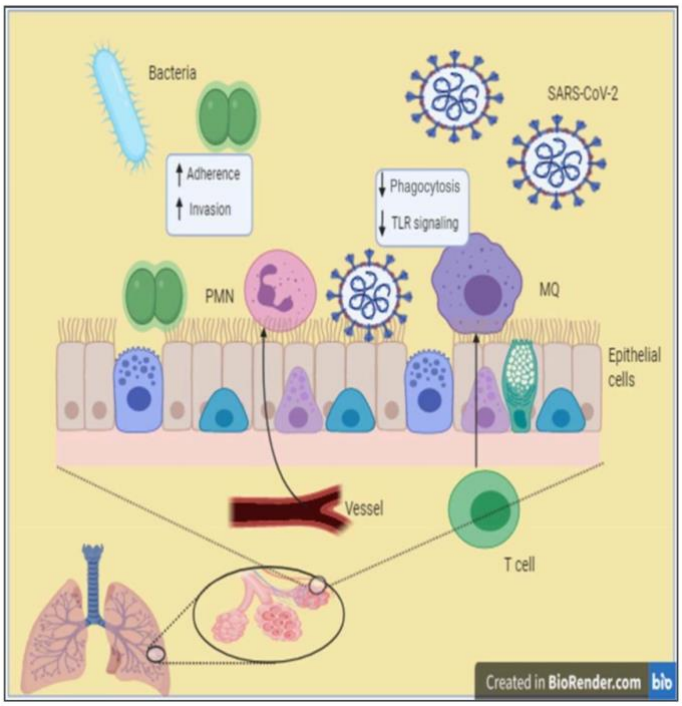
The co infection of the SARS-CoV-2 with other microorganisms, such as virus, bacteria, and fungi, is a very important factor in COVID-19, and it can raise the difficulties of diagnosis, treatment, prognosis of COVID-19, and even increase the disease symptom and mortality. [10]

13 studies reported the prevalence of COVID-19 co- and secondary infections , and all of them were cross-sectional studies.Nine of the above mentioned studies were conducted in China.Meanwhile, three of these studies were conducted in the United States (US),one each in Singapore and Italy. Only laboratory-confirmed COVID-19 cases were identified from these studies, and the study population ranged from 21 to 5700 cases.

In the study of 18 patients in Singapore, none had co or secondary infections. By contrast, Zhou et al. showed that 27 (50%) of 54 non-survivors had secondary infections in a study of 191 patients in China. Among the other 10 studies, the prevalence of COVID-19-associated co- and secondary infection ranged from 0.6% to 45.0%. Six studies reported the occurrence of bacterial co-infection, and M. pneumoniae Legionella pneumophila, Streptococcus pneumoniae, and C. pneumoniae were identified as co-pathogens. Eight studies reported viral co-infections; rhinovirus/enterovirus and influenza A were the commonest co-pathogen, and coronavirus, respiratory syncytial virus, parainfluenza, metapneumovirus, and influenza B virus were also reported as co-pathogens. In Chen et al.'s study of 99 COVID-19 patients, 4 (4.0%) had fungal co-infections, including Candida albicans and C. glabrata Secondary bacteremia can develop in 37% (27/73) of patients with acute respiratory distress syndrome . In this study, we established that COVID-19 can cause co-infections with bacteria, viruses, and fungus. The prevalence of COVID-19-associated co-infections varied; however, the prevalence of secondary infections could be as high as 50% among non-survivors.[11] [12]

Mechanism of co-infections

One reason for this bacterial co-infection is due to many hospital-associated bacteria being adapted to develop an infection in individuals with a weakened immune system. It has been noted that the SARS-CoV-2 infection can damage the cells and the lung infrastructure. Subsequently, the changed condition enables bacteria to increase adherence and invasion[16]



Postulated schematic of bacterial coinfection with SARS-CoV-2 infection [16]

The SARS-CoV-2 enters human cells by binding to the ACE2 protein of the cells lining the upper and lower airways . specific molecular kinetics of these additional infections in COVID-19 patients are still remained unclear [13]

Respiratory viruses are frequently collaborated by secondary bacterial infections due to the outgrowth of opportunistic bacterial pathogens. Although the specific molecular mechanisms of co-infections in COVID-19 patients remain unclear, it may include virus-induced airway damage, cell loss, goblet cell hyperplasia, altered mucus secretion, reduced ciliary beat frequency, function and clearance, reduced oxygen exchange, and damage to the immune system . [14]

Recent studies suggested that COVID-19 patients having microbial co-infections are characterized by lymphopenia and enhanced levels of proinflammatory cytokines including interleukin-6 (IL-6) and IL-1β as well as MCP-1, IP-10, and granulocyte colony-stimulating factor (G-CSF)

in the plasma. It has been proposed that high levels of proinflammatory cytokines might lead to shock as well as respiratory failure or multiple organ failure, and several trials to assess inflammatory mediators are under way[15]

after an acute inflammatory reaction and pulmonary tissue damage induced by viral infections, a resolving/repair phase of the lung tissue takes place. Due to varied immune responses in different individuals, this phase may cause an enhanced susceptibility to respiratory bacterial infections. Thus, bacterial superinfection can occur after a viral infection, which in turn might lead to increased morbidity and mmortality[4]

Diagnosis

The microbiological examination is a practical way for diagnosis, especially sputum culture . However, taking sputum or blood samples from SARS-CoV-2–infected patients may pose a significant risk to biological sample collectors and laboratory technicians as the SARS-CoV-2 does not only spread through respiratory droplets and direct contact but also through virus-laden aerosols

In addition, imaging is very important. We might see a new infiltrate on chest x-ray or CT scan. We also look at inflammatory markers to see whether there are any changes, for example, in C-reactive protein (CRP), ferritin, and lactate dehydrogenase. Some people also look at procalcitonin (PCT), but PCT may be more useful in deciding whether to continue antibiotic rather than as a diagnostic tool. This is particularly true for HABP and VABP. A recent study found that PCT can rule out secondary bacterial infections with good predictive values, help physicians decide whether to stop antibiotic therapy. [17]

Treatment

The prevalence, incidence and characteristics of bacterial infection in patients infected with SARS-CoV-2 is not well understood and has been raised as an important knowledge gap

While antibiotics are ineffective for treatment of COVID-19, they are prescribed in patients with suspected or documented COVID-19 for a variety of reasons. This includes difficulty in ruling out bacterial co-infection on presentation but also the possibility of bacterial secondary infection during the course of illness. Extrapolating from concerns of an increase in mortality in patients with bacterial superinfection during influenza pandemics,

several guidelines advocate the use of empiric antibiotics for patients with severe COVID . However, this assumption raises concerns of antibiotic overuse and subsequent harm associated with bacterial resistance.

How important is the timely and appropriate administration of antibiotics, and what factors should be considered when deciding on a treatment?

Studies have shown that it is essential to start antimicrobial therapy as early as possible. However, it needs to be appropriate and effective therapy, which means several factors must be considered. How long has the patient been in the hospital? What are their risk factors? What is the local antimicrobial resistance in your hospital? Has the patient already been exposed to an antibiotic? Once you consider those factors, you need to start therapy within a few hours - not 24 hours or 48 hours -- because delayed therapy increases the risk ، Sepsis data have shown that every hour delay in antimicrobial therapy increases the risk of morbidity and mortality. identifying these infections early increases the likelihood of for complications. successful treatment. [18]

So , For Gram-negative coverage, we usually use a broad-spectrum beta-lactam such as cefepime, piperacillin, tazobactam, or meropenem, along with a quinolone or aminoglycoside. For MRSA coverage, we primarily use vancomycin or linezolid, with telavancin as a third-line agent. We also start empiric treatment. It is very important to obtain the culture and identify the pathogens, then de-escalate therapy the moment you get the result rather than keep the patient on double therapy for a long time.[19]

Conclusion

Among patients with COVID-19, the overall proportion of bacterial co-infection was low but usage of antibiotics was high. There is insufficient evidence to support widespread use of empiric antibiotics in patients hospitalized for COVID-19, particularly those without critical illness.

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