

Management of respiratory illnesses



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CA40 – Pneumoniae (CAP)

Pneumoniae is an infection of the lungs which could occur due to an invasion by bacteria, viruses, or fungi. This assists in the classification of pneumoniae such as bacterial pneumoniae, viral pneumoniae, and fungal pneumoniae. However, in adults, bacterial pneumoniae is the most common. Pneumoniae results in the inflammation of alveoli (air sacs) and can cause them to fill up with fluid or pus, which can also result in experiencing some difficulty breathing. Pneumoniae can also be classified based on where it was acquired, such as Community-Acquired Pneumoniae and Hospital-Acquired Pneumoniae (1). Community-Acquired Pneumoniae is most common and is often associated with acute respiratory distress syndrome (2). Most of the Community-Acquired Pneumoniae is bacterial and is caused by *Streptococcus pneumoniae*, and very commonly it can follow flu or cold and show similar signs or symptoms as those of flu or cold.

Symptoms of pneumoniae can be mild to severe to life-threatening.

Symptoms that most commonly appear in patients with pneumoniae include cough with phlegm (mucous), fever and chills, shortness of breath, and chest pain under a bit severe conditions. These are the early symptoms that may be observable in a patient; however, symptoms may vary according to an infection's cause and its severity. For example, bacterial pneumoniae can result in fever as high as 104-105°, resulting in bluish lips and nails. Also, bacterial *Streptococcus pneumoniae* is the number one cause of mortality, representing up to 70% of all community-acquired pneumoniae deaths (3).

As community-acquired pneumoniae is being discussed, it makes total sense that it will be contagious. Pneumoniae can most certainly occur as a result of airborne transmission, as people may sneeze or cough around and without noticing, once can inhale the bacteria. Basically, both viral and bacterial pneumoniae are contagious. Fungal pneumoniae is not a common disease; however, one can most certainly acquire it from the environment, but it does not have the capability to spread from person to person.

Based on the symptoms and a patient's health, a suitable treatment is given by a physician. It is found that nearly always, pneumoniae is caused by bacteria and therefore, must be treated with antibiotics; however, antibiotics should be avoided for other acute respiratory conditions that are not bacterial (1). Generally, for healthy patients who may have been infected with pneumoniae, Azithromycin 500 mg is prescribed to be administered orally. Whereas for unhealthy patients, such as the ones suffering from chronic heart, liver, lung, or renal disease, Levofloxacin 500 mg may be prescribed to be administered orally.

Based on what I have learned from HMX Fundamentals from Harvard Medical School, both Azithromycin and Levofloxacin are metabolized in the liver and are excreted out of the body through urine. The mechanism of action for both antibiotics is bactericidal; they inhibit DNA gyrase which results in inhibition of DNA replication and transcription process, keeping the bacteria from reproducing and multiplying in our body.

CA23 – Asthma

Asthma is a very common disease for lung airways, resulting in the inflammation of airways, which cause obstruction of the air passageway making it difficult to breath, and in some severe cases can make some physical activities difficult to perform or even impossible. Nowadays, Asthma is a very common disease, especially in children, and it can be either acute or chronic. Basically, apart from trachea and the left and right bronchi, the main path that takes the air into our lungs, there are many smaller airways that are responsible for supplying oxygen to the air sacks and eventually, our blood stream. Asthma can result when there is a swelling or thickening of the lining of the airways or if the muscles around the airways tighten up the space thereof, it results in the reduction in the amount of air that is able to pass through. As mentioned above, Asthma can be acute or chronic, and it appears a little differently. For instance, chronic Asthma is characterized by reversible airway obstruction in response to different stimuli. Acute Asthma worsening are present and looked at very differently in children and adults (4). In a study, it was found that acute Asthma worsening may range from brittle Asthma, or wide variation in in peak respiratory flow rate (PEFRs) and severe sudden attacks against a background of a fairly controlled disease, to nearly fatal Asthma in adults, where mechanical ventilation becomes a necessity (4).

In adults, acute Asthma is characterized by a reduction in PEFr, an increase in heart rate, and not being able to speak sentences in one breath. Whereas, the characterization is much simpler in children, that children with severe acute Asthma may be too breathless and may not be able to speak sentences in one breath and may have increased heart rate while talking or

even eating (4). The most common symptoms that may appear in Asthma patients include coughing, especially while laughing or exercising, a wheezing sound when breathing, shortness of breath, chest tightness, and sometimes fatigue, as due to obstruction in the airways, less oxygen is reaching the cells making it difficult to carry out regular activities. In recent research, it was shown that *Chlamydia Pneumonia* was one of the cause of infectious Asthma; however, this is a condition where Asthma may be acute and viral infections such as the Respiratory Syncytial Virus (RVS) and Human Rhinovirus (HVR) may be causing it (5). Keeping in mind that Asthma can also be acute, *Chlamydia Pneumonia* is not the only microorganism that causes it, and there is a great possibility that it is being caused by other viral, bacterial, and fungal microbes and most certainly, an acute Asthma condition may turn into a chronic one. However, people with a history of viral infections are not the only one that may develop this condition; Asthma can be inherited (genetically) as well. It was found, as of 2017, by the World Health Organization that approximately over 300 million people, including children and adults worldwide, were suffering from Asthma, and that almost 255, 000 people die each year due to this condition (5).

Considering the fact that our environment is now much more polluted, as compared to couple hundred years ago, there is not much that can be done in order to prevent Asthma, but we can still try. Parents should try to keep their children (infants and toddlers) away from heavily crowded places, as there is a high risk of getting a viral infection. Infants and toddlers do not have a string immune system and may easily catch an infection. Parents should also get their children vaccinated as required to prevent viruses from

getting into them, as it can significantly increase the risk of acquiring Asthma in individuals who got infected in their early life with microbes like *Chlamydia Pneumonia* (5). Not only there is increased risk of acquiring Asthma, it also significantly affects the treatment outcomes.

For people who may have developed Asthma due to a microbe such as *Chlamydia Pneumonia*, based on my learning from HMX Fundamentals (Pharmacology) from Harvard Medical School, Azithromycin may be given to patients to eliminate the microbe. I also learned that Azithromycin is used for a lot of conditions, including Acute Exacerbation of Chronic Obstructive Pulmonary Disease, which is very similar condition as Asthma. I also learned that in terms of pharmacodynamics (effects and mechanism of a drug), Azithromycin, a semi-synthetic antibiotic is able to treat diseases caused by Chlamydia. Azithromycin is very similar in structure to Erythromycin; however, can reach higher intracellular concentrations resulting in increased efficacy (maximum achievable response) and duration of action.

Azithromycin is given orally, and, in this case, biliary excretion is a major route of elimination, as well as urine. Its mechanism of action is bactericidal, as it binds the 50s subunit of the 70s ribosome, resulting in inhibition of protein synthesis that is dependent on RNA.

Based on the concepts learned through HMX Fundamentals (Pharmacology), for patients with moderate to severe Asthma conditions or patients suffering from chronic Asthma, a drug called Albuterol can be used. This drug is a bronchodilator and is commonly used for the management of Asthma and chronic obstructive airway diseases. This drug can have an oral administration or aerosol administration (inhalation). When taken through

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aerosol administration, it can result in rapid systemic absorption, delivering faster results, as the drug is directly getting in the bloodstream from our lungs. For its mechanism of action, Albuterol binds to beta (2) receptors in our lungs, which are responsible for relaxation of bronchial smooth muscle. Binding of Albuterol with beta (2) receptors results in different protein and enzymatic activities, which eventually leads to a decrease in the calcium concentration, causing the smooth muscle to relax → bronchodilation. Along with bronchodilation, Albuterol results in the inhibition of Bronchoconstricting agents release from the mast cells that would enhance the mucociliary clearance by the of inhibition microvascular secretions.

CA01 – Acute Sinusitis

One of the most important system of our body is the Respiratory System. Respiratory system assists us in removing carbon dioxide from our body and providing oxygen. This is critical as oxygen is required by almost all the cells of our body in order to carry out different activities, such as the production of ATP molecules which provide us energy to perform routine tasks, like walking, running, exercising, etc., as well as anything that happening internally (inside our cells, tissues, or organs). There are various infections of the respiratory systems hence, they may be classified as upper or lower respiratory infections. Infections in the lower respiratory tract are more severe and include *Bronchitis*, *Bronchiolitis*, and *Pneumoniae* ; whereas, the upper respiratory infections are less severe and include common cold, pharyngitis, and otitis (1). Another upper respiratory infection is *Sinusitis* . It is an acute infection which results in inflammation of one or more paranasal sinuses and is one of the most common respiratory infections.

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As mentioned earlier, sinusitis is one of most common respiratory infections hence, it is generally followed by a flu or cold. Flu or cold can indicate that our body has been invaded by bacteria and in order to fight back and prevent further damage, mucous is produced by the mucous membranes present in the sinuses to trap foreign bodies such as dust particles and try keep them from entering our body, this including things like polyps, may predispose to acute sinusitis (6). The most common causative agents of acute sinusitis include *Streptococcus pneumoniae*, *Haemophilus influenzae*, and *Moraxella catarrhalis*. People can also have chronic sinusitis, which may occur due to improper treatment of acute sinusitis or due to a deviated nasal septum; however, a deviated nasal septum may be fixed by a minor sinus surgery. Also, aerobic and anaerobic microorganisms can together cause chronic sinusitis.

Studies have shown that an acute sinusitis can over time transition into chronic sinusitis, and this can occur due to therapy failure which causes resistant aerobic and anaerobic bacteria to emerge (2). It was also illustrated that the selective pressure of antimicrobial agents can allow the growth of resistant microbes and provide conditions that promote the growth of anaerobic bacteria. This could happen due to swelling and persistent edema, and the aerobic bacteria consuming oxygen. Besides that, other factor that may contribute towards virulence could include the selection of anaerobic microbes that have certain virulence factors, like a capsule (2). Sinusitis caused by *Streptococcus pneumoniae* have certain enzymes and proteins located on their surfaces that help them carry out pathogenesis efficiently hence, contributing towards its virulence.

As mentioned earlier, acute sinusitis is not so severe as compared to chronic sinusitis hence, it may not require a lot of treatment and can be cured by over the counter medicines like acetaminophen (Tylenol). Acetaminophen is also known as paracetamol and is a very commonly used analgesic (pain reliever) and antipyretic drug (a drug that reduces fever). Based on my learning from HMX Fundamentals (Pharmacology), in terms of pharmacodynamics, acetaminophen can be used to treat fever, headaches, and other minor aches which may also occur during flu or cold. As acetaminophen is an analgesic drug, it can be used in a combination with some opioid medicines such as codeine, oxycodone, and hydrocodone, which are used to treat severe pain. Researchers are not very sure about its mechanism of action; however, it is thought that acetaminophen primarily acts on the central nervous system and inhibits certain enzymes that are involved in the synthesis of prostaglandins hence, increasing the pain threshold. As acetaminophen acts on the central nervous system and because it is also an antipyretic drug, it has direct effects on the hypothalamus, a part of brain that regulates our body's temperature, which results in relieving fever by causing peripheral vasodilation and sweating. Generally, acetaminophen is prescribed orally therefore, it gets metabolized in the liver and it uses urine as its route of elimination, and approximately 75-80% of acetaminophen is excreted in the urine. Along with acetaminophen, even some home remedies, like drinking warm water with salt, may decrease the symptoms and eventually cure the infection. Under a bit more serious conditions, an individual may require antibacterial therapy and in such cases amoxicillin or cephalosporin, β -lactamase resistant antibiotics, can be taken (6) – Amoxicillin is used more commonly. According <https://assignbuster.com/management-of-respiratory-illnesses/>

to my learning from HMX Fundamentals (Pharmacology) from Harvard Medical School, in terms of pharmacodynamics and mechanism of action, amoxicillin binds to the penicillin-binding protein present inside the bacterial cell wall, inhibiting cell wall synthesis.

If not treated correctly and in time, acute sinusitis may develop into chronic sinusitis and may not be cured with just antibiotics as it is much more severe and in that case irrigation of the sinus may be required or even a surgery if an individual has a deviated nasal septum. Chronic sinusitis can sometimes be natural, in terms when an individual is born with deviated nasal septum or pathways, but generally, it follows acute sinusitis which is caused by flu or cold which may have occurred due to the changes in weather, by viral germs, by shaking hands or staying in crowded places where infected people may be present (flu or cold is contagious), by touching dirty surfaces and then touching nose, eyes, or mouth with unwashed hands. In order to prevent this infection, people should practice more hygienic habits, like washing hands regularly and taking care and precautions during weather change.

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