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Pneumonia is a potentially dangerous lung condition that has a wide variety of causes. These causes usually include microorganisms, such as viruses, bacteria, fungi, and parasites. Pneumonia involves an infection in the parenchyma, including the alveoli and bronchioles, which makes breathing difficult. In the healthcare field, pneumonia is often categorized by the location where the infection was contracted. This helps to identify the most likely causes of the pneumonia in order to begin treatment. The most common categories are community-acquired and medical care-associated pneumonia. This paper will discuss community acquired pneumonia, including the pathophysiology, treatment, patient education, and nursing practice points. With proper diagnosis and education, community acquired pneumonia can result in a positive patient outcome.

A patient may be diagnosed with community-acquired pneumonia (CAP) if symptom onset has not occurred within 14 days of being in a medical care facility. In the United States, CAP is the sixth leading cause of death in those over the age of 65. This is often due to the decreased immune system that comes naturally with age. The lower respiratory tract can usually defend against infection through mechanisms such as the cough reflex, epiglottal reflexes, and mucociliary escalator (Lewis et al., 2014). The mucociliary escalator is performed by epithelial cells lining the respiratory tract. These cells produce a layer of mucus, trapping particles attempting to enter the airway. The cilia of the epithelium move this mucus in an upward motion until the mucus is either swallowed or coughed out. If functioning normally, this process will help to remove organisms that could be potentially infectious (Grossman & Porth, 2014). However, with factors including aging, smoking, and loss of consciousness, this mechanism, as well as others, may be impaired. Without these defenses, pathogens are more likely to enter the

lungs through aspiration of normal flora, inhalation, and hematogenous spread (Lewis et al., 2014).

The direct effect of pathogens on the lungs depends on the specific cause. However, most microorganisms infect the lung and induce an inflammatory response. Inflammation normally occurs with two stages: vascular and cellular. The vascular response involves vasodilation at the site of injury or infection. As blood flow increases, vessels become more permeable, allowing protein to escape the intravascular space. This release of fluids causes swelling and hemostasis. With hemostasis and subsequent clotting, the body attempts to localize the infection and prevent further spread. Additionally, with the second phase of inflammation, leukocytes are presented to the site of infection to kill the invading pathogens. As blood flow slows from the vascular phase, leukocytes adhere to vessel walls. Molecules called selectins aid the leukocytes, primarily neutrophils, in transmigrating through the vessel wall, then chemotaxis leads the cells to the infected area (Grossman & Porth, 2014). When this normal inflammatory response occurs in the lungs, many problems can follow. As blood vessels release fluid, it begins to fill the alveoli. This process, known as consolidation, can be found through physical examination or diagnostic testing. Consolidation can impair gas exchange within the alveoli, resulting in symptoms of hypoxia. Furthermore, this is worsened with the production of excess mucus in the airway. However, if macrophages can successfully remove the debris and restore lung tissue, gas exchange will normalize. This may or may not occur, depending on the presence of complications during pneumonia treatment (Lewis et al., 2014).

Before starting treatment for pneumonia, it is important to acquire a proper diagnosis and discover the causative microbe. Community-acquired pneumonia is most commonly caused by a bacteria called *Streptococcus pneumoniae*. Common signs and symptoms may include chest

pain, productive cough, fatigue, fever, nausea or vomiting, and dyspnea. Those older than 65 or younger than 2 years old should see a physician if pneumonia is suspected. A diagnosis may be confirmed with a chest x-ray, blood test, sputum test, or pulse oximetry. These tests allow the physician to asses for consolidation, oxygen levels, and the presence of a pathologic organism. Ultimately, treatment will depend on the type of pneumonia (Mayo Clinic, 2016). As the cause of community-acquired pneumonia is bacterial in origin, once a culture has been taken, patients are given empiric antibiotic therapy. This is given before reaching a definitive diagnosis to begin treating the infection immediately. This often begins with a broad spectrum antibiotic, which will later be substituted with a narrow spectrum agent once the exact cause is identified (Lewis et al., 2014).

Empiric antibiotic therapy is dependent on previous risk factors, including comorbidities, likelihood of antibiotic resistance, and the location the patient is being treated. The primary groups of antibiotics used are macrolides, fluoroquinolones, and β-lactams (Lewis et al., 2014). Macrolides are broad spectrum agents that impede bacterial protein synthesis. The prototype drug, erythromycin, is effective against most gram positive bacteria, which are typically the cause of CAP. It is generally a safe antibiotic, with some possible gastrointestinal side effects. However, there is a small risk of cardiotoxicity, especially with the use of antidysrhythmic drugs, such as quinidine. Additionally, this drug interacts with warfarin, an anticoagulant, by increasing warfarin levels in the blood. Warfarin is a regularly used drug, so use of erythromycin by a patient taking warfarin may require additional monitoring. However, the second group of antibiotics, called fluoroquinolones, work differently. These broad spectrum agents inhibit DNA synthesis and can be taken orally. Additionally, fluoroquinolones are bactericidal, rather than bacteriostatic, directly resulting bacterial death. While the prototype

drug for this groups of antibiotics is ciprofloxacin, levofloxacin is generally used for respiratory infections. All fluoroquinolones are generally well tolerated, but can cause some gastrointestinal effects and confusion. However, there also exists a rare possibility of these drugs causing tendon rupture. Risk factors for this side effect include taking glucocorticoids, being over 60 years of age, and having had a transplantation of the heart, lung, or kidney. If this drug is prescribed, patients should avoid antacids or dairy products, as absorption will be inhibited. Similarly to macrolides, fluoroquinolones have an adverse interaction with warfarin, which should be monitored closely in a patient taking these antibiotics (Burchum, Rosenthal, Jones, Neumiller, & Lehne, 2016).

Despite the effectiveness of macrolides and fluoroquinolones, the use of β-lactams in some patients may be warranted to treat CAP. β-lactams are a broad antibiotic category that includes penicillins, cephalosporins and carbampenems. These antibiotics are in the same category due to their similar mechanism of action. They affect the cell wall of bacteria, either by inhibiting its synthesis or by directly weakening it. Penicillins include a wide variety of narrow and broad spectrum agents, which have similar chemical properties. When first discovered, penicillin was used widely to treat various diseases. However, many bacteria have now developed resistance to the drugs, including methicillin-resistant *Staphylococcus aureus* (MRSA). However, drugs like amoxicillin can still be used effectively to treat CAP. One of the most common adverse effects of penicillins is hypersensitivity, which is fairly common. For these patients, there is also a one percent chance of a cross-over hypersensitivity to cephalosporins. Therefore, as a precaution, cephalosporins may not be used in those with a penicillin allergy. Cephalosporins are composed of five generations, which increasingly improve treatment against gram negative bacteria, resistance to beta-lactamases, and the ability to cross

the blood-brain barrier. Adverse effects usually include hypersensitivity, but can also include an effect on vitamin K metabolism. Since vitamin K is essential for clotting factors, cephalosporins may cause bleeding disorders. Lastly, carbampenems are the broadest spectrum of antibiotics. However, they can cause adverse gastrointestinal effects, hypersensitivity, and seizures. Imipenem and meropenem are examples that are used to treat CAP (Burchum et al., 2016).

Overall, there are many options to treat CAP if caused by a bacterial infection. Other treatments for community-acquired pneumonia include symptomatic care. Antipyretics may be used to reduce fever, including acetaminophen and ibuprofen. These drugs will also work to relieve pain which is present with pneumonia. Cough suppressants can be used to achieve rest, if coughing is preventing a patient from sleeping. However, a low dose should be used to prevent total removal of the cough reflex (Mayo Clinic, 2016).

In order to prevent community-acquired pneumonia, it is important to educate the patient before they actually acquire an infection. This can include promotion of proper nutrition, rest, exercise, and hand hygiene. These lifestyle choices lower the risk for acquiring an infection. Additionally, since a primary risk factor for CAP is smoking, healthcare professionals should encourage patients to avoid smoking if possible (Lewis et al., 2014). Moreover, there are currently two vaccinations available that lower the incidence of pneumonia in patients at risk. These are the pneumococcal conjugate and pneumococcal polysaccharide vaccinations. Both are recommended for adults older than 65, and those younger than 65 with medical conditions that place them at greater risk for acquiring pneumonia, including diabetes mellitus. While the vaccines are not totally effective, they can greatly decrease the likelihood of acquiring CAP. Patients at risk should be educated on their options regarding this vaccination (Centers for Disease Control and Prevention, 2016). However, if a patient has already contracted pneumonia,

it is important to educate the patient on drug therapy and home care. All antibiotic regimens must be completed in their entirety, or the patient may be at risk of acquiring a drug resistant infection. Additionally, the patient should be informed of any drug or food interactions and how the medications are taken. Pneumonia patients should also be taught about the importance of rest and fluid intake. The patient should be drinking around 6-10 glasses of fluids daily. Recovery may take weeks, and further diagnostic exams may be performed before the diagnosis is resolved (Lewis et al., 2014).

Along with patient education, the nurse plays an important role in directly treating patients with CAP. One of the most important interventions for a nurse is to practice medical asepsis. If proper medical asepsis is not used, including proper hand hygiene and glove use, infection can be spread from patient to patient. As the patient with CAP already has a more compromised immune system, he or she may also be more vulnerable to further infections. Additionally, the patient with CAP may spread their infectious agent to other patients, therefore the nurse must be vigilant in protecting all patients with proper practice. For the CAP patient, the nurse must administer appropriately prescribed medications. This includes antibiotics, antipyretics, and analgesics to treat both the patient's infection and symptoms. Additionally, it is important that while the patient is in the hospital, proper fluid intake is encouraged. Fluids can help mobilize secretions that are building up in the patient's airway. For this same reason, to the individual patient's ability, activity should be encouraged. If the patient's pneumonia is unilateral, then the patient should remain in a side lying position, with the unaffected lung facing downward. Ultimately, most nursing interventions will improve mobilization of secretions and treat symptoms (Lewis et al., 2014).

Overall, community acquired pneumonia normally has a good prognosis. Some patients may experience improvement in as little as 2 weeks. Patients that are young, immunocompromised or elderly may have a more different period of recovery. Many complications can come from community acquired pneumonia, including pleural effusion, empyema, and lung abscesses. In the worst cases, pneumonia may result in death. However, with proper treatment, most patients with community-acquired pneumonia can make a full recovery (Hadjiliadis, 2015). Therefore, healthcare professionals providing the patient with education and proper treatment is critical to their prognosis. In conclusion, while community acquired pneumonia can be a dangerous respiratory condition, proper treatment and education may result in a positive prognosis.

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