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Pulmonary Embolism

Jill Parker
jap_616@yahoo.com

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PULMONARY EMBOLISM

Jill Parker, BSN, RN
Otterbein University, Westerville, Ohio

Introduction

The topic of Pulmonary Embolism (PE) was selected because the author, Jill Parker BSN, RN, works in the Riverside Hospital Emergency Department (ED). In the ED, diagnoses of Pulmonary Embolism are common, and are often not obvious when a patient arrives with chest pain or shortness of breath. However, quick recognition and treatment of PEs are very important.

By creating this poster, the author hopes to provide a summary of current research that explains signs and symptoms of a Pulmonary Embolism, the underlying pathophysiology of the condition, and an explanation about why that is significant. This important information, together with information about treatment and prevention, can serve as an accessible way to help educate patients about the condition.

As an Advanced Practice Nurse, the author plans to continue working with emergent patients, where fast and accurate diagnostic and treatment skills are crucial. Patient education is an important resource in recognizing symptoms of PEs and knowing that they require immediate treatment.

Prevalence of PE

Pulmonary embolism, together with deep venous thrombosis (DVT), are often together referred to as venous thromboembolism. In the United States, the CDC estimates that:

- Approximately 900,000 people develop VTE each year
- Of that number, 60,000 to 100,000 die
- Ten to thirty percent of patients die within a month of diagnosis
- Sudden death is the first symptom in approximately 25% of that population

Therefore, it is extremely important to recognize the risk factors and symptoms of pulmonary embolism so that it can be avoided or treated immediately.

Signs and Symptoms

Patients with a pulmonary embolism often present with a set of nonspecific symptoms. Therefore, it is important for the general population to understand symptoms that might indicate PE. These include leg pain, swelling, or both, often in the calf, shortness of breath, chest pain, fever, excessive sweating, discolored or clammy skin, lightheadedness, and a rapid or irregular heartbeat ("Pulmonary embolism: Overview - Mayo Clinic," 2016). However, the actual diagnosis of PE requires careful clinical judgment. At one end of the spectrum, patients may be completely asymptomatic, while at the other end they may present with cardiogenic shock. Other symptoms that indicate more severe PE include hypotension, hypoxia, tachycardia, elevation of B-type natriuretic peptides or N-terminal pro-B-type natriuretic peptides or troponins, and EKG changes that suggest right ventricular strain (Shapiro & Bhatt, 2016, p. 36).

There are both acquired and genetic risk factors for PE. Acquired factors include immobilization, the use of oral contraceptives or hormone replacement therapy, older age, a malignancy, trauma or fractures, pregnancy or having recently given birth, as well as obesity, and certain types of cardiac or neurologic disease, and a prior history or family history of DVT. The use of central venous catheters or peripheral central catheter lines, immobilization, and postoperative infections are also conditions that carry a high risk of PE.

Pathophysiological Processes

Genetic risk factors include protein C or S deficiency, antithrombin deficiency, factor V Leiden and prothrombin 20210A gene variants, non-O blood groups (Coleman, Obi & Henke, 2015, p. 2-3).

Underlying Pathophysiology

The basic underlying cause of PEs is a blockage in one of the pulmonary arteries. Usually, blood clots originate in the legs, break off, and travel to the lungs where they block blood flow. A high level view of this process is illustrated in Figure 2 ("Pulmonary embolism: Overview - Mayo Clinic," 2016).

Current scientific thinking suggests that the embolism event occurs at the wall of the vein. This includes the inflammatory responses to, as well as the cause of the clot formation. After a vascular injury, platelets form a hemostatic plug and start the aggregation process. A platelet plug is formed, and then coagulation protein assemblies and form a clot (Coleman, Obi & Henke, 2015, p. 4). If the blood clot breaks off and passes to the heart, it can cause cardiac failure. The underlying pathophysiological process of that cardiac failure is described in Figure 1 (Wood, 2002, p. 882).

A pulmonary embolism that travels to the heart causes cardiac failure due to increased wall stress and cardiac ischemia that makes up the Right Ventricle function and impairs the Left Ventricle output. The embolism itself initiates the cycle shown below and to the left.

The embolism travels to the heart and causes pressure on the right ventricle as well as an inadequate blood supply. That leads to increased right ventricle volume, which results in a decreased left ventricle preload, which in turn causes decreased Cardiac Output (CO) and Mean Arterial Pressure (MAP). This leads to decrease right ventricle Coronary Perfusion Pressure (CPP), which starts the cycle over again. Wood, 2002, p. 881-882).

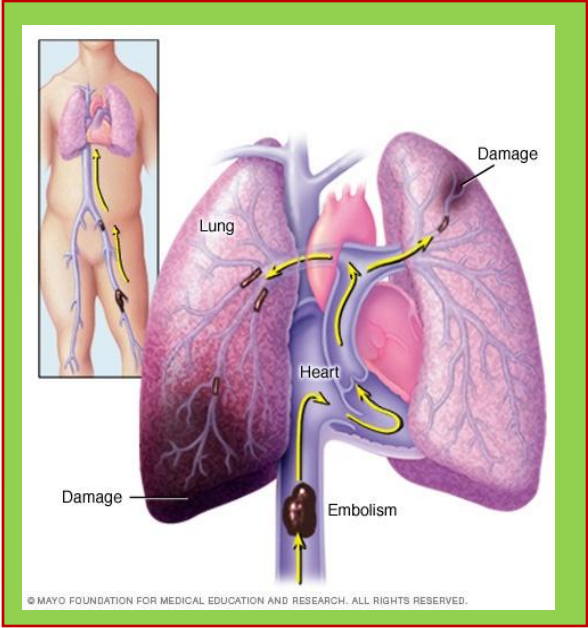


Figure 2 - Illustration of Pulmonary Embolism

Path of a PE

Figure 3 below provides a more detailed view of a PE. A blood clot forms in the lung, travels through the bloodstream to the heart and through it, and then obstructs a blood vessel in the lung.

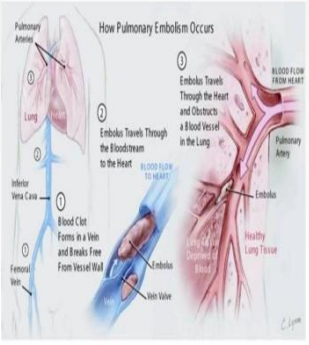


Figure 3 - Detailed View of Pulmonary Embolism

Significance of Pathophysiology

Because of the very high incidence of morbidity and mortality in patients with a pulmonary embolism, as well as the difficulty in diagnosis, it is important that at-risk patients be screened for PE. The pathophysiology that leads to PE is significant, because of the consequences and risk associated with the diagnosis. PE Patients who have been treated have approximately an 8% mortality rate, and in untreated patients the mortality rate can be as high as 30% (Deng, Li, Zhou, Liu, et al., 2015, p. 1). Therefore, detection and prevention of PE is critical.

Implications for Nursing Care

The diagnosis has implications to nursing care, as nurses must be able to educate patients about the causes and effects of the condition, the importance of treatment and follow up care, and emphasize steps to take to avoid another PE. Nurses should assess and discuss each patient's risk factors and ways to specifically lower chances of a recurrence of the condition. In addition, they should ensure they patient recognizes any warning signs and new symptoms, and has a plan of action if symptoms do recur.

Conclusion

The diagnosis of pulmonary embolisms can be difficult, but the condition is common and can have very serious consequences. Doctors and Advanced Practice Nurses must be aware of the underlying pathophysiology of the condition so they can effectively diagnose and treat it. In addition, this knowledge helps to educate patients about risk factors, symptoms of the condition, the importance of treatment, and ways to prevent a recurrence..

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