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Coronary Artery Disease

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Introduction

- Coronary Artery Disease (CAD) is an atherosclerotic process, eventually leading to impaired coronary blood flow and oxygen delivery.
- CAD is one of the leading causes of death in the United States, killing 370,000 people annually (Centers for Disease Control and Prevention, 2017).
- 16.3 million people in the United States have some form of cardiovascular disease, with CAD being the leading cause (Kalanuria, Nyquist, & Ling, 2012).
- The indirect costs of CAD and stroke in the United States is estimated at $297.7 billion. Therefore, understanding the mechanisms causing CAD, prevention, and treatment is a large area of improvement in reducing mortality as well as healthcare costs in the United States (Kalanuria, Nyquist, & Ling, 2012).

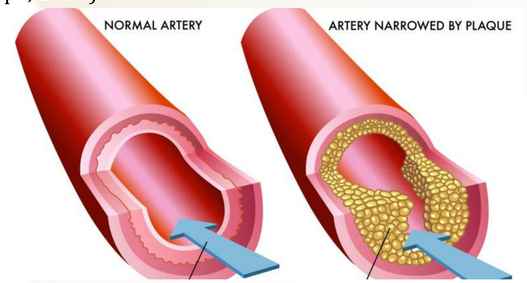
Underlying Pathophysiology

Atherosclerosis

Atherosclerosis is a progressive process beginning with injury to the vascular endothelium and can lead to plaque rupture (Mallika, Goswami, & Rajappa, 2007). Endothelial injury leads to a decrease in antithrombic and fibrinolytic factors, decrease in nitric oxide (NO), an increase in the production of vasoconstrictors (thromboxane A2 and prostaglandins), and an increase in intracellular calcium derived vasoconstricting factors (Kalanuria, Nyquist, & Ling, 2012). Damage also causes platelets to migrate to damaged sites and monocytes to enter the area and proliferate (Kalanuria, Nyquist, & Ling, 2012). Macrophages then ingest LDL in the bloodstream and become foam cells, adhere to the arterial walls, and progressively narrow the inner lumen of the artery forming plaques (Mallika, Goswami, & Rajappa, 2007).

Coronary Artery Disease

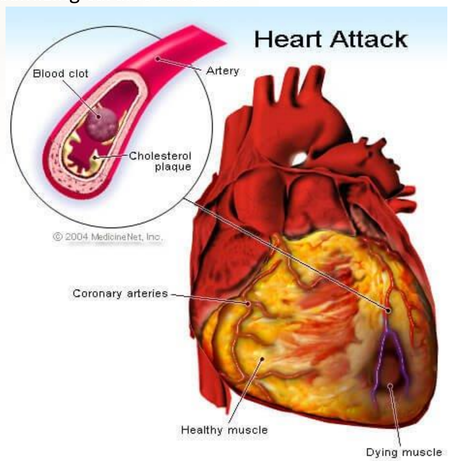
In patients with CAD, the coronary arteries are plagued with diffuse plaques as a result of the atherosclerotic process (Kristensen, Ravn, & Falk, 1997). Plaques can rupture due to increases in blood pressure, increased activity, and intrinsic factors related to the characteristics of the plaque (Kristensen, Ravn, & Falk, 1997). Plaque rupture can impair coronary blood flow, acutely or progressively and lead to an Acute Coronary Syndrome (ACS) and myocardial ischemia. Myocardial ischemia occurs when myocardial oxygen demand is greater than myocardial oxygen delivery. Myocardial oxygen delivery is impaired due to plaque induced narrowing of the coronary artery lumen, limiting blood flow to myocardial tissue.



https://www.naturalfoodseries.com/9-remedies-atherosclerosis/

Significance of Pathophysiology

- Impaired blood flow to myocardial tissue as a result of limited blood flow can cause severe myocardial damage and infarction (MI). Occlusion of a coronary artery causes myocytes to shift to glycolysis instead of aerobic respiration to produce ATP (Burke, & Virmani, 2007). Decreased ATP inhibits the Na+, K+ ATPase pump, leading to an accumulation of intracellular Na+ and cell swelling (Burke, citation needed). Autophagic cell death and apotosis follow if the ischemia is not corrected before irreversible myocyte damage occurs (Burke, & Virmani, 2007).
- There are many consequences of myocardial infarction. One consequence is ventricular rupture, which is a severe, life threatening event (Burke, & Virmani, 2007). As a result of myocardial infarction and ineffective remodeling, cardiac tissue is prone to rupture in the first 1-4 days following the infarction (Burke, & Virmani, 2007).
- Congestive Heart Failure (CHF) is another complication following MI. Cardiac remodeling can result in impaired myocyte function, ventricular hypertrophy, and CHF (Burke, citation needed).
- Impaired cardiac function as a result of CAD, MI, and CHF can result in impaired blood flow to the other organs of the body such as the brain, lungs, gut, kidneys, and liver. In ACS and MI, all organs can be damaged due to decreased blood flow. Therefore, in patients with cardiac disease, special care should be taken to prevent damage to other organs by maximizing cardiac function.



https://www.medicinenet.com/heart_attack/article.htm

Signs and Symptoms

- Chest pain (angina): Can be pain or tightness of the chest. Angina can be exacerbated by increased activity and physical or emotional stress.
- Shortness of breath: Can be caused by increased physical exertion. The body is trying to compensate for the decreased myocardial blood flow by increasing the respiratory rate. SOB can be relieved by stopping activity and resting.
- Heart attack: Classic MI symptoms include crushing chest pain radiating to the left arm, SOB, diaphoresis. Women may experience chest pressure, and neck or jaw pain.

(Mayo Clinic, 2018)

Risk Factors

Risk factors for CAD include anything that can increase inflammation in the vasculature. Risk factors include:

- Increased age
- High levels of stress
- Smoking
- High blood pressure
- High cholesterol
- Diabetes or insulin resistance
- Sedentary lifestyle
- Obesity

(Mayo Clinic, 2018)

Implications for Nursing

Nurses should monitor patients for signs of CAD and MI. Reperfusion as quickly as possible can limit the extent of myocardial damage, resulting in a more positive patient outcome. Nursing specific considerations for patients with CAD include:

- Education: Cardiac medicine is constantly changing. It is important for nurses to remain up to date regarding pathophysiology and treatment.
- Telemetry monitoring: Nurses should monitor for ECG changes consistent with CAD and MI.
- Laboratory testing: Nurses should trend lab values indicating myocardial damage such as troponins.
- BLS and ACLS certifications: Rapid reperfusion limits myocardial tissue damage. Nurses should be BLS and ACLS certified to facilitate reperfusion in ACS.
- Training with advanced circulatory support devices: Treatment for CAD, MI, and CHF can include Intra-Aortic Balloon Pumps, Ventricular Assist Devices, and Extracorporeal Membrane Oxygenation, nurses should be trained regarding these advanced devices.

Treatement

- Medical management is focused on maximizing cardiac blood flow, decreasing myocardial oxygen demand, and preventing the atherosclerotic process. This can include Nitroglycerin, statins, beta blockers, calcium channel blockers, ACE inhibitors, and anticoagulation.
- Reperfusion strategies can include vascular stents and cardiac catheterization as well as Coronary Artery Bypass Grafts.

(Braun & Stevens, 2018)

Conclusion

Coronary Artery Disease is has a high mortality rate and is one of the largest contributors to high healthcare costs. Research and treatments are constantly evolving. Therefore, it is important for healthcare providers to be well educated regarding pathophysiology, risk factors, and treatment. Early recognition and treatment can limit the extent of myocardial damage, resulting in favorable patient outcomes.

References

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