Coronary artery disease: causes, symptoms and treatments

CAD also known as coronary heart disease or ischemic heart disease is a disease caused by the buildup of plaque in the coronary arteries, referred to as atherosclerosis which reduces the amount of oxygenated blood to the heart (McPhee & Papadakis, 2011). CAD encompasses two pathologies, angina and myocardial infarction, commonly recognized as a heart attack (Parmet, Glass & Glass, 2004). Angina is best described by pain or discomfort in the chest area, pain caused by angina can radiate throughout the body to various muscle areas (McPhee & Papadakis, 2011). Stoppage of oxygen-rich blood to particular heart muscles results in a heart attack, delayed restoration of blood flow can result in severe muscle damage to the heart and possibly death (Parmet, Glass & Glass, 2004). With approximately sixteen million Americans suffering from CAD, a person dies every minute as a victim of the disease (American Heart Association [AHA], 2012). The following paper will comprehensively examine CAD.

Anatomy and Physiology of the Heart

The heart is an essential organ that is responsible for pumping blood all throughout the body and supplying it with oxygen and nutrients; it is the central hub for the cardiovascular system and acts as the transport system of the body, which performs via electrical conduction activity (Burke et al., 1999). Major anatomical structures of the heart consist of the aorta, the pulmonary artery and vein, coronary arteries and the valves (McPhee & Papadakis, 2011). The aorta is the main artery that pumps the blood out of the heart and to the rest of the body; the pulmonary artery and vein transport deoxygenated and oxygenated blood respectively, and the coronary arteries make a crown on the heart muscle and supply the

myocardium with oxygenated blood and nutrients (Crawford, 2011). The valves in the heart are responsible for preventing backflow of blood and allow the blood to circulate in a uniform fashion (Crawford, 2011). The electrical conduction system of the heart accounts for the beating of the heart allowing it to contract and act as the pump of the body (Burke et al., 1999).

CAD: Pathophysiology

Occlusion of the coronary arteries due to plaque buildup leads to a condition called atherosclerosis; atherosclerosis refers to the narrowing and hardening of the arteries leading to damage to the blood vessels and is a major contributor to many heart diseases and disorders (McPhee & Papadakis, 2011). Atherosclerotic plaques are formed from lipid and fat deposits such as cholesterol, these formations are indicative of diet as a risk factor in developing CAD (Chandra-Bose, 2012). Arteries are composed of three layers: adventita, intima, and media; the plaque typically develops between the intima and media layers (Crawford, 2011). The atherosclerotic plaques narrow the lumen of the arteries causing decreased amounts of blood to reach the heart and over time harden them causing decreased flexibility during vasoconstriction and vasodilatation (Chandra-Bose, 2012). Additionally, the atherosclerotic plaques can dislodge causing thrombosis and ischemic events, when the coronary arteries' function is compromised, the heart does not receive adequate supply of oxygenated blood and nutrients causing decrease cardiac function (McPhee & Papadakis, 2011). At times of stress, the body will try to counteract these changes to achieve homeostasis by exerting more energy than normal; however, prolonged

exertion initiates a cascade of many disease processes and pathologies, such as cardiomyopathy, heart failure, arrhythmias, cardiac arrest, and characteristically myocardial infarction (Ruth, 2011).

CAD: Risk Factors

CAD tends to be the most common cause of death and disability in the United States (AHA, 2012). Common risk factors of CAD are family history, physical inactivity, poor diet, smoking and alcohol consumption; additionally, health issues such as hypertension, diabetes, high cholesterol, and obesity are also prevailing risk factors (Ruth, 2011). A person that has a family history of heart disease is at greater risk of developing CAD; physical inactivity, poor diet, and obesity interrelated for developing CAD (AHA, 2012). Obesity has become an epidemic that affects one in four Americans and results in many life-threatening consequences, notably CAD (AHA, 2012). Heart disease has become the cause of death in industrialized nations compared to underdeveloped nations due to sedentary lifestyles and an increased consumption of fast food (Chan, 2011). One of the most preventable risk factors for any disease is smoking, and for cardiovascular disease it is the number one preventable cause (Ruth, 2011). Other contributing risk factors include age and gender, males are typically more likely to develop CAD at an earlier age than women, however, the risk equalizes in old age (Ruth, 2011). Research has indicated that CAD paired with diabetes, hypertension, and/or hypercholesterolemia can breed fatal consequences (Chan, 2011).

CAD: Symptoms

Most patients of CAD are asymptomatic, whereas other patients can present with a variety of symptoms such as shortness of breath, tightness around the chest, chest pain, clenched fist, or possibly death; patients that do however exhibit symptoms typically tend to have advanced stages of damage to their coronary arteries (McPhee & Papadakis, 2011). Angina is the classic heart pain most patients complain about that is caused by ischemia which is the lack of oxygen supply to a region of the heart (Chandra-Bose, 2012). Patients can experience angina at anytime, however characteristically it's exhibited after a person has been involved in an extraneous activity, such as exercise; angina can be categorized as stable, unstable, or variant (McPhee & Papadakis, 2011).

CAD: Complications

Myocardial infarction occurs when the heart is deprived of oxygenated blood because of rupture of the atherosclerotic plaque, resulting in a state of ischemia; the area of the heart that the damage occurs depends on the vessels that are occluded, exhibiting a variety of symptoms and/or complications (Torpy, Lynm & Glass, 2008). Therefore, essentially if a patient experiences a myocardial infarction at a particular region of the heart that area will suffer an ischemic event and kills the heart tissue and makes it dysfunctional (Torpy et al., 2008). Overall, a myocardial infarction has a poor prognosis and tends to lead to morbidity and mortality (Burke et al., 1999).

CAD: Diagnosis

CAD is a condition that develops over time; therefore, there aren't any palpable tests that can indicate if a person is suffering from CAD (McPhee & Papadakis, 2011). When examining the onset of CAD, healthcare providers consider a patient's history, physical exams and relative risk factors (Andraws, Berger & Brown, 2005). Healthcare providers utilize electrocardiogram, stress testing, echocardiography, and laboratory testing when examining patients that are at risk of developing CAD (Andraws, Berger & Brown, 2005). Electrocardiograms also known as an EKG or ECG detect the heart's electrical activity, rhythm, heart rate, axis, and any abnormal enlargements of the heart; an EKG is a quick and efficient way of indicating whether a patient has experienced or is experiencing a myocardial infarction (Andraws et al., 2005). Stress testing can be induced by exercise or medication for evaluating ischemia in a patient; an echocardiography utilizes sound waves to monitor the heart's activity, including the size, shape, and blood flow; laboratory testing, such as blood tests are conducted on a regular basis to assess the levels of cholesterol, sugar, and proteins such as inflammatory markers (Andraws et al., 2005). Other tools, such as chest x-rays, angiography, positron emission tomography, and cardiac cauterization can be utilized for patients with greater risk factors and/or advanced stages of CAD (McPhee & Papadakis, 2011).

CAD: Treatment

CAD is a complex disease since it encompasses other pathologies (AHA, 2012). However, treatment options for CAD tend to be simple at its early stages, such as lifestyle changes; patients are encouraged to partake in

therapeutic lifestyle changes such as daily exercise, eating healthy well-balanced meals, and stress and weight management; comprehensive therapeutic lifestyle changes help regulate the risk of other diseases such diabetes, hypertension and obesity (Ruth, 2011). Therapeutic life changes help reduce the risk of heart disease by lowering cholesterol and maintaining a body mass index of less than 25, which is considered to be normal (Ruth, 2011). For advanced stages of CAD, medication such as anticoagulants, aspirin, beta-blockers, calcium channel blockers, and nitroglycerin are prescribed to help reduce symptoms, lower cholesterol and blood pressure, prevent blood clots; aspirin is the leading medication to help relieve angina and prevent myocardial infarction (McPhee & Papadakis, 2011). Patients that have extensive damage to their arteries or have experienced a myocardial infarction may require medical procedures, such as angioplasty or coronary artery bypass grafting; angioplasty or percutaneous coronary intervention is a medical procedure done to open blocked or narrowed coronary arteries, this is commonly referred to having a stent put in place to prevent future blockage from occurring (Ruth, 2011). Coronary artery bypass grafting is an extensive surgical procedure done where doctors use blood vessels from other areas of the body that aren't blocked to bypass narrowed and damaged coronary arteries, thus improving the blood flow to the heart (Ruth, 2011).

Conclusion

CAD is a disease caused by the buildup of plaque in the coronary arteries, referred to as atherosclerosis which reduces the amount of oxygenated blood to the heart (McPhee & Papadakis, 2011). Occlusion of the coronary

arteries due to plaque buildup leads to a condition called atherosclerosis; atherosclerosis refers to the narrowing and hardening of the arteries leading to damage to the blood vessels and is a major contributor to many heart diseases and disorders (McPhee & Papadakis, 2011). With approximately sixteen million Americans suffering from CAD, a person dies every minute as a victim of the disease (AHA, 2012).

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