

Sudden Death Caused by Disorders of the Cardiovascular System



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Submission: December 19, 2017; **Published:** January 08, 2018

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Abstract

Sudden death was defined as one which has taken place within 24 hours from the onset of symptoms and signs of disease, based on World Health Organization (WHO) definition. Cardiovascular disease is the leading global cause of Sudden death and dominates as the cause of death in the future. Cardiovascular disease is a disease that involves the heart or blood vessels. There are many risk factors linked to cardiovascular disease.

Keywords: Sudden Death; Cardiovascular System; Forensic

Introduction

By the year of 2030, scientists estimates that non-contagious disease will be the cause of more than three-quarter of deaths in the world and cardiovascular disease is responsible for more number of deaths compared to contagious disease such as HIV/AIDS, tuberculosis and malaria in developing countries, maternal and perinatal deaths and nutrition disorders. Therefore, cardiovascular disease has become the largest contributor in number of deaths in general and will continue to dominate as the cause of death in the future [1].

Discussion

Symptoms caused by heart disease appears mostly due to myocardial ischemia, myocard contraction or relaxation disorder, blood vessel obstruction or abnormal hearth rhythm/beat frequency [2].

In general, death caused by heart disease can be classified into several types as the following :

Atherosclerosis Heart Disease

It is estimated that 75-90% of cardiac artery atherosclerosis can lead to sudden death. This incident may occur on 25-40% of individuals who previously have suffered myocardial infarction and followed by contraction or heart rhythm disorder which then leads to death. In most cases, infarct happens if an atherosclerotic plaque ruptures, forming a thrombus that may cause artery occlusion. The amount of myocard damage caused by coronary occlusion is determined by the areas supplied by

the affected blood vessels, whether it is completely clogged or not. The amount of blood supplied by the collateral artery of the affected tissue, the amount of oxygen required by the myocard where blood supply suddenly becomes restricted [2]. During an autopsy, it has been discovered that approximately 75% of coronary artery constriction occurs on the branch of the left coronary artery and left ventricle rupture is the cause of most hemopericardium cases found by forensic pathologist during autopsy. Left ventricle rupture occurs approximately 3-7 days post of myocardial infarction (Figure 1)[3].

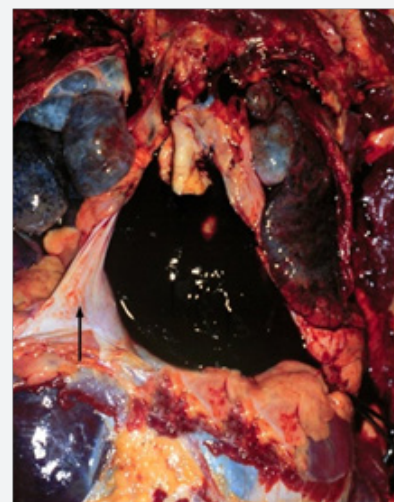


Figure 1: Hemipericardium.

In several death cases due to atherosclerotic heart disease where the previous history of heart disease was found to be unclear, shows signs of chronic ischemia condition during

autopsy. Besides a constricted coronary artery, it was also discovered that infarct, fibrosis with hypertrophy and left ventricle dilatation has taken place (Figure 2)[3,4].

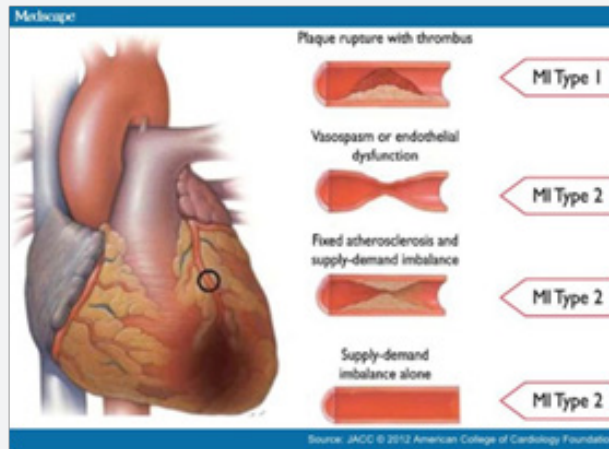


Figure 2: Coronary occlusion.

This corresponds to the literature which stated that approximately 25-40% of sudden deaths originated from coronary atherosclerosis and the only significant discovery during an autopsy was the constriction of cardiac arteries of less or more than 75% of the coronary artery lumen [5]. The estimation of cardiac artery constriction can be seen by the cross sectional area of the vessel lumen. Where the radius of artery for an amount of 50% is to be considered equal by subtracting the

area by 75%. An example of an autopsy case performed to a 58 year old woman who previously showed up to the emergency unit with pain complains located on the upper back area with an electrocardiography showing normal results. During an autopsy, a hemorrhage within the pericardium was discovered containing 500ml of blood clot and cardiac artery constriction. The infarction was discovered at the heart apex up to the posterior part of the left ventricle (Figures 3 & 4)[3].

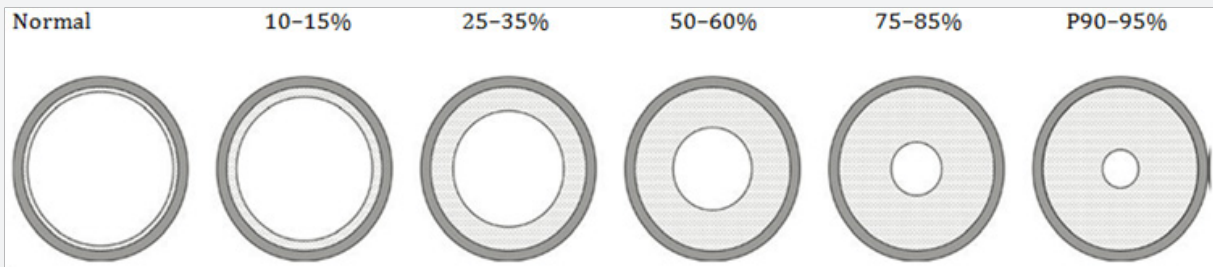


Figure 3.

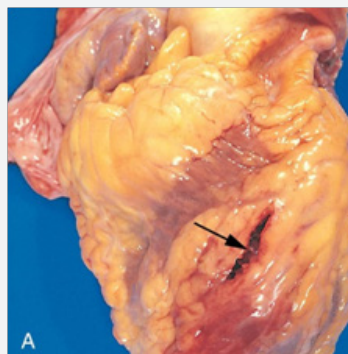


Figure 4: Ruptur ventrikel kiri.

Hypertension: Blood pressure that remains uncontrolled for a long period of time can lead to many changes of the myocardium and coronary artery structure and cardiac conduction system disorder. These changes may eventually induce the development of left ventricle hypertrophy, coronary artery disease and several conduction system disease, and also systolic and diastolic dysfunction of the myocardium with the potentially occurring complication such as myocardial infarction, cardiac arrhythmia and congestive heart failure. A macroscopic view of the heart discovered the presence of cardiac wall hypertrophy (Figure 5) [5].

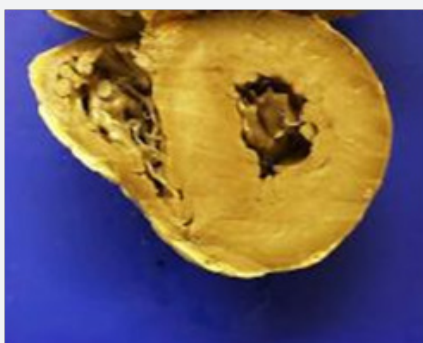


Figure 5: left ventricle hypertrophy.

Valve Disorder: The valve disorder which is often associated with death cases are the mitral valve prolapse, aortic valve stenosis and endocarditis.

Mitral valve stenosis: The mitral valve stenosis is the damage of heart valve characterized by the improper closing of the mitral valve. The mitral valve is a valve consisting of 2 leaflets located between the left atrium and left ventricle. This particular valve helps regulate the blood flow from the atrium towards the ventricle by opening up during the atrial contraction and closing during the ventricle contraction in order to prevent blood flowing back towards the atrium. In a mitral valve prolapse, the valve bulges upwards into the atrium and sometimes causing blood reentering the left atrium [6].

Aortic valve Stenosis: The aortic valve stenosis is the narrowing or occlusion of the aortic valve. The aortic valve is a valve located on the left ventricle that will open up when blood will enter the aorta in order to be distributed throughout the body. Normally, the aortic valve consists of three leaflets that will close and open, thus allowing blood to flow through.

On aortic valve stenosis, usually the valve only consists of 2 leaflets, therefore having a slightly much more narrow lumen and can potentially block blood flow. Thus, the left ventricle will have to pump stronger in order for the blood to pass the valve. Aortic valve stenosis is the result of scar tissue formation and accumulation of calcium within the valve leaflet. This particular aortic valve stenosis only occurs after the age of sixty but symptoms

itself might only appear after the age of seventy until eighty years old. Aortic valve stenosis can also be caused by rheumatic fever on children. This condition is usually accompanied by the mitral valve disorder, either in form of stenosis, regurgitation or both. In a macroscopic view, it can be seen that the size of the valve remains the same while the heart continues to expand. A valve may only consist of 2 leaflets, in which normally should be three, or having an abnormal form such as the funnel shape. The valve often becomes rigid or narrows due to the accumulation of calcium precipitation (Figure 6) [7].

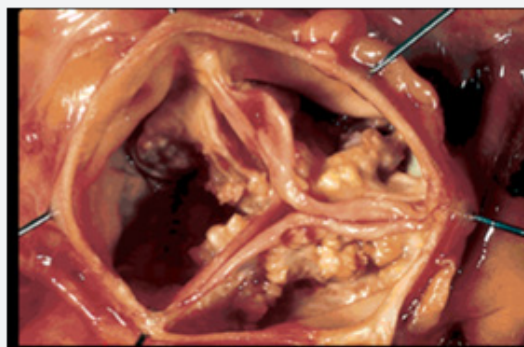


Figure 6: Aortic valve stenosis.

Endocarditis

Endocarditis is a condition characterized by the presence of infection within the endocardium. This condition is usually due to bacteria spreading from other particular parts of the body which damages the heart area. Endocarditis is a rare condition but significantly worrying due to the potential of causing heart valve destruction (Figure 7) [8].



Figure 7: Endocarditis.

Conclusion

Sudden death is a major source of mortality in developed countries. During an autopsy we can find hemopericardium, atherosclerosis, hypertrophy ventricular, valve stenosis or infection within the endocardium. Histopathologic examination can establish a differential diagnosis of the cause of sudden death from cardiovascular system.

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DOI :10.19080/JFSCI.2018.07.555704

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