

ATHEROSCLEROSIS AND ITS BIOCHEMICAL FACTORS

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Annotation: Atherosclerosis^[a] is a pattern of the disease arteriosclerosis, characterized by development of abnormalities called lesions in walls of arteries. This is a chronic inflammatory disease involving many different cell types and is driven by elevated levels of cholesterol in the blood. These lesions may lead to narrowing of the arterial walls due to buildup of atheromatous plaques. At the onset there are usually no symptoms, but if they develop, symptoms generally begin around middle age. In severe cases, it can result in coronary artery disease, stroke, peripheral artery disease, or kidney disorders, depending on which body part(s) the affected arteries are located in the body.

Introduction. The exact cause of atherosclerosis is unknown and is suggested to be multifactorial. Risk factors include abnormal cholesterol levels, elevated levels of inflammatory biomarkers, high blood pressure, diabetes, smoking (active and passive smoking), obesity, genetic factors, family history, lifestyle habits, and unhealthy diet. Plaque is composed of fat, cholesterol, immune cells, calcium, and other substances in the blood. Narrowing of the arteries restricts the flow of oxygen-rich blood to certain parts of the body. Diagnosis is based on physical examination, electrocardiogram, and exercise stress test, among others.[1]

Prevention guidelines include a healthy diet, exercise, not smoking, and maintaining a normal body weight. Treatment of established atherosclerotic disease may include cholesterol-lowering medications such as statins, blood pressure-lowering drugs, and anticoagulant therapy to reduce the risk of developing blood clots. As the disease progresses, more invasive strategies such as percutaneous coronary intervention and coronary artery carotid endarterectomy are used. Genetic factors also strongly influence the course of the disease; it is unlikely to be based entirely on lifestyle choices.[2]

Atherosclerosis usually begins in young adulthood and worsens as people age. Almost all people are affected to some degree by the age of 65.

It is the leading cause of death and disability in developed countries. Although first described in 1575, there is evidence to suggest that the condition is genetically specific to the wider human population, with its origins traced to CMAH genetic mutations that may have arisen during the evolution of the hominin ancestors of modern humans two million years ago.[3]

Signs and symptoms Atherosclerosis is usually asymptomatic for decades, as the arteries become enlarged throughout the body, thus not affecting blood flow. It does not cause symptoms until there is sufficient narrowing or blockage of the vessel due to blood clots. Signs and symptoms only occur after the narrowing or blockage has become severe enough to cause

symptoms, and patients often only become aware of the disease when they experience another cardiovascular event, such as a stroke or heart attack. However, these symptoms still vary depending on which artery or organ is affected.[4]

Early atherosclerotic processes probably begin in childhood. Fibrous and gelatinous lesions have been observed in the coronary arteries of children. Fatty streaks have been observed in the coronary arteries of adults. Although coronary artery disease is more common in men than in women, atherosclerosis of the cerebral arteries and stroke affect both sexes equally.[5]

Significant narrowing of the coronary arteries, which are responsible for bringing oxygenated blood to the heart, can cause symptoms such as angina pectoris and shortness of breath, sweating, nausea, dizziness or lightheadedness, shortness of breath, or palpitations. Abnormal heart rhythms, called arrhythmias—heart beats that are too slow or too fast—are another consequence of ischemia.[6]

The carotid arteries supply blood to the brain and neck. Significant narrowing of the carotid arteries can cause symptoms such as weakness; difficulty thinking clearly; difficulty speaking; dizziness; difficulty walking or standing; blurred vision; numbness of the face, arms, and legs; severe headache; and loss of consciousness. These symptoms are also associated with a stroke (death of brain cells). Strokes occur when the arteries leading to the brain become significantly narrowed or blocked; the lack of adequate blood supply causes the cells in the affected tissue to die.[7]

The peripheral arteries that supply blood to the legs, arms, and pelvis also become significantly narrowed due to ruptures and blisters. Symptoms of narrowing include pain and numbness in the arm or leg. Another important site for plaque formation is the renal arteries, which supply blood to the kidneys. The formation and accumulation of plaque leads to reduced blood flow in the kidneys and chronic kidney disease, which, like all other areas, is usually asymptomatic until the late stages.[8]

In 2004, US data showed that in ~66% of men and ~47% of women, the first symptom of atherosclerotic cardiovascular disease was a heart attack or sudden cardiac death (defined as death within one hour of symptom onset).[9]

The case study included autopsies of American soldiers killed in World War II and the Korean War. The most widely cited report included autopsies of 300 American soldiers killed in Korea. The average age of the men was 22.1 years, but 77.3 percent were older.[10]

Risk factors. Atherosclerosis is associated with inflammation in the endothelial cells of the vessel wall, which is associated with low-density lipoprotein (LDL) particles. This inflammation may be a cause, a consequence, or both of the underlying inflammatory process.[11]

The presence of plaque causes the muscle cells of the blood vessels to stretch, which accommodates the additional mass. The endothelial lining then thickens, which increases the separation between the plaque and the lumen. The thickening somewhat compensates for the narrowing caused by plaque growth, but it also causes the wall to stiffen and become less flexible to stretch with each heartbeat.[12]

Conclusion. Atherosclerosis is one of the most common and dangerous diseases of the cardiovascular system, in the development of which many biochemical factors play an important role. In particular, increased levels of lipids and lipoproteins in the blood, oxidative stress, inflammatory processes and endothelial dysfunction are the main components of the pathogenesis of atherosclerosis. As a result of the oxidation of cholesterol, especially low-density lipoprotein (LDL) molecules, and their accumulation in the arterial wall, plaques are formed and

blood circulation is impaired.

Studies show that in the prevention and treatment of atherosclerosis, adherence to a healthy lifestyle, correction of dyslipidemia and the use of antioxidant therapy are important. At the same time, early detection and monitoring of biochemical markers in the analysis of the development of the disease are effective measures to prevent complications arising from atherosclerosis.

Thus, atherosclerosis is a complex, multi-stage process, and its timely detection and in-depth study of biochemical factors play a crucial role in the prevention and effective management of the disease.

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