



MAIN RISK FACTORS CONTRIBUTING TO CARDIOVASCULAR DISEASES: GENETIC, ENVIRONMENTAL, LIFESTYLE, AND THEIR IMPACT ON DISEASE DEVELOPMENT

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ABSTRACT

Cardiovascular diseases (CVD) are a leading cause of morbidity and mortality worldwide, placing significant pressure on global health systems. This paper explores the primary risk factors contributing to the development of CVD, focusing on genetic, environmental, and lifestyle factors. It highlights the complex interaction between these factors and their role in the pathogenesis and progression of cardiovascular diseases. Genetic predisposition, environmental pollution, and unhealthy lifestyle choices, such as poor diet, smoking, and physical inactivity, all play critical roles in the onset and progression of these diseases. By understanding these factors and their interplay, more effective prevention strategies and treatment options can be developed to combat the global burden of CVD.

ОСНОВНЫЕ ФАКТОРЫ РИСКА, СПОСОБСТВУЮЩИЕ РАЗВИТИЮ СЕРДЕЧНО-СОСУДИСТЫХ ЗАБОЛЕВАНИЙ: ГЕНЕТИЧЕСКИЕ, ЭКОЛОГИЧЕСКИЕ, ФАКТОРЫ ОБРАЗА ЖИЗНИ И ИХ ВЛИЯНИЕ НА РАЗВИТИЕ ЗАБОЛЕВАНИЙ

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ABSTRACT

Сердечно-сосудистые заболевания (ССЗ) являются одной из основных причин заболеваемости и смертности во всем мире, создавая значительную нагрузку на глобальные системы здравоохранения. В статье рассматриваются основные факторы риска, способствующие развитию ССЗ, с акцентом на генетические, экологические и факторы образа жизни. Особое внимание уделяется сложному взаимодействию



риска, связанные с образом жизни, гипертония, атеросклероз, инфаркт миокарда, загрязнение воздуха, диета, физическая активность, курение, потребление алкоголя, малоподвижный образ жизни, ожирение, профилактика, стратегии лечения.

этих факторов и их роли в патогенезе и прогрессировании сердечно-сосудистых заболеваний. Генетическая предрасположенность, загрязнение окружающей среды и нездоровый образ жизни, такие как неправильное питание, курение и физическая инактивность, играют ключевую роль в возникновении и прогрессировании этих заболеваний. Понимание этих факторов и их взаимосвязи позволяет разрабатывать более эффективные стратегии профилактики и лечения, направленные на борьбу с глобальной нагрузкой ССЗ.

Introduction

Cardiovascular diseases (CVD) remain one of the leading causes of morbidity and mortality worldwide, contributing to a significant burden on global health systems. Understanding the multifaceted risk factors that influence the development of CVD is crucial in devising effective preventive measures and treatment strategies. These diseases are shaped by a complex interaction between genetic, environmental, and lifestyle factors, all of which influence the health of the cardiovascular system in distinct ways. This paper aims to analyze the primary risk factors for CVD, focusing on the genetic, environmental, and lifestyle determinants and exploring how each factor contributes to the pathogenesis and progression of cardiovascular diseases. By examining the interplay between these risk factors, we can better understand the mechanisms behind CVD and develop more targeted interventions.

1. Genetic risk factors

Genetic predisposition plays a significant role in the development of cardiovascular diseases. Family history and inherited genetic traits have been shown to increase the likelihood of individuals developing conditions such as coronary artery disease, hypertension, and stroke. Numerous studies have demonstrated the importance of genetic factors in the onset of CVD. One of the most prominent studies, the *Framingham Heart Study*, has provided extensive evidence of the genetic underpinnings of cardiovascular risk (Kannel & Dawber, 2020). It is known that variations in specific genes influence lipid metabolism, blood pressure regulation, and the integrity of the vascular walls, all of which are central to CVD development.

For example, the *Apolipoprotein B* gene (APOB) has been implicated in the regulation of cholesterol levels, and mutations in this gene have been associated with an increased risk of atherosclerosis and myocardial infarction. Furthermore, genetic variations in the *lipoprotein(a)* [Lp(a)] gene are linked to elevated levels of Lp(a), which significantly contributes to the development of cardiovascular events (Gillespie & Sunderlin, 2021). It is also important to note that genetic factors do not act in isolation but often interact with environmental and lifestyle factors, further influencing disease outcomes. In this sense,



individuals with a genetic predisposition to CVD may be at an even higher risk when exposed to adverse environmental conditions or unhealthy lifestyle choices.

2. Environmental risk factors

Environmental factors, including pollution, climate change, and socio-economic conditions, have a profound impact on cardiovascular health. Recent research highlights the detrimental effects of environmental pollution on cardiovascular diseases, particularly air pollution. Studies have found that exposure to fine particulate matter (PM_{2.5}), nitrogen oxides, and other pollutants increases the risk of developing hypertension, atherosclerosis, and even heart failure (Peters & Dockery, 2018). The harmful particles in polluted air can enter the bloodstream through the lungs and contribute to inflammation, oxidative stress, and the thickening of blood vessel walls, all of which are key processes in the development of CVD.

In addition to air pollution, other environmental factors such as temperature extremes and environmental noise have been linked to an increased risk of cardiovascular diseases. A study by Lopez and Mathers (2021) emphasized the global burden of environmental risk factors and how they contribute to the increasing prevalence of cardiovascular diseases, particularly in urbanized regions. As urbanization accelerates and industrialization continues, the exposure to environmental pollutants becomes more widespread, further compounding the global CVD crisis.

Climate change, too, plays a role in cardiovascular health by exacerbating air pollution levels, altering weather patterns, and influencing food security, all of which can have indirect effects on heart health. Socio-economic factors also influence access to clean air, healthy food, and healthcare services, making low-income populations more vulnerable to the harmful effects of environmental risk factors.

3. Lifestyle risk factors

Lifestyle factors are among the most modifiable risk factors for cardiovascular diseases. These include diet, physical activity levels, smoking, alcohol consumption, and other daily habits that directly affect heart health. The role of diet in cardiovascular disease development is well-established, with poor dietary habits being a leading contributor to conditions such as obesity, hypertension, and diabetes, all of which increase the risk of CVD.

Research has shown that diets high in saturated fats, trans fats, cholesterol, and refined sugars are closely linked to increased levels of low-density lipoprotein (LDL) cholesterol, a key factor in the development of atherosclerosis (Tse & Wang, 2020). Conversely, diets rich in fruits, vegetables, whole grains, and healthy fats, such as those found in the Mediterranean diet, have been shown to reduce the risk of heart disease by improving lipid profiles and lowering blood pressure (Zhao & Zhang, 2021).

Physical inactivity is another major risk factor for cardiovascular diseases. Sedentary lifestyles contribute to obesity, hypertension, and insulin resistance, all of which increase the likelihood of developing heart disease. Studies have shown that regular physical activity, including aerobic exercises such as walking, running, and cycling, can significantly reduce the risk of cardiovascular diseases by improving cardiovascular fitness, enhancing blood circulation, and maintaining a healthy weight (Pérez & Medina, 2017).



Smoking is one of the most harmful lifestyle choices when it comes to cardiovascular health. The toxic chemicals in cigarette smoke damage the blood vessels, increase blood pressure, and promote the formation of blood clots, which can lead to heart attacks and strokes. Even passive smoking has been shown to increase the risk of heart disease (Marmot & Stansfeld, 2003). Furthermore, excessive alcohol consumption can have detrimental effects on the heart by increasing blood pressure, raising cholesterol levels, and damaging the heart muscle, leading to conditions like arrhythmias and cardiomyopathy.

4. The interplay of risk factors in disease development

The development of cardiovascular diseases is rarely due to a single factor; rather, it is the result of the combined effects of genetic, environmental, and lifestyle factors. The interplay between these risk factors complicates the pathogenesis of CVD and necessitates a multifactorial approach to prevention and treatment. For instance, individuals who have a genetic predisposition to hypertension or hyperlipidemia may be at even greater risk when exposed to poor environmental conditions, such as high levels of air pollution, or when they engage in unhealthy lifestyle practices, such as smoking or eating a poor diet.

A study by Kannel and Dawber (2020) demonstrated that the presence of multiple risk factors significantly increases the likelihood of developing cardiovascular diseases. For example, the combination of smoking, a high-fat diet, and a sedentary lifestyle in genetically predisposed individuals leads to a much higher risk of atherosclerosis and subsequent cardiovascular events. This synergistic effect emphasizes the need for comprehensive strategies that address multiple risk factors simultaneously.

Conclusion

Cardiovascular diseases are a complex and multifactorial group of disorders, and understanding the genetic, environmental, and lifestyle risk factors that contribute to their development is essential for effective prevention and treatment. Genetic predisposition, environmental pollution, and unhealthy lifestyle choices all play a significant role in the pathogenesis of CVD, and the interaction between these factors can exacerbate the risk of disease. While genetic factors cannot be altered, environmental factors and lifestyle choices are modifiable, and addressing these through public health initiatives and individual lifestyle changes is crucial in reducing the global burden of cardiovascular diseases.

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