

Carotid Plaques, Hypertension and Cardiovascular Risk

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Introduction

Carotid plaques are a common manifestation of atherosclerosis, a chronic inflammatory condition characterized by the accumulation of lipid-rich deposits, immune cells and fibrous tissue within the walls of the arteries. Hypertension, defined as elevated blood pressure persistently exceeding 140/90 mmHg, is a major risk factor for the development and progression of carotid plaques. Individuals with hypertension are more likely to develop atherosclerosis and experience cardiovascular events such as stroke and myocardial infarction [1]. This paper provides an in-depth exploration of the relationship between carotid plaques, hypertension and cardiovascular risk, with a focus on the underlying pathophysiological mechanisms, diagnostic approaches and therapeutic implications. Despite advancements in cardiovascular medicine, atherosclerosis remains a leading cause of morbidity and mortality worldwide, with hypertension playing a central role in its pathogenesis. Hypertension contributes to the initiation and progression of carotid plaques through multiple mechanisms, including endothelial dysfunction, inflammation, oxidative stress and arterial remodeling. The presence of carotid plaques serves as a marker of systemic atherosclerosis and is associated with an increased risk of adverse cardiovascular events, including stroke, myocardial infarction and cardiovascular death. Understanding the complex interplay between carotid plaques, hypertension and cardiovascular risk is crucial for improving risk stratification, guiding therapeutic interventions and ultimately reducing the burden of cardiovascular disease. This paper aims to provide a comprehensive overview of the current evidence on this topic, drawing upon existing literature, clinical studies and expert opinions. Subsequent sections will delve into the pathophysiological mechanisms underlying the association between carotid plaques and hypertension, diagnostic approaches for assessing plaque burden and characteristics and therapeutic strategies for mitigating cardiovascular risk in individuals with carotid plaques and hypertension [2].

Description

Carotid plaques are focal lesions that develop within the carotid arteries, which supply blood to the brain. These plaques consist of a lipid-rich core covered by a fibrous cap, with inflammation playing a central role in their pathogenesis. Chronic exposure to risk factors such as hypertension, dyslipidemia, smoking and diabetes mellitus promotes endothelial dysfunction, oxidative stress and inflammatory responses within the arterial wall, leading to the formation and progression of carotid plaques. Hypertension contributes to the development of carotid plaques through multiple mechanisms. Elevated blood pressure increases hemodynamic stress on the arterial wall, causing endothelial injury and dysfunction. This disruption of the endothelial barrier allows for the infiltration of lipids and immune cells into the subendothelial space, initiating

the formation of atherosclerotic lesions. Additionally, hypertension promotes arterial stiffness, impaired vasodilation and microvascular rarefaction, further exacerbating the atherosclerotic process [3].

The presence of carotid plaques is associated with an increased risk of cardiovascular events, including stroke, Transient Ischemic Attack (TIA) and coronary artery disease. Plaque rupture or erosion can lead to the formation of thrombi, which may embolize to the cerebral circulation, causing ischemic stroke. Moreover, carotid plaques may serve as a source of systemic inflammation and oxidative stress, contributing to the development of atherosclerosis in other vascular beds and promoting the progression of cardiovascular disease. Various imaging modalities are used to assess carotid plaques and quantify their burden and characteristics. Duplex ultrasonography is a non-invasive and widely available technique for visualizing carotid arteries and detecting plaques. High-resolution B-mode ultrasound allows for the visualization of plaque morphology, including plaque size, composition and surface characteristics. Doppler ultrasound enables the assessment of hemodynamic parameters such as blood flow velocity and turbulence, providing additional information on plaque stability and the risk of embolization. Other imaging modalities, such as Magnetic Resonance Imaging (MRI), Computed Tomography (CT) and carotid angiography, may be used for further characterization of carotid plaques and assessment of associated features such as intraplaque hemorrhage, fibrous cap rupture and luminal stenosis. These advanced imaging techniques offer insights into plaque vulnerability and provide valuable prognostic information for risk stratification and therapeutic decision-making [4,5].

Conclusion

In conclusion, carotid plaques represent a common manifestation of atherosclerosis and are associated with an increased risk of cardiovascular events, particularly in individuals with hypertension. Hypertension plays a key role in the pathogenesis of carotid plaques by promoting endothelial dysfunction, inflammation and arterial remodeling. The presence of carotid plaques serves as a marker of systemic atherosclerosis and is predictive of future cardiovascular events, including stroke and myocardial infarction. Early detection and risk stratification of carotid plaques are essential for guiding preventive interventions and optimizing cardiovascular outcomes. Non-invasive imaging modalities such as duplex ultrasonography provide valuable information on plaque burden, morphology and hemodynamics, enabling clinicians to identify high-risk individuals who may benefit from aggressive risk factor modification and pharmacological therapy. Future research efforts should focus on elucidating the underlying pathophysiological mechanisms linking hypertension, carotid plaques and cardiovascular risk, as well as evaluating the efficacy of targeted interventions in reducing plaque burden and preventing cardiovascular events. By advancing our understanding of the complex interplay between hypertension and atherosclerosis, we can ultimately improve risk stratification, therapeutic management and outcomes for individuals at risk of cardiovascular disease.

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Conflict of Interest

No conflict of interest.

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