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Left Ventricular Hypertrophy in Hypertensive Patients: Prevalence and Prognosis

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Introduction

Left Ventricular Hypertrophy (LVH) is a common and clinically significant complication of long-standing hypertension, characterized by the thickening of the left ventricular wall and changes in myocardial architecture. It represents a compensatory mechanism to the chronic pressure overload imposed by elevated systemic blood pressure. While initially adaptive, persistent LVH leads to increased myocardial oxygen demand, fibrosis, diastolic dysfunction and a predisposition to arrhythmias and heart failure. Numerous epidemiological studies have confirmed a strong association between LVH and increased cardiovascular morbidity and mortality, making it a crucial prognostic marker in hypertensive individuals. Detecting LVH early and understanding its implications are critical for risk stratification and optimizing management strategies. This report explores the prevalence of LVH in hypertensive patients, its pathophysiological underpinnings and its long-term prognostic significance, with emphasis on current diagnostic tools and therapeutic considerations [1].

Description

The prevalence of LVH among hypertensive patients varies significantly depending on diagnostic modality and population characteristics. Electrocardiogram (ECG)-based studies typically report lower prevalence rates (15–20%) due to limited sensitivity, whereas echocardiography and cardiac Magnetic Resonance Imaging (MRI) reveal substantially higher rates, ranging from 35% to over 50%, particularly in untreated or poorly controlled hypertensive populations. Age, sex, race, duration and severity of hypertension, obesity and genetic predisposition are key determinants of LVH development. African ancestry, for example, is associated with a higher prevalence of LVH for the same level of blood pressure, highlighting a possible interplay between genetic and environmental factors. Additionally, metabolic factors such as insulin resistance, hyperlipidemia and chronic inflammation may accelerate myocardial remodeling. Importantly, LVH can be present in both systolic and diastolic hypertension, with isolated systolic hypertension in the elderly contributing significantly to concentric hypertrophy. Understanding the risk profile of patients is essential for targeted screening and early intervention [2-3].

Accurate identification of LVH is fundamental for assessing cardiovascular risk in hypertensive individuals. The most commonly used tools include electrocardiography (ECG) and echocardiography, with cardiac MRI emerging as a gold standard in research and specialized settings. ECG criteria such as the Sokolow-Lyon index or Cornell voltage are specific but lack sensitivity, especially in obese or elderly patients. In contrast, transthoracic echocardiography allows for the direct measurement of left ventricular mass (LVM) and wall thickness, with the Left Ventricular Mass Index (LVMI) used to account for body size. Patterns of hypertrophy, such as concentric or eccentric, provide insight into hemodynamic stress and ventricular remodeling. Cardiac MRI offers unparalleled accuracy and tissue characterization, aiding in the detection of diffuse fibrosis and subtle structural changes. Incorporating advanced imaging with biomarkers like NT-proBNP and high-sensitivity troponins may further improve diagnostic precision and prognostic assessment. However, the choice of modality often depends on availability, cost and clinical context, emphasizing the need for pragmatic diagnostic pathways in routine care [4].

LVH is not merely a structural abnormality but a powerful independent predictor of adverse cardiovascular events. Numerous cohort studies have demonstrated that LVH increases the risk of myocardial infarction, heart failure, stroke, arrhythmias (particularly atrial fibrillation and ventricular tachyarrhythmias) and sudden cardiac death, even after adjusting for other risk factors. Regression of LVH, either through pharmacologic treatment or lifestyle modification, has been associated with improved outcomes or reduced event rates. The prognostic impact of LVH also varies with the pattern of hypertrophy; concentric LVH is generally associated with worse outcomes compared to eccentric forms. Moreover, the presence of myocardial fibrosis, detected via late gadolinium enhancement or T1 mapping on MRI, further elevates the risk of heart failure with preserved ejection fraction (HFpEF) and malignant arrhythmias. These findings underscore the importance of regular cardiovascular monitoring and aggressive risk factor modification in hypertensive patients with evidence of LVH. Long-term prognosis depends not only on blood pressure control but also on early recognition and reversal of structural cardiac changes [5].

Conclusion

AI is increasingly being used in Clinical Decision Support Systems (CDSS) to guide hypertension diagnosis, treatment planning and risk communication. These systems synthesize information from patient records, clinical guidelines and predictive algorithms to provide evidence-based recommendations. For example, AI can help determine the optimal timing for antihypertensive therapy initiation, suggest drug choices based on patient-specific factors (e.g., age, kidney function, comorbidities) and predict potential adverse reactions. This personalization enhances treatment efficacy and minimizes trial-and-error prescribing. AI also enables better communication with patients through interactive dashboards and decision aids, which simplify complex medical information.

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Conflict of Interest

None.

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