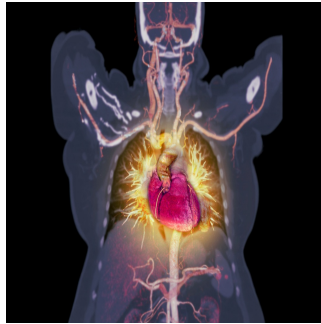

Clinical Significance of Differential Ventricular Stroke Volumes: the MESA Study



In a healthy cardiovascular system, the left and right ventricles work in tandem to maintain equal stroke volumes, ensuring efficient circulation of blood throughout the body. This balance is crucial, as it prevents the buildup of blood in either the systemic or pulmonary circulatory systems. However, conditions such as valvular heart disease and congenital intracardiac shunts can disrupt this equilibrium, leading to persistent differences in stroke volumes between the left ventricular (LV) and right ventricular (RV). [A recent article published in Radiology](#) explores the findings from the Multi-Ethnic Study of Atherosclerosis (MESA), focusing on how differential ventricular stroke volumes (Δ SV) correlate with long-term health outcomes in individuals initially free of cardiovascular disease.

Determinants of Differential Ventricular Stroke Volumes

The MESA study utilised cardiac MRI to measure and analyse ventricular volumes, categorising participants based on their Δ SV—defined as the difference between LV and RV stroke volumes. A positive Δ SV indicates a greater LV stroke volume, while a negative Δ SV indicates a greater RV stroke volume. This differentiation is significant because it can reflect underlying pathologies. For instance, a positive Δ SV often points to conditions like mitral regurgitation, where the valve's inability to close properly leads to an increase in LV volume as blood leaks back into the chamber. On the other hand, a negative Δ SV may be associated with tricuspid regurgitation, where a similar backflow of blood occurs in the RV. These conditions disrupt the normal compensatory mechanisms that usually correct minor imbalances in stroke volumes, such as the Frank-Starling law, which adjusts ventricular output based on changes in venous return.

Clinical Outcomes and Their Associations with Δ SV

The MESA study's long-term follow-up of participants revealed that those with significant stroke volume imbalances faced elevated risks for several adverse health outcomes. Participants with a positive Δ SV exhibited a higher incidence of mortality, heart failure, and atrial fibrillation compared to those with balanced stroke volumes. This group often showed signs of eccentric LV remodelling, characterised by increased LV volume and altered geometry, which can exacerbate the severity of mitral regurgitation. The increased left atrial (LA) dimensions and reduced LA function observed in these participants further underscore the burden of mitral valve disease, as the LA struggles to compensate for the excess volume.

Conversely, those in the negative Δ SV group, while less numerous, demonstrated a distinct set of risks primarily associated with tricuspid regurgitation. This condition can lead to right-sided heart failure if left untreated, as the RV becomes increasingly strained by the backflow of blood. The study also noted that participants in this group had a lower LV ejection fraction, a critical measure of heart efficiency, which further compounded their risk for heart failure. These findings highlight the importance of recognising even subtle deviations in stroke volume as potential indicators of significant cardiac pathology.

Implications for Clinical Practice and Technological Integration

Integrating Δ SV measurements into routine clinical practice could revolutionise the early detection and management of valvular heart diseases. The use of cardiac MRI, enhanced by deep learning algorithms, provides a non-invasive, highly accurate method for assessing ventricular function and identifying patients at risk for adverse outcomes. This capability is particularly valuable in asymptomatic individuals who may otherwise go undiagnosed until the disease progresses. By identifying those with significant Δ SV early, healthcare providers can intervene with lifestyle modifications, medical therapies, or surgical options as appropriate, potentially delaying or preventing the onset of symptomatic disease.

Moreover, applying automated quantification techniques in cardiac MRI offers a promising path toward more widespread use of these assessments. These technologies not only increase the reproducibility and accuracy of measurements but also reduce the time and expertise

required for analysis, making advanced diagnostics more accessible to a broader range of healthcare settings, including those with limited resources.

The findings from the MESA study underscore the critical role of differential ventricular stroke volumes in assessing cardiovascular risk. By providing a clearer understanding of how imbalances between LV and RV stroke volumes relate to conditions like mitral and tricuspid regurgitation, this research highlights the potential for ΔSV to serve as a valuable biomarker in clinical practice. As we move toward a more personalised approach to cardiovascular care, incorporating advanced imaging techniques and automated analysis will be key in identifying and managing patients at risk for adverse outcomes. This study lays the groundwork for further exploration into the mechanisms behind stroke volume imbalances and their impact on long-term health, paving the way for improved surveillance and early intervention strategies in cardiovascular disease management.

Source: [RSNA Radiology](#)

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