

Enhancing Diagnosis and Monitoring of Left Ventricular Noncompaction with Echocardiography

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DESCRIPTION

Left Ventricular Noncompaction (LVNC) is a cardiomyopathy characterized by excessive trabeculations and deep intertrabecular recesses in the left ventricular myocardium. Echocardiography plays a central role in the diagnosis and monitoring of LVNC due to its widespread availability, non-invasiveness, and ability to visualize cardiac morphology and function. This article explains the role of echocardiography in the diagnosis and longitudinal assessment of LVNC, including its diagnostic criteria, imaging features, prognostic implications, and limitations.

Echocardiography is instrumental in diagnosing LVNC based on established imaging criteria. The most commonly used criteria include the Jenni criteria, which define LVNC as a non-compacted to compacted myocardial ratio >2.3 in end-diastole on two-dimensional echocardiography. Additional features include prominent trabeculations, deep intertrabecular recesses, and color Doppler evidence of blood flow within intertrabecular spaces. These criteria aid in distinguishing LVNC from other cardiomyopathies and normal anatomical variants. Echocardiography provides comprehensive assessment of LVNC morphology and function. Two-dimensional echocardiography visualizes the characteristic trabeculations and intertrabecular recesses in the left ventricular apex and midventricular segments. Color Doppler imaging demonstrates blood flow within the intertrabecular spaces, confirming the presence of noncompaction. Three-dimensional echocardiography offers improved visualization and quantification of LVNC morphology, enhancing diagnostic accuracy and reproducibility. In addition to morphological evaluation, echocardiography assesses left ventricular systolic and diastolic function in LVNC patients. Two-dimensional echocardiography measures left ventricular ejection fraction, wall motion abnormalities, and regional myocardial dysfunction. Doppler echocardiography evaluates diastolic function parameters, including mitral inflow velocities, tissue Doppler velocities, and left atrial size, which may be abnormal in LVNC patients with impaired relaxation or restrictive physiology.

Echocardiography plays a role in risk stratification of LVNC patients by identifying markers of adverse prognosis. Parameters associated with increased risk of adverse outcomes include reduced left ventricular ejection fraction, severe left ventricular dilatation, global or regional systolic dysfunction, and presence of significant valvular regurgitation. Longitudinal assessment of LVNC patients with echocardiography enables early detection of progressive cardiac dysfunction and guides timely intervention and risk management strategies. Echocardiography facilitates longitudinal monitoring of LVNC patients to assess disease progression and treatment response. Serial echocardiographic evaluations track changes in left ventricular morphology, function, and chamber dimensions over time. Progressive ventricular dilatation, worsening systolic function, or development of complications such as heart failure or arrhythmias indicate disease progression and may prompt intensification of medical therapy or consideration of device therapy. Despite its utility, echocardiography has certain limitations in the diagnosis and monitoring of LVNC. Image quality may be suboptimal in some patients, particularly those with poor acoustic windows, obesity, or lung disease. Additionally, echocardiography may underestimate myocardial trabeculations in certain segments or fail to detect subtle forms of noncompaction. Multimodal imaging approaches, including cardiac Magnetic Resonance Imaging (MRI), may complement echocardiography in challenging cases and provide additional diagnostic information.

Echocardiography allows for comprehensive assessment of LVNC, including evaluation of left ventricular morphology, trabeculations, intertrabecular recesses, chamber dimensions, and systolic and diastolic function. This comprehensive evaluation aids in confirming the diagnosis of LVNC and assessing disease severity and progression over time. Echocardiography-based diagnostic criteria, such as the Jenni criteria, provide standardized parameters for diagnosing LVNC. These criteria define specific echocardiographic features indicative of LVNC, guiding clinicians in making accurate and consistent diagnoses. Echocardiography facilitates longitudinal monitoring of LVNC patients, allowing for serial assessments of

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left ventricular morphology, function, and chamber dimensions. Serial monitoring enables early detection of disease progression, identification of complications, and evaluation of treatment response, optimizing patient management and outcomes.

Echocardiography aids in risk stratification of LVNC patients by identifying markers of adverse prognosis, such as reduced left ventricular ejection fraction, ventricular dilatation, and systolic dysfunction. These parameters help identify patients at increased risk of adverse outcomes, guiding therapeutic decision-making and risk management strategies. Echocardiography can be integrated with other imaging modalities, such as cardiac Magnetic Resonance Imaging (MRI), to complement its diagnostic capabilities. Multimodal imaging approaches enhance diagnostic accuracy and provide additional information on myocardial structure, function, and tissue characterization in LVNC patients. Echocardiography provides real-time guidance for interventional procedures, such as endomyocardial biopsy or

device implantation, in LVNC patients. Real-time imaging helps ensure accurate placement of catheters or devices and minimizes procedural risks and complications.

CONCLUSION

Echocardiography is indispensable in the diagnosis and longitudinal assessment of left ventricular noncompaction, offering comprehensive evaluation of cardiac morphology, function, and hemodynamics. By applying established diagnostic criteria and imaging techniques, echocardiography enables accurate diagnosis of LVNC and facilitates risk stratification, monitoring of disease progression, and evaluation of treatment response. Despite its limitations, echocardiography remains a cornerstone in the management of LVNC patients, contributing to improved clinical outcomes and personalized care.