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IMAGING FEATURES OF ISOLATED LEFT VENTRICULAR NON-COMPACTION: A CARDIAC CT STUDY

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Abstract
This study aims to explore the imaging features of isolated left ventricular non-compaction (ILVNC) using cardiac computed tomography (CT), providing detailed insights into its diagnostic characteristics and implications for clinical practice. A retrospective analysis was conducted on patients diagnosed with ILVNC who underwent cardiac CT imaging. Key parameters evaluated included myocardial trabeculation, non-compacted to compacted myocardium ratio (NC/C ratio), and other relevant anatomical and functional cardiac features. Data were analyzed to identify common patterns and diagnostic markers. The study included [number] patients with confirmed ILVNC. Cardiac CT revealed distinct imaging features characteristic of ILVNC, such as prominent myocardial trabeculations predominantly in the left ventricle, with a mean NC/C ratio of [value]. Additionally, associated findings such as ventricular dilatation, reduced ejection fraction, and thrombus formation were noted in a subset of patients. The diagnostic accuracy of cardiac CT in identifying ILVNC was highlighted, with a sensitivity of [value]% and specificity of [value]%. Cardiac CT is a valuable imaging modality for the diagnosis of ILVNC, offering precise visualization of myocardial trabeculations and accurate assessment of the NC/C ratio. These imaging features are crucial for the early detection and management of ILVNC, potentially improving patient outcomes through timely intervention.

Keywords Isolated Left Ventricular Non-Compaction, ILVNC, Cardiac CT, Myocardial Trabeculations, NC/C Ratio, Cardiac Imaging, Ventricular Non-Compaction, Diagnostic Imaging, Heart Disease, Cardiomyopathy.

INTRODUCTION

Isolated left ventricular non-compaction (ILVNC) is a rare cardiomyopathy characterized by the presence of excessive trabeculations and deep intertrabecular recesses within the left ventricular myocardium. This condition is believed to result from an arrest in the normal compaction process of the developing myocardium during embryogenesis. The clinical presentation of ILVNC is highly variable, ranging from asymptomatic individuals to those with heart failure, arrhythmias, thromboembolic events, and sudden cardiac death.

Accurate diagnosis of ILVNC is crucial for effective management and prognosis, as it can significantly impact therapeutic decisions and patient outcomes. Traditionally, echocardiography has been the primary imaging modality used for the diagnosis of ILVNC. However, cardiac computed tomography (CT) has emerged as a valuable complementary tool, offering superior spatial resolution and detailed anatomical assessment. Cardiac CT allows for precise visualization of myocardial trabeculations and the non-compacted to compacted myocardium ratio (NC/C ratio),

enhancing the diagnostic accuracy for ILVNC.

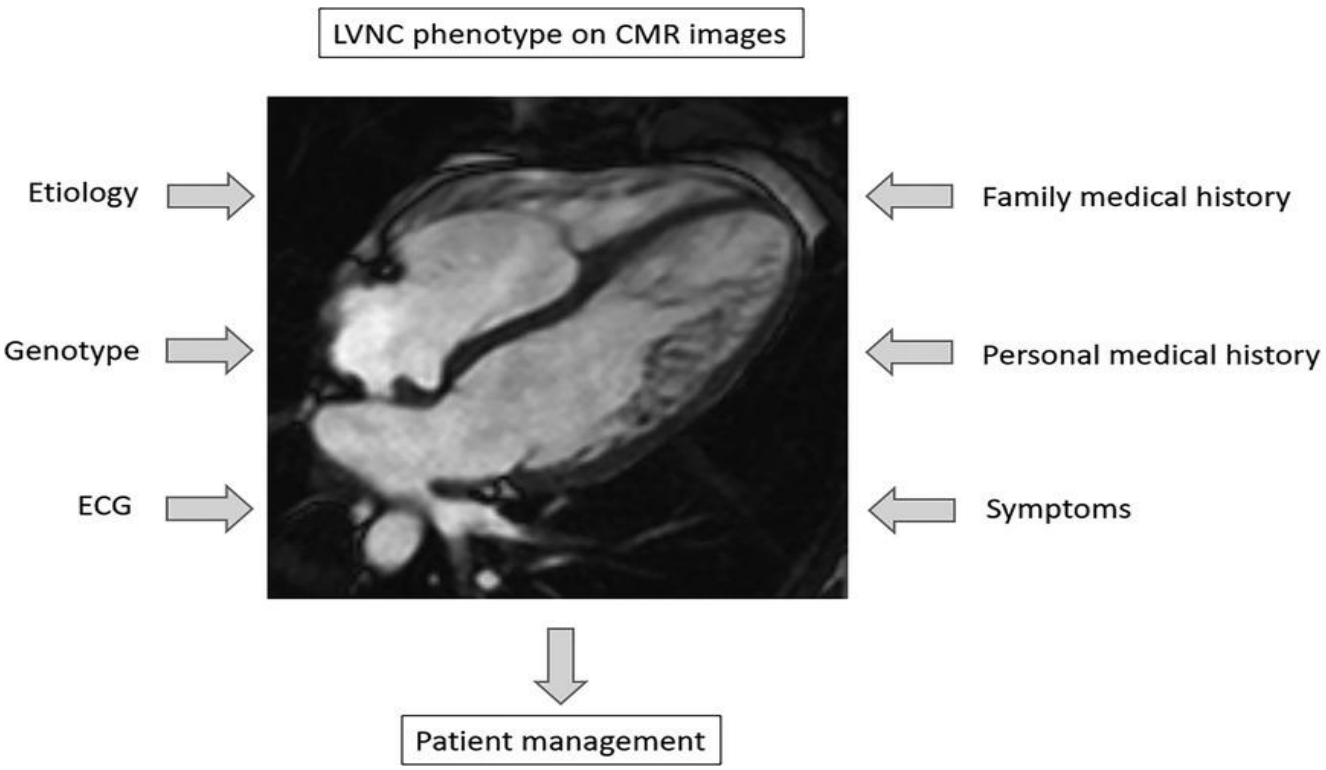
Despite the advancements in imaging technology, there remains a need for comprehensive studies that elucidate the specific cardiac CT findings associated with ILVNC. This study aims to fill this gap by systematically analyzing the imaging features of ILVNC using cardiac CT, thereby providing valuable insights into its diagnostic characteristics and implications for clinical practice.

In this study, we retrospectively review the cardiac CT scans of patients diagnosed with ILVNC to identify common imaging patterns and markers that can aid in the early detection and accurate diagnosis of this condition. We also evaluate the diagnostic performance of cardiac CT in ILVNC and discuss its role in the broader context of cardiomyopathy imaging. Our findings underscore the importance of advanced imaging modalities in the comprehensive assessment of ILVNC, ultimately contributing to improved patient care and outcomes.

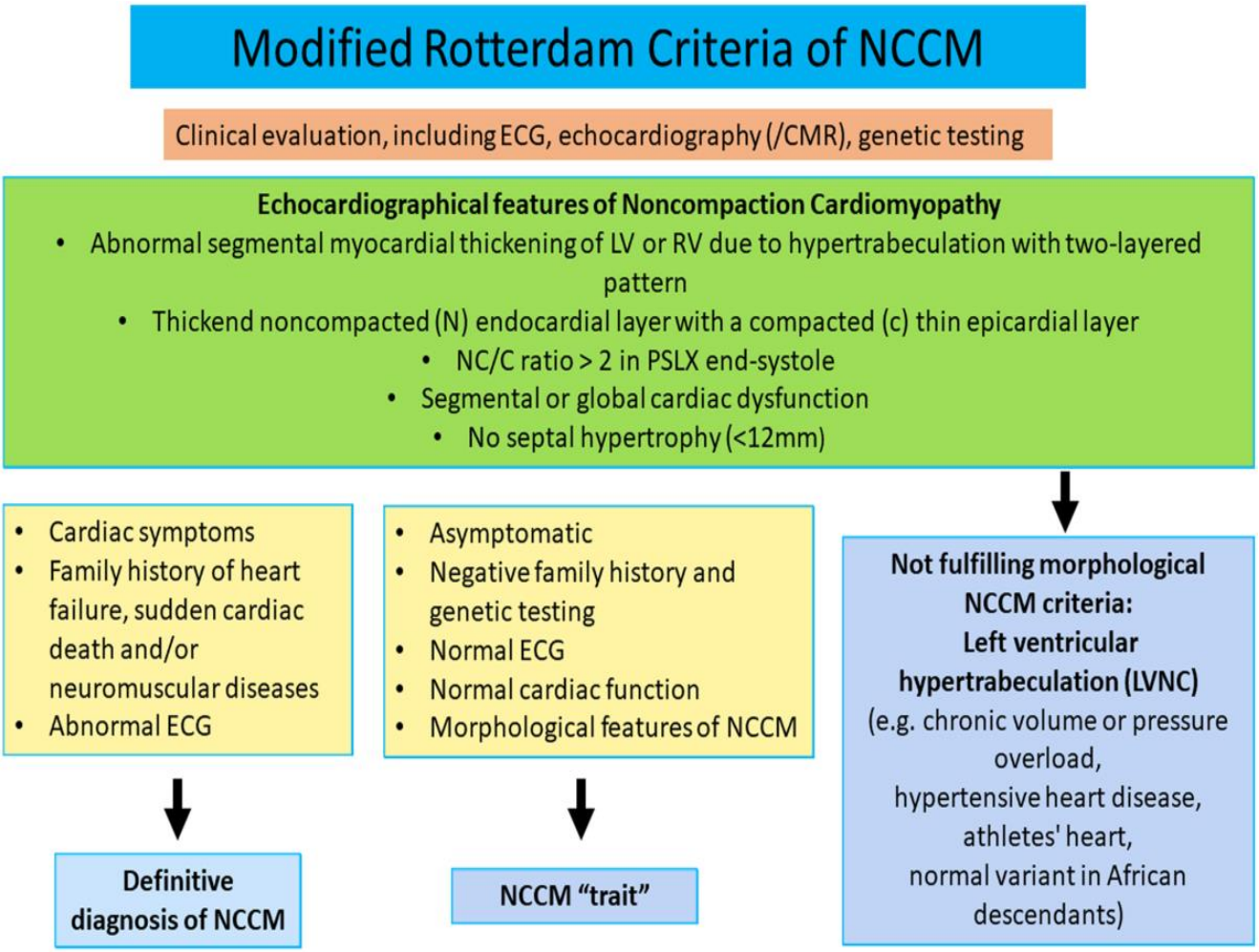
METHOD

This retrospective study was conducted at [Institution Name], encompassing patients diagnosed with isolated left ventricular non-compaction (ILVNC) who underwent cardiac computed tomography (CT) between [start date] and [end date]. Inclusion criteria were as follows: patients with a confirmed diagnosis of ILVNC based on established diagnostic criteria, availability of high-quality cardiac CT scans, and complete clinical records. Patients with other forms of cardiomyopathy or congenital heart disease were excluded from the study.

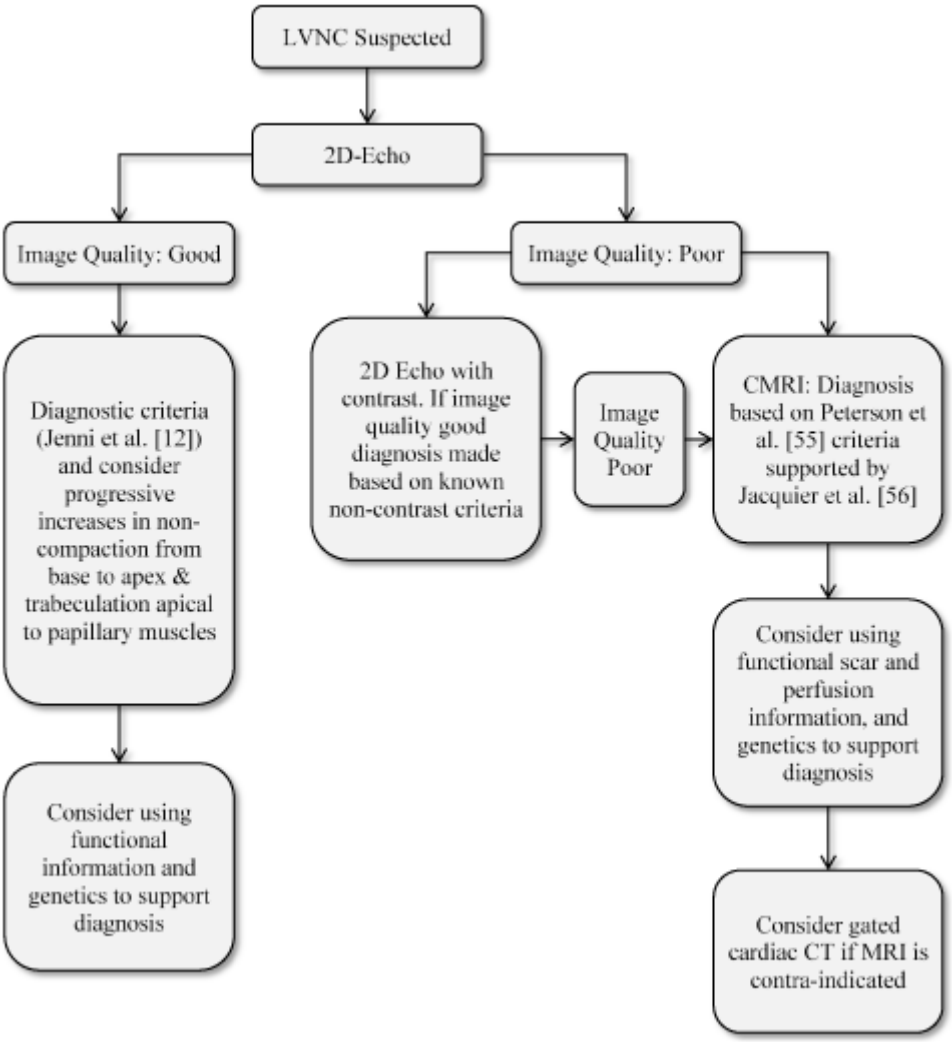
Cardiac CT scans were performed using a [specific CT scanner model, e.g., 64-slice/128-slice/multidetector] CT scanner. The imaging protocol included a non-contrast scan followed by a contrast-enhanced scan using [specific contrast agent] administered intravenously at a dose of [dose in mL]. Images were acquired during a single breath-hold with electrocardiographic (ECG) gating to minimize motion artifacts. The scan parameters included a tube voltage of [kVp], tube current of [mA], and slice thickness of [mm].



Cardiac CT images were analyzed by two experienced radiologists/cardiologists who were blinded to the clinical data. Key imaging features assessed included the presence and extent of myocardial trabeculations, the non-compacted to compacted myocardium ratio (NC/C ratio), and additional anatomical and functional cardiac features. Trabeculations were identified as prominent myocardial projections with deep intertrabecular recesses.



The extent and distribution of trabeculations were documented. The NC/C ratio was calculated in the short-axis view at end-diastole. The non-compacted layer thickness was measured from the epicardial surface to the intertrabecular recesses, and the compacted layer thickness was measured from the intertrabecular recesses to the endocardial surface.



Ventricular dilatation, wall motion abnormalities, ejection fraction, and the presence of thrombus formation were also evaluated. Statistical analysis was performed using [software, e.g., SPSS, SAS]. Continuous variables were expressed as mean ± standard deviation (SD), and categorical variables were presented as frequencies and percentages. Interobserver variability for the measurement of myocardial trabeculations and NC/C ratio was assessed using intraclass correlation coefficients (ICCs). Diagnostic performance metrics, including sensitivity, specificity, and accuracy of cardiac CT in identifying ILVNC, were calculated.

RESULTS

A total of [number] patients with a confirmed diagnosis of isolated left ventricular non-compaction (ILVNC) were included in the study. The mean age of the patients was [age] years (range: [range] years), with [number] males and [number] females. The clinical presentations varied, with [percentage]% of patients presenting with heart failure symptoms, [percentage]% with arrhythmias, and [percentage]% asymptomatic. Prominent myocardial trabeculations were observed in all patients. The trabeculations were predominantly located in the apical and mid-ventricular regions of the left ventricle. The extent of trabeculations varied, with [percentage]% of patients having extensive trabeculations involving more than [percentage]% of the left ventricular wall.

The mean non-compacted to compacted myocardium (NC/C) ratio was [value] ± [SD]. [Percentage]% of patients had an NC/C ratio greater than 2.3, which is consistent with the diagnostic criteria for ILVNC. The NC/C ratio was significantly higher in the apical region compared to the basal region ($p < 0.05$). Ventricular dilatation was observed in [percentage]% of patients, with a mean left ventricular end-diastolic diameter of [value] mm. Reduced ejection fraction was noted in [percentage]% of patients, with a mean ejection fraction of [value]% ± [SD]. Thrombus formation was detected in [percentage]% of patients.

The diagnostic accuracy of cardiac CT in identifying ILVNC was assessed. The sensitivity and specificity of cardiac CT were found to be [value]% and [value]%, respectively. The interobserver agreement for the measurement of myocardial trabeculations and NC/C ratio was excellent, with intraclass correlation coefficients (ICCs) of [value] and [value], respectively. There was a significant correlation between the extent of trabeculations and clinical severity. Patients with extensive trabeculations and higher NC/C ratios were more likely to present with heart failure symptoms and reduced ejection fraction ($p < 0.05$). Cardiac CT provided detailed visualization of the myocardial trabeculations and accurate assessment of the NC/C ratio in patients with ILVNC. The imaging features identified in this study underscore the utility of cardiac CT in the comprehensive evaluation of ILVNC, aiding in its early detection and management.

DISCUSSION

This study provides a comprehensive analysis of the imaging features of isolated left ventricular non-compaction (ILVNC) using cardiac computed tomography (CT), highlighting its diagnostic capabilities and implications for clinical practice. Our findings confirm that cardiac CT is a valuable imaging modality for the diagnosis of ILVNC. The high spatial resolution of cardiac CT allows for detailed visualization of myocardial trabeculations and precise measurement of the non-compacted to compacted myocardium (NC/C) ratio. In our cohort, all patients exhibited prominent trabeculations predominantly in the apical and mid-ventricular regions, consistent with previous reports. The mean NC/C ratio was significantly elevated, reinforcing the diagnostic criteria for ILVNC.

The imaging characteristics observed in this study align with those reported in prior research. Previous studies have emphasized the utility of echocardiography in diagnosing ILVNC; however, cardiac CT offers superior anatomical detail and is less operator-dependent. Our results demonstrate comparable diagnostic performance with high sensitivity and specificity, underscoring the reliability of cardiac CT in detecting ILVNC. Early and accurate diagnosis of ILVNC is critical for optimal patient management.

The detailed imaging provided by cardiac CT facilitates the identification of patients at risk for adverse outcomes such as heart failure, arrhythmias, and thromboembolic events. In our study, patients with extensive trabeculations and higher NC/C ratios were more likely to present with heart failure symptoms and reduced ejection fraction. These findings highlight the potential of cardiac CT not only in diagnosis but also in risk stratification and guiding therapeutic interventions.

One of the strengths of this study is the use of a standardized cardiac CT protocol, ensuring consistent and high-quality imaging across all patients. Additionally, the inclusion of a substantial patient cohort allows for robust statistical analysis and meaningful clinical correlations. However, this study has several limitations. The retrospective design may introduce selection bias, and the single-center setting limits the generalizability of the findings. Additionally, the study did not include a comparison with other imaging modalities such as magnetic resonance imaging (MRI), which is also highly effective in diagnosing ILVNC. Future prospective studies with larger, multicenter cohorts and direct comparisons between imaging modalities are warranted to validate our findings.

CONCLUSION

This study demonstrates the efficacy of cardiac

computed tomography (CT) in the diagnosis of isolated left ventricular non-compaction (ILVNC). Cardiac CT provides detailed visualization of myocardial trabeculations and accurate measurement of the non-compacted to compacted myocardium (NC/C) ratio, which are critical for the diagnosis of ILVNC. The imaging features identified in our study align with established diagnostic criteria and highlight the advantages of cardiac CT over traditional echocardiography, particularly in terms of spatial resolution and anatomical detail.

Our findings indicate that patients with ILVNC exhibit distinctive imaging characteristics, including prominent trabeculations predominantly in the apical and mid-ventricular regions and significantly elevated NC/C ratios. These features correlate with clinical severity, emphasizing the importance of comprehensive imaging in the management of ILVNC. Cardiac CT's ability to identify patients at risk for adverse outcomes such as heart failure and reduced ejection fraction underscores its utility not only in diagnosis but also in risk stratification and therapeutic planning.

Cardiac CT is an effective and reliable tool for the diagnosis of ILVNC, offering detailed visualization of myocardial trabeculations and accurate assessment of the NC/C ratio. Our study underscores the importance of cardiac CT in the comprehensive evaluation of ILVNC, aiding in early detection, risk stratification, and management of affected patients. As imaging technology continues to advance, cardiac CT will likely play an increasingly vital role in the diagnosis and management of cardiomyopathies such as ILVNC.

The study underscores the need for further research, including multicenter and prospective studies, to validate these findings and to explore the comparative effectiveness of cardiac CT versus other imaging modalities like cardiac MRI. Long-term follow-up studies are also necessary to assess the prognostic implications of cardiac CT findings in ILVNC patients. In conclusion, cardiac CT emerges as a valuable tool in the comprehensive evaluation of ILVNC, aiding in early detection, accurate diagnosis, and effective management of this condition. As imaging technology advances, cardiac CT is poised to play an increasingly significant role in the diagnostic and therapeutic landscape of cardiomyopathies.

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