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Analysis of the Efficacy of Cardiac CT Imaging and Cardiac Magnetic Resonance in Diagnosing Diabetic Cardiomyopathy

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Abstract

Objective: To analyze the efficacy of cardiac CT imaging (CCT) and cardiac magnetic resonance (CMR) in diagnosing diabetic cardiomyopathy. **Methods:** Eighty patients suspected of having diabetic cardiomyopathy admitted between January 2024 and June 2025 were enrolled. All underwent CCT and CMR examinations, with coronary angiography (CAG) serving as the gold standard. The diagnostic efficacy of CCT and CMR was compared. **Results:** Among 80 patients, CAG confirmed 66 positive and 14 negative cases; CCT identified 62 positives and 18 negatives; CMR identified 66 positives and 14 negatives. The accuracy, sensitivity, specificity, positive predictive value, and negative predictive value of CMR were all higher than those of CCT ($P < 0.05$). **Conclusion:** Compared with CCT, CMR demonstrates higher accuracy, sensitivity, specificity, positive predictive value, and negative predictive value in diagnosing diabetic cardiomyopathy, with significant value in early diagnosis and lesion assessment.

Keywords

Cardiac CT Imaging; Cardiac Magnetic Resonance; Diabetic Cardiomyopathy; Diagnostic Efficacy

Diabetic cardiomyopathy (DCM) is a common cardiovascular complication in patients with diabetes mellitus, characterized primarily by abnormalities in myocardial structure and function. It presents no obvious symptoms in the early stage but can progress to heart failure in the advanced stage, posing a serious threat to patients' lives and health [1]. Due to its complex pathogenesis and frequent coexistence with conditions such as coronary heart disease, early and accurate diagnosis is crucial for improving prognosis [2]. At present, clinical diagnosis of DCM mainly relies on clinical manifestations, electrocardiography, echocardiography, and other examinations. However, these methods have certain limitations in early diagnosis and lesion assessment.

Cardiac computed tomography (CCT) and cardiac magnetic resonance (CMR) are rapidly developing imaging techniques in recent years, playing an important role in the diagnosis of cardiovascular diseases. Among them, CCT can clearly display cardiac structure, coronary artery lesions, and myocardial perfusion, with advantages such as fast scanning speed and high spatial resolution [3]. CMR, on the other hand, can accurately evaluate myocardial tissue characteristics, cardiac function, and the degree of myocardial fibrosis, boasting excellent soft tissue resolution. Nevertheless, the specific diagnostic efficacy of both techniques in DCM remains to be further clarified [4].

This study aims to compare and analyze the diagnostic efficacy of CCT and CMR in diabetic cardiomyopathy, so as to provide evidence for clinical selection of the optimal diagnostic method, improve the early diagnosis rate, and enhance patient prognosis. The report is as follows.

1. Materials and Methods

1.1 General Information

A total of 80 patients suspected of diabetic cardiomyopathy admitted between January 2024 and June 2025 were enrolled. The patients were aged 40-78 years, with a mean age of 62.16 ± 3.26 years; 36 were male (45.00%), and 44 were female (55.00%). The duration of diabetes ranged from 3 to 16 years, with an average of 8.94 ± 1.57 years. The body mass index ranged from 19.75 to 24.86 kg/m², with a mean of 22.86 ± 1.23 kg/m². Inclusion criteria: confirmed type 2 diabetic cardiomyopathy; voluntary participation with signed informed consent. Exclusion criteria: contraindications to CCT or CMR; arrhythmias; concomitant ischemic cardiomyopathy, valvular disease, or congenital heart disease.

1.2 Methods

1.2.1 CCT Examination

A 16-slice multidetector CT system was used for image acquisition, with scan initiation triggered by contrast enhancement of the aortic root. Parameters: gantry rotation time 250 ms, single rotation coverage 5 mm slice thickness, tube voltage 120 kV, tube current 300 mA. Data were reconstructed using retrospective ECG gating with a slice thickness and interval of 0.5 mm, covering phases from early systole to late diastole. The trigger threshold was set at 130 HU. Contrast protocol: 110 mL iodinated contrast medium injected intravenously at 5 mL/s, followed by 40 mL saline at the same rate. Image reconstruction was then completed.

1.2.2 CMR Examination

A 1.5T MRI system equipped with a 32-channel phased-array body coil and gradient module was used. Parameters: slice thickness 8 mm, repetition time 2.7 ms, echo time 1.34 ms, field of view 300 × 300 mm, matrix 176 × 128, flip angle 60°. Balanced steady-state free precession sequences were applied to acquire cine images in multiple planes covering standard anatomical views.

1.3 Observation Indicators

(1) Diagnostic results from CCT, CMR, and CAG were recorded. (2) The diagnostic efficacy of CCT and CMR was compared.

1.4 Statistical Analysis

SPSS 26.0 software was used for statistical analysis. Categorical variables were expressed as cases/percentages (n/%), and continuous variables conforming to normal distribution were expressed as mean ± standard deviation. Chi-square and t-tests were performed as appropriate. $P < 0.05$ was considered statistically significant.

2. Results

2.1 Diagnostic Results of CCT, CMR, and CAG

Among 80 suspected diabetic cardiomyopathy patients, CAG confirmed 66 positive and 14 negative cases; CCT identified 62 positives and 18 negatives; CMR identified 66 positives and 14 negatives (see Table 1).

Table 1. Diagnostic Results of CCT, CMR, and CAG

	CAG Positive	CAG Negative	Total
CCT Positive	56	6	62
CCT Negative	10	8	18
CMR Positive	65	1	66
CMR Negative	1	13	14
Total	66	14	80

2.2 Comparison of Diagnostic Efficacy of CCT and CMR

The accuracy, sensitivity, specificity, positive predictive value, and negative predictive value of CMR were all higher than those of CCT ($P < 0.05$) (see Table 2).

Table 2. Comparison of Diagnostic Efficacy of CCT and CMR

Indicator	CCT (%)	CMR (%)
Accuracy	80.00 (64/80)	97.50 (78/80)
Sensitivity	84.85 (56/66)	98.48 (65/66)
Specificity	57.14 (8/14)	92.86 (13/14)
Positive Predictive Value	90.32 (56/62)	98.48 (65/66)
Negative Predictive Value	44.44 (8/18)	92.86 (13/14)
χ^2	12.269	
P value	0.001-0.042	

3. Discussion

Diabetic cardiomyopathy (DCM) is a specific myocardial injury unique to patients with diabetes mellitus, whose pathogenesis is closely associated with metabolic disorders, microangiopathy, and neuropathy induced by long-term hyperglycemia [5]. Insulin resistance, oxidative stress, and inflammatory responses lead to cardiomyocyte apoptosis and interstitial fibrosis, ultimately resulting in abnormal cardiac structure and function [6]. In the early stage, most patients present no specific symptoms, while some may experience fatigue, palpitations, or decreased exercise tolerance. As the disease progresses, common symptoms such as dyspnea, lower extremity edema, and paroxysmal nocturnal dyspnea often occur, which are easily confused with those of coronary heart disease [7]. This disease poses significant harm, as it can cause left ventricular hypertrophy and diastolic dysfunction, and eventually progress to congestive heart failure or malignant arrhythmia [8]. If detected early, effective control of blood glucose, intervention of cardiovascular risk factors, and early administration of ACEI/ARB drugs can significantly delay myocardial remodeling and reduce the risk of heart failure hospitalization and sudden cardiac death.

Coronary computed tomography (CCT) is characterized by fast scanning speed and high spatial resolution, which can clearly display the anatomical structure of the heart and the status of coronary artery lesions. Coronary artery disease is relatively common in patients with diabetic cardiomyopathy. CCT can accurately assess the degree of coronary artery stenosis and the nature of plaques, providing an important basis for the selection of clinical treatment strategies [9]. However, CCT has a limited ability to evaluate myocardial tissue characteristics and is difficult to detect early micro-lesions of the myocardium, which to a certain extent, affects its diagnostic sensitivity. Cardiac magnetic resonance (CMR) has the advantages of high soft tissue resolution and multi-parameter imaging, enabling comprehensive evaluation of myocardial structure, function, and tissue characteristics. Among them, cine magnetic resonance imaging can accurately measure cardiac systolic and diastolic function indicators, facilitating the early detection of abnormal changes in cardiac function; myocardial perfusion imaging can reflect the myocardial blood flow perfusion status, helping to determine the degree of myocardial ischemia; late gadolinium enhancement (LGE) scanning can clarify the scope and severity of myocardial fibrosis, providing crucial information for the diagnosis and prognostic evaluation of diabetic cardiomyopathy [10].

This study conducted a comparative analysis of the diagnostic efficacy of CCT and CMR for diabetic cardiomyopathy. The results showed that the accuracy, sensitivity, specificity, positive predictive value, and negative predictive value of CMR were all higher than those of CCT ($P < 0.05$). These findings indicate that CMR has greater value in the diagnosis of diabetic cardiomyopathy. Although CMR exhibits high diagnostic efficacy for diabetic cardiomyopathy, CCT has unique advantages in the assessment of coronary artery lesions. The combined application of the two examination methods can achieve complementary advantages and improve the diagnostic accuracy of diabetic cardiomyopathy. For patients with suspected diabetic cardiomyopathy, CCT can be performed first to evaluate the coronary artery condition, followed by CMR to further assess myocardial tissue characteristics and cardiac function, thereby providing more comprehensive information for clinical diagnosis.

In conclusion, compared with CCT, CMR has higher accuracy, sensitivity, specificity, positive predictive value, and negative predictive value in the diagnosis of diabetic cardiomyopathy, and thus plays an important role in early diagnosis and lesion assessment.

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