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MRI Predictors Of Left Ventricle Diastolic Dysfunction

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Abstract. RELEVANCE. Non-invasive assessment of diastolic dysfunction remains challenging, and this study aims to identify the most informative parameters of cardiovascular magnetic resonance (CMR) for assessing left ventricular diastolic dysfunction (LVDD)
OBJECTIVE: To study MRI parameters as predictors of left ventricular diastolic dysfunction (LVDD) in patients with suspected heart failure.
PATIENTS AND METHODS. The study included 39 patients with CHF, 25 were men (61%), and the average age of patients was 48.12 ± 16.79 years.
RESULTS. The enlarged LA dimensions have diagnostic accuracy according to our data for the detection of diastolic dysfunction (DD).
Tissue tracking and tissue phase mapping (TRM) reveal impaired diastolic deformity of the basal-lateral wall in DD+ as a direct sign of DD.
Keywords: chronic heart failure, Cardiovascular magnetic resonance, echocardiography, diastolic myocardial dysfunction.

Relevance. Magnetic resonance imaging is considered the “gold standard” for measuring the volume, mass and contractility of the heart chambers. MRI is the best alternative if the image quality of transthoracic echocardiography is unsatisfactory [1]. Noninvasive assessment of diastolic dysfunction remains challenging, and this study aims to identify the most useful cardiac magnetic resonance imaging (CMR) parameters for assessing left ventricular diastolic dysfunction (LVDD).

The purpose of this study is to examine MRI parameters as predictors of left ventricular diastolic dysfunction (LVDD) in patients with suspected heart failure**.**

Patients and methods. The study was conducted on the basis of a retrospective examination of patients who underwent MRI from April 2022. until August 2023 All patients underwent a comprehensive clinical and instrumental examination, taking into account factors such as age, gender, nationality, smoking, diabetes mellitus (DM), arterial hypertension (AH), lipid profile, body mass index (BMI). A total of 39 patients, 7 of them with fibrosis in heart failure, 4 patients with congenital heart disease identified during the study, 28 patients with suspected myocarditis**.** CMR measurements of the patients' heart chambers were obtained from an independent manual examination using an image archiving and communication system.

CMR measurements were performed as follows; Patients were examined using a 1.5 Tesla MRI machine, eight-channel cardiac coils were used to obtain images. The position and orientation of the heart in the chest were determined after serial reference images of the chest were taken. Using steady-state free precession sequences, a two-chamber image of the left ventricle was obtained with a breath hold of 10–15 s at the end. Four-chamber short-axis and three-chamber sequences were then obtained. [2].

Right ventricular end-diastolic diameter (RVED) was measured between the right ventricular endocardium and the interventricular septum, parallel to the tricuspid valve and 1 cm distal to the valve on four-chamber sinusoids with free precession (SSFP). [3]

Whereas, left ventricular end-diastolic (LVED) and left ventricular end-systolic (LVES) diameters were measured between the left ventricular endocardium and the interventricular septum, parallel to the mitral valve and 1 cm distal to the valve on three-sinusoidal camera images. Right atrium mediolateral diameter was measured at the mid-auricle between the right atrium free wall and the interatrial septum, parallel to the tricuspid valve. Right atrial diameter measurements were calculated during the ventricular end-systolic phase on four-chamber sinusoidal images. On the other hand, left atrial anteroposterior diameter was measured during the ventricular end-systolic phase on three-chamber SSFP sinusoidal images from the left atrium free wall to the interatrial septum, parallel to the mitral valve[4]

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Research results.

Of the 39 patients included in the study, 25 were male (61%), and the mean age of the patients was 48.12 ± 16.79 years.

Sample size (n)	23	6	10
Gender (male|female)	16|7	6|0	6|4
Age (years)	65,2 ± 7,7	6,0 ± 7,3	70,5 ± 7,3
BMI (kg/m2)	25,7 ± 3,2	27,6 ± 4,5	29,8 ± 3,3 *
6MWD(m)	508 ± 75	479± 115	448 ± 123
LVDP (mm Hg)	8 ± 3	15 ± 1 *	21 ± 5
HER'	8,5 ± 2,0	10,8 ± 1,4 *	10,1 ± 2,0
NT-proBNP (ng/ml)	185 ± 150	158 ± 109*	448 ± 424 *
Heart rate (bpm)	72 ± 10	69 ± 11	66 ± 7
Arterial hypertension (%)	85,6	102,0	94,2
Cardiac ischemia (%)	87,5	99.0	81,0
Single-vessel disease (%)	24.1	34,3	25,6
Two-vessel disease (%)	33,6	53,6	22,0
Three-vessel disease (%)	31,2	11.2	32,9
Diabetes(%)	35,2	10.9	34,3
Hyperlipoproteinemia (%)	39,0	66,7	59,8

Discussion.

Based on quantitative assessment of LA size, a threshold value for detecting DD can be determined. In addition, quantification of LV diastolic strain was found to be prognostic for identifying patients with DD. [5] Left atrial enlargement is well known in LVDD, caused by a chronic increase in LV filling pressure due to impaired relaxation and decreased compliance. [6]

Left atrial dilatation is already part of the diagnostic algorithm for DD, both in the consensus statement of the Heart Failure and Echocardiography Association of the European Society of Cardiology published in 2007, and in current guidelines from the American Society of Echocardiography and the European Association of Cardiovascular Diseases. [7] But to confirm our findings of left atrial enlargement and diastolic dysfunction in the basal-lateral wall, reclassification would be desirable. In addition to detecting DD itself, grading of DD can provide more information about disease stages and pathophysiology. Our approach did not focus on the classification of DD, and therefore patients with grade 1 DD were likely missed or undetected. Identification of borderline cases and parameters for reclassification should be considered in future studies.Выводы:

Thus, CMR allows the identification of patients with DD. Left atrial enlargement is the most predictive factor for DD among the comprehensive MRI parameters evaluated. TPM and tissue tracking reflect intrinsic aberration, revealing abnormal strain patterns in the basal-lateral segments compared to patients with normal diastolic function

And although it is possible that our parameters will be introduced into clinical practice in the future, transthoracic echocardiography will remain the first-line method for assessing diastolic function. But in cases of primary MRI, for example in patients with suspected cardiomyopathy, it will be useful to be able to reliably assess diastolic function as an additional parameter. [8]

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