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CASE REPORT

Diffuse and patchy intra-myocardial fat deposition in left ventricle: unclassified cardiomyopathy in an obese woman without pathological condition

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Abstract
Fat deposition in the left ventricle in patients without proven myocardial diseases has not been sufficiently investigated. In this paper, a case of diffuse and patchy intramyocardial fat deposition in the left ventricular myocardium in a patient with no cardiac disease history has been detected by cardiac magnetic resonance imaging (CMRI). Such a finding would not be considered a usual cardiomyopathy and further studies are needed to investigate its prevalence, pathophysiological mechanisms, and prognosis.

Keywords Cardiac magnetic resonance imaging · Fat deposition · Myocardium

Introduction

The presence of fat in or around the heart has been one of the most interesting topics of discussion amongst physicians [1]. Although there have been a considerable number of reports mentioning fat deposition related to pathologic conditions such as old myocardial infarction (MI), arrhythmogenic right ventricular dysplasia (ARVD), cardiac lipoma, myocarditis, and cardiomyopathies [2], fat deposition in the left ventricular (LV) myocardium in patients without proven myocardial diseases is still an untouched topic of discussion. In this study, we report a case of diffuse and patchy intra-myocardial fat deposition in the LV detected by CMRI.

Case report

A 44-year-old woman was admitted to the emergency department with dyspnea and a history of presyncoptic attacks. The patient had been well 3 months prior to the onset of her symptoms, when chest pain and palpitations developed. During the past 3 months, she had been suffering from a couple of attacks of palpitation and presyncoptic conditions. In her general

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assessment, she was obese (weight 88 kg; height 154 Cm; BMI 37.1 kg/m^2) with a good general appearance. Her vital signs were normal. Other physical examination undertaken was unremarkable except mild edema detected on the pretibial area.

Her past medical history did not reveal anything positive. She had five successful deliveries without complications during her gestational periods. Laboratory data revealed subclinical hypothyroidism. The ECG showed a bigeminal premature ventricular contraction (PVC) rhythm with normal axis, most probably originating from the right ventricle (RV) (Fig.1). There was no evidence of ischemic changes in the ECG.

Echocardiography showed mild systolic dysfunction (Table 1).

Because of PVCs, mexiletine was administered, but the desired results were not seen, so amiodarone (200 mg per day) was prescribed instead.

Her symptoms started improving but were not completely resolved. Because of repeated episodes of palpitation and chest pain, a computed tomography (CT) angiography was performed 1 month later. All coronary arteries were patent, but there was evidence of fatty infiltration in the LV myocardium, especially in the apex, septum, and infero-apical segments, in which the latter was the most prominent (up to 8 mm in diameter). Some degree of fat infiltration was found in the

Table 1 Echocardiographic findings in patient

Quantitative findings	
Anteroseptal delay	111 mSec
Transaortic gradient	10 mmHg
E and A	E (92 Cm/S) > A (60 Cm/S)
Pulmonary arterial pressure	35 mmHg
Pulmonic acceleration time	111 mSec
Right atrium size	49*44 (within normal range)
Right atrium area	19.4 Cm^2
Right ventricle size	77*25*28 (within normal range)
Left ventricular ejection fraction	40%
IVC diameter	8.4 mm
MR area	5 Cm^2
LA area	22.4 Cm^2
MR:LA area	0.22

Qualitative findings: global hypokinesia with dilated LV and mild to moderate systolic dysfunction

No PS; Trivial PI, No PFO

IVC inferior vena cava, *MR* mitral regurgitation, *LA* left atrium, *LV* left ventricle, *PS* pulmonary stenosis, *PI* pulmonary insufficiency, *PFO* patent foramen ovale

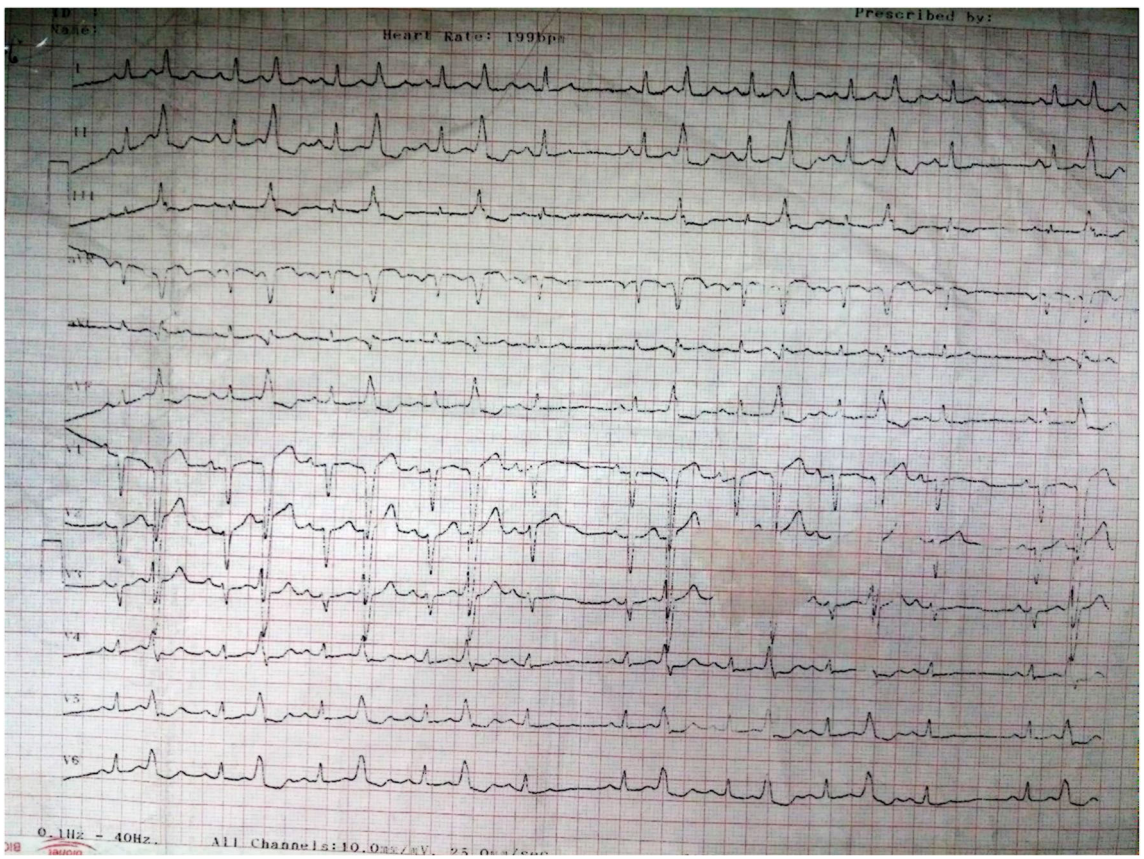

Fig. 1 ECG findings in patient. Bigeminal PVC rhythm originated probably from right ventricle with normal axis

infero-basal and lateral parts of the RV. As fatty infiltration and mild enlargement were reported in both ventricular chambers, RV dysplasia with LV involvement or some kind of dilated cardiomyopathy was assumed for the patient. For a more thorough evaluation, she underwent CMRI which showed diffuse and patchy intra-myocardial fat deposition in the infero-apical, apico-lateral, and antero-septal LV segments. Furthermore, the apico-septal portion of myocardium was bisected in appearance specifically in the cardiac apex (Fig. 2). Mild RV enlargement and systolic dysfunction (ejection fraction of 40%) was also reported by CMRI.

In spite of administration of amiodarone, the patient had some arrhythmic attacks during this period; thus, carvedilol and losartan were added. Although PVCs were still seen in the ECG, symptoms were relieved. Although she was a candidate for electrophysiological study (EPS), she refused further workup. A written informed consent was signed by the patient. This study was approved by Ethics committee, affiliated to Isfahan University of Medical Sciences.

Discussion

By increasing the use of multislice CT and CMRI, the prospect of myocardial fat detection has increased. The characteristic of myocardial fat is hypodense, low attenuation areas, within the myocardium on contrast-enhanced CT [3].

Many studies have shown that pathologic myocardial fat is seen in patients suffering from old MI, ARVD, cardiac-lipoma, lipomatous hypertrophy of the inter-atrial septum, tuberous sclerosis complex, cardiomyopathy with muscular dystrophy, hypertrophic cardiomyopathy (HCM), dilated cardiomyopathy (DCM), and other cardiomyopathies. However, fat deposits in the LV are not generally observed unless there is a history of previous myocardial infarction (MI) [4].

Park et al.'s study showed that fat deposition in the LV apex and apical segments is the most common type of LV fat deposition pattern on CT. LV fat in patients without proven myocardial disease was mostly seen in the mid-to-epicardium and apical segments. Patients with diffuse linear fat deposits in the LV also tended to have decreased regional or global heart function and were occasionally considered as DCM [4].

Myocardial fat was observed in up to 6% of patients suffering from ischemic heart diseases.

Common findings revealed on CT of patients with old MI include thinning and/or calcification of LV wall and subendocardial LV segment foci of linear or curvilinear fat attenuation [5].

A classification for cardiomyopathies published by Elliott et al. emphasized on phenotypic divisions. In this system, cardiomyopathies are divided into five specific morphological and functional subgroups including hypertrophic, dilated, arrhythmogenic, restrictive, and unclassified [6].

Hypertrophic cardiomyopathy may be associated with the presence of myocardial fat in a thickened LV wall without a loading condition such as hypertension or valvular disease. Dilated cardiomyopathy may also be associated with

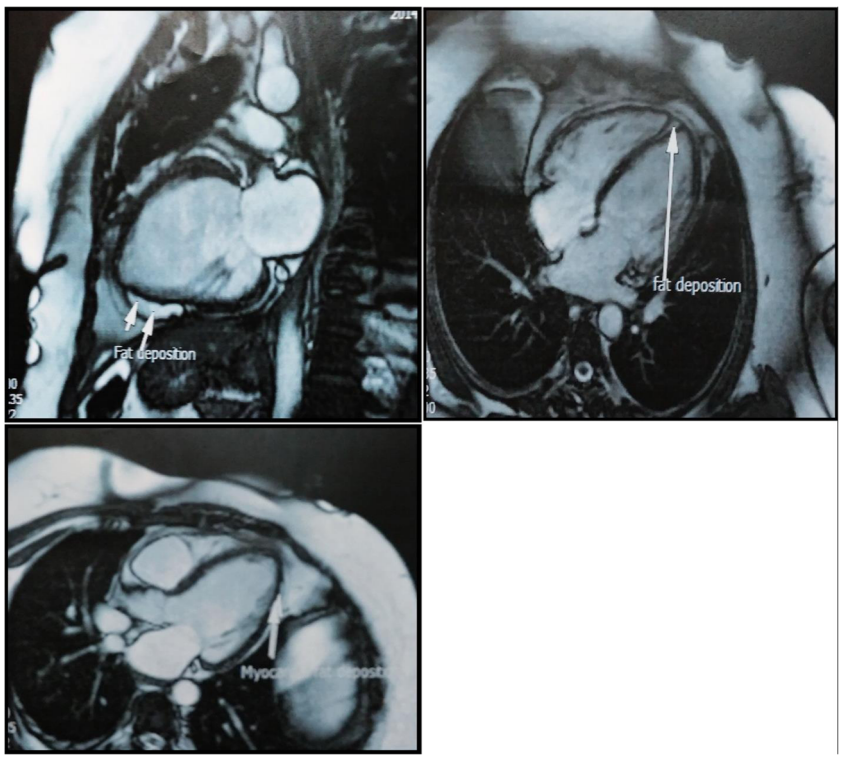

Fig 2 Cardiac magnetic resonance imaging of patient. Note the fat deposition in the infero-apical, apico-lateral, and antero-septal LV segment and also in the apico-septal segments resulted bisected appearance of myocardium

myocardial fat deposition in CMRI [7]. In addition to ventricular arrhythmias with left bundle branch blockage found in ARVD, RV dilation, clear fatty tissue in RV trabeculae especially in apical, anterior, and inferior wall, and scalloped RV shape are frequently observed CT findings [8].

In this case, diffuse and patchy intra-myocardial fat deposition in the infero-apical, apico-lateral, and antero-septal LV segments were reported without coronary stenosis and vascular territory involvement. No evidence of the CT or ECG findings, such as Epsilon waves, were found for detection of ARVD. Hypertrophic and restrictive cardiomyopathies were excluded based on the CT findings. Finally, unclassified cardiomyopathy with fatty infiltration of LV was considered for the patient. This could be a type of acquired cardiomyopathy with mainly LV involvement. We have no impression regarding its incidence, the manner in which such patients should be managed or its prognosis.

In conclusion, we report an unusual case of diffuse and patchy fat deposition in the middle layer of the LV myocardium without any identified causes on CT coronary angiography. This report indicates that LV middle layer fat deposition should be further investigated in multiple studies in order to determine its etiology, pathogenesis, and prognosis.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all individual participants included in the study.

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