

CASE REPORT

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Movahed's sign of left ventricle on myocardial perfusion scintigraphy in a case with chronic thromboembolic pulmonary hypertension

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Abstract

Chronic thromboembolic pulmonary hypertension (CTEPH) dramatically replaces biventricular remodeling and modifies the right ventricular function. In this case, a 75-year-old female patient who was followed up with a diagnosis of chronic pulmonary thromboembolism and had an acute embolism attack covering the entire right lung was retrospectively reviewed. In this examination, Movahed's sign, a sign of right ventricular overload, was also detected scintigraphically on myocardial perfusion scintigraphy. This case is important in clearly showing the cardiac and pulmonary reflections of CTEPH.

Keywords: Myocardial perfusion scintigraphy, pulmonary embolism, D-shaped left ventricle, Movahed's sign

Introduction

Gated SPECT imaging has recently revealed that a D-shaped ventricle, referred to as Movahed's sign [1,2], correlates with right ventricular overload, mirroring the D-shaped ventricle observed on echocardiography. Visualizing the right ventricle (RV) during gated SPECT procedures presents challenges due to minimal tracer uptake, which is attributed to the comparatively smaller myocardial mass and lower coronary flow of the RV. Increased RV mass or workload results in enhanced tracer uptake within the RV wall, a consequence of thickened RV walls, and improved coronary flow. Moreover, elevated RV volume or pressure can displace the septum toward the left ventricle, causing septal flattening and a D-shaped configuration of the left ventricular septum. This observation should be integrated into the analysis of nuclear-gated SPECT images.

Case Presentation

A 75-year-old female patient diagnosed with chronic pulmonary thromboembolism (CPTe) was referred for Tc-99m MIBI

myocardial perfusion scintigraphy for complaints of dyspnea and chest pain. Stress perfusion SPECT revealed Movahed's sign (Figure 1A). Movahed's sign was also observed in gated SPECT imaging in both end-diastole (ED) and end-systole (ES) stages (Figure 1B). No LV perfusion or movement abnormalities were observed. The patient also underwent lung ventilation and perfusion (V/Q) scintigraphy (Tc-99m Technegas/Tc-99m MAA) for dyspnea and pleuritic chest pain. The corresponding V/Q scintigraphy views showed V/Q mismatch perfusion defects within the entire right lung (Figure 2). The non-contrast CT findings were compatible with those of CTEPH (Figure 3). The main pulmonary artery (MPA), right pulmonary artery, and left pulmonary artery were found to be severely dilated (36 mm, 28 mm, and 30 mm, respectively) on non-contrast lung CT [3]. The D-dimer level was measured as 7.35 mg/L. Computed tomographic pulmonary angiography could not be performed in this case because of chronic renal failure. The patient was diagnosed with acute massive pulmonary thromboembolism. Venous Doppler examination revealed deep vein thrombosis, and the patient was followed-up with anticoagulant therapy. The

CITATION

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patient died of cardiopulmonary arrest while being treated for right-sided heart failure and edema in the intensive care unit.

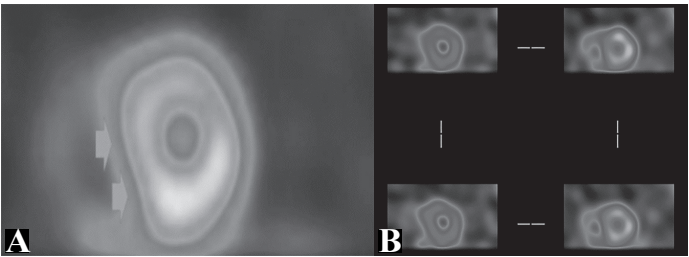


Figure 1. A. Stress perfusion (arrows) and B. stress-gated SPECT images revealed a D-shaped LV (Movahed's sign) morphology with flattening and stretching of the interventricular septum in both the ED (left column) and ES (right column) stages; the right ventricle was also observed in the right column because of the patient's history of right heart failure

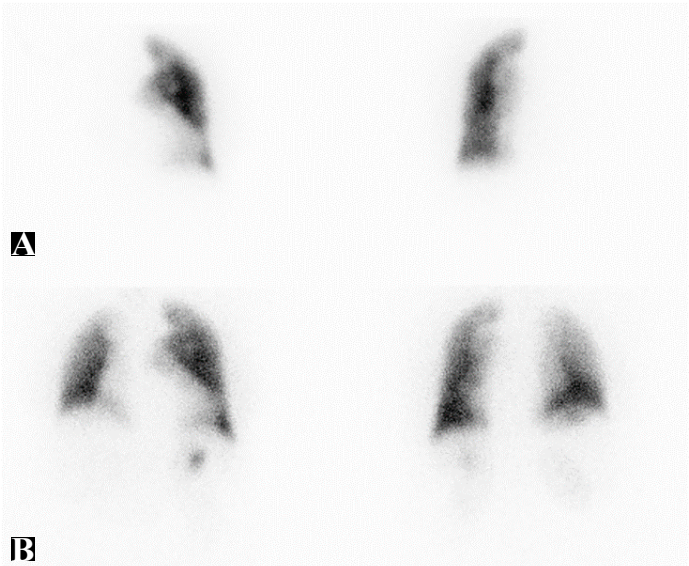


Figure 2. A. Perfusion scintigraphy upper row, B. and ventilation scintigraphy lower row; left column anterior images, right column posterior images

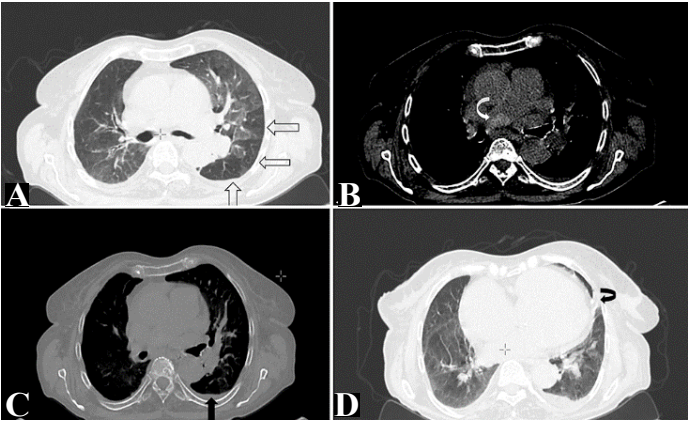


Figure 3. Mixed lung and mediastinal window images of non-contrast CT: a. multiple areas (white arrows) of mosaic perfusion, b. enlarged main and right pulmonary arteries (36 mm and 28 mm, respectively), embolus in the right pulmonary artery (white curved arrow), c. minimal pleural effusion in the left hemithorax (black arrow), d. atelectasis area (black curve arrow), and enlarged right heart was seen respectively.

Discussion

Pulmonary hypertension (PH) causes remodeling of both ventricles and many physiological changes in the RV function. In cases of RV pressure or volume overload, interventricular septal flattening can mechanically alter the LV geometric structure and disrupt LV function. ECHO is a fundamental method for assessing and monitoring RV function. D-shaped LV is an ECHO parameter that suggests the presence of elevated RV pressure [4]. RV volume overload can result from congenital heart diseases, valve abnormalities, or pulmonary pathologies such as chronic obstructive pulmonary disease or pulmonary embolism [5].

In this case, a D-shaped LV finding (Movahed's sign) was detected scintigraphically. ECHO also revealed a pulmonary artery pressure of 70 mmHg, dilated right heart chambers, and severe Tricuspid Regurgitation (TR) as the other manifestations of CTEPH. In a study investigating whether an increase in MPA diameter has prognostic implications in patients with PH, it was found that an increase in MPA diameter was associated with higher PA pressure, lower PA compliance, worse RV function, and reduced survival [6]. Similar to the studies mentioned above, many studies have reported that dilated MPA is a prognostic factor. In another study that aimed to evaluate the relationship between diastolic interventricular septal flattening and clinical outcomes in patients with severe TR, an increased eccentricity index (EI) at the ED was strongly associated with worse clinical outcomes [7]. The Eccentricity Index (EI) is an echocardiographic measurement of the left ventricle that can quantify the amount of right ventricular strain and overload affecting the left ventricle (Figure 4.) [8]. It was described by Ryan et al. and calculated by taking two measurements of the left ventricular cavity [9]. Only a few studies have reported that the presence of a D-shaped LV, defined as an $EI \geq 1.2$ or 1.7 , [10], provides prognostic value for cardiovascular events.

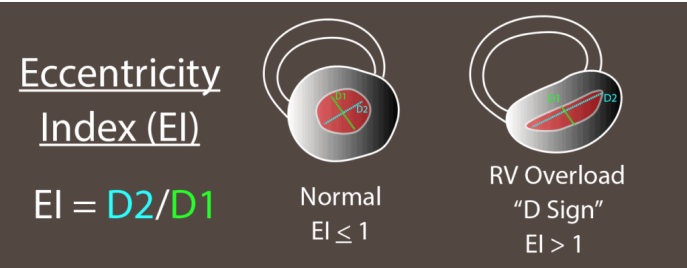


Figure 4. Eccentricity index equation for right ventricular overload and D sign

Conclusion

There are few studies on the effect of scintigraphic Movahed's sign on clinical outcomes in patients with severe TR [1,2]. However, adding the finding of Movahed's sign encountered in daily nuclear cardiology practice and the severely dilated MPA diameter from thoracic CT or SPECT/CT imaging to clinical evaluation may provide additional value for management and treatment decisions in patients with severe TR and CTEPH.

Postscript

This case was presented orally at the 6th International Congress of Palandöken Scientific Studies (24-25 June 2023), and the full text was published in the proceedings.

Conflict of Interests

The authors declare that there is no conflict of interest in the study.

Financial Disclosure

The authors declare that they have received no financial support for the study.

Patient informed consent

Written informed consent was obtained from the patient for the publication of this case report and any accompanying images.

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