The Transthoracic Three-Dimensional Echocardiography is Superior Technique to Reveal the Parachute-Like Asymmetric Mitral Valve

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Abstract

A 13-year-old woman was underwent transthoracic two-dimensional echocardiography (2DE), which revealed that only a small anterolateral papillary muscle was observed in the left ventricle (LV). Additional transthoracic three-dimensional echocardiography (3DE) revealed the posteromedial-papillary muscle which has not correctly delaminated from the LV wall and directly connected to the mitral valve leaflets without tendon chordae. She was diagnosed as a parachute-like asymmetric mitral valve rather than a true-parachute mitral valve. It was difficult to understand the precise anatomy evaluated by the 2DE. However, additional 3DE provided helpful information to reveal the exact characteristics of papillary muscle tissue.

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The 3D Image of Parachute-Like Asymmetric MV

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Conflicts of interest

The authors have no conflict of interest.

Abstract

A 13-year-old woman was underwent transthoracic two-dimensional echocardiography (2DE), which revealed that only a small anterolateral papillary muscle was observed in the left ventricle (LV). Additional transthoracic three-dimensional echocardiography (3DE) revealed the posteromedial-papillary muscle which has not correctly delaminated from the LV wall and directly connected to the mitral valve leaflets without tendon

chordae. She was diagnosed as a parachute-like asymmetric mitral valve rather than a true-parachute mitral valve. It was difficult to understand the precise anatomy evaluated by the 2DE. However, additional 3DE provided helpful information to reveal the exact characteristics of papillary muscle tissue.

Keywords

Parachute-like asymmetric mitral valve, Three-dimensional echocardiography, Transthoracic echocardiography, Congenital heart disease

A 13-year-old woman who underwent surgical ventricular septal defect (VSD) closure at the age of 3 years was performed transthoracic echocardiography for postoperative follow-up. No congenital heart disease other than VSD has been recognized. Two-dimensional echocardiography (2DE) revealed that the mitral valve (MV) motion was limited due to the fused posterior commissure (Figure 1A). In the short-axis view, only a small anterolateral papillary muscle (ALPM) was observed (Figure 1B and Movie S1). Both MV leaflets were connected to the ALPM by chordae tendinae on the lateral side but were appeared to be directly attached to the left ventricular (LV) wall on the medial side (Figure 1C, 1D). We first suspected the parachute-MV, but there was no evidence of mitral stenosis with a mean trans-MV pressure gradient of 2 mmHg, nor the left atrial dilatation, pulmonary hypertension. Additional transthoracic three-dimensional echocardiography (3DE) was performed to evaluate the detail of MV morphology (Figure 2, Movie S2, and S3). Observed the MV complex, the rudimentary posteromedial-papillary muscle (PMPM) which has not correctly delaminated from the LV wall was identified. Furthermore, the PMPM tissue was connected to directly the posterior leaflet and to the anterior leaflet via a short immature tendon chordae. The medial leaflet motion was restricted, besides the orifice area was maintained (Movie S4). The ALPM was connected to the leaflets via chordae tendineae (Figure 3). She was diagnosed as a parachute-like asymmetric MV without mitral stenosis rather than a true-parachute MV[1,2].

It was difficult to distinguish the rudimentary PMPM from the LV wall and understand the precise anatomy evaluated by the 2DE. However, additional 3DE provided helpful information to reveal the exact characteristics of papillary muscle tissue.

Author contribution

Conception and design (NS, HU, YI), data analysis and interpretation (NS), draft preparation (NS) and revision (HU, YI), approval of article (NS, HU, YI).

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Figure legends

Figure 1. Two-dimensional echocardiographic image

The left ventricular short-axis views revealed (A) the fused posterior commissure and (B) only a small anterolateral papillary muscle. (C) The anterolateral papillary muscle connected to the mitral valve leaflet via tendon chordae (blue arrows). (D) The posteromedial papillary muscle was unclear (red arrows), and the mitral valve leaflet directly attached to the left ventricular wall. AML, anterior mitral leaflet; ALPM, anterolateral papillary muscle; LA, left atrium; LV, left ventricle; PML, posterior mitral leaflet.

Figure 2. Echocardiographic volume rendering image of parachute-like asymmetric mitral valve

(A) The mitral valve complex viewed from the medial side. The PMPM and the tendon chordae has not correctly delaminated from LV wall. (B) The en-face view of the mitral valve from the LV side. The

PMPM integrated with the LV wall was connected to the mitral leaflet. The ALPM has the tendon chordae. (C) The ALPM was connected to the mitral valve leaflet via the tendon chordae. ALPM, anterolateral papillary muscle; LA, left atrium; LV, left ventricle; PMPM, posteromedial papillary muscle.**Figure 3. The asymmetric papillary muscle demonstrated by multi-planar reconstruction**Volume data was used to reconstruct a cross-section showing the connection between the mitral valve leaflet and the ALPM (green box in the upper left), and the PMPM (red box in the upper right). The ALPM was connected to the leaflet via the chordae tendineae. The PMPM had a direct attachment with the posterior leaflet (red arrow) and connected to the anterior leaflet via a short immature tendon chordae (blue arrow). The blue box shows the short-axis view of the papillary muscle level of the left ventricle. Although only one obvious papillary muscle was observed on the anterolateral side, the papillary muscle on the posteromedial side was rudimentary and unclear. ALPM, anterolateral papillary muscle; LA, left atrium; LV, left ventricle; PMPM, posteromedial papillary muscle.

Supplementary material:

Movie S1. The short axis view of the papillary muscle level of left ventricle. ALPM, anterolateral papillary muscle.

Movie S2. The enface view of the mitral complex from left ventricle side. ALPM, anterolateral papillary muscle; PMPM, posteromedial papillary muscle.

Movie S3. Relationship between the posteromedial papillary muscle and the leaflet. ALPM, anterolateral papillary muscle; PMPM, posteromedial papillary muscle.

Movie S4. Volume rendering image of the mitral valve (MV) motion.