

ECHO ROUNDS Section Editor: Edmund Kenneth Kerut, M.D. _____

Echo Features of Posteromedial Papillary Muscle Rupture without Papillary Muscle Prolapse into the Left Atrium

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(Echocardiography 2011;28:1046-1048)

Key words: myocardial infarction, papillary, shock

A 67-year-old male presented to the hospital emergency department with a 3-day history of decreased exercise tolerance, fatigue and exertional chest tightness. These symptoms began after an initial episode of prolonged chest pain associated with diaphoresis and dyspnea. The admission electrocardiogram (EKG) and cardiac "markers" were consistent with a recent inferolateral myocardial infarction (MI).

There was no history of cardiovascular disease. Risk factors were that of a family history of heart disease, long-standing tobacco use and elevated lipids. The patient was on no medications.

Beside echocardiography (TTE) revealed left ventricular (LV) basal inferior-inferolateral aneurysmal formation with mild mitral regurgitation (MR). Significant aortic sclerosis was noted (movie clip S1). Because of continued exertional chest pain up through admission, diagnostic angiography was performed. The coronary tree was codominant, with only disease in the circumflex system noted. A large obtuse marginal (OM) branch of the circumflex artery was occluded and could not be opened percutaneously. Left ventriculography was consistent with findings by TTE, with inferobasal dyskinesis noted.

The following morning, the patient developed sudden dyspnea, hypotension and pulmonary edema. Cardiac auscultation revealed only a soft systolic murmur, heard at the left sternal border and also apex. The EKG was unchanged, except that Mobitz Type I AV block developed. The patient required endotracheal intubation with mechanical ventilation, along with inotropic support.

A second bedside TTE was performed. Two-dimensional imaging revealed new prolapse of the posterior mitral valve leaflet, "erratic" reverberations within the LV cavity, and evidence of severe MR by Doppler interrogation (Fig. 1, movie clip S2). Of note, no "mass" was identified within the left atrium (LA) during systole.

Based on the clinical scenario and suggestive findings by TTE, transesophageal echocardiography (TEE) was performed. Findings confirmed rupture of the posteromedial (PM) papillary muscle (Fig. 2, movie clip S3).

An intraaortic balloon pump (IABP) was placed and the patient taken to the operating room, where the PM papillary muscle was found to be ruptured (Fig. 3). A porcine mitral prosthesis was placed. The patient was subsequently weaned from inotropes and the IABP. After a prolonged hospitalization, the patient succumbed from infection and multiple systems failure.

In the setting of myocardial infarction, papillary muscle rupture is rather an uncommon event, occurring in 1% to 3% of patients with acute MI.^{1,2} It most often involves the posteromedial papillary muscle, where the blood supply is derived from the posterior descending artery. The anterolateral papillary muscle generally is supplied from both the left anterior descending coronary artery and the circumflex artery; therefore, anterolateral papillary muscle rupture is distinctly uncommon.³

Echocardiographic diagnosis involves finding prolapse of the papillary muscle head into the LA as a diagnostic finding.^{4,5} As was found evident in this case, Nanda et al. found a lack of papillary muscle prolapse into the LA in seven patients (n = 20).⁶ In those seven cases, and with this case, the following criteria were found to help establish the diagnosis of a ruptured papillary muscle:

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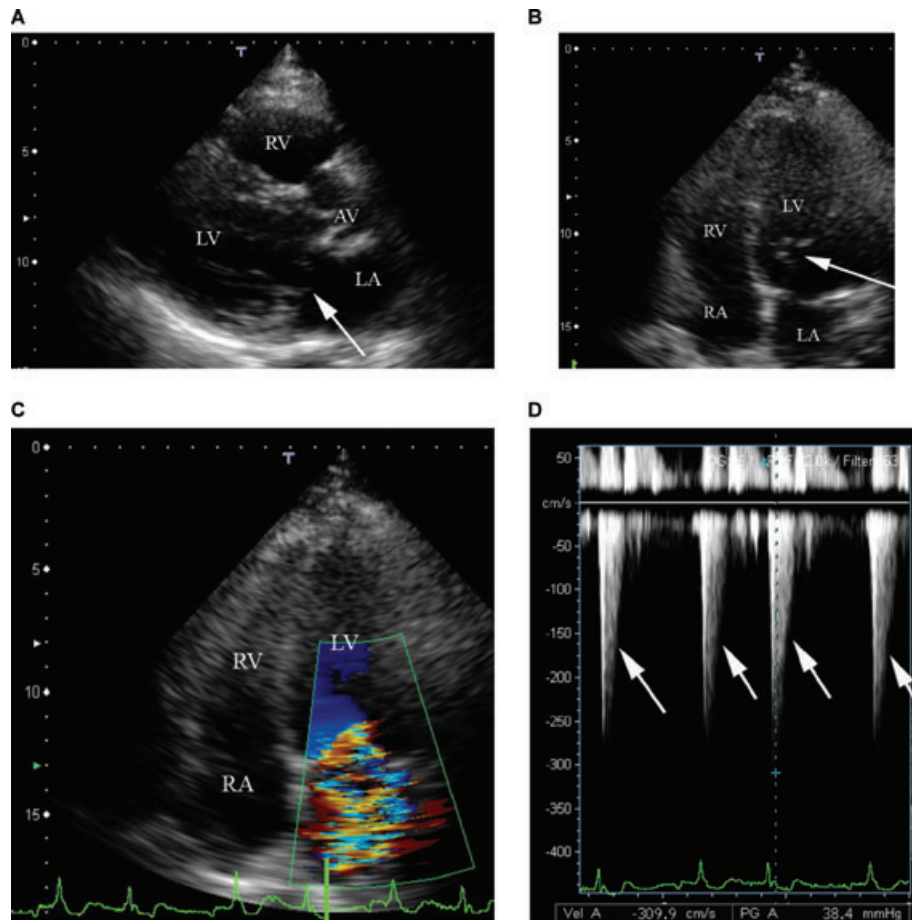


Figure 1. (A) End-systolic parasternal long-axis imaging reveals prolapse of the posterior mitral valve leaflet. AV = aortic valve; LA = left atrium; LV = left ventricle; RV = right ventricle. (B) Systolic apical four-chamber frame demonstrates “extra” chaotic echoes (arrow) within the cavity of the LV. (C) Apical four-chamber view in systole with color Doppler revealed torrential mitral regurgitation, color essentially “filling” the entire left atrium during systole. (D) Continuous wave Doppler from the apical four-chamber view, through the mitral valve orifice. Mitral regurgitation (MR) with evidence of a “cut-off” sign (arrows) was noted. Indicative of rapid equalization of pressures between the LV and LA, the MR jet demonstrates a rapid deceleration time.

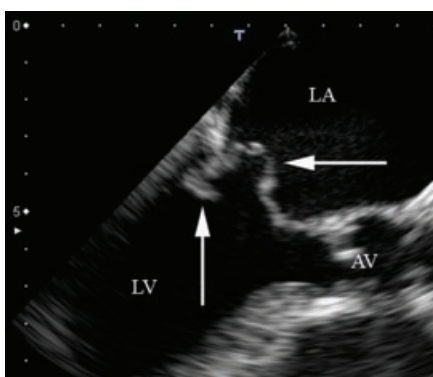


Figure 2. Transesophageal echocardiography within the esophagus at 120° demonstrates marked prolapse of the mitral leaflets (horizontal arrow). Part of the ruptured papillary muscle is also visualized just below the mitral leaflets (vertical arrow). With this patient, the papillary muscle does not prolapse into the left atrium.

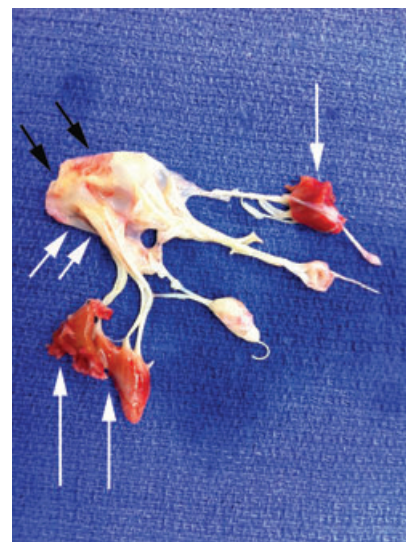


Figure 3.

Figure 3. Resected posteromedial papillary muscle. Vertical arrows point to papillary muscle torn from the LV. Black arrows point to the posterior mitral leaflet site of attachment to the posterior annulus. White arrows (at an angle) point to the free edge of the posterior mitral leaflet.

- (1) mobile echo density with “erratic motion out of phase with ventricular wall motion,”
- (2) prolapse of mitral valve cusps,
- (3) mitral regurgitation, and
- (4) ventricular wall motion abnormalities.

In conclusion, patients with rupture of a mitral papillary muscle may not demonstrate papillary muscle prolapse into the LA. In the proper clinical context, the four-presented criteria appear to help establish the diagnosis of a ruptured papillary muscle.

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Supporting Information

Additional Supporting Information may be found in the online version of this article:

Movie clip S1: Bedside echocardiography with parasternal long-axis imaging demonstrates aneurysmal formation of the inferobasal segment. Aortic sclerosis is noted. There is no mitral valve prolapse seen.

Movie clip S2: Parasternal long-axis imaging demonstrated “chaotic” echoes within the LV. Compare this movie with that from the previous day, before clinical occurrence of papillary muscle rupture (movie clip S1).

Movie clip S3: Transesophageal echocardiography within the esophagus at 120° demonstrates marked prolapse of the mitral leaflets. Chaotic motion of the ruptured papillary muscle head is noted, but it does not prolapse into the left atrium.

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