

## Resuspension of the Uninfarcted Papillary Muscle at the Time of Mitral Valve Replacement in a Patient with Post Myocardial Infarction Papillary Muscle Rupture

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**A 60-year-old woman was referred to the Department of Cardiovascular Surgery of Social Insurance Chukyo Hospital for the rupture of a postinfarction papillary muscle. The rupture was in the posterior part of the anterolateral papillary muscle, in which more than two-thirds of its posterior leaflet was prolapsed. Mortality from the surgical repair of a papillary muscle rupture is quite high. For this case, we resuspended the uninfarcted papillary muscle heads case to preserve mitral ventricular continuity because the mitral annulus was quite small and more than two-thirds of the posterior leaflet were detached from the papillary muscle. The post-operative course of the patient was uneventful. Resuspension of uninfarcted papillary muscle is a useful technique to repair a rupture in the papillary muscle.**

**Key words:** myocardial Infarction, papillary muscles, mitral valve, papillary muscle rupture, resuspension of papillary muscle

### Introduction

Papillary muscle rupture is a devastating complication of acute myocardial infarction (MI), and its natural prognosis is extremely poor.<sup>1)</sup> Since the first valvular replacement performed in 1965,<sup>2)</sup> several reports have documented the surgical rescue of this acute complication.<sup>3–5)</sup> However, surgery for post-MI papillary muscle rupture is associated with high surgical mortality. The majority of patients undergo mitral valve replacement, although the mitral valve can be repaired by re-attachment of the pap-

illary muscles in some cases.<sup>6)</sup> Preservation of the leaflets and subvalvular apparatus are generally recommended to improve short-term and long-term outcomes in mitral valve replacement.<sup>7,8)</sup> However, it is not always a possible procedure.

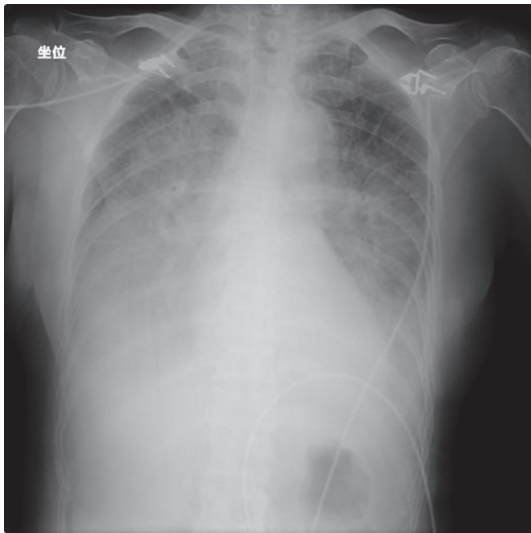
David et al. have introduced a technique in which papillary muscle is resuspended to improve cardiac function after mitral valve replacement (MVR).<sup>9)</sup> This report presents a case in which the noninfarcted papillary muscle heads were re-suspended.

### Case

A 60-year-old woman was referred to the cardiac surgery division of Social Insurance Chukyo Hospital for the repair of a postinfarction papillary muscle rupture. The patient had experienced severe chest pain at night, 13 days earlier. She was rushed to the local hospital and admitted the next day. She was hypertensive and had a previous history of stroke. Troponin I was negative. An

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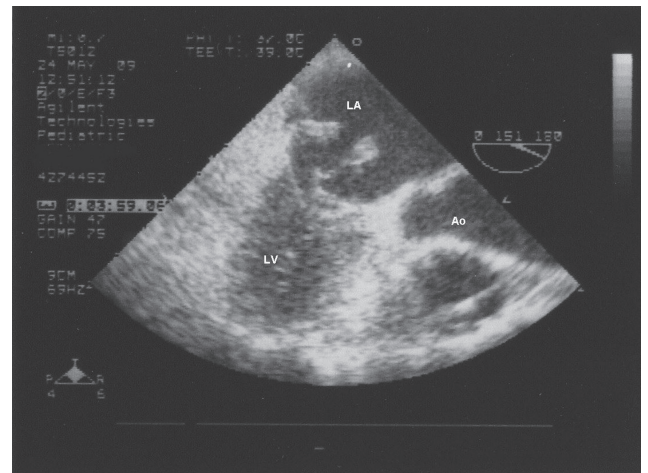
**Fig. 1** Preoperative chest X-ray.



**Fig. 2** Preoperative coronary angiogram.  
The obtuse marginal artery had 99% stenosis.

electrocardiogram showed ST depression of 0.1 mV in lead V<sub>4</sub> to V<sub>6</sub>. The working diagnosis was angina pectoris, and she was medically managed. She started to cough 7 days after admission, and a chest X ray showed bilateral pleural effusion. She was transferred to our hospital for further examination and treatment. A transthoracic echocardiogram revealed severe mitral regurgitation. The posterior leaflet was prolapsed. She was admitted to the cardiology department. Troponin I and creatine kinase levels were normal. We thought that she might have degenerative mitral valve regurgitation rather than a papillary muscle rupture. The patient was medically managed for congestive heart failure, though her condition deteriorated 5 days after the transfer. A chest X-ray showed severe pulmonary edema (**Fig. 1**). She required endotracheal intubation and mechanical ventilation. Her blood pressure became unstable. A transthoracic echocardiogram showed that the degree of the posterior leaflet prolapse was worse than before. She was taken to the catheter lab to have an intra-aortic balloon pumping catheter inserted. Coronary angiography showed 99% stenosis of the first obtuse marginal artery (**Fig. 2**). She underwent emergency surgery.

Intra-operative transesophageal echocardiogram showed a ruptured head of the papillary muscle (**Fig. 3**). During surgery, the obtuse marginal artery was grafted by a saphenous vein graft. The mitral valve was approached via an atrial septal incision. She had an extensive prolapse of the posterior leaflet from segments P1 to P2. Two heads of anterolateral papillary muscle



**Fig. 3** Intra-operative transesophageal echo.  
Ruptured papillary muscle heads were seen.  
LA, left atrium; LV, left ventricle; Ao, aorta

were disrupted (**Fig. 4**). The area of prolapse was so broad that a mitral valve replacement was required.

We excised the P1 and left only the basal chordae. The mitral annulus was sized, and it was found that the 27-mm sizer would be tight, and the 25-mm prosthesis was thought to be too small for her, thus, we excised the anterior leaflet, which enabled the passing of the 27-mm sizer, though barely. The papillary muscles were carefully inspected, and the whole posteromedial papillary muscle and the anterior part of the anterolateral papillary muscle looked normal. The posterior part of the anterolateral papillary muscle apparently had acute MI. A 4-0 Gore-



**Fig. 4** Specimen of the mitral valve. Two heads of anterolateral papillary muscles, which supported the posterior leaflet were disrupted.

Tex suture was sutured the tip of the posteromedial papillary muscle and then the needles were passed through the annulus at 2 o'clock. Another suture was passed through the tip of the healthy head of the anterolateral papillary muscle and then passed through the mitral annulus at 10 o'clock (**Fig. 5**).

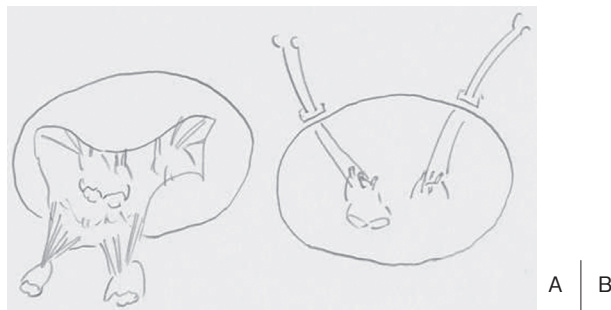
We replaced the mitral valve with a 27-mm mechanical prosthesis (St. Jude Medical, Inc., St. Paul, MN, USA) using 2-0 everting mattress sutures.

She was easily weaned off cardio-pulmonary bypass. Though she initially had severe hypoxia in the unit, it improved quickly. She was extubated on POD 4, but her post operative course was complicated by bleeding from diverticular disease of the colon. The bleeding was controlled endoscopically. She was discharged, and her condition remains stable. Post-operative echocardiogram showed an adequate left ventricular contraction. The artificial chordate seemed to be functioning properly (**Fig. 6**).

## Discussion

A papillary muscle rupture is a devastating complication of acute MI. Up to 80% of patients die within one week, while it is medically managed.<sup>10</sup> The mortality is quite high even with surgery. Mortality of 16% to 24% has been reported.<sup>3, 6, 11</sup>

Papillary muscle rupture typically occurs within the first week of an acute myocardial infarction. Rupture of the posteromedial papillary muscle is five to ten times more frequent than that of the anterolateral papillary



**Fig. 5** Scheme of the mitral valve and surgery.

**A:** Two heads of the anterolateral papillary muscle were disrupted. The anterior part of the anterolateral papillary muscle looked normal, though its posterior part apparently had acute myocardial infarction.

**B:** The posteromedial papillary muscle and the healthy head of the anterolateral papillary muscle were re-suspended by 4-0 Gore-Tex sutures to the mitral annulus.

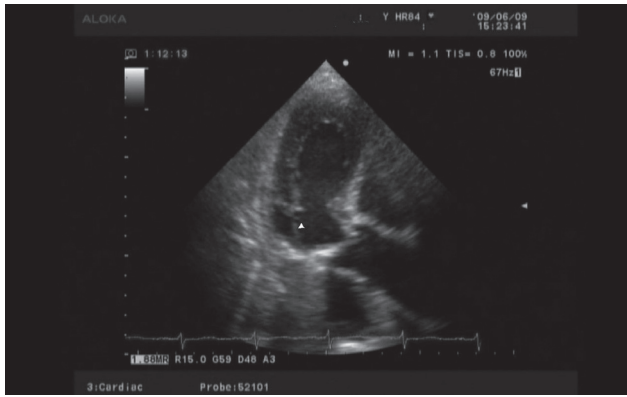
muscle.<sup>12</sup>

The case presented here had some interesting clinical features. First, this patient had a rupture of anterolateral papillary muscle, which is relatively rare. The diseased obtuse marginal artery should have been the responsible artery, though some authors have reported diagonal artery disease in the rupture of an anterior papillary muscle. Second, the condition of the patient deteriorated in a stepwise fashion. Surgery revealed extensive prolapse of the posterior leaflet, so it seemed that the patient might not survive unless her mitral valve was replaced. Since the patient had two ruptured heads, one head might have ruptured before the transfer to the hospital, and the other, on the day of the consultation. The mitral valve was found to be quite different on these days.

The majority of patients undergo mitral valve replacement following a rupture of the post-myocardial infarction papillary muscle.<sup>3, 6, 11</sup> However, it is sometimes possible to repair the mitral valve by re-attaching the disrupted papillary muscle head. In this case, the area of prolapse was too broad to be repaired.

Preserving mitral ventricular continuity is important for left ventricular function.<sup>13</sup> Posterior leaflet preservation or both anterior and posterior leaflet preservation is recommended.<sup>14</sup> In this case, posterior leaflet preservation was pointless because more than two thirds of the posterior leaflet detached from the left ventricle. Although anterior leaflet preservation could be done, this strategy was not selected because the annulus was quite small. There is a debate about the clinical significance of patient-prosthesis mismatch at the mitral position. Some





**Fig. 6** Post-operative trans-thoracic echo. The arrow indicates Gore-Tex artificial chord.

investigators believe it is a problem.<sup>15)</sup>

The re-suspension of the papillary muscles by Gore-Tex sutures is a technique introduced by David et al.<sup>9)</sup> This technique was applied in this patient because it allowed the use of a larger prosthesis. It was not difficult to differentiate healthy papillary muscles from the infarcted papillary muscles in this case.

The papillary muscles were re-suspended anteriorly to 10 o'clock and to 2 o'clock in this case. Some surgeons re-suspend papillary muscles both anteriorly and posteriorly,<sup>16)</sup> and some investigators believe that the oblique method is the best method to preserve the left ventricular function.<sup>17)</sup> However, we prefer the anterior method to other ways because it is simpler and less likely to interfere with the motion of a bileaflet prosthesis. This patient has been followed for three months since surgery, and the artificial chord seem to be functioning properly.

In conclusion, mitral valve replacement was performed in one patient with a postinfarction papillary muscle rupture. We consider re-suspension of healthy papillary muscle to be technically feasible and clinically important in this case.

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