Papillary muscle rupture is an uncommon, but fatal complication of acute myocardial infarction. Rupture of the anterolateral papillary muscle rupture is less common than that of the posteromedial muscle because of the difference in blood supply. The natural history of papillary muscle rupture is dismal, but the surgical mortality also remains high. Here we report the successful surgical management of acute mitral regurgitation due to rupture of the anterolateral papillary muscle in a patient with acute myocardial infarction.

**Case Report**

An 80-year-old woman without any history of cardiovascular disease presented to our emergency room with the sudden onset of chest pain and dyspnea. On examination, her blood pressure was 65/49 mmHg and heart rate was 121/min. Her neck veins were distended, but she had no pretibial edema. There was a grade 3/6 holosystolic murmur at the apex and bilateral moist rales throughout the lung fields. Troponin-T was positive and brain natriuretic peptide was elevated to 1170 pg/ml. The electrocardiogram provided evidence of acute lateral myocardial infarction and the chest radiograph showed bilateral pulmonary edema. Transthoracic echocardiography was performed, revealing a mobile mass attached to the mitral valve leaflet (suggesting a ruptured papillary muscle) (Fig. 1), severe mitral regurgitation with prolapse of both mitral leaflets, and severe hypokinesia of the lateral wall of the left ventricle. Arterial blood gas analysis revealed hypoxia and severe hypercapnia, so she was intubated and mechanical ventilation was started immediately.

**Keywords:** surgical management, papillary muscle rupture, mechanical complications of acute myocardial infarction

**Introduction**

Papillary muscle rupture is an uncommon, but fatal complication of acute myocardial infarction. Rupture of the anterolateral papillary muscle rupture is less common than that of the posteromedial muscle because of the difference in blood supply. The natural history of papillary muscle rupture is dismal, but the surgical mortality also remains high. Here we report the successful surgical management of acute mitral regurgitation due to rupture of the anterolateral papillary muscle in a patient with acute myocardial infarction.
Inotropic support with dopamine was also started, but the patient’s hemodynamics deteriorated and support with an intra-aortic balloon pump was required. Emergency coronary angiography revealed complete occlusion of the first obtuse marginal artery with no stenosis of the left anterior descending artery or the right coronary artery. A Swan-Ganz catheter was inserted, revealing that the mean pulmonary capillary wedge pressure was 22 mmHg. She had a diagnosis of a shock state by the papillary muscle rupture following acute myocardial infarction, and an emergency surgery was judged with need. She underwent emergency mitral valve replacement with a bioprosthetic valve (Epic 27 mm, St. Jude Medical, Inc., St. Paul, Minnesota, USA) and concomitant coronary artery bypass grafting to the first obtuse marginal artery with a saphenous vein graft. It was found that the anterolateral papillary muscle had ruptured completely at the base (Fig. 2), so that the anterolateral halves of both mitral leaflets showed extensive prolapse. The cardiopulmonary bypass time was 134 minutes and the aortic cross-clamping time was 67 minutes. Her postoperative course was uneventful. The patient was weaned from the intra-aortic balloon pump after 5 days, extubated after 9 days, and discharged from hospital on postoperative day 35.

Discussion

Papillary muscle rupture is a mechanical complication of acute myocardial infarction that is fatal, although it is fortunately uncommon with an incidence of 1%–3%.1–3) The prognosis with medical therapy alone is extremely poor, and 50% of these patients die within 24 hours.2,3) In particular, it has been reported that the prognosis is worse after complete rupture than after partial rupture due to rapid hemodynamic deterioration.1,2)

Several characteristics of papillary muscle rupture have been reported. First, the anterolateral papillary muscle rupture is affected less often than the posteromedial papillary muscle, with the relative incidence being approximately 1/4 to 1/9.1–4) This is considered to be because of the difference in blood supply, since the anterolateral papillary muscle receives blood from both the diagonal branch and the left circumflex artery, while blood for the posteromedial papillary muscle is only supplied by the right coronary artery.5) Second, it has been reported that complete rupture is more common for the anterolateral papillary muscle, while partial rupture is more likely for the posteromedial papillary muscle.2,6) The reason is considered to be that the anterolateral papillary muscle is generally a single mass of muscle tissue, while the posteromedial papillary muscle is formed from several smaller parts. Third, it has been reported that compared with other mechanical complications of myocardial infarction such as ventricular septal perforation or left ventricular free wall rupture, the extent of infarction is smaller, although subendocardial involvement is greater.1–3) Single-branch lesions account for over half of the culprit coronary artery lesions and the right coronary artery is often involved.3,6,7)

Expeditious surgery for papillary muscle rupture is essential to save the patient. However, the early death rate after surgery for papillary muscle rupture remains very high at 19%–45%.3,4,6,7) Several issues about surgery for these patients have been discussed. The first is whether to choose mitral valve replacement or valve plasty. When
emergency surgery is done during the acute phase of myocardial infarction, mitral valve replacement is recommended as the first choice because the cardiac muscle around the ruptured papillary muscle is vulnerable, making it difficult and time-consuming to perform mitral valve plasty.7) Particularly in patients with complete anterolateral papillary muscle rupture, mitral valve replacement is more appropriate due to extensive mitral valve prolapse. However, mitral valve plasty can be considered in selected patients, such as patients with partial posteromedial papillary muscle rupture who have residual healthy papillary muscle and good quality left ventricular wall tissue around the rupture. Fasol, et al. employed mitral valvuloplasty and reported favorable results, although there were only 6 cases.8) In the present patient with complete anterolateral papillary muscle rupture, mitral valve replacement was selected because there was extensive prolapse of both leaflets.

The next issue is whether coronary artery bypass grafting (CABG) should be performed concomitantly. Some authors consider that there is no need to do so because many patients with papillary muscle rupture have single-branch lesions and their myocardial infarction is not extensive, as well as because this reduces the operating time and cardiopulmonary bypass time. Figueras, et al. reported that the early postoperative results were not altered by performing or not performing CABG.6) However, improvement of not only early results but also the long-term outcome has been reported in patients with concomitant CABG.4,7) Russo, et al. found a low early death rate of 8.7% for patients with concomitant CABG who had surgery after 1990.8) In addition, Kishon, et al. reported that concomitant CABG was the only factor that reduced the early postoperative death rate.7) Therefore, preoperative coronary angiography is recommended to investigate coronary artery lesions, so that CABG can be done concomitantly. In our patient, although her preoperative hemodynamic condition was unstable, emergency coronary angiography was performed while support was provided by an intra-aortic balloon pump. After complete occlusion of the first obtuse marginal artery was detected, CABG was performed concomitantly. The operating time and cardiopulmonary bypass time were considered to be within the acceptable range.

Conclusion

We salvaged a patient with complete anterolateral papillary muscle rupture and cardiogenic shock after acute myocardial infarction by performing angiography with intra-aortic balloon pump support, followed by emergency mitral valve replacement and concomitant CABG. Rapid preoperative assessment and aggressive surgical management are important to improve the prognosis of patients with papillary muscle rupture after myocardial infarction.

Disclosure Statement

The authors have no conflict of interest to disclose with this study.

References