Acute Mitral Regurgitation Due To Total Rupture In The Anterior Papillary Muscle After Acute Myocardial Infarction Successfully Treated By Emergency Surgery

A 68-year-old female was admitted for sudden onset of chest pain. She received a successful percutaneus coronary intervension for total occlusion in the diagonal artery, but continued to develop progressive heart failure. A chest X-ray showed right pulmonary edema without cardiomegaly, and an echocardiogram revealed massive mitral regurgitation with prolapse in the anterior mitral leaflet due to a rupture in the papillary muscle. An emergency operation was conducted using routine cardiopulmonary bypass. There was complete rupture in the anterior papillary muscle. Mitral valve replacement with posterior mitral leaflet preservation was performed using a size 25 mm Carbomedics prosthetic valve. The postoperative course was uneventful, and she was discharged on postoperative day 29 in New York Heart Association class I. Postoperative pathological findings showed necrosis in the papillary muscle with inflammatory changes. Early diagnosis, prompt medical stabilization, and aggressive surgical intervention are essential to save such a group of patient. (Jpn J Thorac Cardiovasc Surg 2003; 51: 208–210)

Key words: papillary muscle rupture, mitral regurgitation, acute myocardial infarction

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Rupture in the papillary muscle following acute myocardial infarction is a rare but severe complication associated with acute left ventricular failure and pulmonary edema. It occurs in 1–5% of patients with acute myocardial infarction,[1] especially a complete rupture in the anterior papillary muscle is rare. Here, we report successful management of acute mitral regurgitation caused by a complete rupture in the anterior papillary muscle due to acute anterolateral myocardial infarction.

Case

A 68-year-old female was admitted to a nearby hospital for sudden onset of chest pain. Acute myocardial infarction was initially suspected from the electrocardiogram and she was referred to our hospital. Emergency coronary angiography showed total occlusion in the first diagonal branch of left coronary artery and percutaneus coronary intervention (PCI) was tried for the lesion (Fig. 1). While PCI was performed, the blood pressure suddenly decreased from 120 mmHg to 80 mmHg and sinus tachycardia was noted. The mean pulmonary capillary wedge pressure increased to 24 mmHg. She was treated with continuous intravenous high-dosage dopamine, and norepinephrine. She was then transferred to the intensive care unit, where a chest roentgenogram showed right pulmonary edema without cardiomegaly, which is a typical feature of acute mitral regurgitation. Auscultation indicated a systolic murmur grade II/VI at the apex. An electrocardiogram showed abnormal Q wave in I, aV_L, V_5 and V_6, suggesting myocardial infarction in the lateral area of the left ventricle. An echocardiogram revealed massive mitral regurgitation and prolapse in the anterior mitral leaflet presumably due to a rupture in a papillary

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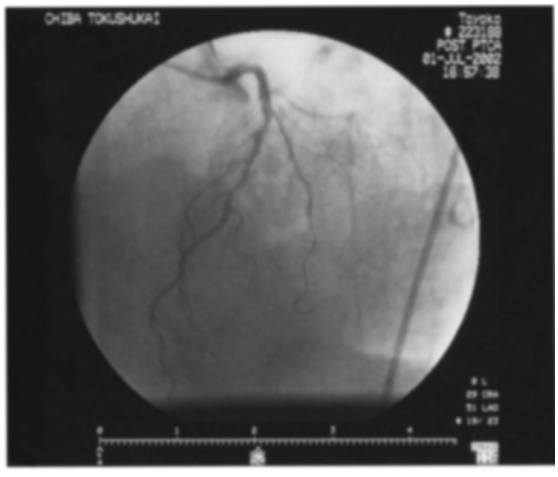

Fig. 1. Preoperative coronary angiogram revealing total occlusion in the first diagonal branch of the left coronary artery. Percutaneus coronary intervention (PCI) was attempted for this lesion.

Fig. 2. Transesophageal echocardiogram showing a mass of ruptured anterior papillary muscle in the left ventricular cavity during diastole.

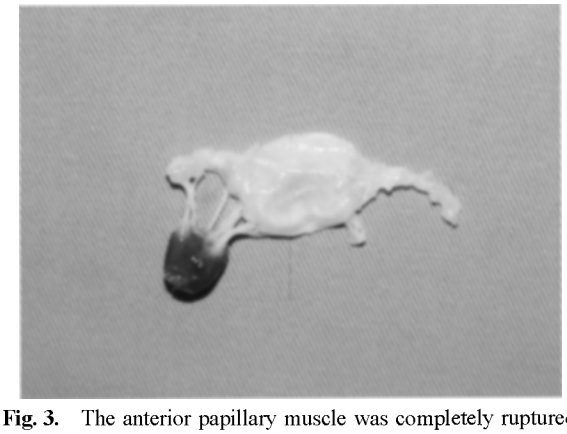

Fig. 3. The anterior papillary muscle was completely ruptured at the head. The valve leaflet and chordae were mostly normal.

muscle (Fig. 2). The next day, intubation and mechanical ventilation became necessary, and an emergency operation was performed at 2.5 days after onset of the papillary muscle rupture. Intraaortic balloon pumping (IABP) was initiated after anesthesia was induced. Cardiopulmonary bypass (CPB) was established, and cardiac arrest introduced with cardioplegia. The lateral approach was used to access the mitral valve. There was complete rupture in the anterior papillary muscle, while the valve leaflet and chordae were normal (Fig. 3). Mitral valve replacement with posterior mitral leaflet preservation was performed using a size 25 mm Carbomedics prosthetic valve. Weaning from CPB was achieved smoothly and uneventful with the aid of IABP and inotropic support. The aortic cross-clamping time was 95 minutes, and the CPB time was 180 minutes. The postoperative course was uneventful, with 2 days of IABP and 3 days of ventilator support. She was discharged on postoperative day 29 in NYHA class I. At follow-up, postoperative pathological findings showed necrosis in the papillary muscle with inflammatory changes.

Discussion

Rupture in a papillary muscle is known to be a rare and usually fatal complication of acute myocardial infarction, since it often leads to rapid deterioration in the clinical condition including pulmonary edema and cardiogenic shock. It usually occurs at 2 to 7 days (mean 4 days) after infarction and, if untreated, 50% of patients die within 24 hours. The mortality rate is 94% within 2 months.[2,3]

Because it has a single blood supply from the posterior descending artery, the posterior papillary muscle is involved in a rupture 6–12-fold more frequently than the anterior papillary muscle that is often perfused by 2 separate arteries, the first obtuse marginal branch and the first diagonal branch.[4-6] There have been only 7 reported cases of a successful operation for an anterior papillary muscle rupture, in the Japanese literature (Table I).[6-9] In the present case, total occlusion in the first diagonal branch and a hypoplastic left circumflex coronary artery were the cause of the rupture in the anterior papillary muscle. Tepe et al. have reported that the interval from onset of shock to surgical therapy averaged 1.7 days for survivors vs. 9.3 days for non-survivors.[10] In the present case, we spent one whole day for diagnostic examinations. Fortunately, the hemodynamics remained relatively stable with catecholamine infusion during this one day period, which gave us sufficient

Table I. *Summary of cases of anterior papillary muscle rupture after AMI, which have had a successful operation in Japan.*

Case	*Author (year)*	*Age*	*Sex*	*Interval AMI-MR*	*/ MR-Op*	*Type of rupture*	*Coronary lesion*	*Surgery valve/CABG*
1	Hoshino (1993)	79	F	4d	1d	complete	LCX	SJM27/+
2	Moriyama (1994)	64	M	6d	1d	complete	LCX	SJM27/+
3	Takemoto (1995)	47	M	18h	18h	complete	LCX	MVR/+
4	Gou (1995)	74	M	5d	13d	complete	LAD, HL	SJM27/+
5	Masuda (1997)	68	M	7d	0.5d	complete	LCX, hypo D1	SJM29/–
6	Fukushima (1998)	71	F	0.5d	1d	complete	LCX	ATS27/–
7	Takahashi (2002)	80	F	1d	1d	complete	D1	CE25/–
8	Yoshida (2002)	68	F	2d	2.5d	complete	D1, hypo LCX	CM25/–

AMI, Acute myocardial infarction; *MR*, mitral regurgitation; *Op*, operation; *CABG*, coronary artery bypass grafting; *F*, female; *M*, male; *d*, days; *h*, hours; *LCX*, left circumflex artery; *LAD*, left anterior descending artery; *HL*, high lateral branch; *hypo*, hypoplastic; *D1*, first diagonal branch; *SJM*, St. Jude Medical; *MVR*, mitral valve replacement; *CE*, Carpentier-Edwards; *CM*, CarboMedicus.

time to prepare for the operation, and we could save her. Early diagnosis, prompt medical stabilization and surgical treatment are mandatory to save such a patient.

Two dimensional transthoracic and/or transesophageal Doppler echocardiography and coronary angiography are mandatory for therapeutic decision-making. Based on the results, combined myocardial revascularization, if necessary, and mitral valve surgery should ensue without delay. Mitral valve repair could be undertaken preferably when adjacent tissue damage is of very limited extent. In our case, we chose mitral valve replacement because the tissues were friable and the left atrium was very small.

Conclusion

We have reported a rare case of acute mitral regurgitation caused by complete anterior papillary muscle rupture as a complication of acute anterolateral myocardial infarction, which underwent successful emergency mitral valve replacement in the acute stage.

REFERENCES

1. Wei JY, Hutchins GM, Bulkley BH. Papillary muscle rupture in fatal acute myocardial infarction: A potentially treatable form of cardiogenic shock. Ann Intern Med 1979; 90: 149–52.
2. Sanders RJ, Neubuerger KT, Ravin A. Rupture of papillary muscles: Occurrence of rupture of the posterior muscle in posterior myocardial infarction. Dis Chest 1957; 31: 316–23.
3. Nishimura RA, Schaff HV, Shub C, Gersh BJ, Edwards WD, Tajik AJ. Papillary muscle rupture complicating acute myocardial infarction: Analysis of 17 patients. Am J Cardiol 1983; 51: 373–7.
4. Tavakoli R, Weber A, Vogt P, Brunner HP, Pretre R, Turina M. Surgical management of acute mitral valve regurgitation due to post-infarction papillary muscle rupture. J Heart Valve Dis 2002; 11: 20–6.
5. Chen Q, Darlymple-Hay MJ, Alexiou C, Ohri SK, Haw MP, Livesey SA, et al. Mitral valve surgery for acute papillary muscle rupture following myocardial infarction. J Heart Valve Dis 2002; 11: 27–31.
6. Takahashi T, Kohno K, Kashida M, Morita T, Saito K, Kamei A, et al. A survival case of acute mitral regurgitation and cardiogenic shock caused by subtotal occlusion of the first diagonal branch. Circ J 2002; 66: 615–8.
7. Goh K, Kubo Y, Sasajima T, Inaba M, Yamamoto H, Otani N. Emergency CABG and mitral valve replacement for anterolateral papillary muscle rupture after acute myocardial infarction (Eng abstr). Jpn J Thorac Cardiovasc Surg 1995; 43: 1034–8.
8. Masuda Z, Hata T, Tsushima M, Matsumoto M, Uchita S, Hamanaka S. A surgical case of total anterior papillary muscle rupture after acute myocardial infarction (Eng abstr). Jpn J Thorac Cardiovasc Surg 1997; 45: 869–73.
9. Moriyama Y, Kawaji H, Toyohira H, Yamashita T, Taira A, Tanaka H. Surgical treatment for complete rupture of anterior papillary muscle after acute myocardial infarction (Eng abstr). Jpn J Thorac Cardiovasc Surg 1995; 43: 384–9.
10. Tepe NA, Edmunds LH Jr. Operation for acute postinfarction mitral insufficiency and cardiogenic shock. J Thorac Cardiovasc Surg 1985; 89: 525–30.