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Original article

Strategy of delayed surgery for ventricular septal perforation after acute myocardial infarction

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ABSTRACT

Background: The timing of surgical repair for ventricular septal perforation (VSP) is important because patients are susceptible to bleeding from fragile myocardial tissue or residual shunt during the acute phase of acute myocardial infarction (AMI).

This study aimed to assess the results of delayed surgery for VSP performed 2 weeks after AMI.

Methods: In total, 24 consecutive postinfarction patients with VSP (mean age: 72.6 ± 10.4 years; 13 males) underwent operation between May 2003 and June 2016. We postponed surgery during the acute phase and performed an elective surgery if the patient could wait for 2 weeks with support from intra-aortic balloon pumping (IABP) and respiratory management. If we could not control heart failure and organ function worsened during that period, we performed emergency surgery. Postoperative outcomes included complications, 30-day mortality rate, long-term hospital death, reoperation rate, and risk factors for hospital mortality. We examined whether organ function was maintained by delaying the surgery.

Results: Of the 24 patients, 11 (45.8%) required emergency surgery, and 13 (54.2%) could wait 2 weeks for surgery. The average time from AMI onset to diagnosis of VSP was 4.5 ± 1.6 days, and the average time from VSP diagnosis to surgery was 9.0 ± 6.0 days; 5 patients (20.8%) required resurgery for VSP due to residual shunt, recurrent VSP, or pseudoaneurysm of the left ventricle. The 30-day mortality rate was 4.2% (1 patient), and long-term hospital mortality rate was 12.5% (3 patients). Organ function was maintained in 10 patients (76.9%) who underwent elective surgery, and organ dysfunction was not advanced by delaying the surgery.

Conclusions: We could delay surgery for an average of 9 days from VSP onset by means of IABP or respiratory management without the deterioration of organ function. The 30-day mortality and long-term outcome were favorable.

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Introduction

Ventricular septal perforation (VSP) after acute myocardial infarction (AMI) is one of the most serious mechanical complications of AMI, with high mortality [1–7]. Postinfarction VSP can cause heart failure due to volume load and depression of ejection power, and therefore, the timing of surgical repair is important. Western guidelines recommend immediate operation to prevent VSP from progressing to heart failure [8,9]. However, bleeding from fragile myocardial tissue and residual shunt in the acute phase are problems that remain unsolved. Therefore, we believe that performing surgery during the acute phase of AMI is not desirable. Some studies have reported higher mortality from operations performed soon after AMI and implied that postponing surgery, if possible, until the septum becomes fibrotic is favorable [1–3,10]. Based on past studies and our experience, even if guidelines recommend an earlier operation, we believe that immediate operation is not necessary, particularly for a patient who has experienced AMI.

To reduce mortality in our facility, we postponed the operation, even if only by a few days, by completely utilizing support devices, such as intra-aortic balloon pumping (IABP) and respirator. Hence,

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Table 1
Patient demographics.

Demographics: *n* (%) or mean ± SD		All	Emergency *n* = 11	Elective *n* = 13	*p*-value
Preoperative data					
Age (years)		72.6 ± 10.4	70.1 ± 12.0	74.8 ± 8.6	0.272
Male sex		13 (54)	6 (54)	7 (54)	0.973
Comorbidities	Hypertension	14 (58)	6 (54)	8(61)	0.729
	Diabetes	8 (33)	3 (27)	5 (38)	0.562
	Dyslipidemia	7 (29)	2 (18)	5 (38)	0.276
	Renal dysfunction (Cre > 1.5)	8 (33)	6 (55)	2 (15)	0.043
	COPD	2 (9)	1 (9)	1 (8)	0.949
Echocardiographic findings	EF (%)	48.3 ± 13.4	46.4 ± 16.5	49.8 ± 10.6	0.520
	Diameter of VSP (mm)	14.3 ± 5.6	16.0 ± 7.0	13.0 ± 4.0	0.232
	Qp/Qs	3.3 ± 0.9	3.5 ± 1.2	3.2 ± 0.7	0.449
Laboratory data	Peak CPK (IU/l)	2382 ± 2728	2533 ± 2633	2254 ± 2906	0.799
	Peak CK-MB (IU/l)	208 ± 270	269 ± 334	140 ± 183	0.306
Culprit lesion	LAD	21 (87.5)	10 (91)	11 (85)	0.642
	RCA	3 (12.5)	1 (9)	2 (15)	
Preoperative PCI for culprit lesion		11 (46)	5 (45)	6 (46)	0.973
Support device	IABP	20 (83.3)	10 (91)	10 (77)	0.360
	PCPS	2 (8.3)	2 (18)	0 (0)	0.108
	Respirator	11 (46)	6 (55)	5 (38)	0.670
Duration	From AMI to VSP (d)	4.5 ± 1.6	4.9 ± 2.1	4.2 ± 2.6	0.819
	From VSP to operation (d)	9.0 ± 6.0	5.0 ± 1.5	12.5 ± 1.3	0.010*
Intraoperative data					
Operative time (min)		267 ± 66	266 ± 76	278 ± 68	0.931
CPB time (min)		152 ± 48	168 ± 56	140 ± 38	0.180
Blood loss (ml)		526 ± 457	505 ± 588	543 ± 339	0.844
Concomitant procedure	CABG	12 (50.0)	4 (36)	8 (62)	0.219
	LV reconstruction	2 (8.3)	2 (18)	0 (0)	0.108
	MVR + TAP	1 (4.2)	1 (9)	0 (0)	0.267
	TAP	1 (4.2)	0 (0)	1 (8)	0.347
	AVR	1 (4.2)	0 (0)	1 (8)	0.347

AMI, acute myocardial infarction; AVR, aortic valve replacement; CABG, coronary artery bypass grafting; CK-MB, creatine kinase MB; COPD, chronic obstructive pulmonary disease; CPB, cardiopulmonary bypass; CPK, creatine phosphokinase; Cre, creatinine; EF, ejection fraction; IABP, intra-aortic balloon pumping; LAD, left anterior descending coronary artery; LV reconstruction, left ventricular reconstruction; MVR, mitral valve replacement; PCI, percutaneous coronary intervention; PCPS, percutaneous cardiopulmonary support; RCA, right coronary artery; SD, standard deviation; TAP, tricuspid valve annuloplasty; VSP, ventricular septal perforation.
* $p \leq 0.05$.

this study aimed to assess whether delayed surgery led to improved outcomes.

Methods

Patients

Consecutive postinfarction patients numbering 24 with VSP (mean age, 72.6 ± 10.4 years; 13 males) underwent operation at Matsubara Tokushukai Hospital between May 2003 and June 2016. The patients were diagnosed with AMI by electrocardiography, ultrasonography, and blood tests in other hospitals. After they were diagnosed with VSP by ultrasonography, they were transferred to our hospital. For 3 patients who consulted a doctor for heart failure symptoms, an estimated few days or weeks had already passed since the onset of AMI. In these cases, we assumed that the onset of chest symptoms such as discomfort or pain represented the onset of AMI. All patients were evaluated by coronary angiography (CAG), unless they had already undergone CAG or percutaneous coronary intervention (PCI) in other hospitals.

Heart failure was controlled with continuous drip infusion of carperitide and nicorandil and intravenous injection of furosemide at our direction and oxygen therapy in cases of mild heart failure. We tried to manage cases of severe heart failure or shock with IABP, non-invasive positive pressure ventilation (NPPV), and a respirator. If a patient's condition was unstable or worsened due to organ dysfunction, as indicated by increased creatinine or liver enzymes and oliguria, we considered an emergency operation. Patients whose hemodynamic status was unstable and who were about to collapse required percutaneous cardiopulmonary support (PCPS). At this time, an emergency operation was performed. For patients whose heart failure could be controlled, our strategy was to wait to perform an elective operation 2 weeks after AMI if the patient could be maintained with support from IABP and respiratory management until then.

We retrospectively examined the patients' preoperative status and results. We also considered the influence of emergency operation on the results and whether organ dysfunction proceeded during the waiting period. These patients who underwent surgery between May 2003 and June 2016 were followed up for a period of 2 weeks to 13 years (between May 2003 and December 2016; mean, 66 ± 54 months). Observers were blinded to patient groups. This study was performed in accordance with the standards of our ethics committee.

Table 2
Postoperative outcomes.

Outcome, *n* (%)	All	Emergency	Elective	*p*-value
Major complications				
Prolonged ventilation (>72 h)	10 (42)	7 (64)	3 (23)	0.045
Tracheotomy	3 (13)	1 (9)	2 (15)	0.642
Cerebral vascular dysfunction	3 (13)	1 (9)	2 (1)	0.642
Reoperation	5 (21)	4 (36)	1 (8)	0.085
Mortality				
30-day	1 (4.2)[a]	1 (9)	0 (0)	0.267
Long-term hospital death	3 (12.5)[b]	3 (27)	0 (0)	0.044*

[a] Sepsis.
[b] Pneumonia or subarachnoid hemorrhage.
* $p \leq 0.05$.

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