Early and midterm outcomes of triple patch technique for postinfarction ventricular septal defects

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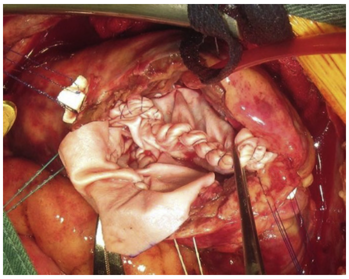
ABSTRACT

Objective: Early and midterm outcomes were evaluated in patients who had postinfarction ventricular septal defect (VSD) and underwent VSD repair using the triple patch technique.

Methods: Twenty-one patients underwent VSD repair for postinfarction VSD between April 2004 and September 2015. A retrospective analysis of all in-hospital and postdischarge data was performed. In addition, we compared pre- and perioperative variables between survivors and nonsurvivors.

Results: Thirty-day mortality was 23.8% (5 patients). Three patients died due to low output syndrome and 2 patients died due to sepsis. All of these patients were in cardiogenic shock preoperatively. Although 3 patients had a small residual shunt after surgery, the residual shunt disappeared 6 months after surgery in 1 patient and has been decreasing gradually in another. The mean follow-up was 43.5 ± 36.1 months. Overall survival rates (Kaplan-Meier method) at 3 and 8 years were 70.8% and 57.9%, respectively. Compared with survivors, nonsurvivors had a higher incidence of preoperative cardiogenic shock, higher incidence of chronic kidney disease and end-organ failure, and longer aortic crossclamp times during surgery.

Conclusions: Early and midterm outcomes of modified infarct exclusion using the triple patch technique are acceptable. This technique is safe and simple, and may be useful for reducing postoperative residual shunt. (J Thorac Cardiovasc Surg 2016;■:1-6)



Triple patch technique.

Central Message

A modified infarct exclusion using the triple patch technique is safe and useful for reducing postoperative residual shunt.

Perspective

Surgical repair for postinfarction ventricular septal defect is still a challenging procedure. We present a safe and simple modified infarct exclusion using the triple patch technique. The technique was found to be reproducible with good late outcomes and to be useful for reducing postoperative residual shunt.

ACQ

Postinfarction ventricular septal defect (VSD) remains an important and life-threatening complication of myocardial infarction (MI). The prevalence is approximately 0.2% to 2% among patients with MI.[1,2] Despite the development of numerous improvements in surgical techniques and materials, the mortality remains high. In addition, it is well known that residual shunt may affect cardiac function or late outcomes after VSD repair.[2,3]

In 2004, we began treating postinfarction VSD using the triple patch technique, which is a modified infarct exclusion method. We reported the surgical outcomes of 4 patients using this new technique in 2008.[1] This technique is simple and easy to perform, and is designed to minimize residual shunt, exclude infarcted myocardium, and regulate left ventricular volume. Herein, we review our experience in 21 patients who had postinfarction VSD and underwent VSD repair using the triple patch technique.

MATERIALS AND METHODS

Patients

Between April 2004 and September 2015, 21 consecutive patients presenting postinfarction VSD underwent VSD repair at Tachikawa Medical Center, Nagaoka City, Niigata, Japan. Clinical, echocardiographic, operative, and outcome data were collected prospectively. The study was approved by the institutional review board.

Scanning this QR code will take you to a procedural video.

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Abbreviations and Acronyms

ACC = aortic crossclamp
CABG = coronary artery bypass graft
MI = myocardial infarction
LV = left ventricle
Qp/Qs = pulmonary blood flow/systemic blood flow ratio
VSD = ventricular septal defect

The patient demographic and clinical characteristics are summarized in Table 1. Preoperative echocardiography and coronary angiography were performed in all patients. The patients had a mean age of 73.2 ± 9.5 years (range, 49-88 years). Eight patients (38.1%) were in cardiogenic shock at the time of operation. An intra-aortic balloon pump was used in all patients preoperatively. In addition, preoperative percutaneous cardiopulmonary support was required in 2 patients (9.5%). The mean and median times from MI to operation were 9.9 ± 11.1 and 7 days, respectively. Moreover, the mean and median times from VSD diagnosis to operation was 4.2 ± 7.4 and 2 days, respectively.

The preoperative mean left ventricular ejection fraction was 45.3% ± 15.1%. Eleven patients (52.4%) had a left ventricular ejection fraction ≤ 40%. The mean pulmonary blood flow to systemic blood flow ratio (Qp/Qs) was 2.86 ± 0.91 (range, 1.75-5.27).

Surgical Technique

Cardiopulmonary bypass was initiated using ascending aorta cannulation and bicaval cannulation under mild hypothermia. Myocardial revascularization, if necessary, was performed on the beating heart before repair of the VSD. Myocardial protection was achieved with antegrade cold blood cardioplegia, and the arrested state was maintained with intermittent retrograde cold blood cardioplegia. Operative schema is shown in Figure 1. Repair was done through a longitudinal left ventriculotomy in the infarcted area, about 1 to 2 cm away from the left anterior descending coronary artery (anterior type) or about 0.5 to 1 cm away from the posterior descending artery (posterior type). First, a tailored bovine pericardial patch was used to close the VSD directly with a running 4-0 polypropylene suture (Figure 2, *A*). Then, 2 bovine pericardial patches were cut into rectangular shapes (about 10 cm × 10 cm). One pericardial patch was sutured to the noninfarcted endocardium around the ventricular septal side, and the other patch was sutured to the noninfarcted endocardium on the anterolateral ventricular wall. In case of posterior type, 1 pericardial patch was sutured and fixed the fibrous annulus of the mitral valve, and the other patch was sutured to the posterior wall along a line of the medial margin of the base of the posteromedial papillary muscle.

Both patches were sutured with running 4-0 polypropylene sutures (Figure 2, *B*). These 2 patches were then cut and sewn to determine the ideal size and shape of the pouch fitting the left ventricular cavity. By means of this technique, left ventricle (LV) dimension is easily adjusted to avoid undersizing because we are able to directly look into the LV cavity and suture both patches. Then, fibrin glue, Bolheal (Chemo-Sero-Therapeutic Research Institute, Kumamoto, Japan) or Beriplast P Combi-Set (CLS Behring GmbH, Marburg, Germany) was applied to fill the cavity between the first patch and the pouch. The ventriculotomy was closed in 2 layers with 2 polytetrafluoroethylene felt strips and 2-0 polypropylene sutures. Upon completion of the procedure, a terminal retrograde hot-shot cardioplegia was given and the crossclamp was released.

Data Collection and Statistical Analysis

Each patient's status and data after hospital discharge were determined from hospital visits and consultation with the family physician. The follow-up data were 100% complete. The mean follow-up period for all patients was 43.5 months (range, 1-113 months). Echocardiographic examination were collected and evaluated in all patients at the preoperative, early postoperative and late operative stage.

Data are presented as mean ± standard deviation. The Kaplan-Meier method was used to calculate the overall survival curve. The χ^2 test (Fisher exact test when appropriate) or *t* test was used to analyze categorical and continuous variables, respectively, between survivors and nonsurvivors. All statistical analyses were performed using the JMP 12.0 software package (SAS Institute Inc, Cary, NC).

TABLE 1. Patient demographic characteristics (N = 21)

Variable	Triple patch
Age, y	73.2 ± 9.5
Range	49-88
>75 y	10
Gender, male/female	13/8
Body surface area, m^2	1.51 ± 0.20
Hypertension	11
Diabetes mellitus	5
Hyperlipidemia	2
Atrial fibrillation	1
Stage 4 or 5 CKD	5
COPD	1
Smoking	8
Laboratory data	
AST, IU/L	283 ± 378
ALT, IU/L	181 ± 310
Serum creatinine, mg/dL	1.45 ± 0.92
Shock status	8
Preoperative IABP	21
Preoperative PCPS	2
Preoperative PCI	1
Urgent or emergent status	16
Duration from MI to operation, d	9.9 ± 11.1
Duration from VSD diagnosis to operation, d	4.2 ± 7.4
Median, d	2
Ejection fraction, %	45.3 ± 15.1
<40%	11
LVEDD, mm	48.5 ± 5.3
LVEDS, mm	35.7 ± 5.4
Qp/Qs	2.86 ± 0.91

CKD, Chronic kidney disease; *COPD*, chronic obstructive pulmonary disease; *AST*, aspartate aminotransferase; *ALT*, alanine transaminase; *IABP*, intra-aortic balloon pump; *PCPS*, percutaneous cardiopulmonary support; *PCI*, percutaneous coronary intervention; *MI*, myocardial infarction; *VSD*, ventricular septal defect; *LVEDD*, left ventricular diastolic dimension; *LVEDS*, left ventricular systolic dimension; *Qp/Qs*, pulmonary/systemic blood flow ratio.

RESULTS

Five patients underwent elective VSD repair >7 days after the onset of MI because of hemodynamic stability before surgery. The remainder underwent urgent or emergent surgery.

Operative data are shown in Table 2. The mean cardiopulmonary bypass and aortic crossclamp (ACC) time were 143 ± 49 minutes (range, 87-251 minutes) and 84 ± 25 minutes (range, 58-149 minutes), respectively.