Surgical Techniques for Emergent Repair of Post-infarction Ventricular Septal Defect: Compare Endocardial Patch and Infarct Exclusion Method with Traditional Method

Background. The traditional surgical repair of post-infarction ventricular septal defect (VSD) includes excision of necrotic myocardium and approximation of the remaining healthy ventricular wall and septal portion. The exclusion method emphasizes no excision of infarcted myocardium, preservation of the left ventricular geometry and exclusion of infarction area. We discuss our experiences in 13 patients and compared the results obtained from 2 different surgical methods.

Methods. From July 1996 to December 2001, 13 patients with post-infarction VSD received emergent repair. Seven patients were repaired in the traditional way and the other 6 with infarct exclusion method. There were 9 men and 4 women, ranging in age from 57 to 79. In the traditional group, all 7 patients were classified as NYHA IV and supported by intra-aortic balloon counterpulsation (IABP) and 4 patients were for coronary bypass grafting. Patients using exclusion method were the 1 classified as NYHA III and 5 as IV with cardiogenic shock and supported by IABP. Coronary bypass grafting was performed concomitantly in 2 patients.

Results. Five patients died within 30 days after the surgery. Four patients (mortality rate = 57.1%) had repair in the traditional way and 1 (mortality rate = 16.6%) in the exclusion way. The complication rate was higher in the traditional group (100%, n = 7, p = 0.005). In the traditional group, 1 patient received heart transplantation due to persistent severe pump failure and died of sepsis. Two patients received tracheostomy due to respiratory failure and died 2 months later. In the group of exclusion method, 1 patient suffered recurrent VSD 2 days after the fist surgery and died due to ventricular arrhythmia.

Conclusions. The surgical mortality caused by acute post-infarction VSD has decreased with endocardial patch and infarct exclusion method. Rapid diagnosis, appropriate preoperative management and delicate surgical repair improve the overall results and help to attain long-term survival.
clusion method introduced by David in 1987 offered a preservation of the left ventricle (LV) geometry and excluded the infarcted area with an endocardial patch. This method got dramatically superior results in 6 patients in our hospital. In this article, 13 patients with post-infarct VSD, reconstructed via either diastolic or exclusion approach, will be described and compared.

METHODS

Patient population
From July 1996 to December 2001, totally 17 patients were diagnosed as having post-infarction VSD in our hospital. Those with diagnosis established over 2 weeks after surgery were excluded from this study. Therefore, only 13 patients who received emergent operation in time were included. Among them, 10 patients were male and 3 patients were female at age between 51 and 79 y/o (mean = 69.7 y/o). The diagnosis was established via emergent coronary angiography (CAG) or echocardiography. Twelve patients were classified as New York Heart Association Function Class (NYHA) IV and all of them were supported by intra-aortic balloon pulsation (IABP) preoperatively. Only 1 patient was classified as NYHA class III, without preoperative IABP support. The extent of coronary disease was located by CAG report and divided into 3 groups: single vessel disease (SVD), double vessel disease (DVD), and triple vessel disease (TVD). The SVD group presented in the majority of 46% (n = 6), followed in order by DVD group (23%, n = 3) and TVD group (15%, n = 2). Two cases had VSD detected by echocardiography only. Their preoperative CAG examinations were not possible to perform due to the unstable hemodynamics and the emergency of the operation. The perforation site was located by the surgeons. In all cases, the perforating sites were located conveniently in the anterior portion.

Operative techniques
Most of the patients except one, who hesitated about the surgery, received emergent VSD repair once their diagnosis was confirmed. The operative techniques were either diastolic way or exclusion method. We divided the patients in 2 groups: the first 7 patients who received diastolic repair with infarctectomy and reconstruction of left and right ventricular defect with Dacron patch were in the “diastolic” group; the other 6 patients who received VSD repair with an endocardial patch with out excision of necrotic myocardium were in the “exclusion” group. The decision to perform coronary artery bypass graft (CABG) was at the surgeon’s discretion. In the diastolic group, the incision was made through the LV ventriculotomy and combined with infarctectomy and reconstruction of the defect with Dacron patch. In the exclusion group, the material of the endocardial patch was equine pericardium. Then the incision was made through the necrotic area. The synchronous CABG would be completed after the septal repair. All the data presented as mean±standard deviation were analyzed by fisher exact test.

RESULTS

Patient characteristics
In the diastolic group, there were 5 male and 2 female. The mean age was 71.7 years (range from 57 to 79 years). All 7 patients were in NYHA IV and experienced cardiogenic shock with preoperative IABP support. There were 4 patient undergone concomitant CABG.

Among patients in the exclusion group, 66.67% were male (n = 4). The mean age was 67.5 years (range from 61 to 74 years). Five patients were in NYHA class IV with preoperative IABP support, except 1 who experienced the severe chest pain for the first time and was in functional class III. In that case, the post MI VSD was found in the den tally by elective CAG on the next day and the operation underwent right away. In the exclusion group, 2 of them received concomitant CABG.

Peri-operative result
All the patients received emergent VSD as soon as possible. In half of the cases, the time interval from acute myocardial infarction (AMI) to surgery was within 1 days (n = 6). Some of the patients suffering from chest
pain several days before the referral to our hospital were diagnosed within 2 days to make an interval up to 10 days. Generally speaking, 6 patients had the interval within 1 day; 5 patients in 1 week; and 2 patients above 10 days. In the traditional group, the mean in terval was 4.6 days and in the exclusion group, it was 2.2 days.

The distribution of coronary diseases was defined as CAG re ports. Six patients were in SVD, 3 patients had DVD and 2 patients had TVD. Only 2 patients whose hemodynamics was too critical to undergo peroperative CAG were diagnosed via echocardiography. Therefore the extent of coronary disease was not detectable.

Operative mortality

The overall mortality was 57.1% (n = 4) in the traditional group, significantly higher than 16.6% in the exclusion group (n = 1). The complication rate could run up to 100% when the repair under went with infarctectomy and Dacron reconstruction. Dramatically, only 1 case in the exclusion group suffered from post-operative complication (p = 0.005). This case received a second operation in the suspicion of residual VSD although no obvious leakage was found from the previous patch. The pre-operative patient characteristics and the operative mortality are showed in Table 1.

The most frequent complication in this study was acute heart failure. It occurred in 6 patients (46.1%), all in the traditional group. Five of them were supported by ECMO postoperatively until death, except 1 who experienced heart transplant later and survived. One of them was supported by post-operative IABP, and expired 2 months later with the autopsy report of RV necrosis with perforation.

The second frequent complication was respiratory failure (n = 3, 23.1%). Two of them received tracheostomy and the other one’s ventilator was weaned off successfully 2 months later. Acute renal failure was the 3rd common complication. It happened in 2 patients. Both of them received post-operative hemodialysis. One patient under went “go-in” operation with the diagnosis of residual VSD. So this complication was defined as a ”technical problem”. The patient expired 6 days later due to sudden onset of ventricular arrhythmia.

DISCUSSION

Ventricular septal rupture has been recognized as a catastrophic complication of myocardial infarction since 1846 when Latham first described it. It occurs in 1~2% of the cases of MI and contributes to 5% of post-MI deaths. Previous studies have pointed out the mortality prognosis of non-surgical therapy. Since Cooley and colleagues reported the first repair in 1957, surgical

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SD = standard deviation; IABP = intra-aortic balloon pump; CABG = coronary artery bypass surgery; aNo. of patients; bStatistically significant; NS: not statistically significant.
The repair of post-infarction ventricular septal defect (VSD) has been a challenge for cardiologists. In the 1990s, David and colleagues reported a new method of VSD repair with an endocardial patch to exclude the necrotic myocardium. According to David’s report, the repair preserves the LV geometrics and reduces the impairment of LV function, subsequently decreasing the mortality of the post-MI VSD. There fore in the last 6 patients in our model, we tried to re-pair the defect with an endocardial patch.

Many surgeons believed that delayed surgery allows sufficient scar tissue to afford more secure suture line and better delineation between the infarcted and viable tissue. The time interval of 6 weeks is recommended. The long-term mortality rate is about 50%. In Hill and Stiles’ study, 48 patients received operation within 30 days from the myocardial infarction and the mortality was 67%. In our study, surgery was performed right after the diagnosis was confirmed. In our opinion, short in interval from MI insult to surgery improves the prognosis in patients with post-MI VSD.

Cummings and associates’ study has found cardiogenic shock to be the independent predictor of operative mortality. The mortality with cardiogenic shock was reported to fall in the rank from 47% to 88%. In our 13 patients with pre-operative cardiogenic shock, the overall mortality was 41%. The mortality in exclusion group was 16.6%, compared with 57.1% in the traditional group. Another determinant predictor of mortality was the site of the VSD. It was in general agreement that the posterior VSD has higher mortality rate than the anterior VSD, as the posterior VSD poses greater surgical anatomic challenge. In Moore’s 25 patients, the mortality rate was 30% in the group of anatomic de-fect versus 73% in the post-infarction group. All 13 patients pre-sented in our series had anatomic de-fect. So we could not have a comparable result between the posterior site and anterior site. But the overall mortality was about 38.46% as we presented, which was close to the result of Moore’s investigation on anterior defect.

The extent of coronary diseases is another issue suspected to affect the mortality of post-infarct VSD. Among cases of SVD, DVD and TVD, only TVD counted in other reports, to have high mortal ity. In our model it was 100% (n = 2/2), compared with 33% (n = 1/3) in DVD group and 16.6% (n = 1/6) in SVD group. The TVD group seemed to make an obviously higher mortality rate. But owing to the small number of the patients, the finding is not statistically significant.

The primary limitation of the present study lies in its retrospective nature. Many preoperative and postoperative evaluations, in cluding the function of LV and right ventricle (RV) lack standardized criteria, therefore to make it difficult to investigate the effects of concomitant CABG or RV dysfunction on the result of mortality. The second limitation is the small number of the cases that makes many conclusions lack statistical significance. In a retrospective view, more criteria for patient selection inevitably leads to less cases enrolled. To make sense, our subsequent study has to collect more prospective sources for logistic analyses of variable factors.

The in-farction exclusion method with an endocardial patch potentially helps to decrease the mortality and complications of post-infarct VSD. Rapid diagnosis, appropriate peri-operative management and delicate surgical repair improve the overall results.

REFERENCES