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Original Article

Post Myocardial Infarction Ventricular Septal Rupture, Early Surgery – Is It Beneficial?

Authors

Dr Ravikumar Nagashetty[1], Dr Pranav Janardhan Adoni[2], Dr Rakesh Seetharaman[3], Dr Giridhar Kamalapurka[4]

[1]M.Ch. Cardiothoracic Surgery, Associate Professor, Department of Cardiothoracic Surgery
[2]D.M. Cardiac Anaesthesia, Assistant Professor, Department of Anesthesiology
[3]M. Ch. Cardiac Surgery, Assistant Professor, Department of Cardiothoracic Surgery
[4]M. Ch. Cardiothoracic Surgery, Professor, Department of Cardiac Surgery
Sri Jayadeva Institute of Cardiovascular Sciences and Research, Bengaluru

Corresponding Author

Dr Pranav Janardhan Adoni

Assistant Professor, Dept of Anesthesiology, Sri Jayadeva Institute of Cardiovascular Sciences and Research Bengaluru, Karnataka
Email: *pranavjadoni@gmail.com*

Abstract

Introduction: *Ventricular septal defect (VSD) is a rare but potentially fatal complication of acute myocardial infarction. In this report we aimed to study the characteristics and outcomes of patients who underwent surgical repair of post-infarction VSD using the excision technique.*

Methodology: *We performed a retrospective review of hospital records of all patients who were treated for post-infarction VSD using the excision surgical technique at the Department of Cardiothoracic Surgery, Sri Jayadeva Institute of Cardiovascular Sciences and Research, Bengaluru, Karnataka from 2005 till 2017. Preoperative characteristics of the patients like age, gender, past medical history, location of infarction and VSD, echocardiographic investigations and postoperative status of the patient with respect to need for IABP, extubation, inotropic weaning, mean hospital stay and residual septal defects were noted for the patients.*

Results: *During the study period we operated on 16 patients (7 females) with mean age of 58.7 years. Mean time between infarction and VSD was 5.2 days and time between symptom development due to VSD and surgery ranged from one to thirty days. Myocardial infarction of the anterior wall, anterolateral wall and inferior wall was seen in 7, 8 and 1 patient respectively. Preoperative echocardiography found reduced left ventricular function in all patients and ascertained VSD to be antero-apical in 8, mid-septal in 7 and posterior in 1 patient. IABP was inserted preoperatively in 10 patients and intra operatively in two patients. Postoperatively all patients were extubated in 12 to 18 hours and inotropes were weaned off on the 4th or 5th postoperative day. Three patients (19%) died postoperatively due to aspiration, left ventricular failure and septic shock (one each). An insignificant residual septal defect was revealed in postoperative echocardiogram of one patient.*

Conclusions: *Exclusion technique for operating on patients with post infarction VSD reduced the chance of dehiscence, improving the success rate of surgery. Future studies are required to support our findings.*

Keywords: *acute myocardial infarction, infarct exclusion, ventricular septal rupture.*

Introduction

Ventricular septal defect (VSD) is a rare but potentially fatal complication of acute myocardial infarction. It develops in approximately 1% of survivors and generally occurs one week after the acute event.[1] Within the first day 24% and within one month 80% mortality has been reported.[2] In 1847 Latham first recognized VSD as a complication of acute myocardial infarction.[3] Medical treatment of post-infarction VSD has been associated with approximately 70% mortality in the first 2 weeks. The first surgical repair of VSD was reported by Cooley et al, which drew the attention of cardiac surgeons worldwide to the possibility of surgical intervention in such patients.[4] This repairaims to improve the cardiac output and achieve a hemodynamic stability, still 54% mortality has been reported when surgical repair is attempted within seven days post infarction.[5] Daggett et al reported satisfactory results with their surgical technique and demonstrated reduced mortality and improved cardiac function.[6] Komeda and colleagues suggested surgical repair using the "infarct exclusion method".[7] In this report we aimed to study the characteristics and outcomes of patients who underwent surgical repair of post-infarction VSD using the excision technique.

Methodology

Study Design and Setting: We performed a retrospective review of hospital records of all patients who were treated for post-infarction VSD using the excision surgical technique at the Department of Cardiothoracic Surgery, Sri Jayadeva Institute of Cardiovascular Sciences and Research, Bengaluru, Karnataka from 2005 till 2017. The study was approved by the institutional ethics committee.

Surgical procedure: All patients referred to the Department of Cardiothoracic Surgery, Sri Jayadeva Institute of Cardiovascular Sciences and Research with a diagnosis of post myocardial infarction ventricular septal rupture were considered for surgery. Patients in cardiogenic shock were given intra aortic balloon pump (IABP) support immediately. Exclusion technique was performed for all patients. All patients were operated with in 24 hours of diagnosis. Left ventricular transinfarct incision approach was used. Healthy septum was identified and a series of pledgeted interrupted mattress sutures were placed on the healthy portion of the septum around the defect. VSD and infarcted septum were excluded while passing the sutures. The edges of ventriculotomy were approximated by two-layers-interrupted mattress sutures passed through buttressing strips of teflon felt and finally over and over running suture (Figure 1). Intra operative epicardial echocardiography was done to assess residual VSD and Swan Ganz method of pulmonary artery blood gas analysis was done to check for oxygen saturation step-up.

Data Collection and Data Analysis: We collected preoperative characteristics of the patients like age, gender, past medical history, location of infarction and VSD, requirement for intraaorticballon pump (IABP) and preoperative thrombolysis therapy due to myocardial infarction was noted. Preoperative echocardiographic investigations were performed through the cardiologist at the time of admission and the time interval from infarct to septal defect were noted for all patients. Postoperative status of the patient with respect to need for IABP, extubation, inotropic weaning, mean hospital stay and residual septal defects were noted for the patients. Allpatients were followed up by personal examination in the postoperative period. Number of deaths and reasons for it were noted as well. The data were analysed using the EpiInfo statistical software. Quantitative variables were described as mean and standard deviation and qualitative variables were described using the frequency distribution tables.

Results

During the study period we operated on 16 patients (7 females) with mean age of 58.7 years. A past history of diabetes mellitus was reported by

11 patients and 10 patients were hemodynamically unstable (Table 1). Typical presentation of the patients included new systolic murmur, dyspnea, abrupt deterioration in hemodynamics and heart failure of New York Heart Association class III to IV. Mean time between infarction and VSD was 5.2 days and time between symptom development due to VSD and surgery ranged from one to thirty days. Myocardial infarction of the anterior wall, anterolateral wall and inferior wall was seen in 7, 8 and 1 patient respectively. Preoperative echocardiography found reduced left ventricular function in all patients and ascertained VSD to be antero-apical in 8, mid-septal in 7 and posterior in 1 patient. Nine patients had a single vessel disease (8- proximal left anterior descending and 1- mid left anterior descending), six double vessel disease and one triple vessel disease. IABP was inserted preoperatively in 10 patients and intra operatively in two patients. In our patient population, nine underwent thrombolysis for myocardial infarction preoperatively. Concomitant coronary artery bypass surgery was done for all patients except one whose left anterior descending artery was diffusely diseased. Postoperatively all patients were extubated in 12 to 18 hours and inotropes were weaned off on the 4^{th} or 5^{th} postoperative day (Table 2). Mean hospital stay of the patients was 2 weeks. Three patients (19%) died postoperatively due to aspiration, left ventricular failure and septic shock (one each). An insignificant residual septal defect was revealed in postoperative echocardiogram of one patient.

Table 1. Baseline characteristics of the patients included in the study

	n
Number of patients	16
Age (mean ± standard deviation)	58.7 ± 11.2 years
Gender	
Females	7
Males	8
Past medical history	
Diabetes mellitus	11
Hypertension	7
Diabetes mellitus and hypertension	6
Hemodynamic stability	
Unstable	10
Stable	6
Location of Myocardial Infarction	
Anterior wall	7
Anterolateral	8
Inferior wall	1
Location of Ventricular Septal Defect	
Antero-apical	8
Mid-septal	7
Posterior	1
Intra Aortic Balloon Pump inserted	
Preoperative	10
Intraoperative	2
Thrombolysis done	9

Table 2 Postoperative parameters of the patients

Extubation period	12-18 hours
Intra Aortic Balloon Pump	4-5th postoperative day
Inotropic support	Weaned 6-7 th day
Average hospital stay	2 weeks
Mortality (*n*)	
Aspiration	1
Left ventricular failure	1
Septic shock	1
Residual septal defect	1

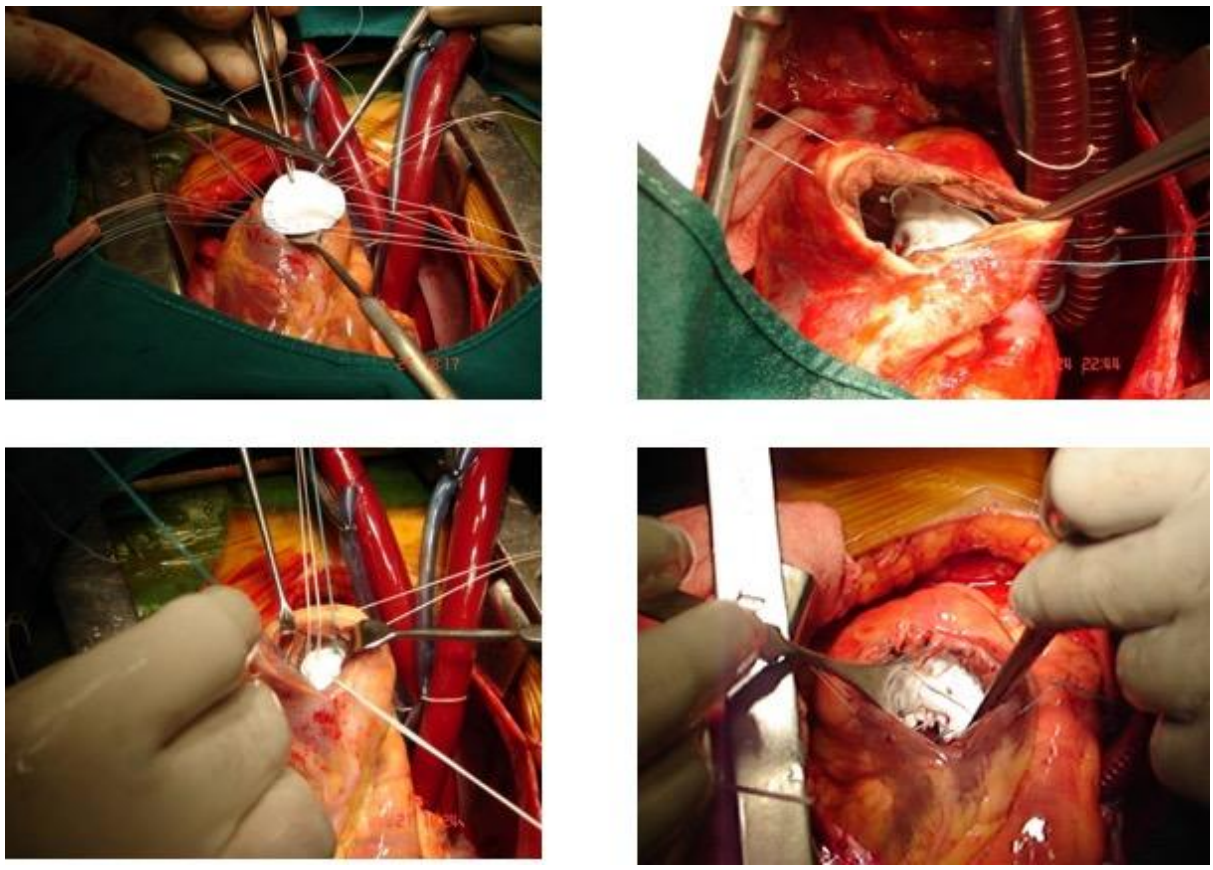

Figure 1: Surgical repair of post infarction ventricular septal defect using the excision technique

Discussion

Ruptured inter ventricular septum is a rare complication of myocardial infarction. As the septal defect occurs in the zone of necrotic myocardial tissue, early and timely use of thrombolytic agents may improve the circulation and thus reduce the incidence of VSD. Infarction resulting in asepatal defect is usually trans mural and extensive. About two thirds of these defects occur with infarction of the anterior wall and rest with infarction of the posterior or inferior wall. Post infarction septal defect has also been frequently associated with ventricular aneurysms (35% to 68%) which contribute significantly to the hemodynamic compromise in these patients.

Pharmacological treatment aims to reduce after load and to increase forward cardiac output. The left to right shunt associated with the septal defect may be decreased and managed temporarily by using vasodilators. Additionally, IABP offers the most important means of providing temporary hemodynamic support. Patients with VSD die as a result of end-organ failure and not cardiac failure per se. The high risk of mortality associated with post infarction VSD can only be decreased by shortening the duration of shock. Although achieving hemodynamic stability before surgery is very beneficial for the patient, but delaying surgical intervention in an attempt to improve the patient's hemodynamic status can result in poor clinical outcomes.[8] In view of the bleak prognosis for medically treated patients, the diagnosis of post infarction VSD itself constitutes an indication for surgery.

Growing evidence over the years has put an end to the controversy surrounding the timing of surgical intervention. Recent literature suggest that early surgery is indicated to minimize the risk of mortality and morbidity.[9] The relative safety of repair two to three weeks after perforation has been established. By this time, the edges of the defect have become firm and fibrotic, which makes the repair more secure and easily to perform. The surgical intervention can, however, be delayed only after there is a high degree of certainty that the patient is in hemodynamically

stable. Still in stable patients, post infarction VSD can rapidly leads to a worsening of the hemodynamic state, lead to cardiogenic shock, and result in marked and unmangeable symptoms of heart failure.[10] In such cases immediate surgery is usually indicated. It should be noted that the increased risk of operating early is acceptable as the risk of death without surgery under such circumstances is even higher. An overall mortality of less than 25% has been shown by most studies with the use of an early operative approach. Moreover, mortality tends to be lowest for patients with apical defects, followed by patients with anteriorly located septal defects. For anterior defects, mortality ranges from 10% to 15%; for posterior defects, mortality ranges from 30% to 35%. The most important risk factors for death in the early post infarction period are poor hemodynamic status due to the poor right ventricular function, which develops before the patient enters the operating room. This in turn is affected by the degree and distribution of myocardial necrosis which occurred as a result of the infarction.

Various approaches and techniques have been described by several authors around the globe. The choice of procedure is determined by the location of the septal defect. Most defects are anteroapical, like in our study, and are closed by buttressing the defect with healthy muscle from the adjacent anterior left ventricular wall. A dacron patch is used to close smaller defects located high in the ventricular septum. Recently, a triple-patch approach has been described and reported to have acceptable early and midterm clinical outcomes.**Error! Bookmark not defined.**[9] In some patients, especially those with posterior wall infarctions, mitral regurgitation may be associated with acute VSD. In these patients, the mitral valve must be replaced, which is best approached through the left ventriculotomy by using interrupted, pledgeted mattress sutures. In case a left ventricular aneurysm is associated with post infarction sepatal defect, excision of the aneurysm is also done.

Residual ventricular defect was revealed in one patient in our study. These have been reported after surgical intervention in approximately 10-25% of patients.[11] These residual defects can be diagnosed easily with the help of intra operative or postoperative echocardiography. Residual defects may occur because of the reopening of a closed defect, the presence of a neglected defect, or the development of a new defect in the early postoperative period. When the residual defects are small and asymptomatic, a conservative treatment is recommended to aid spontaneous closure. Repeat surgical intervention may be required for closing such residual VSDs when the pulmonary to systemic blood flow (Qp/Qs) ratio is greater than two.

There are a few limitations of this study. The main limitation is the retrospective study design. Moreover, our study sample size was smaller than larger multi-centre studies.

Conclusion

Exclusion technique for operating on patients with post infarction VSD reduced the chance of dehiscence, improving the success rate of surgery. Delaying the surgery in view of friability of myocardium, myocardial oedema and unfavorable hemodynamics will adversely affect the outcome as the patients invariably will develop multi organ failure if pre-operative hemodynamics are not good. All hemodynamically unstable patients should be given the benefit of surgery at the earliest.

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