

# SURGICAL MANAGEMENT OF POST-MYOCARDIAL INFARCTION VENTRICULAR SEPTAL DEFECT: EIGHT YEARS EXPERIENCE.

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## **ABSTRACT**

**INTRODUCTION:** *To study the outcome of surgical repair in patients with post-myocardial infarction ventricular septal defect and to study the difference in the outcomes in anterior and posterior ventricular septal defects.*

**MATERIAL AND METHODS:** *In a retrospective case series study done between December 2004 to December 2012 at the National Institute of Cardiovascular Diseases, Karachi, a total of 52 patients (n=52) were selected according to our inclusion criteria. These patients were further divided into two groups according to the location of ventricular rupture, anterior ventricular defect group and inferior ventricular defect group. Patients were managed by surgical intervention. SPSS 15 was used to collect and analyze data. The Chi-square test was used.*

**RESULTS:** *Data showed that 38 (73.1%) patients had anterior septal defects and 14 (26.9%) had inferior septal defects. Our study showed a predominance of males presenting with post infarct VSD. Anterior wall rupture group male and female distribution was 24males (63%) and 14 females (37%) while in the inferior septal rupture group there were 8 males (57%) and 6 females (43%). Age ranged from 45 to 70 years. Surgical intervention was performed in all cases with revascularization (if required) with VSD repair. Mechanical Cardiac support was instituted with the Intra Aortic Balloon Pump in all patients. Overall mortality was 53.8% (n=28) detailing to 47.4% (n=18) in the anterior septal rupture group and 71.43% (n=10) in the inferior septal group.*

**CONCLUSION:** *Immediate surgical intervention is indicated in a majority of patients who develop cardiogenic shock after post myocardial infarction ventricular defect although surgical mortality is higher in the early period after Acute Myocardial Infarction. Patients who develop Anterior Ventricular Septal Defect after acute myocardial infarction have better survival after surgical repair as compared to those which develop Inferior ventricular septal defects.*

**Key Words:** *ventricular septal defect, rupture, cardiogenic shock, mortality.*



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**BACKGROUND**

Around 1-3% of patients with acute myocardial infarction develop a ventricular septal defect (post-MI-VSD) within 3-5 days. The presentation mimics sepsis with patients having low cardiac output, organ failure, shock, and severe respiratory distress. There is an increased risk in patients with cardiac index of  $<1.75\text{L/min/m}^2$ , a mean right atrial pressure of  $>12\text{mmHg}$ , presentation in  $<6$  days and with right ventricular & septal dysfunction. There are two main entities an antero-apical VSD and a postero-septal rupture. This is a life threatening complication with a high mortality without surgical intervention.

**INTRODUCTION**

Post myocardial infarction ventricular septal defect (VSD) is a rare but serious complication, resulting in cardiac wall rupture<sup>1</sup>. It usually occurs within 3-7 days after the initial event. Septal perforation develops on the average 2-3 days after MI. Without surgical intervention 85% patients die in 2 months time<sup>2</sup>. Usually two types of rupture can occur, an anterior VSD that accounts for 60-80% of cases and a posterior VSD that accounts for 20-40% of cases. Anterior VSD is basically antero-apical where the left anterior descending artery is the culprit. Posterior VSDs are postero-septal and due to the occlusion of a dominant right coronary artery. Anterior septal rupture occurs due to occlusion of LAD and infarction of anterolateral infarction affecting 32% of left ventricle and 10% of right ventricle. Posterior septal rupture is due to occlusion of dominant RCA and causes infarction of the proximal posterior septum<sup>3</sup>. The ratio of anterior VSD to posterior VSD is 3:1. Antero-apical VSDs can present with tamponade and right ventricular failure while postero-septal VSDs can be complicated by mitral regurgitation. There is an increased risk in patients having a cardiac index  $<1.75\text{L/min/m}^2$ , mean right arterial pressure  $>12\text{mmHg}$ , early occurrence  $<6$  day and, significant right ventricular and septal dysfunction. 10–27% of patients having  $>40\%$  ventricular mass involvement, develop cardiogenic shock<sup>4</sup>. Cardiogenic shock is a major factor that defines outcomes with only medical treatment the mortality rate exceed  $>95\%$ <sup>5</sup>. The goal of surgery is to improve systolic function and achieve hemodynamic stability. A study of the literature reveals mortality rates varying between 15–60%<sup>6</sup>. Absence of angina has been associated with increased incidence of post infarction VSD, possibly because angina leads to myocardial preconditioning and collateral formation, which protects the myocardium from septal rupture<sup>7</sup>. Operative survival is 70% in patients presenting within two weeks of myocardial infarction<sup>8</sup>.

**MATERIAL AND METHODS**

This study is a retrospective case series done at National Institute of Cardiovascular Diseases Karachi. Data was collected between December 2004 and December 2012. All those patients who were referred for surgical management of post myocardial infarction ventricular defect



were treated surgically. A total of 52 patients (n=52) were selected for our study according to our inclusion criteria. These patients were further divided into two groups according to the location of ventricular septal rupture, the anterior ventricular defect group and the posterior ventricular defect group. All patients were managed by surgical intervention. SPSS 15 was used to collect and analyze data. The Chi-square test was used.

All those patients who were operated for post myocardial infarction ventricular septal defects with or without CABG were included in the study. There were no refusals. All those patients were excluded from study in whom some additional procedure besides VSD repair and CABG had to be performed. A pre-operative Trans Thoracic Echocardiography study was done in all patients. Besides counterpulsation with an Intra Aortic Balloon Pump (IABP), no other mechanical assist device was used. The surgical approach was through an infarctectomy using double velor dacron patch to effect the VSD closure with concomitant CABG. Pre operative characteristics included gender, age, localization of VSD, presence of shock, angiographic data and the presence of MR. the Ejection Fraction and the use of IABP were noted. Between December 2004 and December 2012, 52 patients were treated at the National Institute of Cardiovascular Diseases Karachi with a diagnosis of ventricular septal defect secondary to myocardial infarction. Out of these 38 (73.1%) had developed anterior septal rupture while 14 (26.9%) had posterior septal ruptures.

If the patient was haemodynamically stable, an effort was made to postpone operation until at least six weeks after the onset of chest pain<sup>16</sup>. But hemodynamic instability (as evidenced by cardiogenic shock, refractory pulmonary edema, rising BUN or prolonged requirement for catecholamines) forced operative intervention immediately. Coronary angiography was not performed every case.

All patients in the series underwent patch closure of the septal defect through a left ventriculotomy through the infarcted segment. After ventriculotomy, the extent of the septal defect was determined. A double velor dacron patch was used with interrupted polypropylene 3/0 sutures and teflon pledgets to close the VSD. With posterior defects, the VSD was approached by dislocating the heart anteriorly out of the pericardium and a right ventriculotomy was done through the infarcted segment.

## RESULTS:

Out of the total of the 52 cases referred for surgery, 38 (73.1%) patients had anterior septal rupture and 14 (26.9%) had posterior wall ruptures. In the anterior wall rupture group, male and female distribution was 24:14, while in the inferior septal rupture group, there were 8 males and 6 females. The age ranged from 45 to 70 years. Mitral regurgitation was present in 25 patients in the anterior septal group and in 8 patients in the inferior septal group. Cardiogenic shock was present in 27 patients with a group distribution of 21:6 patients. Intra Aortic Balloon Pump was inserted in all 52 patients. The timing of IABP insertion is shown in table-4. Coronary Angiography was done in all (100%) patients, angiographic data showed single vessel disease in 28 (anterior group 19, posterior group 9), two vessels disease in 21 (anterior group 16, posterior group 5) and three vessels disease in 3 all of whom were in the anterior septal rupture group.

		Location of VSD		Total
		Anterior VSD	posterior VSD	0
E.F.	20.00	6	1	7
	25.00	10	4	14
	30.00	7	3	10
	35.00	6	2	8
	40.00	6	3	9
	45.00	3	0	3
	50.00	0	1	1
Total		38	14	52

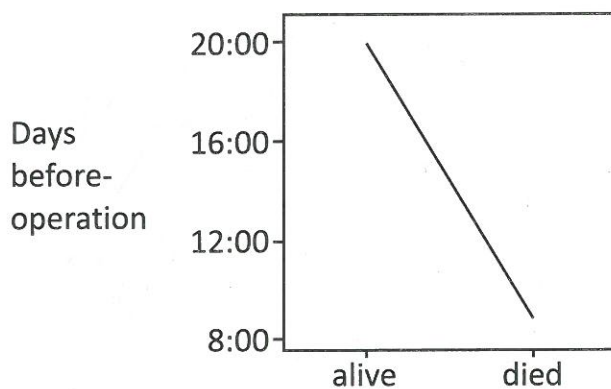
**Table-1: Location VSD**

ICU stay (days)		Location of VSD		Total
		Anterior VSD	posterior VSD	0
	.00	3	0	3
	1.00	5	2	7
	2.00	4	3	7
	3.00	5	1	6
	4.00	5	3	8
	5.00	4	0	4
	6.00	6	1	7
	7.00	1	1	2
	8.00	2	0	2
	9.00	2	1	3
	10.00	1	0	1
	12.00	0	1	1
	14.00	0	1	1
Total		38	14	52

**Table-2: Postoperative ICU stay in both groups**

Days before operation	Location of VSD		Total
	Anterior VSD	posterior VSD	0
2.00	1	1	2
4.00	7	2	9
5.00	4	1	5
6.00	9	2	11
7.00	1	1	2
8.00	1	2	3
9.00	0	1	1
10.00	2	1	3
12.00	2	0	2
14.00	0	1	1
16.00	1	0	1
20.00	2	0	2
24.00	1	0	1
25.00	1	0	1
32.00	0	1	1
34.00	1	0	1
40.00	2	0	2
42.00	1	0	1
45.00	0	1	1
47.00	1	0	1
50.00	1	0	1
Total	38	14	52

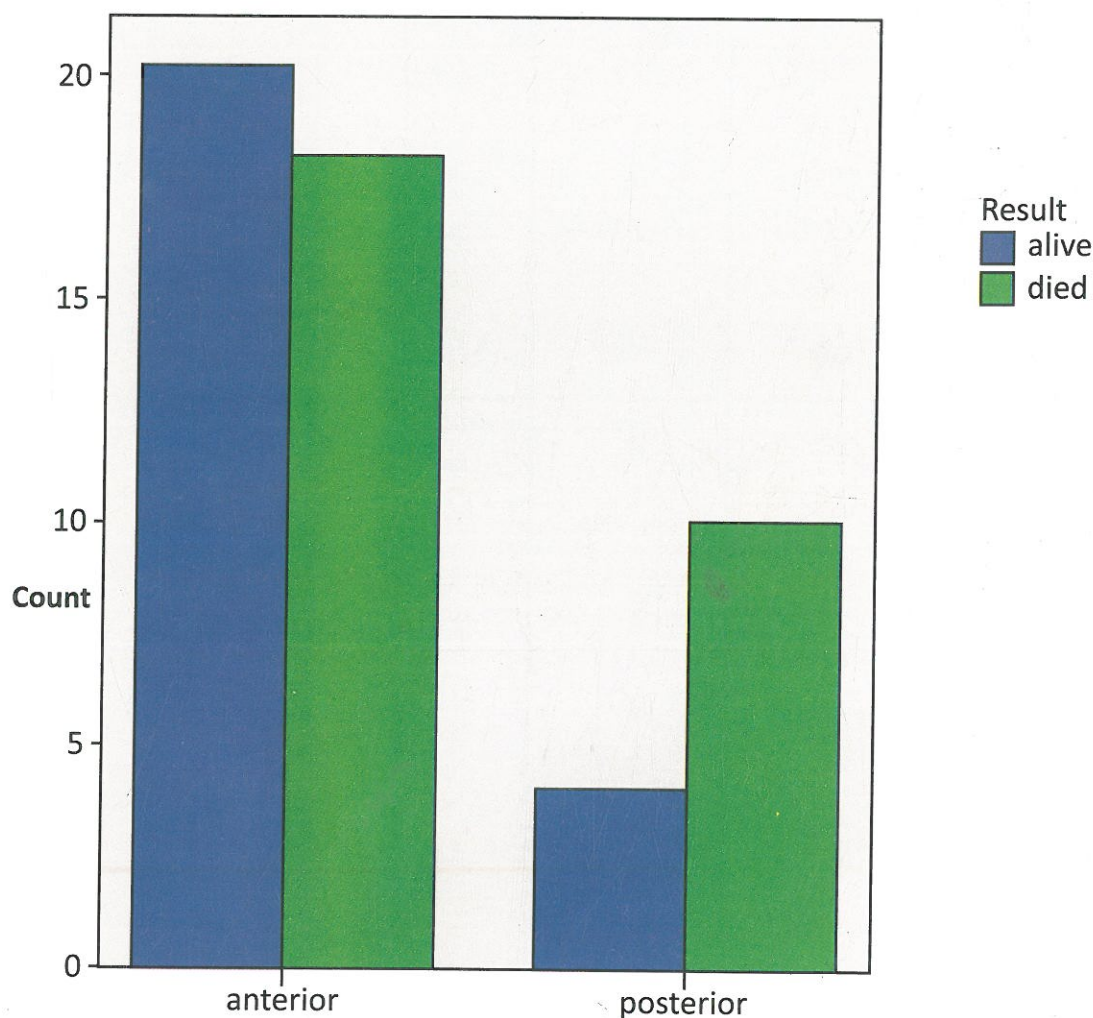
**Table-3: Duration between start of chest pain and onset of operation**



**graph-1: Relationship of days before operation and its effect on over all outcome in both groups.**



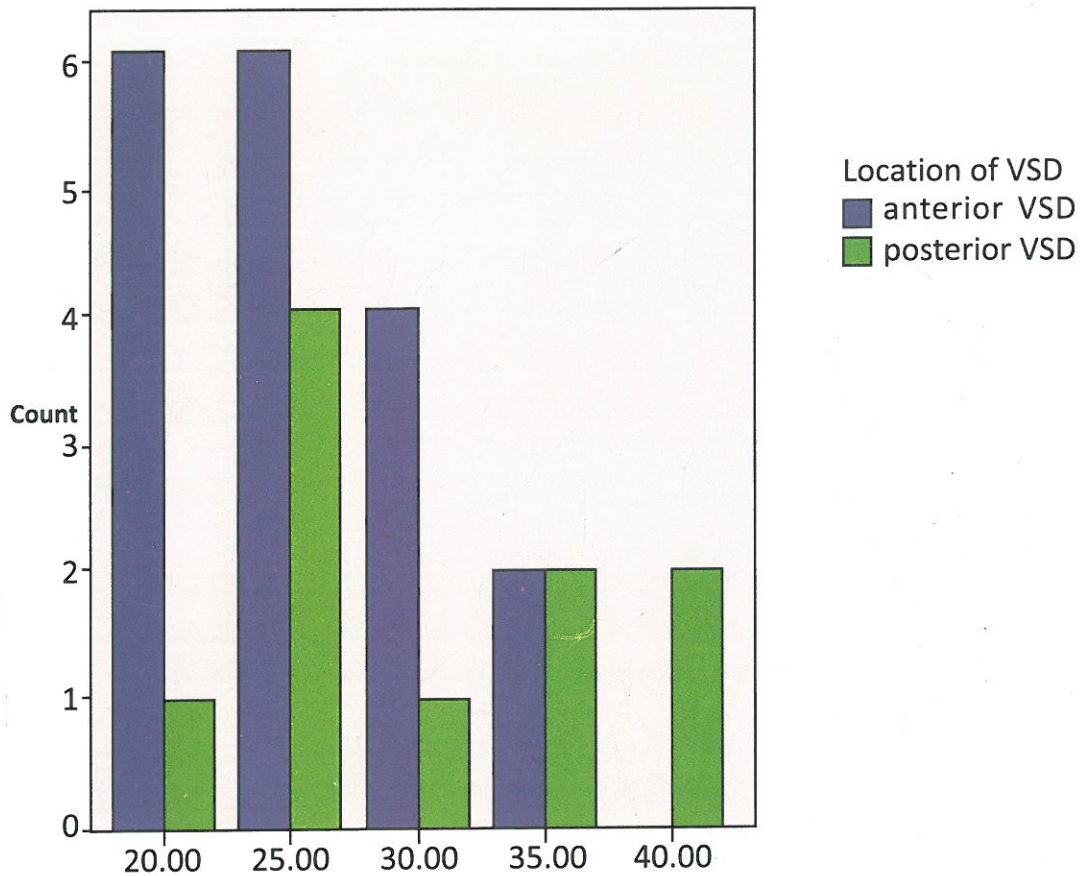
The overall mortality was 53.8% (n-28). While mortality in the anterior septal rupture group was 47.4% (n-18), the mortality in the posterior septal rupture group was 71.43% (n-10). Bar chart-1 shows the mortality in both groups. The ejection fraction was found to have a direct bearing on mortality in both groups. Patients with ejection fractions ranging between 20-25% had the highest mortality in both groups, whereas patients with anterior septal rupture and having ejection fractions >40% had 0% mortality. Graph-3 shows distribution of dead patients in both groups in according to their EF.



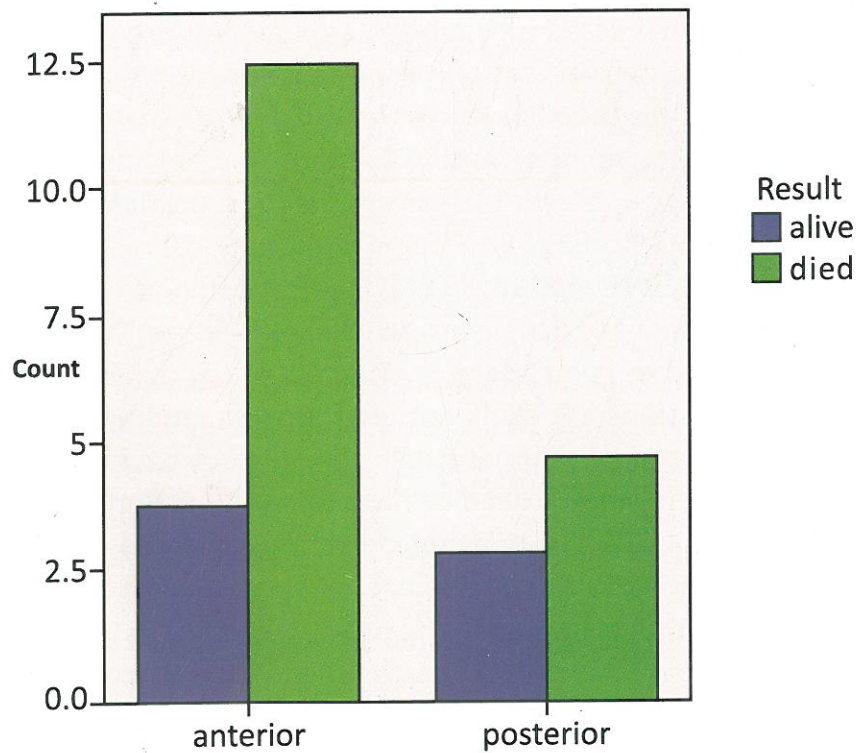
**bar chart-1: Outcome of patients with post infarction VSD.**

## DISCUSSION

Post infarction VSD (PVSD) is a complication of myocardial infarction presenting as an acquired mechanical defect. It is usually associated with poor prognosis if not treated early. The important parameters are infarct localization, myocardial function and timing of operation. Patients usually present with biventricular failure, mitral regurgitation and shock. The mitral regurgitation is diagnosed by echocardiography performed before surgery. Patient survival is directly related to the state of cardiac function and the hemodynamic stability of patients at the time of operation. There has been an observed reduction in the incidence of this serious complication over the last decade, possibly due to early management of AMI with thrombolysis and primary



bar chart-2: Outcome of patients with post infarction VSD.



bar chart-3: The number of patients in cardiogenic shock in both groups and their outcome.



Results			Location of VSD		Total
			Anterior	Inferior	0
ALIVE	IABP	Periop	5	1	6
		postop	1	0	1
		Preop	14	3	17
	Total		20	4	24
DEAD	IABP	Periop	0	3	3
		postop	1	0	1
		preop	17	7	24
	Total		18	10	28

**Table-4: IABP, location of VSD and result cross tabulation.**

coronary intervention procedures<sup>9</sup>. As it seems unethical to delay patients for surgery and impossible to detect patients who might be able to wait this period, an emergency procedure has to be proposed for all patients with post infarction VSD. These patients should be operated on urgently if they are in a hemodynamically stable condition and immediately if they are in cardiogenic shock<sup>14</sup>. Fourteen patients had an ejection fraction of 25%, of which 10 patients had an anterior VSD and 4 patients had posterior VSD. Most of the patients had a low ejection fraction <45%, only 1 patient with a posterior VSD had an ejection fraction of 50%. Patients need to be stabilized hemodynamically with support as in the institution of Intra Aortic Balloon Pump in a bid to improve their cardiac status. Having said that, as proven in numerous studies and in our retrospective analysis the hemodynamic status of the patient is a good prognostic indicator of the improved survival rates and in better outcomes. Achieving hemodynamic stability before surgery is very beneficial<sup>10</sup>. In current practice, postinfarction VSD is a surgical emergency, and the presence of cardiogenic shock is an indication for immediate intervention<sup>11</sup>. Right ventricular dysfunction is related to several factors: left ventricular dysfunction, right ventricular infarction or ischemia and right ventricle volume overload. Only the last is reversible. Analysis of the part of these three components is not easy, and as our sample size of VSD series is small, analysis and conclusions are likely not very reliable, and would need much larger samples to determine exact predictors of outcome<sup>12</sup>. In our study we found concomitant CABG to show improved outcomes in patients needing revascularization. Better outcomes were seen due to improved techniques and use of prosthetic patches. Improved surgical techniques (eg, infarctectomy) and better perioperative mechanical and pharmacologic support have helped lower mortality. In addition, the development of surgical techniques to repair perforations in different areas of the septum has led to improved results<sup>13</sup>. Most patients who survive the hospital period have good functional status, with the majority falling into New York Heart Association (NYHA) class I or II<sup>14</sup>. A delay in treatment helps the infarct area to become well demarcated and fibrotic thereby allowing better suture hold as the tissue heals. The timing of



surgery is the most important factor to determine the operative results and surgical mortality rates are reduced when performing surgery after 3-6 weeks following acute myocardial infarction.

## CONCLUSION

Immediate surgical intervention is indicated for a majority of patients to achieve hemodynamic stability in those patients who develop cardiogenic shock after post myocardial infarction ventricular defect although surgical mortality is higher in the early period after Acute Myocardial Infarction.

Patients who develop Anterior Ventricular septal defect after acute myocardial infarction have better survival rates after surgical repair as compared to those which develop Inferior ventricular septal defect after acute myocardial infarction.

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