

# Classical Single Patch Repair and Revascularization for Post-infarction Ventricular Septal Defect: A Follow-up Study from a Semi-urban Tertiary Care Centre in South India

J Ravikrishnan<sup>1</sup>, J Suresh Patel<sup>2</sup>, Nibi Hassan<sup>3</sup>

<sup>1</sup>Associate Professor, Department of Cardiothoracic and Vascular Surgery, Pushpagiri Institute of Medical Sciences and Research Centre, Thiruvalla, Kerala, India, <sup>2</sup>Associate Professor, Department of Cardiovascular and Thoracic Surgery, S.B.K.S Medical College, Sumandeep Vidyapeeth, Waghodia, Piparia, Baroda, Gujarat, India, <sup>3</sup>Resident, Department of General Surgery, Pushpagiri Institute of Medical Sciences and Research Centre, Thiruvalla, Kerala, India

## Abstract

**Introduction:** Rupture of ventricular septum is a rare complication of myocardial infarction and occurs in approximately 0.2% of the cases. Surgical management can reduce the chances of mortality in these cases from over 90% to less than 50%. The present study was aimed at finding out the short- and long-term outcomes of surgical management of post-infarction ventricular septal defect (VSD), using classical single patch repair and revascularization procedure.

**Materials and Methods:** A total of 46 patients who underwent surgical repair of post-infarction VSD at a tertiary care hospital in South India were included in the study. All of them had classical single Dacron patch repair and revascularization. The participants were followed up at the end of 2 months, 2 years, and 4 years using a 2D echocardiography, looking for the efficacy of the Dacron patch and possible improvement in left ventricular function. The survival status of the participant and incidence of any new cardiac event was queried at the end of 2 and 4 years.

**Results:** The mean (standard deviation) ejection fraction went up from 26.52% (4.27) during pre-operative period to 33.08% (2.58) at the end of three months ( $P < 0.001$ ). At the end of 2 months after surgery, 41 (89.1%) of the participants were alive. At the end of 2 and 4 years of follow-up, the survival status of the participants was similar, and 38 (82.6%) were alive. However, the short-term survival status was vastly different between those participants who underwent an emergency surgical correction and an elective procedure. 4 (50%) of the participants in the emergency group died in the first 2 months following surgery, while only 1 (2.7%) died in the elective group.

**Discussion and Conclusion:** Our study has shown that post-infarction VSD can be successfully managed at semi-urban centers, with globally acceptable levels of mortality. Emergency surgical intervention for the management of post-infarction VSD was shown to result in high short-term mortality when compared to patients undergoing elective surgeries. Furthermore, single Dacron patch repair with concomitant revascularization was found to be a safe and effective procedure, for the management of the problem.

**Key words:** Low cardiac output, Post-infarct ventricular septal defect, Single Dacron patch repair

## INTRODUCTION

Cardiovascular diseases have become the leading cause of mortality and morbidity across the world. The incidence

of cardiovascular diseases in India is also on the rise and is now one of the top five causes of death in the country.<sup>1</sup> The incidence is predicted to rise manifold and India will be host to more than half of the patients suffering from cardiovascular diseases, by 2030.<sup>2</sup> The Indian population and people of South Asian descent are also genetically susceptible for cardiovascular illnesses. Multiple studies have demonstrated a significantly higher prevalence of cardiovascular risk factors and cardiovascular disease among Indian population, than Caucasians living in the same geographical areas.<sup>3</sup> This warrants an increase

### Access this article online



www.ijss-sn.com

**Month of Submission :** 02-2016  
**Month of Peer Review :** 03-2016  
**Month of Acceptance :** 03-2016  
**Month of Publishing :** 04-2016

**Corresponding Author:** Dr. J Ravikrishnan, Department of Cardiothoracic and Vascular Surgery, Pushpagiri Heart Institute, Pushpagiri Institute of Medical Sciences and Research Centre, Thiruvalla - 689 101, Kerala, India. Phone: +91-9446311999. E-mail: vu3jkr@gmail.com

in research into cardiovascular diseases, especially its epidemiology and intervention measures.

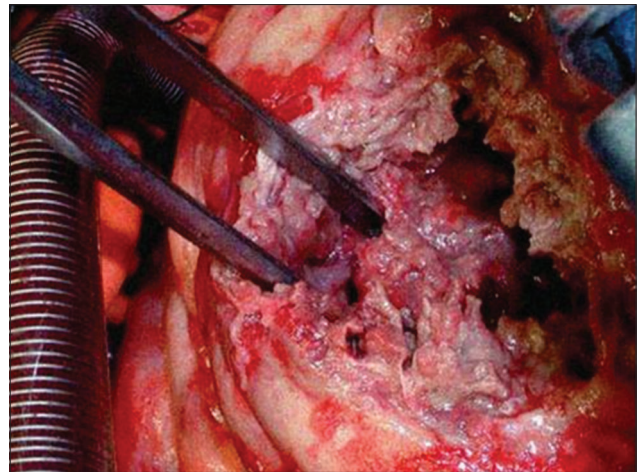
Rupture of ventricular septum is a rare complication of myocardial infarction and occurs in approximately 0.2% of the cases. It has a very high mortality, especially in patients who are medically managed or in whom it is not identified. Surgical management can reduce the chances of mortality from over 90% to less than 50%.<sup>4</sup> Certain studies have demonstrated even higher survival figures post-surgical management of these cases. A study from Hong Kong reported an overall survival of 68%, 55%, and 42% at 1, 5, and 10 years, respectively.<sup>5</sup> Emergency surgeries and surgical intervention within three days of the event have been shown to increase short-term mortality, in the case of surgical management of post-infarction Ventricular septal defect (VSD).<sup>6</sup> It has also been shown that the repair of post-infarction VSD along with a concomitant revascularization procedure can further improve the chances of survival. A systematic review found that out of the 18 papers evaluated for the review, 12 recommended a coronary artery bypass grafting (CABG) along with the repair of ventricular septum.<sup>7</sup>

The present study was aimed at finding out the short- and long-term outcomes of surgical management of post-infarction VSD, using classical single patch repair and revascularization procedure.

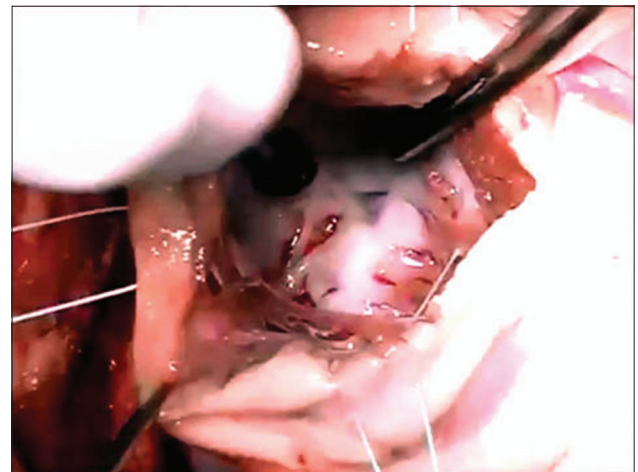
## MATERIALS AND METHODS

About 46 patients who underwent surgical repair of post-infarction VSD at Sri Venkateswara Institute of Medical Sciences, Tirupati, India, were included in the study. All the participants underwent the procedure during the period 2005-2009, and all of them had classical single patch repair and revascularization. The study was cleared by the Institutional Ethics Committee.

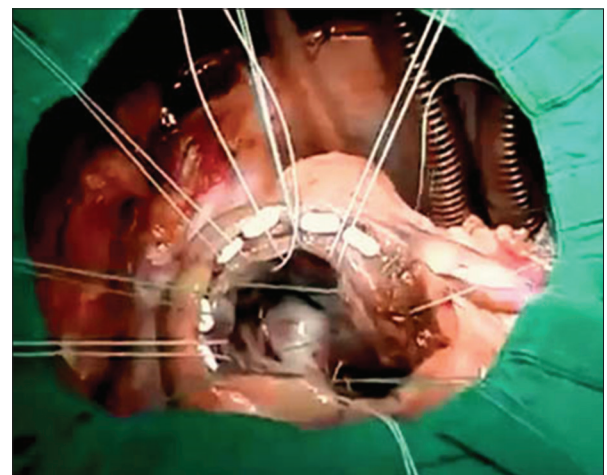
The surgical approach was through a median sternotomy in all participants. Cannulation was done after heparinization (3 mg/kg). Aorto-bicaval cannulation, membrane oxygenators, and blood cardioplegia were used in all patients. Aortic cross-clamp time varied from 40 to 90 min and bypass time varied from 90 to 120 min. The VSD was approached through the infarcted area. The size of the VSD ranged from 2 to 4 cm ( $2.59 \pm 0.48$ ). 14 of the defects were apical, and rest was apico-anterior. These defects were closed with a Dacron patch which was secured using double armed pre pledgeted 2/0 ethibond interrupted sutures, and the ventriculostomy was closed using 2/0 prolene continuous sutures with Teflon felt reinforcement (Figures 1-5).



**Figure 1: Post-infarct ventricular septal defect with ill-defined margins (emergency group)**



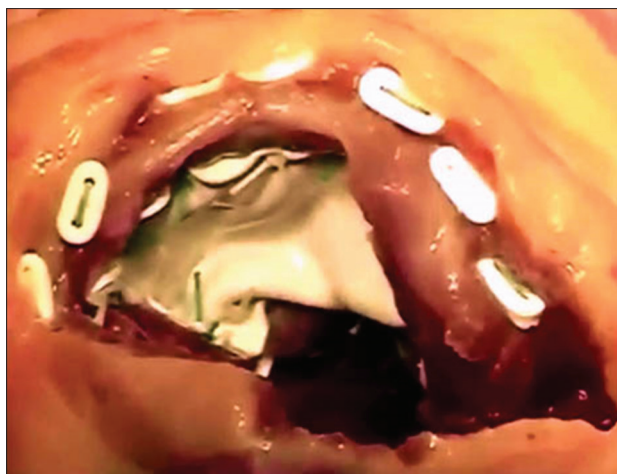
**Figure 2: Post-infarct ventricular septal defect with mature margins (elective group)**



**Figure 3: Pre pledgeted 2/0 ethibond stitches taken at ventricular septal defect margins for fixing the Teflon patch**

Concomitant CABG with reversed saphenous vein graft was done in all the participants. Inotropic support with

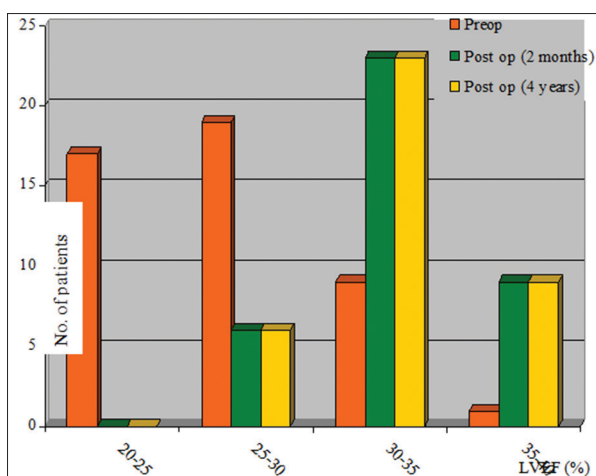




**Figure 4: Ventricular septal defect closed by Teflon patch**



**Fig 5. Ventriculostomy closed with continuous 2/0 prolene suture with Teflon reinforcement**



**Figure 6: Comparison of left ventricular ejection fraction (%)**

intravenous adrenaline, dopamine, or dobutamine was used along with intraarterial blood pressure monitoring. All the patients were electively ventilated for 24-48 h.

The participants were followed up at the end of 2 months, 2 years, and 4 years. At 60 days, the participants were reassessed using a 2D echocardiography, looking for the efficacy of the Dacron patch and possible improvement in left ventricular function. The survival status of the participant and incidence of any new cardiac event was queried at the end of 2 and 4 years.

## RESULTS

The patients who underwent surgical correction of post-infarction VSD from 2005 to 2009 were included in the study. Age ranged between 40 and 70 years with mean age of 59.52 years (5.33). 22 (47.8%) of the participants were under the age of 60 years, and a vast majority (71.3%) were males. Almost 70% of the participants were suffering from diabetes mellitus, while only 30.4% had hypertension. A huge majority (65.2%) of the participants who underwent surgical correction of post-infarction VSD were smokers. About 22 (47.8%) of the participants had single vessel disease, 16 (34.8%) had double vessel disease, and 8 (17.4%) had triple vessel disease. More than 80% of the participants underwent elective surgical procedures after initial stabilization of hemodynamic status (within 6 weeks of the event) while the rest underwent emergency surgical correction due to onset of rapidly progressing cardiac failure (within 5 days) (Table 1).

The systolic function of the patients was assessed at the end of 60 days using the 2D echocardiography. The mean (standard deviation) ejection fraction went up from 26.52% (4.27) during pre-operative period to 33.08% (2.58) during the post-operative period ( $P < 0.001$ ) (Figure 6).

The data were further analyzed to look for factors affecting improvement in ejection fraction. It was found that age ( $P = 0.098$ ), sex ( $P = 0.621$ ), type of coronary artery disease ( $P = 0.589$ ), and mode of surgical procedure ( $P = 0.647$ ) were not significantly associated with improvement in ejection fraction following surgical correction of post-infarction VSD. However, it was seen that the size of VSD is a factor which can predict the improvement in ejection fraction following surgical intervention, with defects less than 3 cm showing a 4.78% improvement and defects of 3 cm or more showing a 10.64% improvement ( $P < 0.001$ ) (Table 2).

The patients were followed up for a total of 4 years to assess the survival status. At the end of 2 months of surgery, 41 (89.1%) of the participants were alive. At the end of 2 and 4 years of follow-up, the survival status of the participants was similar, and 38 (82.6%) were alive. However, the short-term survival status was vastly different

**Table 1: Patient demographics**

Characteristic	Number (%)
Age (years)	
<60	22 (47.8)
>60	24 (52.2)
Sex	
Male	33 (71.3)
Female	13 (28.3)
Diabetes mellitus	
Yes	32 (69.6)
No	14 (30.4)
Hypertension	
Yes	14 (30.4)
No	32 (69.6)
Smoking	
Yes	30 (65.2)
No	16 (34.8)
Type of CAD	
Single vessel	22 (47.8)
Double vessel	16 (34.8)
Triple vessel	8 (17.4)
Mode of surgical procedure	
Emergency	8 (17.4)
Elective	38 (82.6)

CAD: Coronary artery disease

**Table 2: Factors affecting improvement in systolic function following surgical intervention**

Factor/Characteristic	Mean (SD) improvement in LVEF following surgery	P value
Age (years)		
<60	5.18% (5.70)	0.098
>60	7.83% (4.93)	
Sex		
Male	6.51% (5.19)	0.621
Female	7.41% (5.85)	
VSD size		
<3 cm	4.78% (5.18)	<0.001
>3 cm	10.64% (3.45)	
Type of CAD		
Single vessel	6.09% (6.68)	0.589
Double vessel	6.31% (4.54)	
Triple vessel	8.37% (2.44)	
Mode of surgical procedure		
Emergency	7.37% (3.42)	0.647
Elective	6.39% (5.77)	

CAD: Coronary artery disease, VSD: Ventricular septal defect, SD: Standard deviation, LVEF: Left ventricular ejection fraction

**Table 3: Patient survival**

Time lapsed after procedure	n (%)	
	Emergency (8)	Elective (38)
Survival at 60 days	4 (50)	37 (97.3)
Survival at 2 year	4 (50)	34 (89.4)
Survival at 4 years	4 (50)	34 (89.4)

between those participants who underwent an emergency surgical correction and an elective procedure. 4 (50%) of the participants in the emergency group died in the first

2 months following surgery, while only 1 (2.7%) died in the elective group. 50% of the participants in the emergency were alive at the end of 4 years after the surgery, while 89.4% of the participants from the elective group were living after the corresponding follow-up period (Table 3).

## DISCUSSION

Even though the incidence of post-infarction VSD is very low, an understanding of the various considerations in managing such patients is of utmost importance due to the high mortality. The surgical management of such patients involves complex procedures, which are difficult even in the best of centers, manned by highly trained cardiac surgeons.

The overall mortality in the immediate post-operative period was only 10.9% in our study, which is much lower than the mortality rates reported in the literature. A study done in the United Kingdom reported 30-day mortality rates of up to 37% while a study done in a university hospital in Sweden showed that acute mortality was as high as 41%.<sup>8,9</sup> Our center is situated in a semi-urban area with poor access to ambulance services and emergency medical services, and therefore, most of the patients with massive myocardial infarction succumb before they can access medical facilities. This can cause a significant selection bias as only the relatively stable patients undergo surgical management causing inflated survival statistics.

Early surgical intervention has shown to be a risk factor for short-term mortality, in many studies done elsewhere.<sup>6,8</sup> In our study also, this trend is visible as the short-term mortality among those who underwent emergency intervention was as high as 50% while 60-day mortality among those patients who had elective surgery was only 2.7%. Studies have shown that pre-operative cardiogenic shock and early surgical intervention are the most important risk factors for short-term mortality. Furthermore, it has been demonstrated that hemodynamic stabilization along with delayed surgical intervention can improve the mortality statistics.<sup>8</sup>

Some studies have shown that double patch repair was a superior intervention when compared to single patch repair, in the management of post-infarction VSD.<sup>10</sup> However, others state that single patch repair has a comparable efficacy in terms of clinical improvement and left ventricular systolic function and that it is a simpler technique.<sup>11</sup> In the present study, all the patients underwent single patch repair, and the mortality rates were comparable to the best centers in the world. This shows that single patch repair can be used at semi-urban centers also, with acceptable levels of mortality and morbidity. Only a large

randomized control trial can finally settle the debate on the superiority of these interventions.

In our study, all the participants underwent concomitant CABG along with the repair of VSD using single Dacron patch. Some previous studies have indicated that CABG does not improve the short-term or long-term outcomes in patients undergoing surgery for post-infarction VSD.<sup>12</sup> However, most studies have shown that there is a definite benefit for doing a concomitant CABG, which translates into better patient survival.<sup>7</sup> Our study has shown acceptable results for a concomitant CABG through lower long-term mortality rates though we did not have a comparison group.

## CONCLUSIONS

Our study has shown that post-infarction VSD can be successfully managed at semi-urban centers, with globally acceptable levels of mortality. Emergency surgical intervention for management of post-infarction VSD was shown to result in high short-term mortality when compared to patients undergoing elective surgeries. Hemodynamic stabilization and allowing maturation of VSD margins yielded a better outcome. Furthermore, single Dacron patch repair with concomitant revascularization was found to be a safe and effective procedure, for the management of the problem.

## ACKNOWLEDGMENTS

The authors would like to thank the management, faculty, staff, students and patients of Sri Venkateswara Institute of Medical Sciences, Tirupati, India. We also thank Dr. Philip

Mathew, Assistant Professor, Department of Social and Preventive Medicine, Pushpagiri Medical College, Thiruvalla, India, for his statistical inputs.

## REFERENCES

1. Krishnan MN, Zachariah G, Venugopal K, Mohanan PP, Harikrishnan S, Sanjay G, *et al.* Prevalence of coronary artery disease and its risk factors in Kerala, South India: A community-based cross-sectional study. *BMC Cardiovasc Disord* 2016;16:12.
2. Gupta R, Joshi P, Mohan V, Reddy KS, Yusuf S. Epidemiology and causation of coronary heart disease and stroke in India. *Heart* 2008;94:16-26.
3. Enas EA, Garg A, Davidson MA, Nair VM, Huet BA, Yusuf S. Coronary heart disease and its risk factors in first-generation immigrant Asian Indians to the United States of America. *Indian Heart J* 1996;48:343-53.
4. Serpytis P, Karvelyte N, Serpytis R, Kalinauskas G, Rucinskas K, Samalavicius R, *et al.* Post-infarction ventricular septal defect: Risk factors and early outcomes. *Hellenic J Cardiol* 2015;56:66-71.
5. Yam N, Au TW, Cheng LC. Post-infarction ventricular septal defect: Surgical outcomes in the last decade. *Asian Cardiovasc Thorac Ann* 2013;21:539-45.
6. Mantovani V, Mariscalco G, Leva C, Blanzola C, Sala A. Surgical repair of post-infarction ventricular septal defect: 19 years of experience. *Int J Cardiol* 2006;108:202-6.
7. Perrotta S, Lentini S. In patients undergoing surgical repair of post-infarction ventricular septal defect, does concomitant revascularization improve prognosis? *Interact Cardiovasc Thorac Surg* 2009;9:879-87.
8. Deja MA, Szostek J, Widenka K, Szafron B, Szyt TJ, Hickey MS, *et al.* Post infarction ventricular septal defect - Can we do better? *Eur J Cardiothorac Surg* 2000;18:194-201.
9. Jeppsson A, Liden H, Johnsson P, Hartford M, Rådegran K. Surgical repair of post infarction ventricular septal defects: A national experience. *Eur J Cardiothorac Surg* 2005;27:216-21.
10. Deville C, Labrousse L, Choukroun E, Madonna F. Surgery for post-infarction ventricular septal defect (VSD): Double patch and glue technique for early repair. *Multimed Man Cardiothorac Surg* 2005;2005:mmcts.2004.000562.
11. Park SJ, Kim JB, Jung SH, Choo SJ, Chung CH, Lee JW. Surgical repair of ventricular septal defect after myocardial infarction: A single center experience during 22 years. *Korean J Thorac Cardiovasc Surg* 2013;46:433-8.
12. Dalrymple-Hay MJ, Langley SM, Sami SA, Haw M, Allen SM, Livesey SA, *et al.* Should coronary artery bypass grafting be performed at the same time as repair of a post-infarct ventricular septal defect? *Eur J Cardiothorac Surg* 1998;13:286-92.

**How to cite this article:** Ravikrishnan J, Patel JS, Hassan N. Classical Single Patch Repair and Revascularization for Post-infarction Ventricular Septal Defect: A Follow-up Study from a Semi-urban Tertiary Care Centre in South India. *Int J Sci Stud* 2016;4(1):85-89.

**Source of Support:** Nil, **Conflict of Interest:** None declared.