

Off-Pump Repair of a Post Myocardial Infarction Ventricular Septal Defect

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Date of Submission: Dec 26, 2013

Date of Acceptance: Feb 15, 2014

How to cite this article: Sabzi F, Dabiri S, Reza Poormotabed A, Faraji R. Off-Pump Repair of a Post Myocardial Infarction Ventricular Septal Defect. *Int J Prev Med* 2014;5:907-11.

ABSTRACT

Refractory cardiogenic shock meant that traditional patch repairs requiring cardiopulmonary bypass would be poorly tolerated and external sandwich closure of post myocardial ventricular septal defect (VSD) appears to be simple and effective after initial myocardial infarction (MI). The three cases presented with a VSD after of acute MI with or without thrombolysed with streptokinase during patient admission. The general condition of the three patients was poor with pulmonary edema, low cardiac output and renal failure. The heart was approached through a median sternotomy. Off-pump coronary artery bypass grafting of the coronary artery lesion was done first using octopus and beating heart surgery method and latero - lateral septal plication was performed using sandwich technique. Low cardiac output managed with intra-aortic balloon pump in these patients accompanied with inotropic drugs. Post-operative transesophageal echocardiography revealed that VSD was closed completely in one patient and in two patients small residual VSD remained. More experience is required to ascertain whether this technique will become an accepted alternative to patch repairs.

Keywords: Off-pump repair, sandwich, ventricular septal

INTRODUCTION

Post myocardial ventricular septal defect (PMI VSD) is a rare complication of myocardial infarction (MI) and in autopsy studies reported incidence of free wall rupture was 10% but incidence septal wall perforation is much less common, occurring at a rate of approximately 1-2%.^[1] The most important risk factors for death in the early phase are poor hemodynamic and associated right ventricular dysfunction (RVD) developing before the patient comes to the operating room. RVD results from ischemic damage or frank infarction of the right ventricle and is present when stenosis occurs in the right coronary artery (RCA) system. Barker *et al.* has suggested hamburger techniques (postero-anterior approximation) without cardiopulmonary bypass (CPB) for this condition.^[2] We report three case of off-pump repair with lateral to lateral approximation of VSD (sandwich procedure) in apical portion of inter ventricular septum.

CASE REPORTS

Case 1

The first case is about a 67-year-old male patient who referred to our hospital after an acute anterior MI. His hemodynamic condition was poor and remained with low cardiac output state and so for him an intra-aortic balloon pump (IABP) was inserted and emergency angiography which showed severe stenosis of RCA, left circumflex artery and the left anterior descending artery and transthoracic echocardiography (TTE) confirmed a 3 cm antero-apical VSD and an akinetic ventricular apex. Despite IABP and high dose inotropic drugs, diuretics and nitrates were added for progressing renal failure and respiratory failure. Repeat TTE images showed the right ventricle was severely dilated; global left ventricular (LV) function was severely reduced. Facility of transcatheter closure was not present in our center. 5 day after admission, she developed respiratory and renal failures which were not controlled by diuretics. A decision was made to perform an emergent surgical repair and he underwent an off-pump sandwich repair concomitant with coronary artery bypass grafting (CABG). The heart was approached through a median sternotomy and a latero-lateral septal plication or sandwich procedure was performed using two Dacron strip supported with interrupted sutures. The dacron strip was preloaded with sutures and the needles were passed first through the LV free wall inferior to apical portion than inferior to interventricular septum defect aiming to right ventricular (RV) free wall where the tip of the needle is retrieved and tightened [Figures 1 and 2] VSD closure was assessed using transesophageal echocardiography (TEE) [Figure 3]. Soon after surgery, she began to improve and her inotropes and furosemide were discontinued. However, she required a tracheotomy to facilitate weaning from mechanical ventilation. She was transferred to a rehabilitation facility 4 weeks after the operation. She was found to be asymptomatic and mobilizing independently at 6 month follow-up.

Case 2

A 70-year-old man referred to the emergency department with extensive antro lateral MI, respiratory failure and high serum level of blood urea nitrogen (BUN) and creatinin. He was

hemodynamically unstable initially and a coronary angiogram was performed and showed three vessel diseases. An urgent TTE show a pericardial effusion and VSD was confirmed. Surgery was performed via a median sternotomy and on the beating heart without the use of CPB. The VSD defect was repaired with sandwich method as described in first case as CABG [Figure 4]. An IABP (IABP, Datascope) was inserted emergently after the procedure to reduce cardiac after-load. Post-operatively, the patient returned to the intensive therapy unit in unstable condition with high dose inotropic support. The patient was successfully extubated 3 days post-operatively and remained hemodynamic ally stable. The IABP was removed 2 days after surgery. The rest of the post-operative course was complicated with acute renal failure. A trans-thoracic echocardiogram show thin residual VSD and severe left and RVD and no valvular abnormalities [Figure 5]. Low cardiac output did not respond to IABP, high dose inotropic drugs and MOF progressed and patient died with low cardiac output syndrome.

Case 3

The case we present here is a 77-year-old patient was admitted to the hospital due to typical chest pains that had persisted for several days. Coronary angiographic examination was performed immediately, revealing three-vessel coronary artery disease. The patient refused any intervention like percutaneous coronary intervention or surgery and leaved the hospital in the 14th day of the infarction, the patient readmits with sudden dyspnea and discomfort in the chest. Auscultative examination revealed a new loud murmur over the whole heart. Echocardiography revealed a VSD in the anteroapical part of the ventricular septum with a significant left-to-right shunt. Immediately after the implementation of an IABP the patient lost consciousness; he was intubated and moved to a cardiac intensive care room. Thanks to the assistance of the IABP and the inclusion of catecholamine's and diuretics, hemodynamic stability was attained; however, the patient was unconscious and was not reacting to stimuli and due to unclear neurological status emergency cardiac surgery was not undertaken. During the subsequent days, the patient's neurological status improved gradually, the patient regained consciousness and started to

react to stimuli; periodically he appeared to comply with simple instructions. During the 7th day after the diagnosis of PMI VSD, with raising BUN and creatinin serum levels, the patient was moved to the operating room for surgical treatment [Figure 1]. The chest was opened by median sternotomy and repair performed by sandwich procedure [Figure 6]. However the patient respond to painful stimuli but his low consciences and blood gas finding was not appropriate for weaning from mechanical ventilation and for better respiratory care tracheostomy was performed post-operative TEE showed no residual VSD. Inotropic drugs were tapered and IABP was removed in 7th post-operative day. The patient died with clinical picture MOF in 20th days of operation.

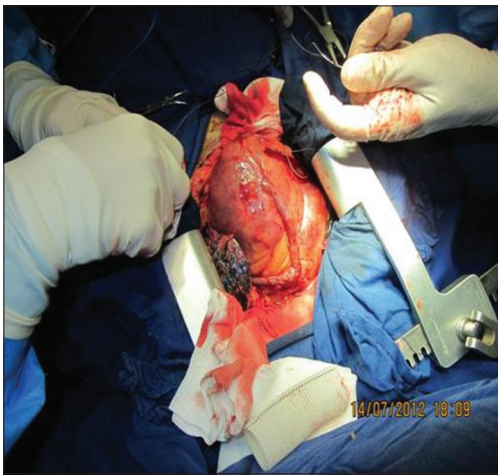


Figure 1: Coronary revascularization with off-pump method before sandwich procedure



Figure 3: Echocardiography in four chamber view showed small residual ventricular septal defect with reduction of left ventricular geometry (white arrow)

DISCUSSION

However, Barker *et al.* showed that the “sandwich procedure” was an effective method for repair of a PMI VSD but we think that preoperative organ failure has important effect on good postoperative outcome. Effectiveness of sandwich procedure revealed by dramatic reduction in pulmonary arterial pressure and inotropic doses occurred immediately after surgery.^[2] These patients benefited from a short operative time compared with a longer, more complex open patch repair requiring CPB and ventriculotomy. The only limitation of this technique related to mild or moderate reduction in LV and RV chamber size produced by bringing the left and right ventricles into close apposition with sandwich procedure, Another's benefit of this procedure is that we don't need to postponed VSD repair for 4 weeks to allow



Figure 2: Intraoperative view of sandwich procedure



Figure 4: Sandwich procedure

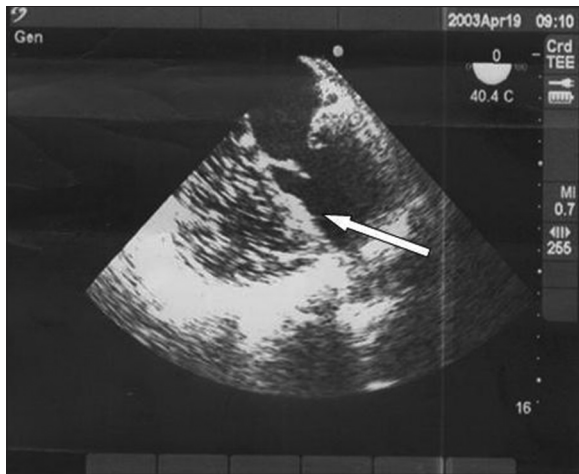


Figure 5: Echocardiography in four chamber view with injection of propofol in right atrium showed no residual ventricular septal defect (white arrow)

the fibrotic process in the infarcted myocardium to become established. As Chikwe *et al.* demonstrates, echocardiography is not only essential in the diagnosis of PMI VSDs but also plays an important role in guiding VSD closure when the “hamburger procedure” is utilized. In two of our cases, extra sutures were added to the initial plication after echocardiography had demonstrated that VSD closure was incomplete. TEE enabled us to ensure that successful closure was achieved. TTE was used in the post-operative period to show that there was no residual VSD prior to discharge. Barker *et al.* found that the sandwich procedure’ is a new alternative method for antroapicalseptal position in PMI VSD repair. This technique would not be appropriate for posterior VSDs or VSDs higher up the septum closer to the atrioventricular valves.^[2,3] A study by Mullasari *et al.* found that a clinical controlled trial could be needed to compare outcomes after non-surgical technique such as trans catheter closure with those after conventional methods such as open and closed surgical methods. The author demonstrated that in this comparison, VSD recurrence rates, functional outcome and mortality would be considered and evaluated.^[4] In this case series, however two of patients died in the hospital but these two patients had preoperative ARF, respiratory failure and neurologic dysfunction but we believe that the risk of morbidity and mortality was reduced by avoiding CPB in preoperative low risk patients and therefore we are confident that the “hamburger procedure”

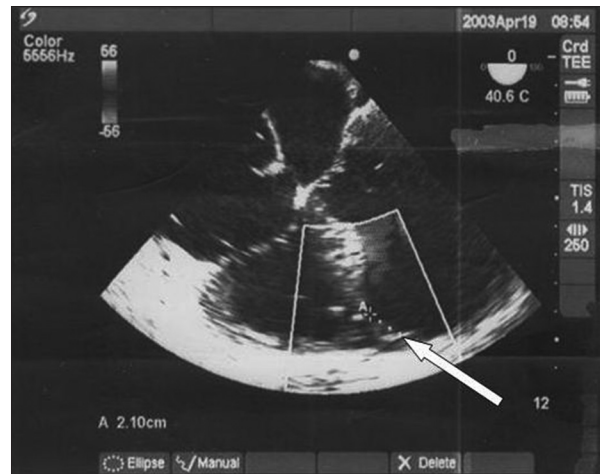


Figure 6: Echocardiography in four chamber view showed no flow across the repaired septum (white arrow)

may become an accepted and useful technique in the future. Hosoba *et al.* in their study have reported mid-term result of mid-term results for the use of the extended sandwich patch technique through right ventriculotomy for post infarction VSDs in open heart surgery that different with ours closed and beating technique.^[5]

CONCLUSIONS

Off-pump closure technique called the “hamburger procedure” has been pioneered by Chikwe *et al.* as an alternative to open procedures that require CPB and ventriculotomy. The aim of our report and Barker report is to describe how a post-infarct VSD may be repaired without CPB and to highlight the importance of echocardiography to guide VSD closure.

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

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