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VENTRICULAR SEPTAL RUPTURE AFTER MYOCARDIAL INFARCTION - ANALYSIS OF SURGICAL REPAIR

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ABSTRACT

Background of study: Management of Ventricular Septal Rupture (VSR) following myocardial infarction is a formidable surgical challenge. The objective of this study was to analyze the outcome of surgical repair in post infarct VSR.

Materials & methods: A retrospective study over a period of ten years was carried out in patients who presented with post MI VSR in our institution. All the patients were operated as early as possible, the only contraindication being multiorgan dysfunction. The techniques employed and the usage of IABP in this context is also discussed.

Summary: Early surgical intervention in spite of deteriorating hemodynamics is the dictum in most of these patients. Right ventricular dysfunction, LVEF and NYHA class at presentation were independent factors affecting long-term survival. Concomitant CABG did not influence early or late survival. Use of IABP did not improve the outcome substantially in our study.

KEYWORDS : Ventricular Septal Rupture (VSR); Myocardial Infarction (MI); Coronary Artery Disease (CAD), Intra-Aortic Balloon Pump (IABP)

Introduction

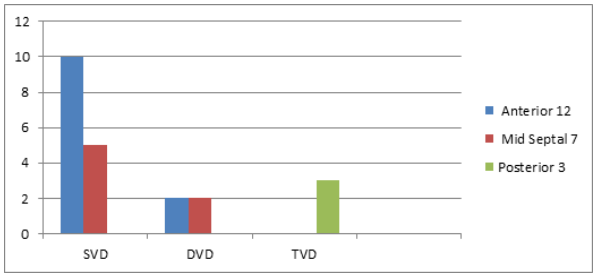
Mechanical complications of acute myocardial infarction (MI) are life threatening. Ventricular Septal Rupture (VSR) occurs in 1-2 % of patients in the first week following myocardial infarction[1]. Mortality rate for post MI VSR remains high in the range of 20-40% in spite of advances in critical care and life support systems[2]. Early surgical intervention offers the only best chance of survival in majority of these patients even though associated with high morbidity and mortality. The earlier occurrence of VSR and its complex profile in the background of thrombolysis make the surgical results even guarded[2,3]. The objective of this study was to analyze the outcome of surgical repair in post infarct VSR

Materials and methods

Over a period of 10 years from June 2007 to June 2017, a total of 22 patients underwent surgery in our unit for post infarct VSR. Eight patients were not considered for surgery of which 5 were elderly, moribund and terminally ill with multi organ dysfunction at the time of diagnosis, whereas 3 patients were not willing for surgery. Most patients were operated within 18 hours (range 4-48hours) after diagnosis except in 2 where surgery was delayed because of logistic reasons. Patients who were diagnosed elsewhere typically had late referrals leading to non-operable scenarios.

The mean age of the Patients was 53 years (45-73 years). There were 13 males and 9 females in the operated group. All patients were in NYHA class 4 at presentation with a mean ejection fraction of 36% (25-60%). Diagnosis of VSR was established with Trans thoracic Echocardiography with emphasis to rule out mitral regurgitation and assessment of both left and right ventricular function. The location of VSR was anterior in 12, mid septal in 7 and posterior in 3. The mid septal location was assigned to VSRs which were high and close to the basal septum, but not posterior enough to be classified in that entity. All patients underwent Coronary angiography which showed that 15 had single vessel disease(SVD), 4 had double vessel disease(DVD) and 3 had triple vessel disease(TVD) (chart 1). Left ventricular angiography was not done in any patient not only because it was deemed to be of no additional benefit but risky as well. Five patients needed pre-operative mechanical ventillatory support.

Chart 1: VSR location and incidence



All patients were taken up for surgery on an emergency/ semi emergency basis. Trans esophageal Echo guidance was used in patients who were operated after 2010. After sternotomy expeditious Cardiopulmonary bypass was established with aortic and cavo atrial two stage venous cannula. Patients were cooled to 30 degrees and cold blood cardioplegia (St Thomas solution) given through aortic root for myocardial protection after aortic cross clamping. VSR was approached through a trans infarct left ventriculotomy incision. Infarcted muscle was excised and defect closed by a general technique as follows; Interrupted pledgetted polypropylene 4-0 sutures were taken all around the defect, taking generous normal myocardium into each bite to prevent the suture cutting through the tissues. Thereafter a Double Velour Dacron patch was used to close the defect and the repair reinforced with a running continuous polypropylene suture of same size all around the patch. Apart from patch closure, combination of procedures like infarctectomy and apical amputation were done in 3 cases which had defects close to apex. In 3 cases of anterior VSR, we have employed infarct exclusion technique with gratifying results. Thereafter ventricular wall was closed directly with Dacron felt buttressed double layer polypropylene 4-0 sutures. Tissue sealant gum was applied prophylactically over the sutured anterior wall of ventricle to reinforce repair and thereby prevent bleeding, in patients who got operated after 2010 .

We have adopted a conservative strategy for LAD grafting in extensive infarct of the anterior wall. Only if the vessel quality was good with reasonably good run off, LAD was grafted which was decided finally on table after assessing the thrombus load and caliber of vessel and extent of muscle involved by infarct. Coronary Artery Bypass Grafting was done in all triple and double vessel disease cases with vein grafts in non-LAD territory.

Results and Analysis

All patients could be successfully weaned off Cardiopulmonary Bypass with moderate inotropic supports. Elective preoperative IABP was instituted in 10 patients, 4 patients received IABP support in post-operative period. Of the 8 patients who did not receive IABP, there were 7 survivors. Sixteen patients survived the operation and are on regular follow up. Six patients expired postoperatively in the first month, either in hospital or after discharge. The causes of mortality included re appearance of VSR, low cardiac output and multi organ dysfunction in 3 patients and difficulty to wean off ventilator in 3 cases. Cardiopulmonary Bypass time was 96- 178 minutes (mean 142) and Aortic Cross Clamp time was 58-112 minutes (mean 66). Concomitant CABG was performed in 8 patients. Most patients needed prolonged ventilation for at least 48 hours and moderate inotropic supports (Adrenaline 0.05mic/ kg and Dobutamine 5 mic/kg).

Post-operative residual shunts were detected in 6 patients. Out of these, 3 patients succumbed to the illness, but the other 3 patients had insignificant shunts. Because the hemodynamic status was satisfactory and functional class better, it was deemed not necessary to re correct the anatomical defect.

Discussion

Even after evolution of modern surgical strategies, Ventricular Septal Rupture remains one of the most challenging conditions encountered by cardiac surgeons today. The availability of early reperfusion therapy for myocardial infarction has led to the declining incidence of post-infarction VSRs . The operative mortality in our series was 27% which is comparable to other studies in literature[3].

The optimal timing of surgical repair for VSRs is critical. A longer interval before surgery has been reported to be associated with improved survival in a subset operated patients if they remain functionally stable. But considering the same yardstick, 70% of patients die in the first month without any intervention, emphasizing the fact that early surgery confers benefit in more than 50% of patients.

Coronary angiography is done for all patients who are planned for surgery. Single Vessel Disease was significantly more common in anterior VSRs compared to posterior VSRs in this series, similar to the findings of Davies et al[4]. Our conservative strategy of grafting LAD (Done only if macroscopic viable myocardium was present after VSR repair and distal runoff was good) in anterior VSR with SVD has had good results. Lundblad et al[5] found that concomitant CABG during VSR repair reduces both early and late mortality when compared with patients with non-bypassed coronary artery disease.

In a review of recent literature, Perotta et al[6] reported an improvement of mortality rates from 26.3% in those without CABG to 21.2% in those who had undergone CABG. These results applied to patients with multi-vessel disease where complete myocardial revascularization was achieved by bypassing all stenotic coronary arteries supplying non-infarcted areas. Actuarial survival at five years from this series ranged from 29% to 72%. In this study, there was no statistically significant early or long-term survival advantage for patients who had undergone concomitant CABG. Other authors have reported similar findings. Despite the lack of significant survival benefit associated with concomitant CABG in their studies, some authors advocate concomitant CABG during VSR repair as long as it can be performed safely[7]. The aim is to reduce further ischemic risk associated with multi-vessel coronary artery disease by improving collateral flow to the myocardium.

The Society of Thoracic Surgeons database to characterize patients undergoing surgical repair of post-MI VSR and to identify risk factors for poor outcomes found that Operative mortality was 54.1% if repair was within 7 days from MI and 18.4% if more than 7 days from MI[8]. Multivariable analysis identified several factors associated with increased odds of operative death. The incidence of post-operative residual shunt was 27% comparable to the incidence of 24 to 26% described in other series in which a variety of techniques were used. Hemodynamically insignificant shunts probably due to peripatch leaks can be left alone as has been done in our series. But when a VSR reopens in the immediate post operative period especially in the background of previous thrombolysis, it is bound to have deteriorating hemodynamics and catastrophic consequences. The myocardial fragility and vague margin of the infracted tissue may be attributable to the relatively high incidence of residual shunt. A study suggests that residual VSD occurrence would be reduced with a double patch technique as compared to a single patch technique[9]. We have adopted a technique of generous left ventricular resection whereas to perform judicious and cautious limited resection of right ventricle to prevent right ventricular dysfunction. RV failure has a negative impact on early and late survival as suggested by Moore et al[10]. This assumes even more significance in surgery of posterior VSR, as we have seen in our series. As RV failure ensues, the left-sided cardiac chambers are unable to fill, leading to biventricular failure and low cardiac output.

The use of IABP and its impact on survival can be analyzed in two ways. At one end of spectrum is a set of very sick patients who need pre-operative circulatory support for survival. The results after surgery in these patients are poor because multiorgan dysfunction ensues in post-operative period as we have seen from our study. Of the relatively stable patients who come to operating room, the use of IABP has not really contributed to patient outcome, if the surgical repair is complete. This is underlined by the fact that without IABP, 7 out of 8 patients survived the operation.

Percutaneous closure has been increasingly used in patients with postinfarction VSRs, initially in patients with recurrent ventricular septal defects (VSDs) after primary surgical repair, but more recently as primary therapy in patients with acute VSR and high surgical risk, or as a temporizing bridge to surgery[11]. Despite a less invasive technique, procedural mortality and morbidity are high, especially in patients with cardiogenic shock. Overall 30-day mortality rates for percutaneous closure range from 28% to 65%. Other procedure-related major complications include residual shunting, left ventricular rupture and device embolization. The highest technical success has been reported with the Amplatzer device[12]. Lee et al[13] recently described the use of a hybrid approach with the advantage of allowing direct manipulation of the Amplatzer device. This approach prevents interference of the valve apparatus, avoiding the need to perform ventriculotomy in an already infarcted ventricle.

Recently ventricular assist devices have been employed as adjuncts in treatment of VSR in univentricular or biventricular failure, either preoperatively as a bridge to surgery or postoperatively following VSR repair[14]. Mechanical circulatory support with VADs allows restoration of peripheral organ perfusion and provides an opportunity for recovery and maturation of the infarcted myocardium before secondary VSR repair.

Conclusion

Despite improvement in medical treatment and revascularization techniques, the rate of VSR complicating AMI has not changed during the previous two decades, and the mortality associated with VSR has remained high and relatively constant. Early surgical intervention in spite of deteriorating hemodynamics is the dictum in most of these patients. Right ventricular dysfunction, LVEF and NYHA class at presentation were independent factors affecting long-term survival. Concomitant CABG did not influence early or late survival. Similarly, the institution of IABP did not improve the outcome substantially in our study .Timing of surgery is the key, emphasizing the fact that surgery has to be undertaken before blood urea nitrogen begins to rise and multiorgan dysfunction sets in.

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