Echocardiographic Assessment of Ventricular Septal Rupture and Left Ventricular Aneurysm after Inferior and Posterior Myocardial Infarction

Giuliana Pace, Gianfranco Filippone¹, Egle Corrado, Fabio Triolo¹, Vincenzo Argano¹, Salvatore Novo
Department of Internal Medicine and Cardiovascular Disease, Division of Cardiology and Cardiovascular Rehabilitation, University Hospital Paolo Giaccone, ¹Unit of Cardiac Surgery, University Hospital Paolo Giaccone, Palermo, Italy

Abstract

We present a case of posterior ventricular septal rupture associated to left ventricular aneurysm managed, during peri-operative period, by transthoracic and transesophageal echocardiography. Three-dimensional transesophageal echocardiography findings add adjunctive and more accurate information regarding morphological details of the ventricular septal rupture rather than two-dimensional echocardiography, allowing, meanwhile, the detection of the outcome of the surgical repair.

Keywords: Left ventricular aneurysm, myocardial infarction, transesophageal echocardiography, ventricular septal rupture

Introduction

Mechanical complications of myocardial infarction (MI) represent, in the last decade, a rare disorder due to early and wide use of percutaneous intervention.[1,2] Postinfarction ventricular septal rupture (VSR) is the second most common form of cardiac rupture[3] with a reported incidence up to 2% of all acute MI. Almost 80% of all patients with postinfarction VSD develop cardiogenic shock or congestive heart failure leading to early surgical treatment or death if medically managed.

Cardiogenic shock is the most important predictor of intraoperative mortality in these patients, and conservative management of apparent hemodynamically stable patients is not advisable because most of them develop heart failure and/ or cardiogenic shock. To optimize surgical repair, the accuracy of diagnosis, both in preoperative moment as well as in the perioperative one, is mandatory. Diagnosis and assessment can be obtained by the combinational use of two-dimensional and three-dimensional transthoracic echocardiography (TTE) and transesophageal echocardiography (TEE). Two-dimensional findings can be further enhanced by the use of three-dimensional TEE, allowing either a better delineation of the size and the shape of the rupture size either optimal visualization of the mitral annulus and papillary muscles.[4,5]

Herein, we report about a patient presenting with a posterior VSD associated to inferior aneurysm successfully treated using the David technique, managed during pre- and peri-operative period, by transthoracic and TEE. Three-dimensional echocardiography findings add adjunctive and more accurate informations about VSD rather than those obtained using two-dimensional echocardiography exclusively.

Case Report

A 70-year-old male with a history of smoking and hypertension was referred to our department due to acute onset of low output syndrome after inferior and posterior ST-segment elevation MI (STEMI) and the suspect of ventricular septal rupture. The patient came from other institution orotracheal intubated...

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Address for correspondence: Dr. Giuliana Pace, Department of Internal Medicine and Cardiovascular Disease, Division of Cardiology and Cardiovascular Rehabilitation, University Hospital Paolo Giaccone, Via del Vespro, 129, 90127, Palermo, Italy.
E-mail: giuliana.pace@libero.it

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Physical examination reveals a Grade 3–4/6 Levine holosystolic murmur on left sternal side and a reduced pulmonary sound. The ECG showed a ST segment elevation and Q waves in the inferior leads in association with ST-segment depression in V2–V6 [Figure 1]. The blood tests reported positivity of high sensitivity troponin values (86 pg/ml) and mild leukocytosis.

Preoperative TTE showed a huge aneurysm of the midbasal segments of the inferior wall of left ventricle; moreover, from subcostal view, it was highlighted as a rupture of the interventricular septum [Figure 2].

TEE confirms the evidence of the interventricular septal rupture, depicting the size of the defect and the shunt between left and right ventricle with 2.2 Qp/Qs ratio [Figure 3].

Diagnosis of inferior and posterior STEMI with mechanical complication was established and then angiography was performed. It showed long critical occlusion in the proximal segment of the right coronary artery, critical stenosis of the circumflex artery, and moderate stenosis of the proximal left anterior descending. The examination was completed with the ventriculography. It confirms the huge left ventricular aneurysm of about 6.5 cm × 6 cm with a 3.5 cm neck, with contrast enhanced in the right ventricle and opacification of trabeculae carneae of the moderator band, indirect sign of the interventricular septal rupture [Figure 4].

Patient’s hemodynamic condition was stabilized with the introduction of intra-aortic balloon pump (IABP) associated to inotropic therapy. Despite best medical therapy, heart failure worsening and patient was referred for surgery. Intraoperative findings confirmed the interventricular septal rupture and huge inferior left ventricular aneurysm [Figure 3]. Mechanical complication of MI was repaired according to the exclusion technique described by David et al.,[3] using a large bovine pericardial patch; finally, the aneurysm was excluded with a linear repair. The culprit lesion (right coronary artery) was not treated during angiography neither during surgery because the repair of the two mechanical complications involved posterior descending artery; the circumflex artery was not considered suitable for graft. Postoperative TEE showed a reduced size of the defect, secondary to a lowering in strain forces, indirect sign.
of good performance of the patch, and good systolic function of both ventricles; on performing the 3D echocardiography, we were able to locate the good placing of the patch, which was well adherent to the interventricular septum; moreover, no residual shunt was observed by the Color Doppler analysis [Figure 5]. Postoperative course was uneventful, IABP has been withdrawn on 4th postoperative day (POD), the patient was extubated on 6th POD, and discharged on 17th POD.

**DISCUSSION**

Rupture of the interventricular septum is a fatal complication of acute MI characterized by very high mortality as well as dismal prognosis.\[6\] It has become a rare disorder, and based on the database of the Society of Thoracic Surgeons from 1999 to 2010, <300 interventions were performed per year in a total of 666 cardiac units surveyed.\[7\] The combined association of VSD with left ventricular aneurysm is a rare event.\[7,8,10\] The presence of both complications worsens the prognosis of the patient, as a consequence either of the left to right ventricular shunt, either of the systolic volume steel into the aneurysmatic sac.\[11\]

Medical therapy may only stabilize the patient, but the treatment of choice is surgery.\[13\]

To improve management, a prompt diagnosis is mandatory. Echocardiography permits an easy and noninvasive recognition of both mechanical complications. Two-dimensional TTE is a valuable tool for initial diagnosis, but the use of TEE allows a better assessment of ventricular function of both ventricles, dimension of the ventricular aneurysm, entity of the shunt, and eventual postsurgical residual shunt. However, two-dimensional TEE underestimates the size of the defect due to the nonparallel orientation of the ultrasonic beam to the long axis of the cardiac defect.\[14\] This limitation is obviated by three-dimensional TEE since multiple slices are aligned sequentially to reconstruct the full extent of the defect in three dimensions.\[5\] In fact, during surgical repair, a large defect was found, as the responsible of the deterioration of the hemodynamic status of the patient. Moreover, three-dimensional analysis permits a better definition of the surgical repair, depicting the anatomic and functional relationship between the pericardial patch and the cardiac structures (i.e., papillary muscles and mitral leaflets).\[2,5\]

We have reported this case to underline the relevant contributions and the utility of the TEE not only in the pre- and peri-operative management but mainly in the postoperative period.

**Declaration of patient consent**

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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**Conflicts of interest**

There are no conflicts of interest.

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