Case Report

Mitral valve repair in severe mitral regurgitation after blunt chest trauma

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ARTICLE INFO

Keywords:
Severe mitral regurgitation
Blunt chest trauma
Mitral valve repair
Echocardiography
Mitral leaflet

ABSTRACT

Mitral valve insufficiency is a pathological condition frequently caused by etiologies such as rheumatic heart disease, ischemic cardiomyopathy, leaflets prolapse, endocarditis, rupture of a chordae tendineae, ventricular disorders or congenital heart defects among others. Nevertheless, blunt thoracic trauma, although as a rare cause, can produce valve abnormalities. We describe a case of surgical mitral valve repair of a severe insufficiency caused by blunt chest trauma in a high energy road motorbike accident.

Background

Heart valve injuries related with blunt chest trauma are a rare condition. Only a few cases have been reported in the literature. The most common valve affected is the aortic, followed by the tricuspid and mitral valves. Echocardiography should always be performed as it is the most sensitive diagnostic test. Due to the complexity of these injuries an early diagnosis allows appropriate management and improves the postoperative functional outcomes.

A 47-year-old female without any prior medical history, who suffered a high energy blunt chest polytrauma in a motorcycle accident was referred to our institution six days after being admitted to a different hospital where the initial echocardiogram diagnose severe mitral valve insufficiency and suggesting a partial rupture of the annular ring, at the same time she was diagnosed with traumatic brain injury, multiple facial fractures (LeFort III fracture, a left orbit and zygomatic arch fracture), a left humerus open fracture, and several soft tissue minor lesions. At first she was referred to our institution as a possible candidate for extracorporeal membrane oxygenation (ECMO) therapy because of her hemodynamic instability, she developed acute respiratory distress syndrome secondary to pulmonary edema, as consequence respiratory failure requiring invasive mechanical ventilation. Studies confirmed a severe mitral insufficiency, bilateral pulmonary contusions, bilateral pleural and pericardial effusion, and multiple facial fractures as previously mentioned. Central nervous system hemorrhage or ischemia and spinal injury were ruled out.

Transesophageal echocardiography showed a severe mitral valve insufficiency, a partial tear of the annulus at the anterolateral commissure, prolapse of the posterior leaflet at the level of P1 and a coaptation defect at A2-A3 leaflets (Fig. 1). The coronary angiography ruled out coronary arteries disease. Additionally, a cardiac magnetic resonance was performed confirming multiple regurgitation jets and suggesting a partial tear or avulsion of the mitral annulus as shown in Fig. 2.

The patient underwent multiple surgical procedures during her index hospitalization including osteosynthesis of the left humerus, tracheostomy for a prolonged intubation, and multiple thoracentesis because of the presence of bilateral pleural effusions as...
Fig. 1. Images of echocardiogram. A–B–C: Parasternal window short-axis view of the four chambers showing thickening of the mitral annulus valve in relation with the trauma mechanism. D–E–F: Transesophageal window with 3D reconstruction, showing a regurgitation jet from severe mitral insufficiency due to suggested leaflet lesions in A1 and P1, with a suggestive FLAIL of leaflet P1 and an annular disruption.
Fig. 2. Magnetic resonance imaging of the heart: A. Insufficient mitral jet flow (red arrows) across the anterior commissure of mitral valve, pleural effusions also evident. B. Axial slice. C. Long axis - two heart chambers.
decompensated heart failure was instaued. Consequently, a multidisciplinary approach involving cardiologists, intensive care specialists, cardiac surgeons and other involved specialties determine the timing of the different interventions; on an every day follow up basis we determined to optimize medical therapy focusing on heart failure due to mitral insufficiency and to postpone heart surgery until the patient was stabilized from the others injuries as well as nutritional and functional aspects improved. Two months after her admission, the patient was discharged to her home with tracheostomy, self walking and eating, on a physical rehabilitation program, optimal medical management guided by cardiology and scheduled office visits as well.

Multiple office visits were performed. With a completely functional and well nourished patient follow up echocardiograms showed the persistence of severe mitral insufficiency and the same insufficiency mechanism mentioned above. As symptoms of dyspnea continued we decided to readmit her for mitral valve repair.

Approximately six months after her index trauma admission, we performed a programmed mitral valve surgery. A full sternotomy incision was made under cardiopulmonary bypass (central cannulation in the ascending aorta, bicausal venous drainage, aortic cross clamp and cold antegrade cardioplegia was administered), mitral valve was exposed by the Soondergard groove and left auriculotomy. Surgical findings showed that the anterolateral commissure suffered a partial 5 millimeter tear approximately, compromising the insertion of the posterior leaflet on the mitral annulus at this level, the rest of the valve anatomy was examined and presented as normal. The defect was repaired with two pledgeted non-absorbable braided sutures and 5/0 polypropylene sutures repairing the partial tear of the ring at the level of the commissure restoring the usual implantation of the posterior valve to the native mitral ring, we also performed annuloplasty with a semi rigid complete ring size 26 as a reinforce of the tissue and sutures. Water test and intraoperative transesophageal echocardiography showed a satisfactory mitral plasty and ruled out any residual insufficiency. The patient's postoperative course was uneventful and without complications. To date, there is no evidence of new events related to cardiac failure as she remains asymptomatic and in functional class I/NYHA.

Discussion

Cardiothoracic blunt trauma accounts for 30 % of all myocardial lesions in major accidents [1]. Cardiac contusion is the most frequent injury, occurring in up to 76 % of patients [2,3]. Valve involvement, as reported in this case. Only a few cases have been reported in the literature, whereby the most common valve affected are the aortic, followed by tricuspid and mitral [2,4].

Mitral valve damage accounts for 0.01 % of cardiac lesions after chest trauma. It is more frequent in car crashes (51 %), followed by falls from great heights (15 %), and lastly motorcycle accidents (13 %) [2]. Described Mechanisms for mitral valve insufficiency are sudden increases of intracardiac pressure, this occurs when extreme tension is applied in the isovolumetric contraction of the cardiac cycle, at the precise moment when the mitral valve is most vulnerable [3]. Thus, the mitral valve is most susceptible to injuries during the late diastole and early systole; an impact at these moments can alter the mitral apparatus significantly [1] causing papillary muscle injuries, chordae tendineae ruptures and/or leaflet tears [5], with the former being the most common cause in 60 % of the cases [4]. Clinical signs and symptoms can vary, from being asymptomatic to life-threatening acute cardiogenic shock [1]. In our patient, symptoms were associated with the multiple episodes of pulmonary effusion and acute pulmonary edema. Sternal fracture is a common feature reported in these cases [1]; nonetheless, it was not documented in our patient.

Echocardiography should always be performed in patients with blunt chest trauma in the emergency department. This is the most sensitive diagnostic test as well as an excellent tool guiding the therapy because of its capacity to describe the underlying mechanism of the lesion [6,7]. If aortic or mitral valve injury is suspected, a transesophageal echocardiography has been demonstrated to be safe in critically ill patients and should be considered in patients with poor acoustic windows [6].

Acute traumatic severe mitral regurgitation warrants the need for definitive treatment once hemodynamic stability has been ideally achieved [6]. However, the decision remains as a case-by-case multidisciplinary approach depending on the risks and benefits considered on the patient status. Additionally, consideration between valve repair versus valve replacement depends on the extent of the injury after a careful intraoperative examination of the valve anatomy, feasibility of a satisfactory repair and the surgical team expertise and knowledge.

Conclusion

We report a rare case of severe mitral insufficiency caused by a high energy blunt chest trauma in motorcycle accident treated by a multidisciplinary approach and a deferred surgical correction responding to the patient's complex clinical condition upon admission. Surgical mitral valve repair was performed on a partial tear of the anterolateral commissure and posterior leaflet several months after the accident. The successful repair was completed without any residual insufficiency. Based on this report, we recommend that cases of high energy blunt thoracic trauma must be examined thoroughly and an echocardiography has to be performed in order to rule out cardiac disturbances. We also consider that surgical and medical management must be individualized and discussed in a multidisciplinary manner.

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