

Case Report

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Rupture of the Left Ventricle in the Atrioventricular Groove After Mitral Valve Replacement: A Case Report



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Background

As we grow older, and our population continues to live longer due to advancements in modern medical therapies, we have a growing population of elderly patients. There will inevitably be more patients who present with mitral stenosis secondary to severe mitral annular calcification and a corresponding need for repair due to the nature of increased friable myocardium present within these tissues. Atrioventricular dissociation associated with left ventricular rupture after mitral valve replacement occurs in approximately 1.2% of cases, and of those cases there is up to a 75% mortality rate even when appropriate surgical techniques are performed [1].

Case Presentation

A 67-year-old Caucasian male presented with dyspnea on exertion. He has a history of severe mitral valve regurgitation following a previous annuloplasty two years prior in 2019, at the time he underwent repair at an outside facility. Early on, following initial mitral valve repair he was noted to have severe mitral regurgitation and a dehiscenced ring. At that time the decision was made to not reoperate and to follow-up closely in a year and a half. He however was experiencing worsening dyspnea which prompted the cardiothoracic surgery team to take the patient to the operating room as the patient was poor candidate for transcatheter mitral valve replacement (TMVR). In the operating room the ring was dehiscenced for approximately 50% of its circumference and then excised completely. The midportion of the anterior and posterior leaflets of the mitral valve were taken out and a 33mm Edwards tissue valve was secured in place. The patient was weaned from cardiopulmonary bypass, was decannulated, protamine was given, and three chest tubes were placed. Intraoperative transesophageal echocardiogram was performed, which showed an ejection fraction of 30%, and the patient's mitral valve had an annular dimension of 4.8 x 4.4 centimeters with visible ring dehiscence with 4+ mitral valve

regurgitation with a small perivalvular leak which improved after protamine administration. Patient was transferred to the intensive care unit on a ventilator for post procedure care.

While in the intensive care unit, patient began to develop symptoms of hypotension as well as severe bradycardia, needing increasing requirements of pressor support. Additionally, there was bleeding from the distal portion of the sternotomy incision site. Emergent Transesophageal echocardiogram (TEE) was performed and a large collection of pulsatile flow likely representing a contained pseudoaneurysm in the posterior portion of the left atrium was seen. Patient was immediately taken back to the operating room for emergent mediastinal exploration. The previous left atrial incision was opened and it was noted at this point that the mitral valve appeared to dehiscence at the posterior annulus. The previous mitral valve replacement was excised and there was a large defect at the base of the mitral valve down to the left ventricle. There was an extensive hematoma in this region. The bovine pericardium was used to seal the entire region of the posterior annulus and directed down to the ventricle and circumferentially beyond the mitral annulus. The native tissue was found to be extremely poor and friable. Then a 31mm Saint Jude epic tissue valve was used with 23 sutures in total and the valve was secured in place. Following this, the left atrium was closed. At this point there was noted to be extensive bleeding posterior to the atriotomy and on the left along the left ventricular surface. Additionally, there was extensive bleeding underneath the left atrium in general. Cardiac function was noted to be extremely poor despite significant inotropic support. There was an extensive amount of bleeding along the atrioventricular groove and this could not be managed despite placement of multiple sutures. Multiple unsuccessful attempts were made to wean from cardiopulmonary bypass and attempted to stop the bleeding. Unfortunately, despite our best resuscitative efforts the patient succumbed to his complications (Figure 1).

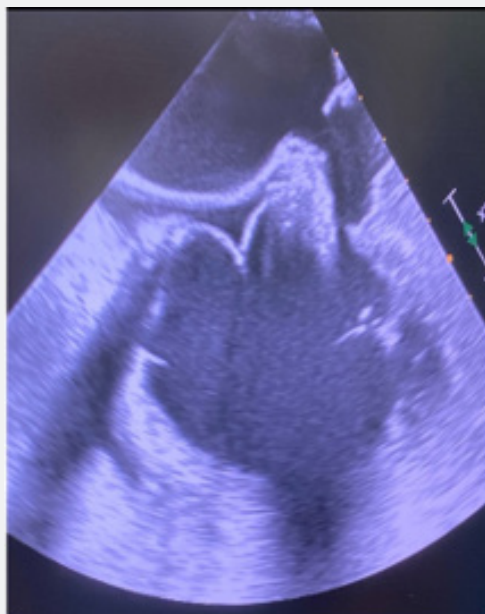


Figure 1: Intraoperative transesophageal echocardiogram: mitral valve had an annular dimension of 4.8 x 4.4 centimeters with visible ring dehiscence with 4+ mitral valve regurgitation with a small perivalvular leak.

Discussion

Rupture of the left ventricle is a rare complication of mitral valve replacement, occurring 0.5 to 2 % of the time and is often fatal despite prompt and appropriate surgical repair [2]. Left ventricular rupture after mitral valve replacement can be classified into three main subtypes. Type I is the most common type and is located at the atrioventricular groove. Is most commonly associated with a heavily calcified mitral valve annulus, bacterial endocarditis with mitral valve annular abscess, resection of the posterior leaflet and chordae with placement of subannular sutures for valvular replacement, with consequent local trauma, hematoma, or rupture. Type II occurs at the base of the papillary muscles, primarily due to excessive resection of the posterior papillary muscle, with local hemorrhage and rupture. This can be due to ischemic, rheumatologic, infectious causes, or iatrogenic injury to the ventricular wall during excision of the papillary muscles. Type III is located between Type I and Type II lesions, and is most often related to posterior ventricular wall trauma, due to a large prosthetic valve in the setting of a small left ventricular cavity. The ventricular rupture can progress to give you a mixed type picture depending upon the location which can be a combination of any of the above types. Due to the advancements of mitral valve surgery over the past few decades, the incidence of Type II and Type III ruptures have significantly declined [1].

Risk factors/ pathogenesis: Include older age, hemodialysis, an end diastolic diameter less than 50mm, and poor preservation of the basal chordae of the posterior leaflet [3]. Most ruptures

are associated with surgical maneuvers such as retraction of the left ventricle while the left atrium is fixed with adhesions from a previous operation; extensive retraction of a papillary muscle; too large a prosthesis, presence of deep sutures in the myocardium, mechanical injuries to the left ventricle; forceful retraction, removal of the mitral valve under ischemic conditions or through stretch injury such as injury produced by the untethering of the left ventricle through removal of the mitral leaflet of the mitral valve [1].

Clinical presentation/Diagnosis: Unstable hemodynamics after cardiac bypass weaning, failure to wean off cardiac bypass, major bleeding from the left ventricle in the operating room or through the chest tubes, ventricular arrhythmias and or abrupt hypotension, and/or a huge dissecting hematoma with left ventricular failure can also be a presentation. Another lethal complication is left ventricular failure, thrombus embolization or rupture of aneurysm and death [3]. Doppler color flow echocardiography should demonstrate a sphere-shaped-like extravasation along the posterolateral wall of the left ventricle. Patients with a left ventricular rupture, especially in the atrioventricular groove, should have a left ventriculography performed before discharge, but with MRA and echocardiogram the need for this is decreasing [3].

Image on Left: Transthoracic echocardiogram, apical long axis view, with ventricular rupture present.

Image on Right: Transthoracic echocardiogram, apical long axis view, color-doppler mapping.

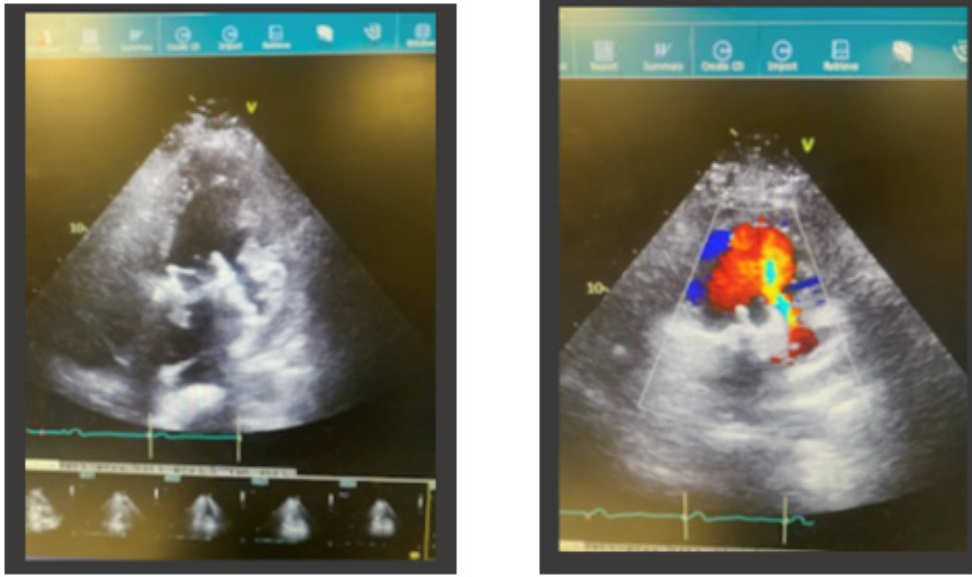


Image on Left: Transthoracic echocardiogram, apical long axis view, with ventricular rupture present.
Image on Right: Transthoracic echocardiogram, apical long axis view, color-doppler mapping.

Repair/Management: Difficulties in repairing a left ventricular rupture after mitral valve replacement are friable ventricular myocardium and which cannot hold sutures well, poor visualization of the anatomy at the site of rupture, inaccessibility of placing sutures through and through the ventricular wall which is adjacent to the atrioventricular groove and circumflex artery. Two main approaches to repair left ventricular rupture are both the external and internal approaches [3]. The internal method is considered the safest and most successful approach. Considerations to prevent left ventricular perforation are all posterior mitral valve chordae should be preserved, if possible, avoidance of extensive excision of calcium as it extends through the annulus, accurate sizing of the valve to the body of the ventricle and the area of the ventricle underneath the annulus, limited papillary muscle excision.

Our patient was an elderly 67-year-old male with previous mitral valve annuloplasty likely from significant adhesions from a previous operation. As stated earlier, our patient was brought to the operating room for elective mitral valve replacement, which occurred successfully without complications. The patient began to develop sudden onset hypotension as well as bradycardia, needing pressor support with 30mcg/kg/min of norepinephrine. Bleeding from the distal portion of the sternotomy incision

site was present. Transesophageal echocardiogram (TEE) was performed demonstrating blood flow across the left ventricular pseudoaneurysm. Entire region of the posterior annulus was sealed using bovine pericardium, his tissue was found to be extremely poor and friable. Ventriculography post repair was unable to be obtained as the patient unfortunately passed away.

Conclusion

Left ventricular rupture following mitral valve repair has a high mortality rate and is often under reported. We hope that early recognition of the signs of left ventricular rupture in elderly patients with a history of previous mitral valve repair/surgery and use of internal surgical method will aid in facilitating better surgical outcomes.

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