Case report

"FROM TAMPONADE TO TRIUMPH: LA rupture leading to cardiac tamponade during BMV managed successfully with Device closure followed by successful BMV"

Abstract:

The main objective of PTMC/BMV is to relieve the symptoms of MS by percutaneous approach and avoiding valve replacement surgery. However, complications like rupture of the Aortic root or heart chamber can lead to hemopericardium and eventually increase morbidity and mortality associated with emergency surgery. In this case report we have discussed a case in which the rupture of the left atrium was managed by device closure and BMV was done successfully by percutaneous route and valve replacement surgery was avoided.

Introduction:

Hemopericardium represents a significant complication associated with BMV. This complication stems from chamber perforation during transseptal puncture or manipulation of the balloon and wire during the procedure.[1] The incidence of hemopericardium during BMV varies from 0.6% to 4% and is one of the most common indications for emergency surgery.The manifestation (effusion/tamponade) is influenced by the device responsible for the perforation (needle/sheath/dilator), the perforated structure, hemodynamic status, and coagulation status. These factors play a crucial role in determining the outcome of the procedure.[1]In cases of cardiac tamponade complicating BMV, emergency surgery is strongly recommended, as percutaneous pericardial drainage alone is unlikely to effectively resolve the issue.[2]

In this case report, we have discussed a case of LA rupture during BMV by Accura Balloon leading to hemopericardium and cardiac tamponade which was managed by percutaneous device closure followed by successful BMV.

Case report:

A 52-year-old female, a known case of rheumatic heart disease came to cardio OPD with chief complaints of dyspnea which increased from NYHA class II to NYHA class III over one year despite OMT with beta-blockers and diuretics. The patient was also having a history of intermittent episodes of palpitations. The patient had undergone successful BMV three

times in the past in 1998,2011 and 2019. She had no other comorbidities or addictions. The general examination was normal. On auscultation, there was a loud S1 with an Opening snap followed by a mid-diastolic rumble. Routine lab investigations were within normal limits.

ECG was suggestive of AF with a controlled ventricular rate. TTE was suggestive of RHD with severe MS (MVA by PHT and planimetry=0.75 cm^2, P/M TMG 50/30 mm Hg), Both commissures fused, Trivial MR, Moderate TR and severe PAH (PASP= 90 mm Hg). Wilkin'sscore was 7. The patient was planned for elective BMV with CVTS standby.

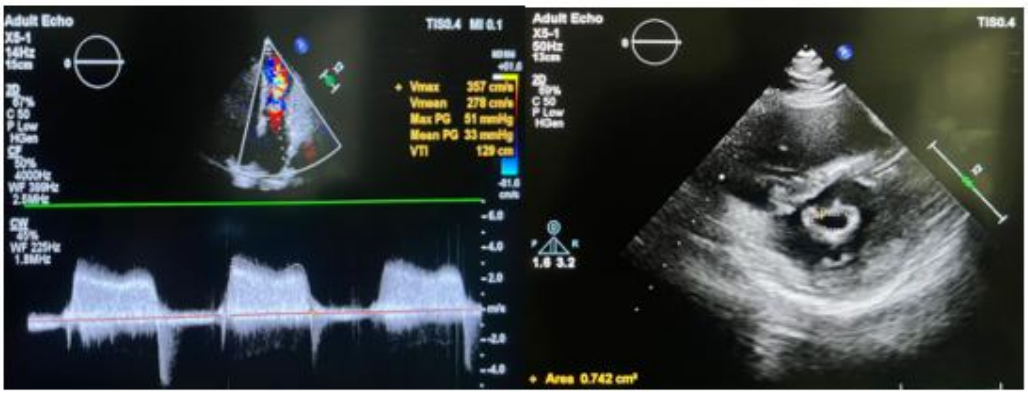

Figure 1 – (A) Colour Doppler across MV showing turbulent jet due to MS and CW showing P/M TMG of 51/33 mm Hg suggestive of severe MS. (B) PSAX view showing Fish mouth appearance of MV in open state in diastole with MV area of 0.74 cm^2 by Planimetry.

During BMV transseptal puncture was done using standard landmarks under fluoroscopic guidance. The position of the TSP needle in LA was confirmed with bright red blood, LA pressure waveform, and Dye injection under fluoroscopy. Looped LA wire wire was positioned in LA. There was no evidence of pericardial effusion at this point. Septal puncture dilated with Transseptal dilator over looped LA wire.

Figure 2 – (A) Transseptal puncture taken under standard fluoroscopic markers (B) Dye injection showing Mullins sheath positioned in LA after TSP

Accura balloon no 25 was passed over the looped LA wire into LA through the transeptal puncture. Accura balloon was then passed into LV and first inflation was given, giving suboptimal results with respect to TMG and MVA. Hence, a second inflation was attempted. While the balloon was maneuvered inside the LA to pass it into LV, the patient developed sudden onset hypotension and bradycardia. The patient had asystole which led to syncope following which the patient became unresponsive. CPCR was started immediately and the patient was intubated and put on ventilatory and ionotropic support. On TTE, there was pericardial effusion with tamponade physiology. Immediately pericardiocentesis was done and auto-transfusion was initiated. The patientwas revived with CPCR and pericardiocentesis. However, there was rapid recollection of blood and hence tapping with auto-transfusion continued.

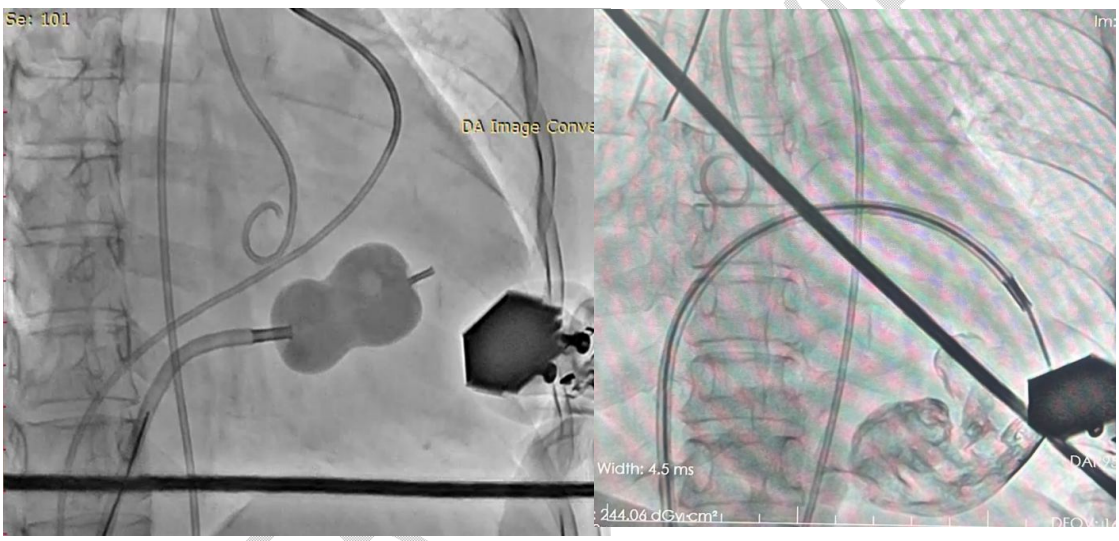

Figure 3 – (A) First inflation by Accura Balloon no 25 (B) Dye injection through Accura balloon s/o dye leak in pericardial space as the balloon is in the pericardial cavity due to LA free wall rupture.

The balloon was observed within the cardiac shadow at the left ventricle level during the fluoroscopy. As it was not going outside cardiac shadow we ruled out pulmonary vein rupture. Also, no ventricular premature contractions were detected on the electrocardiogram (ECG), indicating that the balloon had ruptured LA and was likely positioned in the pericardial cavity. Subsequently, a diagnostic fluoroscopic image obtained by injecting dye through the Accura Balloon revealed evidence of active dye leak into the pericardial space, resulting in staining of the pericardium. Therefore, it was definitively established that the balloon caused a rupture in the left atrium free wall and moved into the pericardial space. The Cardiovascular Thoracic Surgery (CVTS) team was immediately informed about the urgent need for surgery. Unfortunately, the patient couldn't be relocated because an emergency procedure was underway in the CVTS operating room, which was unavailable. Consequently, we made the decision to promptly close the left atrium defect using a device. The patient's family members were thoroughly informed about the

experimental nature of the procedure, as it offered a potential alternative to an otherwise inevitable surgery.

Amplatzersuperstiff wire passed through the Accura balloon into pericardial space crossing the defect in LA. Lifetech Konar MF VSD device 12/10 mm was loaded in 7F Lifetech delivery sheath and was passed over Amplatzersuper stiff wire. One rim of the device was opened into pericardial space andgradually pulled inside LA. As the outer rim of the device got stuck at the LA defect on pericardial side, the other rim was opened in LA. The device was placed perfectly across the LA defect and there was no dye leak into the pericardial space in the LA shoot.

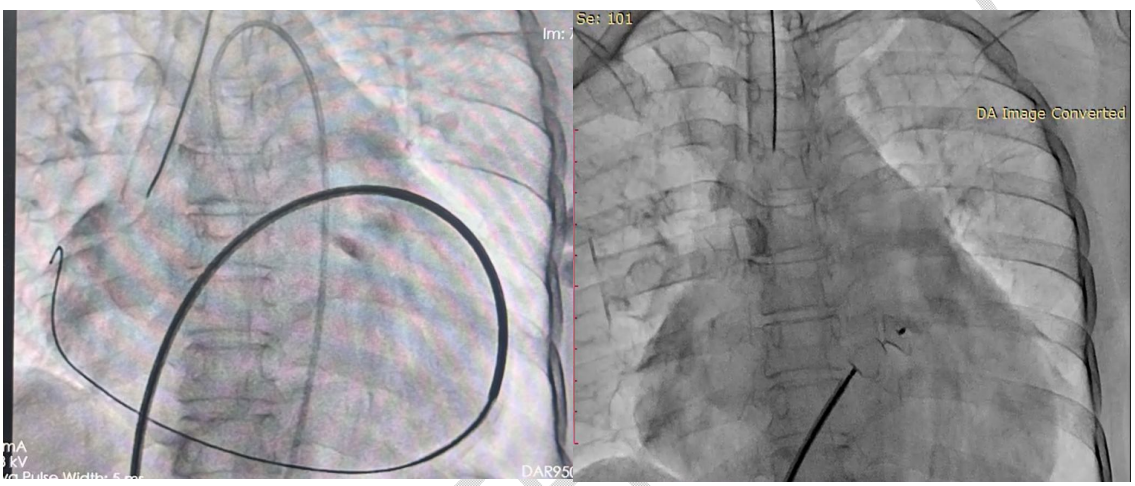

Figure 4 – (A) Amplatzersuperstiff wire in pericardial space (B) Positioning of the Konar MF 12/10 device across the defect in the LA free wall.

Pericardial effusion was drained completely and the patient was observed for half an hour in the cathlab for any recollection of blood in the pericardium. As there was no recollection and the patient had improved hemodynamics, the device was released.Now,the looped LA wire was passed into LA and then the Accura balloon was passed over the wire. The second inflation of BMV was given and optimum results were obtained with the decrease in TMG and an increase in MVA. LA pressures dropped from 58/25 mm Hg (mean 38) to 37/13 mm Hg (mean 24) and PA pressures dropped from 65/28 mm Hg (mean 47) to 50/22 mm Hg (mean 32).

Figure 5 – (A) Dye injection s/o device completely sealing the defect as there is no dye leak in pericardium (B) Second inflation given by Accura balloon no. 25 after stabilizing the patient with pericardial sheath in situ.

The patient shifted to ICCU on low-dose inotropic support.Post-procedure arterial line and pericardial sheath were kept in place for monitoring. There was no increase in pericardial effusion till 24 hours and ionotropes were tapered off. The patientwas extubated and the Pericardial sheath was removed.

Post BMV TTE: MVA by planimetry = 1.80 cm^2 with P/M TMG = 18/10 mmHg with splitting of both commissures with mild MR and mild PH with PASP/TR jet =40 mm Hg

The patient was discharged on T. Ecosprin 150 mg OD and oral anticoagulationwith low-dose diuretics and beta blockers.

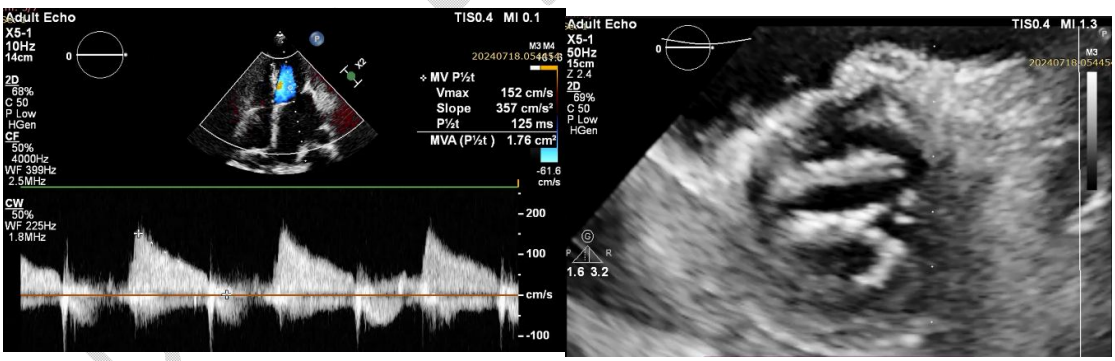

Figure 6 – (A) CW across MV showing MVA of 1.76 cm^2 by PHT and decreased TMG (B) PSAX view of MV post BMV showing bilateral split comissures with increased MVA up to 1.8 cm^2

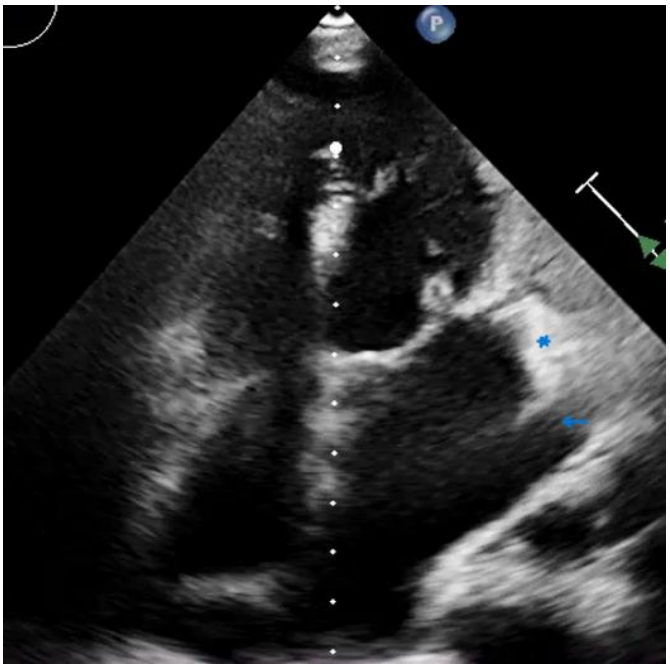

Figure 7 – The device (*) is seen towards the LV side of LA appendage (Blue Arrow)

Discussion:

Cardiac tamponade secondary to cardiac perforation following percutaneous transvenous mitral commissurotomy (PTMC) with an incidence of 0 to 9% in several studies account for half of procedure related mortalities, and is often managed by surgery if hemodynamically unstable.[3]The sites of perforation could be one of the cardiac chambers or the aortic root.[4]It has been suggested in previous research that emergency surgery is the recommended course of action for cases of cardiac tamponade complicating BMV, as percutaneous pericardial drainage alone is unlikely to successfully resolve the issue.[5]

The preferred approach involves per-operatively sealing the perforation and performing a surgical mitral commissurotomy, with the specific technique (open or closed) depending on the chosen surgical approach for sealing the perforation. Additionally, there have been reports of using cyanoacrylate glue to seal the stitch injury perforation via a pericardial sheath.[6]

Upon encountering this situation, we began to contemplate a different approach for closing the perforation. Subsequently, we opted to utilize a novel method involving a muscular VSD device to close the defect.We acknowledged the potential risks, including inadequate sealing of the defect and the possibility of ongoing hemopericardium. Additionally, we considered the risk of the device becoming dislodged into the LA/LV/pericardial cavity, which would have necessitated emergency surgical intervention.

Considering the diameter of the transseptal diameter (14F~5mm), the defect created is 5 mm in diameter. Hence, for adequate sealing of the defect devices with two rims and waist size approximately 10 mm will be adequate. We emphasize on keeping such device in cathlab where BMV is routinely done. This approach needs experienced interventional cardiologist with good experience in device closure procedures.

It is important to note that our intention is not to diminish the significance of emergency surgical intervention. Instead, we aim to emphasize the importance of interventionists carefully evaluating the circumstances and considering alternative methods when appropriate.

ABBREVIATIONS:

AF – Atrial Fibrillation

BMV – Balloon mitral valvotomy

CVTS – Cardiovascular Thoracic Surgery

CWD – Continuous Wave Doppler

LA – left atrium

MR – Mitral Regurgitation

MS – Mitral stenosis

MV – Mitral Valve

MVA – Mitral valve area

NYHA – Newyork heart association

OMT – Optimum Medical Therapy

OPD – Outpatient department

P/M TMG – peak/mean Transmitral Gradient

PAH – pulmonary artery Hypertension

PASP – Pulmonary artery systolic pressure

PHT – pressure half time

PSAX – Parasternal Short Axis

PTMC – Percutaneous transcatheter mitral commissurotomy

RA – right atrium

RA – Right atrium

RHD – Rheumatic Heart Disease

TEE – transesophageal echocardiography

TR – Tricuspid regurgitation

TSP – Transseptal puncture

TSP – Transspeptal puncture

TTE – transthoracic echocardiography

VSD – ventricular septal defect

VSD _ ventricular septal defect

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