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Right Ventricular Failure Post Minimally Invasive Mitral Valve Repair: Early Diagnosis and Management; Case Report

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Abstract: ***53 year old male was diagnosed with severe mitral valve regurgitation (MR) with P2 prolapse and ruptured cord. He underwent Minimally-Invasive (MIS) Mitral Valve (MV) repair via right mini-thoracotomy approach and femoral-femoral (fem-fem) cut down for Cardio-Pulmonary bypass (CPB). He developed Right ventricular failure (RVF) post operatively that was managed with Veno-Arterial (VA) Extracorporeal circulation Membrane oxygenator (ECMO) temporary mechanical heart support. He fully recovered and discharged home. Here we present a successful management of a rare complication that carries a high mortality after cardiac surgery. The key of successful management is early diagnosis and early management also discussed.***

Keywords: Right ventricular failure, mitral valve repair, Minimally invasive mitral valve surgery, ECMO

1. Introduction

Right ventricular failure (RVF) carries a significant burden of morbidity and mortality following cardiac surgery, necessitating early recognition and prompt treatment. RVF can occur early and late post open heart surgery. Our patient is 53 y.o male who underwent successful MV repair via MIS approach. On day-2 post-operatively he developed severe RVF causing cardiogenic shock characterized by metabolic, hemodynamic, and echocardiographic features. He was treated early with VA ECMO. He was weaned gradually from ECMO and was discharged home after full recovery.

2. Case Presentation

53 year old male presented with shortness of breath and murmur on exam. After full workup with transthoracic and transesophageal Echocardiography (TTE and TEE), he was found to have severe MR with P2 prolapse and ruptured chordae tendineae (see figure-1 and 2). His Left and right ventricle (LV and RV) were normal preoperatively as well as his coronary anatomy on coronary angiography. He was offered MV repair via minimally invasive approach.

Intraoperatively, we approached his MV via right mini-thoracotomy and fem-fem cut down for CPB. His MV was repaired in routine fashion used in all of our cases, i.e., Neo-chord implantation and annuloplasty rigid-ring. We tested the repair with saline test and it showed competent valve with no MR. However, after separation from CPB we examined intraoperative TEE that showed severe MR with systolic Anterior Motion (SAM) obstructing the left ventricular outflow tract (LVOT). SAM is a hemodynamic problem that appears only if the Heart is beating, hence, our saline test for MV repair was excellent after 1st repair. We went back on CPB and we re-paired the MV and SAM by making the posterior leaflet short and getting the anterior leaflet away from the LVOT. This was successful and he left the operating room with no MR or SAM (figure-3) In the ICU and on post operatively day 2, he developed Features of RV failure evident by metabolic, hemodynamic and ECHO cardio-graphic features of dilated RV and empty LV (figure-4). He failed to improve with inotropic support only and aggressive diuresis especially after he developed acute renal failure. We immediately put him on VA ECMO via the same fem-fem incision we used early-on in the MV repair surgery. He was weaned gradually from ECMO after 6 days and his RV fully recovered (figure-5). The patient also recovered fully and discharged home with no end-organ damage and in full health.

3. Discussion

Although RV failure is infrequent following cardiac surgery, it remains a significant mediator of perioperative and long-term morbidity and mortality (2, 3). Post cardiotomy incidence of severe acute RVF is 0.1%. Outcome of RVF varies in literature with a mortality rate of 22-90%. This high mortality rate and poor outcome mainly occur due to the collateral damage to other organ in the body that is associated with the severe form of RVF (4). Patients with severe RVF may develop renal or hepatic failure, prolonged ICU stay, inotropic support requirement and mayneed mechanical circulatory support such as ECMO which carries a high mortality as well (4).

Diagnosis of RV failure is challenging and the key of survival is early management. Perioperative

echocardiography has enabled earlier and more rapid assessment of RV anatomy/function and hence cause-specific management. This modality, along with commonly accepted clinical and hemodynamic criteria are commonly used for early diagnosis for such rare but catastrophic complication (3).

Once diagnosed, RV failure is commonly managed with aggressive diuresis, inotropic support and in some cases renal dialysis. The key of successful treatment and survival is early use of mechanical support if conservative management failed (2). Mechanical circulatory support such as ECMO, are commonly Veno-arterial to support the circulation and blood pressure to be able to remove as much fluid as possible especially with good LV function. The patients who survive this complication are the one that receive early management before end-organ damage occur.

SAM is a rare complication that can occur after MV repair surgery, despite the approach, MIS or sternotomy (5). Certain patients can develop SAM if they have the risk factors for it. These risks are: Narrow aorto-mitral angel, the use of small annuloplasty Ring or band during repair, long and floppy posterior leaflet that pushes the anterior leaflet towards the LVOT and finally long and redundant anterior leaflet. Recognizing this problem after MV repair surgery is challenging as it has to be in thought process of MV repair surgeons. When SAM occurs it is always associated with Severe MR and hemodynamic instability. SAM can be treated medically with stopping all inotropic support and increasing pre-load. If medical treatment fails then re-repair or MV replacement should be done before leaving the operating room.

4. Conclusion

RV failure post cardiac surgery is rare by catastrophic complication that carries a high mortality. Early diagnosis of RV failure can be treated with aggressive diuresis. However, failure of later approach necessitates early installation of Mechanical support to prevent End-organ damage and death.

References

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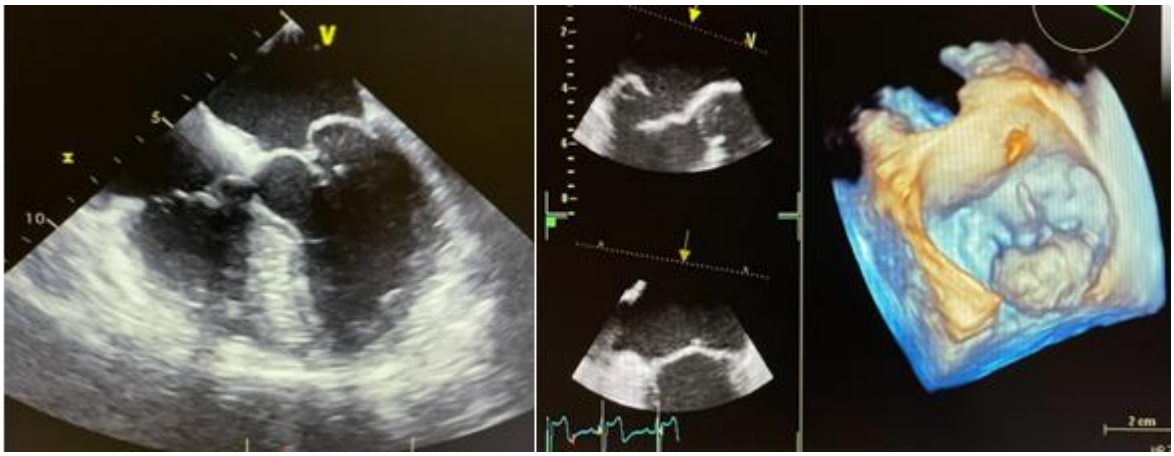
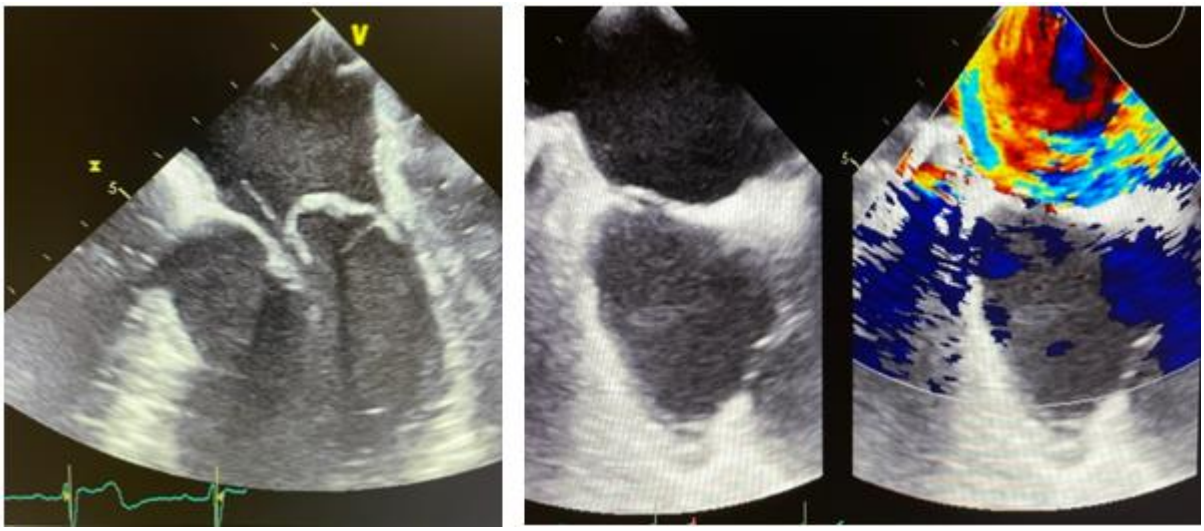


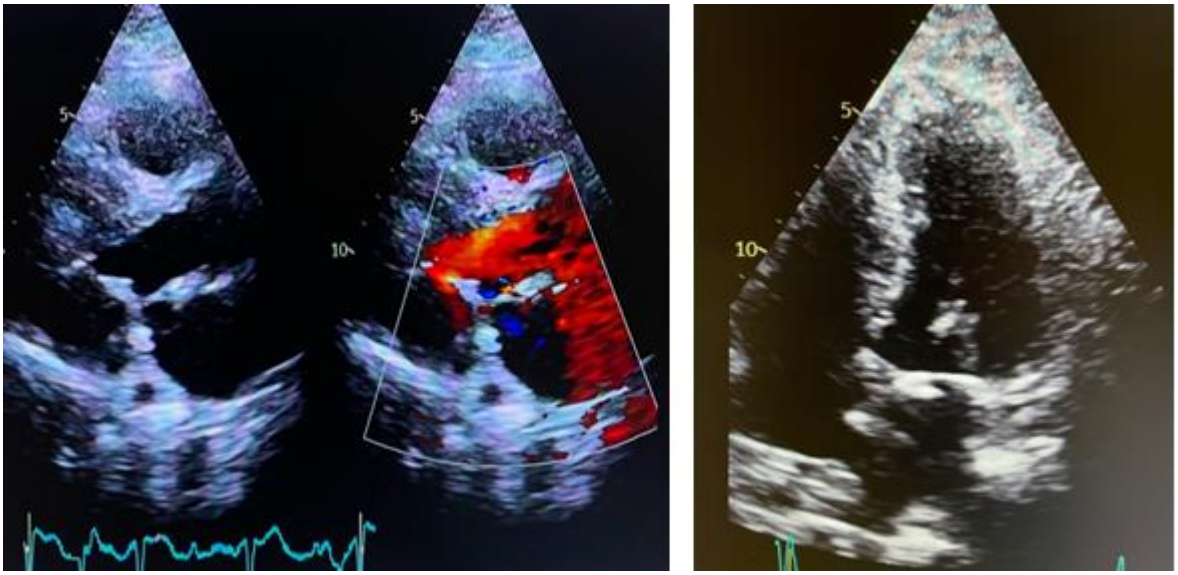
(A) (B)

Figure 1: A) Preoperative TTE showed redundant elongated MV leaflets. Note the normal RV size preoperatively. B) TEE showed myxomatous prolapsed posterior MV leaflet and ruptured chordae.



(A) (B)

Figure 2: A) Preoperative TEE showed ruptured chordae of the posterior MV leaflet and B) the resultant severe eccentric MR.



(A) (B)

Figure 3: A) Immediately post MV repair, competent MV with no residual regurgitation. B) Note the relatively preserved RV size immediately post op.

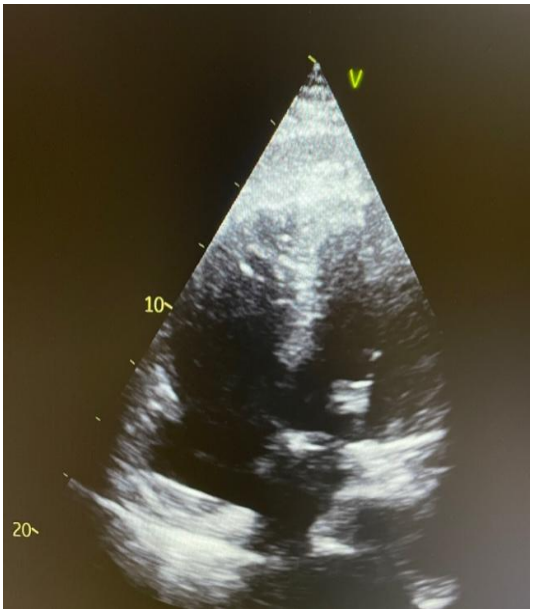


Figure 4: Post op day 3 Severely dilated RV

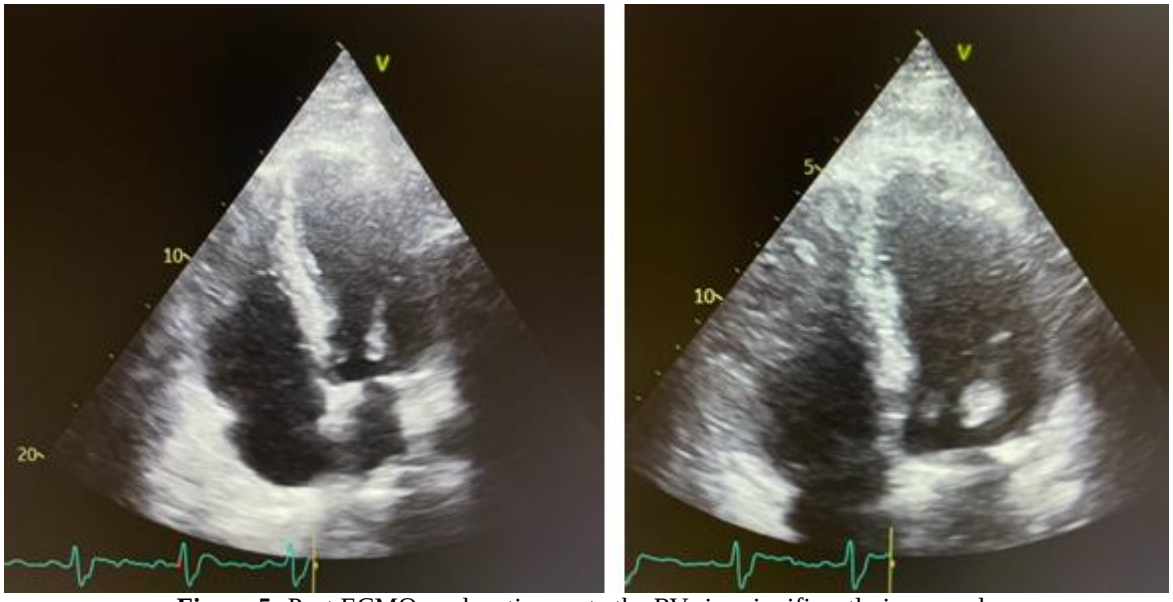


Figure 5: Post ECMO explanation, note the RV size significantly improved.