A challenging case of trans catheter mitral valve in valve replacement in a pregnant patient

Dr Roly Mishra [1*], Dr Rashmi D Gujaran[2], Dr Harvesp Panthakey[3], Dr Tapas Mandal[4], Dr Hemant Mehta[5]

ABSTARCT

TMVR, also known as trans catheter mitral valve replacement is a relatively recent technique of replacing the mitral valve in the heart without the need for conventional open-heart surgery. TMVR is a treatment for mitral valve stenosis or mitral valve regurgitation or a mix of the two. Being a lesser invasive technique, it was developed initially as a method of replacing the mitral valve in patients considered too high risk for surgery. There are very few reports of TMVR procedure in pregnant patients. The advantage of TMVR in these patients is better maternal and fetal outcome. We would like to discuss about a patient in her second trimester of pregnancy posted for TMVR and the multiple challenges faced during and after this procedure.

Key Words: *TMVR; Trans catheter; Bio prosthetic Valve Degeneration; Valvular Heart Diseases in Pregnancy.*

INTRODUCTION

Surgical mitral valve replacement (SMVR) has been considered gold standard treatment for mitral valve disease. However, many patients do not undergo intervention when considered high risk for surgery with multiple comorbidities [1].

Mitral repair can be done using trans catheter mitral valve-in-valve (TMViV) or valve-in-ring (ViR) repair. Currently, devices designed for trans catheter aortic valve replacement are used for mitral valve (MV) procedure [2,3].

A pregnant patient with severe symptomatic mitral stenosis can pose a great challenge in terms of anesthetic management for interventional procedure as well as safe continuation of pregnancy. With careful preprocedural planning and a multidisciplinary team approach, TMVR has been used successfully to provide a reliable bridge to a healthy, term delivery.

CASE REPORT

A 35 years old 66 kgs female with 20 weeks of gestation, came with mitral bioprosthetic valve restenosis with grade II-III dyspnea.

She had history of aortic valve and mitral valve repair in 2003 and bio prosthetic mitral valve replacement in 2012. She spontaneously conceived in 2013 but had to abort due to maternal health hazard. In 2014 she was anticoagulated for mitral valve thrombosis.

Present pregnancy was a spontaneous conception. She was on Inj. Enoxaparin 0.6 mg S/C since first month and on Tablet Aspirin 75 mg in her second month of pregnancy.

On 2D echo, peak/mean gradient across mitral valve was 39/17 mmHg and 20/11 mmHg across aortic valve with mild mitral and moderate aortic regurgitation (Figure 1). There was mild pulmonary hypertension, moderate tricuspid regurgitation with PASP: 45 mmHg, PAEDP: 20 mmHg. Overall left ventricular ejection fraction was 60%. Left atrium was markedly dilated and right atrium and right ventricle were mildly dilated.On obstetrician's advice, pre procedure obstetrics ultrasonography was performed to confirm fetal wellbeing and Inj. Hydroxyprogesterone 500 mg (IM) was given to prevent premature delivery.

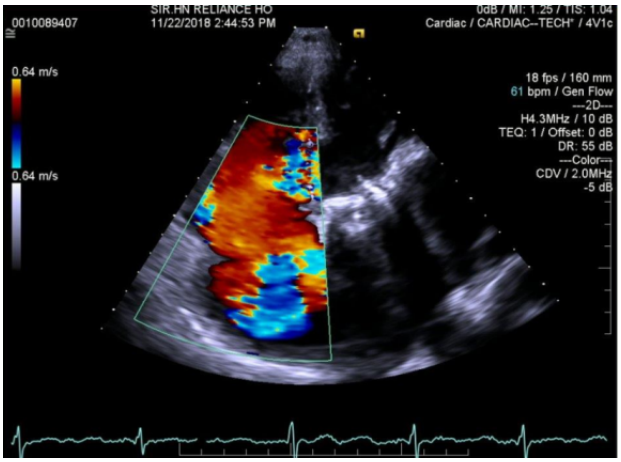

Figure 1) Preoperative 2D Echo Depicting The Biosprosthetic mitral valve with Peakman gradient of 39/17 mmHg and dilated LA.

After consent, patient was taken up for procedure under general anesthesia in hybrid operating room. The obstetrician was present to monitor fetal wellbeing. With all the standard ASA monitors attached, radial arterial line was secured. Intravenous rapid sequence induction was done with Inj. Midazolam, Inj. Fentanyl, Inj. Etomidate and Inj. Succinylcholine and patient was intubated using cuffed endotracheal tube no.7. Two wide bore peripheral lines and 8.5 FrIntero flex central line were secured. Defibrillator pads were attached. She was maintained on Sevoflurane, Inj. Atracurium infusion and Inj. Fentanyl boluses during the procedure. Trans esophageal echo (TEE) was used to guide valve replacement. A lead abdominal shield was used to reduce radiation exposure. Controlled mechanical ventilation was maintained avoiding hypocarbia to maintain placental circulation.

There was difficulty in trans-septal puncture and access to mitral valve due to hugely dilated left atrium and fibrosed thickened septum. The valve crossed the prosthetic mitral valve with great difficulty. Valve deployment could not be done as balloon burst during deployment. The partially deployed valve and the delivery system was pulled back into iliac vein and had to be removed by surgical exploration performed by cardiac surgeon. This lead to a blood loss of around 2.2 liters. Inj. Noradrenaline infusion was started to maintain hemodynamics along with blood transfusion and intravenous fluids. Four packed cells were transfused.

Total intake during the procedure was 4.2 liters and urine output 400 ml. Patient was shifted to intensive care unit (ICU) on ventilator, sedated and

1Department of Anesthesia and Pain Management, Sir H N Reliance Foundation Hospital And Research Centre, Prarthana Samaj, Girgaon, Mumbai-400004, India

[2]R.C.S.M. G.M.C. And CPR Hospital, Kolhapur-416013, Maharashtra, India

[3]K.J Somaiya Medical College and Hospital, Eastern Express Highway, Sion East, Mumbai, Maharashtra-400022

[4]Pravara Medical College, Loni, Maharashtra, India

[5]Department of Anesthesia and Pain Management, Kim Hospital and SGS Medical College, Mumbai-400012, India

Correspondence: *Dr. Roly Mishra, Third year DNB Resident, Department of Anesthesia and Pain Management, Sir H N Reliance Foundation Hospital and Research Centre, Girgaon, Maharashtra-400004, India, Tel: +91-7999521801;E-mail:rolymishra031@gmail.com*

Received date: *May 30, 2020;* ***Accepted date:*** *June 14, 2020;* ***Published date:*** *June 21, 2020*

paralyzed. Patient was in atrial fibrillation with fast ventricular rate of 180 beats per minute. Noradrenaline infusion was going on at 0.018 mg/kg/h.

The mitral gradients decreased significantly due to ballooning of the valve. Post procedure mean gradient was 7 mm Hg.

Intravenous Metoprolol, Digoxin and Diltiazem managed to get heart rate to 130-140 beats per minute. The option of cardioversion was also contemplated, but then rhythm converted to sinus spontaneously. Post procedure fetal heart was confirmed to be around 140 beats per minute. 2D Echo showed mitral valve gradient of 7/4 mm Hg with PA pressure of 36 mm Hg (Figure 2). However, post procedure after few hours, obstetrics ultrasonography confirmed intra uterine fetal demise.

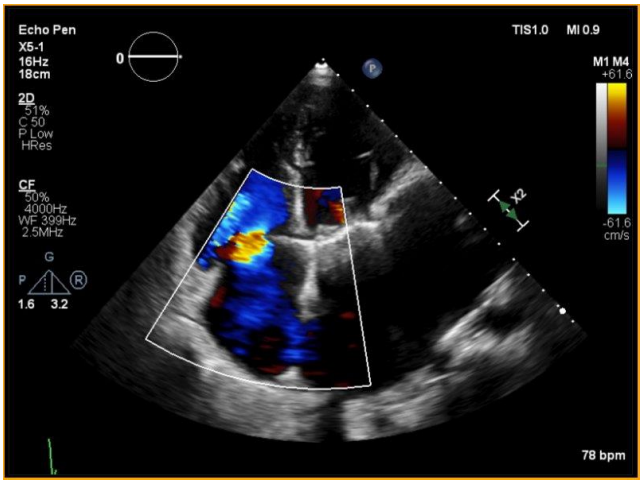

Figure 2) Postoperative 2d Echo Shows An Improvement In Gradient Of 84 mmhg.

Patient was slowly weaned off ventilator and extubated the next day. After reviewing coagulation profile, patient was induced with mifepristone. After nearly 12 hours, fetus was delivered but the placenta failed to separate completely. Manual removal of placenta was done in the operation theatre under monitored anesthesia care. On postoperative day 8, patient developed deep vein thrombosis with significant swelling of the right thigh, which was managed with anticoagulants.

During her recovery period, we also came to know that patient had periods of awareness during TMVR procedure.

Patient was discharged on postoperative day 19 on oral Warfarin, Furosemide, Amiodarone, and Diltiazem.

She was admitted again in emergency after 22 days with cardiac failure and cardio renal syndrome. She underwent emergency open mitral valve replacement. The recovery after this procedure was uneventful.

DISCUSSION

According to the modified World Health Organization classification [4, 5] severe mitral valve stenosis (MVS) during pregnancy is classified as class IV for which pregnancy termination should be considered.

Symptomatic stenoticvalvular lesions are poorly tolerated during pregnancy due to the physiological changes in pregnancy and there is a high risk of complications and death during advanced stages of pregnancy and delivery [6].

In pregnant patients with mitral stenosis, medical therapy is aimed at optimizing the heart rate and reducing left atrial pressure. It includes selective β 1-adrenergic blockers to reduce interference with β 2-mediated uterine relaxation, diuretics, salt restriction [7].

Fetal mortality is higher with cardiac surgery done on cardiopulmonary bypass. Trans catheter valve-in-valve implantation may prove to be useful to improve the fetal and maternal outcomes in these situations [8].

The major challenges in TMVR are that the mitral valve is large and asymmetrical, lacks a well-defined annulus for anchoring the replacement valve, it's geometry changes throughout the cardiac cycle and placing a replacement valve in it involves the risk of left ventricular outflow tract obstruction [2]. Another major concern in this procedure is the use of fluoroscopy resulting in radiation exposure to the foetus. Strategies adopted to minimize radiation exposure include avoidance of unnecessary radiological investigations, use of radiation shields, minimizing duration and amount of radiation with low dose fluoroscopy, echo guidance whenever possible, placing the source as distant as possible from the patient, preference of anteroposterior projections, collimating as much as possible to the area of interest and finally an experienced cardiologist doing the procedure [4].

The valve-in-valve concept was first described by Walther et al. in 2007 [9].The feasibility of trans catheter mitral valve replacement was first demonstrated on June 12, 2012 with Cardiac valve system through transfemoral-transseptal [10].

In June 2017, the U.S. Food and Drug Administration approved an expanded indication for the Sapien 3 trans catheter valve for patients with symptomatic heart disease due to failed bio prosthetic aortic or mitral valve and whose risk of death or severe complications from repeat surgery is high. The SAPIEN 3 is a balloon-expandable trileaflet tissue valve [6, 11].

General anesthesia in a hybrid operating room is the usual plan of anesthesia for TMVR. This allows use of TEE guidance intraoperatively; airway is secured with reduced risk of aspiration especially in pregnant patients. A radial arterial line is preferably placed prior to induction of general anesthesia. Large bore intravenous access should be obtained considering the risk of bleeding blood should be readily available. Central venous catheterization allows additional access for administering intravenous fluids and connecting infusions. Trans venous pacing is inserted for rapid ventricular pacing during valve deployment and to treat arrhythmias intraop. Anticoagulation is achieved with intravenous heparin during the procedure to maintain an activated clotting time (ACT) of 250-300 seconds. Extubation can be done after the procedure depending on patient's condition with postoperative intensive care monitoring. In our patient due to intraoperative complications and significant blood loss, immediate extubation was deferred.

Complications include atrial or ventricular arrhythmias triggered by guide wire or cardiac manipulation. Therefore defibrillator pads should be attached preoperatively. Injury to surrounding structures can lead to pericardial tamponade requiring pericardiocentesis or conversion to open. Fixed LVOT obstruction can occur during deployment of the new valve, due to displacement of the native anterior mitral leaflet into the LVOT causing acute hemodynamic decompensation and high mortality rate.Air embolism during venous access can be easily diagnosed with TEE. Other complications include compression or injury to a coronary artery necessitating intervention. If the valve is placed too high into the atrium, the risk of embolization increases and if too low, the risk of LVOT obstruction increases [12].

There have been reports of burst balloons with SAPIEN 3 trans catheter heart valve during implantation procedures resulting in difficulty retrieving the valve and withdrawing the system from the patient which can cause vascular injury, bleeding and surgical intervention as was seen in our patient.

The cause for intraoperative awareness in our patient may have been acute severe blood loss or reduction in anesthetic doses during periods of hemodynamic instability caused by hemorrhage. Monitoring depth of anesthesia can be useful to avoid this complication in TMVR.

CONCLUSION

There are very few cases reported on TMVR in pregnant patients. Though there are many advantages of this procedure in pregnant and high risk patients, one must be aware of the possible complications associated with it not only during the procedure but also during the post procedure course.

REFERENCES

1. Mariana M, Bernard I, Gabriel B, et al. What are the characteristics of patients with severe, symptomatic, mitral regurgitation who are denied surgery? European Heart Journal, 2017;28(11):1358–65.
2. Chandra P, Goel R, Chouhan NS. Transcatheter mitral valve replacement for failed mitral bioprosthesis: The new frontier!. Indian Heart J Interv [serial online]. 2018 ;1:63-70.
3. Sarkar K, Reardon MJ, Little SH, et al. Transcatheter Mitral Valve Replacement for Native and Failed Bioprosthetic Mitral Valves. Methodist DebakeyCardiovasc J. 2017;13(3):142–51.
4. Vera R Z, Jolien W R H, Johann B,etal.Guidelines for the management of cardiovascular diseases during pregnancy: The Task Force for the Management of Cardiovascular Diseases during Pregnancy of the European Society of Cardiology (ESC), European Heart Journal, 2018;39(34), 07:3165–41.
5. Robert H, Eric K, Jeffrey S, et al. Transcatheter Aortic Valve Replacement During Pregnancy. CircCardiovascInterv. 2016 ;9(10).
6. Sophie R, Christelle D, Aurélie V, Alain B,et al. Transcatheter Mitral Valve-In-Valve Implantation. J Am CollCardiol Case Rep. 2020;2 (1) 145-49.
7. Boulemden A, Malin GL, Wallace SVF,et al.MechanicalMitral Valve Replacement during the 2nd Trimester of Pregnancy. Tex Heart Inst J. 2018;45(1):31–34.
8. Chengode S, Shabadi RV, RaoRN,et al. Perioperative management of transcatheter, aortic and mitral, double valve-in-valve implantation during pregnancy through left ventricular apical approach. Ann Card Anaesth. 2018;21:185-8.
9. Walther T, Falk V, Dewey T,et al. Valve-in-a-valve concept for transcatheter minimally invasive repeat xenograft implantation. J Am
10. CollCardiol. 2007;50:56–60.
11. Van der M , J CasselmanF. Mitral Valve Replacement Current and Future Perspectives. Open Journal of Cardiovascular Surgery. 2017.
12. Cheung A W, John B, Marco F,et al. 5-Year Experience With TranscatheterTransapical Mitral Valve-in-Valve Implantation for Bioprosthetic Valve Dysfunction. Journal of the American College of Cardiology. 2012.
13. Stephen H G,Nishtha S, Jonathan K,et al. Anesthetic considerations for the transcatheter management of mitral valve disease, J Cardiothoracic Vascular Anesth.2018.