OPINION

Perioperative effects opoid-free anaesthesia

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ABSTRACT

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: *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. 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.

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.

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. 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. 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

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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.

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 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. Post procedure after few hours, obstetrics ultrasonography confirmed intra uterine fetal demise. 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 severe mitral valve stenosis (MVS) during pregnancy is 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.

In pregnant patients with mitral stenosis, medical therapy is aimed at optimizing the heart rate and reducing left atrial pressure. It includes selective β1-adrenergic blockers to reduce interference with β2-mediated uterine relaxation, diuretics, salt restriction. 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.

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. 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.

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 arrhóthmias guide wire or cardiac manipulation. Therefore defibrillator pads should 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. 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

The world's environmental health must be improved, sustained, and maintained through the use of renewable energy. It is required to completely replace non-renewable fossil fuel energy with renewable energy. The environment and the people who use renewable resources benefit from a variety of safety effects that come with them. To make that possible, a number of issues must be overcome. Aging infrastructure, governmental regulations, political pressures, public acceptance, plant development costs, excess supply capacity, and corporate influence are some of these issues. To provide people the chance to engage in renewable energy, it is crucial to find common ground and negotiate with the government. A number of nations have acknowledged humankind's contribution to environmental health and made it possible for some corporate sectors to benefit from renewable energy sources, making them affordable for the general public. The most recent research on the generation of biofuels and energy from biomass demonstrates that a long-term production strategy involves using cutting-edge technologies like bioreactors and refineries to carry out chemical transformations. Government regulations must encourage technological advancements in academia and business that can aid in creating fuels and high-value products from a range of biomass in order to fully realize the promise of bio refineries. The market for renewable energy is currently increasing over time, but more has to be done to encourage the widespread use of these sources. Building the appropriate infrastructure and technology, such as wind turbines, dams, and levees, is important for capturing renewable energy. To maximize the advantages of hydropower, it is also crucial to maintain a clean and healthy marine and aquatic environment. To expand its market and get more popular acceptability among regular people, the use of solar panels in residential homes should be encouraged and promoted.