DOI: 10.21088/jcms.2454.7123.11225.6

Journal of Cardiovascular Medicine and Surgery
Volume 11 Number 2/May – August 2025

CASE REPORT

Mitral Valve Replacement Surgery for a Pregnant Patient with Severe Mitral Stenosis and a Large Left Atrial Clot: A Case Report and Brief Review of Literature

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HOW TO CITE THIS ARTICLE:

Sumedha Suresh Kumar, Sambhunath Das, Thiruselvan T. Mitral Valve Replacement Surgery for a Pregnant Patient with Severe Mitral Stenosis and a Large Left Atrial Clot: A Case Report and Brief Review of Literature. Indian J Cardiovasc Med Surg.2025;11(2): 79–84.

ABSTRACT

Rheumatic mitral stenosis is the most common cardiac disease complicating pregnancy in India constituting almost 88% of the cardiac diseases in pregnancy. Surgical valve replacement during pregnancy is reserved for those patients in whom percutaneous techniques are not feasible or in whom medical management has failed. Although cardiac surgery during pregnancy is associated with significant maternal and fetal risks, it can be carried out safely by a meticulous plan of anesthesia and making modifications in the initiation and maintenance if cardiopulmonary bypass.

In this report, we present the successful perioperative management of a patient posted for mitral valve replacement at 17 weeks of gestation with a huge left atrial clot and a live fetus.

KEYWORDS

• Pregnancy • Mitral valve stenosis • Mitral valve replacement surgery • Left atrial clot • Cardiopulmonary bypass • Anesthesia

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Receive : 28.07-2025 **Accepted:** 09-08-2025

INTRODUCTION

Rheumatic mitral stenosis (MS) is the most common cardiac disease complicating pregnancy in India constituting almost 88% of the cardiac diseases in pregnancy.[1] With the advent of safer, less invasive techniques of management, surgical replacement of the mitral valve is performed during pregnancy only in those in whom medical management has failed or where percutaneous techniques are contraindicated. In this report, we present the management of a patient posted for mitral valve replacement at 17 weeks of gestation with a huge left atrial (LA) clot and a live fetus.

CASE REPORT

A 29 year old lady (G4P1L1A2) at 17 weeks of gestation presented for mitral valve surgery. 2D Echocardiography showed that she had severe mitral stenosis (MS) with a mitral valve area of 0.4 cm2, a large clot (4.4 x 3.9 cm) in the dilated left atrium (68mm) with mild tricuspid regurgitation (TR) and normal left ventricular systolic function. Ultrasound was performed and showed a single live intrauterine fetus.

The presence of a large LA clot in our patient precluded the possibility of a percutaneous approach and the decision to perform a mitral valve replacement was taken. An exhaustive pre anesthetic evaluation was performed. She was comfortable at the time of examination, with a heart rate of 82/min, blood pressure – 93/64mmHg and a saturation of 100% on room air. On systemic examination, she was found to have clear lung fields and a mid diastolic murmur. Her recent hematological investigations showed mild anemia with a hemoglobin of 10gm/dl. The rest of her bloodwork was unremarkable.

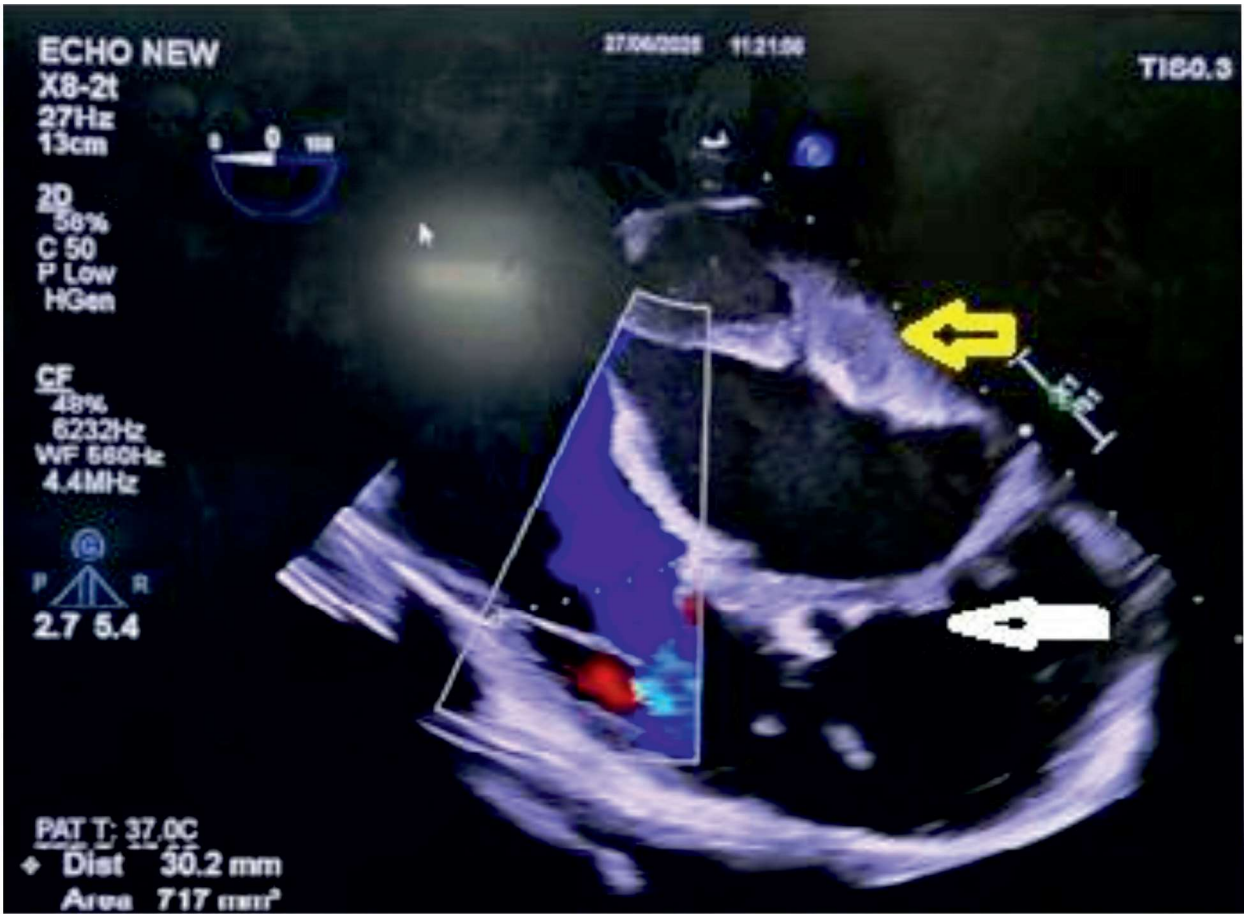

Figure 1: ME Four chamber view showing a dilated LA, large LA clot (yellow arrow) and severe MS (white arrow)

A brief review of the available literature on the conduct of anesthesia and cardiopulmonary bypass during pregnancy has also been discussed.

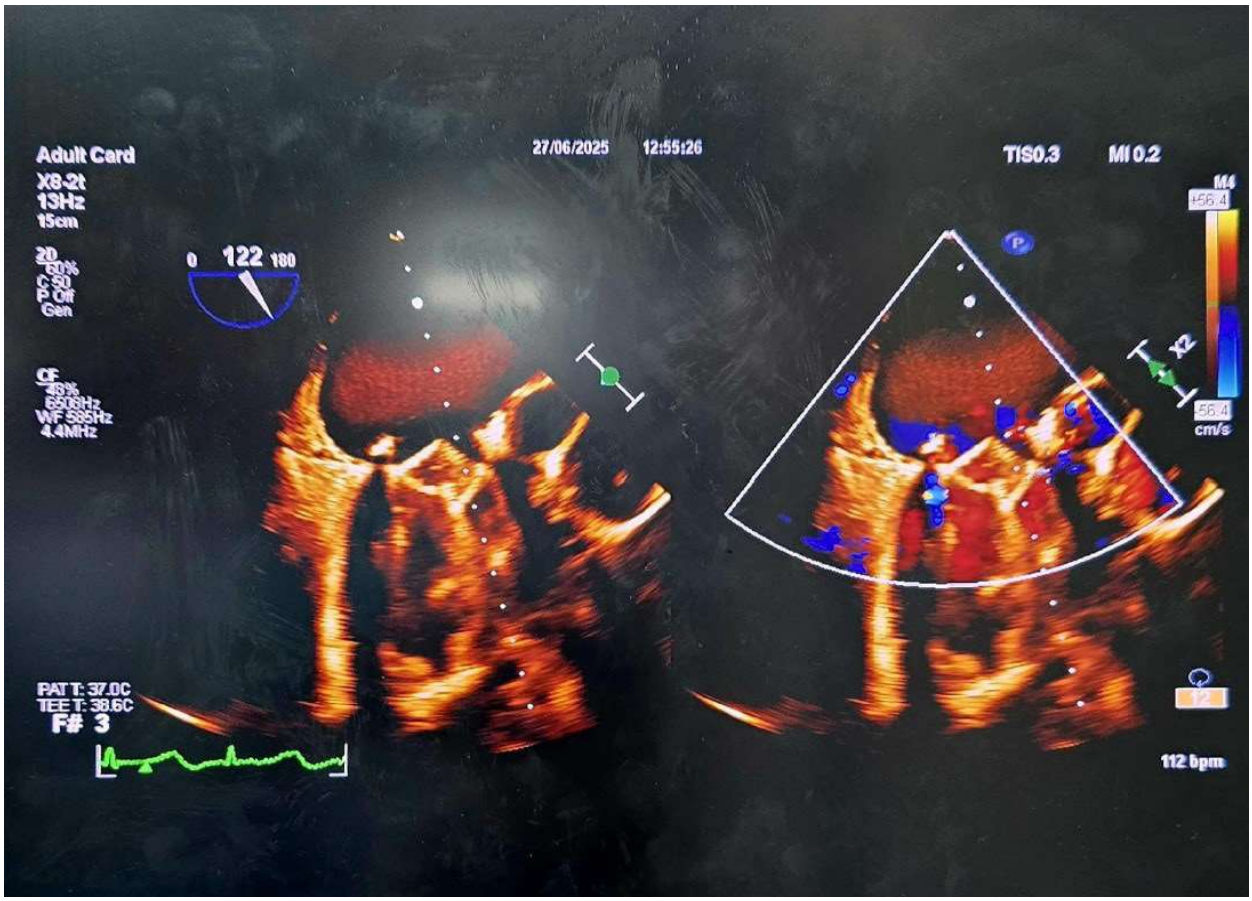

Figure 2: Post bypass TEE – bileaflet prosthetic valve with no paravalvular leak

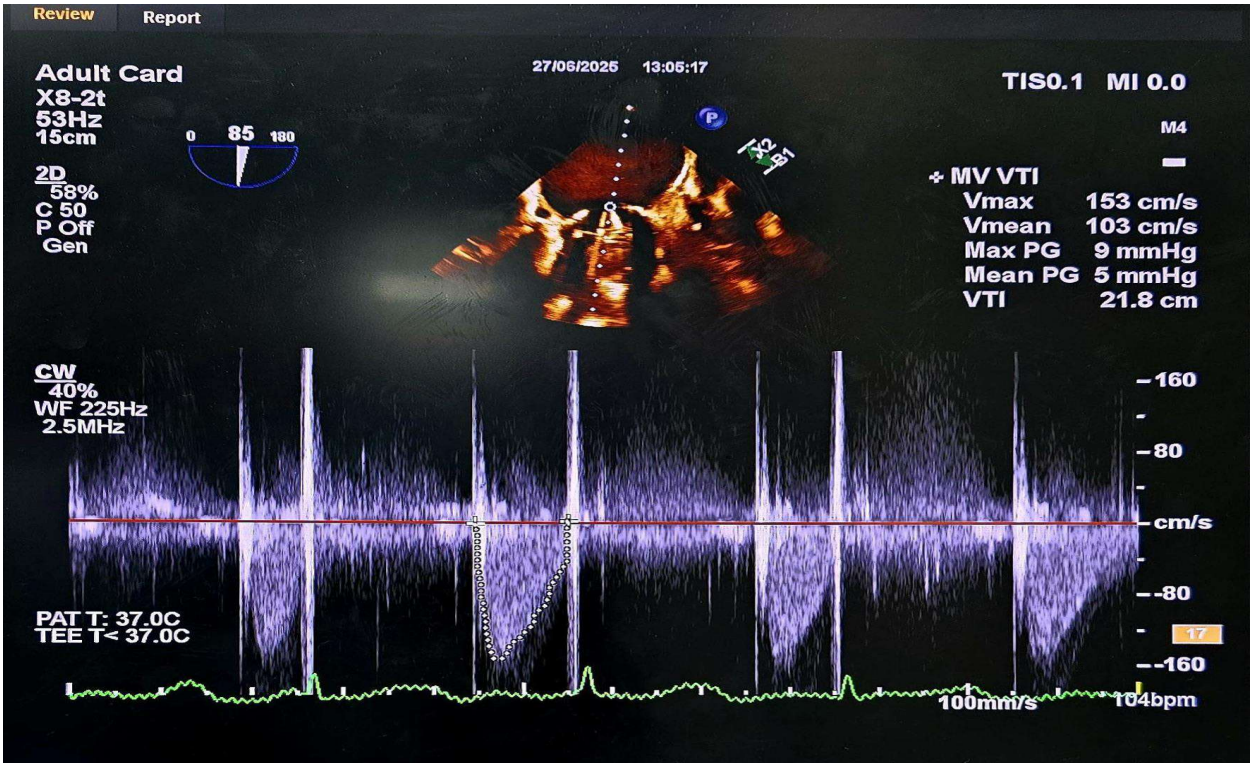

Figure 3: Post bypass TEE – showing the Mitral valve gradient

Once the patient was taken into the operating room and after connection of all standard ASA monitors, a left radial arterial line was placed pre induction under local anesthesia. An obstetrician was present in the operating room for fetal monitoring and to provide assistance in the event of pre-term labour. Fetal heart sounds were confirmed to be present prior to induction. Induction of anesthesia was performed after pre oxygenation with Etomidate, Fentanyl and Atracurium taking care to ensure the blunting of sympathetic response to intubation. After intubation, the temperature probe and the transesophageal echocardiography (TEE) probe were inserted. A triple lumen central line was placed in the right internal jugular vein. Surgery was commenced as per standard protocol. Preoperative TEE confirmed the findings of severe MS with a large LA clot in a dilated LA (Figure 1) and mild TR. After heparinization, cannulation was performed and cardiopulmonary bypass was initiated. The surgery was performed under normothermic CPB with the maintenance of slightly higher perfusion pressures. The native mitral valve was replaced with a size 31/33mm On-X valve and the LA clot was removed. The patient was weaned off bypass on nitroglycerin and dobutamine infusions uneventfully. The total duration of bypass was 73 minutes and the aortic cross clamp was placed for 53 minutes. Post bypass TEE evaluation showed the prosthetic valve with both the leaflets moving equally, no paravalvular leak (Figure 2) and no residual clot in LA. The pressure gradient across the valve was 9/5mmHg (Figure 3). Fetal monitoring revealed no abnormalities throughout the surgery. Heparin was reversed and once hemostasis was attained, the sternum and skin were closed. The patient was shifted to the intensive care unit. Bedside ultrasound showed a viable fetus. The patient was extubated the same day and was shifted out to the ward after 5 days.

DISCUSSION

Rheumatic Heart Disease is one of the most common cardiac conditions seen in pregnancy. Although the incidence is on the decline, it is still the most prevalent cardiac condition, especially in developing countries. Patients with mitral stenosis may be diagnosed for the first time during pregnancy, as was the case with our patient. The hemodynamic changes in pregnancy often exacerbate the symptoms of the underlying cardiac condition, with most patients presenting in the second trimester. According to the World Health Organization (WHO) classification, pregnant patients with severe mitral stenosis fall under Class IV, where pregnancy is contraindicated secondary to high risk of maternal mortality and morbidity.[2] Our patient was assessed by a team of obstetricians and deemed high risk for termination of pregnancy.

Percutaneous mitral valvuloplasty is the procedure of choice for management of severe mitral stenosis in pregnancy and is generally performed in the second trimester.[3] Surgical mitral valve replacement during pregnancy is a relatively rare procedure.According to the European Society of Cardiology (ESC) guidelines (2018), due to fetal risk, surgery should be reserved for only those cases where other measures have failed and there is risk to the mother's life.[4]

Pathophysiology of mitral stenosis: When the normal mitral valve area decreases from 4 – 6 cm^2 to around 2 cm^2, symptoms start to develop. Under normal conditions, 75% of the blood from left atrium empties passively into the ventricle and around 25% is emptied by atrial systole, the so - called "atrial kick". In patients with severe mitral stenosis, passive filling of the left ventricle is compromised, and the atrial kick becomes crucial for left ventricular filling. Mitral stenosis constitutes a fixed cardiac output state, and the heart is unable to cope with any situation requiring an increase in metabolic demand or increased blood volume. The left atrium dilates with the progression of the disease and increases in the left atrial pressure which can cause pulmonary venous congestion and with time, pulmonary arterial hypertension and pulmonary edema. The presence of a gradient between the left atrium and ventricle in diastole is the hallmark of mitral stenosis. Women with severe mitral stenosis are unable to tolerate the increased metabolic demands of pregnancy. The increase in heart rate which occurs in pregnancy further limits the left ventricular filling. The presence of atrial fibrillation or atrial flutter worsen the scenario and may also put the patient at risk of development of a left atrial thrombus and a thromboembolic stroke.

Management: The perioperative considerations in this case were (1) severe mitral stenosis which would require careful and meticulous induction and maintenance of anesthesia during the surgery (2) the institution and maintenance of cardiopulmonary bypass (3) the maintenance of adequate perfusion pressures throughout the perioperative period (4) the risk of spontaneous preterm labour during the surgery and the risk of significant bleeding in the heparinized patient (5) the need for continuous fetal monitoring throughout the surgery.

The anesthetic goals in mitral stenosis include (1) maintenance of a low to normal heart rate and preservation of sinus rhythm (2) avoidance of aortocaval compression (3) maintenance of preload (4) maintenance of adequate SVR and (5) prevention of increase in PVR.Care should be taken at induction to maintain the hemodynamic status of the patient including the use of cardio stable induction agents and the prevention of stress response to intubation. Prevention of aortocaval compression becomes significant after 20 weeks of pregnancy and this can be achieved by providing a left lateral tilt by the placement of a wedge under the right hip. The use of volatile anesthetic agents for the maintenance of anesthesia can help in lowering the uterine tone.

The maternal mortality associated with CPB is similar to that of a non-pregnant female. The use of CPB in pregnancy is however associated with a high fetal mortality rate (5–30%).[5–7] Itcan compromise uteroplacental perfusion, cause uterine contractions and cause fetal hypoxia. The fetal response to cardiopulmonary bypass is bradycardia presumably due to hypoperfusion secondary to malperfusion of the fetoplacental unit. This can be overcome by increasing the flow rates while on CPB.[8] Non - pulsatile perfusion leads to vasoconstriction in the fetal circulation hypothesized to be caused by prostaglandins and the inhibition of endothelium derived relaxing factor.[8,9] In theory, this is overcome by the use of pulsatile flows during CPB by the reduction of catecholamine production and peripheral vascular resistance.[8–10]

Maintenance of normothermia during CPB has been found to improve fetal outcomes. While hypothermia theoretically protects the fetus by decreasing the fetal oxygen requirement[8], it also triggers mechanisms causing increased uterine irritability and contractions which are particularly prevalent during the rewarming phase, and hampers gas exchange at the placental level.[11] Avoiding hypothermia therefore attenuates the risk of development of uterine contractions.[8,12]

Monitoring of fetal and uterine activity during CPB has been reported to decrease the risk of fetal mortality.[11] This can be done with the help of cardiotocography and ultrasound. In our patient, fetal activity was monitored intraoperatively using ultrasound.

Therefore, to summarize, the recommendations for the management of cardiopulmonary bypass in pregnancy include (a) the use of increased flow rates (b) maintenance of maternal hematocrit >28% (c) maintenance of normal maternal SaO2 (d)normotension or slightly elevated perfusion pressures (e) alpha stat pH management (f) normothermia or mild hypothermia (g) minimization of CPB duration.[13,14]

CONCLUSION

The perioperative management of a pregnant patient for a cardiac surgical procedure on cardiopulmonary bypass is challenging, but with adequate precautions, the surgery can be conducted safely. Transesophageal echocardiography and ultrasound have been found to be invaluable tools in the intraoperative monitoring of the patient and the fetus.

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