CASE REPORT

Anesthesia for cesarean section in patients with severe mitral stenosis with congestive heart failure

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ABSTRACT

Providing anesthesia for cesarean section to a patient with mitral stenosis (MS) with congestive heart failure can be a big challenge. The authors present a report of a known patient of hypothyroidism, who presented with cardiac failure in 9th month of gestation with severe MS, significant resting pulmonary hypertension and pericardial effusion. She was successfully managed with epidural anesthesia and intrathecal fentanyl. A skillful multidisciplinary approach in the diagnosis and management can reduce the morbidity and mortality in patients of this setting.

Key words: Mitral stenosis; Cesarean section; Pulmonary hypertension; Cardiac failure; Epidural anesthesia

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INTRODUCTION

Although the incidence of rheumatic heart disease (RHD) has decreased over a period of time, mitral stenosis (MS) still makes a large ratio of heart disease complicating pregnancy.[1] MS in pregnancy is poorly tolerated because coexisting physiological changes of pregnancy and the peripartum period, may worsen symptoms even in moderate degree cardiac disease. Many women with cardiac disease are first diagnosed during pregnancy. Pulmonary hypertension is a rare condition and in combination with pregnancy, it can result in high maternal mortality. We present a report of a known patient of hypothyroidism, who presented with cardiac failure in 9th month of gestation with severe MS, significant resting pulmonary hypertension and pericardial effusion, which was successfully managed by a team of experts.

CASE REPORT

A 21 year old, second gravida with previous spontaneous abortion weighing 60 kg with 9 months amenorrhea, presented with giddiness for two days, grade IV dyspnea, cough and hemoptysis for the last one day. She was a known case of hypothyroidism, taking tab thyroxine 125 μg/day. During examination mid-diastolic murmur with loud S1 at apical area and bilateral basal crepts were noted. She was investigated and confirmed to have severe mitral stenosis with significant resting pulmonary artery hypertension, minimal pericardial effusion and mild mitral regurgitation. Her chest x-ray (with abdomen shielding) showed cardiomegaly and bilateral congestion. ECG showed p-mitrale. Echocardiography revealed thickened and dome shaped anterior mitral leaflet, thick and fixed posterior mitral leaflet with severe stenosis having mitral valve area (MVA) 1.0 cm^2, enlarged left atrium, peak pressure gradient 21 mmHg, pulmonary artery BP 29 mmHg, a dilated pulmonary artery and left ventricular ejection fraction (LVEF) 60%. Patient was treated in CCU with tab. digoxin

0.25 mg 5 days a week, tab. frusemide 20 mg, spironolactone 50 mg, tab. metoprolol 25 mg, and tab. cefuroxime 500 mg bid. On investigation, PT was 13.7 sec, Hb 11.8 gm/dl, TSH 5.51 micro IU/ml, serum uric acid 4.5 mg/dl, Na 130 meq/l and K 3.2 meq/l. Infective endocarditis prophylaxis was done with inj. ampicillin 500 mg and inj. gentamicin 80 mg IV bid. Patient was stabilized (basal crepts resolved and dyspnea improved from grade IV to grade II) and accepted for elective cesarean section.

After taking proper informed written consent and confirming NPO status, patient was examined in OR. She was conscious, oriented to time, place and person. IV line with 18G cannula had already been secured. Multiparameter monitor was attached. Her BP was 100/70 mmHg, PR 96/min and SpO_2 was 98% on room air. Preloading was done with 200 ml lactated ringer solution, epidural catheter was inserted at L3-L4 space and intrathecal fentanyl 25 μg was injected in L4-L5 space using 27G spinal needle (CSE with separate needle technique); 12 ml of inj. ropivacaine 0.4% was administered in epidural space in incremental manner in 2 ml aliquots till desired level was achieved. On reaching T6 level (after 10 min) surgery was started and a baby weighing 2.7 kg was delivered with APGAR score 8 at 1 min and 10 at 5 min. Oxytocin 10 units in 500 ml Ringer's lactate infusion was started at a rate of 100 ml/h.

Hemodynamic parameters of the patient were maintained within 20% of baseline values using a wedge below right hip and early use of 25-50 μg boluses of phenylephrine. During the intraoperative period, there were no episodes of tachycardia, bronchospasm, desaturation or pulmonary edema. Surgery lasted for 45 min; A total of 1L ringer lactate was administered; intraoperative urine output was 100 ml. After the surgery, she was monitored in ICU. Postoperatively 5% dextrose in saline was administered taking in account output and insensible losses. Oral furosemide and metoprolol were resumed after 6 h. Blood pressure was maintained above 110 mmHg systolic and heart rate between 60 and 70/min. Postoperative pain was managed with epidural infusion of 0.125% ropivacaine with 1 μg/ml of fentanyl at 6 ml/h for the next 24 h. She was shifted from ICU on second day with a healthy baby.

DISCUSSION

MS is the most commonly acquired valvular lesion encountered in pregnant women and is almost invariably caused by RHD.[2] The morbidity and mortality have been considerably reduced by better perinatal care, where the anesthesiologist plays a major role in the multidisciplinary approach.[3] Although MS is often associated with mitral regurgitation morbidity is usually related to MS.[4]

When the normal mitral valve area (4–6 cm^2) is progressively reduced to 2 cm^2, the classical symptoms of MS start appearing. MS is classified as mild when the valve area is 1.5-2 cm^2, moderate between 1.0–1.5 cm^2 and severe below 1.0 cm.[2] Our patient had severe MS (MVA-1 cm^2). As MS is a fixed cardiac output state, the heart cannot cope up with situations demanding increased metabolic demand or increased blood volume. Women with severe MS often do not tolerate the cardiovascular demands of pregnancy and hence are diagnosed first time during pregnancy like our patient. This increased volume load and tachycardia together cause the patients to deteriorate and advance from one New York Heart Association (NYHA) class to another. The increased heart rate of pregnancy restricts the time available for left ventricular filling, leading to increased left atrial and pulmonary pressures and an increased probability of pulmonary edema.[5] Atrial fibrillation worsens the scenario and about 80% of the cases of systemic emboli occur in patients with atrial fibrillation. Cardiac decompensation and pulmonary edema may occur in pregnant women with overt or silent mitral valve stenosis during the second or third trimester. The risk of maternal death is greatest during labor and during the immediate post-partum period due to autotransfusion from the uterus.[5]

Echocardiography is the standard imaging tool used to assess patients. Doppler examination provides information about severity of the stenosis, presence of other associated valve lesions and the degree of pulmonary hypertension. Mortality rates for class I and II amount to <1%, whereas they range between 5 and 15% for class III and IV. The perinatal mortality rate for class III and IV is as high as 20–30%.

Management of the pregnant woman with MS requires a multidisciplinary team approach for optimal maternal and fetal outcomes. In symptomatic patients, medical treatment with bed rest, oxygen therapy and diuretics should be the first line of management. Beta blockers and diuretics remain the pillars of medical management for symptomatic patients in pregnancy,[6] so were used in our patient to improve the clinical

condition. Atrial fibrillation requires aggressive treatment with digoxin and beta blockers to revert it to sinus rhythm and anticoagulation to prevent systemic embolization. Cardioversion should be performed if pharmacologic therapy fails to control the ventricular response. Anticoagulation, even in the absence of atrial fibrillation, is beneficial.[7,8]

Mitral valve surgery is reserved for cases refractory to medical therapy and candidates who are not suitable for valvuloplasty. However, cardiovascular surgery during pregnancy has been associated with increased fetal mortality.[9]

The aim of the anesthesia should be to provide good labor analgesia as tachycardia, secondary to labor pain, increases flow across the mitral valve, producing sudden rises in left atrial pressure, leading to acute pulmonary edema. This tachycardia cab be avoided by epidural analgesia without significantly altering the patient hemodynamics[10] as seen in our patient. No single technique is solely indicated or contraindicated as every technique has its own pros and cons. The major concern is to avoid and/ or treat specific pathophysiologic changes that may exacerbate the disease process. For this, Epidural and continuous spinal anesthetic techniques are suitable options. One of the prime advantages of epidural analgesia is that it can be administered in incremental doses and that the total dose could be titrated to the desired sensory level as we did in our patient. This, coupled with the slower onset of anesthesia, allows the maternal cardiovascular system to compensate for the occurrence of sympathetic blockade, resulting in a lower risk of hypotension and decreased uteroplacental perfusion. Many authors have recommended vaginal delivery under epidural anesthesia, unless obstetrically contraindicated and cesarean section is indicated for obstetric reasons only.

The goals for the anesthetic management of patients with mitral stenosis are maintenance of an acceptable slow heart rate, maintenance of adequate venous return and systemic vascular resistance (SVR), avoidance of aortocaval compression, immediate treatment of acute atrial fibrillation and reversion to sinus rhythm and prevention of pain, hypoxemia, hypercarbia and acidosis, which may lead to increased pulmonary vascular resistance (PVR).

Supplemental oxygen should be administered to minimize increases in PVR and left uterine displacement should be maintained for adequate venous return. Judicious intravenous administration of crystalloid and administration of small bolus doses of phenylephrine to prevent sudden drops in SVR remain the mainstays to maintain maternal hemodynamic stability.[11] Invasive cardiac monitoring like radial artery cannulation and pulmonary catheter are beneficial in assessing the cardiac output, pulmonary artery pressure and for guiding fluid and drug therapy, especially in NYHA III and IV patients.[12,13] Individualizing the anesthetic management according to the parturient's cardiovascular status is the key to the management in these patients.[14]

After delivery of the fetus, oxytocin 10–20U in 1,000 ml of crystalloid should be administered slowly. It can lower the SVR as well as elevate the PVR, resulting in a drop in cardiac output. Methylergonovine, or 15-methylprostaglandin F, produces severe hypertension, tachycardia and increased PVR, so is avoided.[15,16]

Continuous spinal anesthesia, although infrequently practiced, could be a better option in some rare situations like accidental dural puncture. General anesthesia has the disadvantage of increased pulmonary arterial pressure and tachycardia during laryngoscopy and tracheal intubation. Moreover, the adverse effects of positive-pressure ventilation on the venous return may ultimately aggravate cardiac failure; that's why we preferred CSE in our patient.[17]

If general anesthesia is considered, tachycardia inducing drugs like atropine, ketamine, pancuronium and meperidine, should be totally avoided. A beta-adrenergic receptor antagonist and an adequate dose of opioid like fentanyl should be administered before or during the induction of general anesthesia. Because esmolol has a rapid onset and short duration of action, it is a better choice in controlling tachycardia. Since fetal bradycardia has been reported after esmolol, fetal heart rate should be monitored. Modified rapid sequence induction using etomidate, remifentanyl and succinylcholine is an ideal choice in tight stenosis with pulmonary hypertension.[18,19] Maintenance of anesthesia can be carried out with oxygen and nitrous oxide 50:50, isoflurane, opioids and vecuronium. With associated severe pulmonary hypertension, nitrous oxide can be omitted. At this juncture, invasive hemodynamic monitoring is a useful guide.

CONCLUSION

In conclusion, pregnant patients with cardiac disease can be successfully and safely delivered surgically by skillful anesthesiologists who are well aware of the potential intra-operative problems and have the ability to prevent and respond to undesired events immediately thus reducing morbidity as well as mortality.

Conflict of interest: None declared by the authors

Authors' contribution: MG & SSG-Concept and conducting the case; OPS-Manuscript writing; RK-Editing of manuscript

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