Anesthetic Management of a Patient with Mitral Stenosis Posted for C-Section: A Case Series

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ABSTRACT:

Rheumatic heart disease is the primary cause of mitral stenosis, which leads to symptomatic pregnancies due to increased blood volume and heart rate. However, neuraxial anesthesia for cesarean delivery can be safely administered to patients with moderate mitral stenosis if systemic vascular resistance, preload, and afterload are maintained. Mitral stenosis is a severe cardiac complication often encountered during pregnancy. It is essential to prevent pregnancy in cases where pulmonary hypertension develops in conjunction with mitral stenosis. In some instances of extreme pulmonary hypertension, positive outcomes have been reported using general and regional anesthesia.

Introduction

Rheumatic heart disease is a major cardiac issue that is commonly experienced by women during pregnancy in India, although its incidence is on the decline[1]. Mitral stenosis, which is a form of cardiac disease that can complicate pregnancy, accounts for approximately 88% of the cases that are referred to tertiary healthcare facilities[2]. The role of the anaesthesiologist is multifaceted and involves providing high-quality perinatal care that can lead to a reduction in both the incidence of complications and the associated mortality rates among affected patients[3].

Rheumatic heart disease is the primary cause of mitral stenosis, resulting from rheumatic fever, which causes pan carditis due to cardiac inflammation, leading to valve scarring[4]. The main cardiovascular changes in pregnancy, which worsen the features of mitral stenosis, include a 30% to 50% increase in blood volume starting at the end of the first trimester and peaking at 20 to 24 weeks, which increases pulmonary capillary hydrostatic pressure and the risk of pulmonary edema[5]. Additionally, there is a decrease in systemic vascular resistance, a 10 to 20 beats per minute increase in heart rate, which reduces the diastolic filling time of the left ventricle, and a 30 to 50% increase in cardiac output after the fifth month[6]. Cardiac output returns to normal after 12 to 24 weeks postpartum[7]. The transvalvular gradient increases significantly, which increases left atrial pressure, giving rise to symptoms[8]. There will be a sudden rise in venous return to the heart due to autotransfusion and Inferior vena cava decompression leading to decompensation[9]. Enlarged atrial dimensions predispose to atrial arrhythmias[10,11]. Hence, the management depends on the severity of the disease, with multidisciplinary care for the safe outcome of the mother and neonate.

CASE DESCRIPTION

Case 1

A 25-year-old female patient with a gestational age of 39 weeks was scheduled for an elective cesarean delivery due to cephalopelvic disproportion. The patient had a history of rheumatic heart disease with moderate mitral stenosis and moderate pulmonary hypertension. During the preanesthetic assessment, her blood pressure was 100/70 mmHg, and her heart rate was 70 bpm. All routine laboratory investigations were within normal limits. After obtaining informed consent, the patient was transferred to the operating room, where routine monitors were attached. Two large-bore intravenous cannulas, 16G and 18G, were inserted. An arterial line

was secured in the left radial artery for continuous blood pressure monitoring, and Ringer's lactate was used judiciously. Under aseptic precautions, the patient was painted and draped, and the L3-L4 space was palpated using a combined spinal epidural needle with the needle-through-needle technique. A subarachnoid block was administered with 1.2 ml of 0.5% bupivacaine and 0.5 ml of fentanyl. The skin-to-epidural space was 4 cm, and the epidural catheter was fixed at 10 cm after dilating the epidural space with 3 ml of 1% lignocaine with adrenaline. The test dose was negative. The patient was then made to lie down, and within 5 minutes, the sensory level reached T6. The surgery was uneventful, and the baby was delivered in 10 minutes. Immediately after delivery, Inj. Lasix 10 mg intravenous was given to maintain preload. Oxytocin was administered at 20 IU in 500 ml NS over a 4-hour infusion, and the target mean arterial pressure of 65 mmHg was maintained with phenylephrine boluses. Oxygen was given through a face mask during the surgery, which lasted for 40 minutes. The catheter was removed in the postoperative care unit, and the patient was transferred to the high-dependency unit for further monitoring. The postoperative period was uneventful.

Case 2

A 30-year-old female patient with a gestational age of 37 weeks was scheduled for an elective cesarean delivery due to breech presentation. The patient had a history of rheumatic heart disease with moderate mitral stenosis. During the pre-anesthetic assessment, her blood pressure was 100/80 mmHg, and her heart rate was 82 bpm. All routine laboratory investigations were within normal limits. After obtaining informed consent, the patient was transferred to the operating room, where routine monitors were attached. Preoperative monitoring was conducted as Case 1. The central venous pressure, heart rate, and arterial blood pressure were 20 mmHg, 85 beats per minute, and 110/60 mmHg, respectively. The patient received continuous spinal anesthesia at the intervertebral space between the L4-L5 vertebrae. Subsequently, 1 mL of 0.5% plain bupivacaine was administered to the patient in a seated position, followed by her being positioned supine. After verifying the sensorineural level at T7, an additional 0.5 mL of 0.5% bupivacaine was re-injected. The surgical procedure was initiated when the sensorineural level reached T4. The patient's arterial blood pressure

dropped by 20%, and 15 mg of ephedrine was administered. No bradycardia was observed. During the operation, the patient received a total of 500 mL of fluid, comprising a 0.09% NaCl solution. After the removal of the spinal catheter, postoperative analgesia was achieved intravenously through a PCA pump, delivering fentanyl at a rate of 20 μg/h with a bolus dose of 20 μg and a loading dose of 30 μg. Low-molecular-weight heparin, which had been suspended 24 hours prior to the operation, was resumed.

Case 3

A 32-year-old female patient with a gestational age of 38 weeks was scheduled for an elective cesarean delivery due to previous LSCS. The patient underwent an emergency Caesarean section operation under general anesthesia due to the development of fetal distress during the first CS. The patient had a history of rheumatic heart disease with severe mitral stenosis. For the second CS, continuous spinal anesthesia was planned. The patient was transferred to the operation room, where central venous pressure and arterial pressure were monitored via central venous catheterization through the internal jugular vein and radial artery catheterization under local anesthesia, respectively. Standard monitoring also included the evaluation of peripheral oxygen saturation and electrocardiography. The central venous pressure was 15 mmHg, the heart rate was 84 beats per minute, and the arterial blood pressure was 120/70 mmHg. Then, 1 mL of 0.5% plain bupivacaine was injected through the catheter, and the sensorineural block level was found to be at T10. After the administration of a second dose of 0.5 mL of 0.5% plain bupivacaine, the sensorineural block level was raised to T6, followed by the commencement of the operation, which comprised a Caesarean section and tube ligation. The patient complained of pain following the extraction of the baby, and 0.2 mL of 0.5% plain bupivacaine was re-administered, raising the sensorineural block level to T4. The operation was not complicated by bradycardia or hypotension. The patient was administered a total of 700 mL of fluid (lactated Ringer's solution) during the operation. Prior to transferring the patient to the intensive care unit, the spinal catheter was removed. Postoperative pain management was achieved intravenously by a patient-controlled analgesia (PCA) pump (fentanyl 20 μg/h with a bolus dose of 20 μg and a loading dose of 30 μg). The patient had been taking

low-molecular weight heparin treatment throughout the pregnancy period, and following the removal of the spinal catheter, the same antithrombotic therapy was reinstituted. The patient was closely monitored by a cardiologist for 24 hours in the intensive care unit.

Case 4

A 23-year-old pregnant woman with a history of severe mitral stenosis and prior balloon mitral valvuloplasty was referred for preoperative evaluation. She was asymptomatic during her current pregnancy. Preoperative assessment revealed severe mitral stenosis, mild mitral and tricuspid regurgitation, and left atrial enlargement. An elective caesarean section was planned for her under general anesthesia with epidural analgesia. Intraoperatively, monitors were placed, intravenous access secured, and an epidural catheter was inserted. General anesthesia was induced with appropriate medications, and the patient was intubated without significant hemodynamic changes. Oxytocin was administered post-delivery, and anesthesia was maintained with a combination of medications. The patient's condition was stable throughout the procedure.

At closure, Bupivacaine 0.125% and fentanyl 50 mcg were given for haemodynamics. Patient began spontaneous breathing after procedure. Reversed with glycopyrrolate 0.04 mg and neostigmine 2 mg. Extubation done without haemodynamic changes. Patient moved to cardiac care unit with epidural catheter. Postoperatively, Bupivacaine 0.125% and fentanyl 25 mcg given via epidural catheter every eight hours for 72 hours. Monitored in cardiac care unit for two days, then to postnatal ward. Discharged on seventh day without complications.

Case 5

A 28-year-old pregnant woman presented at 33 weeks with symptoms of dyspnoea, orthopnoea, and pedal edema, diagnosed with mitral stenosis, left atrial enlargement, severe pulmonary hypertension, tricuspid and aortic regurgitation, and intrauterine growth retardation. She received digoxin, atenolol, and torsemide for symptom relief, underwent elective cesarean section at 36 weeks with anesthesia induction using propofol and succinylcholine, delivered a healthy baby with good APGAR scores, and received postoperative medications and care in the cardiac ICU. The patient had a smooth recovery and was discharged

on the fifth postoperative day with instructions for follow-up with a cardiologist.

Discussion

The worldwide prevalence of heart disease in pregnancy is around 1%, mainly due to RHD in developing countries like India. RHD-induced mitral stenosis causes increased left atrial pressure leading to pulmonary hypertension. Untreated, it can progress to right heart failure with bilateral pedal edema and tricuspid regurgitation. Complications may include pulmonary edema, arrhythmias, endocarditis, thromboembolism, growth retardation, abortions, and preterm labor.

Antenatal management

According to the WHO's modified classification of maternal cardiovascular risk, pulmonary hypertension due to any cause falls under a class 4 risk group.2 Medical termination of pregnancy (MTP) is recommended for such patients due to the high risk of maternal and fetal mortality. However, our patient could not undergo MTP since she was 33 weeks pregnant. Beta-blockers are the cornerstone of antepartum management for symptomatic patients with mitral stenosis, as tachycardia reduces left ventricular diastolic filling time, preload, and cardiac output subsequently.

During labor, cardiovascular alterations in patients with mitral stenosis can trigger pulmonary edema, including increased heart rate, circulating blood volume due to uterine contractions, and acute changes in cardiac output and venous return. Cesarean section shortens delivery time and reduces hemodynamic changes caused by uterine contractions, thus an elective cesarean section was preferred over vaginal delivery in our case.

Anesthetic management

Epidural anesthesia is often recommended for cesarean sections in patients with heart disease due to its gradual onset of sympathetic blockade, which prevents rapid peripheral vasodilation and subsequent hypotension. This gradual vasodilation decreases the preload on the heart, reducing the risk of heart failure and pulmonary edema. However, patients with right heart failure secondary to mitral stenosis may not be able to maintain adequate cardiac output if the preload is decreased excessively. In such cases, prior adrenergic blockade and diuretic therapy can worsen the tendency to develop hypotension. Considering the patient's history of right heart failure, we avoided epidural anesthesia. General

anesthesia was preferred in our case as it allows for meticulous control of the patient's ventilatory status, which is necessary for high-risk patients with pulmonary edema. It is also preferred in patients receiving anticoagulation in the peripartum period who are at risk of developing an epidural hematoma, a complication of epidural anesthesia. Sevoflurane was chosen due to its ability to control the stress response adequately. Rapid sequence anesthesia without premedication (except for the inducing agent) decreases the risk of neonatal respiratory depression. Keeping this in mind, we administered fentanyl after clamping the cord, not before it.

Conclusion

Several hemodynamic parameters must be taken into account when determining the most suitable anesthesia method for cesarean section in patients with severe RHD. The management of such cases should be conducted at a tertiary level center under the supervision of a multidisciplinary team comprising an obstetrician, a cardiologist, an anesthesiologist, and a neonatologist.

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