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Case Report

Anaesthesia Section

Graded Epidural Anaesthesia with Low-Dose Phenylephrine Infusion for Management of Caesarean Section Complicated with Severe Mitral Stenosis: A Case Report

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ABSTRACT

A pregnant patient with a heart condition poses a unique challenge for the obstetrician and anaesthesiologist. Understanding the physiology of pregnancy and the pathophysiology of primary heart disease is important when providing anaesthesia for these high-risk patients during childbirth. A 32-year-old primigravida at 35 weeks and two days of gestation was diagnosed with Rheumatic Heart Disease (RHD), severe Mitral Stenosis (MS), moderate Mitral Regurgitation (MR), mild Atrial Regurgitation (AR), moderate Tricuspid Regurgitation (TR), Pulmonary Arterial Hypertension (PAH), Atrial Fibrillation (AF), and Grade-II New York Heart Association (NYHA). The patient underwent an Elective Lower Segment Cesarean Section (LSCS) performed under epidural anaesthesia, and complications were satisfactorily managed.

Keywords: Anaesthetists, Caesarean section, Obstetricians, Pregnancy, Rheumatic heart disease

CASE REPORT

A 32-year-old primigravida was diagnosed with RHD during the second trimester of pregnancy when she developed breathlessness while performing daily activities and developed pulmonary oedema. Transthoracic echocardiography revealed a Mitral Valve Area (MVA) of 1 cm^2 with severe PAH and a normal ejection fraction (60%). She also developed AF secondary to MS and was on rate control (tablet Metoprolol 25 mg twice a day) and subcutaneous injection of Enoxaparin 0.4 mg once a day. Her pulmonary oedema resolved with diuretics.

Later, she was scheduled for an elective LSCS at 35 weeks and two days of gestation. Physical examination revealed an irregularly irregular pulse of 133 beats per minute and a Blood Pressure (BP) of 96/64 mm Hg in the right arm while in the supine position. The first and second heart sounds were audible with the presence of a diastolic murmur. Bilateral vesicular breath sounds were heard with no additional sounds. All laboratory investigations, including serum electrolytes, were within normal limits.

The patient was classified as American Society of Anaesthesiologists (ASA) Grade-IV and provided with written and informed high-risk consent. She was advised to be nil per oral for six hours prior to surgery and skip the injection of Enoxaparin 12 hours before the procedure.

Pre-anesthetic assessment was conducted, and the patient was taken to the operation theatre. All monitors were attached following ASA standards, and two large-bore intravenous catheters were secured. Under aseptic precautions, a 20G cannula was inserted in the right radial artery for intra-arterial BP monitoring.

Using strict aseptic precautions, an 18G Tuohy's needle was placed in the L2-L3 space using the loss of resistance technique, and an epidural catheter was threaded and secured at 9 cm. Incremental doses of 2 mL of 0.5% Bupivacaine were administered until an adequate sensory block up to the T6 dermatome was achieved. A total dose of 12 mL was given over 20 minutes. A very low dose infusion of Phenylephrine at 10 mcg/min was started and titrated to maintain BP within 20% of the baseline value. The surgery was performed without complications, and the baby had APGAR scores of six and eight at one and five minutes, respectively. Intravenous fluids were administered judiciously, and an infusion of Oxytocin at 10 IU/hr was started after delivery. Intraoperatively, there was approximately 400 mL of blood loss, and urine output was 250 mL. The patient received oxygen supplementation throughout the surgery.

The intraoperative course was uneventful, and she was transferred to the cardiac careunit for further postoperative monitoring. Her postoperative vitals were as follows: BP- 100/62 mm Hg, pulse-104 beats per minute, respiratory rate- 22/min, SpO_2- 100% on a face mask at 5 liters per minute. The infusion of Phenylephrine was gradually tapered off. Postoperative analgesia was managed with an epidural top-up of 0.125% Bupivacaine and intravenous paracetamol. Her hospital stay was uneventful.

DISCUSSION

Cardiovascular disease affects 1% to 3% of all pregnancies and accounts for 10% to 15% of maternal mortality [1]. RHD is the most common condition responsible for maternal cardiac complications [2]. During pregnancy, there are normal physiological changes such as an increase in intravascular volume and cardiac output (CO), and a decrease in systemic vascular resistance (SVR) [3]. Uterine contraction and involution further lead to auto transfusion and increased CO [4]. Stenotic lesions, where the CO is fixed against the stenosed valve, are poorly tolerated and often worsen during pregnancy [5]. Since no anesthesia technique is considered entirely freefrom adverse effects, it is crucial to individualise each case by weighing the benefits against the risks.

In developing countries, cardiovascular diseases often go undiagnosed until they manifest symptoms due to a lack of antenatal checkups. Pregnancy-associated physiological changes in the cardiovascular system, such as an increase in heart rate, plasma volume, CO, and a reduction in SVR, impose an additional burden on an already diseased heart [3]. In this case, the patient was diagnosed with RHD only after developing breathlessness, palpitations due to pulmonary edema, and AF secondary to a stenotic mitral valve.

Despite technological advances, cardiovascular complications during pregnancy remain one of the leading causes of maternal mortality

and morbidity [6]. Therefore, the approach and management should be meticulously planned. In this case, the patient had severe MS (valve area 1 cm^2) with severe PAH, AF, and Grade-II NYHA, and was scheduled for elective LSCS. The goals for anesthetic management of this patient were to prevent rapid ventricular rate, avoid excessive or rapid decrease in SVR, prevent overloading of central blood volume while maintaining left atrial (LA) preload, avoid hypoxia, hypercarbia, and acidosis (which can further worsen pulmonary arterial pressures and precipitate right ventricular failure), avoid aortocaval compression, and provide analgesia.

General anaesthesia (GA) has been a preferred choice for managing LSCS in patients with severe stenotic valvular lesions, but it is associated with complications such as difficult or failed intubation, risk of aspiration of gastric contents, and increased blood loss. To minimise the tocolytic and fetal effects of inhalation agents, they are often used in reduced concentrations, which increases the risk of intraoperative awareness [7]. Positive pressure ventilation and the use of nitrous oxide can increase pulmonary vascular resistance and worsen PAH [8]. Additionally, the use of opioids is associated with a risk of neonatal respiratory depression. However, GA is necessary for critically ill parturients requiring mechanical ventilation, unstable AF, or in patients at risk of hemodynamic complications.

The benefits of Regional Anesthesia (RA) for LSCS over GA have been well proven in studies [9,10]. RA allows the mother to be awake during the birth of her child, avoids airway handling, preserves protective airway reflexes, and minimises the adverse effects of induction and inhalational agents. However, due to the risk of hemodynamic alterations, reduced afterload, and hypotension associated with subarachnoid block, it was not the technique of choice in this case.

Epidural anesthesia, with its slower and gradual onset, has the least impact on hemodynamics, prevents cardiovascular decompensation, and improves utero-placental perfusion. The duration of epidural block can be extended into the postoperative period, providing postoperative analgesia as well. Since this patient was scheduled for elective cesarean section, we opted for a gradual incremental epidural block for better maternal and fetal outcomes.

It is noteworthy that low-dose infusion of phenylephrine has been found to be superior in preventing hypotension following a neuraxial block compared to bolus doses [11]. In this case, a prophylactic baseline low-dose infusion of phenylephrine at 10 mcg/min was started and titrated to maintain mean arterial pressure (MAP) within 20% of the baseline value.

Intravenous fluids were judiciously administered to prevent fluid overload and pulmonary edema. Once the baby was delivered, an oxytocin infusion was started at 10 U/hr. Injection Esmolol was kept readily available to manage any post-delivery tachycardia with oxytocin infusion, but it was not needed. Epidural analgesia was provided for postoperative pain, and the patient's recovery was uneventful. We should remain highly vigilant for complications such as uterine autotransfusion during the postpartum period. The case was successfully managed with graded epidural block combined with phenylephrine infusion, minimising invasive procedures and systemic drug administration.

CONCLUSION(S)

Graded epidural anesthesia with low-dose phenylephrine infusion provides stable hemodynamics in patients with severe MS. Therefore, it can be used to manage LSCS in parturients with severe MS, resulting in good maternal and fetal outcomes.

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