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Case Report
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Anesthetic Management for Cesarean Section in Patient with Severe Pulmonary Stenosis

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Abstract

Anesthesia in patients with cardiovascular disease requires a multidisciplinary approach especially during pregnancy with circulatory changes. We present anesthetic management of Caesarean Section (CS) in a pregnant patient with severe Pulmonary Stenosis (PS). This presentation briefly emphasizes the importance of careful management to avoid deterioration in perioperative cardiac performance in parturients with valvular heart diseases.

Keywords: Anesthesia technique; Cesarean section; General anesthesia; Pregnancy; Pulmonary stenosis

Introduction

The combination of cardiac disease and pregnancy has considerable risk [1]. Pregnancy-associated cardiovascular changes result in a significant hemodynamic variability that is associated with higher possibility of morbidity and even mortality in women with cardiac disorders, and their offspring [2]. Pulmonary stenosis accounts for 10% to 12% of Congenital Heart Disease (CHD) in adults [3]. It is either a part of a complex congenital cardiac anomaly, or an isolated congenital defect. Mostly, this problem is detected and corrected in childhood. An acquired form can be due to rheumatic fever, carcinoid syndrome, infective endocarditis, previous surgery, or other interventions. Elevated transvalvular pressure gradients lead to Right Ventricular (RV) hypertrophy and dilation, angina pectoris, syncope, and even right ventricular failure. The anesthetic management of the parturient must be based on individual assessment of cardiac function and reserve to anticipate the impact of anesthetic techniques for vaginal delivery or Caesarean section on cardiac performance [4-6]. Considering the rarity of these cases, the optimal anesthetic management is thoroughly discussed here for cesarean section.

Case Presentation

The 34 years old, 70 Kg gravid two female with 36 weeks of gestation presented to obstetrics and gynecology department for elective cesarean section and tubal ligation. She had history of PS that was diagnosed in 2007 and her previous CS was under epidural anesthesia without any complications. She was not having any complaints of dyspnea, cyanotic episodes, chest pain, or palpitation in the recent past. She did not use any medication regularly and had no habitual history related to her health issues. The preoperative anesthetic examination revealed a New York Heart Association (NYHA) Functional Classification II, normal airway examination and normal biochemical profile. On clinical examination there was a Grade III/VI mid systolic high-pitched crescendo-decrescendo murmur heard best at second left inter costal space with 67 beat/min pulse rate and 90/60 mmHg blood pressure. The echocardiography revealed severe valvular PS, thick and dome-shaped pulmonic valve, and moderate pulmonic regurgitation. Pulmonary artery was dilated to 33 mm and pulmonary valve annulus was 22 mm. Pressure Gradient across the Pulmonary Valve (PVPG) was as high as 68 mmHg (Gmax 68 mmHg) and ejection fraction of 55%, normal systolic function with mild right ventricular dilatation. The Electrocardiogram (ECG) showed multiple Premature Ventricular Contractions (PVC). The cardiologist recommended terminating the pregnancy in gestational age between 36 and 37 weeks by cesarean section. In the operation room, a five-lead ECG with ST segment analysis, Non Invasive Blood Pressure (NIBP) and pulse oximetry were applied. Patient's blood pressure was 110/80 mmHg, pulse rate was 75/min, and oxygen saturation (SPO_2) was 98% on room air. Intravenous (IV) access was secured with two 18 gauge cannula. There were multiple bigeminal PVCs on ECG monitoring. Patient was preoxygenated by fit simple face mask for three minutes and anesthesia was induced with intravenous injection of 400 mg of

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sodium thiopental. Tracheal intubation was facilitated by intravenous injection of 100 mg lidocaine 2% and 100 mg succinylcholine and then by 20 mg of atracurium. Anesthesia was maintained with 3 lit/min O_2 and 0.6% to 1.2% of Isoflurane. A live male fetus of 2.8 kg was delivered. Intravenous infusion of oxytocin 5 to 10 μ/h started and 100 mg of fentanyl and 6 mg of morphine was injected for postoperative pain relief. She received 1.5 liters of crystalloid during the surgery. She had a total amount of 350 ml of urine and 400 ml of bleeding during surgery. At the end of surgery neuromuscular blockade was reversed with neostigmine 3 mg and atropine 1.5 mg. Patient was extubated in the operating room and shifted to Post Anesthesia Care Unit (PACU) where she was monitored for one hour for any hemodynamic instability and then transferred to Intensive Care Unit (ICU) for further monitoring during next 24 h. The patient was shifted to the ward after that and discharged from hospital on the 4th postoperative day without any complication. Postoperative pain relief was achieved by intravenous paracetamol in the ward, and oral Nonsteroidal Anti-Inflammatory Drugs (NSAIDs) at home.

Discussion

Pulmonary stenosis, as an isolated problem, accounts for approximately 10% to 12% of all congenital heart diseases [7]. The PS is caused by the lesions associated with obstruction to the right ventricular outflow tract. A stenosis may be valvular, sub-valvular, supra-valvular or in pulmonary arterial tree [8]. Anesthetic management of patients with severe PS requires understanding of the physiological changes and also the events and medication that can rectify or worsen this problem. Pulmonary stenosis increases the work of the right ventricle to pump the blood out. During pregnancy, preload may be reduced because of aortocaval compression. Preload could also be diminished during delivery due to vasodilatation induced by neuraxial sympathetic block [4]. Severe pulmonary stenosis can reduce left ventricular output so it is important to maintain preload to optimize myocardial contractility; however, excessive preload can precipitate right heart failure and also atrial arrhythmias [9,10]. Pulmonary stenosis can be deteriorated during labor and vaginal delivery due to increase in oxygen consumption and reduced preload during valsalva maneuvers therefore Normal Vaginal Delivery (NVD) does not seem to be a proper method for child birth. Sanikop et al., [2] reported a similar case which was successfully managed by general anesthesia. Spinal anesthesia may be associated with an uncontrolled reduction in right ventricular preload and should be avoided in severe cases. Epidural anesthesia again can result in episodes of hypotension, which is not acceptable. General anesthesia offers a safe approach for fluid management and maintaining hemodynamic stability as reported by other case studies [8-13]. On the other hand, there are some cases that were successfully managed by neuraxial anesthesia [12]. Although no conclusions can be drawn from these few case reports, it is demonstrated that in selected cases, caesarean section can be performed safely under general anesthesia [2]. Pulmonary stenosis increases intraventricular pressure and work of the right ventricle. The left ventricular output may be impaired by shifting of ventricular septum toward the left. Pregnancy induced increase in intravascular volume and heart rate can precipitate Right Heart Failure (RHF) and cardiac arrest. Resuscitation in case of cardiac arrest is extremely difficult as cardiac compressions are not effective in forcing the blood out of stenotic pulmonary valve. It is important to maintain effective right ventricular filling pressure by optimum preloading but excessive preloading can also precipitate RHF. The goal of anesthetic management is optimizing right ventricular preload, avoiding any increase in pulmonary vascular resistance and decrease in systemic vascular resistance, maintaining normal sinus rhythm, and effective ventricular contractility [13]. In general, hypothermia, hypercarbia, acidosis, hypoxia and high ventilator pressures should be avoided. General anesthesia is a better choice, since almost all of the parameters above could be controlled more easily during general anesthesia, by giving intravenous induction drugs in titrated doses and slowly, and meanwhile, closes cardiac and respiratory monitoring. However, invasive monitoring does not seem to be necessary and we did not attempt to insert a central venous catheter, because surgery was planned to be a short procedure with no major fluid loss or shifts. Inhalational and the narcotic based induction were avoided due to slow induction and higher risk of aspiration, neonatal depression and maternal myocardial depression. Nitrous oxide could increase pulmonary vascular resistance, and was avoided, as well. The main hemodynamic objectives for this patient were to maintain a normal heart rate, as ideally a low to normal heart rate is preferable for patients with pulmonary stenosis. One of the most important factors in the success of this procedure is the co-operation between physicians of various specialties in the management of the procedure and the patient. In this regard Nilofer et al., [1] reported a successful pregnancy in a patient with univentricular heart and pulmonary stenosis and they experienced that interdisciplinary management between the cardiologist, obstetrician, anesthetist, and neonatologist throughout the pregnancy, delivery, and postpartum period seems to be mandatory for a good outcome.

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