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Spinal Anesthesia for Cesarean Delivery of a Pulmonary Arterial Hypertension Parturient; A Case Report

Seyed Amir Mohajerani [1], Seyed Mojtaba Moosavi [2] and Reza Aminnejad [2, *]

[1] Department of Anesthesiology, Shahid Beheshti University of Medical Sciences, Tehran, Iran
[2] Department of Anesthesiology, Shahid Beheshti Hospital, Qom University of Medical Sciences, Qom, Iran

[*] *Corresponding author*: Department of Anesthesiology, Qom University of Medical Sciences, Qom, Iran. Tel: +98-9123098598, Email: r.aminnejad@yahoo.com

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Abstract

Anesthesia for parturients with pulmonary arterial hypertension (PAH) is challenging. Successful management of anesthesia in PAH parturients during labor requires an interdisciplinary approach and a multidisciplinary team. During parturition, neuraxial anesthesia can be a safe and reasonable choice in this group of patients. Choosing the safest anesthesia method is always a challenge in this scenario. In a case report study, the current researchers used management of anesthesia with neuraxial block and preserving afterload and meticulous control of pulmonary hypertension.

Keywords: Cesarean Delivery, Pulmonary Arterial Hypertension, Ropivacaine, Spinal Anesthesia

1. Introduction

Congenital heart diseases (CHDs) are one of the leading causes of cardiac diseases. Atrial septal defect (ASD) is the second or third most common CHD in Iran (1, 2). Pulmonary arterial hypertension (PAH) could be considered as primary or secondary to congenital or valvular heart anomalies with age-related increase in its incidence (3). Maternal mortalities are relatively high in pregnant females with pulmonary arterial hypertension despite available advanced therapies. According to the current guidelines, pregnancy is not recommended for this group of patients and early termination of pregnancy should be considered in pregnant females (4). Anesthesia management is of paramount importance in these cases due to rapid changes in cardiac parameters during anesthesia.

2. Case Presentation

The patient was a 30-year-old parturient with a history of pulmonary arterial hypertension due to long-standing congenital uncorrected atrial septal defect (ASD) admitted due to the initiation of labor pain. In his past medical history, she also had asthma. In obstetric history, she had an uneventful child birth by normal vaginal delivery five years ago. During the preoperative visit, she was tachypnic with a respiratory rate of 24 to 26 bpm. She also had tachycardia with pulse rate of 138 bpm and blood pressure of 115/65 mmHg. Echocardiography was not performed due to presence of severe fetal distress, and the patient was prepared for anesthesia without delay. The last echocardiography of the patient one year ago indicated sinus venosus, mildly reduced systolic function of the left ventricle, left ventricular ejection fraction (LVEF) estimation of about 40%, basilar and mid-inferoseptal hypokinesia of the LV, severely enlarged RV (5.4 cm), mildly reduced function of the RV, dilated RA, trivial MR, no MS, normal structure and function of AV, normal PV with mild PI and no PS, severe TR, no TS and TR Gradient of 40 mmHg and finally PAP of 50 mmHg. Minimal pericardial infusion was also reported. The abnormal laboratory finding was mild anemia (hemoglobin level of 11.4 g/dL and MCV of 79.9 fL). In prenatal screening ultrasound, neonatal cardiac evaluation was normal. Cardiology consult recommended cesarean section and appropriate prophylaxis of thrombosis.

In the operation room, 0.5 mg of midazolam was injected intravenously as premedication due to maternal anxiety. Preloading was accomplished by infusion of 500 mL of normal saline. Neuraxial anesthesia was selected as the method of anesthesia for this patient because of incomplete NPO time, bilateral widespread wheezes in both lungs, lower respiratory tract infection symptoms, and

anticipated difficult airway (short neck, micrognatia and temporo-mandibular distance of about 4 cm). Spinal anesthesia was performed by mixture of 10 mg of hyperbaric ropivacaine (5 mg/mL) solution and 25 μg of fentanyl administered in the intrathecal space at L_{4-5} lumbar interspace level. Level of anesthesia was achieved and limited to T_6 by appropriate positioning. About five minutes after skin incision, the baby was delivered with Apgar score of 10 in one and five minutes. The entire procedure was carried out uneventfully in about half an hour. During anesthesia, standard monitoring of the patient was performed using pulse oximetry for oxygen saturation (SPO_2 percentage), noninvasive measurement of blood pressure, and 5 lead electrocardiogram (ECG). Supplemental oxygen was delivered to the mother via a face mask in flow rate of 5 L/minute during the procedure. At the end of the operation, the mother was transferred to the intensive care unit (ICU) and the newborn was admitted to the NICU. Postoperative analgesia for the mother was performed using ketamine, administered via the PCA pump for the first postoperative day. The mother and the baby were discharged two days later with good condition and no incident during the postoperative hospital stay. The patient and her family were recommended to follow up proper evaluation and treatment of her heart defect. Institutional review board approval and informed patient consent was taken from the patient for publishing the case for educational and research purposes.

3. Discussion

Anesthesia in a parturient with uncorrected congenital heart disease is always challenging. Pregnancy carries additional risk of morbidity and mortality in these patients (4). Pulmonary arterial hypertension is associated with a significant risk of maternal mortality during pregnancy and delivery and it is associated with significant risk of maternal death. In this situation, cardiac function depression leads to increased pulmonary vascular resistance (5).

Atrial septal defect is often well tolerated during pregnancy (6). Pulmonary arterial hypertension induced by ASD requires planning and meticulous measurements in both regional and general anesthesia, and prevention of incidental intravenous or epidural injection of air bubbles. Attenuation to hypotension following induction of general anesthesia or sympathetic block by spinal anesthesia, which can lead to a decrease in systemic vascular resistance and following reversal of shunt with maternal hypoxemia, should be managed vigorously. Avoiding hypercarbia, acidosis, and pain, which could induce an increase in pulmonary vascular resistance and shunt reversal, should be considered during management of anesthesia in this situation (6).

Management of anesthesia in obstetrics with pulmonary arterial hypertension is another challenge to anesthesia, and severity of the disease is one of the most important determinant factors. In such cases both general and regional anesthesia have been performed successfully (5). The main goal of anesthesia management in this group of patients is avoiding desaturation and improving oxygenation. This goal could be achieved by avoiding increase in PVR and decrease in SVR. Oxygen supplementation could help this goal. Sildenafil and prostacyclin are useful as pulmonary vasodilator agents for controlling pulmonary arterial pressure. Epidural anesthesia may be the preferred method of neuraxial block in these patients and parturients because of better hemodynamic stability compared to spinal block. However, spinal anesthesia, specially with additives such as opioids or benzodiazepines, is another attractive option for this purpose (7). In any neuraxial anesthesia, the highest level of block maybe fixed at the level of T_6 for adequate anesthesia and avoidance of unsafe hemodynamic instability. Close monitoring of patients' hemodynamic status is the mainstay of this issue. For this purpose, electrocardiogram, direct arterial blood pressure and central venous pressure (CVP) monitoring, oxygen saturation, right ventricular end-diastolic volume (RVEDV), cardiac output, urinary volume, and arterial blood gas analysis should be considered. Monitoring of pulmonary arterial pressure by pulmonary arterial catheter is not recommended because of potential complications. Avoidance of decreases in SVR or vigorous treatment of unfavorable events by phenylephrine or noradrenaline should be considered. Extracorporeal membrane oxygenation (ECMO) could be a rescue treatment for refractory cases of pulmonary hypertensive crisis. Limiting the administered intravenous fluid is another key issue of anesthesia management in these parturients. Liberal fluid administration can lead to heart failure and subsequent unwanted events. For this reason, CVP or RVEDV monitoring would be beneficial. Diuretics should be available for treating intravenous fluid excess. Following delivery of the fetus, Esmarch rubber bandages on the lower extremities could be used for preventing unwanted increases of venous return that may lead to heart failure. In addition, inotropic medications, such as dopamine, should be available to treat heart failure (8, 9).

General anesthesia is another yet unfavorable choice for anesthesia management in parturients with PAH. This method may be preferred in patients with greater illness. If general anesthesia is inevitable, lung protective method of ventilation is necessary for avoiding increases in PVR (the patient should be ventilated with the lowest airway pressure and tidal volume possible). Prevention of hypercarbia is another concern and should be managed in this situation. Intravenous administration of catecholamines should also be considered prior to induction of anesthesia (9).

Oxytocin administration is another challenging issue in anesthesia management for PAH parturients. Intravenous administration of this drug can lead to hypotension and therefore should be used cautiously and by slow infusion (9, 10).

In conclusion, a multidisciplinary approach is required for successful management of anesthesia of cesarean section in parturients with PAH, including attending team of anesthesiologists, obstetrics, neonatologists, and pulmonary hypertension specialist, along with experienced support staff (11). As it was described in this case, neuraxial anesthesia and meticulous control of pulmonary and systemic blood pressure and rapid response to blood pressure changes is vital for PAH parturient during cesarean section.

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