Spinal Anesthesia in a Pregnant Woman with Primary Pulmonary Hypertension

1 Fatemeh Javaherfroosh, 2 Ahmad Ebadi, 3 Mohammad Reza Pey Polzadeh, 4, 5 Hossein Rahmani

1 Assistant Professor, the Anesthesia Department, Ahvaz Jundishapur University of Medical Sciences
2 Assistant Professor, the Anesthesia Department, Ahvaz Jundishapur University of Medical Sciences
3 Assistant Professor, the Anesthesia Department, Ahvaz Jundishapur University of Medical Sciences
4 Departments of Toxicology, Shahreza Branch, Islamic Azad University, Shahreza,
5 Medical Research Center, Jundishapur Health Development Co, Tehran, Iran

ABSTRACT

Background and objective: Primary pulmonary hypertension is a rare disease that, if concomitant with pregnancy, will have a high mortality rate. It usually occurs in women and since the output of the right side of the heart in these patients is highly dependent on the venous return and the pulmonary artery pressure, any factor that disturbs these two can cause severe disruption in cardiac output. This condition is frequently observed following labor pains.

Material Methods: In this study, the case of a 25-year old woman was reviewed who was in her 36th week of pregnancy, diagnosed with PPH, and referred for an urgent cesarean section. Spinal anesthesia was performed in the sitting position by injecting 50 mg of 5% lidocaine and 0.5 cc of 20% hypertonic glucose at the L3-L4 interspace.

Results: Prior to anesthesia, gases in the arterial blood sample were analyzed, and the following results were obtained:

\[ \text{BE} = -18, \text{PaO}_2 = 34 \text{ mmHg}, \text{HCO}_3^- = 15 \text{ mEq/L}, \text{SaO}_2 = 90\%, \text{PaO}_2 = 60 \text{ mmHg}, \text{pH} = 7.4 \]

The imbalance between acids and bases was corrected by prescribing 25 cc of bicarbonate to be intravenously injected. After the operation, the patient was in good general conditions, was transferred to the ICU with SaO2 of 98%, and sent to the maternity ward four days later.

Conclusion: Spinal anesthesia was then performed for the pregnant woman with PPH. It was found that if acidosis was corrected and pregnant women received sufficient hydrotherapy, spinal anesthesia could be a suitable method for pregnant women with PPH.

© 2015 FADAK PUBLICATIONS All rights reserved.

Introduction

Primary pulmonary hypertension is a rare disease that, if concomitant with pregnancy, can cause a high rate of mortality in pregnant women (1). PPH can occur at any age in men and women but most often happens in young to middle-aged women (1-2). In this disease, pulmonary vessels undergo changes that result in elevated pulmonary artery pressure and elevated pulmonary vascular resistance (2). The output of the right side of the heart in PPH patients depends on the filling pressure resulting from venous return and from pulmonary artery pressure. Therefore, any slight painful stimulation, worry, or stress that does not harm normal people, increases the heart rate in PPH patients and decreases their cardiac output (1, 2, 3). Any factor (such as cold, stress, pain) that leads to increased pulmonary vascular resistance and decreased venous return will also greatly disrupt cardiac output and put the patient in an abnormal situation (1-2). This situation, under conditions of labor pains, has frequently arisen and has increased death rates up to 50% in women with PPH who give birth naturally, and up to 100% in women who have cesarean sections (1, 2, 4). Many studies were conducted on managing anesthesia in PPH patients who were not pregnant, but few on pregnant women with PPH and on the ways they were anesthetized (1, 2, 3, 4). Therefore, we decided to introduce the case of a pregnant woman with PPH who was referred to the operation room at the Imam Khomeini Hospital in Ahvaz in order to briefly discuss the way anesthesia is managed in these patients.
**Case Report:**
The patient was 25 years old, in the 36th week of her first pregnancy, and referred to the hospital for an urgent cesarean section. The day before the operation when an anesthesiologist visited her, she was suffering from central and peripheral cyanosis and dyspnea. The medical history she presented showed she visited a doctor for dyspnea and cardiopalms in her sixth month of pregnancy. After echocardiography, she was diagnosed with PPH, and 60 mg of Enoxazepin per day was prescribed for her. When examined, her respiration rate was 22 breaths/min, heart rate 100 bpm, blood pressure 95/60 mm Hg. Pulmonary artery pressure recorded in the two echocardiograms in her file was 90 mm Hg (the normal value is 25.10 mm Hg). Wide splitting of the second sound and arrhythmia were audible in the auscultation of the heart, and hoarseness at the bases of both lungs in the auscultation of the lungs. Both echocardiograms in the file recorded enlarged right ventricle, elevated pulmonary artery pressure (90 mm Hg), likelihood of ASD, and 60% ejection fraction. Chest X-rays showed the heart had enlarged greatly. Considering the pulmonary artery pressure was equal to the systemic arterial pressure, surgery was too risky for the patient, and it was suggested she have the baby. Gases in arterial blood of the patient (while she was receiving oxygen through a mask) were as follows:

**BE** = -18, HCO3 = 15, Sao2 = 90%, Pao2 = 60, Peo2 = 34, pH = 7.40

The next day, following the start of labor induction, the patient developed severe cyanosis, dyspnea, and cardiopalms with the first uterine contractions. Therefore, labor induction was stopped and it was decided to perform a cesarean section. When she was transferred to operating room, she was cyanotic with PR = 30/min, Bp = 110/60, R = 120/min. Simultaneous with connecting various monitors (electrocardiography, non-invasive blood pressure, pulse oximetry, and a capnograph that measured cardiac output at the same time) to the patient’s body, she started to receive oxygen through a mask at 5 l/min. Two large peripheral vessels in her body were selected to administer up to 1500 cc of crystalloid solutions. Under these conditions, although she received oxygen through a mask, the pulse oximetry device recorded 90% Sao2. An arterial blood sample was sent to the laboratory to measure the gases and results obtained were as follows:

**BE** = -14, HCO3 = 17, Sao2 = 90%, Pao2 = 58, Peo2 = 28, pH = 7.4

Therefore, 25 cc of bicarbonate was slowly injected intravenously. It was decided to employ intrathecal regional anesthesia. After the patient was put in the sitting position, 50 mg of 5% lidocaine together with 0.5 cc of 20% dextrose were injected at the L3-L4 (Lombair 3, 4) interspace using a 24-gauge needle, and the patient was immediately put in a half-sitting position at 30 degrees. The anesthesia level rose up to T6. Systolic blood pressure declined to 90 mm Hg 2-3 minutes after anesthesia, ephedrine was injected twice (each time 5 mg), and blood pressure increased to 110 mm Hg. Another arterial blood sample was sent to the laboratory and the following results were obtained:

Po2 75, Sao2 = 95%, pH = 7.38, HCO3 = 20. After the child was born, the mother developed severe tachycardia (up to 148 bpm). Another 25 cc dose of bicarbonate was prescribed following which TNG was started at 2 μg/kg/min. Her heartbeat started to decline and decreased to 100, her blood pressure stabilized at 110/60, and the Sao2 measured by the pulse oximeter device was 98%. Surgical operation ended with the newborn in good conditions (with the Appar score of 8/10-10/10). After the operation, the patient was injected subcutaneously with 10 mg of morphine to reduce her pain and anxiety and intravenously with 2 mg of morphine if she complained of pain (PRN, or per rate if necessary), and also prescribed with 2 mg of midazolam to be injected intravenously. She was kept in the recovery room for an hour to control her vital signs and was then transferred to the ICU. During the 4 days she was there, her vital signs were desirable and on the fourth day the cardiologist restarted her use of Enoxazepin at 40 mg/day. Then she was taken to the maternity ward in satisfactory general conditions, and was discharged a week later.

**Discussion**
Pregnancy in patients with pulmonary hypertension is accompanied by high mortality rates (up to 100%) following cesarean section (1-5). Cardiac output in these patients is dependent on hemodynamic changes, including preload and afterload modifications. Pain, anxiety, excitement, and any stimulation releasing catecholamine, can disrupt afterload and preload, thereby disrupting cardiac output, greatly increasing pulmonary pressure, and creating pulmonary edema symptoms in patients (5). These conditions occur much more frequently during pregnancy and, therefore, these patients mainly complain of dyspnea and peripheral and central cyanosis. If intrathecal local anesthetics are used in these patients, they may reduce peripheral vessel resistance and finally result in cardiovascular collapse (6).
Continuous epidural anesthesia is an effective method in preventing increases in pulmonary vascular resistance resulting from pain, but great attention must be paid to administering the correct quantity of drugs in order to minimize peripheral vessel resistance (6). Adding narcotics to local anesthetics is useful and, considering characteristics of regional anesthesia methods including epidural and, to greater degrees, spinal methods in reducing systemic vessel resistance, it is suggested that general anesthesia be used in these patients, whenever possible (6). However, these patients suffer from metabolic acidosis and low cardiac output, and the conditions of the child to be born are strongly affected by these hemodynamic changes. Moreover, if these patients undergo labor induction using the high doses of narcotics required in these cases, the born child will certainly be born depressed and its life will be threatened by after birth risks. The mother will not be in a stable condition either because increased pulmonary vascular resistance during laryngoscopy and tracheal placement, the harmful effects of ventilation with positive pressure on venous return, and the negative inotropic effects of volatile anesthetics, will pose potential risks for her. Moreover, acid-base disruptions and high pulmonary pressure increase the possibility of the need for postoperative respiratory assistance, and problems related to separation from ventilation will themselves increase risks that will threaten the mother. In fact, these patients have Eisenmenger syndrome, with the difference that they are curable. Considering the points mentioned above, we could use the spinal anesthesia technique with minimal drop in systemic blood pressure for the described patient. Administering about 10-15 cc/kg of solutions, left lateral position, and adding 20% hypertonic glucose will stabilize the level of spinal anesthesia and will gradually reduce blood pressure. These conditions enable the anesthesiologist to use low-dosage dopamine together with nitroglycerine. TNG is an effective vasodilator for the pulmonary artery with less effect on systemic vessels (7). This drug has little effect on the fetus and uterine activity and, hence, can be used before the child is born. Sodium nitroprusside, which strongly dilates pulmonary vessels and also strongly reduces systemic pressure, is a replacement drug for TNG (5-6), but the possible effects of its metabolite (that is, cyanide) on the mother and the fetus must also be considered. Therefore, TNG is the first choice. Using this technique and the simultaneous correction of acidosis by administering bicarbonate, calcium gluconate, and even magnesium sulfate, will prevent systemic blood pressure drop. This will reduce afterload due to decreased peripheral vessel resistance, especially in the lower extremity, and will augment the patient’s preload. Therefore, advanced heart failure can be successfully treated and an ideal level of anesthesia up to T6 can be monitored for cesarean section. After that, high doses of morphine (0.1 mg/kg) can be administered to treat pain and oxygen saturation level of over 95% provided for the patient. Considering the above-mentioned points in the spinal technique, we were able to use this technique for the first time to manage anesthesia in a pregnant woman with PPH. Previously, only epidural methods and general anesthesia were used for these patients, and there are no reports of using the spinal technique. However, more extensive studies are needed in this area.

References