



## Anesthesia Management for Cesarean Delivery in a Pregnant with Severe Mitral Stenosis and Pulmonary Hypertension

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### Abstract

Pregnant women with heart disease constitute a unique problem for obstetrician and obstetric anesthesiologists. Mitral stenosis (MS) is the most common, clinically important valve lesion and the first symptoms occur during pregnancy in 25% of the patients. In this case report, we presented the anesthesia management of a 31-year-old woman in the 22 weeks of pregnancy with severe MS and pulmonary hypertension, which was decided to termination of pregnancy with cesarean delivery due to high risk of maternal mortality. CSE anesthesia, which allowed administration of intrathecal opioid following epidural local anesthetic, with invasive monitoring provided successful and safe anesthesia. After successful mitral valve replacement operation on the postoperative 15<sup>th</sup> day, the patient was discharged.

**Keywords:** Pregnancy; Heart disease; Regional anesthesia; Cesarean delivery

### Introduction

The incidence of cardiac diseases encountered in pregnancy in developed countries is between 0.2-3%. It is of great importance in terms of maternal, fetal morbidity and mortality, and is responsible for 10-15% of all mother deaths [1-3].

Heart valve diseases generally occur due to rheumatic heart diseases, endocarditis or congenital abnormalities in reproductive-age female [4]. Mitral stenosis (MS) is the most common, clinically important valve lesion and almost always develops due to rheumatic heart disease. The first symptoms occur during pregnancy in 25% of the patients [2,4-6]. If the mitral valve area, which is normally 4-6 cm<sup>2</sup>, is 1 cm<sup>2</sup> or less, it is called severe MS [5].

Pregnant women with heart disease constitute a unique problem for obstetrician and obstetric anesthesiologists. Severity of the lesion and hemodynamic status of the patient are of importance in anesthesia management for cesarean delivery in these patients. Anesthetic management can be challenging and quite risky, particularly in patients with MS and pulmonary hypertension [2,6,7].

In this case report, we aimed to present the anesthesia management of a pregnant with severe MS and pulmonary hypertension, which was decided to termination of pregnancy with cesarean delivery due to high risk of maternal mortality.

### Case Presentation

A 31-year-old woman in the 22 weeks of pregnancy (Gravida 4, Parity 2, Abortion 1) applied to emergency service with the complaints of hemoptysis, coughing and dyspnea. The patient, who had no regular follow-up of pregnancy, did not have any problems in her previous pregnancies and there was no clinical abnormality except smoking in her history. According to arterial blood gas analysis, there was marked hypoxemia (pH 7.34, pO<sub>2</sub> 52.3 mmHg, pCO<sub>2</sub> 29 mmHg, HCO<sub>3</sub><sup>-</sup> 21 mmol/L, BE -5, 3 mmol/L, and sPO<sub>2</sub> 86.7%). The transthoracic echocardiography revealed severe fibro-calcific MS, tricuspid regurgitation, and pulmonary hypertension (mitral valve area, 0.7 cm<sup>2</sup>; mean gradient, 24 mmHg; pulmonary artery pressure, 80 mmHg; 2-30 mitral regurgitation; 1-20 tricuspid regurgitation; dilated right atrium; left ventricular ejection fraction, 60%). The patient was taken to coronary intensive care unit and medical therapy with furosemide 40mg/day and metoprolol 50 mg/day was started, orally. On the next day, the symptoms of patient were partially relieved with medical treatment. In the multidisciplinary assessment, percutaneous valvuloplasty was not considered due to mitral regurgitation and accompanying inappropriate structure of mitral valve.

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**Table 1:** Hemodynamic parameters of patient during the operation.

	Blood pressure (mmHg)	Heart rate (beat/min)	SpO <sub>2</sub> (%)	CVP (mmHg)
Baseline value	115/64	77	95	10
After injection of epidural LA	99/56	65	96	10
After delivery of the baby	90/52	99	92	12
At the 15 <sup>th</sup> min of the operation	81/37	89	100	13
At the end of the operation	95/ 54	85	100	12

The patient was class IV according to maternal cardiovascular risk classification of WHO, and it was decided to terminate the pregnancy with cesarean delivery since the mother's well-being was the first priority in the setting of a non-viable pregnancy.

The patient was taken to the operation room after antibiotic prophylaxis. In addition to the routine monitoring (electrocardiography, non invasive blood pressure and pulse oximeter), invasive arterial pressure and central venous pressure (CVP) monitoring were made. Her preoperative blood pressure was 115/64 mmHg; her heart rate was 77 beats/min, sPO<sub>2</sub> 95%, and CVP 10 mmHg (Table 1). Ringer lactate and colloid infusion were started and the infusion rate was adjusted according to the CVP follow-up.

Regional anesthesia was planned for the patient and she placed in sitting position. After cleaning the skin and aseptic precautions, the marked space was infiltrated with 1% prilocaine. Accompanied by 16-gauge Tuohy needle of the combined spinal-epidural (CSE) set (Egemen, Izmir), epidural space was located using a loss-of-resistance to saline technique. A 26-gauge Whitacre spinal needle was placed into the subarachnoid space, and 25mcg fentanyl was injected after cerebrospinal fluid flow was observed. The epidural catheter was advanced, and 4 cm of catheter was left within the epidural space after the negative aspiration test for blood and cerebrospinal fluid. The patient was placed supine with 15o left lateral tilt, and supplemental oxygen was given via mask. Then, the mixture of 2% lidocaine and NaHCO<sub>3</sub> was incrementally administered from epidural catheter with closed hemodynamic monitoring. A bilateral T4-5 sensory block level was obtained after 15 min with a total 13 mL volume injection and the operation was allowed. A baby weighing 490 gms was delivered 90 sec after skin incision. The baby was taken to the neonatal intensive care unit after resuscitation, however, became ex at the postoperative 6th hour.

After delivery of the baby, oxytocin was not applied, as it was not seem necessary by the surgical team. There was no need of additional local anesthetic (LA) dose from epidural during the operation. As there was decrease of 30% in systolic blood pressure at the 15th minute of operation, 5 mg IV ephedrine was given twice (Table 1). During the operation that lasted 45 min, total of 900 mL of Ringer Lactate and 400 mL of colloid were infused. For postoperative analgesia, morphine 2 mg in 10 mL saline was given from epidural catheter. The patient was taken to coronary intensive care unit after the operation, for the reason that hemodynamic changes were highest in the first 48 hours.

The patient's hemodynamic parameters remained stable and she was taken to the service at second postoperative day. Cardiovascular surgery team decided to mitral valve replacement on the postoperative 15<sup>th</sup> day that the changes induced by pregnancy were ameliorated. After the successful operation, the patient was discharged.

## Discussion

In normal pregnancy, major physiological changes are observed in the cardiovascular system, such as increase in blood volume, heart rate, cardiac output (CO) and decrease in systemic vascular resistance (SVR). Stenotic valvular disease is poorly tolerated with advancing pregnancy, owing to the ability to increase CO in relation to the increased plasma volume [4]. When the mitral valve area decreases less than 2 cm<sup>2</sup>, significant gradient is developed across the mitral valve. The increase in left atrial pressure causes congestion in the pulmonary area and increases the risk of pulmonary edema that happened more dramatically in pregnancies due to increased heart rate and intravascular volume. This progression results in pulmonary arterial hypertension that may lead to increases in right ventricular pressures and to right ventricular failure. Pulmonary hypertension was associated with extremely high maternal and fetal mortality [2].

There is no controlled study, guidelines or standard applications for anesthesia management of the pregnant women with MS. It was recommended that individualizing the anesthetic management according to the patient's cardiovascular status and the practitioners' knowledge and experience of the existing treatment options. Successful general and regional anesthetic procedures have been reported in some cases of severe pulmonary hypertension [8]. The goals for the anesthetic management of patients with mitral stenosis are maintenance of an acceptable low- normal heart rate, avoidance of aortocaval compression, maintenance of adequate venous return and SVR, and prevention of pain, hypoxemia, hypercarbia and acidosis, which may increase pulmonary vascular resistance. Hence, closed invasive hemodynamic monitoring is essential [8,9]. For patients with New York Heart Association functional classification III-IV, pulmonary artery catheterization (PAC) is recommended, however placement procedures of such catheters have potential complications and their value is controversial in compensated patients with prior  $\beta$ -blocker and diuretic therapy [5]. In our patient, the hemodynamic follow-up during the perioperative period was performed by invasive arterial and CVP monitoring and liquid infusion was made according to CVP follow-up. CVP levels were maintained at 10-13 mmHg during the operation.

Regional anesthesia was best administered with titratable techniques, such as epidural and continuous spinal anesthesia in mitral stenosis [9]. Although delivery might be safely managed via epidural anesthesia for mild-to-moderate mitral stenosis, there are very few reports of women with severe mitral stenosis undergoing cesarean section via regional anesthesia [5,8]. Kocum et al. [5] reported a gradually titrated lumbar epidural anesthesia in a pregnant woman with severe MS and pulmonary hypertension. They placed CVP and invasive arterial monitoring, and did not apply PAC, like ours. They gave totally 20 mL of bupivacaine from the epidural catheter and provided stable hemodynamics during operation without vasopressor [5]. Celik et al. [9] preferred continuous spinal anesthesia with similar invasive monitoring in two pregnant patients with pulmonary hypertension due to MS. They applied 15 mg ephedrine in one patient due to a 20% decrease in blood pressure [8].

Due to lack of equipment, we could not be performed continuous spinal anesthesia. By using combined spinal-epidural set, we administered intrathecal opioid only through spinal needle, so aimed to avoid sympathectomy and reflex tachycardia induced by LA. After that, mixture of lidocaine with sodium bicarbonate was applied into

the epidural space by divided doses and rapid and adequate level of block was provided with less LA volume.

Similar application was recommended for epidural analgesia during normal vaginal delivery. Kee et al. [10] reported the use of intrathecal fentanyl (25 mcg) followed by diluted epidural bupivacaine and fentanyl infusion in three pregnant women with moderately severe mitral stenosis, without significant hemodynamic changes or requirement of LA boluses .

It was mentioned that these patients might be prone to develop hypotension with epidural anesthesia secondary to a combination of venous pooling and prior  $\beta$ -adrenergic blockade and diuretic therapy. So, appropriate hydration is significant. Low dose phenylephrine was suggested to use instead of ephedrine as it might result in tachycardia [4]. A hypotension attack happened only at the 15<sup>th</sup> minute of operation in our patient and we used ephedrine by titrating accompanied by judicious fluid infusion. Since phenylephrine was not available in our country, we had to give ephedrine and, fortunately, no tachycardia was observed.

Another important point in these patients is the hemodynamic effect of uterotonic agents used after delivery of the baby. Uterotonic agents have certain hemodynamic effects and should be used with caution. Particularly, 15-methyl prostaglandine-F<sub>2</sub> $\alpha$  that may lead to increase in pulmonary vascular resistance should be avoided. Due to early gestational age of our patient, there was no need for uterotonic agents in this case.

Consequently, perinatal management of pregnant women with MS should be made by a multidisciplinary team consistent of an obstetrician, anesthesiologists, a cardiologists, and cardiovascular surgeon. We consider that CSE anesthesia, which allows administration of intrathecal opioid following epidural LA with invasive hemodynamic monitoring, is a feasible option in pregnant women with severe MS and pulmonary hypertension.

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