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Central Neuroaxial Block Anesthesia: A Safe Choice for Caesarean Section in Patients with Mitral Stenosis

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ABSTRACT

Background: Mitral stenosis heart valve abnormalities in pregnant women is a complication of pregnancy that is quite common, accompanying rheumatic heart disease, endocarditis, and congenital abnormalities. In pregnancy, there have been changes in the cardiorespiratory system caused by increased cardiac output, which the presence of mitral valve stenosis can then exacerbate. Anesthesia management plays an essential role in the safety of the mother and baby during and after surgery. The choice of technique and anesthesia management depends on the abnormality's severity. ***Case:*** We report the successful management of anesthesia with pure central neuraxial epidural block and combined spinal epidural (CSE) in two cases of a cesarean section of 3rd-trimester pregnant women with mitral stenosis and class II functional heart failure caused by rheumatic heart disease. ***Conclusion:*** Central neuraxial block epidural anesthesia and combined spinal epidural (CSE) anesthesia are safe anesthesia techniques for both mother and baby because they can maintain hemodynamic stability.

Keywords: anesthesia; central neuraxial block epidural; mitral stenosis; pregnancy; spinal epidural

INTRODUCTION

During pregnancy, a woman's physiological systems will undergo modification due to hormonal, anatomical, and metabolic changes. One of the most significant modifications in the circulatory system is the increased cardiac output experienced in the first trimester of pregnancy. Maternal heart disease causes 10 to 25% of maternal deaths. Women with heart valve abnormalities can experience severe complications during pregnancy due to failure of adaptation. Mitral stenosis (MS) is a heart valve disorder often associated with pregnancy. Mitral stenosis accounts for nearly 90% of rheumatic heart lesions in pregnancy, with 25% of patients first experiencing symptoms during pregnancy.[1] Of the 312 pregnancies with valvular abnormalities, 60% were rheumatic heart disease. Mitral stenosis was the dominant valve disorder (61%), followed by mitral regurgitation (33%) and aortic regurgitation (6%).[2]

In pregnancy, there is an increase in intravascular volume and cardiac output to 100% from the third trimester to postpartum. At the same time, systemic vascular resistance (SVR) decreases to maintain normal mean arterial pressure. Uterine contractions result in automatic blood transfusion, causing a more significant increase in cardiac output at labor. Likewise, feelings of anxiety and pain increase sympathetic stimulation, which increases SVR, and heart rate, then further increases cardiac output, which can cause further stress.[3] 3 Under normal conditions, the mitral valve area ranges from 4-6 cm; clinical symptoms appear on the surface of the mitral valve, which decreases to 2 cm and worsens in the mitral valve area of less than 1 cm. Increased cardiac output in pregnancy will increase the New York Heart Association class so that heart valve abnormalities often manifest during pregnancy. Hypervolemia and tachycardia increase the transmitral gradient, causing an increase in volume and pressure in the left atrium. Pressure can be transmitted to the pulmonary vasculature, resulting in pulmonary edema. In severe cases, pulmonary hypertension, right ventricular hypertrophy, and right heart failure may occur.[3,4] Right atrial hypertrophy can interfere with cardiac conduction and turbulence of cardiac blood flow, which often causes thrombosis.

CASE REPORT

Case 1

We report the case of a 23-year-old woman with a 32-week second pregnancy who presented with complaints of shortness of breath and difficulty in activities and sleeping in a supine position 1 week before admission to the hospital. The patient was diagnosed with rheumatic heart disease (RHD) in the 2nd trimester of pregnancy with benzathine penicillin 1.2 million units intramuscularly every 28 days, digoxin 0.25 mg orally, furosemide 40 mg orally.

The patient had no history of allergies or bad habits and had not fasted for eight hours. The previous 6 years' delivery history was normal with a term baby. A patient diagnosed with G2P1001 32 mg single live, congestive heart failure (CHF), functional class II et causa RHD, moderate-severe Mitral Stenosis (MS), TR mild with echocardiographic examination showed Figure 1.

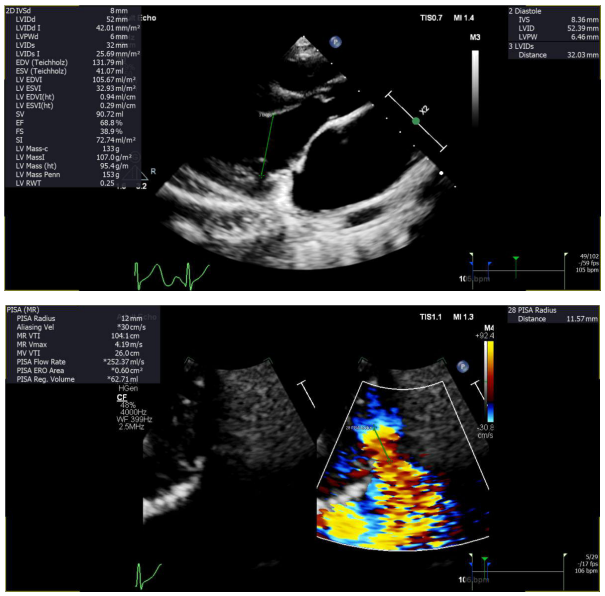

FIGURE 1: Echocardiogram patient show dilated left atrium (LA) heart chamber dimensions, left ventricle (LV) concentric hypertrophy, mild LV systolic dysfunction, 50% ejection fraction (EF), normal LV diastolic function, global normokinetic, moderate aortic regurgitation (AR), mild tricuspid regurgitation (TR), moderate-severe mitral stenosis (MS) and probability of pulmonary hypertension (PH)

The patient was then planned for an urgent cesarean section and tubectomy because the shortness of breath was getting worse, and the fetus's condition was getting worse. In the perioperative evaluation in the operating room, the patient was moderately breathless with compos mentis consciousness, blood pressure 100/70 mmHg, pulse 100 beats per minute, respiratory rate, 24-28 breaths per minute, axillary temperature 36.6 degrees Celsius, oxygen saturation. 94%-96%, coarse wet crackles in both lung fields, grade II-III diastolic murmur at ICS 2 left. Abdominal conditions describe gravida according to gestational age and fetal heart rate (FHR) 158x/minute. Routine blood laboratory examination, liver, and kidney function within normal limits, normal ECG sinus rhythm. In the perioperative period, facemask oxygen is given 6 liters per minute in the left lateral decubitus. Furosemide 20 mg intravenously, metoclopramide 10 mg intravenously, dexamethasone 5 mg intravenously, diphenhydramine 10 mg intravenously, and midazolam 1.5 mg intravenously. Once in the operating room, a 5-lead ECG monitor, oxygen saturation, temperature monitor, and arterial line were installed. Application of the epidural catheter in the left oblique position through the L2-L3 intervertebral space with a median approach, long of resistance (LOR) 6 cm, test dose with 2% lidocaine 3 ml, and adrenaline. Give bupivacaine 0.25% 15 ml, slowly divided into 2 doses of 10 ml in the first 15 minutes, followed by another 5 ml. The patient was positioned on a 15-degree side to prevent aortocaval compression. After 30 minutes, pinprick pressure was applied to ensure the height of the block to the thoracic. 6. Cesarean section walked for 1 hour. During the operation, oxygen was given at 6 liters per minute through a facemask, and the total crystalloid fluid was 500 ml.

Cardiovascular was relatively stable; blood pressure was in the systolic range from 98 to 100 mm Hg, diastolic was 60 to 80 mm Hg, pulse was 80 to 88 times per minute, and respiratory rate was 18. up to 22 breaths per minute, oxygen saturation 94% to 96%, bleeding 200 ml. They have born a baby boy with a birth weight of 1.885 grams with an Apgar score of 7/8. The patient was transferred to the intensive care unit after observation in the operating recovery room for 8 hours with postoperative analgesia using epidural analgesia combined with 0.1% bupivacaine and morphine 1 mg in 10 ml every 12 hours and paracetamol 1 gram every 8 hours intravenously. Cardiac medications were continued as before. The patient was discharged from the hospital after the 6th postoperative day, after being treated in the intensive room for 48 hours.

Case 2

We report the case of a 43-year-old woman with 37 weeks of fourth pregnancy who came with complaints of shortness of breath accompanied by coughing up phlegm, making it difficult to do activities and sleeping in a supine position since 5 days before admission to the hospital accompanied by rupture of membranes without abdominal pain since 7 hours before admission to the hospital. The patient had no history of allergies, bad habits, and previous illnesses. The patient was then planned for an urgent cesarean section.

In the perioperative evaluation in the operating room, the patient was moderately short of breath with compos mentis consciousness, blood pressure 108/70 mmHg, pulse 92 beats per minute, regular filling, respiratory rate, 20-24 breaths per minute, axillary temperature 36.8 degrees. Celsius, oxygen saturation 96%-97%, coarse wet crackles in both lung fields, grade I-II diastolic murmur at ICS 2 left. Abdominal conditions describe gravida according to gestational age and fetal heart rate (FHR) 144x/minute. Routine blood laboratory examination showed leukocytosis without clinical symptoms, liver function, and kidney in normal electrolyte limits, ECG shows HR 83 x/min, normal axis, T inverted V1 – V3, V5. Echocardiography showing *left atrium* (LA) dilated, *left ventricle* (LV) concentric hypertrophy, *mild systolic dysfunction* ejection fraction (EF54%), *norm*al LV diastolic function, Normal right ventricular systolic function, global normokinetic, mild to moderate mitral stenosis (MS). Laboratory results of blood gas analysis with nasal cannula 2 litters/minute was within normal limits. The patient was diagnosed with G4P2012 37 weeks single life, transverse position, premature rupture of membranes, CHF FC II, et causa RHD MS mild-moderate.

In the perioperative period in the operating room, a nasal cannula was given oxygen 4 liters per minute, furosemide 20 mg intravenously, premedication ondansetron 4 mg intravenously, ranitidine 50 mg intravenously, and midazolam 1.5 mg intravenously. Entered into the operating room after the patient was moderately sedated, then the application of installation of a blood pressure monitor, ECG, temperature, oxygen saturation, heating, insertion of an arterial line, and continued installation of an epidural catheter by adding an injection of propofol 50 mg intravenously by titration as previous sedation. The epidural catheter was placed in the L2-L3 intervertebral space with the median technique, long of resistance (LOR) 6 cm, and administration of 0.25% bupivacaine 10 mg bolus followed by spinal anesthesia with a 27-G needle inserted through the tuffier's line then local anesthetic bupivacaine 0.5 % 5 was administered. Mg. We found that Bromage 2 scores were achieved in 50 - 60 seconds, Bromage 1 in 100 - 120 seconds, and Bromage 0 in 130-160 seconds after insertion.

In comparison, the height of the T6 block is reached in 3 minutes. Hemodynamics after intrathecal injection of bupivacaine was stable, then continued with cesarean section (Figure 2). The baby boy was born with a birth weight of 2,100 grams and an Apgar score of 7/8. The operation lasted about 2 hours and 10 minutes, and cardiorespiratory conditions during the operation were stable, with bleeding 200 ml. The patient was then treated for two days in the intensive care unit and the usual care room with epidural pain management, analgesia, a combination of 0.1% bupivacaine and morphine 1 mg in 10 ml every 12 hours and paracetamol 1 gram every 8 hours intravenously.

DISCUSSION

Mitral stenosis is a valve disorder that is almost 90% found in rheumatic heart disease in pregnancy, and 25% of symptoms appear during pregnancy. The two cases reported were 3rd-trimester pregnant patients with CHF and mitral stenosis due to RHD. Complaints of shortness of breath interfere with activity and sleep from a few days to several weeks before hospital admission. The patient in the first case had a history of RHD with intramuscular benzathine penicillin therapy every 28 days for 3 months before admission to the hospital. The second patient with RHD was only discovered since admission to the hospital with complaints of shortness of breath. Both clinical conditions occur due to an increase in cardiac output caused by an increase in plasma volume and red blood cell mass by 40%-50% in the third trimester of pregnancy, even an 80-100% increase during labor until 72 hours postpartum which is very difficult—tolerated by the mother because it is accompanied by backflow due to mitral stenosis. In pregnancy, 18% of valve abnormalities cause complications of heart failure. Concomitant severe pulmonary hypertension (PASP > 75) causes high maternal and fetal morbidity, and mortality.[5]Decreased mitral valve area cause left ventricular filling obstruction during diastole. However, initially, the left atrium can overcome this problem, but as the disease progresses, the volume and pressure in the left atrium increase, progressively increasing capillary wedge pressure and pulmonary venous pressure; pulmonary hypertension; hypertrophy, and right ventricular failure.[1]

Tachycardia, increased blood volume following uterine contractions, retraction, and separation of the placenta exacerbate pulmonary edema, especially in cases of mitral stenosis.[6] 6 All prevention of sympathetic stimulation was attempted since the perioperative period, such as giving premedication to reduce anxiety with benzodiazepines, preventing nausea and vomiting, and ensuring fluid adequacy before the operation started. The limited sympathetic blockade is helpful in mitral valve lesions because it has minimal effect on decreasing preload and afterload.

The occurrence of atrial fibrillation in RHD is associated with enlargement of left atrial size, prolonged left atrial fibrosis, duration of acromegaly, and patient age resulting in left atrial stasis of blood flow, endothelial dysfunction, and activation of clotting factors. Left atrial size is negatively correlated with mitral valve area but positively correlated with atrial fibrillation in cases of mitral stenosis.[7].

In pregnancy, the elevation of the classic proinflammatory cytokine TNF-and IL-1β has a dominant effect on the endothelium, where TNF-alpha facilitates, the development of endothelial procoagulants that make it easier for thrombus to form (thrombotic situations)[8]. Atrial fibrillation usually follows an ECG that reflects left atrial lengthening.

In both patients, there were no AF findings on the ECG, and no cardiac thrombus was found, so it was considered not to provide thromboprophylaxis during pregnancy and the perioperative period.

The effect of the ideal anesthetic technique on a cesarean section in the presence of complex cardiac conditions is a topic of debate. Almost all anesthetic techniques can be used for cesarean section in cases of pregnancy with mitral stenoses, such as subarachnoid block, epidural anesthesia, combined spinal epidural and general anesthesia by following the rules of anesthetic management in mitral stenosis in the hope that the maternal hemodynamic condition remains stable so that it does not cause Pulmonary edema and pulmonary hypertension, uteroplacental circulation, and oxygenation are maintained to avoid depression in the fetus so as not to increase morbidity and mortality rates.

In contrast to the case when faced with fetal distress, an anesthetic technique with a rapid onset is required, namely general anesthesia. Although some authors describe the maternal outcome with general anesthesia as good [9], general anesthesia is associated with increased pulmonary pressure due to laryngoscopy intubation and cardiovascular depression due to anesthetic agents [10]. Administration of opioids such as fentanyl before induction of anesthesia may prevent the sympathetic response of the tachycardia. Still, it may result in respiratory depression in the infant and postoperative respiratory depression that prolongs ventilator use. Positive pressure ventilation can worsen cardiopulmonary conditions due to autotransfusion at the time of the baby's birth because it can increase blood flow. However, it can be attempted with positive pressure ventilation to increase oxygen diffusion in cases of pulmonary edema.

In recent decades, regional anesthesia has been a safe choice of anesthetic technique for cesarean section in pregnant women with heart defects. Epidural anesthesia is preferred over spinal anesthesia because it is a gradual-onset central neuraxial block that can avoid hypotension with intermittent bolus drug administration and can reduce the use of vasopressors in several previous studies.[4,5]

In both cases, the dominant symptom was left atrial dilatation due to RHD and increased plasma volume during pregnancy which the mother could not tolerate with or without pulmonary hypertension and decreased ventricular function.

Neuraxial central anesthesia technique, epidural block anesthesia, and CSE can maintain hemodynamic stability by the rules of anesthetic management in mitral stenosis, namely by maintaining optimal SVR, preload, heart rate, heart rhythm, and pulmonary resistance. This can be achieved by using a small fraction of the dose of local anesthetic and ensuring a gradual onset of a block to minimize hemodynamic changes due to sympathetic block, and avoiding the use of ephedrine which causes tachycardia in the event of hypotension, by prioritizing intravenous fluid resuscitation. During the duration of the operation, we try to prevent hemodynamic fluctuations that result in hypotension, tachycardia, and increased pulmonary vascular resistance.

CONCLUSION

Pregnant patients with valvular heart defects require careful perioperative evaluation, assessment, management planning, and anesthetic technique before the cesarean section is adjusted to cardiac function during the perioperative period.

Understanding the physiology of pregnancy and the underlying pathophysiology of valvular heart disease is particularly important in managing anesthesia in high-risk parturient. Central neuraxial block epidural anesthesia and combined spinal epidural (CSE) anesthesia are safe anesthesia techniques for both mother and baby because they can maintain hemodynamic stability.

COMPETING INTERESTS
No competing interests were disclosed.

CONFLICT OF INTEREST
The authors declare no conflict of interest, financial or otherwise.

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Declared none.

ETHICAL APPROVAL
The patient has given permission and informed consent to publish this case report.

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