

Low Dose Combined Spinal-Epidural Anesthesia: An Anesthesia Technique for Cesarean Section in a Patient Suffering from Congenitally Corrected Transposition of Great Arteries and Severe Pulmonary Stenosis

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Düşük Doz Kombine Spinal Epidural: Doğuştan Düzeltilmiş Büyük Arter Transpozisyonu ve Şiddetli Pulmoner Stenozu olan Hastada Sezaryen için Bir Anestezi Tekniği

ABSTRACT

A primigravida, aged 22 years, at 39th gestational week was hospitalized with dyspnea since onset of labor. On systemic evaluation and echocardiography, she was diagnosed to have congenitally corrected transposition of the great arteries (CCTGA) along with severe pulmonic stenosis and bidirectional ventricular and atrial septal defects. A multidisciplinary team provided initial symptomatic management, stratified the risk and planned for a cesarean section. A low-dose combined sequential spinal-epidural anesthesia with invasive monitoring was used which provided excellent surgical condition with stable intraoperative and postoperative hemodynamics.

Keywords: Low dose combined spinal-epidural, congenitally corrected transposition of the great arteries, cesarean section

Öz

22 yaşında 39. gebelik haftasında bir primigravid, doğumun başlamasından itibaren dispne ile hastaneye yatırıldı. Sistemik değerlendirme ve ekokardiyografide, ciddi pulmoner stenoz ve çift yönlü atriyal ve ventriküler septal defekt ile konjenital düzeltilmiş büyük arter transpozisyonu (CCTGA) tanısı konuldu. Multidisipliner bir ekip ilk semptomatik yönetimi sağladı, riski sınıflandırdı ve sezaryen için plan yaptı. Hem intraoperatif hem de postoperatif stabil hemodinami ile mükemmel cerrahi koşul sağlayan düşük doz sıralı kombine spinal epidural anestezi invaziv monitörizasyon ile kullanıldı.

Anahtar kelimeler: Düşük doz kombine spinal-epidural, büyük arterlerin düzeltilmiş transpozisyonu, sezaryen

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INTRODUCTION

Congenitally corrected transposition of the great arteries (CCTGA) is one of the rare congenital heart defects. It results from abnormal twisting of heart during fetal development which leads to reversal of ventricles. The left ventricle of the heart becomes pulmonary ventricle whereas the right ventricle becomes the systemic ventricle supplying blood to

the whole body with tricuspid valve acting as a systemic arterioventricular valve (SAVV). This transposition of ventricle leads to the coexistence of atrioventricular and ventriculoarterial discordance and natural direction of the blood flow. Hence this condition is termed as 'corrected', which is a misnomer⁽¹⁾. Maternal and fetal prognosis in these patients in pregnancy depends upon the ability of the right ventricle and the SAVV to handle the increased volume



load and the associated cardiac anomalies^(2,3). These associated anomalies include atrial septal defect (ASD), complete heart block, ventricular septal defect (VSD), dextrocardia, pulmonary stenosis (PS) and Ebstein-like malformation of SAVV^(4,5). We are describing the use of low dose combined spinal and epidural anesthesia (CSE) for successfully conducting cesarean section (CS) in pregnant women with CCTGA along with VSD, ASD, PS and tricuspid regurgitation. In this case report, we will review our experience along with recent evidence on fetal as well as maternal outcome(s) in pregnancies having complex congenital cardiac anomalies.

CASE DESCRIPTION

A 22-year-old primigravida in labor having amniotic fluid stained with thick meconium presented to emergency unit with difficulty in breathing. She had a room air saturation of 92% along with tachypnea, tachycardia, and blood pressure around 124/78 mmHg. She was administered oxygen in the emergency unit and transferred to the obstetric care where hemodynamic and fetal monitoring was started. The obstetric evaluation revealed a reassuring fetal status at 39 weeks of gestation but the ECG showed T wave inversions in the left leads while auscultation revealed the grade IV systolic murmur in left parasternal area. Thus bedside echocardiography was done which disclosed a CCTGA anomaly and severe pulmonary stenosis. Also, there were two VSDs with right-to-left shunts, larger one being 27 mm in the upper and 9 mm in the mid muscular area, a large ostium secundum ASD with a bidirectional shunt, distal thoracic aorta narrowing with a gradient of 17 mmHg and mild SAVV regurgitation. Systemic right ventricular hypertrophy was present with good ventricular function. The cardiologist advised administration of 10 mg of furosemide and avoidance of oxytocin augmentation. Therefore, the obstetrician with due consultation planned an elective cesarean section.

She weighted 50 kg with a height of 154 cm. Her vitals were stable and pulse oximetry showed saturation of 95% on continued oxygen administration. Auscultation revealed normal S1 and S2 heart sounds along with ejection systolic murmur which was best heard at the pulmonary area. She had hemoglobin concentration

of 12.5 g dL⁻¹ and platelet count of 130 000 mL⁻¹. Serum biochemistry, renal, and liver function tests were also normal. Symptomatically, the patient was NYHA III since the onset of labor 8 hours back, while the patient had been NYHA I throughout her life.

A low dose CSE anesthesia was planned for CS so as to minimize hemodynamic fluctuation. In the operating theatre, 5 lead-ECG, noninvasive blood pressure (NIBP) monitor and pulse oximetry were connected to the patient, while oxygen supplementation and FHR monitoring continued. An arterial line with 20G cannula in the right hand was secured under local anesthesia for invasive arterial blood pressure monitoring. Then right internal jugular vein was cannulated which showed an initial central venous pressure (CVP) of 10 mmHg.

A low dose CSE anesthesia was given using 5 mg of hyperbaric bupivacaine and 20 µg of fentanyl in sitting position through L3-L4 interspace using needle-through-needle CSE technique. Immediately after injecting the drug into the subarachnoid space, a 22-gauge epidural catheter was threaded 4 cm into the epidural space and the patient was returned to supine position along with maintaining left lateral tilt in order to avoid aortocaval compression. There was no drop in arterial blood pressures following spinal anesthesia, however, anesthesia was not adequate and produced a block up to T12 level. Boluses of 2% lignocaine were administered through epidural route in a graded manner after 10 minutes of spinal injection at 5-minute intervals. After 25 minutes, with a total epidural volume of 8 mL lignocaine administered, the T6 sensory block detected with pinprick test was achieved together with stable hemodynamics. The CS was performed uneventfully and delivery of further drugs through epidural catheter were not required. A female baby was born weighing 3.01 kg, and having APGAR scores of 8 and 10 at 1 and 5 minutes respectively. Administration of oxytocin bolus was avoided and only low oxytocin infusion was given which produced satisfactory uterine contraction with minimal blood loss of 300 mL. Surgery lasted 45 minutes with minimal alteration in hemodynamics. Total fluids given were 1.2 litres and urine output was 500 mL. Vitals at end of surgery were as follows: SpO₂ 96%, BP 134/82 mmHg, PR 92 min⁻¹, and CVP 6 mmHg.

Outcome and follow-up

The patient was comfortable, and pain-free with no respiratory distress at the end of the surgery. Epidural morphine was given for postoperative analgesia, and epidural catheter was removed 6 hours after surgery. The patient was shifted to ICU postoperatively for hemodynamic monitoring and fluid management. On the night of surgery, prophylactic enoxaparin 40 mg SC was started. Postoperative analgesia was managed with intravenous paracetamol and ketorolac round the clock. On the second day, the patient was shifted to obstetric ward following an uneventful course in the ICU and subsequently discharged on the third day with recommendation of follow-up in cardiology department.

DISCUSSION

TGA presents with complex cardiovascular physiology that gets much more complicated due to changes in cardiovascular system during pregnancy. As a result of the reversal of ventricles, there is a strain on anatomic right ventricle supplying the aorta and the anatomic tricuspid valve acting as a SAVV, which can progress to ventricular dysfunction. During pregnancy, cardiac output increases by 40% which puts extra strain on the already strained right ventricle and the SAVV, which is further accentuated with the onset of labor resulting in rise in backpressure in the left atrium and pulmonary circulation. This condition leads to pulmonary congestion and dyspnea with the onset of labor. Moreover, anomalies associated with CCTGA are also significant factors affecting patient's cardiovascular physiology. Severe pulmonic stenosis increases the pressures on the right side of the heart and decreased systemic vascular resistance in pregnancy leads to the right-to-left shunting of blood across the VSD and ASD. This reversal of the shunt could lead to hypoxia, desaturation, risk of paradoxical embolism, and cerebrovascular thrombosis, especially in high thrombotic states like pregnancy^(6,7).

In a case series by Therrien et al.⁽²⁾ assessing fetal and maternal outcomes in 19 CCTGA patients, 5 patients (26%) had cardiovascular complications. Complications intrinsic to CCTGA, like congestive heart failure and systemic tricuspid valve regurgitation occurred in 2 (10%) patients. Atrial fibrillation

stemming from a stenotic left atrioventricular prosthesis, worsening cyanosis, and cerebrovascular accident each occurred in one patient. Cyanosis is an important risk factor in miscarriages and poor fetal outcome. Similarly, pregnancy outcomes were also reported by Connolly et al.⁽³⁾ in a case series of 22 patients with CCTGA.

Previously, general anesthesia (GA) was considered a gold standard for managing anesthesia of patients with congenital heart disease (CHD) as hemodynamic fluctuation caused by neuraxial anesthesia due to sympathectomy and vasodilation can further aggravate the right-to-left shunt and cardiac dysfunction. But recent evidence suggests that GA may have some deleterious effects. An intravenous anesthetic agent like propofol and inhalational anesthetic agents like isoflurane or sevoflurane can decrease cardiac contractility and peripheral vascular resistance resulting in increased right-to-left shunting of blood. An increase in intrathoracic pressure due to mechanical ventilation can decrease venous return to the heart resulting in decreased cardiac output⁽⁸⁻¹⁰⁾. Pregnancy is associated with reduced gastric emptying which rises the risk of aspiration while securing the airway. Hence, GA should be given with the utmost care to a pregnant patient with CHD.

Spinal anesthesia, on the other hand, is a simple technique which provides fast onset of dense neuromuscular blockade. As a result, there is reduced need for additional analgesics or conversion to GA. Since, spinal anesthesia needs only lesser amount of drugs to achieve the desired level, there is a negligible risk of local anesthetic toxicity or transfer of anesthetic drugs to the fetus.

Combined spinal-epidural anesthesia has the advantage of spinal anesthesia as well as the capability to increase the duration of anesthesia with the help of an epidural catheter. It aids in titration of density, duration and level of anesthesia.

Our patient had severe pulmonary stenosis, tricuspid regurgitation, ventricular, and atrial septal defect but preserved systemic ventricular function. Our anesthetic goal was to maintain preload, preserve systemic ventricular function, prevent rise in systemic and pulmonary vascular resistance. She star-

ted having dyspnea with the onset of labor as a result of pulmonary congestion with an increase in cardiac output with labor, which got relieved with a small dose of furosemide and oxygen administration. Thereafter, during preanesthetic planning for C-section, we had three main concerns. First, post-induction hypotension after general anesthesia or spinal injection should be avoided to prevent shunt reversal. Second, hemodynamic response to intubation, extubation, and surgical incision should be attenuated to prevent an increase in strain on systemic right ventricle and SAVV. Third, development of volume overload due to autotransfusion after delivery should be precluded to prevent the development of pulmonary congestion and edema.

Therefore, the primary aim, in this case, was to prevent an exaggerated fall in blood pressure following the subarachnoid block. Subarachnoid block with usual doses of 8-10 mg bupivacaine could result in severe hypotension. Epidural anesthesia can be an effective alternative to spinal as the epidural anesthesia is less likely to cause sudden hypotension, but epidural anesthesia alone will take a longer time and there is a higher chance of inadequate anesthesia ⁽¹¹⁾.

Therefore, we planned administration of a low dose of sequential CSE anesthesia. The conventional CSE anesthesia technique consists of administering the standard intrathecal dose of local anesthetic and using the epidural catheter intraoperatively for extending the effect of block and postoperatively for providing analgesia. Recently this technique has been modified which comprise of intrathecal delivery of a lesser dose of local anesthetic with opioids, followed by sequential delivery of local anesthetic into the epidural space to achieve the required anesthetic level ⁽¹²⁾. This anesthesia technique has been used in managing high-risk pregnancies with different forms of acquired and congenital heart disease ^(13,14). We used a 5 mg dose of bupivacaine with 20 mg of fentanyl. We first achieved a bilateral sensory block up to T12 level. We then extended the block to the level of T6 by graded boluses of 2% lignocaine delivered into the epidural space. A low dose CSE technique helped us to achieve the desired hemodynamic goal. The slow onset of sympathetic blockade not only helped to maintain adequate preload and venous return but accompanying slight reduction in

systemic vascular resistance alleviated the load of the overworked systemic right ventricle. Hence, we achieved a stable cardiovascular anesthesia by combining the advantages of spinal as well as epidural anesthesia techniques.

A number of case reports have demonstrated acceptable cardiovascular stability with low dose CSE in pregnancies with higher cardiac risk in the last decade even in cases of cyanotic tetralogy of Fallot and Eisenmenger syndrome ⁽¹³⁻¹⁶⁾. Han et al. ⁽¹⁷⁾ reported a case in which CSE was safely administered to a term mother suffering from congenital heart disease (cor triloculare biventriculare) and fetal distress. A baby boy was delivered without any complication to the mother or fetus. The CSE anesthesia used in this case had a good effect and the emergency surgery was conducted uneventfully. Tawfik et al. ⁽¹⁸⁾ reported a case in which a 19-year-old mother suffering from CCTGA along with severe PS, severe tricuspid regurgitation and complete heart block on permanent pacemaker underwent cesarean section using a low dose CSE anesthesia. They demonstrated that low dose CSE resulted in an adequate level of anesthesia required for CS along with good hemodynamic control and favorable maternal and fetal outcome(s).

CONCLUSION

Through this case report, we try to highlight the importance of low dose CSE with invasive monitoring in complex heart diseases like CCTGA with severe pulmonic stenosis and bidirectional shunt through the septal defect, thereby avoiding general anesthesia in such high-risk pregnancies. Nonetheless, the importance of a multidisciplinary team approach including the cardiologist and obstetrician, risk stratification, patient counseling, and case by case individualized approach deserves special mention.

Conflict of Interest: None

Informed Consent: Obtained

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