CASE REPORT

# Low-dose sequential combined-spinal epidural anesthesia for Cesarean section in patient with uncorrected tetrology of Fallot

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## ABSTRACT

Tetrology of Fallot (TOF) is the most commonly encountered congenital cardiac lesion in pregnancy. Although there are controversies regarding safe anesthetic technique for parturient with TOF, we use low-dose sequential combined-spinal epidural anesthesia in such a case posted for Cesarean section and found that low dose (0.5 ml of 0.5%) intrathecal bupivacaine and fentanyl with sequential epidural bupivacaine supplementation was adequate for the performance of an uncomplicated Cesarean section with minimal side effects and good fetal outcome. Thus, though the choice of anesthesia can vary in such patients, low-dose sequential combined-spinal epidural can be a safe alternate to achieve good anesthesia with impressive cardiovascular stability.

**Key words:** *Cesarean section, combined-spinal epidural anesthesia, tetrology of Fallot*

## INTRODUCTION

Tetrology of Fallot (TOF) is the most commonly encountered (10% of all CHD) congenital cardiac lesion in pregnancy.[1] Anesthetic management of these patients for Cesarean section is challenging and current recommendations are based only on reported clinical experiences and pathophysiological concepts. Thus, the best anesthetic technique for Cesarean section in these patients is yet to be established. We here describe the successful use of a low-dose sequential combined-spinal epidural (CSE) anesthesia in a parturient with uncorrected TOF for elective Cesarean section.

## CASE REPORT

A 27-year-old parturient ($G_4P_{1110}$) was referred to the obstetric anesthesia service at 34 weeks gestation for assessment before elective Cesarean delivery. Her third pregnancy resulted in a full-term normal vaginal delivery at home. However, the baby died of pneumonia at 4 months of age. She had not received any antenatal visit in her prior three pregnancies. She was diagnosed with TOF 1 year back, when she developed symptoms of dyspnea on exertion, palpitation and easy fatigability. She was advised propanolol 40 mg twice a day. Surgical correction of TOF was suggested which she refused to undergo. She was incidentally diagnosed to be HIV-positive at 12 weeks of current pregnancy and was started on zidovudine 300 mg twice a day.

On preanesthetic examination she was 58 kg in weight with height of 150 cm. Her pulse rate was 120/min with blood pressure of 110/84 mmHg and respiratory rate of 24/min. On auscultation normal S1 with ejection systolic murmur at pulmonary area was heard. Airway examination revealed short neck with small receding chin with a thyromental distance of 7 cm. Her mouth opening was 3 cm with protruding teeth. She was mallampati class III with full range of neck movements. Her complete blood count revealed hemoglobin of 13.5 gm% with total leukocyte count of 6600/$mm^3$ and platelet count of 2 lac/$mm^3$. Serum biochemistry was normal. Renal and liver functions tests were also normal. Her T-helper % of lymphocytes (CD3+CD4+/CD45+) was 9% with T-helper lymphocyte absolute count of 326. Her blood gases were pH-7.33, $pO_2$-48, $pCO_2$-29, $cHCO_3$ – 14, BE- (-9) and $SaO_2$–83%. Chest X-ray showed right ventricular hypertrophy (RVH) with oligemic lung field. Electrocardiogram showed RVH with right-axis deviation. Echocardiography revealed large

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ventricular septal defect (VSD) with overriding of aorta and right to left shunt. Severe valvular and subvalvular pulmonary stenosis with peak systolic gradient of 58 mmHg was evident.

In the operating room standard 5 leads ECG, NIBP and pulse oximetry were attached. Her blood pressure was 117/79 mmHg, heart rate was 134/min and $SpO_2$ was 82%. Oxygen supplementation ($FiO_2$ 0.5) was administered via venturi mask. Invasive blood pressure (IBP) monitoring was established via left radial artery cannulation under local anesthesia. Central venous cannulation of the right internal jugular vein was performed. An 18-G epidural catheter was inserted at the L3-L4 level in the left lateral position. The subarachnoid space was located using a 26-G Quincke needle. A 2.5 mg (0.5 ml of 0.5%) of hyperbaric bupivacaine with 25 μg fentanyl was administered intrathecally. A prophylactic phenylephrine infusion was started at 20 μg/min. The patient was subsequently placed in the supine position with left lateral tilt and slightly head up position. A T10 sensory block to pin-prick was achieved. Epidural boluses of 3 mL and then 2 mL of plain 0.5% bupivacaine were given 10 and 20 min after the intrathecal injection. This was supplemented by fentanyl 100 μg, also given via the epidural catheter. After 35 min there was a bilateral sensory level to pin-prick, at T4. At this point, the patient was turned into the wedged supine position. About 60 min after the intrathecal injection, a further 5 mL of plain 0.25% bupivacaine with fentanyl 50 μg was given epidurally. Cardiovascular parameters remained stable during the development of the block and during surgery. Her pulse rate ranged from 82 to 120/min with mean blood pressure between 85 and 106 mmHg and saturation of 92-95%. Arterial blood gases obtained 1 hr after intrathecal injection revealed were pH-7.39, $pO_2$-64, $pCO_2$-26, $cHCO_3$ – 15, BE- (-7), SO2–93%. She received a total of 1300 mL of Hartmann's solution, given as a slow intravenous infusion throughout the surgery. Her central venous pressure (CVP) was maintained between 12 and 15 cm $H_2O$. Estimated blood loss was 300 mL. A low birth-weight baby boy of 1900 g was delivered. The APGAR scores were 8 and 9 at 1and 5 minutes respectively with cord pH of 7.22. The uterus contracted well so oxytocin was withheld. Immediately postoperatively the patient was transferred to the postanesthesia care unit where she received epidural morphine 3 mg for analgesia. She was nursed supine, with headup tilt until sympathetic tone returned. Her subsequent course in hospital was uneventful.

## DISCUSSION

TOF is characterized by presence of ventricular septal defect (VSD), aortic overriding, pulmonary artery outflow obstruction and RVH.[2] It is the classical and most commonly encountered (10%) congenital cardiac lesion in pregnancy.[1] Women with uncorrected TOF do poorly during pregnancy and maternal mortality approaches 10%. Stillbirth rates of 14% and fetal growth retardation of 36% of pregnancies in women with CHD has been reported[3] Thus, the anesthetic management of pregnancy in such a patient is based on the knowledge of physiological changes that occur during pregnancy, assessment of the existing degree of cardiovascular impairment and a detailed knowledge of the underlying pathophysiology. The main characteristic of TOF is cyanosis. Right-to-left shunting of blood through VSD and inadequate pulmonary blood flow due to right ventricle outflow obstruction is the main reasons of cyanosis and chronic hypoxemia in TOF. Chronic hypoxemia leads to polycythemia, increased blood viscosity, vasodilatation, hyperventilation and chronic respiratory alkalosis to provide adequate tissue oxygenation. Such adaptive mechanisms may limit cardiac reserve and oxygen delivery during stress.[4] These patients may also have coagulopathy, chronic heart failure, embolism, episodic and reactive pulmonary vasoconstriction and altered acid base status and rarely perioperative cyanotic spells.[5] Pregnancy in TOF can cause worsening of pre-existing symptoms. Cardiac decompensation due to physiological changes of pregnancy is the main danger and if patients have infection, hemorrhage or thrombo-embolism it further increase the risk.[1]

Hence, the anesthetic consideration should be focussed on minimizing the hemodynamic changes that would increase right to left shunting. Decrease in systemic vascular resistance (SVR), decrease in venous return, tachycardia and myocardial depression should be strictly avoided.[6] But, the best anesthetic technique for Cesarean section in these patients has yet to be established.

General anesthesia offered the benefit of better oxygenation but with the attended risk of adverse hemodynamic responses associated with laryngoscopy and possibility of airway complications in pregnancy, such as aspiration and difficult intubation. Many of the agents used for induction and maintenance of general anesthesia depress myocardial function and reduce SVR. Controlled mechanical ventilation may results in decreased venous return, compression of pulmonary vessels, hypoxemia, hypo or hypercarbia and acidemia.[1] Narcotics can cause neonatal depression and APGAR scoring may be low requiring endotracheal intubation and ventilation.

Use of regional anesthesia in uncorrected TOF is a controversial issue. Regional technique causes sympathetic blockade and may decrease SVR. Hence, TOF is considered relative or absolute contraindications for single shot spinal anesthesia,

though slow segmental blockade of dermatomes may offer an alternative.[6] However, the current recommendations for anesthetic management are only based on reported clinical experience and pathophysiological concepts.

We chose to do a sequential CSE technique so as to have the advantage of spinal anesthesia with a rapid onset, low-level block with the flexibility of further extension of the block with the epidural catheter. Also the technique has shown to produce better analgesia and muscle relaxation, and is associated with decreased total drug usage and less hypotension when compared to epidural anesthesia for Cesarean section.[7] Further, we used a very small dose of local anesthetic (LA) intrathecally in order to minimise hypotension. After careful induction of spinal anesthesia, we administered Ringer's lactate and started a prophylactic infusion of phenylephrine. Thus, the preload and SVR could be well-maintained. We sequentially used 7 ml of LA via the epidural catheter to achieve a sensory level of T4.

Invasive monitoring like IBP monitoring through arterial line and CVP monitoring is mandatory.[6,8] IBP monitoring was performed to facilitate early recognition of blood pressure changes and frequent arterial blood gas analysis. Central venous catheterization was done in order to guide fluid therapy and maintain right ventricular filling pressures while avoiding excessive preload. PA catheter is usually not preferred in these cases as risk is more than benefits and also in patient with a large VSD, pulmonary wedge pressure may not reflect left ventricular filling pressure.[6] As the right ventricle is mainly at risk of dysfunction CVP monitoring is more beneficial.[9]

Prolonged fasting and volume depletion should be avoided. Prophylactic antibiotic for endocarditis should be given and all intravenous lines should be equipped with a device to filter air bubbles to prevent paradoxical air embolism.[10] Blood loss should be minimum and excessive bleeding be promptly treated with blood products. Hematocrit should be in higher level as normal hematocrit may not provide adequate oxygen saturation.

In conclusion, CSE using low-dose intrathecal bupivacaine and fentanyl with epidural bupivacaine supplementation was adequate for the performance of an uncomplicated Cesarean section with minimal side effects and good fetal outcome in our parturient with severe TOF. The technique combines the advantages of spinal and epidural blockade, whilst avoiding some of their respective limitations. Thus, though the choice of anesthesia can vary in parturient with TOF, low-dose sequential CSE can be a safe alternate to achieve good anesthesia with impressive cardiovascular stability.

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