Combination of Low-Dose Spinal Anesthesia and Epidural Anesthesia as Anesthetic Management in Patient with Uncorrected Double Outlet Right Ventricle (DORV) Underwent Cesarean Section

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ABSTRACT
Pregnant patients with uncorrected Double Outlet Right Ventricle (DORV) undergoing cesarean section are challenging for anesthesiologists. We present a case of a 24-year-old woman with a gestational age of 30–32 weeks with DORV, ventricular septal defect, pulmonary hypertension, and stage C functional class III heart failure who was successfully managed using a combination of low-dose spinal anesthesia bupivacaine 0.5% 7.5 mg with adjuvant fentanyl 50 mcg and epidural ropivacaine 0.2%, and fentanyl 50 mcg TV 10 cc given 30 minutes after the birth of her baby. Hemodynamics was stable after low-dose spinal anesthesia and until the end of the operation.

Keywords: Cesarean section, DORV, epidural anesthesia, low-dose spinal anesthesia

INTRODUCTION
The incidence of pregnancy with heart defects is about 0.4–4.1%, with the mortality rate being 15%.\[^1\] Double Outlet Right Ventricle (DORV) is a congenital heart defect in which the aorta and pulmonary artery partially or completely exit the right ventricle. In this situation, no blood vessels leave the left ventricle, and the blood from the left ventricle mixes with the blood in the right ventricle thus mimicking ventricular septal defect (VSD). The incidence of pregnancy with DORV is extremely rare, with the incidence of about 0.5–0.8 in 10,000 pregnancies.\[^2\]

Hemodynamic changes in pregnancy with congenital heart disease are not well tolerated and can lead to cardiovascular complications. Pregnant women with DORV will further aggravate heart function due to physiological changes in pregnancy, especially increased blood volume and decreased Systemic Vascular Resistance (SVR).\[^3\]

General anesthesia is the common choice for anesthesia in patients with DORV, but the risk of increased pulmonary vascular resistance (PVR) must be considered due to hypoxia, hypercarbia, and acidosis. Epidural anesthesia can also be used in cesarean sections because the reduction...
in SVR is not as rapid as spinal anesthesia.[4] We report successful management of the patient with DORV who underwent cesarean section using a combination of low-dose spinal and epidural anesthesia.

**CASE HISTORY**

A 24-year-old pregnant woman, weight 50 kg and height 150 cm, gestational age 30–32 weeks, fetal distress with DORV underwent cesarean section (SC). The patient’s heart defects had been monitored since childhood, but were not routinely controlled. The patient arrived at the emergency room without complaints of shortness of breath, chest pain, or palpitations. The contraction was felt stronger and more frequent. The patient often experienced shortness of breath since the beginning of pregnancy and had been restricted from activities.

Physical examination found spontaneous breathing with a respiration rate 20–22x/minute. There was no chest retraction or nostril breathing. Oxygen saturation was between 94 and 96% with a nasal cannula of 3 liters per minute. The patient had a blood pressure 110/55 mmHg, a pulse rate 80–85 x/minute, and a grade III/VI systolic murmur with maximal punctum in ICS II left para-sternal. The fundus height was 26 cm with a fetal heart rate (+) 120–130 beats per minute. Electrocardiogram (ECG) showed normal sinus rhythm with a heart rate 92 x/minutes.

From ECG, DORV + VSD sub-pulmonic was found with malposition of the great arteries (right aorta in PA, side by side) without pulmonic stenosis and balance ventricles (Taussig-Big anomaly), RA, RV, LV dilation, TR severe, PH high probability, and moderate PR. Thorax X-ray shows cardiomegaly with 73% CTR [Figure 1].

The patient was ASA 3 pregnancy, with large VSD, DORV, high probability Pulmonary Hypertension (PH), moderate PR, severe Tricuspid Regurgitation (TR), Heart Failure Stage C Functional class III. We got an informed consent explaining that the mother was at high risk of anesthesia and the preterm condition of the baby. The patient kept fasting. We put the intravenous line and administered NaCl 0.9% 90 ml/hour with ranitidine 50 mg and metoclopramide 10 mg intravenously 1 hour prior to surgery. Anesthesia was administered using low-dose subarachnoid block and epidural with spinal regimen 0.5% hyperbaric bupivacaine 7.5 mg with adjuvant fentanyl 50 mcg and epidural ropivacaine 0.2% + Fentanyl 50 mcg TV 10 cc.

Pre-induction, patient had SpO$_2$ 97% on nasal cannula 3 liters per minutes (LPM), BP 119/67 MAP 83, HR 92x/minute. Post-spinal, patient had SpO$_2$ 97%, BP 105/54 MAP 71, HR 114 x/minute. After the baby was born, patient had SpO$_2$ 97% nasal cannula 2 LPM, BP 99/64, HR 90 x/minute. Baby cried immediately with Apgar Score 8 (1st minute) and 9 (5th minute) with bodyweight 1,950 grams.

The patient was transferred to the recovery room after surgery with a blood pressure of 106/70 mmHg, pulse 84 beats per minute, respiratory rate 22 x/minute, and oxygen saturation 96% with a non-rebreathing mask (NRBM) 10 LPM. The Bromage score was 0 at 65 minutes after surgery. The analgesic administration included ketorolac injection 30 mg per 8 hours and epidural Ropivacaine 0.2% + Fentanyl 50 mcg TV 10 cc/12 hours. After observation in the recovery room, the patient was transferred to the Intensive Care Unit for further observation for 2 days with a stable hemodynamic condition [Figure 2] and then transferred to the intensive delivery ward.

![Figure 1: Thorax X-ray shows cardiomegaly](image1)

![Figure 2: Hemodynamic condition in the intensive care](image2)
DISCUSSION

The goals of anesthesia management in patients with DORV include maintaining cardiac output by maintaining preload, contractility, heart rate, and high SVR than PVR to avoid increased systemic venous blood recirculation. A decrease in SVR causes a further decrease in pulmonary blood flow, which hinders oxygenation. The PVR needs to be lowered to ensure adequate blood flow to the lungs.[2]

Anesthesia in DORV can be performed using general anesthesia or neuraxial block. However, single spinal anesthesia is not recommended because of decreased SVR due to post-spinal peripheral vasodilation leading to hypotension.[4] This is avoided in patients with heart defects who have had a shunt. Another target for anesthesia in patients with DORV is to prevent hypovolemia, hypoxia, hypercarbia, and acidosis, which increases PVR and reduces the SVR.[8]

In this case, we performed low-dose spinal anesthesia using 7.5 mg of 0.5% hyperbaric bupivacaine and adjuvant fentanyl 50 mcg, with a total volume of 2.5 ml. Hemodynamics after spinal injection remained stable with minimal fluctuation compared with the patient’s baseline hemodynamics [Figure 2]. In this case report, we found no episodes of hypotension and desaturation. A previous study showed that the spinal technique with 10 mg bupivacaine showed a significant reduction in systolic and diastolic blood pressure after 3 and 5 minutes compared with 7.5 mg bupivacaine with 25 mcg fentanyl adjuvant. This is due to a higher sympathetic block.

There is no evidence showing that general or neuraxial anesthesia is superior in DORV patients with pregnancy. However, in this case, we supported previous observational data that neuraxial anesthesia could be administered safely, especially when using the low-dose spinal anesthesia technique.[9] Previously, the use of low-dose local anesthesia bupivacaine (5-7.5 mg) combined with slow and incremental administration of epidural bupivacaine for surgery has been carried out with minimal hypotensive effects.[7]

Patients with low cardiac index who underwent surgery with spinal anesthesia with small doses of local anesthetic drugs showed a minimal reduction in MAP due to their lower intensity of sympathetic system block compared to using local anesthesia drug dosage. Due to the lower intensity of sympathetic blocks, it does not cause a significant decrease in SVR. Thus, the incidence of hypotension that has often occurred in spinal anesthesia can be prevented.[8] Fentanyl acts synergistically with bupivacaine in lowering the pain threshold without increasing sympathetic and motoric blockade.[9]

After the baby was born, 20 IU of oxytocin (Syntocinon) was given in 500 cc of 0.9% NS used to maintain uterine contractions for 8 hours. However, there is concern that a high dose of oxytocin bolus in patients with heart disease can cause an increase in pulmonary arterial pressure and PVR, and a decrease in SVR with compensatory tachycardia, resulting in cardiac stress. However, the risk must be balanced against the risk of uterine atony and postpartum hemorrhage. According to the European Society of Cardiologist guideline, a slow infusion of 2 unit oxytocin in 10 minutes immediately after birth and followed by 12 mU/minutes for 4 hours reduces the risk of postpartum hemorrhage and has minimal impact on cardiovascular parameters.[10] After surgery, the patient was treated in the ICU for 2 days and discharged on the fifth day with stable condition. The baby was also in stable condition and discharged on third day.

The main principle of anesthesia in a patient with DORV includes maintaining cardiac output by maintaining preload, contractility, heart rate, and higher SVR than PVR. Low-dose spinal combined with epidural anesthesia could be used as an alternative to anesthesia management in patients with DORV.

Declaration of patient consent
The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has given her consent for her images and other clinical information to be reported in the journal. The patient understands that her name and initials will not be published and due efforts will be made to conceal her identity, but anonymity cannot be guaranteed.

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Conflicts of interest
There are no conflicts of interest.

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