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Case Report

Anesthesia Management in Patient with Uncorrected Double Outlet Right Ventricle Underwent Cesarean Section: Serial Case Report

Ilham Fadlilah[1], Ruddi Hartono[1], Isngadi[1]
[1] Department of Anesthesiology and Intensive Therapy, Dr. Saiful Anwar Regional Hospital, Faculty of Medicine, Universitas Brawijaya Malang, Indonesia

Correspondence:
Ilham Fadlilah, MD*
Department of Anesthesiology and Intensive Therapy, Dr. Saiful Anwar Regional Hospital, Faculty of Medicine, Universitas Brawijaya Malang, Indonesia
e-mail: ilham.da.justice@gmail.com

ABSTRACT

Background: Double outlet right ventricle (DORV) is a rare cardiac condition in which the heart demonstrates single ventricle physiology. Pregnancy complicates cyanotic heart disease as the decrease in systemic vascular resistance (SVR) worsens the right-to-left shunt. The effect worsens by neuraxial anesthesia for cesarean delivery. Anesthesia for these patients needs understanding for the physiology of DORV in order to maintain stable hemodynamics. Heart defect still become non obstetric main factor causing morbidity and mortality in pregnant woman.
Case: We present three case of parturients with DORV scheduled for cesarean section. Elective caesarean section was scheduled using spinal anesthesia hyperbaric bupivacain combined with fentanyl. Hemodynamic during operation was stable.
Conclusion: Low dose spinal anesthesia performed in this patient did not cause hypotension and minimal hemodynamic changes because the intensity of the sympathetic block was lower.

Keywords: Double outlet right ventricle, cesarean section, obstetric anesthesia

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INTRODUCTION

Cardiac abnormalities in pregnancy are still the main non-obstetric factors causing morbidity and mortality in pregnant women.[1] Pregnant women with heart disorders due to congenital heart disease, acquired heart disease, or cardiomyopathy, require special attention and management. Due to physiological changes during pregnancy will increase the workload on the heart, whereas the heart will have impaired ability to compensate and adapt to pregnancy.[2,3] Double outlet right ventricle (DORV) is a rare cardiac condition in which the heart demonstrates single ventricle physiology. DORV refers to any cardiac anatomy in which both the aorta and pulmonary artery originate from the right ventricle. Both the systemic and pulmonary circulations are in parallel, and thus a delicate balance exists between the two.[4] Four different anatomic types of DORV are defined on the basis of the relationship of the ventricular septal defect (VSD) to the great arteries: subaortic VSD, sub-pulmonary VSD, doubly committed VSD, and non-committed VSD.

Compared to general anesthesia, neuraxial block reduces venous return and alleviates the cardiac burden. If general anesthesia was chosen, the drugs used for general anesthesia might suppress the heart function which was already fragile. The mother was in the condition of hypoxia which would result in hypoxia of the baby. The drugs used in general anesthesia induction might worsen the hypoxia of the newborn.[5]

Several studies concluded that low doses of spinal anesthesia do not cause hemodynamic changes and fentanyl as an adjuvant has the effect of prolonging adequate analgesia and motor block so that in this patient we performed anesthesia with low doses of spinal anesthesia and found no hypotension or other hemodynamic changes.[1,2,6,7,8] In this serial case report, we evaluate the outcome of the low dose spinal anesthesia technique in pregnant patients with cardiac abnormalities undergoing sectio caesarea.

CASE

There are three cases of pregnancy with DORV presented in table 1 scheduled for cesarean section.

First case

A 38 years old, female, sixth pregnancy, labor twice, history of abortion 3 times, with a pregnancy of 37-38 weeks with cardiac comorbidities in the form of DORV and large

Table 1. Patient's characteristic preoperative

Parameter	Case 1	Case 2	Case 3
Diagnosis	DORV large secundum VSD	DORV Large VSD	DORV large subaortic VSD
Age (years)	38	24	22
Blood Pressure (mmHg)	118/78	95/53	111/80
HR (beats/minutes)	85	92	94
RR (respirations/minutes)	20	22	20
Comorbidity	• Class II functional stage C heart failure • left ventricle enlargement • DORV • Subaortic ventricular septal defect large secundum,	• large VSD • DORV • Pulmonary Hypertension high probability, • Moderate Pulmonal Regurgitation • Severe Tricuspid regurgitation, • Heart Failure Stage C Functional class III • Community Acuired Pneumonia	• DORV with bidirectional L to R shunt Subaortic VSD • PS Sub-valvular mild • MR Mild-Moderate • ASD Small secundum L to R Shunt • Right Ventricel Hyperthropy • Heart Failure stage C Fungcional Class II.
Hemoglobin (mg/dl)	12.8	9.9	14.5

secundum VSD caesarean section. Patients with Class II functional stage C heart failure with left ventricle enlargement and DORV with subaortic ventricular septal defect large secundum, no pulmonary hypertension was found. Preoperative laboratory Hemoglobin was 12.8 mg/dl and blood clotting profile within normal limits. Physical examination found 97% oxygen saturation with a nasal cannula of 2 l/minute with a respiration rate of 20 breath/minute, with a blood pressure of 120/80 mmHg with a pulse of 85 beat/minute, and found a murmur of 3/6 in the midclavicular. Patients were assessed as physical status American Society of Anesthesiologist (ASA) 3 Gravida Congenital heart disease with large VSD with DORV, Class II functional heart failure stage C.

Patient denies any history of cyanosis, but the patient complains of getting tired when doing physical activities. Patient never felt palpitations and never fainted. The patient's physical condition when pregnant has the same as before pregnancy.

Patients have received information about the plan for surgery and anesthesia in the form of regional subarachnoid blocks, as well as the risks of both surgery and anesthesia, postoperative intensive care. The patient's oxygen saturation at admission was 97% with a nasal cannula of 2 lpm. Invasive blood pressure was 118/78 mmHg. Low dose regional subarachnoid block technique, 5 mg of 0.5% heavy bupivacaine with a combination of 50 µg fentanyl, at L3-L4 in a sitting position. The sensory block is achieved at the T6 level. Hemodynamics after the first minute of blood pleasure 127/81 with a pulse of 81 beat/minute and oxygen saturation of 97%. The patient's systolic blood pressure during the operation period ranged from 110-130 mmHg with the diastolic ranged from 70-80 mmHg (Figure 1). Intraoperative fluid administered was colloid 500 ml, intraoperative bleeding approximately 400 ml. Postoperative, patient was admitted to the ICU with fentanyl infusion 20 µg/hour.

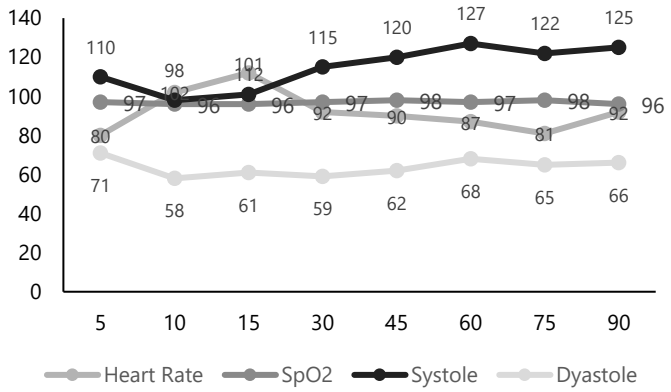

Figure 1. Hemodynamic monitoring during operation

Second Case

A 24 year old woman, primigravida, with a DORV case with primigravida pregnancy, 30-32 weeks of gestation, patient has a complex condition with high probability of Pulmonary hypertension and the presence of community acquired pneumonia (CAP). The clinical condition of patients with functional class III stage C heart failure with left ventricular enlargement and echocardiography indicated subpulmonic VSD with great artery malposition, ventricular balance (Taussig-Big Anomaly), severe tricuspid regurgitation with high probability pulmonary hypertension. An echocardiogram (ECG) examination was performed with normal results of sinus rhythm with a heart rate of 92 times/minute. Laboratory examination results Hemoglobin 9.9 mg/dl, hypoalbuminemia 2.87mg/dl, other laboratory values within normal limits, arterial blood gas showed PO_2 values of 72.5 mmHg and PCO_2 of 27.3 mmHg. Physical examination of the patient found 98% oxygen saturation with a 2 l/minute nasal cannula with blood pressure 95/53 with heart rate 108 beats/minute. Patients were assessed as physical status ASA 3 Gravida Congenital heart disease with

large VSD + DORV + Pulmonary Hypertension high probability, moderate Pulmonal Regurgitation, severe Tricuspid regurgitation, Heart Failure Stage C Functional class III, Pneumonia CAP.

The patient explained that she had a heart problems since childhood, but the patient denied any history of cyanosis. The patient experienced shortness of breath 5 days before admission to the hospital. A radiological examination could not rule out an infection in the lung. Currently, patients receive diuretic treatment routinely, namely furosemide 2 x 20 mg intravenous and the antibiotic ceftriaxone 2 x 1 g.

After obtaining informed consent regarding perioperative risk, the patient planned for elective caesarian with combination Spinal-epidural anesthesia. The patient's oxygen saturation was 97% with a nasal cannula of 2 l/minute. Invasive arterial blood pressure was placed on the right radial artery, and a central venous catheter was placed in the right subclavian vein. The regional subarachnoid block regimen uses a low spinal dose, 7.5 mg of 0.5% heavy bupivacaine combined with 25 µg fentanyl, at L3-L4 in a sitting position. After the block was achieved at T6, the first incision was made. During hemodynamic surgery, the patient was relatively stable with the highest systolic blood pressure of 121 and the lowest of 101, as well as the highest diastolic blood pressure of 72 and the lowest of 57 (Figure 2). The surgery procedure lasted for 1 hour with maintenance of 100 ml of crystalloid fluid and 100 ml of colloid. At the end of the operation, ropivacaine 0.2% and fentanyl 50 µg were given with a total volume of 10 ml through an epidural catheter as a postoperative analgesic. Patients are transferred to intensive care unit.

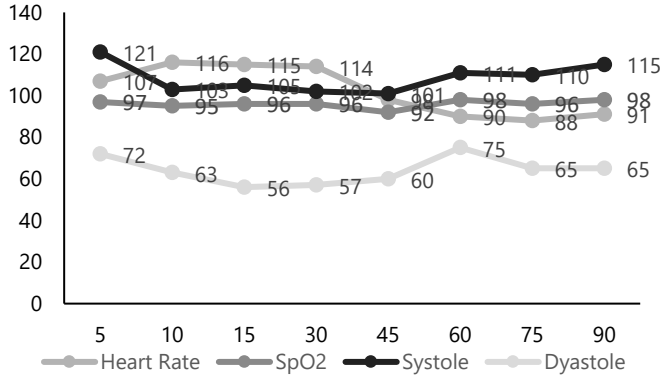

Figure 2. Hemodynamic monitoring during operation.

Third case

A 22 year old woman, primigravida, 30-32 weeks of gestation were planned for caesarean section with comorbid DORV and large subaortic VSD in the absence of pulmonary hypertension. Patients with functional class II stage C heart failure with left ventricular enlargement and found a normal Double Outlet Right Ventricle in relation to perimembranous VSD extends balance shunt, pulmonary stenosis Valvar-sub valvar mild, ASD small secundum left to right shunt, Mitral regurgitation Mild-Moderate, Ventricular Balance, with no pulmonary hypertension. Preoperative laboratory examination with hemoglobin 14.5 mg/dl and blood clotting profile within normal limits. Physical examination found an oxygen saturation of 89-92% with room air, with a blood pressure of 111/80 mmHg, heart rate 94 beats/minute, and found a murmur of 3/6. Radiological examination found an increased pulmonary vascular tone (increased flow) with cardiomegaly configuration of RVH in amlordance with left to right shunt and minimal left pleural effusion. Patients were assessed with ASA 3 Gravida physical status 32-34 weeks, DORV with bidirectional L to R shunt Subaortic VSD + PS Sub-valvular mild + MR Mild-Moderate, ASD Small secundum L to R Shunt, RVH, HF stage C FC II. The patient did not deny that she has history of cyanosis, clubbing finger, and patient complains of getting tired when doing physical activities. The patient has a history of palpitations and fainting.

Patients have received information about the plan for surgery and anesthesia in the form of regional subarachnoid blocks, as well as the risks of both surgery and anesthesia, postoperative intensive care. The patient's oxygen saturation at admission was 94% with a nasal cannula of 2 l/minute. An invasive arterial blood pressure was placed on the right radial artery. Low dose regional subarachnoid block technique, 7.5 mg of 0.5% heavy bupivacaine with a combination of 25 µg of fentanyl. The sensory block is achieved at the T6 level. Hemodynamics after the first minute BP 102/68 with pulse 81x/minute and oxygen saturation 97%. The patient's systolic blood pressure during the operation period ranged from 92-121 mmHg with the diastolic ranged from 56-79 mmHg (Figure 3). During the surgery fluid used colloid 300 ml, bleeding as much as 350 ml. Postoperatively, the patient was admitted to the ICU with fentanyl infusion 25 µg/hour for pain management.

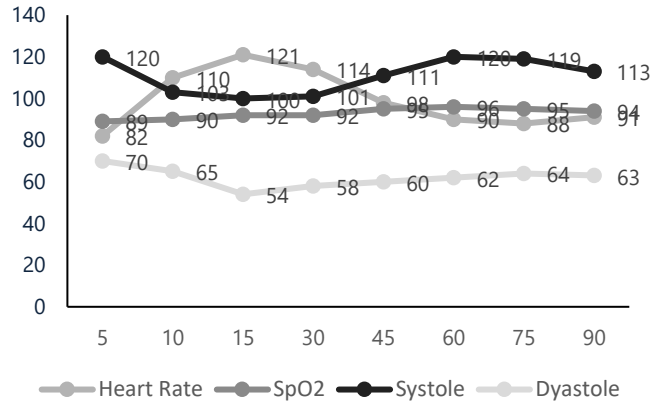

Figure 3. Hemodynamic monitoring during operation.

DISCUSSION

Double outlet right ventricle is a type of ventriculoarterial connection in which both great vessels arise either entirely or predominantly from the right ventricle. This definition is intended to simplify what is in fact a complex spectrum of defects, ranging from morphology that mimics tetralogy of Fallot to that which resembles transposition of the great vessels. Embryologically, DORV is a ventricular malformation that results from failure of proper alignment of the constructs with the ventricular septum**.** Pregnancy would complicates cyanotic heart disease such as DORV because the decrease in systemic vascular resistance (SVR) worsens right-to-left shunting. This effect is further compounded by neuraxial anesthesia for cesarean delivery. Pregnancy in patients with cyanotic heart disease is associated with more than 30% incidence of maternal cardiovascular complications. Maternal oxygen saturation less than 85% may be predictive of increased risk.[9] Patients with DORV have parallel systemic and pulmonary circuits.[6] Anesthetic considerations in patients with complex cyanotic heart disease including high risk of infective endocarditis, hepatic dysfunction due to chronic congestion, and deranged kidney function due to glomerulosclerosis from chronic hypoxia. The goals of anesthetic management for

patients with double outlet left ventricle undergoing surgery are preventing tachycardia, maintaining systemic vascular resistance (SVR) higher than pulmonary vascular resistance (PVR) to avoid increases in systemic venous blood recirculation,[10] preventing decrease in SVR which will increase the heart rate thus worsening the cardiac load, preventing hypovolemia, fluid overload, and factors that increase pulmonary artery pressure such as hypoxia and hypercarbia or pain.[9]

Invasive hemodynamic monitoring is usually needed in patient with DORV undergoing surgery. Use of invasive monitoring such as central venous catheter (CVC) and arterial line can be considered depending on the complexity of the procedure and the possibility of disruption on physiology such as pregnancy.[7,11] In all three cases, arterial line was placed in all patients. The use of arterial lines can be used as directly monitor changes in hemodynamics.

Regional anesthesia can be considered in patient with DORV undergoing surgery, as long as stable hemodynamics is maintained. The use of low dose spinal anesthesia provides adequate neuraxial blockade while maintaining stable hemodynamics.[2] In the first case, 5 mg of bupivacaine heavy was used with fentanyl 50 µg as adjuvant with a total volume of 2 ml.[2,3] On the second case and third case, 7.5 mg of bupivacaine heavy was used with fentanyl 50 µg as adjuvant.[12] Both doses had adequate sensory and motoric blockade with a duration of surgery in the range of 90 minutes. Stable hemodynamics are observed in all three cases. Opioids given to the intrathecal space in addition to local anesthesia, in this case 50 µg of fentanyl, will selectively produces analgesic effect with through interactions with opioid receptors in the dorsal horn of the spinal cord and thereby minimizing dosage and local supraspinal effect of anesthetics such as hypotension, respiratory depression, sedation and nausea vomiting.[2,3] Low dose of hyperbaric bupivacaine combined with fentanyl produce adequate blocks with minimal effects on hemodynamics. The use of low dose spinal anesthesia can reduce the incidence of post-spinal hypotension. Incidence rate of hypotension was approximately 31% in patients who were given the 5 mg bupivacaine combined with fentanyl 25 µg, when compared to 94% in patient who only get 10 mg bupivacaine without opioids.[4,5]

CONCLUSION

Anesthetic management in patient with DORV undergoing section cesarean includes maintaining stable hemodynamics, maintain near normal or physiological SVR and PVR, stable heart rate and cardiac load. Regional anesthesia can be considered in hemodynamically stable patients. Invasive monitoring such as arterial line is usually needed to carefully monitor the patient's hemodynamic status. Low dose spinal anesthesia could provide adequate neuraxial blockade while maintaining stable hemodynamics. The combination of low dose bupivacaine heavy with fentanyl produce adequate blocks with minimal systemic side effects and reduce the incidence of post-spinal hypotension in patient with DORV underwent section cesarean surgery.

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CONFLICT OF INTEREST

None

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