

ANESTHESIA FOR CESAREAN SECTION IN A PATIENT WITH A TRANSPOSITION OF GREAT ARTERIES

- Case Report -

ADEL MAKHDOOM^{*}, ADNAN ABDULLA AL-MAZROOA^{**},
WALEED EL-MARAKBY^{***}
AND ABDULAZIZ BOKER^{****}

Abstract

Transposition of great arteries (TGA) is one of the mixing lesions between right and left side with a prevalence of 0.21 per 1,000 live births.

A 25 years old lady from KSA, Gravida 3, Para 1 + 1, at 34 weeks gestational age was admitted to KAUH with symptoms suggestive of heart failure (NYHA Class IV). She was born with congenitally corrected TGA and coarctation of the aorta for which she underwent several operations, the last one of which was tricuspid valve replacement, she being on chronic anti-coagulation. On hospital admission, she was treated with anti-failure measures with stoppage of the oral anti-coagulant intake and shift to I.V. heparin. Cesarean section was performed under subarachnoid block using 2 ml of hyperbaric bupivacaine 0.5% with several precautions to avoid abrupt decrease in the systemic vascular

From Department of Anesthesia & Critical Care King Abdulaziz University Hospital, Jeddah, Saudi Arabia.

* FACHARZ.

** FFARCSI.

*** MBBS, FRCPC.

From Department of Anesthesia & Critical Care Faculty of Medicine Ain Shams University, Cairo, Egypt.

**** MD.

Correspondence: Adel Makhdoom FACHARZ, Department of Anesthesia and ICU, King Abdulaziz University Hospital. P.O. Box: 80215, Jeddah 2158, Saudi Arabia. Tel: 00966501820418, Fax: 0096626408335, E-mail: adelmakdoom@hotmail.com.

resistance. Baby was delivered with APGAR score 10 after 5 minutes. Postoperatively, the patient was admitted to the ICU for monitoring of the vital signs, and subcutaneous heparin was resumed immediately.

Introduction

Recent advances in medical therapies and surgical interventions over the last few years have had positive impact on survival of patient with congenital heart diseases (CHD). Children with CHD now reach adult life (16 years and over) and the reproductive age. However, they carry higher morbidity particularly during surgical and obstetrical interventions.

At adulthood, these cases are often presented in a complicated condition. In cases of transposition of the great arteries (TGA), the right ventricle gives rise to the aorta. Almost 50% of patients with this anomaly have a ventricular septal defect; some of them have variable degree of sub-pulmonic stenosis. Oxygenated pulmonary venous blood returns to the left atrium and is returned to the pulmonary artery without reaching the systemic circulation. Similarly, systemic venous blood returns to the right atrium and ventricle and pumped into the aorta again. Obviously, this arrangement is compatible with life only for a few circulation times unless there is some sort of pulmonary and systemic venous blood mixing via a patent ductus arteriosus or an opening in the atrial or ventricular septum at birth¹.

This paper presents a pregnant patient with complex CHD for cesarean section and was managed under spinal anesthesia at KAUH.

Case Report

Twenty five years old woman from Saudi Arabia, Gravida 3, Para 1 + 1, 34 weeks gestational age, admitted to KAUH complaining of symptoms suggestive of decompensated cardiac function (CHF class I-III) in the form of dyspnea, orthopnea and palpitations with minimal exertion. The patient was born with TGA and also was diagnosed to have a dextrocardia, atrio-ventricular and ventricular-atrial discordance. The patient underwent a number of multiple corrective surgical cardiac intervention.

The first was in her first year of life where she underwent subclavian flap repair of her coarctation and banding of her pulmonary artery. At one year of age, she underwent de-banding of the pulmonary artery, direct closure of patent foramen ovale, and patch closure of VSD through the tricuspid valve. Five years previously, at age of 20, she underwent stenting of her residual coarctation and tricuspid valve replacement at Cleveland Clinic. Surgery was complicated by complete heart block, requiring placement of dual chambered pacemaker.

MRI done, three years previously revealed residual TGA in the setting of ventricular inversion with dextro-cardia due to malrotation. This combination was complicated by severe left sided non ebsteinoid atrio-ventricular valve regurgitation (regurgitant fraction 55%), systolic dysfunction of the systemic ventricle (morphologic right ventricle) with depressed ejection fraction (EF) of total 42% and effective EF of 23% and insignificant pulmonary valve stenosis. No significant residual aortic stenosis was present at latest evaluation.

In view of this decompensated cardiac function, a decision by the managing team, (obstetrician, cardiologist and the cardiac anesthesiologist) was made to deliver the baby by cesarean section at term. This was planned to be done just after optimizing the patient cardiac function by anti-failure (medication) measures. These measures consisted of Digoxin 0.125 mg (Lanoxin R, Glaxco wellcome) PO-OD, furosemide 20 mg PO, OD (diusemide, APMC). Also, the patient continued her anti-coagulant management in the form of LMWH (subcutaneous Tizaparin 4500 units BID).

On the preceding week before surgery, repeat echocardiography revealed effective EF of 18%, though the patient clinical condition showed symptomatic improvement of her heart failure and without dyspnea or orthopnea (CHF Class II)?

Management of Anesthesia

Discussion was made with the patient and her husband regarding the different anesthetic options available; general and regional. The patient

and the family showed high preference to have a regional anesthetic in the form of sub-arachnoid block for reasons which will be discussed later.

Preoperative Preparation

The subcutaneous LMWH (Tizparin 4500 units BID) was discontinued and resorted to IV unfractionated heparin infusion (HIKMA-Heparin R, HIKMA) 18 units/kg/hr for 7 days with a loading dose of 81 units/kg till PTT become twice the normal value (maintained between 90-100 seconds). Through these 7 days, the patient was maintained on cardiac failure management up to the day of the procedure. Prophylaxis against infective endocarditis was achieved by Ampicillin 2 mg IV and Gentamycin 80 mg IV administered 30 min before induction of anesthesia.

Intravenous heparin was discontinued one hour before induction of anesthesia, with a normal PTT at time of induction (PTT = 40 seconds). Before start of anesthesia, hydroxyethyl starch 13% (voluven 6%; PSI) 12 ml/kg was infused over 30 min. Application of tight elastic stocking extending above the knee was applied.

Monitoring

Monitoring consisted of 5 leads ECG, pulseoximetry and NIBP (Datex-Ohmeda). Transcutaneous pacemaker was ready to use and instructions for the scrub nurse and surgeon to use Bipolar electro cautery. The fetal heart rate was monitored. Patient was then given Midazolam (Dormicum, Roche) 1 mg IV. Following local anesthesia (Xylocaine 1%, Astra Zenica) the left radial artery was cannulated by 20G arterial cannula (Arrow, Germany) by which invasive ABP monitoring was facilitated. Also right internal jugular vein was catheterized using triple lumen catheter (Arrow, Germany).

The baseline ABP = 123/74 mmHg, Pulse 95/min, Oxygen SAT 98% and CVP = 8 cm H₂O. The patient was put in the right lateral position with local anesthesia applied using xylocaine 1% 2 ml with 25G 3/4 inch. needle 27G pencil point needle (Whitacre, Spain) was

introduced at L3-L4 level. Once free clear cerebrospinal fluid (CSF) was obtained 2 ml hyperbaric bupivacaine 0.5% (Heavy Marcaine-Astra) plus Fentanyl 12.5 mcgs were injected over 15 seconds into the subarachoid space. Subsequently the patient was repositioned to supine position with left uterine tilt (30°), once a sensory level at T6 was confirmed by loss of sensation to cold stimulus (ice cube).

The patient experienced one bout of hypotension (80/40 mmHg) 2 min after spinal anesthesia for which ephedrine 8 mg (Ephedrini R-Lauhamaan Italy) was injected, that returned her baseline ABP (120/70 mmHg).

The hemodynamic parameters were unchanged throughout the procedure. A lower segment cesarean section was performed, and a baby girl delivered. The skin incision to delivery time was 6 minutes and her Apgar score was 7 and 10 after 1 and 5 min respectively.

Postoperatively, the patient was shifted to surgical intensive care unit. Pain was treated by morphine Patient-Controlled Analgesia (PCA) and heparin anticoagulation was resumed. The rest of the postoperative course was uneventful and the baby and the mother were discharged on 9th postoperative day.

Discussion

This case presents a successful management of a pregnant patient at term with a complex post-corrective CHD. The patient presented complex challenges and debatable goals related to the choice of anesthesia provision. Historically, such patients are managed under general anesthesia^{2,3,4} with regional anesthesia being increasing popular for high risk obstetric patients^{5,6}.

Regional anesthesia in the form of epidural or subarachnoid block was chosen by the patient in order to save her baby from the impact of narcotics of general anesthesia that is to be followed by tubal ligation as recommended by the cardiologist. She wanted the pleasure of seeing her baby on delivery.

Epidural anesthesia has been considered as the best choice for

patients with decompensated cardiac function for a number of reasons: Epidural anesthesia results in a more gradual onset of sympathectomy as compared to subarachnoid anesthesia, less abrupt drop in the peripheral vascular resistance and hypotension. It also produces moderate decrease in the cardiac after-load and preload, thus mimicking the pharmacological goals in the treatment of the congestive cardiac disease⁷. The disadvantages of epidural consist of the use of larger needles, and the risk of spinal hematoma is greater. In addition, the possibility of having atrio ventricular valve thrombosis would be greater as we have to normalize the PTT twice, once for the purpose of epidural catheter insertion and the second for catheter removal. Epidural was not recommended. Hence, subarachnoid block was chosen taking in consideration the avoidance of the abrupt drop in the peripheral vascular resistance by preloading the patient with hydroxy ethyl starch (10 ml/kg) over 30 minutes before induction of anesthesia⁸.

Bilateral lower limbs wrapping was done just above the knee as recommended by Sun et al⁹ whose study revealed that bilateral lower limbs wrapping prevents hypotension after regional anesthesia for cesarean section. (The postulated mechanism is the occurrence of partial auto-transfusion due to compression of venous capacitance and subsequent increase in venous return). In order to avoid abrupt sympathectomy with spinal anesthesia, the patient was put in the right lateral position during subarachnoid injection. This is based on the study of Law et al¹⁰ which revealed that injection of 2 ml of hyperbaric Bupivacaine 0.5% in the right lateral position followed by left uterine tilt 30° resulted in sensory block up to T4 in 5 minutes.

In this patient whose heart is after-load sensitive (Big-heart) as proved by the cardiac decompensation in the 32nd weeks of gestation (the usual time of maximum volume over load during pregnancy (about 45-50%)⁶, ephedrine (ephedrine R, Lohmann) was the vasopressor of choice as it provided some degree of B-stimulation. Conversely, predominant alpha receptor stimulation, as produced by phenylephrine could theoretically evoke adverse increases in ventricular afterload and myocardial oxygen demand while reducing the stroke volume so that left ventricular end-

diastolic volume and wall tension will be elevated¹¹.

During placental separation, there is acute transfusion of blood about 800 ml into maternal circulation with anticipation of cardiac decompensation in cardiac patients⁶. With dilated hearts (Big hearts) after load sensitive and preload insensitive) may require vasodilator drug e.g. Dobutamine to decrease the peripheral vascular resistance, myocardial oxygen consumption and cardiac work¹².

The intra-operative hypotension, is logically treated with ephedrine, which provides some degree of beta stimulation, causing positive inotropism. Conversely, predominant α -stimulation, as produced by phenylephrine could theoretically evoke adverse increase in ventricular after load owing to increased systemic vascular resistance.

For postoperative analgesia, PCA with morphine was used without risk of neonatal respiratory depression, as the baby was artificially fed. The mother would resume heparin subcutaneously immediately in the post operative period which is excreted in milk. Thus breast feeding was avoided¹³.

Conclusion

The challenging nature of CHD mandates a great team approach to deliver safe, well planned and executed management. Despite the recently published reports of generally safe course of pregnancy in patients with CHD, patients with decompensated cardiac performance need early involvement of a multi-disciplinary team including obstetrician, cardiologist in addition to anesthesiologist. Careful antenatal surveillance for the magnitude of cardiac dysfunction is recommended. The use of regional anesthesia and vasopressor in this group of patients need to be carefully evaluated before it is considered safe especially with the possibility of significant hemodynamic disturbances particularly with neuroaxial sympathectomy. In summary, team work combined with the careful attention to details and the timely use of diagnostics imaging is of paramount importance in the successful management of patients with unstable CHD.

References

1. NADAS AS, FYLER DC: *Pediatric Cardiology*. 3d ed ed. Philadelphia: Saunders; 1972.
2. CHAN F, NGAN KEE WD: Idiopathic dilated cardiomyopathy presenting in pregnancy. *Can J Anaeth*; Dec, 46(12):1146-9, 1999.
3. KAWANO K, TOBO K, SHINMURA N, YAMAGUCHI S, KITAMURA N, YUGE K, ET AL: [Perioperative management for cesarean section in a patient with corrected transposition of the great arteries]. *Masui*; Mar, 52(3):268-73, 2003.
4. NAKAMURA S, NISHIYAMA T, HANAOKA K: [General anesthesia for a patient with pulmonary hypertension, bronchial asthma and obesity]. *Masui*; Oct, 54(10):1143-5, 2005.
5. SPINATO JA, KRAYNACK BJ, COOPER MW: Eisenmenger's syndrome in pregnancy: Epidural anesthesia for elective cesarean section. *N Engl J Med*; May, 14:304(20):1215-7, 1981.
6. ATANASSOFF P, ALON E, SCHMID ER, PASCH T: Epidural anesthesia for cesarean section in a patient with severe pulmonary hypertension. *Acta Anaesthesiol Scand*; Jan, 34(1):75-7, 1990.
7. AMARANATH L, ESFANDIARI S, LOCKREM J, ROLLINS M: Epidural analgesia for total hip replacement in a patient with dilated cardiomyopathy. *Can Anaesth Soc J*; Jan, 33(1):84-8, 1986.
8. KAMENIK M, PAVER-ERZEN V: The effects of lactated Ringer's solution infusion on cardiac output changes after spinal anesthesia. *Anesth Analg*; Mar, 92(3):710-4, 2001.
9. SUN HL, LING QD, SUN WZ, WU RS, WU TJ, WANG SG, ET AL: Lower limb wrapping prevents hypotension, but not hypothermia or shivering, after the introduction of epidural anesthesia for cesarean delivery. *Anesth Analg*; Jul, 99(1):241-4, 2004.
10. LAW AC, LAM KK, IRWIN MG: The effect of right versus left lateral decubitus positions on induction of spinal anesthesia for cesarean delivery. *Anesth Analg*; Dec, 97(6):1795-9, 2003.
11. STOELTING RK, DIERDORF SF: Cardio myopathies. *Anesthesia and co-existing disease*. 4th ed ed. Philadelphia, Penn: Churchill Livingstone; pp. 117-26, 2002.
12. BORER JS, REDWOOD DR, LEVITT B, CAGIN N, BIANCHI C, VALLIN H, ET AL: Reduction in myocardial ischemia with nitroglycerin or nitroglycerin plus phenylephrine administered during acute myocardial infarction. *N Engl J Med*; Nov, 13:293(20):1008-12, 1975.
13. BOND GM, HOLLOWAY AM: Anaesthesia and breast-feeding the effect on mother and infant. *Anaesth Intensive Care*; Nov, 20(4):426-30, 1992.