

Mini-dose Combined Spinal-epidural Anaesthesia In A Parturient With Univentricular Heart And Severe Pulmonary Hypertension

C Cheng, J Chiu, E Thomas, S Quek

Citation

C Cheng, J Chiu, E Thomas, S Quek. *Mini-dose Combined Spinal-epidural Anaesthesia In A Parturient With Univentricular Heart And Severe Pulmonary Hypertension*. The Internet Journal of Cardiology. 2000 Volume 1 Number 1.

Abstract

This case report describes the anaesthetic management of a 35-year-old parturient with a univentricular heart when she required uterine curettage after a medical mid-term termination of pregnancy. The anaesthetic options are discussed with our justification for using a mini-dose combined spinal-epidural anaesthetic for this procedure. An intrathecal injection of 5mg bupivacaine and 25mcg fentanyl (in a 5ml volume) followed by an epidural injection of 15mg lignocaine produced adequate anaesthesia without haemodynamic instability.

CASE REPORT

A 35-year-old woman with a univentricular heart presented in her 15th week of gestation. Her underlying heart condition was found incidentally during childhood and has allegedly been of little consequence to her daily life. She denied all symptoms of cardio-pulmonary dysfunction and claimed to have an effort tolerance of 4 flights of stairs. She had also defaulted cardiology follow-up for a period of 3 years.

Two-dimensional echocardiography done four years previously revealed that she had a morphologic right ventricle from which both pulmonary artery (anterior) and aorta (posterior) arose. There was free blood flow into the larger pulmonary artery. A rudimentary left ventricle and small left atrium were also present. Her ventricular function was satisfactory. Her cardiac status was described as clinically resembling Eisenmenger's syndrome in view of the unprotected pulmonary circulation. The cardiologist felt that the continuation of the pregnancy would be at high risk to her, given her advanced pulmonary hypertension and complex cyanotic heart condition, so advocated termination of the pregnancy.

Clinical examination showed her heart rate was a regular 80 beats per minute, blood pressure was 130/80 mmHg, jugular venous pressure was not elevated and minimal pedal oedema

was present. Her fingers were clubbed and she was centrally cyanosed. Her apex beat was located at the sixth intercostal space, 1 cm lateral to the midclavicular line and a parasternal heave was present. Auscultation revealed a loud second heart sound, a pansystolic murmur and a diastolic murmur. Her lung fields were clinically clear. Her oxygen saturation whilst inspiring room air was 78%.

Trans-abdominal ultrasound scanning confirmed the presence of a live foetus and correlated the foetal age with the fundal height. Haematological investigation revealed a haemoglobin concentration of 17.6g dl-1 (haematocrit 53.7%). Blood gas analysis revealed a pO₂ of 47.8 mmHg. All other blood investigations were essentially within the normal range.

Unfortunately, no haemodynamic data was available from a cardiac catheter study as the patient refused further evaluation of her heart condition.

She was transferred to the intensive care unit for haemodynamic monitoring, oxygen therapy and medical termination of pregnancy (TOP). In the presence of antibiotic prophylaxis, the TOP was induced by the insertion of gemprost pessaries. Analgesia was in the form of paracetamol tablets and sublingual buprenorphine. Delivery of a morphologically intact placenta followed foetal

delivery. However, an ultrasound examination performed subsequently was suspicious of some remnant products of conception. She was thus prepared for uterine curettage under anaesthesia.

The patient was pre-medicated orally with ranitidine, metoclopramide and 0.3M sodium citrate. Antibiotic prophylaxis was with gentamicin and ampicillin. Her blood pressure was continuously monitored with an intra-arterial cannula to enable any changes to be rapidly identified and treated. Her oxygen saturation and ECG were also monitored.

A combined spinal-epidural (CSE) anaesthetic was administered with the patient in left lateral position through the L3/4 interspace using a loss of resistance technique. A mixture consisting of 5mg bupivacaine (1ml of 0.5%) and 25(g of fentanyl made up to 5 mls with normal saline) was injected into the intrathecal space. One ml of 1.5% lignocaine was also injected through the epidural catheter 5 min later to augment the block. There was a loss of sensation to cold to the T4 level after 10 minutes and surgery was able to proceed with good anaesthesia. The intra-operative course was uneventful with the surgery lasting 5 minutes. There was haemodynamic stability throughout the procedure, although there was a delayed drop in systolic blood pressure (from 160 to 125mmHg) after transfer back to the intensive care unit. This responded promptly to a single dose of metaraminol 0.1mg. She also experienced some shivering as a result of the regional anaesthesia and her oxygen saturation dropped to 70% despite the administration oxygen at 10 l min-1 through a face mask. Thrombo-embolic prophylaxis with subcutaneous nadroparin 0.3ml was started 6 hours after the operation.

She discharged herself against medical advice a day after the procedure, and has failed to attend her follow-up appointments.

DISCUSSION

Univentricular hearts describe a range of congenital cardiac malformations with one functional ventricle. This can be right, left or indeterminate morphologically¹. The outcome of such patients depends on the presence of other congenital abnormalities and on the blood flow patterns within such hearts, which could be highly variable, with preferential flow into either aorta or pulmonary artery. Pulmonary stenosis has a protective effect on the pulmonary vasculature, whilst pulmonary hypertension occurs with an unprotected

pulmonary blood flow. This may become advanced and even irreversible with time. A “balanced” flow is said to be present when both systemic and pulmonary circulations obtain adequate blood flow to enable survival into adulthood without surgical intervention².

A recent review has described the management options in parturients with univentricular hearts³. The risks to such patients are related to their inability to respond adequately to the increased demands for oxygen during pregnancy. As a result of their increased pulmonary vascular resistance in the face of a reduced functional residual capacity, a high incidence of intra-uterine growth retardation and fetal demise is evident in these patients⁴. Although the quoted maternal mortality rate ranges from 23-52%³, there have been reports of good outcome for both mother and foetus³. The majority of the reported cases have had some form of surgery in the form of either palliative central shunts (Pott’s or Glenn) or definitive (Fontan’s) procedures. Termination of pregnancy was only attempted in 2 cases out of the 20 case reports in Buckland’s review, one of which resulted in a maternal death a day after the termination of a 20-week pregnancy³.

As our patient has not had any surgical or medical treatment, and had defaulted follow-up for some time, we assessed her cardiac status to be at higher risk than before, particularly in terms of pulmonary vascular disease. Her oxygen saturation only improved from 78% to 85% with the administration of 50% oxygen, reflecting significance of her right-to-left shunt. The prognosis of such patients with univentricular hearts and Eisenmenger-type pulmonary vascular pathology is known to be poor should pregnancy occur^{3,6}.

The optimization of pulmonary blood flow in these patients entails the avoidance of systemic vasodilatation, maintenance of the intravascular volume and adequate venous return, and the prevention of pain, hypoxaemia, hypercarbia and acidosis (as these will increase the pulmonary vascular resistance). Any general anaesthetic technique employed should avoid myocardial depression. The anaesthetic options for this patient are monitored anaesthesia care (MAC), general anaesthesia or regional anaesthesia. MAC with intravenous sedation was ruled out to obviate her risk of aspiration. A rapid sequence induction of general anaesthesia was avoided in view of its myocardial depressant effects⁵. General anaesthesia for caesarean section in these patients have been described using etomidate and a slow induction technique with a favorable outcome^{3,6}.

Regional techniques have been avoided, as there is fear of inadequate pulmonary blood flow in the face of systemic vasodilatation from the sympathetic blockade⁵, although a carefully titrated epidural anaesthetic resulting in no adverse sequelae has been described⁷. There has only been one published case report of a CSE (for labour analgesia) on a parturient with a univentricular heart⁸, who had delivered vaginally at term. Both fentanyl and morphine were administered into her intrathecal space. She had a univentricular heart, pulmonary atresia, and had undergone both Pott's and Glenn procedures. She was thought to have normal pulmonary vasculature.

We decided that a low-dose CSE would provide the required anaesthesia to at least the T10 level without much systemic and pulmonary haemodynamic disturbance⁹. This technique involves the administration of an intentionally small intrathecal dose, accepting that the block so obtained may be inadequate. This can subsequently be topped up with epidural drugs. This technique allows the block to be restricted to the lowest level needed, thus minimizing sympathetic blockade and the consequent hypotension. It may therefore be a useful technique in patients with cardiac disease or at risk of hypotension.

The use of central venous pressure and pulmonary artery pressure / cardiac output monitoring is controversial^{5,7,10}.

These patients are considered to be at high risk of worsening shunt ratios and thrombo-embolism. They should therefore remain in an intensive care facility for a few days after delivery^{6,7}, with continued anticoagulation for six weeks. Thromboembolism has been reported to account for 43% of all maternal deaths in parturients with Eisenmenger's syndrome⁶. We were, unfortunately, unable to keep our patient in hospital and she is likely to have defaulted any treatment.

In conclusion, parturients with univentricular hearts have delivered live infants despite the superimposed risks of pregnancy. Such women should be counseled with regards to the risks either early in pregnancy or preferably prior to conception. Assessment of pulmonary: systemic flow ratios and shunt reversibility should be undertaken to quantify the risks. Upon conception, a multidisciplinary team encompassing the obstetrician, obstetric anaesthetist and cardiologist knowledgeable in adult congenital heart disease should be involved. Regular fetal monitoring and early

caesarean section should be considered should there be signs of either maternal or fetal compromise³.

CORRESPONDING AUTHOR:

Dr Jen W. Chiu,
Department of Anaesthesia,
KK Women's & Children's Hospital,
100 Bukit Timah Road,
Singapore 229899.
Tel: +65 3941081;
Fax: +65 2912661;
E-mail: chiujw@pacific.net.sg

LEGEND

FIGURE 1

ECG showing sinus rhythm at rate 79 bpm, with signs of right ventricular hypertrophy and bifascicular block (right bundle branch block and left posterior fascicular block).

FIGURE 2

Chest X-ray showing cardiomegaly with right ventricular prominence. There was mild interstitial pulmonary oedema, indicating some degree of heart failure.

References

1. Colvin EV. Single ventricle. In: Garson A Jr, Bricker JT, McNamara DG, eds. *The Science and Practice of Pediatric Cardiology*. Lea & Febiger, Philadelphia 1990; 1145-72.
2. Ammash NM, Warnes CA. Survival into adulthood of patients with unoperated single ventricle. *Am J Cardiol* 1996; 77:542-4.
3. Buckland R, Pickett JA. Pregnancy and the univentricular heart: case report and literature review. *International Journal of Obstetric Anaesthesia* 2000; 9: 55-63.
4. Oakley CM. Pregnancy and heart disease. *Br J Hosp Med* 1996; 55: 423-6.
5. Thornhill ML, Camann WR. Cardiovascular disease. In: Chestnut DH, ed. *Obstetric Anaesthesia, Principles and Practice*. Mosby, St Louis 1994; 746-79.
6. Kandasamy R, Koh KF, Tham SL, Reddy S. Anaesthesia for caesarean section in a patient with Eisenmenger's syndrome. *Singapore Med J* 2000; 41: 356-358.
7. Johnson MD, Saltzman DH. Cardiac disease. In: Datta S, ed. *Anesthetic and obstetric management of high-risk pregnancy*. Mosby, St. Louis 1996; 200-45.
8. Ammar T, Beilin Y, Bernstein HH. Successful regional anaesthesia for a woman with a single ventricle presenting for labor and delivery. *J Cardiothorac Vasc Anesth* 1996; 10: 640-2.
9. Cook TM. Combined spinal-epidural techniques. *Anaesthesia* 2000; 55: 42-64.
10. Gambling DR, Huckell VF. Structural heart disease. In: Gambling DR, Douglas MJ, eds. *Obstetric anaesthesia and uncommon disorders*. WB Saunders, Philadelphia 1998; 1-20.

Author Information

Christine JC Cheng, BSc (Hons), MBBCh, FRCA

Registrar, Anaesthesia & Intensive Care, Surgery, Singapore General Hospital

Jen Wun Chiu, MBBS, MMed (Anaes), DEAA

Consultant, Anaesthesia, Obstetrics & Gynaecology, KK Women's & Children's Hospital

Easaw Thomas, MBBS, MMed (Anaes), FANZCA, FAMS

Senior Consultant, Anaesthesia, Obstetrics & Gynaecology, KK Women's & Children's Hospital

Swee Chye Quek, MBBS, MMed (Paeds), DCH, FACC, FAMS

Consultant & Associate Professor, Paediatric cardiology, Paediatrics, National University Hospital