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Aortic coarctation and pregnancy: anesthesia management in two Cesarean sections with invasive and non-invasive measurement of blood pressure in both upper and lower limbs

Abstract

We present two pregnant patients with aortic coarctation: 1) a 30-year-old woman with a history of surgically repaired aortic coarctation. 2) An 18-year-old woman with a history of PDA, VSD, and aortic coarctation. Both patients received antenatal care involving obstetrics, anesthesia, and cardiology; and both delivered by elective Cesarean section. We used general anesthesia in the first patient and epidural anesthesia in the second one. We monitored blood pressure in both upper and lower limbs non-invasively in the first patient and invasively in the second one. Perioperative management focused on minimizing hemodynamic disturbances.

Keywords: aortic coarctation, cesarean sections, anesthesia

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Introduction

Some congenital heart diseases are amenable to treatment in early childhood thanks to recent developments in diagnostic and therapeutic interventions.[1] Most of these patients can reach reproductive age after the initial treatments. However, the gestational hemodynamic changes can complicate their pathology significantly.[2]

Aortic coarctation (AoCo) comprises 6-8% of all congenital heart defects on average and is up to 35% in some syndromes.[3] It consists of an abnormal juncture of the aortic isthmus with the arterial duct, resulting in narrowing of the aorta during the neonatal period or later in the adulthood.[4] The presentation of AoCo varies according to its severity, the presence of associated defects, the extent of ductal patency and the presence of collaterals.[5,6] Aortic coarctation is the fourth congenital disease that needs catheterization and surgery in the first year of the life.[4] Although all patients with AoCo require treatment, the choice and timing of the treatment depends on the severity of the coarctation.[5,6] Balloon angioplasty, for instance, is usually reserved for treatment of mild or recurrent AoCo in older children. Surgical therapies encompass various methods such as end-to-end anastomosis and subclavian flap angioplasty.[7]

Aortic coarctation may complicate pregnancy, delivery, and postpartum period with sustained hypertension, aortic root dilatation or recoarctation.[8] Cesarean section is advisable in these patients to reduce the hemodynamic stress of labor and its complications. Anesthesia considerations of pregnant women with AoCo aim to minimize peripartum hemodynamic disturbances and to avoid hypovolemia, hypoxemia, and hypothermia. We present our anesthesia management in two parturients with a history of AoCo who underwent Cesarean section.

Case 1

A 30-year-old woman G1P1 at 36 weeks gestational age was admitted with a history of AoCo and hypertension. She had a coarctoplasty and stent placement eight years ago. She did not have known medical allergy, history of smoking, drinking alcohol, or use of illicit drugs. Her exercise tolerance was fair and metabolic equivalents were 7.6 before pregnancy. She was on methyldopa 250mg PO twice-daily and ASA 80mg once daily. Her lab findings were unremarkable. Her ECG demonstrated a sinus rhythm, normal axis, ST-T change in V1-V4 and left ventricular hypertrophy. She weighed 70kg with body mass index was 27.34kg/m^2. Her blood pressure was 150/90mmHg on the right arm versus 160/80mmHg on the left arm. The blood pressure on her left calf was 165/90mmHg. Heart rate was 92bpm and respiratory rate was 14bpm. Her oxygen saturation was 96% in room air on the right finger pulse oximetry. She had a reassuring airway and the rest of her physical exam was unremarkable.

Management of anesthesia

The patient consented for general anesthesia while refused neuraxial anesthesia. Before the procedure, she received a bolus of 500ml Ringer's lactated and a premedication including ranitidine 50 mg, metoclopramide 10mg, midazolam 1mg, and fentanyl 50micrograms pre-induction. Standard monitors comprised of pulse oximetry, five-lead EKG, and non-invasive monitoring of blood pressure on the right upper and left lower limbs. After preoxygenation, she was induced using etomidate 0.3mg/kg and succinylcholine 1.5mg/kg; and was intubated uneventfully. Then the patient received cisatracurium 0.1mg/kg and isoflurane 0.8-1.2% in oxygen 4l/min. A lower segment Cesarean section was performed, and seven minutes after the skin incision, she delivered a male neonate with Apgar

scores of 8 and 10 at 1 and 5 minutes respectively. The patient was reversed by neostigmine 0.04mg/kg and atropine 0.02mg/kg at the end. Anesthesia was uneventful and lasted for 85 minutes.

The intraoperative non-invasive blood pressure measurements are depicted in Table 1. The right upper limb blood pressure and the pulse rate measurements at baseline, after premedication, after intubation and at the conclusion of the operation were 174/88mmHg and 104bpm, 155/87mmHg and 107bpm, 215/149mmHg and 98bpm, and 146/75mmHg and 101bpm respectively. The lower limb blood pressure measurements at the same time spots were 148/79mmHg, 146/75mmHg, 150/85mmHg and 119/65mmHg respectively. The arterial blood pressure rose only once immediately after intubation and resumed to the pre-induction values for the rest of procedure. Other hemodynamic parameters were unchanged throughout the procedure. She stayed for 1 hour in the postanesthesia care unit and then was transferred to ICU with stable hemodynamics and spontaneous respiration. The rest of the postoperative course was uneventful, and the baby and the mother were discharged on the fifth postoperative day.

Table 1 The intraoperative non-invasive blood pressure measurements (mmHg)

	Before premedication	After premedication	After intubation	At the conclusion of operation
Right upper limb	150/90	174/88	155/87	215/149
Left lower limb	165/90	148/79	146/75	119/65

Case 2

An 18-year-old woman, G1P1 at 37 weeks+4 days gestational age was admitted with a history of uncorrected patent ductus arteriosus (PDA), ventricular septal defect (VSD), and AoCo. She had no past surgical history. She had a three-month history of worsening dyspnea, orthopnea, paroxysmal nocturnal dyspnea, and progressive functional capacity deterioration consistent with New York Heart Association class III-IV status. She did not have known medical allergy, history of smoking, drinking alcohol, or use of illicit drugs. She was on carvedilol 12.5mg twice daily. Her lab findings were unremarkable. Her ECG was sinus rhythm, normal axis, Q wave and tall R in V5 and V6. The echocardiography indicated an ejection fraction of 75% and a normal pulmonary arterial pressure. She weighed 72kg with BMI 29kg/m^2. Her non-invasive blood pressure was 125/82mmHg on the right arm versus 130/87mmHg on the left arm. The non-invasive blood pressure on her left calf was 78/45mmHg. Heart rate was 96 bpm and respiratory rate was 18bpm. Her oxygen saturation was 91% in room air on the right finger pulse oximetry. She had regular S1-S2 heart sounds with a 3/6 systolic murmur in the pulmonary and tricuspid areas. She had a reassuring airway and the rest of her physical exam was unremarkable.

Management of Anesthesia: The patient opted for epidural anesthesia. Before the procedure, she received a bolus of 300ml Ringer's lactated and a premedication including ranitidine 50mg, metoclopramide 10mg, and midazolam 1mg. Standard monitors comprised of pulse oximetry, five-lead EKG, and invasive blood pressure monitoring on the left radial artery and left dorsalis pedis artery. In the sitting position, the epidural catheter was inserted at the L3-L4 level and bolused with 60mg lidocaine 2% and 30mg bupivacaine 0.5% isobaric. The surgery began with a sensory block level at T6 with the patient in supine position and left uterine tilt. A lower segment Cesarean section was performed, and five minutes after the skin incision, she delivered a female neonate with Apgar scores of 8 and 10 at 1 and 5 minutes respectively. After delivery, she received oxytocin 40 IU, midazolam 1mg, and fentanyl 50 micrograms. The epidural was topped up once during the operation with another 40 mg bupivacaine 0.5% isobaric. Anesthesia was uneventful and lasted for 120 minutes, and the hemodynamics were stable throughout the procedure.

The intraoperative non-invasive blood pressure measurements are depicted in Table 2.The baseline IBP was 125/82 mmHg on left radial artery versus 78/45mmHg on left dorsalis pedis artery, pulse rate 89 bpm, respiratory rate 14rpm and SPO2 98% in the room air. After the procedure, IBP was 120/69mmHg on left radial artery versus 75/32 mmHg on left dorsalis pedis artery, pulse rate 71bpm, and SPO_2 100% in the room air.

The patient was conscious and coherent with spontaneous breathing at the end of the operation and was dispositioned to ICU postoperatively. The epidural catheter was extracted 12 hours after the operation. The rest of the postoperative course was uneventful, and the baby and the mother were discharged on the sixth postoperative day.

Table 2 The intraoperative non-invasive blood pressure measurements (mmHg)

	Before premedication	After epidural procedure	During operation	At the conclusion of operation
Right upper limb	125/82	119/74	121/75	151/89
Left lower limb	78/45	74/44	75/45	97/57

Discussion

In the second-trimester blood volume and cardiac output increase by 30% to 50% and these changes accelerates in the seventh month of pregnancy.[9] Therefore, pregnant patients with AoCo deserve more frequent perinatal visits for blood pressure management, especially in the peripartum period. It is claimed that patients with a previous corrective surgery for AoCo may have stiffness in proximal aorta, may be more susceptible to hemodynamic changes, and may require a multidisciplinary management perinatally involving cardiology, anesthesiology, obstetrics, hematology, psychiatry and expert nursing.[10]

According to the European Society of Cardiology 2010 guideline, any arterial blood pressure of more than 140/90 on the upper limbs with a more than 20% difference between upper and lower limbs deserves medical intervention.[11]

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Regional anesthesia, especially epidural anesthesia is preferred in patients with decompensated cardiac function. There is no published report of anesthesia management of pregnant patients with uncorrected AoCo, VSD, and PDA to our knowledge. Walker and Malins reported anesthetic management of AoCo in two pregnant women.[12] They used epidural anesthesia with no complications in mothers and neonates. Bruno Mendonça Barcellos and colleagues recently presented a Cesarean delivery in a patient with an uncorrected AoCo but a surgically corrected VSD.[13] They used epidural anesthesia with invasive blood pressure monitoring in both upper and lower limbs and achieved a desirable outcome.

We had time and resource constraints to apply invasive blood pressure monitoring in the first patient who had a surgically corrected AoCo. Hence, it is the first reported non-invasive monitoring of blood pressure on both upper and lower limbs in a parturient with AoCo undergoing Cesarean section under general anesthesia.

The hemodynamic disturbances were minimal in the second patient with epidural anesthesia. We did not observe a notable difference between invasive versus non-invasive monitoring of blood pressure in both upper and lower limbs.

In summary, we presented two patients with a history of AoCo who underwent successful Cesarean deliveries under regional and general anesthesia. The mainstay of our management was meticulous blood pressure monitoring from the upper and lower limbs, either invasively and non-invasively. We confirm that epidural anesthesia provides more stable hemodynamics in such patients.

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Consent for publication

The patients gave written permission to the authors to publish the report.

Conflicts of interest

The author(s) declare(s) that there is no conflict of interest regarding the publication of this paper.

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