Combined spinal-epidural anesthesia for cesarean delivery in a patient with tricuspid atresia status post Fontan repair

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Introduction

Patient survival with surgically corrected congenital heart disease continues to improve, as there are now more adults than children with congenital heart disease1. Patients with corrected congenital heart disease present unique challenges for anesthetic care during the peripartum period. We report on the successful use of low dose sequential combined spinal-epidural anesthesia in a parturient with modified Fontan physiology for elective cesarean section.

Case Description

A 27 year old female (90 kg, 172 cm) with history of tricuspid atresia who initially underwent Blalock-Taussig shunt and PDA ligation at age of 1 year, then followed by a modified Fontan at age 3 years, presented for a planned primary cesarean delivery at 38 2/7 weeks gestational age. The patient was monitored throughout her pregnancy with an initial consultation at 12 weeks gestational age with maternal-fetal medicine, pulmonology, and cardiology. The patient complained of dyspnea on exertion with reductions in her hemoglobin saturation via home monitoring. Transthoracic echo demonstrated patent Fontan connections and Glenn anastomosis, left ventricular ejection fraction 55%, severe right ventricular hypoplasia. Cardiopulmonary exercise testing was performed which revealed moderate to severe reduction in exercise capacity, achieving 45% of her predicted workload and 53% of her maximum predicted oxygen consumption, however her oxygen saturation remained greater than 93% throughout her examination. During her second trimester the patient developed exertional fatigue; however, her cardiac function evaluated by transthoracic echocardiography remained unchanged. At presentation of her planned cesarean delivery, the patient complained of positional lightheadedness that would improve with rest, however was able to achieve 4 METs.

On arrival to the operating room, 2 peripheral IVs with inline air filters and a radial arterial line were placed in addition to standard ASA monitors. After monitoring, a sequential combined spinal-epidural was placed in the sitting position utilizing a needle in needle technique with 5 mg of isobaric bupivacaine, 15 mcg of fentanyl, and 150 mcg of morphine injected intrathecally. The epidural catheter was advanced and tested with 3 ml of lidocaine 1.5% with epinephrine 1:200,000. The patient was placed supine with left lateral tilt and an additional 3 ml of lidocaine 2% was administered to obtain an adequate level for surgical anesthesia. A phenylephrine infusion was initiated to maintain mean arterial pressure >65 mmHg. The patient remained hemodynamically stable throughout with no subjective symptoms. After delivery, 3 IU of oxytocin was given intravenously by slow push followed by an infusion of oxytocin at 6 IU/hr. Due to decreasing
anesthetic levels, her epidural was titrated with lidocaine 2% to a total volume of 11 milliliters during the procedure. A total of 3 liters of lactated ringers was given intravenously, with an estimated 850 milliliters of blood loss. The patient was admitted to the intensive care unit postoperatively for cardiac monitoring, progressed to floor cares postoperative day 1, and discharged in stable condition postoperative day 6.

Discussion

Pregnancy induces many physiologic changes including increased preload, increased circulating blood volume, increased heart rate, and decreased afterload. These physiologic changes can be especially detrimental to the patient with complex congenital heart disease. To safely care for this patient population one must have an understanding of the patient’s specific Fontan physiology and also understand the effects the above mentioned physiologic changes have on the Fontan circulation.

Patients with Fontan physiology require passive filling of the pulmonary vessels. Therefore, maintaining a high filling pressure and low pulmonary vascular resistance is important perioperatively. Neuraxial anesthesia has the advantage of maintaining spontaneous ventilation, as positive pressure ventilation can impair passive pulmonary filling in the Fontan circulation. However, in this preload dependent physiology, abrupt changes in vascular tone associated with spinal anesthesia may not be well tolerated. Careful titration of an epidural or a combined spinal-epidural with low dose intrathecal medications have been described in the literature for parturients with congenital heart disease. The sequential spinal epidural allows for excellent sacral coverage with a low dose spinal while allowing for careful titration to an adequate surgical level with the epidural. In addition to cardiac stability, this technique provides excellent analgesia postoperatively from the use of intrathecal opioids. Additional considerations for the Fontan patient include meticulous attention to avoid air entrainment in IVs as these patients likely have right to left shunting at the atrial level.

This case presents a technique for anesthetic care of a parturient with Fontan physiology undergoing cesarean delivery and reviews the specific anesthetic considerations in the peripartum period for this unique patient population.

References