

Anesthetic management of patent ductus arteriosus in adults

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ABSTRACT

Patent ductus arteriosus (PDA) is an extracardiac left to right shunt. It should be corrected at an early age, but some patients may survive into adult life even without repair. Anesthetic management for adult patients with PDA poses many challenges for the anesthesiologist due to alterations in the cardiopulmonary physiology. We report successful anesthesia management of a case of an adult patient of PDA with moderate pulmonary artery hypertension with infective endarteritis (two large mobile vegetations at the pulmonary end of the duct).

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Key words: Cardiopulmonary bypass; Deep hypothermic circulatory arrest; Patent ductus arteriosus

INTRODUCTION

The incidence of patent ductus arteriosus (PDA) is approximately 0.02–0.04% in term infants^[1] and 20–60% in preterm neonates.^[2] PDA accounts for 6–11% of all congenital heart defects.^[3] PDA is found twice as often in females than in males.^[4] It is generally recommended that PDA should be corrected surgically or by endovascular device closure at an early age to prevent future complications such as pulmonary artery hypertension and congestive cardiac failure.

CASE REPORT

A 20-year-old female patient, 30 kg by weight, admitted with a history of continuous high-grade fever associated with chills and rigors, palpitations, and breathlessness. Clinical evaluation revealed hyperdynamic precordium, parasternal heave Grade 3, and continuous murmur Grade 5/6 at the upper left sternal border. A chest X-ray showed cardiomegaly with pulmonary plethora. An echocardiogram showed a 5 mm restrictive PDA (left to right shunt), restricted by gradient of 86/54 mmHg and two large mobile vegetations at the pulmonary end of the duct (1.2 cm × 1.1 cm and 1.6 cm × 1.2 cm) with moderate pulmonary hypertension.

The patient was operated through median sternotomy with cardiopulmonary

bypass (CPB). To prevent flooding of the pulmonary artery and for good exposure, deep hypothermic circulatory arrest (DHCA) was given for 11 min. Temperature throughout DHCA was maintained at 20°C and cross-clamp time was 55 min. During DHCA, methylprednisolone 30 mg/kg, sodium thiopental 20 mg/kg, and ice packs around head and carotid artery were used for brain protection. The patient was weaned from bypass with heart rate of 115/min and blood pressure 105/47 mmHg in normal sinus rhythm, with inotropic support of injection milrinone 0.4 µg/kg/min and adrenaline 0.06 µg/kg/min with good urine output. Twenty-four hours postoperatively, the patient developed severe pulmonary hypertension was treated with injection sildenafil 10 mg. The patient was extubated 36 h postoperatively with stable hemodynamics and normal cerebration.

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DISCUSSION

PDA is one of the common congenital left to right cardiac defects in children and is rarely seen in adults. Closure (surgical/device closure) is usually done in children. Closure of the duct becomes more difficult after development of complications such as infective endarteritis (most common cause of death), congestive heart failure, pulmonary hypertension, and calcification. PDA with infective endarteritis should undergo a surgery because of risk of complications such as cardiac failure and organ failure due to septic emboli, neurological problems such as stroke, mycotic aneurysm, and fatal arrhythmias.^[5]

The incidence of infective endarteritis has been reported to be 1%/year.^[6] Two possible factors, which are thought to contribute to the development of infective endarteritis and vegetations in case of PDA, are turbulence of blood flow between the aorta and the pulmonary artery and endothelial injury by turbulence. Vegetations are detected by echocardiography and are usually present in the pulmonary end of ductus as was present in our case.

In our case, intraoperative DHCA was used to prevent flooding of pulmonary vasculature and for good visualization of the surgical field. The safe duration of DHCA is controversial. According to Svensson *et al.* safe duration to prevent neurological dysfunction is between 40 min and 60 min.^[7] According to McCullough *et al.*, the safe duration of DHCA at 15°C was only 29 min.^[8] In our case, DHCA duration was 11 min and temperature was 20°C. DHCA theoretically uses induced hypothermia for neuroprotection by decreasing cerebral metabolic rate of oxygen (CMRO₂). There is 6–7% decrease in metabolism per 1°C decrease in temperature.^[9] Rapid cooling of cerebral tissue can lead to heterogeneous temperatures and cerebral hypoxia. In our case, patient's temperature was kept at 20°C throughout the duration of DHCA. For neuroprotection, injection thiopentone 20 mg/kg was given to reduce CMRO₂ and external cooling by ice packs around the head and carotid artery was also used to inhibit secondary rewarming during duration of DHCA. Blood glucose level was kept below 140 mg/dl throughout the procedure with the help of insulin drip as hyperglycemia during DHCA has been associated with worsening neurological outcomes.^[10] To prevent

pulmonary artery hypertension, injection milrinone was continued for 24 h. Hypoxia, hypercarbia, acidosis, and hypothermia were avoided.

CONCLUSION

For adult patients of PDA with pulmonary hypertension with infective endarteritis, the use of CPB and DHCA can be a safe technique along with the use of all neuroprotective measures and appropriate monitoring.

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Conflicts of interest

There are no conflicts of interest.

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