Case Report

**Closure of patent ductus arteriosus in an adult patient under cardiopulmonary bypass with total circulatory arrest**

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**ABSTRACT**

We report a 19 years old woman who, in addition to a large, short, window-like Patent Ductus arteriosus (PDA), had pulmonary artery hypertension and multivalvular heart disease. After a pulmonary artery injury during surgery after primary thoracotomy, her PDA was closed transpulmonary with Gore-Tex patch, via median sternotomy and Cardiopulmonary Bypass (CPB)/Hypothermic Total Circulatory Arrest (HTCA) and discharged from hospital without any problem. (Rawal Med J 2008;33:118-120).

**Key words:** Patent ductus arteriosus, Cardiopulmonary bypass, Hypothermic total circulatory arrest.

**INTRODUCTION**

In children PDA closure is performed safely by Percutaneus transcatheter ductal closure (PTDC) using intravenous instruments or Video assisted thoracoscopic surgery (VATS). Contrary to children, in adults, PDA is short, calcified and fragile in which surgical closure is performed via thoracotomy, using intravenous instruments or Video assisted thoracoscopic surgery (VATS) and can be accompanied with unpredictable morbidity or mortality. In such cases, some authors recommend using CPB and HTCA via median sternotomy. In this patient, at first, our team used thoracotomy; however, with a pulmonary artery damage/perforation during the surgery, continuity of surgery was accomplished via median sternotomy, using CPB and HTCA.
CASE REPORT

Patient was a 19 years old woman of 42 kg weight and 149 cm height with diagnosis of PDA and chief complaint of dyspnea, tachycardia, and exertional fatigue from childhood. In clinical examination, she had a continuous murmur. An echocardiography five months ago showed a large PDA (left to right shunt), severe pulmonary artery hypertension (PAH), mitral regurgitation (MR\(^2+\)), tricuspid regurgitation (TR\(^2+\)), pulmonary insufficiency (PI\(^2+\)), left ventricle ejection fraction (LVEF) of 45% and pulmonary to systemic flow ratio (QP/QS) of 4.1. A Chest X-Ray showed moderate cardiomegaly with pulmonary congestion. Cardiac catheterization revealed large PDA, pulmonary artery pressure (PAP)= 95/55\(^{\text{mmHg}}\), right ventricle pressure (RVP)=95/0-10\(^{\text{mmHg}}\), left ventricle pressure (LVP)=130/0-15\(^{\text{mmHg}}\), ascending aorta pressure (AAP)=130/65\(^{\text{mmHg}}\), descending aorta pressure (DAP) =115/65\(^{\text{mmHg}}\), MR\(^2+\), PI\(^1+\), and LVEF of 50%.

At surgery, via left posterolateral thoracotomy, PDA was exposed which was as large as aorta, short (2-3mm) and funnel-shaped. When preparing and exposing, left pulmonary artery was perforated, bleeding was controlled with simple packing. Operation plan was changed from thoracotomy to median sternotomy approach using CPB/HTCA. After applying CPB, patient was cooled to 24\(^{\circ}\text{C}\), then total circulatory arrest, PDA was closed with Gore-Tex patch, with diameter about 15-20mm, via main pulmonary artery. After 22 minutes HTCA, 37 minutes aorta clamping time and 99 minutes CPB by getting nasopharyngeal temperature to 35.5\(^{\circ}\text{C}\), she was weaned from CPB with sinus rhythm and infusion of dobutamine 15\(\mu\text{g/kg/min}\). She was transferred to ICU. During HTCA, patient's pupils became dilated which with rewarming became reactive and normal sized. For brain protection we used dexamethasone 16mg, sodium thiopental 2g, mannitol (20%) infusion 150ml and ice-water cap before total circulatory arrest.

Recovery from anesthesia was delayed starting at about 14-16 hours, without any adverse reaction, and got normal consciousness at 17-18\(^{\text{th}}\) hour of postoperative period. After complete consciousness, at 24\(^{\text{th}}\) hour, patient was extubated. She was transferred to ward after 72 hours ICU stay, with stable
hemodynamics. On 4th postoperative day transthoracic echocardiography revealed a LVEF 50%, mild MR, trivial TR and no residual PDA. Chest x-ray showed normal heart size and lungs. She was discharged from hospital on ninth hospital day. In pursuing by telephone after two months, the patient was in good functional status and without any neurologic problem.

**DISCUSSION**

Patent ductus arteriosus (PDA) is a relatively common congenital heart disease. Its closure in childhood can safely be done with different techniques. Large short, window-shaped PDA with pulmonary hypertension and calcification are unsuitable for non-surgical methods. PDA if untreated, 90% of these patients die by the age sixty. When using PTDC in patients with large or short PDA, there is a risk of device migration with resultant pulmonary artery narrowing or embolism, residual PDA, hemolysis and endocarditis. In adults, PDA is usually large, short, thin and friable with concomitant pulmonary artery hypertension, therefore its closure via thoracotomy, VATC or transcatheter approach might be impossible or unsafe. Therefore other techniques are used for closing PDA. In adults, preferred approach is via median sternotomy, using CPB, and closure through pulmonary artery. In this situation hypothermic total circulatory arrest (HTCA), provides a bloodless field for the surgeon to perform the procedure safely and effectively.

PDA closure, in an adult patient with the help of normothermic CBP has been carried out on beating heart through pulmonary artery during which finger pressure and Foley catheter were used for preventing "backbleeding" from aorta. Although the popular technique in PDA closure in adults is low flow CPB with systemic hypothermia, Gurcun et al. used HTCA in a patient with moderate pulmonary artery hypertension. Their patient had a PDA with a diameter of about 5 mm which was repaired without using a patch and the patient was cooled to 20°C, CPB and circulatory arrest times were 67 and 5 minutes respectively. We cooled our patient to 24°C, times of CPB, aortic clamp and circulatory arrest were 99, 37 and 22 minutes respectively and PDA was closed with Gore-Tex patch with a diameter about 15-20 mm. Despite 22 minutes of HTCA, we were able to extubate our patient without any neurologic or
neurobehavioral complication. There is controversy regarding using drugs with possible neuroprotective effects, however prior to HTCA we used dexamethasone, sodium thiopental and mannitol. At the same time, we used ice water packs around the patient head to further protect the brain. In conclusion, in older patients with large and short PDA, use of CPB and HTCA can be safe and appropriate technique.

REFERENCES