

The effects of antedgrade cerebral perfusion on immediate postoperative outcome in neonatal and infant aortic arch repair concomitant with intracardiac surgery

Antegrad serebral perfüzyonun yenidoğan ve infant dönemindeki arkus aort onarımı ve intrakardiyak cerrahi ile birlikte ameliyat sonrası erken dönemde prognoz ve sonuç üzerine etkileri

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Intracardiac defects associated with aortic arch obstruction are rare congenital anomaly and remains a high surgical risk. The use of correct surgical techniques for protection of brain, spine and myocardium is crucial in a concomitant surgery with aortic arch and intracardiac surgical repairs. Single-stage repair through a median sternotomy with or without circulatory arrest has been adopted and gained popularity among the surgeon with good results, recently (1). In these surgical strategies, cerebral protection is provided by the use of hypothermic circulatory arrest (HCA) or selective antegrade cerebral perfusion (SACP) in infants.

Overall, 27 consecutive patients undergoing surgery for single-stage repair of hypoplastic or interrupted aortic arch associated with intracardiac defect surgeries during the period of March, 2007 to April, 2012 were included in the study.

The clinical range included simple ventricular septal defect (VSD) associated with or without atrial septal defect (ASD) in 15 patients. Major associated cardiac defects were present in 12 and included truncus arteriosus (Vaag Pragh type 4) in 2, transposition of the great arteries (TGA) in 5, and double outlet right ventricle (DORV) with Taussig Bing anomaly in 2 and aortopulmonary window in 3. Sixteen patients had coarctation of the aorta (AoCo), 8 had AoCo with hypoplastic arch, and 3 had interrupted aortic arch.

Five patients died early after the operation at intensive care unit. Two of them were diagnosed with aortic coarctation and TGA. These two had long cardiopulmonary bypass and SACP

times and both of them died due to the low cardiac output in the first 24 hours in the intensive care unit. The third one who was diagnosed as AoCo and VSD had high fever after 3 days in intensive care unit and died due to the sepsis. The fourth one who had a preoperative diagnosis of DORV and AoCo, had congestive heart failure preoperatively. This baby weighed 2750 gr at the surgery and had necrotizing enterocolitis after starting to feed with a nasogastric route, postoperatively. The 5th patient had a diagnosis of DORV, TGA, AoCo, and VSD. This baby had a coronary anomaly that all of the coronary arteries were originating from single orifice, which was noticed during the operation. Although, it was not injured at the operation, baby had low cardiac output and died 3 weeks later.

Recent studies have shown the superiority of brain protection for higher hematocrit levels (2). During hypoplastic aortic arch surgery, the main concerns are the protection of the cerebral and myocardial functions. The adverse effect of HCA during arch repair was described, and the current trend is to avoid it whenever possible (3).

In addition to the neurological adverse effect of HCA, low cardiac output state that can persist after coarctation and hypoplastic aortic arch repair as a result of longer cardiopulmonary bypass time and preoperative left ventricular dysfunction. For this reason, some centers prefer to do the isolated myocardial perfusion technique for minimizing myocardial ischemia during total circulatory arrest (4). Almost one decade ago, a technique was described for extended aortic arch reconstruction with

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selective cerebral perfusion and a working beating heart (5). After that, Lim et al. (6) described a combined perfusion technique that uses two cannulas; one is placed into the innominate artery and the other into the aortic root. By this method, an extended end-to-side anastomosis was performed with continuous cerebral perfusion and a nonworking beating heart.

The appropriate perfusion rate for the brain in the neonate during selective cerebral perfusion remains controversial. During SACP an ideal flow rate of 50 mL/kg/min has been advocated on the base of theoretical calculations but many different protocols have been proposed to date (7). This uncertainty regarding optimum cerebral flow and the management of the SACP has prompted surgeons to utilize control systems to evaluate the effectiveness of cerebral perfusion such as transcranial Doppler ultrasonography or near-infrared spectroscopy (8). In our experience, radial arterial pressure has proved to be simple and reliable methods to adjust flow rate during SACP. The flow rate of 50 to 80 mL/kg/min was used to maintain a perfusion pressure of 50 to 60 mmHg on the radial artery. The pressure in the radial artery is related to cerebral blood flow rather than the flow rate (9).

Infants undergoing aortic arch repair with concomitant intracardiac surgical repair can be done with selective aortic perfusion at a single stage.

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