

Letter to the Editor

Is hypothermia necessary in pediatric cardiac surgery?¹

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1. Introduction

Congenital heart defects are routinely treated by cardiopulmonary bypass (CPB) with flow rate = 2.0–2.4 l/m² per min (3.5–5.5 l/m² per min being the physiologic pediatric range) at normal temperature (37°C), with progressive reduction of temperature and flow rate, sometimes with circulatory arrest under 18°C [1–3]. Negative consequences of low-flow and hypothermia are well known [1–3].

2. Materials and methods

Seventy-seven patients, median age 2 years 2 months (2 months–16 years), median body weight 10.8 kg (3.8–45.0 kg), underwent surgery with normothermic (37°C) high flow (3.5 l/m² per min). Leukocyte-depleted blood and intermittent blood cardioplegia were used. In cyanotic patients ‘controlled reoxygenation’ was utilized [4]. Diagnosis are listed in Table 1. Patients requiring for aortic arch reconstruction with deep hypothermia and circulatory arrest were excluded.

3. Results

Median aortic cross clamping was 29 min (0–165 min). Median duration of CPB was 90 min (28–274 min).

There were three hospital deaths (3/77 = 3.9%) because of sepsis, pulmonary hypertension, and postoperative mismanagement.

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There were no late deaths in a mean follow-up of 15 months (1–26 months).

Spontaneous breathing was possible in 60/74 (=81.1%) of survivors in <3 h after surgery, and in 73/74 (=98.6%) in <24 h.

Dobutamine 0–5 µg/kg per min were required in 69/74 (=93.2%) survivors, 5–10 µg/kg per min in 4/74 (=5.4%) and >10 µg/kg per min in only 1/74 (=1.4%).

NaHCO₃ was required in 4/74 (=5.4%) patients.

Median peripheral temperature after 6 h was 36.0°C (31.2–37.0°C).

Median chest drainage within 6 h was 9.0 ml/kg (2.8–16.7 ml/kg). Median urine output the first 24 h was 2.6 ml/kg h (1.1–6.2 ml/kg h).

Median ICU stay was 1 day (1–13 days), median hospital stay was 7 days (3–39 days).

4. Discussion

Systemic hypothermia during CPB offers some degree of cerebral protection and a safety margin in case of technical difficulties. In pediatric cardiac surgery the need for intracardiac exposure often necessitates a reduction in perfusion flow rate. The deleterious effects of CPB, particularly with reduced flow (metabolic derangement, neurologic and hematologic complications), may be initiated or exaggerated by hypothermia [1–3]. Normothermia, despite reduced cardiac index of 2.0–2.4 l/m² per min, in adult patients confers several advantages over conventional hypothermia: reduced bleeding, shorter intubation times, and improved hemodynamics during the postoperative period [5].

Normothermia and high flow (3.5 l/m² per min) have been never reported for surgical treatment of complex congenital heart defects.

Our experience demonstrated that normothermic high

Table 1

Diagnosis

12	ventricular septal defect
10	tetralogy of Fallot (4 with anomalous coronary artery, 2 with absent pulmonary valve)
10	atrial septal defect
6	atrio-ventricular septal defect
6	pulmonary atresia with ventricular septal defect
5	anomalous pulmonary venous connection
4	multiple ventricular septal defects ± right ventricular outflow tract obstruction
4	tricuspid atresia
3	ventricular septal defect with aortic valve regurgitation
3	pulmonary atresia with intact ventricular septum
3	transposition of the great arteries
3	conduit obstruction
2	double discordance (atrio-ventricular and ventriculo-arterial)
2	mitral valve regurgitation
2	aortic valve regurgitation
1	complex left ventricular outflow tract obstruction
1	pulmonary stenosis with atrial septal defect

flow CPB is feasible, even in infancy and in cyanotic children, with minimal metabolic derangement, low requirement for inotropic and respiratory support, and expeditious postoperative course.

No neurological deficit (choreoatetosis, convulsions, seizures, etc.) has been detected in our patients.

We acknowledge the absence of a control group as a limiting factor of our study.

The inconvenience of the normothermic high flow technique (difficult surgical visualization) is overcome with proper surgical exposure, adequate venous cannulation and left atrial drainage.

5. Conclusions

Normothermic high flow CPB is a viable alternative option, because the benefits of improved intracardiac exposure and surgical comfort must be balanced against the risks of inadequate tissue perfusion.

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