

Bloodless Heart Surgery for an 11-kg Infant of the Jehovah's Witness Faith Undergoing Second Repair for Complete Atrioventricular Canal

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Abstract: Bloodless pediatric cardiac surgery is the intent of most surgical centers especially in the Jehovah's Witness population where it is a desire not to administer blood products because of religious belief. It is a tremendous feat, considering that most pediatric cardiovascular prime volumes are more than 20% of the patient's estimated blood volume (EBV). We report on our bloodless strategy for a 2-year old Jehovah's Witness with trisomy 21 and complete atrioventricular canal repair, who underwent atrial septal defect and ventricular septal defect patch closure, pulmonary artery debanding, and pulmonary arterioplasty. We

modified our circuit to reduce our prime volume to approximately 10% of the EBV and removed 200 mL of the patient's blood before surgery as acute normovolemic hemodilution. We did not alter our institutional standards for transfusion of blood and blood products. The post cardiopulmonary bypass (CPB) hematocrit was 30%. We conclude that bloodless CPB surgery can be performed safely in Jehovah's Witness patients with a carefully planned interdisciplinary approach. **Keywords:** bloodless, Jehovah's Witness, blood transfusion, cardiopulmonary bypass, infant. *J Extra Corpor Technol. 2018;50:184-6*

OVERVIEW

Intraoperative blood usage in pediatric cardiac surgery is ubiquitous because of the great discrepancies between patient blood volume and cardiopulmonary bypass (CPB) circuit volume. The need for any blood transfusion arises when hemoglobin levels reach a threshold below which red blood cell transfusion is necessary to ensure adequate end organ perfusion and oxygen delivery. After institutional approval, we report our strategy of transfusion-free complex surgery in a 2-year old Jehovah's Witness who required repair of a complete atrioventricular (AV) canal defect. Our institutional guidelines comprised acceptable hematocrit (Hct) threshold during CPB, increase of preoperative patient Hct, and CPB circuit volume reduction.

CASE REPORT

A 2-year-old baby girl with trisomy 21 and complete AV canal defect, Rastelli type A, underwent a pulmonary artery band as a first stage palliation at 5 months of age. The patient weighed 11.9 kg and 81 cm tall, with calculated body surface area of 56 m² at the time of complete repair. Her family is of Jehovah's Witness faith and wanted her not to receive blood or blood products. The patient received 500 units/kg of erythropoietin subcutaneously twice per week for 4 weeks before surgery. The patient's estimated blood volume was 952 mL. Her preoperative hemoglobin and Hct were 16.3 g/dL and 48%, respectively. We performed acute normovolemic hemodilution (ANH) from the arterial line and blood pressure with a small dosage of Phenyl epinephrine (20 mcg) after anesthesia induction and removed 200 mL of blood from the patient to be reinfused post CPB. The patient's hemoglobin and Hct were 13.3 g/dL and 39%, respectively, 5 minutes before going on CPB.

Our standard priming volume for a child weighting 12 kg is 180 mL but we modified our circuit by moving our CPB machine as close to the surgical table as possible and

Received for publication January 2, 2018; accepted July 25, 2018.
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The senior author has stated that the authors have reported no material, financial, or other relationship with any healthcare-related business or other entity whose products or services are discussed in this paper.

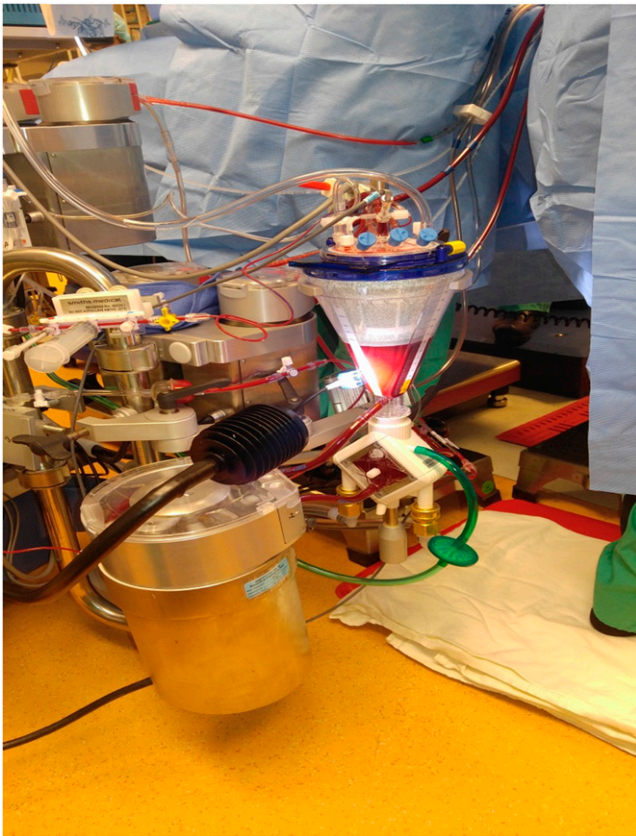


Figure 1. Cardiopulmonary bypass setup.

removed the resultant extra tubing (Figure 1). We did not use vacuum assist drainage. The arterial and venous lines were retrograde primed with autologous blood after cannulation. Our circuit tubing internal diameter was 3/16 inch for the

arterial line and 1/4 inch for the venous line. These changes allowed us to decrease the priming volume to approximately 95 mL not counting for retrograde arterial priming and venous arterial priming. The Quadrox-i Pediatric oxygenator and cardiotomy (Maquet, Germany) used have a total static priming volume of 99 mL. Plasmalyte was used as the crystalloid priming solution with 1,500 units of heparin, 8 mL of sodium bicarbonate, 5 mL of amicar, 4 mL of cefazolin, and 50 mL of 25% albumin. Arterial cannulation was carried out with a 12-Fr Biomedicus and bicaval venous cannulation was performed with 14-Fr and 16-Fr right-angled cannulae (Medtronic, Minneapolis, MN).

On the institution of CPB, patient was cooled to a bladder temperature of 28°C. The aorta was cross-clamped and del Nido cardioplegia was administered and repeated at the hour mark for a total volume of 235 mL. CPB blood flow ranged from 70 to 120 mL/Kg/min. The Hct after initiation of CPB was 31%. Our lowest Hct was 25% which occurred after the cross clamp was removed. The strategy included suctioning the cardioplegia washout from the coronary sinus to the cell saver. The total CPB time was 4 hours and 24 minutes and cross clamp time was 3 hours and 10 minutes. A DHF02 hemoconcentrator (Sorin Group, Arvado, CO) was used to remove excess fluid during CPB and modified ultrafiltration (MUF). Eight hundred milliliters of effluent volume was removed during CPB and 250 mL during MUF. Total urine output was 150 mL during the procedure. We estimated our total blood loss at 50 mL which was not enough to process with the cell saver (CATS, Terumo, Fresenius, Homburg, Germany).

The patient was extubated in the surgical suite and the last hemoglobin and Hct before leaving the OR were 10.2 g/dL

Hematocrit %

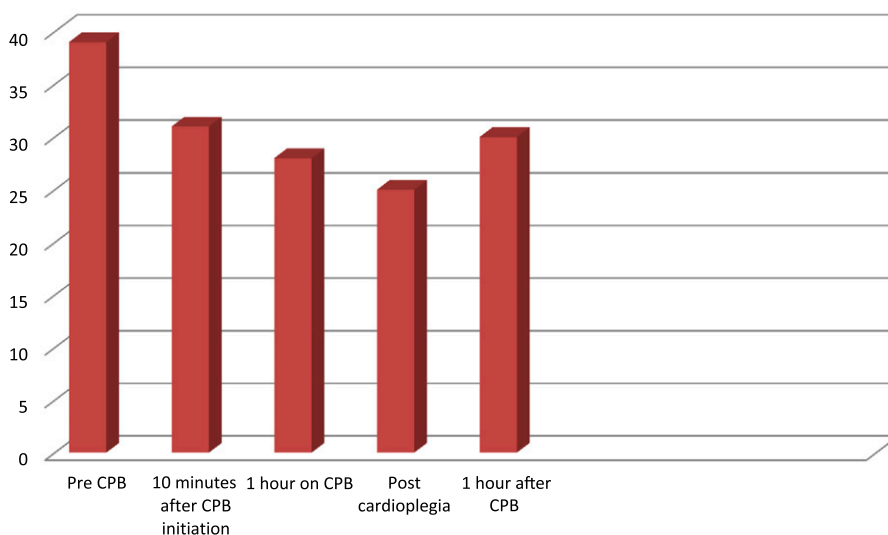


Figure 2. Perioperative Hct levels.

CPB = cardiopulmonary bypass; hr= hour; mins = minutes.

and 30%, respectively. Throughout the procedure the patient's lactate levels ranged between .4 and .8 mmol/L. The cerebral tissue oxygen saturation (rS02) measured by near infrared spectroscopy (NIRS, Medtronic) was maintained between 60 and 92%. The range of mean arterial pressure (MAP) was kept between 40 and 50 mmHg.

COMMENT

The challenge of providing a bloodless surgery in this case is apparent. Our experience indicates that a multidisciplinary approach with a well delineated perioperative strategy can help reduce the ill effects of hemodilution during CPB in congenital heart surgery. We were able to perform bloodless surgery in a complex congenital cardiac surgery without altering our institutional standards of care for maintaining CPB Hct greater than 25% with excellent end organ perfusion measured by serum lactate levels and appropriate NIRS readings.

Other strategies that were used included erythropoietin administration preoperatively for four weeks before surgery. This strategy helped the patient achieve a higher starting Hct

value. In turn, we were able to perform ANH before sternotomy without compromising our standards for maintaining CPB Hct of 25% (Figure 2). This blood volume was reinfused after heparin was reversed at the end of CPB. A small dose of phenylephrine (20 mcg) was also used to increase the MAP by approximately 15% of baseline MAP immediately before coming off bypass.

In addition, we were able to reduce the circuit volume as stated previously while maintaining adequate perfusion without compromising our safety standards. The use of cell saver for suctioning cardioplegia washout instead of pump sucker and the use of good surgical techniques for hemostasis were additionally important adjunct to our strategy.

CONCLUSION

Bloodless congenital cardiac surgery can be performed in select group of patients with a well-planned interdisciplinary approach without compromising institutional safety or Hct standards.