



## Case Report

# *Case Report: Cardiopulmonary Bypass with a Nonhemic Prime for an Infant of Less Than Four Kilograms*

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### ABSTRACT

Cardiopulmonary bypass in infants without the use of blood or blood products poses serious challenges for the cardiac surgical team. Excessive hemodilution may compromise how an infant will tolerate the procedure. We describe the methods used to provide cardiopulmonary bypass without blood for a 3.97 kg infant of Jehovah's Witness parents. The surgical repair was successful and the child was discharged without receiving any blood or blood products.

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## INTRODUCTION

A four month old female of Jehovah's Witness parents presented with an atrial septal defect (ASD), a ventricular septal defect (VSD), and a patent ductus arteriosus (PDA). The patient's weight was 3.97 kilograms and the preoperative hematocrit was 34%. In planning the surgical procedure, we realized our standard bypass circuit without blood transfusion would hemodilute this small patient to an unsafe degree. Therefore we modified the pump circuit to reduce the priming volume.

## MATERIALS AND METHODS

Our standard small infant priming circuit consists of a 400 ml Terumo venous reservoir bag, a Capiiox 308 membrane oxygenator, a Terumo CXCR40 cardiomy reservoir<sup>a</sup> and 1/4" diameter tubing for the arterial and venous lines. The 500 ml priming volume of this circuit was reduced in the following ways: We used a 100 ml Terumo venous reservoir bag<sup>a</sup>, the arterial filter and the filter bypass line were omitted, the 1/4" tubing to the cardiomy and the pump raceway were trimmed to the shortest functional lengths, the oxygenator and reservoirs were raised slightly above normal on the pump mast and the pump was pushed very close to the primary surgeon. Before cannulation the surgeon carefully assessed the lengths of the arterial and venous lines and cut approximately 12 inches off each line. An additional 20 ml of prime was drawn from a sampling port of the oxygenator at the onset of bypass. After all these volume reducing methods were done the circuit volume consisted of 390 ml lactated ringers, plus 20 ml (20 mEq) of sodium bicarbonate and 1.5 ml (1500 units) of heparin.

After cardiopulmonary bypass (CPB) was initiated the patient was cooled to a nasopharyngeal temperature of 15.5°C and a rectal temperature of 19.8°C. The first hematocrit on bypass was 15%. We gave 6 mg of furosemide. After the aorta was cross clamped, the surgeon gave 10 ml/kg of cold crystalloid cardioplegia in preparation for circulatory arrest. CPB was discontinued and the ASD, VSD, and PDA were repaired during the 40 minute arrest time.

Once CPB was resumed, rewarming was begun. During the 30 minute rewarming period, the pump flow averaged 144 ml/kg/min. At this time, the hematocrit was 12.8%. The patient was successfully weaned from bypass on nitroglycerin 0.5 mcg/kg/min, dopamine 3 mcg/kg/min, and epinephrine 100 ngm/kg/min. The aortic cannula was left in place and the pump volume was transfused as needed. Immediately after decannulation, the remainder of the pump volume was drawn up in 60 ml syringes and given to the anesthesiologist to transfuse to the patient. Shortly after cardiopulmonary bypass was ended, the patient received 5.5 mg of furosemide to maintain active diuresis. At this time, the hematocrit was 19%.

## RESULTS

The patient had an uneventful postoperative course. The hematocrit after transport to the intensive care unit was 20%. The patient was extubated on the first postoperative day. During the hospital stay, the patient's hemoconcentration was increased through diuresis. When discharged six days after surgery, the patient had a hematocrit of 34%.

## DISCUSSION

CPB without blood transfusion in children under 10 kilograms has been reported. (1-3) To our knowledge, the patient in this report is one of the smallest patients to undergo cardiopulmonary bypass without blood at our institution. For our patient, we were able to minimize many components of the pump circuit without compromising safety.

The arterial filter and filter bypass line in our standard infant circuit has a volume of 60 ml. After discussion with the surgeon, we agreed to eliminate the arterial filter to minimize the hemodilution on bypass. Both a level alarm (on the cardiomy reservoir) and a bubble detector were utilized to decrease the risk of air embolization.

Most simple ASD and VSD corrections are done without circulatory arrest at our institution. For this case, which required a non-blood prime, we believe the decrease in bypass time by using profound hypothermia and circulatory arrest helped reduce perioperative and post-operative bleeding. In addition, active diuresis throughout the procedure and hospital stay increased the hematocrit to clinically acceptable levels.

Along with respect for religious beliefs, the growing public awareness of bloodborne disease may help restructure the limits of hemodilution on CPB and decrease the number of blood transfusions in pediatric cardiac surgery. One does not wish to face this kind of pediatric case often; but, perhaps if we pool our knowledge and experiences, we will be able to ensure safe cardiopulmonary bypass procedures for this special group of patients.

## REFERENCES

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