

# Cardiopulmonary bypass in Jehovah's Witnesses

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## Summary

Jehovah's Witnesses do not accept heterologous blood transfusion for religious reasons. Autologous transfusions are also rejected if there is no continuous contact between the circulation and the autologous blood. There is, therefore, the need to adopt methods which will avoid transfusion of heterologous blood in elective cases as far as Jehovah's Witnesses are concerned. We report two cases where pre-operatively administration of nutritional supplements, haematenics, erythropoietin, antimalarials and the modification of the extra-corporeal circulation bypass circuit allowed successful open-heart surgery using cardiopulmonary bypass.

**Keywords:** *Jehovah's Witnesses, Antimalarials, Erythropoietin, Isovolaemic haemodilution, Cardiopulmonary bypass, Haemoglobin (Hb), Haematocrit (Hct).*

## Résumé

Témoin de Jéhovah n'accepte pas la transfusion sanguine hétérologue à cause des raisons relatives à la religion. Il reprouve également les transfusions autogoues s'il n'y a pas un rapport continue entre la circulation et sang autologous. Donc, en ce qui concerne le Témoin de Jéhovah, c'est nécessaire d'adopter des méthodes qui vont éviter la transfusion du sang hétérologous dans ces cas facultatifs. Nous faisons un rapport sur deux cas où l'administration du suppléments nutritionnel, hématénique érythropoïétine, antipaludéen et la modification d'une circulation extracorporel mis hors circuit préopératoire a permis une chirurgie à coeur ouvert couronnée de succès avec l'utilisation d'un pontage cardio-pulmonaire.

## Introduction

Jehovah's witnesses for religious reasons do not allow heterologous or some forms of autologous blood transfusion for medical and surgical indications. For open heart surgery using cardiopulmonary bypass various methods have been used in the developed nations which make surgery without the use of bank blood possible<sup>7-10</sup>. The performance of open heart surgery in Jehovah's witnesses poses great challenges to the surgical team. Successful management of patients is, therefore, not only gratifying to the patient and the surgical team but also provides a training ground in the broader field of bloodless surgery. This is of tremendous importance when one considers the risk of heterologous blood transfusion in the face of increasing risk of blood borne diseases such as HIV/AIDS and Hepatitis B and C. The successful management of two Jehovah's witnesses who underwent cardiopulmonary bypass for a ventricular septal defect and mitral valve replacement respectively without resorting to heterologous blood transfusion forms the basis of this communication.

## Case report 1

A. N., a 12 year old boy presented with reduced effort

tolerance and frequent respiratory tract infections since birth. Investigations including 2-D colour doppler echocardiography revealed a membranous ventricular septal defect, with a left to right shunt and good left ventricular function.

Preoperatively he received nutritional supplementation with high calorie and high protein diet, haematenics, antimalarials and weekly injections of erythropoietin (4000iu) for a period of 4 weeks. The preoperative Hb increased from 10.7g% (Hct 32.1%) to 12.5g% (37.5%) at end of the four weeks. Routine examination of the stool excluded helminthic, especially hook-worm infestation.

## Case report 2

G.N., a 41 year old lady presented with recurrent left ventricular failure and chronic atrial fibrillation secondary to a severe mitral stenosis of rheumatic origin. She had also suffered a thrombo-embolic stroke eight weeks previous y. Doppler echocardiography revealed severe mitral valve stenosis with a gradient of 64mm Hg, dilated left atrium containing a large thrombus.

Preoperatively she received nutritional supplementation with high protein diet, hematenics, antimalarials and weekly injections of erythropoietin (10,000iu) for a period of five weeks. This increased the preoperative Hg from 12.7g% (Hct 37.4%) to 16.7g% (Hct 50.3%). Examination of the stool did not reveal any worm infestations.

## Anaesthesia, cardiopulmonary bypass and surgery

In both cases anaesthesia was induced with fentanyl, midazolam, etomidate and pancuronium after which a left radial arterial line for invasive blood pressure monitoring and a right internal jugular line for central venous pressure measurement were inserted. Maintenance of anaesthesia was by midazolam infusion, fentanyl boluses, isoflurane and muscle relaxation with pancuronium. In case one, isovolaemic haemodilution was performed by taking one unit of blood into a citrate phosphate dextrose (CPD) blood bag and replacing the blood with 600mls of gelofusine. In case two, three units of autologous blood were taken from the patient. This was replaced with 1.5 litres of haemacel and one litre of Ringers lactate. In both cases normal central venous and arterial pressures were maintained. The target haematocrit (Hct) after isovolaemic haemodilution was 30%. Surgery in both patients was performed with conventional cardiopulmonary bypass with moderate hypothermia as well as myocardial protection with cold St. Thomas cardioplegic solution.

The systemic temperature was reduced to and maintained at a rectal and nasopharygeal temperatures of 30.8C and 29.7C (case 1) and 28.2C and 27.6C (case 2) respectively.

The mean arterial pressure was between 45 - 65mmHg, the partial pressure of oxygen between 480 - 512mmHg and the SPO<sub>2</sub> 99.9%. The PH was maintained at around 7.38 with a bicarbonate between 22.2 - 26.6mmol/L. The Hb dropped to 10.5g% (Hct 31.5%) for case 1 and 11.4g% (Hct 34.4%) for case

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2 after isovolaemic haemodilution and was between 5.8g% (Hct 17.4%) and 6.8g% (Hct 20.4%) for case 1 and 7.0g% (Hct 20.7%) and 8.1g% (Hct 24.0%) during bypass. In case 1 the VSD was closed using a Gore-Tex ((polytetrafluoroethylene) patch, and in case 2 the calcified and stenotic mitral valve was excised and replaced with a size 29 Sorin bicarbon bileaflet mechanical prosthesis. Both patients were weaned off the heart-lung-machine without any difficulty.

A dialysis filter inserted into the extra corporeal circulation circuit removed all the excess fluid from the circulation and the red blood cell concentrated residual blood was transfused back to the patients. The preoperative harvested blood was also re-transfused before case 1 left operating room whilst re-transfusion of harvested blood for case 2 continued into the immediate postoperative period.

#### The postoperative period

Check Hb immediately postoperative was 9.8g% (Hct 29.2%) for case 1 and 13.9g% (Hct 40.6%) for case 2. This dropped to 7.5g% (Hct 22.3%) for case 1 and 10.7g% (Hct 30.8%) for case 2 in the next 3 days. Administration of haematenics (ferrous sulphate, folic acid and vitamins) and erythropoietin was continued post-operatively for two weeks. At the time of discharge the Hb was 11.6g% (Hct 34.7%) for case 1 and 12.7 (Hct 38.1%) for case 2. Case 2 was started on anticoagulants (warfarin) to maintain an INR of about 2.0 – 2.5. Six months postoperatively the Hb for case 1 is 11.3g% (33.6%) and case 2, 13.2g% (Hct 40.0%).

#### Discussion

Jehovah's witnesses have definite objections to transfusions of heterologous whole blood, packed red cells, and blood plasma for religious reasons. They however accept globulins, albumin and purified clotting factors<sup>1</sup>.

The medical risks of blood transfusions need not be over emphasized especially with the transmission of retro viruses and hepatitis<sup>2</sup>. Until recently the patients in developed countries had cardiopulmonary bypass without prior preparation to raise haemoglobin levels because their Hb's were very good. Henling *et al* in their study had about 32% of their patients with starting Hb's of more than 15g% and the rest of the cases not much less than this<sup>3</sup>. Our personal experience in Ghana is that starting Hb's are low due to a combination of factors including relative nutritional deficiency and red blood cell destroying infections such as malaria. There is, therefore, the need for nutritional augmentation and haematenics. The use of erythropoietin is becoming more common around the world for the preoperative preparation of Jehovah witnesses for most types of surgery where blood loss is expected to be heavy<sup>4</sup>. In the presented cases preoperative nutritional supplementation and weekly erythropoietin injections increased the Hb level by 2.0g% and 4.0g% for cases 1 and 2 respectively. Other genetically engineered proteins are currently available for use to increase other blood constituents apart from red cells, for example interleukin 11 for increasing platelets and stimulation of WBC by granulocyte-macrophage colony stimulating factor (GM-CSF) or granulocyte colony stimulating factors (G-CSF)<sup>4</sup>.

Anti-malarial therapy was used to prevent the breakdown of the red blood cells by malarial parasites. In our sub-region, it is also important to look for intestinal helminthiasis and offer appropriate treatment.

Intra-operative isovolaemic haemodilution in association with autologous blood transfusion is acceptable to Jehovah's

witnesses. The haematocrit is reduced by dilution to about 30%<sup>5-7</sup>. The haematocrit of our patients was reduced to 31.5% and 34.4% for cases 1 and 2 respectively, which means a little more blood could have been harvested. For both cases gelatine was used to replace blood volume. Colloids, especially hydroxyethyl starch are the recommended replacement fluid<sup>6</sup>. The priming volume of the HLM was also reduced to prevent excessive haemodilution. This method has been employed by Akira *et al* in their study using a bloodless technique for paediatric open cardiac operations<sup>8</sup>. Addition of 20% mannitol to the priming fluid was to stimulate diuresis. Maintenance of a good perfusion pressure as well as a high PO<sub>2</sub> provided adequate oxygen supply to the body tissues especially the brain.

The use of a dialysis filter has been employed by many workers to concentrate red blood cells in the HLM<sup>9-10</sup>. The packed cells thus produced are returned to the patients circulation as was done in these cases. Transfusion of the harvested blood done after coming off the HLM provided a warm, platelet and other clotting factors rich blood very much needed after surgery. Continuity of the harvested blood with the circulation of the subjects was maintained throughout the surgery by connecting the blood giving set to the intravenous line. This procedure does not offend the beliefs of the Jehovah's witnesses.

Another blood saving method is the use of cell savers which are accepted by the Jehovah's witnesses if there is no break in the continuity of the cell saver with the patients circulation<sup>1</sup>. Other measures not employed in this case include the use of aprotinin and tranexamic acid, antifibrinolytic agents effective in reducing blood loss and have been used extensively in open heart operations<sup>12</sup>. We find it useful to continue the preoperative measures e.g. haematenics, erythropoietin, antimalarials and high protein diet so as to raise and stabilise the haemoglobin level post-operatively. We conclude that with nutritional supplementation, erythropoietin, haematenics, antimalarials, isovolaemic haemodilution and modification of the extra corporeal circulation circuit, it is possible to safely perform open heart operations on Jehovah's witnesses.

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