Anaesthesia and critical care of Jehovah’s Witnesses

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The Jehovah’s Witness religion is a Christian movement, founded in the US in the 1870s, with 6 million members worldwide (150,000 in the UK). Members of this faith have strong beliefs based upon passages from the Bible that are interpreted as prohibiting the ‘consumption’ of blood. Their beliefs prevent them from accepting transfusion of whole blood or its primary components. They also believe that blood that has been removed from the body is ‘unclean’ and should be disposed of. The use of procedures that involve the removal and storage of their own blood are often unacceptable (Table 1).

Blood-free major surgery in the Jehovah’s Witness patient presents a challenge to the anaesthetic and surgical team. The problems associated with their management highlights a growing health-care issue – the supply, safety and appropriate use of blood products. Techniques learnt from treating them may prove beneficial to all patients undergoing major surgery.

Ethical and legal issues

Respect for a patient’s autonomy and human rights requires procurement of informed consent before any medical intervention. This is fundamental to good medical practice. The absolute refusal of blood transfusion by a Jehovah’s Witness may be at odds with a doctor’s personal beliefs and desire to preserve life. Legally, it is clear that a health professional may not override a valid and applicable advance refusal of treatment. A mentally competent individual has an absolute right to refuse consent for medical treatment, for any reason, even when this may lead to his or her own death. A doctor’s basic legal and ethical responsibilities towards the patient are unchanged, and to proceed with the administration of blood to a patient who has steadfastly refused to accept it is considered a serious personal violation. Such actions are unlawful.

Consent forms and advance directives

Most hospitals have consent forms designed for Jehovah’s Witnesses that include a section for detailing specific exclusions from the consent. When obtaining restricted consent, the patient should be interviewed in the presence of an independent witness, the benefits and possible hazards of blood transfusion explained, and an attempt made to help the patient understand the reasons for the recommended treatment. If the patient remains adamant in their refusal, the precise nature of the restrictions placed on the doctor by the patient should be documented in the clinical notes. All parties involved should sign the consent form.

Jehovah’s Witnesses are generally well informed of their rights, options for treatment and the consequences of refusal of transfusion. They may wish to discuss aspects of treatment with Elders of the Witness community or consult the Jehovah’s Witness Hospital Liaison Committee, who will act in an advisory and intermediary capacity. Many Jehovah’s Witnesses carry a clear ‘advance directive’ prohibiting blood transfusion and often have executed a detailed Health Care Advance Directive (Living Will). Copies are usually lodged with their GP, family and friends. Case law is now very clear that such an advance directive is legally binding.

Table 1 Acceptability of blood products and transfusion-related procedures in Jehovah’s Witnesses

<table>
<thead>
<tr>
<th>Unacceptable</th>
<th>Acceptable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole blood</td>
<td>Cardiopulmonary bypass</td>
</tr>
<tr>
<td>Packed red cells</td>
<td>Renal dialysis</td>
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<tr>
<td>Plasma</td>
<td>Acute hypervolaemic haemodilution</td>
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<tr>
<td>Autologous pre-donation</td>
<td>Recombinant erythropoietin</td>
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<td></td>
<td>Recombinant factor VIfa</td>
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<tr>
<td>May be acceptable (‘matters of conscience’)</td>
<td>Platelets</td>
</tr>
<tr>
<td></td>
<td>Clotting factors</td>
</tr>
<tr>
<td></td>
<td>Albumin</td>
</tr>
<tr>
<td></td>
<td>Immunoglobulins</td>
</tr>
<tr>
<td></td>
<td>Epidural blood patch</td>
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<tr>
<td></td>
<td>Cell saver</td>
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</tbody>
</table>

Key points

It is unlawful to administer a blood transfusion to a Jehovah’s Witness who has expressly forbidden it.

Preoperative planning, preparation and an experienced team are essential for a successful outcome.

Erythropoietin promotes erythropoiesis before or after operation, avoiding blood transfusion.

Hypervolaemic haemodilution and cell-saver technology reduce intraoperative red cell loss.

Recombinant factor VIfa reduces intraoperative blood loss.

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Emergencies

In an emergency, when a patient’s Jehovah’s Witness status is unknown, the doctor caring for the patient is expected to perform to the best of their ability, which may include the administration of blood. Relatives or friends who suggest that a patient would not accept blood transfusion must be asked to provide documentary evidence, such as an advance directive. Without this, blood should not be withheld in life-threatening circumstances. If the patient is a Jehovah’s Witness, the doctor caring for them is obliged to provide care while respecting the patient’s competently expressed views, even if this means they will die for lack of blood transfusion. If at any time refusal of consent is retracted, a contemporaneous witnessed entry should be made in the patient’s notes.

Children

Children under 16 yrs of age of Jehovah’s Witness parents present a difficult legal management problem. For elective procedures, there should be full and frank discussion between the surgeon, anaesthetist, parents and child (if they are old enough to understand). Most parents will accept that while every attempt will be made to avoid blood, a doctor will not allow a child to die for lack of transfusion. Children under 16 can legally give consent themselves if they can understand the issues involved (Gillick Competence). However, the courts have proved willing to overrule the refusal of specific procedures by children.

If consent for transfusion is refused, and it is felt unreasonable to proceed with surgery without the freedom to transfuse, an application to the High Court for a ‘specific issue order’ can be made; this allows transfusion to go ahead without removing all parental authority. Medical social workers can provide assistance in obtaining this action. Where time does not permit application to the courts, blood should be given. Failure to give life-saving treatment to a child could render the doctor vulnerable to criminal prosecution.

Preoperative care

Planning

Elective surgery for Jehovah’s Witness patients should be conducted by a senior team sensitive to the patient’s beliefs and with experience in techniques of ‘bloodless surgery’. An anaesthetist may refuse to anaesthetize an individual in an elective situation, but attempts should be made to refer the patient to a suitably qualified colleague prepared to accept the limitations imposed. In the US, there are a growing number of ‘bloodless surgery centers’. Their work has been driven by the requirement to reduce the use of blood transfusion for scientific, economic and religious reasons. Experience in techniques aimed at reducing blood transfusion is growing in the UK. Jehovah’s Witness patients requiring major surgery should be referred to centres with appropriate experience.

Before surgery, there must be full discussion between the patient, surgeon and anaesthetist. All risks should be explained and ‘rules’ for management established at the outset. Surgery must be carefully planned and tailored to the needs of the individual. Consideration should be given to non-operative techniques and staging of major surgical procedures. Other specialists likely to be involved in the patient’s care (e.g. haematologists and intensivist-care physicians) should be advised of the impending surgery. Theatre personnel should be informed so that any specialist drugs and equipment can be made available.

Preoperative optimization

The patient’s preoperative status should be optimized to reduce the risks of intraoperative haemorrhage. Special attention should be paid to haematology (including haemoglobin concentration, platelet count and clotting studies). Anticoagulant and antiplatelet drugs should be reviewed and, where possible, stopped. Nutritional status should be optimized with the use of supplemental enteral feeding or total parenteral nutrition, if necessary; and the use of drugs to enhance red blood cell production (e.g. iron, folate, B₁₂ and erythropoietin) and promote clotting (vitamin K) should be considered.

Anaemia and iron deficiency

A low preoperative packed cell volume (PCV) increases the need for perioperative transfusion. Patients may benefit from iron supplementation before operation. Conventional red cell indices will detect severe iron deficiency as a microcytic anaemia but will not indicate a less profound degree of iron depletion that will nevertheless limit the haemopoetic response to blood loss. Iron supplementation in patients without obvious anaemia can protect against a reduction in haemoglobin concentration during the immediate postoperative period. Some patients have a functional iron deficiency (FID). Total body iron stores are normal; however, there is a reduction in the iron available for metabolic processes. FID has been associated with poor outcome in several groups of patients, including the critically ill. Such patients often respond to intravenous iron.

Erythropoietin

Erythropoietin is a hormone produced primarily by the kidney. Hypoxaemia stimulates its production, resulting in erythropoiesis. Recombinant erythropoietin (rEPO) has been used for 20 yrs in anaemic patients undergoing renal dialysis, and it is now approved for use in autologous blood donation and to reduce transfusion requirements in patients undergoing major surgery.

The presurgical use of rEPO has proved useful in patients in whom autologous donation of blood is not feasible, including those with anaemia, those with limited time to donate and those unable to participate because of logistical problems or religious beliefs, such as Jehovah’s Witnesses. rEPO-treated patients have approximately half the rate of exposure to allogenic blood despite...
having similar initial mean haemoglobin concentrations. rEPO may be an effective alternative to blood transfusion in patients undergoing major surgery and is recommended in patients if their clinical condition permits sufficient time for rEPO to promote erythropoiesis (~4 weeks). Erythropoiesis is seen in 3 days, the equivalent of one unit of blood is produced in 7 days, and five units are produced in 28 days. Dosage regimens are given in the British National Formulary. Iron supplementation is recommended in all patients undergoing rEPO therapy, except those with elevated serum iron and transferrin saturations (e.g. hereditary haemochromatosis). Intravenous iron saccharate has been shown to be effective in preventing FID associated with rEPO. In Jehovah’s Witness patients with severe postoperative anaemia (haematocrit < 25%), rEPO has been shown to accelerate erythropoietic recovery.

There are some disadvantages to the use of erythropoietin. Cost analyses show allogenic blood to be considerably cheaper than rEPO. These studies do not account for hidden costs of allogenic transfusion or the risks involved. Presurgical treatment with rEPO requires infrastructure, including clinics and staff to administer and monitor the effects of rEPO and administer IV iron, with support from a consultant haematologist and the haematology laboratory. rEPO appears safe. There are reports of hypertension and seizures in patients with chronic renal failure and of rare thrombotic events, but none of these has been described in the surgical setting.

**Intraoperative care**

**General measures**

**Surgical**

Thorough planning, staged or laparoscopic surgery and prompt action to stop bleeding help to minimize transfusion requirements. Meticulous haemostasis with argon beam diathermy and spray coagulation reduce blood loss. Avoidance of large abdominal packs conserve blood if shed blood is recycled by cell salvage techniques. Biological haemostats, including collagen and cellulose pads (Kaltostat) and fibrin glue and sealants (Tisseal), aid coagulation and reduce blood loss.

**Anaesthetic**

Avoidance of venous congestion, high intra-thoracic pressures and hypercapnia help minimize venous oozing, which is difficult to control surgically. Using forced-air warmers and IV fluid warmers helps prevent coagulopathy associated with hypothermia.

The traditional haemoglobin concentrations at which blood transfusion is triggered has been challenged by a number of studies. In young healthy volunteers, oxygen delivery is not compromised even when the haemoglobin concentration is 5 g dl⁻¹. In the elderly, mortality is not increased if haemoglobin concentrations are kept above 8 g dl⁻¹, and this concentration is also considered sufficient in patients with severe cardiorespiratory disease. A large, randomized controlled trial of intensive-care patients showed no detriment in restricting transfusion at haemoglobin concentrations of 7–9 g dl⁻¹ compared with a liberal transfusion policy. Wound healing is not affected unless oxygen tension decreases to less than 6.5 kPa or haematocrit is less than 18%. In the light of these findings, transfusion to achieve a specific haemoglobin concentration (often 10 g dl⁻¹) has been questioned in view of the risks associated with allogenic blood transfusion.

Invasive monitoring allows optimization of tissue oxygen delivery, which is dependent upon many more factors than haemoglobin concentration. These factors may be manipulated by the anaesthetist:

\[
O_2 \text{ delivery} = \text{Cardiac output} \times (1.39 \times [Hb] \times O_2\text{sat}) + 0.02 \times P_aO_2
\]

Cardiac output can be optimized by ensuring adequate filling pressure and the use of inotropic drugs. Oxygen saturation can be improved by increasing the inspired oxygen concentration, which also increases dissolved oxygen in the blood. Such manoeuvres will enable tissue oxygen delivery to be maintained down to haemoglobin concentrations as low as 2.8 g dl⁻¹.

**Drugs**

Drugs with antifibrinolytic and platelet-activating effects, including aprotonin, tranexamic acid, DDAVP (desmopressin) and ethamsylate, have been demonstrated to reduce blood loss during major surgery (e.g. open heart surgery and liver transplantation).

**Minimizing blood loss**

**Acute hypervolaemic haemodilution**

Two strategies have been described to reduce the number of red cells lost during haemorrhage by the non-linear reduction in PCV achieved by haemodilution. Acute normovolaemic haemodilution is often unacceptable to Jehovah’s Witnesses, as it involves the removal and storage of blood before haemodilution. An alternative is acute hypervolaemic haemodilution (AHH), which involves rapid infusion of fluid to achieve haemodilution without withdrawal of blood.

The haemodynamics of AHH have been studied in Jehovah’s Witness patients undergoing major surgery. After haemodilution, PCV and systemic vascular resistance index decreased by approximately 30%, whereas cardiac index and left ventricular end-diastolic area increased by 30%. Pulmonary arterial pressure (PAP) and pulmonary capillary wedge pressure (PCWP) both increased markedly, with only a slight increase in mean arterial pressure and decrease in heart rate. Oxygen flux remained constant and no patient developed pulmonary oedema. When forced infusions were stopped, PAP and PCWP rapidly returned to normal, and all patients were extubated successfully at the end of surgery. AHH was well tolerated by patients in this study; however, all were otherwise fit and well. This technique may be inappropriate for patients with cardiac compromise.
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**Hypotensive anaesthesia**

Hypotensive anaesthesia, defined as ‘the deliberate reduction of systemic arterial pressure in order to reduce bleeding and facilitate surgery’, is controversial but has been demonstrated to reduce blood loss in major surgery and transfusion requirements by up to 50%.

**Regional anaesthesia**

Regional anaesthetic techniques have been shown to reduce surgical blood loss and should be recommended if appropriate. Such techniques are contraindicated in coagulopathic states, and caution should be exercised if excessive bleeding and the development of clotting abnormalities are anticipated, as this may increase the risk of development of an epidural haematoma.

**Intraoperative red cell salvage (cell saver)**

With the cell-saver technique, shed blood is suctioned from the wound, centrifuged, washed, mixed with an additive/anticoagulant solution and then re-infused as required. It may be acceptable to some Jehovah’s Witnesses if the blood is not stored and the circuitry is designed so that it remains in continuity with the patient’s own circulation. It can be used in elective and emergency situations where the expected blood loss is more than 20% of total body volume and has the advantage that returned blood is warm and has normal concentrations of 2,3-diphosphoglycerate. Special equipment and trained personnel are required. It is contraindicated in situations where the blood is likely to be contaminated (e.g. sepsis, contamination with intestinal contents, and malignant disease) and sickle-cell anaemia.

**Red cell substitutes**

Problems associated with the supply, storage and safety of blood have prompted the search for alternatives. The goal is to produce a universally compatible, safe product that is capable of prolonged storage in adverse conditions and is simple to use and inexpensive. Progress has been slow despite enormous efforts and expenditure worldwide. No product is available for clinical use, although several are undergoing phase III trials.

The ideal red cell substitute may be more difficult to produce than originally thought. The mixture of plasma and cells in blood confers unique properties of flow and gas transport in the microvasculature that are very different to the more homogeneous systems upon which current red cell substitutes are based. The critical features of blood include a very low solubility of gases in the plasma phase, diffusion barriers resulting from heterogeneous mixing and streaming of red cells and varying haematocrit depending on vessel diameter. This results in heterogeneity of the oxygen content, viscosity and shear forces on the endothelium.

Greater understanding of the physiology of blood and blood substitutes is leading to the development of more successful blood substitutes. Although oxygen-carrying capacity is important, it is not the most critical property of a successful red cell substitute. Maintenance of microvascular blood flow, vascular volume and acid–base balance are of greater importance. If tissue perfusion is adequate, small amounts of haemoglobin can provide enough oxygen for metabolic needs. Two major discoveries in the physiology of blood and circulation have contributed to improvements in the design of red cell substitutes. Nitric oxide plays an important role in the maintenance of vascular tone. The haem-group of haemoglobin binds nitric oxide with high affinity, and free haemoglobin in plasma is an efficient scavenger of nitric oxide. This probably explains the hypertensive effects seen with some haemoglobin solutions. Blood viscosity is important in microvascular blood flow; maintaining viscosity of blood at about 4 cP is essential to tissue oxygenation. It has been established that the link between blood viscosity and vascular relaxation is that the shear forces that are exerted on endothelial cells are proportional to blood viscosity and the shear forces are transduced into the production of the vasodilators nitric oxide and prostaglandins.

Two main groups of red cell substitute are under development – perfluorocarbons and haemoglobin solutions. When available, some of these products may be acceptable to Jehovah’s Witnesses as an alternative to blood transfusion. They are unlikely to accept products produced from human blood and haemoglobin, although some may accept products made from animal blood. The most promising products appear to be the perfluorocarbons and the haemoglobin solutions made with recombinant technology.

**Alternatives to clotting factors and platelets**

Jehovah’s Witnesses are unlikely to accept transfusion of plasma. Their views with respect to the fractionation products vary. Many coagulation factors are available as recombinant products, including factors VIII, IX and VIIa. These are effective and safer alternatives to their plasma-derived cousins; however, security of supply has been intermittent and they are expensive. Transgenic technology and recent developments in cloning may speed the process and reduce production costs.

Recombinant factor VIIa was originally developed for the treatment of bleeding in haemophilia patients with inhibitors. It has more recently been shown to have a haemostatic effect in high doses in patients with profuse bleeding as a result of trauma, surgery and other causes, such as upper gastrointestinal bleeding. It has been used successfully in Jehovah’s Witnesses.

**Postoperative care**

Close monitoring of the patient is essential to detect postoperative bleeding early and institute corrective measures. After massive blood loss, the patient will require admission to the intensive care unit (ICU). This should be anticipated and elective surgery only commenced if an ICU bed is available. Invasive monitoring is continued and the patient’s condition optimized to achieve best possible tissue perfusion and oxygenation. As well as attention to
Cardiovascular and respiratory status, consideration must be given to nutrition, and in particular the provision of iron and folate. Erythropoietin will hasten red cell recovery.

Cooling to reduce oxygen consumption and increased carriage of oxygen is no longer recommended because of disadvantages (including worsening coagulopathy, impaired wound healing and increased incidence of postoperative infections). Hyperbaric oxygen, in situations of severe blood loss anaemia, may produce swift reversal of hypoxaemia, but the technique has limited application. It may be considered if the facility is readily available.

Wider implications

There is currently serious concern that a significant blood shortage is looming. Donor numbers are decreasing, and if a proposed screening test for variant Creutzfeldt–Jacob disease (vCJD) is implemented within the next 18 months, the supply of donor blood could be seriously compromised. If a test for vCJD becomes available, it is possible that donors will not wish to know the outcome: an incurable disease could have serious implications in terms of life insurance, mortgages, and so on. The National Blood Service anticipates a 50% reduction in blood donors and is developing contingency plans to deal with the impending blood shortage. Their aim is to reduce overall blood and component usage without compromising patient safety. Their strategy includes ensuring effective and efficient use of blood and blood products by implementing guidelines for good transfusion practice (‘Better Blood Transfusion’ and maximum blood order schedules) and ensuring effective clinical audit (Serious Hazards of Transfusion, SHOT). They are considering alternatives to blood transfusion, such as autologous transfusion programmes, all forms of blood substitute therapies, and the feasibility of bloodless surgical units.

Many of the techniques developed for use in Jehovah’s Witness patients will become standard practice in years to come in the effort to conserve blood stocks and reduce the need for transfusion. There are many examples of Jehovah’s Witness patients successfully undergoing major surgical procedures, including liver transplantation and coronary artery bypass grafting, and surviving major trauma, without the use of blood and blood products. The challenge we face for the future is to apply the techniques that have been successful in these cases to all of our patients.

Key references


Department of Health. Reference guide to consent for examination and treatment, 2001


Hedner U, Erhardt E. Potential role for rFVIIa in transfusion medicine. Transfusion 2002; 42: 114–24

Medical Defence Union. Consent to treatment, 2002


Web resources

Jehovah’s Witnesses <www.watchtower.org>

Medical Defence Union <www.the-mdu.com>

National Blood Service <www.blood.co.uk>

See multiple choice questions 27–29.