

Guidelines

Anaesthesia and
peri-operative
care for Jehovah's
Witnesses and
patients who
refuse blood



Association
of Anaesthetists

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Guidelines

Association of Anaesthetists: anaesthesia and peri-operative care for Jehovah's Witnesses and patients who refuse blood

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Summary

There are approximately 8.5 million Jehovah's Witnesses and around 150,000 live in Great Britain and Ireland. Based on their beliefs and core values, Jehovah's Witnesses refuse blood component transfusion (including red cells, plasma and platelets). They regard non-consensual transfusion as a physical violation. Consent to treatment is at the heart of this guideline. Refusal of treatment by an adult with capacity is lawful. The reasons why a patient might refuse transfusion and the implications are examined. The processes and products that are deemed acceptable or unacceptable to Jehovah's Witnesses are described. When a team is faced with a patient who refuses transfusion, a thorough review of the clinical situation is advocated and all options for treatment should be explored. After discussion, a plan should then be made that is acceptable to the patient and appropriate consent obtained. When agreement cannot be reached between the doctor and the patient, referral for a second opinion should be considered. When the patient is a child, the same strategy should be used but on occasion the clinical team may have to obtain legal help.

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This is a consensus document produced by expert members of a Working Party established by the Association of Anaesthetists. It has been seen and approved by the Board of Directors of the Association of Anaesthetists. It has been endorsed by the Royal College of Anaesthetists, the Royal College of Surgeons and the Association of Paediatric Anaesthetists of Great Britain and Ireland.

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What other guideline statements are available on this topic?

The Association of Anaesthetists published a guideline 'Management of anaesthesia for Jehovah's Witnesses' in 2005 [1]; this document supersedes that. The Fifth Edition of the Transfusion Handbook from JPAC (Joint UK Blood Transfusion and Tissue Transplantation Services Professional Advisory Committee) was published in 2013; Chapter 12 deals with this topic [2]. 'Caring for patients who refuse blood' was published by the Royal College of Surgeons in 2016 [3].

Why were these guidelines developed?

Patient blood management (PBM) is now commonly employed [4]; the management of Jehovah's Witnesses is similar to PBM measures, with efforts made to minimise blood loss, use of cell salvage (CS) and adoption of lower transfusion triggers. The ethical and legal framework regarding consent has also changed. Refusal of blood transfusion is not limited to Jehovah's Witnesses and so the principles in this document may be applied in those circumstances.

How and why does this statement differ from existing guidelines?

This document brings together current legal and clinical expertise with the views of the Jehovah's Witness community to provide a current practical guide to clinicians faced with this clinical situation. The contribution of the Jehovah's Witness community means the information on the attitudes and actions of the members of the faith is current and accurate.

Recommendations

- 1 Patients should be given a clear explanation of the blood products that the medical team looking after them consider might be required during or after surgery, and the risks involved if they refuse. Discussion of alternative treatments should be undertaken if available.
- 2 It should be clearly documented in the medical record which treatments and/or procedures the patient consents to and which they do not.
- 3 At least 6 weeks before elective surgery likely to be associated with significant blood loss, the patient's Hb should be checked and if $< 130 \text{ g.l}^{-1}$, optimisation by treatment with iron and/or erythropoietin should be considered.
- 4 All relevant issues should be highlighted at the time of the team briefing and during the surgical safety checklist before induction of anaesthesia. A specific checklist recording which components/products/procedures the patient will or will not accept (as in Appendix S1) is important and should be available at the time of the WHO Surgical Safety checks in the operating theatre.
- 5 The majority of Jehovah's Witnesses will accept intra-operative CS – this should be discussed before surgery and if agreed set up from the start of surgery. Consent should be obtained.
- 6 The interventions promoted as part of a PBM approach should be rigorously applied, including tranexamic acid administration for major surgery.
- 7 After surgery, a comprehensive verbal and written handover of the patient is essential. Staff should be made aware of any adverse intra-operative events and should understand and respect the wishes of the patient that will have been discussed before the procedure.

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Introduction

It has been 12 years since the last edition of this guideline was published [1] and much has changed, with advances in bloodless surgery and the development of alternatives to allogeneic blood transfusion. There has been an increased focus on the management of patients who refuse blood, including the Royal College of Surgeons' recently published good practice guide [3]. Patient autonomy and consent for medical treatments have been discussed increasingly in medicolegal fields with some pivotal cases of note since the last edition, including those relating to blood transfusion and capacity [5].

There are a variety of reasons why patients choose not to accept blood components with the majority being due to religious beliefs or worries about the risks of allogeneic blood transfusion itself.

The principal aim of this publication is to provide a practical peri-operative guide for clinicians managing patients who refuse blood and a useful resource for patients who wish to invoke this right.

It has been produced through collaboration of a variety of professionals with medical representation from anaesthesia, paediatric anaesthesia, transfusion medicine and surgery, legal and patient representation from the Jehovah's Witnesses and other lay members.

Background to the beliefs of Jehovah's Witnesses regarding blood transfusion

'Each is the proper guardian of his own health, whether bodily or mental and spiritual. Mankind are the greater gainers by suffering each other to live as seems good to themselves, than by compelling each to live as seems good to the rest.'

—JOHN STUART MILL [6]

A fundamental teaching of the faith of Jehovah's Witnesses is that life is sacred. They believe that life is given by God, belongs to God and that He is the only one with the right to determine how it should be used. This fundamental premise is the basis for other courses of action: they do not smoke because this is endangering life; they disapprove of dangerous recreation and in times of war they are conscientious objectors.

Jehovah's Witnesses believe that the Bible is God's word, his communication with mankind, revealing his personality, his thinking and his purposes for mankind and this earth. Their beliefs and teachings are based on various Biblical passages from both the Old and New Testament.

Jehovah's Witnesses believe that the Bible teaches that life, which is held as sacred, is represented by the blood of a creature, thus blood (representing life) acquires a sacred status. They, therefore, take the view that taking into their bodies (parenterally or enterally) the blood of another creature violates Biblical law [7]. They believe that this is consistent teaching throughout scripture, arguing that it originated with a command to Noah, was repeated to the people of Israel and reiterated to the first-century Christian church. They have taken this view ever since blood transfusion entered the realm of accepted medical practice. It is adhered to even in the face of clinical advice that allogeneic transfusion is necessary to preserve life. The prohibition of blood transfusion is a deeply held core value and is a sign of respect for the sanctity of life.

With regard to people who have been transfused, the position of the Jehovah's Witness leadership is that patients who 'wilfully and unrepentantly' accept a blood component transfusion may be considered as having chosen to leave the faith. They state that emphasis is placed on support and assistance for those who wish to remain adherents of the faith. They also report that there is no rejection of those transfused against their will, or in error, or of a child where that action has been taken by clinicians in an effort to preserve health and life.

Jehovah's Witnesses have 36 Hospital Liaison Committees working within the UK and 1700 throughout the world. These committees have been established to help Jehovah's Witness patients in preparing for elective surgical procedures and other situations such as pregnancy. They are available to provide pastoral and liaison support even in emergency situations. The members of these committees are available 24 h a day both to patients and clinicians. Where the patient has consented, they also assist clinicians in finding suitable treatment options for individual Jehovah's Witness patients. They have an international database of clinicians which means they can put medical teams in contact with those around the world who may be in a good position to advise in a situation which is proving challenging.

Contact details for Hospital Information Desk, Great Britain and Ireland headquarters: daytime telephone: 020 8371 3415 (24 h service); email: hid.gb@jw.org. International details: <https://www.jw.org/en/medical-library/hospital-liaison-committee-hlc-contacts>.

Practical implications and terminology

Not all patients who refuse a blood transfusion are Jehovah's Witnesses and not all Jehovah's Witnesses will

refuse a transfusion. Each patient should be given a clear explanation of the procedures related to blood transfusion that the medical team looking after them consider might be required during or after surgery; of the risks involved in not having these treatments; and of what alternative treatments, if any, are available. The patient may wish to discuss this with relatives, friends or a member of a Jehovah's Witness Hospital Liaison Committee. However, in the case of an adult with capacity, the decision as to which treatments to accept or refuse is for the patient themselves to make and the patient has a right to confidentiality in respect of that decision.

A Jehovah's Witness patient who has decided to follow the teaching of his or her church in relation to blood transfusion will not accept a transfusion of whole blood nor of the primary components into which donated whole blood is separated, that is, red cells, fresh frozen plasma and platelets. Jehovah's Witness patients who follow the teaching of their church are permitted to accept products derived by further processing of the primary blood components. Accepting such products is considered to be a matter of individual choice. Therefore, many Jehovah's Witnesses will accept products such as cryoprecipitate, fibrinogen concentrate, prothrombin complex concentrate, fibrin glue, platelet gel and human albumin solution.

Jehovah's Witness patients accept recombinant coagulation factor concentrates and drugs such as erythropoietin and iron which are not derived from blood.

Pre-operative donation, that is, donation of the patient's own blood typically a few weeks before surgery with the blood being given back during or after surgery is not usually acceptable to a Jehovah's Witness patient. Acute normovolaemic haemodilution (ANH), in which blood is taken from the patient into a bag containing anticoagulant before or at the start of surgery, kept in the operating room and given back to the patient during or after surgery, is regarded as being a matter of individual choice and may be acceptable.

Other procedures that are usually acceptable to Jehovah's Witness patients but matters of individual choice include:

- 1 Cell salvage, either during surgery or postoperatively
- 2 Renal replacement therapy with haemodialysis or haemofiltration
- 3 Cardiopulmonary bypass
- 4 Extracorporeal membrane oxygenation (ECMO)

In the case of CS, the equipment can usually be set up as for non-Jehovah's Witness patients, that is, there is usually

no requirement for a continuous connection from the patient to the CS system and back to the patient. This is a new recommendation, however, some patients may request, as a matter of personal preference, some form of continuous connectivity.

It should be clearly documented in the medical record to which treatments/procedures the patient consents and those to which they do not consent.

The importance of consent

It is a core ethical and legal principle in Great Britain and Ireland that an adult with capacity has an absolute right to refuse treatment [8]. Although the legal frameworks differ, the central concepts are the same. An adult patient with capacity can give consent to a procedure while withholding consent for specific aspects of management, such as the administration of blood components. For so long as the patient does not give that consent, the bar to the provision of that treatment is absolute. Treatment in the face of such a bar is unlawful and can give rise to both civil and criminal liability, as well as professional sanctions.

A patient does not need to give a reason for refusing consent, but where refusal may lead to a loss of life or serious harm, it is good practice to ensure that there is specific documentation, both of the fact of refusal and of the patient's awareness of its potential consequences. In the process of completing that form with the patient, medical professionals should consider whether there is any indication that the patient's refusal is the result of coercion or undue pressure from any other person. However, medical professionals should equally be careful not to seek to influence a patient to take a course of action which is not in keeping with the patient's wishes and values. The anaesthetic induction room or the operating theatre is not the appropriate venue for discussing consent in the elective situation [8].

In England and Wales, an adult patient with capacity can make a legally binding advance decision to refuse specific medical treatment which would take effect if they have lost the capacity to consent to or refuse that treatment or those treatments. An advance decision to refuse life-sustaining treatment must be in writing, must be witnessed and must make clear that it is to apply to the treatment even if life is at risk. [9] Advance decisions are recognised in different ways in Scotland, Northern Ireland and the Republic of Ireland, with the position in both Northern Ireland and the Republic of Ireland being subject to change at the time of writing [8].

Treatment where the patient has lost capacity

In England and Wales, where a patient has lost capacity to accept or refuse treatment, then whether that treatment will be given depends on whether the patient has made an advance decision:

- 1 If the treatment falls fully within the terms of the advance decision, clinicians must respect its terms unless there is good evidence that the patient did not have capacity to make the advance decision, or that the patient has changed his/her mind since signing it.
- 2 If there is no valid and applicable advance decision, then the decision as to which treatment to give will be made on the basis of the patient's best interests. 'Best interests' encompasses not merely the patient's clinical interests, but their wishes, feelings, beliefs and values: the purpose of any best interests decision is to make the decision that is right for that patient as an individual human being [10]. Even where a patient has not made an explicit advance decision, if it is known that the patient would have refused to give consent to a specific treatment, it is likely that provision of that treatment would not be in the patient's best interests, and therefore unlawful. [11]

The model for decision making in the absence of a binding advance decision differs in each of Scotland, Northern Ireland and the Republic of Ireland [8], but under each framework weight must always be placed upon the patient's known previous wishes and feelings in relation to the proposed treatment.

Centres and procedures

When recommending treatment, clinicians should consider the additional risk posed by the patient's refusal of blood component transfusion. If appropriate, interventions associated with reduced blood loss should be offered and discussed with patients. Likewise, the impossibility to resort to transfusion may render non-operative treatment preferable to surgery in selected cases.

Centres managing patients who refuse allogeneic transfusion should make sure that alternative treatment modalities are available, in particular, interventional or surgical procedures known to be associated with comparatively low blood loss. Examples of such procedures include endovascular repair of aortic aneurysms (vs. open repair) [12], laser transurethral prostatectomy (vs. standard transurethral prostatectomy) [13] and off-pump coronary artery bypass (vs. on-pump coronary artery bypass) [14]. Patients may wish to be considered for referral to other

centres where alternative techniques that they consider desirable are practised.

Centres managing patients who refuse allogeneic transfusion should identify clinicians with special knowledge and expertise in blood conservation within their departments of haematology, surgery and anaesthesia. These clinicians should be routinely consulted when planning surgical treatment of patients who refuse allogeneic transfusion, to plan individual blood conservation strategies. Likewise, immediate advice should be sought when such patients are admitted with a condition that could result in significant blood loss, as early interventional treatment may be appropriate in many cases which would be normally treated expectantly.

Clinical management for elective surgery

This section will discuss the management of patients who refuse transfusion in whom major surgery is planned (defined as blood loss > 500 ml possible or likely). Most of the recommendations are included in PBM guidelines [15].

Pre-operative

A pre-operative multidisciplinary discussion is mandatory, for planning purposes. This discussion should include, as a minimum, a senior surgeon, a senior anaesthetist and a senior haematologist. The Hospital Liaison Committee may also be consulted, with the patient's consent.

During the pre-admission phase, it is important to optimise red cell mass as much as possible to reduce the effect of bleeding and haemodilution on haemoglobin levels [16]. In most circumstances, surgery should be postponed until haemoglobin (Hb) levels have been optimised. It is also important to investigate any bleeding or

Table 1 Characteristics of the different stages of iron deficiency in surgical patients, modified from [18].

| Iron status | Laboratory findings |
|----------------------------|---|
| Normal | Ferritin 100–300 $\mu\text{g.l}^{-1}$ and TSAT 20–50% CRP < 5 mg.l^{-1} |
| Low iron stores | Ferritin < 100 $\mu\text{g.l}^{-1}$ |
| Absolute iron deficiency | Ferritin < 30 $\mu\text{g.l}^{-1}$ |
| Functional iron deficiency | Ferritin 30–100 $\mu\text{g.l}^{-1}$ TSAT < 20% and/or CRP > 5 mg.l^{-1} |
| Iron sequestration | Ferritin > 100 $\mu\text{g.l}^{-1}$ TSAT < 20% and/or CRP > 5 mg.l^{-1} |

CRP, C-reactive protein; Fe, elemental iron; TSAT, transferrin saturation index.

clotting issues, especially if there is a history of bleeding or bruising after surgical or dental procedures in the past. Consideration should also be given to discontinuing anticoagulants and antiplatelet drugs. Avoid unnecessary blood tests, consider using paediatric blood sampling bottles for various tests to minimise blood loss.

The following investigations are recommended: full blood count (FBC); B12 and folate; iron studies (ferritin and transferrin saturations); clotting screen; and fibrinogen (Table 1) [17].

At least 6 weeks before surgery (may not be possible in elective cancer surgery), the patient's Hb level should be checked and if $< 130 \text{ g.l}^{-1}$ in all adults [18], the patient should be assessed and treatment considered. If iron deficiency (absolute or functional), low iron stores or iron sequestration is diagnosed, iron treatment is indicated [19]. Oral iron may be considered, in which case the patient's Hb should be re-checked 4 weeks after starting treatment. If < 6 weeks' time is available until surgery is planned, surgery is urgent or the patient does not respond to oral iron and their Hb is still $< 130 \text{ g.l}^{-1}$, intravenous (i.v.) iron therapy should be administered [20]. The use of recombinant erythropoietin (EPO) together with i.v. iron therapy may also be considered if Hb $< 130 \text{ g.l}^{-1}$ and ferritin $> 100 \mu\text{g.l}^{-1}$ [21, 22]. A checklist should be completed before admission to ensure pre-operative optimisation is complete (Online Supporting Information, Appendix S1).

Intra-operative

All relevant issues should be highlighted at the time of the team brief and during the surgical safety checklist before the start of anaesthesia. We recommend that the question '*is everyone aware of the answers to the blood transfusion checklist* (Online Supporting Information, Appendix S2) *and the techniques we will use to minimise blood loss in this case?*' is added to the WHO Surgical Safety checklist for patients who refuse blood.

Consider acute normovolaemic haemodilution [23]; blood is siphoned off by gravity into a collection bag containing anticoagulant, and replaced with crystalloid or colloid solution; if crystalloid is used it is likely that a larger volume will need to be administered than the volume of blood withdrawn in order to maintain normovolaemia. Surgical blood loss, therefore, has a lower haematocrit and the blood removed from the patient is re-infused during or at the end of surgery. Local policy and guidelines should be in place for acute normovolaemic haemodilution.

Use paediatric blood sampling bottles or in-line patient monitoring if available. Point-of-care tests, for

example, arterial or venous blood gas sampling and thromboelastometry/thromboelastography should be employed [24]. Controlled hypotension may be considered. Efforts should be made to maintain normothermia. Tranexamic acid should be administered intravenously and CS considered for all surgical procedures if blood loss $> 500 \text{ ml}$ is possible/likely [25, 26]. In cancer surgery, a leucofilter should be used with CS.

If bleeding becomes clinically significant, the use of point-of-care testing, such as rotational thromboelastography or thromboelastometry (TEG or ROTEM) to guide management, if available, is recommended. The administration of fresh frozen plasma or platelet concentrate is not normally accepted by Jehovah's Witness patients, but cryoprecipitate may be acceptable. Other potentially acceptable therapeutic options include prothrombin complex concentrate, which contains factors 2, 7, 9 and 10, and fibrinogen concentrate. Raising the fibrinogen concentration with fibrinogen concentrate or cryoprecipitate can partially compensate for the effect of a low platelet count on haemostasis. Desmopressin $0.3 \mu\text{g.kg}^{-1}$ intravenously may also improve haemostasis by increasing large vWF multimers, and possibly improving procoagulant platelet activity. Recombinant factor 7 should only be considered as a 'last resort' treatment due to the excess of prothrombotic events [27].

Postoperative management

A comprehensive verbal and written handover of the patient to recovery, critical care and/or ward staff is essential. They should be made aware of any adverse intra-operative events and should understand and respect the wishes of the patient that have been discussed before the procedure.

Postoperative aims are to minimise ongoing blood loss, promote haemostasis, correct any coagulation defects and optimise oxygen delivery and consumption [28]. The need for each blood test should be carefully considered according to the individual clinical situation [29]. The volume of blood samples should be minimised by using paediatric sampling tubes if possible, and point-of-care testing should be available.

Following surgical procedures that employed a tourniquet intra-operatively there may be excessive blood loss after its release that may continue into the postoperative period. In these situations, postoperative CS can be employed. In case of bleeding, a postoperative dose of intravenous tranexamic acid (1 g) should be considered.

Children and adolescents

Children aged 0–15, England and Wales

The children of Jehovah's Witnesses (up until their 16th birthday) or children whose parents do not want their child to receive a blood transfusion or other blood components may present for elective or emergency surgery. Most techniques used in adults to reduce intra-operative transfusion (including CS) can, with suitable technical adaptation, be applied to children and infants. In general, consent for surgery from at least one of those with parental responsibility will be required, and the issue of transfusion will also need to be discussed with those with parental responsibility. In instances where the views of those with parental responsibility differ from one another, it may be necessary to obtain legal advice. A senior anaesthetist should be involved in the pre-operative discussion with the family and the surgical multidisciplinary team (MDT). The parents' and the surgical team's views on the relative risks of blood transfusion and the risks of withholding blood products should be discussed in detail. This discussion should clarify the peri-operative management options, and is likely to conclude:

- 1 Blood and blood component therapy is likely to be required during surgery and consent for this is obtained.
- 2 There is a very low risk of life-threatening haemorrhage and all sensible precautions will be taken. The team should make clear that, on rare occasions, the situation may change dramatically between the point at which consent is given on the basis of this agreement and surgery such that transfusion may become necessary.
- 3 There is an absolute refusal by the parents of any form of blood component therapy, regardless of the risk to the child's life.
- 4 There is a more nuanced permission, the conditions of which are clear to both the parents and the surgical team, where some blood components or products, drugs or other techniques may be used.

It will be clear to the surgical MDT what parameters they will be working to. In elective surgery, this will allow appropriate pre-operative planning and preparation for surgery. Should the MDT feel, after discussion, that they cannot work under the proposed constraints, then discussion with another appropriately skilled team (or referral to that team) should be considered. The family should be informed and this must be recorded in the notes. The duty of the physician is to act in the best interests of the child. This has usually been considered by the courts to require them to provide a blood transfusion even in the face of parental refusal, although this is not an

absolute rule. Parents usually want an assurance that their beliefs are respected, and that the team will do all they can to avoid transfusion. On this basis, consent forms are signed so that treatment can proceed. It is essential that doctors make every effort to accommodate beliefs rather than resorting to the most obvious medical option when that is contrary to the patient's or parents' wish, or look to the courts as the first resort. When discussion, negotiation and consideration of other options fail to resolve the situation, the treating hospital should apply to the High Court for an order providing legal permission for treatment in the face of parental refusal. In an urgent or dynamic situation, blood should be given to minimise the threat to life or prevent lasting disability in the child, while such an application is made.

In some cases, a child (0–15 years) may be 'Gillick' competent to make a decision about blood transfusion: that is, able to understand the proposal to administer blood; to retain and use or weigh this information. Establishing his/her competence in this way, the child can give (or refuse) their consent to transfusion unaided by their parents. If a competent child consents to blood transfusion, their parents have no authority to override their consent. Although it seems unlikely that a hospital would seek a court declaration in this situation, it would be prudent to discuss the position with the hospital's solicitors before overriding the parents' strongly held objections.

In the reverse circumstances, where a competent child refuses to consent to blood transfusion, those with parental responsibility can override that decision if transfusion is deemed to be in their best interests. Nonetheless, compelling a competent child to undergo a transfusion is a serious affront to his or her human rights, and a prior referral to a court is strongly recommended, if needs be by telephone. If both the competent child and those with parental responsibility refuse consent for transfusion, an application to the court is required, seeking a declaration that the need for consent is set aside, and that administration of blood is lawful; usually under Section 8 of the Children's Act 1989. If circumstances are elective, then this will be dealt with in person in court; but in an emergency, the High Court can be contacted by telephone, if needs be out of hours. If there is no time to telephone, clinicians should administer the blood if it is in the child's interests to do so.

Children aged 16 and 17 in England and Wales

A young person of 16 or 17 years has the same ability as an adult to consent to or refuse medical treatment if they have the mental capacity to do so, with two exceptions:

- 1 they cannot make an advance decision to refuse medical treatment (or grant a lasting power of attorney to a person to consent or refuse on their behalf at a point when they do not have capacity); and
- 2 a court can override their refusal even if they have capacity.

Although old legal cases suggest that a person with parental responsibility can consent on behalf of a 16/17-year-old who has capacity and is refusing medical treatment, it is doubtful that the so-called 'scope of parental responsibility' still extends to giving such consent in the particular context of blood transfusions. It is, therefore, strongly suggested that clinicians should not rely upon parental consent in such a situation but rather should make an application to the High Court.

The likelihood that the court will overturn that refusal will diminish the closer the child is to age 18.

Scotland, Northern Ireland and the Republic of Ireland

The principles set out above by reference to the position in England and Wales are also – broadly – applicable in relation to the legal frameworks that apply in each of the other jurisdictions covered by this guidance, which in the case of Northern Ireland and the Republic of Ireland are subject to change at the time of writing [8]. However, in Scotland neither parents nor the court can override the refusal of treatment made by a competent person over the age of 16. In Scotland, a child under 16 years has legal capacity to consent on his/her own behalf to any surgical, medical or dental procedure or treatment where, in the opinion of a qualified medical practitioner attending him/her, he/she is capable of understanding the nature or possible consequences of the procedure or treatment (Section 2(4) of the Age of Legal Capacity (Scotland) Act 1991). Although the position has not been definitively established by the courts, it would appear that this capacity also extends to the right to refuse treatment and that neither parents nor the court can override the refusal of such a competent child.

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Supporting Information

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Appendix S1. Use as a checklist to ensure that there is a robust pre-optimisation plan that includes the correcting of any pre-operative anaemia, and correction of any clotting profile abnormalities, before surgery.

Appendix S2. Use as a checklist to clarify and record what is, and is not, acceptable to the patient (or parent/guardian) who does not want blood and/or blood components or derivative. Use in conjunction with a consent form, and any *Advance Decision to Refuse Specified Medical Treatment* document that the patient may already have.

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