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## **Bloodless Medicine and Surgery: A Review of Practice and Consideration of Jehova Witnesses**

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### **Authors' contributions**

*This work was carried out in collaboration between both authors. Author NAE designed the study, managed literature search and wrote the first draft of the manuscript. Both authors read and approved the final manuscript.*

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### **ABSTRACT**

Blood transfusion plays important role in medical and surgical practice and has been employed in varying medical and surgical procedures. An increasing amount of literature concerning blood conservation, restrictive transfusion strategies, pharmacological manipulation of the haemostatic and fibrinolytic systems, minimal invasive surgery, local haemostatic agents and guidelines for blood transfusion, is being published each year. This review aims to summaries the key concepts of bloodless medicine and surgery, offer a practical guide on how to approach such cases and outline currently available approaches to manage anemia or bleeding in patients. The standard practice is to keep vigilance to the possibility of reactionary or secondary haemorrhage. Continued bleeding is aggressively managed by postoperative blood salvage, or surgical intervention to stop haemorrhage. A multidisciplinary effort therefore has to be made through the entire chain, from the outpatient clinic through discharge from the hospital, with the utmost exertion of all team members in which surgeons play a key role and the medical laboratory scientist in the adaptation of bloodless surgery program.

**Keywords:** *Bloodless surgery; blood transfusion; Jehovah witnesses.*

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## 1. INTRODUCTION

Blood transfusion plays important role in medical and surgical practice and has been employed in varying medical and surgical procedures [1]. However, blood transfusion goes with its risks of transfusion transmissible infections [2,3].

An increasing amount of literature concerning blood conservation, restrictive transfusion strategies, pharmacological manipulation of the haemostatic and fibrinolytic systems, minimal invasive surgery, local haemostatic agents and guidelines for blood transfusion, is being published each year. Most of these articles deal with different strategies to reduce blood loss and transfusion requirement in the perioperative period. A number of national and international societies 'for the advancement of bloodless medicine' have been launched and the number of institutions claiming the performance of bloodless surgery is increasing [4].

Bloodless medicine and surgery (BMS) is the provision of quality health care to patients without the use of allogeneic blood with the aim of improving outcome and protecting patients' rights [5,6]. Bloodless medicine and surgery started as an attempt by some surgeons in the 1960s to accommodate patients who decline blood transfusion notably Jehovah's Witness [7] their religious belief based on a distinctive interpretation of specific passages from the Bible: "You must not eat the flesh with the life, which is the blood still in it Genesis 9 verse 4"; You are to abstain from blood Acts 15:29. The refusal of

blood and its product is a core value of the faith and transfusion without consent would be regarded by member as a gross physical violation [8].

The aim of the review is to summaries the key concepts of bloodless medicine and surgery, offer a practical guide on how to approach such cases and outline currently available approaches to manage anemia or bleeding in patients.

## 2. BLOODLESS SURGERY AND MEDICINE

The principle of bloodless medicine took its roots in the 1960s following exclusion of patients who refused blood transfusion in major surgeries [6]. The term 'bloodless surgery' refers to series of ameliorative approach aimed at reducing the necessity for allogenic blood transfusion at the same time improving the overall outcome of the patient. Recently, this principle has become popular and has been adopted by many centres in North America. The wide acceptance is aided by the apparent deleterious effects of blood transfusion. Severe acute respiratory syndrome (SARS), West Nile virus [9] and prion-related diseases are the latest to join human immunodeficiency virus (HIV), hepatitis B, C and others on the list of potentially transmissible diseases [2,3,10]. More so, to lag the risk of transmitting infection, donor pool for blood and blood products has been shrunk [11]. Bloodless medicine and surgery involves some proactive preparations and the principle involved is listed in Table 1 below.

**Table 1. The principles of bloodless surgery/medicine**

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<b>Pre-operatively</b>
Thorough assessment and optimization
Consider improving haemopoiesis
Ensure adequate planning (equipment & personnel)
<b>Intra-operatively</b>
Meticulous haemostasis and haemostatic aids
Anaesthetic techniques
Acute normovolaemic haemodilution
Intra-and postoperative cell salvage
<b>Postoperatively</b>
Early detection blood loss
Pediatric size sampling
Increase haemopoiesis
Maximize respiratory function and cardiac output
Sepsis prevention

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Source: Bloodless (Liver) Surgery (July 27, 2007)

## 2.1 Pre-operative Measures

### 2.1.1 Patient assessment

A comprehensive patient history and thorough clinical evaluation is paramount in bloodless medicine and surgery. This allows evaluation of physiological reserve as well as the tolerability of hypovolaemia. Pre-existing cardiac or respiratory disease should be optimised prior to surgery. Clanking of the patient to unravel bleeding disorders and medications that can trigger blood loss such as NSAIDs. The patient should also be questioned about bleeding disorders, and medication that may increase blood loss such as NSAIDs, steroids should be reviewed, and preferably stopped. Coagulation defects is be corrected if found.

### 2.2 Improve Haemopoiesis / Optimization of Haemoglobin

Pre-operative anaemia requires adequate monitoring and management using adequate supplementation of iron, folate and vitamin B [6]. In the absence of anaemia, Epoetin (human recombinant erythropoietin) can be used to improve red cell mass [12,13]. Patient response to Epoetin is variable, but the manufacturers of Epoetin-beta (Roche, UK) has algorithm that predict response to Epoetin in each individual patient. However, expertise is essential I this practice as careful dose calculation is essential and it is via intravenous route [5]. The procedure for haemoglobin optimization involves:

- i. Measurement of patients participants haemoglobin (Hb)/haematocrit (HCT).
- ii. Determination of the level you intend to build up the Hb/HCT to.
- iii. Application of the formula:  $\text{Weight} \times [\text{normal HB} - \text{actual HB}] \times 0.24 + 500 \text{ mg}$  or  $[\text{normal Hb} - \text{actual} \times 200 + 500 \text{ mg}]$  to arrive at the total amount of iron needed to achieve your target Hb/HCT.
- iv. Dividing the total amount of iron by the amount of element iron in one vial of iron dextran or iron sucrose depending on which one will be used for the patient.
- v. Admitting the patient in a standard haematology day care unit for proper mentoring pending when surgery is schedule.

#### 2.2.1 Planning

Bloodless surgery requires a coordinated multidisciplinary approach. Cases are discussed

in advanced by the medical team; surgical, anaesthetic, and theatre staff in view of optimizing blood conservation strategies such as cell salvage. Appropriate equipment are made readily available.

#### 2.2.2 Intra-operative measures

In the intra-operative measure, special attention is needed on haemostasis during surgery. There is a trend to the increased use of diathermy dissection during surgery. This is a safe and effective surgical tool, which can reduce blood loss [14]. Other technological advances that may minimize blood loss include the harmonic scalpel. The use of local haemostatic aids such as bone wax, or absorbable cellulose or collagens may reduce unnecessary haemorrhage [6]. More so, feasible procedures are performed in stages to reduce loss of large volume of blood. Also, when feasible, procedures should be performed in stages to minimize loss of a large blood volume. For instance, a bilateral mastectomy could be performed in two stages. At all times, minimally invasive procedures that are associated with less blood loss is the prime consideration where appropriate.

#### 2.2.3 Anaesthetic techniques

Here, it is common practice to reduce bleeding by anesthetically altering the patient's physiological response during surgery. Controlled hypotension is a well recognized technique used in bloodless medicine whereby the mean arterial pressure is maintained at a low level during surgery, to minimize intra-operative bleeding [15]. However, this goes with numerous risks. Caution is threaded in the procedure as hypotensive state may to irreversible ischaemic damage to kidneys, brain or myocardium [16]. Also, haemostasis performed during controlled hypotension may be contraindicative when the patient returns to a normotensive state. Consequently leading to severe postoperative haemorrhage. Ultimately, blood pressure is returned to normal prior to completing the operation.

### 2.3 Acute Normovolaemic Haemodilution (ANH)

ANH involves the removal of whole blood from the patient pre-operatively, and replacement with crystalloid or colloid fluids to maintain intravascular volume. Blood lost during surgery and in the postoperative period has a reduced

haemoglobin concentration, resulting in fewer red blood cells lost. The technique relies on an adequate physiological compensation to the acute blood loss, primarily by an increase in cardiac output [17]. The removed blood is available for transfusion should it be needed. Factors such as coexisting illness, response to venesection and experience of the team all influence the quantity of blood withdrawn, and no universally accepted guidelines exist. Relative contraindications to ANH include severe anaemia, ischaemic heart disease and renal failure [17].

## 2.4 Autologous Blood Transfusion

Blood lost during and after surgical procedure can be collected and transfused back to the patient with the use of specialist equipment. Cell salvage machines can be used during surgery and are capable of collecting and filtering blood removed by suction and in swabs, which can then be given back to the patient [18]. Drains can also be attached to sterile collection systems to allow transfusion, a procedure most commonly seen in orthopaedic surgery. Although adverse effects of cell salvage have been reported [19], however, these are extremely rare. Many surgeons advocate the use of cell salvage in cases of malignancy and infection as the risks are thought to be low [20,21]. However, further research is needed to clarify the role of cell salvage in these patients.

## 2.5 Postoperative Measures

### 2.5.1 Increasing haematopoiesis and reducing blood loss

The standard practice is to keep vigilance to the possibility of reactionary or secondary haemorrhage. Continued bleeding is aggressively managed by postoperative blood salvage, or surgical intervention to stop haemorrhage. Prolonged hypertension is avoided in the postoperative period. Postoperative blood tests is usually rationalised and samples sent in micro-sample tubes. Increasing blood haematopoiesis and reducing blood loss can be achieved viz:

#### 2.5.1.1 Increase haemopoiesis

Anaemia is usually treated post surgery. However, large intra-operative blood loss may require specific approach to boost red blood cell

production. Iron, vitamin B [6] and folate is usually well supplemented, and recombinant erythropoietin can be used if necessary [6,22]. In some instances, inadequate nutrition may likely lead to impaired red cell production [6]. Nutritional supplementation is usually offered at an early stage in appropriate patients.

#### 2.5.1.2 Increase oxygen delivery

Impaired oxygen delivery may occur postoperative in the patient through varying mechanisms. Routine breathing exercise and oxygen supplementation therapy are usually used to optimize respiratory functions, with addition of aggressive chest physiotherapy for high risk patients. There is usually need watch out for postoperative respiratory complications. The entire process usually requires multidisciplinary approach involving: physiotherapists, nursing staff, respiratory physicians and critical care staff. Intravascular volume is usually monitored and adequately maintained. This, along with thorough preoperative cardiac evaluation will aid in maximizing cardiac output and, consequently, oxygen delivery. The use of hyperbaric oxygen has been recommended by some scholars [23] but has a very limited role in routine postoperative patient care.

#### 2.5.1.3 Reduce oxygen consumption and sepsis prevention

High oxygen consumption may result consequent to increased metabolic rate owing to physiologic response to infections. As a result, adequate prophylaxis against infection is ensured. Epidural analgesia usually provides excellent pain relief, and may also reduce postoperative respiratory complications [24]. In experienced hands, sedation or paralysis and ventilation may also be used to control oxygen consumption.

## 2.6 WHO Grading System for Anemia Severity in Bloodless Medicine and Surgery

The World Health Organization grading of anemia in bloodless medicine and surgery is stated viz below:

Grade 0	$\geq 11.0$ g/dl
Grade 1 (mild)	9.5-10.9 g/dl
Grade 2 (serious/severe)	6.5-7.9 g/dl
Grade 3 (life-threatening)	<6.5 g/dl

## 2.7 Challenges of Bloodless Surgery

- i. There is usually time constrain for institutions carrying out elective surgeries scheduled less than a week to enable proper evaluation, therapy and correction of anemia or bleeding disorders if present.
- ii. In case of need especially in emergency situation the physician in charge may still give blood transfusion after having informed the official authorities of the life saving plan and receiving a court order.
- iii. Elderly patient requiring bloodless surgery is more delicate and represents a problem for surgeons taken into consideration that the compensation mechanism to anemia is slower.
- iv. Manpower to care for bloodless surgery in most institutions is still lacking because of lack of multidisciplinary team needed for the establishment.

## 2.8 Benefits of Bloodless Medicine

- i. Bloodless medicine and surgery is safe, proven and effective method of treating patients without the use of blood or blood product.
- ii. Blood conservation techniques not only improve the management of a patient's blood also reduce reliance and associated cost on regional blood supplies.
- iii. Reducing the hospital cost related to maintaining blood inventory.
- iv. According to Pennsylvania hospitals centre for transfusion bloodless surgery and medicine has been at the forefront for two decades recognize that patient has: Faster healing time, faster recovery time, fewer reactions from blood store for a longer period of time, less changes of infection, zero risks of receiving mismatched blood in error.

## 2.9 Bloodless Medicine and Surgery in View of Jehovah Witnesses

### 2.9.1 What Jehovah's witnesses accept

Generally, Jehovah Witnesses do accept a good number of surgical and medical treatments as well as infusion of fluids such as colloids, starch and crystalloids. [25]. However, they abhor the transfusion of whole blood, platelet, packed red cells, plasma, and white blood cells. [26]. However, derivatives of these are viewed as a matter of individual choice, for example products

such as albumin, immunoglobulin, vaccines and clotting factors. When faced with decision o cell derivatives, members of Jehovah Witnesses are obliged to make personal conscientious decision. Same liberal choice is applied in matters of organ donation and transplant [27]. Jehovah Witnesses frown at predonation of blood in view of later transfusion (predeposit), however, majority will accept peri- and post-operative autologous transfusion based on personal decision especially when there is steady circuit of blood circulation such as cell salvage [12].

In recent time, some Jehovah Witness patients have given consent for infusion of haemoglobin-based oxygen carriers without offending either conscience or community. However, many may reject such novel procedures. Hence, the need to assess individual patient believe and need and respect same. Such specifics are usually discussed with the patient before commencement of treatment in order to know what is acceptable to the patient. This may require a multidisciplinary approach, with medical and nursing staff as well as local representatives from the Jehovah's Witness hospital liaison committee, who can be of great assistance.

## 2.10 Legal Considerations

In all situation, the decision to refuse blood transfusion by well informed, adult patient must be respected at all time irrespective of the reason and rationality. The dilemma between urge to preserve life and that to respect patient wish is less in elective surgery in which case there is advance consent or withheld consent by the patient, but same gets more difficult while dealing with unconscious patient with severe hemorrhage. In such situation, the best practice is to search for any evidence against transfusion such as "Advance Directive" stating that the patient will not accept blood transfusion even in the presence of life threatening bleeding. If such is not found, the clinician is obliged to act in the best interest of the patient. For children of Jehovah's Witnesses, legal precedent supports life-saving transfusion against parents' wishes, but two doctors of consultant status should clearly document the reasons for transfusion. In less urgent cases, the matter may be referred to the courts [28].

## 2.11 Advance Directive

Many Jehovah Witnesses usually carry along health care Advance Directive which is a

document stating the patients wish regarding transfusion of blood and blood products. In some cases, these are submitted to the hospital management ahead of time. At all times, the wishes contained are to be respected, but must be well scrutinized to ascertain applicability in the procedure involved. The implications relevant to the case should be discussed with the patient with a copy kept within the hospital notes.

### 3. CONCLUSION

It is clear that at present there is still a need to reduce the use of allogeneic blood. A multidisciplinary effort therefore has to be made through the entire chain, from the outpatient clinic through discharge from the hospital, with the utmost exertion of all team members in which surgeons play a key role and the medical laboratory scientist in the adaptation of bloodless surgery program. Pre-donation, adherence to transfusion triggers, (non-) pharmacological approaches to decrease intraoperative blood loss, hemodilution techniques, peri- and postoperative cell salvage and postoperative re-transfusion and use of proerthropoietic and/or prohemostatic agents may all contribute to the success of a bloodless surgery program.

### CONSENT

In the case of Jehovah's Witnesses, specific details as to which treatments would be acceptable should be clearly established and documented. The specific risks and benefits of any procedure including the added risk of blood refusal should be considered and discussed with the patient. The threshold for surgical treatment may be altered in some cases. Explanation of risks should include local complication rates, and the surgeon might need to consider giving an explanation of the risk of needing transfusion under ordinary circumstances.

### ETHICAL APPROVAL

It is not applicable.

### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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