Occasional Review

Surgery in Jehovah's Witnesses

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This is a retrospective study of the outcome of surgical procedures in patients who were Jehovah's Witnesses. Over a 75-month period, 58 Jehovah's Witness patients had 78 surgical procedures at the Vancouver General Hospital. Three patients had preexisting anaemia of less than $100 \text{ g} \cdot \text{L}^{-1}$ haemoglobin. Postoperative haemoglobin concentration decreased below $50 \text{ g} \cdot \text{L}^{-1}$ in three patients. One patient had a postoperative haemoglobin of $34 \text{ g} \cdot \text{L}^{-1}$ (haematocrit 10.1 per cent) and survived. One patient died from uncontrollable postoperative haemorrhage. Perioperative morbidity was not uncommon, including significant hypotension (eight cases), cardiac arrhythmias (six), myocardial ischaemia (three), excessive bleeding (four), postoperative nausea or syncope (four), and wound or urinary tract infection (four).

"All the animals, birds, and fish will live in fear of you. They are all placed under your power. Now you can eat them, as well as green plants: I give them all to you for food. The one thing you must not eat is meat with blood still in it; I forbid this because the life is in the blood."

Based on these words from Genesis 9:2–4 and many other passages from the Bible, most Jehovah's Witnesses refuse transfusion of blood or blood products even when their life is at stake. Physicians who take care of the members of this faith are often placed in a dilemma when clinical conditions indicate that such therapy can save their lives.^{1–9}

While it is important that the patient's religious conviction be respected, it is also imperative that both the patient and the physician fully understand the risks that they are taking. There is documentation of survival from severe anaemia,^{10–11} and of exsanguination¹² in isolated cases involving surgery in Jehovah's Witnesses. Between these extremes are the majority of patients surviving their surgical procedures.

This is a retrospective hospital chart study to examine the clinical outcome of adult Jehovah's Witnesses undergoing elective surgical procedures with anaesthesia.

Methods

At the Vancouver General Hospital, when a patient requests that no blood or blood derivatives be administered, the possible consequences resulting from the refusal are explained to the patient and his/her immediate family. The patient is required to sign a "Refusal to Permit Blood Transfusion" form (Figure 1), releasing the hospital and health care personnel from responsibility for unfavourable reactions or complications resulting from the refusal. "No blood products" is printed on the elective surgical slate to alert everyone involved in the care of the patient. At the preanaesthetic visit, the anaesthetist interviews the patient alone, away from the family influence. The potential risks are again explained, and the patient's wishes are noted on the anaesthetic record.

A total of 58 surgical patients who refused blood products were identified during a 75-month period from

Key words

ANAESTHESIA: Jehovah's Witness; COMPLICATIONS: anaemia, bleeding, cardiac ischaemia; ORGANIZATIONS: Jehovah's Witnesses.

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**YANCOUVER GENERAL HOSPITAL
REFUSAL
TO PERMIT BLOOD TRANSFUSION**

DATE _____ HOUR _____

I request that no blood or blood derivatives be administered to my _____
(SELF, SON, DAUGHTER)

(NAME)

during this hospitalization, I hereby release THE VANCOUVER GENERAL HOSPITAL, its agents and personnel, and the attending doctors from any responsibility whatsoever for unfavourable reactions or complications or any untoward results due to my refusal to permit the use of blood or its derivatives and I fully understand the possible consequences of such refusal on my part.

Signature of patient _____

Signature of patient's
Husband or Wife _____

When a patient is a minor or incompetent to give consent:

Signature of person
authorized to consent
for patient _____

Relationship to patient _____

Witness _____

FIGURE 1 The "Refusal to Permit Blood Transfusion" form used at the Vancouver General Hospital.

1981 to 1987. This report is based on chart reviews of this group of patients.

Results

Surgery for two of the 58 Jehovah's Witness patients who signed the blood refusal form was cancelled. One patient was a 74-year-old woman who had anaplastic endometrial adenocarcinoma with hepatic metastases. Following radiotherapy and chemotherapy, a total abdominal hysterectomy with salpingo-oophorectomy was recommended because of progressive anaemia and the likelihood of re-bleeding once chemotherapy was discontinued. Her other medical problems were cardiac failure and chronic obstructive pulmonary disease. Her preoperative haemoglobin level was $65 \text{ g} \cdot \text{L}^{-1}$. After reassessment, surgery was declined and the patient was discharged from the

FIGURE 2 Sex and age distribution of 56 Jehovah's Witnesses who had surgery.

hospital by the attending gynaecologist. No information was available from the chart regarding the final outcome of this patient. The second patient was a 65-year-old man slated for total hip arthroplasty three years after a Girdlestone excision arthroplasty. He decided not to have the surgery after learning the potential risks resulting from refusal of blood transfusion.

The remaining 56 patients underwent a total of 78 surgical procedures. Their sex and age are shown in Figure 2. The ASA physical status classification of the patients was: ASA I – six, ASA II – 19, ASA III – 22, and ASA IV – nine patients. The pre-existing medical problems are listed in Table I and the medical therapy is shown in Table II. Medications such as antihypertensives, β -blockers, digoxin, calcium channel blockers, and bronchodilators were continued to the time of surgery. The surgeons discontinued ASA before hospital admission. The 78 surgical procedures performed are grouped according to the surgical specialties in Table III. Most surgical services were involved, except ophthalmology and otolaryngology.

Sixty-five of the 78 procedures were performed under general anaesthesia (the primary agent being isoflurane in 44, halothane in 12, and enflurane in nine cases). Spinal anaesthesia was used in six, epidural in three, and local anaesthesia with intravenous sedation in four procedures. Apart from avoiding blood products, the surgical, anaesthetic and perfusion techniques for cardiac surgery were similar to those used for non-Jehovah's Witness patients.

There were six procedures in which the estimated intraoperative blood loss exceeded one litre (range 1000 to 4000 ml) (Table IV). The lost volume was replaced with 0.9 per cent sodium chloride, lactated Ringer's solution, and Dextran 75. Blood loss with reduced oxygen-carrying capacity is the major concern with these

TABLE I Pre-existing medical problems among 56 Jehovah's Witness patients

Cardiovascular	
ECG abnormalities	26
Atherosclerotic heart disease	22
Angina pectoris	21
Cardiac arrhythmias	21
Hypertension	14
Previous myocardial infarction	7
Valvular heart disease	6
Congestive heart failure	2
Endocrine	
Obesity	8
Diabetes mellitus	4
Hyperparathyroidism	1
Carcinoid syndrome	1
Respiratory	
Bronchial asthma	6
Bronchitis or emphysema	3
Neurological	
Previous cerebrovascular accident	5
Seizure disorder	1
Parkinson's disease	1
Renal	
Renal insufficiency	4
Haematological	
Haemoglobin $100 \text{ gm} \cdot \text{L}^{-1}$	3
Musculo-Skeletal	
Rheumatoid arthritis	2
Multiple sclerosis	1
Myopathy	1

patients. However, in five patients, the attending surgeons ordered that no postoperative haemoglobin determinations be done, as it would not alter postoperative management. In twelve patients the lowest postoperative haemoglobin level was less than $80 \text{ g} \cdot \text{L}^{-1}$. In these 12 patients, nine had a haemoglobin between 51 and $80 \text{ g} \cdot \text{L}^{-1}$ (four cardiac surgery, one each clipping of a cerebral aneurysm, resection of a large mesenteric tumour, total hip arthroplasty, open reduction and internal fixation of a fractured femur, and retropubic prostatectomy). The other three patients had a haemoglobin below $50 \text{ g} \cdot \text{L}^{-1}$ (one each burn debridement, total hip arthroplasty and cholecystectomy and choledocojejunostomy).

The lowest haemoglobin concentration was seen in a 34-year-old man with 26 per cent electrical burns. After resuscitation, fasciotomy and escherothomy and amputation of an arm, the haemoglobin decreased from $175 \text{ g} \cdot \text{L}^{-1}$ to $34 \text{ g} \cdot \text{L}^{-1}$ (haematocrit 10.1 per cent) on the fifth day following the accident. He had four more general anaes-

TABLE II Medical therapy among the 56 Jehovah's Witnesses

Diuretics	11
β -blockers	8
Antihypertensives	7
Digoxin	6
Calcium channel blockers	5
Nitroglycerine	4
Insulin	4
Acetylsalicylic acid	4
Bronchodilators	3
Iron	3
Cyclophosphamide	2
Prednisone	1
Phenobarbitone	1

thetics for burn debridements. It took 41 days for the haemoglobin to reach $100 \text{ g} \cdot \text{L}^{-1}$. He was transferred to a rehabilitation hospital on the 49th day with a haemoglobin of $119 \text{ g} \cdot \text{L}^{-1}$. A significant decrease in platelet count did not occur as frequently as that of haemoglobin. Nevertheless, three patients had platelet counts between 41 and $70 \times 10^9 \cdot \text{L}^{-1}$ following cardiac surgery, and one had a platelet count down to $20 \times 10^9 \cdot \text{L}^{-1}$ following abdominal aortic aneurysm resection which was thought to be induced by heparin. In most cases the reduction in platelet count was minimal, and there was usually a marked increase in platelet production by the third postoperative day. Thirteen patients had abnormal coagulation studies following surgery, but only four had excessive postoperative bleeding, none of whom required re-exploration. The pre- and postoperative haemoglobin and platelet concentrations and the abnormal postoperative coagulation profiles, including bleeding problems, among the major surgical procedures in the series are summarized in Table V.

The perioperative management of a few patients was modified because of the avoidance of blood use. Three anaemic patients scheduled for major operations were given iron therapy and their surgery was postponed from one week to one month. In addition, therapeutic embolization and catheter balloon occlusion of the supplying arteries were used before open reduction and fixation of a

TABLE III 78 surgical procedures performed in 56 Jehovah's Witnesses

General surgery	14
Gynaecological surgery	13
Plastic surgery	12
Orthopaedic surgery	10
Open heart surgery	9
Urological surgery	9
Neurosurgery	6
Radiological procedures	3
Vascular surgery	2

TABLE IV Postoperative course of Jehovah's Witnesses with over 1,000 ml of intraoperative blood loss

Procedure	Estimated blood loss	Fluid replacement	Preop HB (g·L ⁻¹)	Postop HB (day postop) (g·L ⁻¹)	Remarks
Abd aortic aneurysm	1,000 ml	9,000 ml	123	86 (5th)	Angina, MI*
Revision total hip arthroplasty	3,000 ml	5,400 ml	143	Not done	Syncope, myocardial ischaemia*
Mesenteric tumour	4,000 ml	15,450 ml 1,000 ml dextran	133	75 (3rd)	Elective postop ventilation
Abd hysterectomy	1,200 ml	2,000 ml	110	Not done	
Adrenal tumour	2,000 ml	10,400 ml	132	94 (2nd)	Elective postop ventilation
Total hip arthroplasty	1,800 ml	3,000 ml	112	49 (2nd)	Persistent nausea and weak

*In both, the incidents occurred on the third postoperative day.

TABLE V Pre- and postoperative haemoglobin and platelet concentrations, and incidence of abnormal coagulation tests, including bleeding problems, in 52 major surgical procedures in Jehovah's Witnesses

Surgery	n	Haemoglobin (g·L ⁻¹)			Platelets (× 10 ⁹ ·L ⁻¹)			Cases abn. postop coagulation (Clinical bleeding)
		Preop		Postop lowest	Preop		Postop lowest	
		Average	Lowest		Average	Lowest		
Cardiac	9	138.6	120	65	228	113	55	7 (1)
Cerebral aneurysm	1	—	94	70	—	562	236	
Abd aneurysm	1	—	123	86	—	251	20	1 (1)
Biliary	2	116.5	115	38	250	233	87	1 (1)
Abd tumour/bowel	8	139.0	112	75	293	158	81	1
Hip arthroplasty	5	126.0	118	49	313	276	193	2 (1)
Spine	6	140.8	125	108	246	222	203	
Burns	9	93.0	44	34	543	184	124	
Hysterectomy	5	121.3	110	105	266	229	194	
Transurethral prostate resection	5	147.2	120	107	540	193	162	1
Retropubic prostatectomy	1	—	94	70	—	562	236	

pathological fracture of the femur in one anaemic patient. Induced moderate hypotension was used in three patients to minimize intraoperative blood loss.

The postoperative complications are summarized in Table VI. One patient died. This was an 86-year-old woman who had a cholecystectomy and choledochojunostomy for carcinoma of the head of the pancreas, with obstructive jaundice. She had myocardial infarction in the remote past, and ECG evidence of left ventricular hypertrophy. The prothrombin time was noted to be prolonged (but the actual report was not available). The estimated blood loss was 400 ml. The intraoperative blood pressure was labile, and she received a total of 2500 ml crystalloid solution. In the evening of the day of surgery, she developed hypotension and oliguria from bleeding around the wound. Her hypotension responded initially to crystalloid solutions and dextran, but she continued to bleed from the wound and through the naso-gastric tube. The haemoglobin concentration was 38 gm·L⁻¹, platelet count was 87 × 10⁹·L⁻¹, and the coagulogram was abnormal. She refused blood transfusion.

Significant hypotension which required drug support or fluid replacement in the postoperative period occurred in eight patients. Five had cardiac surgery, and one each had total hip arthroplasty, resection of adrenal carcinoma with splenectomy, and choledochojunostomy, the last was

TABLE VI Postoperative complications following 78 surgical procedures in 56 Jehovah's Witnesses

Elective lung ventilation	10
Significant hypotension	8
Cardiac arrhythmias	6
Excessive bleeding	4
Syncope	3
Wound infection	2
Urinary tract infection	2
Myocardial ischaemia (ECG)	2
Myocardial infarction	1
Heart block	1
Pulmonary oedema	1
Nausea (anaemia)	1
Mortality	1

the patient who died. Pulmonary oedema occurred in one patient following the second of six burn debridements. New cardiac arrhythmias occurred in six post-cardiac surgery patients (five had atrial fibrillation, and three had frequent premature ventricular contractions).

One patient developed an anteroseptal myocardial infarction five days after resection of an abdominal aortic aneurysm, when the haemoglobin concentration was $86 \text{ g} \cdot \text{L}^{-1}$. Two patients, following total hip arthroplasty, had ECG evidence of myocardial ischaemia. One occurred in the early postoperative period and the other collapsed in the bathroom on the third postoperative day after a postural hypotensive episode. The ECG, immediately following the episode, showed ischaemia.

Although abnormal postoperative coagulograms were present in 13 patients, only four showed excessive bleeding. These occurred following a resection of an abdominal aortic aneurysm, a choledochojejunostomy, a total hip arthroplasty, and an aortic valve repair.

Ten patients had elective postoperative pulmonary ventilation. Seven of these were after cardiac surgery, and the duration of ventilation ranged from 19 to 118 hours. Following non-cardiac surgery, one patient (male, 47 years) received pulmonary ventilation for two-and-a-half hours following a thoraco-abdominal approach for the resection of an adrenal carcinoma. The intraoperative blood loss of this patient was two litres, urine output was 2400 ml, and the crystalloid replacement was 10,500 ml. The second patient (male, 37 years) received pulmonary ventilation for 17 hours following resection of a large mesenteric tumour. This patient had a measured blood loss of four litres, urine output of 3500 ml, and received a total of 15,500 ml of crystalloid solution and one litre six per cent Dextran 75 in 0.9 per cent saline during surgery. A third patient (male, 78 years) received pulmonary ventilation for 13 hours after small bowel resection, having received 6,500 ml of crystalloid replacement.

One patient had persistent nausea probably due to a low haemoglobin of $49 \text{ g} \cdot \text{L}^{-1}$ on the second postoperative day. Three patients had postural hypotension and syncope occurring between the second to the fifth postoperative days. Wound infection occurred in two patients, and urinary tract infection in another two.

Discussion

Major cardiac,¹³⁻¹⁸ vascular,¹⁹⁻²¹ gynaecological and obstetrical,²² orthopaedic,²³⁻²⁵ and urological surgery²⁶ can be performed successfully without using blood or blood products in Jehovah's Witness patients. The haematological factors that are important in the perioperative period are (1) circulating volume, (2) oxygen-carrying capacity (haemoglobin concentration), (3) platelet count and coagulation profile, (4) oncotic pressure, and (5) status of host defence.

1 Circulating volume

Without the benefit of blood transfusion, the loss of circulating volume can be reconstituted with electrolyte and colloid solutions. Electrolyte solutions are ineffective volume expanders. As a result of extravascular redistribution, three to four times the volume has to be administered for every volume of whole blood lost. Infusion of large amounts of electrolyte solutions may predispose to the development of pulmonary oedema.²⁷⁻²⁸ In this series, volume re-expansion was achieved mainly with the use of electrolyte solutions, and occasionally also with dextran or hydroxyethyl starch solutions. During acute haemodilution with non-blood solutions, maintenance of oxygen transport and utilization requires not only adequate volume replacement, but also the appropriate compensatory increase in both cardiac output and tissue extraction of oxygen. This is possible only if cardiac function is adequate.

2 Oxygen-carrying capacity

Volume replacement with electrolyte solutions cannot correct the deficiency of oxygen-carrying capacity due to loss of red cell mass and haemoglobin. Perfluorochemical blood substitutes, such as Fluosol-DA 20 per cent, has promise for providing oxygen-transporting capabilities and has been used successfully in managing Jehovah's Witness patients.²⁹⁻³¹ However, these chemicals have a limited half-life, require concomitant administration of high concentrations of oxygen, and lack the functions of the other components of whole blood.³²⁻³⁵ Another approach is to make use of the patient's own blood but most Jehovah's Witness insist their blood remains in contact with the body and within the circulation. Methods for intraoperative blood collection for temporary storage and simultaneous reinfusion at variable rates as determined by need have been described.³⁶⁻³⁷

Twelve patients (21.4 per cent) in this series had a postoperative haemoglobin concentration below $80 \text{ g} \cdot \text{L}^{-1}$, and in three of these patients it was less than $50 \text{ g} \cdot \text{L}^{-1}$. This was the result of loss of red cell mass and secondarily of dilution by electrolyte solutions. Although anaemia is a strong stimulus for erythropoiesis, as shown by the marked reticulocytosis and presence of nucleated red blood cells in some of the patients, the process is slow. The oxygen reserves in these patients are stretched, and the patients may decompensate if oxygen demand is increased as in the presence of sepsis. Prolonged weakness, lethargy and nausea may complicate the postoperative course. The myocardium may suffer, as was seen in one patient who developed a myocardial infarction and two who had ECG evidence of ischaemia. In addition, cardiac arrhythmias, heart block and cardiac failure may occur.

Successful management of both emergency³⁸ and

elective²⁴ surgery for Jehovah's Witnesses who were anaemic have been reported. Three patients in this series had an initial preoperative haemoglobin level of less than $100 \text{ g} \cdot \text{L}^{-1}$. In addition, the patient with electrical burns had very low haemoglobin concentrations prior to his third to sixth surgical debridement: $37 \text{ g} \cdot \text{L}^{-1}$ (haematocrit 11.3 per cent), $45 \text{ g} \cdot \text{L}^{-1}$ (13.7 per cent), $54 \text{ g} \cdot \text{L}^{-1}$ (16.5 per cent), and $61 \text{ g} \cdot \text{L}^{-1}$ (19.8 per cent) respectively.

3 Platelet count, coagulation profile

Thrombocytopenia and deficiency of coagulation factors constitute high risks for these patients. Thirteen patients had abnormal postoperative coagulograms, and four of them had excessive bleeding. The only patient who died in this series had coagulation defects from obstructive jaundice, and died after generalized postoperative bleeding. This patient could have been managed differently. If there was no response to vitamin K therapy, the choice was either to cancel the surgery, or to perform a lesser procedure.

Three patients had moderate thrombocytopenia. One patient had severe thrombocytopenia and developed a retroperitoneal haematoma following resection of an abdominal aortic aneurysm. However, in most patients, the reduction of platelet count was minimal, and there was usually an "overshoot" by the third postoperative day.

4 Oncotic pressure

The reduction of oncotic pressure resulting from loss of plasma proteins and haemodilution may cause peripheral and pulmonary oedema. Corneal oedema was seen frequently following infusion of large amounts of electrolyte solutions. Postoperative pulmonary ventilation with PEEP may be indicated in patients with pulmonary oedema to improve oxygenation.

5 Status of host defence

The reduction of white cells from blood loss may predispose to infection. However, the regeneration of white cells is so rapid that persistent leukocytopenia is uncommon. The incidence of wound infection in Jehovah's Witnesses was found to be very high in one series,³⁹ but did not seem to be more common than usual in another.²² Wound infection occurred in two, and urinary tract infection in another two of our patients, but these were easily controlled with antibiotic therapy.

Mutual understanding and communication between the patient, surgeon and anaesthetist before surgery⁴⁰ is essential. The potential risks, especially those associated with major surgical procedures, should be fully discussed. Before elective procedures where major blood loss is anticipated, the patient's condition should be brought to the optimum. This may involve delaying or staging the surgery.^{24,25} Investigation and correction of

anaemia and coagulation defects with iron and vitamin K, and improving nutritional status in debilitated patients, by total parenteral nutrition, may be indicated in selected patients. These techniques were used in some patients in this series.

Meticulous haemostasis during surgery, and use of tourniquets where feasible are recommended. In this series, preoperative placement of an occlusion balloon catheter to minimize major blood loss was used in an anaemic patient with a fractured femur. Induced hypotension can be used to minimize intraoperative blood loss in suitable patients.^{23,24,41} If large volumes of electrolyte solutions have been used to replace blood loss during surgery, mechanical lung ventilation with PEEP may be necessary in the postoperative period. Monitoring of cardiovascular status for an extended period after major blood loss to recognise and manage complications such as postural hypotension, syncope and myocardial ischaemia should be available.

A young and healthy patient can survive major blood loss with an extremely low haemoglobin concentration. However, preoperative factors can increase the operative risks. These include the elderly patient, concurrent cardiopulmonary disease, anaemia and coagulation defects. When managing these patients for major surgical procedures, survival is not the only consideration. Perioperative morbidity, including hypotension, myocardial ischaemia, postural hypotension, excessive bleeding, wound infection, and respiratory complications, should also be considered to ensure optimal recovery.

Conclusion

The religious beliefs of Jehovah's Witnesses should be respected, and the surgeon and anaesthetist should take the challenge, bearing in mind that they must be aware of special considerations for these patients in order to minimize the perioperative morbidity and mortality. For elective procedures, the patient's conditions should be brought to the optimum whenever possible, and this would include correction of anaemia and coagulation defects. Delaying or staging the operation may be necessary. Potential complications include cardiovascular instability, myocardial ischaemia, cardiac arrhythmias, excessive bleeding, pulmonary oedema, prolonged nausea, and wound infection.

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Résumé

Nous avons revu notre expérience d'interventions chirurgicales pratiquées chez des Témoins de Jéhovah. Echelonnés sur plus de six ans, 58 Témoins subirent 78 interventions au Vancouver General Hospital. Trois d'entre eux avaient en pré-op, une hémoglobine de moins de $100 \text{ g} \cdot \text{L}^{-1}$. En post-opératoire, l'hémoglobine de trois patients est descendue sous les $50 \text{ g} \cdot \text{L}^{-1}$ et même jusqu'à $34 \text{ g} \cdot \text{L}^{-1}$ (hématocrite de 10,1 pour cent) chez un survivant. En post-opératoire, les complications n'étaient pas rares: hypotension (huit cas), arythmie cardiaque (dix cas), ischémie myocardique (trois cas), nausée ou syncope (quatre cas), infection de plaie ou infection urinaire (quatre cas), diathèse hémorragique (quatre cas) et une hémorragie incontrôlable qui emporta un patient.