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Jehovah's Witness Patients in Cardiac Surgery: A Retrospective Chart Review

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Abstract

Objective: To describe outcomes of Jehovah's Witness patients undergoing cardiac surgery at our center, and relate these to a comparable group of non-Jehovah's Witness patients.

Methods: Twenty-five adult Jehovah's Witness patients underwent cardiac surgery between January 2008 and June 2013. Pre-operative characteristics, operative data and outcomes were obtained through retrospective chart review. Data was similarly collected on twenty-five non-Jehovah's Witness patients, manually matched for baseline characteristics. Outcomes were compared between groups.

Results: Baseline characteristics were well-matched between groups, with the exception of pre-operative ejection fraction and diabetes which differed slightly. Low patient numbers precluded statistical analysis for some outcome measures, and resulted in a lack of power to demonstrate significant differences in others. In-hospital deaths were reported in 2 Jehovah's Witness patients versus 0 in non-Jehovah's Witness patients; there were no re-operations in either group. There was a non-significant trend to more acute complications in the non-Jehovah's Witness group. Non-Jehovah's Witness patients stayed in hospital an average of 3.1 days longer than Jehovah's Witness patients. Fibrinogen concentrate (available in our center since 2010) was administered to 2Jehovah's Witness patients and 8 non-Jehovah's Witness patients received blood products.

Conclusions: The low number of Jehovah's Witness patients precludes detection of statistically significant differences in outcome compared with non-Jehovah's Witness patients undergoing cardiac surgery. Nonetheless, it appears that Jehovah's Witness patients may undergo cardiac surgery with favorable outcomes. This study serves as a basis to track outcomes of these patients, as increasing emphasis is placed on blood management in the surgical patient.

Perspective: As Jehovah's Witness (JW) patients do not accept whole blood products, they are at presumed higher risk of morbidity and mortality during major surgery. We demonstrate that JW patients can safely undergo cardiac surgery with similar outcomes to non-JW patients. If blood management techniques contribute significantly to positive outcomes in JW patients there may be a role for increased use in non-JW patients.

Central message: Favorable outcomes in Jehovah's Witness patients undergoing cardiac surgery are relevant as more emphasis is placed on blood management

Abbreviations

ACPB	Cardiopulmonary bypass
CVICU	Cardiovascular intensive care unit
JW	Jehovah's Witness
STS	Society of Thoracic Surgeons

Introduction

Blood management is an important consideration during cardiac surgery. In addition to the invasive nature of any cardiac procedure, there is a risk of substantial blood loss related to hemodilution, platelet dysfunction, low fibrinogen levels and prolonged cardiopulmonary bypass (CPB) time [1]. As a result, transfusion rates in the literature range from 20–80% [2].

Figure 01: Jehovah's Witness patients may undergo cardiac surgery with favorable outcomes

For religious reasons, Jehovah's Witness (JW) patients do not accept whole blood products, although some may choose to accept fractions such as cryoprecipitate, albumin and fibrinogen [3]. As a result of this practice, they are at high risk for morbidity and mortality during invasive procedures. Recent advances in perioperative blood management strategies may allow JW patients to undergo complex procedures with

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better outcomes. However, these advances, which include pre-operative administration of iron and erythropoietin, anti-fibrinolytic therapy, cell-saver technology and acute normovolemic hemodilution, may carry their own inherent risks (e.g. thromboembolic complications as a result of erythropoietin administration) [2,4,5].

Given recent changes in practice surrounding the management of perioperative blood conservation, this study aimed to describe outcomes of JW patients undergoing cardiac surgery at our center and compare these with a similar group of non-JW patients in the period 2008–2013.

Methods

Ethics committee approval and waiver of consent were obtained (NSHA-RS/2014-063, July 18, 2013). JW patients (N=25) who underwent cardiac surgery at the Queen Elizabeth II Health Sciences Centre from January 2008 to June 2013 were identified, and matched manually (1:1) from a set of baseline characteristics with a group of non-JW patients (N=25) through the Maritime Heart Centre database. Characteristics employed in matching were age (>18 years), sex, body mass index, procedure, urgency of procedure, previous sternotomy, renal failure (defined as creatinine greater than 176 µmol/l, to correspond with the definition used by the Maritime Heart Centre database), peripheral/cerebral vascular disease, diabetes, and Ejection Fraction (EF) less than 40%. Standardized differences were calculated for all characteristics. Data regarding the outcomes of study patients was collected via retrospective chart review on electronic charts and via the Maritime Heart Centre database. Statistical comparisons were attempted using McNemar's test, paired t-test, repeated measures analysis of variance (ANOVA) and Wilcoxon signed rank test where appropriate. The power of these comparisons, were hampered by the low number of patients included in the study.

Of note, all patients undergoing elective cardiac surgery at our institution are seen preoperatively in an anesthesia assessment clinic for medical optimization. In addition, patients with anemia, bleeding risk or transfusion refusal (e.g. JW patients) are evaluated through a perioperative blood management program. This involves a nurse assessment and multidisciplinary optimization approach that may include pre-operative medications, intra- and post-operative blood products as accepted and required by the patient, as well as the discussion and use of blood conservation strategies. The following blood conversation strategies are used routinely at our institution: Preoperative intravenous Iron, erythropoietin, anti-fibrinolytic therapy with tranexamic acid, cell saver, Acute Normovolemic Hemodilution (ANH) and retrograde autologous priming (Table 2).

Results

In total, 25 JW patients underwent cardiac surgery at this center during the study period. Manually, JW patients were matched with a group of non-JW patients (standard difference less than or equal to 0.1) for all characteristics except pre-existing diabetes and ejection fraction (Table 1). Blood conservation methods were more commonly employed in the JW population. Both groups received anti-fibrinolytic therapy with intravenous tranexamic acid (Table 2). Comparisons of mean pre-operative, post-operative, and operative change in hemoglobin are shown in table 3. No statistical difference was observed between groups for change in hemoglobin, with a p-value from repeated measures ANOVA of 0.19 for group effect and 0.68 for the interaction of group and time. As a result of the small sample size, it was not possible to demonstrate statistically significant comparisons in the majority of outcomes examined. In addition, in some cases it was not possible to utilize statistical comparisons reliably. Results for outcomes studied are shown in Tables 4 and 5. There were more in-hospital deaths in the JW group (2 vs. 0) and more in-hospital complications in the non-JW group. Mortalities were secondary to low cardiac output syndrome complicated by anemia and a valvular failure. Of note, since its introduction at our center in 2010, 2 JW patients have received fibrinogen concentrate and 8 non-JW patients have received blood products. The JW patients who were given fibrinogen concentrate received 2 g after reversal of heparin with protamine. Of those non-JW patients who received blood products, all eight received packed red blood cells (median 2 U, range 1–8); one patient also received 2 bags of platelets (1 bag is equal to ~250 ml of platelets from four pooled donations) and 3 U of fresh frozen plasma.

Table 1: Baseline characteristics of study groups

Variable	JW (N=25)	Non-JW (N=25)	Standardized Difference
Mean Age, years	63.4	64.6	0.08
Sex, n			
Male	19	19	0.10
Female	6	6	
Mean BMI	31.4	30.8	n/a
Procedure, n			
CABG only	11	11	
CABG + valve	1	1	
CABG + other	1	1	n/a
Valve only	8	8	
Valve + other	4	4	
Previous Sternotomy, n	3	3	n/a
Urgency of Surgery, n			
Elective	19	19	
In-house	5	5	n/a
Emergent	1	1	
Renal Failure, n	1	1	n/a
PVD and/or CVD, n	5	6	0.10
EF <40%, n	3	4	0.12
Diabetes, n	9	6	0.26

BMI, body mass index; CABG, coronary artery bypass graft; CVD, cerebral vascular disease; EF, ejection fraction; JW, Jehovah's Witness; PVD, peripheral vascular disease

Non-JW patients spent less time on CPB (not statistically significant) and had longer hospital stays (p=0.032) than JW patients. Both groups had similar Cardiovascular Intensive Care Unit (CVICU) stay lengths.

Table 2: Blood conservation strategies employed

Blood conservation modality, n	JW (N=25)	Non-JW (N=25)
Retrograde autologous priming	13	1
Acute normovolemic hemodilution	10	7
Cell saver	14	0
Anti-fibrinolytic therapy with tranexamic acid	25	25

JW, Jehovah's Witness

Table 3: Mean (SD) pre-operative, post-operative and operative change in hemoglobin (g/l)

Time of Measurement	JW (N=25)	Non-JW (N=25)
Pre-operative	140 (13)	133 (19)
Post-operative	100 (20)	95 (17)
Operative Change	40 (12)	38 (11)

JW, Jehovah's Witness; SD, standard deviation

Table 4: Post-operative complications

Complication, n	JW (N=25)	Non-JW (N=25)	*p*-value
In-hospital death	2	0	-
Re-operation	0	0	-
Cerebrovascular Accident	0	2	-
Infection	1	4	0.375
Acute Kidney Injury	2	5	0.375
CVICU Readmission	1	4	0.375

CVICU, cardiovascular intensive care unit; JW, Jehovah's Witness

Table 5: Time-based outcomes

Outcome	JW (N=25)	Non-JW (N=25)	*p*-value
Mean time on pump, minutes	140.2	118.5	0.054
Mean time on ventilator, hours	109.2	103.3	0.25
Mean CVICU length of stay,hours	138.8	140.8	0.93
Mean length of post-operative hospital stay, days	10.3	13.4	0.032

CVICU, cardiovascular intensive care unit; JW, Jehovah's Witness

Discussion

The outcomes of JW cardiac surgery patients have been described in previous publications [2, 4, 5]. In the study by Vaislic et al., 250 JW patients who had undergone cardiac surgery between 1991 and 2003 were compared with 250 JW patients operated on from 2003 to 2012. Despite the latter group, on average, being older, with a greater number of previous cardiac surgeries and lower pre-operative ejection fraction, acute post-operative complications including myocardial infarction, re-operation, stroke and renal failure, as well as 30-day mortality were reduced when compared with the group treated earlier. The authors considered this to be a reflection of updated blood management techniques, including the use of erythropoietin, aprotinin, cell-saver and retrograde priming [2]. Other advancements in the in-hospital care of post-surgical patients not specific to blood management may have also played a role in the improved outcomes of the latter group. In a second study, the outcomes of 91 JW patients that underwent cardiac surgery between 2000 and 2010 were compared with those predicted by the Society of Thoracic Surgeons (STS) risk models [5]. Mortality rates for coronary artery bypass graft surgery and aortic valve replacement fell within the expected 95% confidence intervals predicted by the STS model, demonstrating that cardiac surgery can be performed in JW patients with a risk similar to that in the general population. Sources of error in this study would be inherent to the use of a model as a comparison: despite the large amount of data incorporated into the model, it does not allow for comparison of baseline characteristics with the JW group. In addition, both studies were retrospective in nature. A third study compared 322 JW patients who refused transfusion during cardiac surgery with propensity-matched non-JW patients who received transfusions over the period of 1983–2011 [4] JW patients had fewer acute complications including myocardial infarction, re-operation, prolonged ventilation and hospital length of stay, as well as higher 1-year survival than non-JW patients. In-hospital and longer-term survival were similar between groups [4]. This study, while seeming to suggest that JW patients had similar or better outcomes, didn't record specific blood management practices and took place over a relatively large time period during which a significant flux in the practice of perioperative medicine occurred.

In the study herein, statistical analysis was hampered by the low numbers of patients, a reflection of the volume of cardiac surgery performed on JW patients in our institution. Nevertheless, a description of the outcomes achieved is valuable in garnering an impression of our center's performance with respect to JW patients.

Because of low inclusion numbers, we were unable to achieve our initial goal of propensity score matching our JW and non-JW groups; however, we were still successful in manually matching a group of comparable non-JW patients who were similar in baseline characteristics, with the exception of pre-operative ejection fraction and diabetes, in which the standardized differences were larger than our desired goal. When comparing these groups, there was no significant difference in the change in hemoglobin over the course of surgery, despite eight non-JW patients receiving transfusions. This may reflect the higher use of blood conservation strategies, such as retrograde autologous priming, acute normovolemic hemodilution and cell saver in JW patients, more careful technique employed by the surgeons, or a combination of factors. It is predictable that blood conservation strategies, as outlined above, may be used more frequently in JW patients, in whom blood loss is a major concern; however, if these techniques contribute significantly to positive outcomes in JW patients there may be a role for increased use in non-JW patients to reduce transfusions and their associated risks.

Acute complications in the post-operative field were identified and compared between the groups, revealing that all 25 non-JW patients survived to hospital discharge, while there were two deaths in the JW group. Causes of death in these patients were a valvular failure in 1 patient, and low cardiac output syndrome complicated by anemia in the other. It is possible that transfusion may have aided the anemic patient with low cardiac output syndrome; however, recovery from low cardiac output syndrome may still have been impossible. There were no re-operations in either study group, but there were 2 cerebrovascular accidents in the non-JW group vs. 0 in the JW group, 4 post-operative infections (defined as sepsis, wound infection or pneumonia) in the non-JW group vs. 1 in the JW group, 5 episodes of acute kidney injury in the non-JW group vs. 2 in the JW group, and 4 incidences of CVICU readmission in the non-JW group vs. 1 in the JW group. Although none of these differences are statistically significant, there is a trend to fewer complications in the JW study group.

The only statistically significant difference in the temporal outcomes recorded was that JW patients spent less post-operative time in hospital than non-JW patients (10.3 days vs. 13.4 days; p=0.032). Although not

statistically significant, JW patients spent a longer average time on pump in the operating room (140.2 minutes vs. 118.5 minutes, p=0.054),which may suggest extra time taken by the surgical team to minimize blood loss, or simply differences in anatomy and surgical difficulty that are not accounted for in this study. There was no difference between groups in either mean time on ventilator or mean CVICU length of stay.

Of note, two patients in the JW study group received fibrinogen concentrate as a perioperative blood conservation measure. This product was introduced at our center during the study period. Fibrinogen, having been demonstrated to be a key factor in coagulopathy induced during cardiac and other high-risk surgery, [6-8] may be a variable that will allow for further improvement in blood management during cardiac surgery. As bedside fibrinogen measurements and the use of fibrinogen concentrate become more commonplace in our institution, future comparisons may reveal whether this addition can improve patient outcomes further.

Weaknesses of this study include its small size, retrospective nature, and the imperfect manual matching performed as a result of an inability to perform propensity score matching. Despite these weaknesses, and a majority of findings lacking statistical significance, a general trend in the descriptive data were observed. It appears that in the majority of cases, JW patients at our center can safely undergo cardiac surgery with outcomes at least comparable to those of non-JW patients. Future work at our center may include analysis of outcomes over time with the addition of new blood management strategies, possible temporal comparison of current and future outcomes (as in the study of Vaislic et al.) [2], as well as prospective and retrospective studies of larger scope as the number of JW patients in the Maritime Heart Centre database grows. In addition, the incorporation of fibrinogen concentrate as an important tool in the prevention of bleeding complications in our center may prove important for JW patients undergoing interventions, and a comparison between JW patients that receive it with those who haven't is another area of potential future interest.

Conclusion

In summary, although, for most measures, the low volume of JW patients precluded detection of statistically significant differences in outcome between JW and non-JW patients, it appears that JW patients may undergo cardiac surgery with favorable outcomes. This study serves as a starting point to track outcomes of these patients at our center as increasing emphasis is placed on blood management in the surgical patient. Future work will include temporal comparison of JW groups, and subgroup analyses for patients receiving newer blood management strategies and treatment modalities such as fibrinogen concentrate.

Author disclosures

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Informed consent

Research ethics board approved with waiver of consent, file NSHA-RS/2014-063, date of approval: July 18, 2013.

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