case supports an aggressive surgical approach for these often critically ill patients.

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Overcoming challenges: The use of minimal extracorporeal circulation in Jehovah's Witnesses undergoing cardiac surgery

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Cardiac surgery in Jehovah's Witnesses often poses a challenge to the surgeon because these patients refuse transfusion of the primary components of blood (red cells, white cells, plasma, and platelets), although individual believers can decide for themselves to accept processed fractions of the primary components. Most cardiac surgeons around the world use standard cardiopulmonary bypass circuits for coronary artery bypass grafting in these patients. Minimal extracorporeal circulation (MECC) is a fully heparin-coated closed-loop cardiopulmonary bypass system. It excludes the blood-gas interface and has active venous drainage, a centrifugal pump, membrane oxygenator, and a priming volume of 800 mL, reduced further to around 300 mL by the use of retrograde priming of the circuit.

Average preoperative hemoglobin level was 14 ± 2.01 g/dL; postoperative hemoglobin level 10.35 ± 1.32 g/dL and percentage drop of hemoglobin on day 1 was $25\% \pm 9.04\%$. Average bypass time was 53 ± 8.57 minutes.

DISCUSSION

Standard cardiopulmonary bypass circuits are associated with marked hemodilution in addition to initiation of the inflammatory response because of contact between blood and artificial surfaces on the lines and oxygenator and also at the

CLINICAL SUMMARY

Between May 2007 and February 2009, 7 Jehovah Witness patients underwent cardiac surgery using this technique (coronary artery bypass grafting in 6 and aortic valve replacement in 1). There were 6 male patients and 1 female patient with an average age of 63 years. Comorbidities included hypertension, and 1 patient had poor left ventricular function (Table 1).

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TABLE 1. Patient characteristics

	Patient no.						
	1	2	3	4	5	6	7
Age (y)	65	71	71	50	64	50	72
Sex	M	M	M	M	M	M	F
Hypertension	No	Yes	Yes	Yes	No	Yes	No
LV function	Good	Good	Poor	Good	Good	Good	Good
Surgery	CABG	CABG	CABG	CABG	CABG	CABG	AVR
No. of grafts	3	3	3	2	3	2	None
Preop Hb (g/dL)	14.8	14	9.7	13.9	15.6	15.6	14.2
Crossclamp (min)	30	34	36	23	27	25	37
Bypass time (min)	51	62	57	36	60	52	52
Postop Hb (g/dL)	12.2	10.4	8.2	11.7	9.6	10.3	10.1
Drop in Hb (%)	18	26	15	16	38	34	28
Day 4 Hb (g/dL)	14.2	11.4	8.7	11.4	11.3	11.2	10
Total blood loss (mL)	540	470	865	380	420	310	440
Extubation time (h)	2.5	4	2.5	2	2	2	3
ITU stay (d)	1	1	2	2	1	1	1
Length of stay in hospital (d)	6	7	14	6	6	6	6

LV, Left ventricular; CABG, coronary artery bypass grafting; AVR, aortic valve replacement; Hb, hemoglobin; ITU, intensive treatment unit.

blood–air interface.¹ Inasmuch as this response affects coagulation, it probably contributes to the perioperative fall in hemoglobin.²

The MECC circuit has a very short tubing length with elimination of the venous reservoir and avoids the conventional cardiectomy suction. As a result, there is a lower priming volume and reduced hemodilution compared with conventional cardiopulmonary circuits³ and probably less initiation of the inflammatory response.

Patients undergoing bypass surgery on MECC systems have 30-day mortalities comparable with those of patients treated with conventional bypass circuits.⁴ Studies have also repeatedly demonstrated a decreased requirement for blood transfusions.⁴ In our patients, the postoperative hemoglobin concentration remained higher than our standard transfusion trigger (8.0 g/dL) and was consistent with previous studies^{4,5} (Table 1). MECC also allows for complete revascularization on a still heart and bloodless field and in our experience is technically less demanding than off-pump surgery.

The reduced priming volume of the MECC system results in less hemodilution and maintains a near normal hematocrit during the CPB process. This technique contributes significantly to the avoidance of blood transfusion in this subgroup of patients. We have successfully used this technique in our institution for coronary artery bypass surgery and more

recently for aortic valve surgery, and we consider the MECC procedure a useful tool in the armamentarium for Jehovah's Witnesses undergoing cardiac surgery. As the evidence for the adverse consequences of homologous blood transfusion mounts, we should consider treating all of our patients with fully heparin-coated circuits, low priming volumes, and meticulous surgical hemostasis as in our Jehovah Witness patients.

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Use of the hybrid operating room for aortic valve replacement in a patient with anomalous left circumflex artery

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Preoperative detection of anomalous coronary artery anatomy and clear delineation of its anatomic course are essential in patients undergoing aortic valve surgery so that the surgical technique can be modified to avoid coronary vessel injury. We present the case of aortic valve replacement (AVR) in a patient who was discovered to have an aberrant left circumflex artery (LCX) on coronary angiographic

analysis. We present a new surgical approach for AVR in the setting of an anomalous LCX.

CLINICAL SUMMARY

A 51-year-old man with a history of aortic stenosis, progressively worsening dyspnea, and an abnormal stress test result was referred to the Vanderbilt Heart Institute for AVR. Transesophageal echocardiographic analysis had revealed an aortic valve area of 0.75 cm² and an ejection fraction of 65% to 70%. Preoperative coronary angiographic analysis revealed no significant atherosclerotic disease but demonstrated an anomalous LCX that originated from a separate ostium adjacent to the ostium of the right coronary artery and coursed behind the aortic annulus. Computed tomographic angiographic analysis confirmed the retroaortic course of the LCX.

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