

# RECURARIZATION AFTER ACUTE INTRAOPERATIVE NORMOVOLEMIC HEMODILUTION AND USE OF SUGAMMADEX

BRUNO LC ARAUJO\*, ALFREDO GH COUTO\*\*  
AND DANIELE THEOBALD\*\*\*

Acute normovolemic hemodilution (ANH) is a blood conservation procedure that can be used in cases of refusal of blood transfusion for religious reasons. Herein, we describe a case of recurarization after reinfusion of collected blood. A combination of rocuronium/sugammadex has the potential to increase the safety of patients if ANH is done after induction. Prospective controlled studies evaluating this unique indication for sugammadex use are thus warranted.

**Keywords:** Advance Directives; Hemodilution; Jehovah's Witnesses; Neuromuscular Blocking Agents; Bloodless Medical and Surgical Procedures.

## Introduction

The Jehovah's Witness religious community is remembered by health professionals for its refusal to receive blood products as part of the therapeutic arsenal<sup>1</sup>. Minor fractions of blood and other transfusion alternatives, such as acute normovolemic hemodilution (ANH), are optional depending on the follower's personal beliefs<sup>1</sup>.

The perioperative management of patients who refuse to receive blood products requires interaction between various medical specialties as well as experience with blood conservation procedures. This case report presents the use of ANH in gynecological oncology surgery with recurarization after the infusion of collected blood and the use of sugammadex for reversal.

To our knowledge, this is the first reported case on the indication for and use of sugammadex for reversal of recurarization after ANH.

## Case

The patient was a 76-year-old woman with arterial hypertension and type 2 diabetes mellitus. The operation proposed was a total abdominal hysterectomy associated with para-aortic pelvic lymphadenectomy, omentectomy, and biopsies because of an endometrial adenocarcinoma. Laboratory tests revealed the following: hemoglobin: 13.0 g/dL; hematocrit, 38.5% : urea: 24 mg/dL; glucose: 145 mg/dL; and normal coagulation tests. The patient refused to receive the 4 main blood products under any circumstances owing to her religious conviction (Jehovah's Witness).

\* MD, Supervisor, Department of Anesthesiology, Hospital do Câncer II - Instituto Nacional do Câncer José Alencar Gomes da Silva.

\*\* MD, Anesthesiologist, Department of Anesthesiology, Hospital do Câncer II - Instituto Nacional do Câncer José Alencar Gomes da Silva.

\*\*\* MD, Anesthesiologist, Department of Anesthesiology, Hospital do Câncer II - Instituto Nacional do Câncer José Alencar Gomes da Silva.

**Corresponding author:** Bruno Luís de Castro Araujo, Instituto Nacional do Câncer José Alencar Gomes da Silva, Rua do Equador, 831, 7º andar. Santo Cristo. CEP: 20.220-410. Rio de Janeiro. RJ. Brazil. Tel: 55-21-32072915; 55-21-88400944. E-mail: brunoaraujomed@yahoo.com.br; baraujo@inca.gov.br

Fig. 1  
Temporal relationship between evaluation of neuromuscular function by train-of-four (TOF) stimulation, infusion of the collected blood, administration of rocuronium and sugammadex.

	0	15'	30'	45'	1h	15'	30'	45'	2h	15'	30'	45'	3h	15'	30'	45'	5'	10'	15'
TOF	0	0	0	0	1	1	2	2	2	3	3	30%	0	12%	0	0	0	96%	105%
	Collection															Re-infusion			
	#	*													# <sup>1</sup>	* <sup>1</sup>		# <sup>2</sup>	X

# - Anesthetic induction with rocuronium 0.6 mg/kg.

\* - Start of the surgical procedure.

#<sup>1</sup> - Rocuronium 0.15 mg/kg at the beginning of the closure of the abdominal wall.

\*<sup>1</sup> - End of the surgical procedure.

#<sup>2</sup> - Sugammadex 4 mg/kg.

X - Extubation.

During anesthesia, the patient was monitored with electrocardiography, pulse oximetry, capnography, esophageal temperature, bispectral index, train-of-four (TOF) stimulation, urine output, invasive blood pressure measurement with cardiac output and central venous oxygen saturation measurement. The anesthetic technique was general anesthesia with sevoflurane, remifentanyl and rocuronium associated with a lumbar epidural puncture (L2–L3) using a catheter. The blood collection was started 5 min after the induction of anesthesia and 1,030 mL was obtained over 1 h. The hematocrit was 26% after collection. Volume replacement was performed with continuous monitoring of changes in stroke volume. A total of 1,500 mL of colloids (0.6% hydroxyethylamide, 130/0.4) and 1,000 mL of crystalloids were administered through anesthesia. The operating time was 3 h, 15 min with an estimated bleeding of 1,000 mL. Monitoring of the neuromuscular junction, rocuronium and sugammadex administration occurred as shown in Figure 1.

The patient was admitted to the intensive care unit in the immediate postoperative period without pain or other complaints. On the first postoperative day (POD) she presented with 33% hematocrit and 11.5% hemoglobin. Her pain was controlled using an epidural until the second postoperative day. The postoperative recovery was uneventful and the patient was discharged on the fifth postoperative day.

**Discussion**

ANH is usually well accepted by Jehovah’s Witnesses, and it is important to note that there is no

religious prohibition to its use. For this, it is necessary to guarantee that the collected blood will remain in contact with the patient during all stages of the process, thus maintaining a closed system<sup>1</sup>.

We chose to collect blood after anesthesia induction. A very important technical aspect is the recirculation of drugs during the transfusion of collected blood. The drugs present in plasma at the time of collection will perform their action on the effector organs at the time of reinfusion. Neuromuscular blockers deserve special attention.

We opted to administer rocuronium for neuromuscular blockade because of the safety associated with rocuronium/sugammadex versus the other nondepolarizing neuromuscular blockers and succinylcholine. Cases of recurarization with the use of atracurium, vecuronium, mivacurium, and rocuronium have been described<sup>2</sup>. Sugammadex has been proven to be a safer reversal agent than neostigmine, particularly in moderate and deep blockade<sup>3</sup>. Thus, proper planning to prevent residual curarization is crucial when one opts for blood collection after induction.

The use of the combination of rocuronium and sugammadex offers a unique opportunity to perform a suitable neuromuscular blockade at all stages of the surgical procedure without increasing the risk of postoperative residual paralysis.

*Consent Statement*

The patient provided written informed consent and the paper was accepted by the hospital’s research ethics committee.

## References

1. HUGHES DB, ULLERY BW, BARIE PS: The contemporary approach to the care of Jehovah's witnesses. *J Trauma*; 65:237-47, 2008.
2. ROHLING RG, RENTSCH KM, BECK-SCHIMMER B, FUCHS-BUDER T: Risk of recurarization during retransfusion of autologous blood withdrawn after injection of muscle relaxants: a comparison of rocuronium and mivacurium. *J Clin Anesth*; 15:85-90, 2003.
3. KARALAPILLAI D, KAUFMAN M, WEINBERG L: Sugammadex. *Crit Care Resusc*; 15(1):57-62, 2013.

