Rocuronium induced neuromuscular blockade reversion with sugammadex in a patient with Charcot-Marie-Tooth disease

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Summary

Introduction. Charcot-Marie-Tooth disease (CMTD) is a rare degenerative neuropathy. *Case report.* We describe our experience with a CMTD1 patient using a TIVA anesthesia, and the rocuronium ($1ED_{95}$) induced neuromuscular blockade (NMB) evolution: latency in 3 min 27 s, and recovery of T1 height 25% with TOF-ratio 50% in 2 hr. Residual NMB was treated with sugammadex 2 mg.kg^{-1}, obtaining TOF-ratio 80% in 1 min 30 s, TOF-ratio 90% in 1 min 45 s and TOF-ratio 100% in 2 min. There are no experience related the use of sugammadex in CMTD, but this could be a useful drug to allow greater recovery of residual rocuronium induced NMB. *Anestezjologia i Ratownictwo 2010; 4: 307-309.*

Keywords: anaesthesia, Charcot-Marie-Tooth disease, neuromuscular blockade, rocuronium, sugammadex

Introduction

Charcot-Marie-Tooth disease (CMTD) (peroneal muscular atrophy) is a rare degenerative neuropathy that affects about 1 in 2500 people [1]. Onset of CMTD is typically in the second decade of life, usually starting with motor impairment of the lower extremities, with slowly progressive weakness, deep tendon reflexes diminished or absent and muscle atrophy. Mild distal sensory impairment develops later, an even the syndrome spread to involve the hands and forearms. Autonomic disturbances (i.e. orthostatic hypotension, hypohidrosis or decreased skin temperature) can also appear in CMTD. The spectrum of clinical severity varies from asymptomatic individuals to those with severe impairment of the legs requiring corrective surgery and/or wheel-chair dependency. CMTD has been classified (according to nerve biopsies and nerve conduction studies) in CMTD1 (with marked reduction in nerve conduction velocity with demyelination) and CMTD2 (nerve conduction velocity is normal or low normal, with axonal loss but no prominent demyelination). In the majority of cases of CMTD1 and CMTD2 the inheritance is autosomal dominant, and most rarely X-linked and autosomal recessive variants [2]. Some authors [2] also include CMTD3, also denominated Dejerine Sottas disease, a severe variant of CMTD with onset in infancy.

Finally, it is well known by neurologists that in many affected patients, CMTD remains undiagnosed because, despite of the foot deformities and the pathologic findings revealed by neurophysiologic investigations, the patient's disability may be surprisingly slight, or even absent.

Case report

We describe a 72 yr, 50 kg and 150 cm male patient, scheduled for femoral fracture osteosynthesis. His past

medical history included CMTD1 and polycythemia vera, myocardial infarction, pulmonary thromboembolism, cranial fracture, chronic pulmonary obstructive disease, diabetes mellitus, hypothyroidism, vertigo, dyspepsia, cognitive deterioration, urinary incontinence and wheel-chair dependency.

The patient was uncooperative, so regional anesthesia was not a suitable option in this case, and general anesthesia was needed.

He did not received premedication, and after application of routine monitoring (ECG, pulse oximeter, non-invasive arterial pressure) anesthesia was induced with fentanyl (0.10 mg) and total intravenous anesthesia (TIVA) using a target controlled infusion of propofol. Neuromuscular blockade (NMB) monitoring was performed using train-of-four (TOF) nerve stimulation with acceleromyography (TOF-Watch SX®) at the adductor pollicis muscle, with prior calibration after achieving a long signal stabilization as described in the Good Clinical Research Practice in pharmacodynamic studies of neuromuscular blocking agents [3].

A single bolus of rocuronium (15 mg, $1ED_{95}$) was administered to facilitate tracheal intubation (latency 3 min 27 s). During the uneventful surgical procedure, the endtidal partial pressure of CO_2, was maintained at 28-30 mm Hg. Central body temperature was measured continuously in the nasopharynx and maintained at ≥ 35 °C using standard techniques of heat conservation (fluid warming and air convection heating). Antibiotic prophylaxis was made with cefazoline 2 g i.v. No other drugs were used. At the end of the 2 hr operation, the TOF stimulus elicited 4 twitches (T1 height 25% with TOF-ratio 50%) and residual NMB was treated with sugammadex 2 mg.kg^{-1} (100 mg IV, 1 ml of Bridion®). The patient was extubated when a 100% TOF-ratio was observed (TOF-ratio 80% in 1 min 30 s, TOF-ratio 90% in 1 min 45 s and TOF-ratio 100% in 2 min), and then transferred to the postanesthesia care unit.

Discussion

Regional techniques are often proposed as the gold standard for anesthetic management of neuromuscular diseases. Cesarean section in a parturient with CMTD has been described uneventful by Kuczkowski et al [4]. However, the use of neuroaxial blockades in these patients remains controversial and sometimes general anesthesia is needed.

It has been suggested that polyneuropathy in CMTD can cause a hyperkalemic response to succinylcholine due to up-regulation of the endplate cholinergic receptors, and although succinylcholine and other malignant hyperthermia (MH) triggering agents have been reported without untoward effects, the relationship of CMTD with MH is not well established [5], so MH triggering agents were avoided.

The response to non-depolarizing neuromuscular blocking agents is variable in patients with CMTD. It has been speculated that involvement of the monitored muscles may be partially responsible for this inconsistency because the heterogeneous muscular affectation can difficult the adequate assessment of NMB, but this affirmation remains unclear. Sometimes, NMB monitoring is complicated to realize, so some authors indicate to examine the patient and select the muscular groups that are preserved or less affected (in this case the adductor pollicis muscles). Nevertheless, near normal responses to mivacurium at the adductor pollicis and orbiculari oculi muscles have been observed [6].

The peripheral generalized neuropathy of CMTD may up-regulate the cholinergic receptors at the neuromuscular junction and, hence, may counteract any expected decrease of non-depolarizing neuromuscular blocking agents requirements secondary to the generalized muscle weakness.

A normal response has been described for mivacurium and atracurium [7]. In patients with CMTD receiving vecuronium, a normal with even a moderate resistance [8] or a prolonged NMB have been reported [1].

There is only a case report describing the use of rocuronium in CMTD, but the longer duration of action of rocuronium observed in this case could be explained because the patient was complicated with liver cirrhosis [9].

There are no references up to date concerning the use of the rocuronium induced NMB antagonist sugammadex. We obtain an adequate response to 2 mg.kg^{-1} of sugammadex (TOF-ratio 100% in 2 min). Although it is usually accepted, mainly based on retrospective reviews, that the use of neuromuscular blocking agents is uneventful in patients with CMTD [5,10].

Careful neuromuscular blockade monitoring is mandatory. This is probably because in the vast majority of these patients denervation phenomena are restricted to the distal segments of lower and upper limbs [11]. Having low clinical importance, any residual NMB in these segments is likely to be underestimated

at the end of operation and immediately thereafter. It should be noted, on the other hand, that hypersensitivity is well recognized in the rare instances in which denervation is more extended and affects respiratory muscles [12]. This patient required obtaining the best possible neuromuscular blockade recovery due to the CMTD disease coexisting with chronic pulmonary obstructive disease, so a rocuronium induced NMB was selected in order to be completely reversed with sugammadex.

In conclusion, there are no experience related the use of sugammadex in Charcot-Marie-Tooth disease, but this could be a useful drug to allow greater recovery of residual rocuronium induced neuromuscular blockade.

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