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CORRESPONDENCE

Significantly prolonged neuromuscular blockade after a single dose of rocuronium

The importance of monitoring

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Editor,

Postoperative residual curarisation (PORC) continues to be a common problem in modern anaesthesia.[1] An incidence of 26% was registered in a Portuguese multicentre study published in 2013.[2] Residual paralysis is associated with impaired pharyngeal function and increased risk of aspiration, airway obstruction, attenuation of the hypoxic ventilatory response and symptoms of muscle weakness.[3] As PORC is associated with clinical adverse events, all efforts must be made to reduce it. Quantitative monitoring of neuromuscular (NM) function after neuromuscular blockade (NMB) has been indicated as the best way to avoid it.[1,4] In addition, the results of the National Audit Project 5 demonstrate that a significant proportion of cases of accidental awareness occur during emergence from anaesthesia, supporting the routine use of monitoring NM function during that phase of anaesthesia.[5]

We report a case of significantly prolonged NMB after a single dose of rocuronium. This case report emphasises the importance of NM monitoring as a tool to avoid PORC. After reviewing this case report, the patient gave written permission for publication.

A 45-year-old woman, 60 kg – American Society of Anesthesiologists' physical status 2 – was scheduled for laparoscopic cholecystectomy with intraoperative cholangiography after lithiasic pancreatitis. She suffered from mild hypertension and depression although was not taking any medication for this. Preoperative investigation showed a haemoglobin concentration (normal value) of 8.9 g dl^{-1} (12 to 15 g dl^{-1}), normal renal function, direct bilirubin 12.8 $\mu g l^{-1}$ (<3 $\mu g l^{-1}$), alanine aminotransferase 26 IU l^{-1} (10 to 36 IU l^{-1}), aspartate aminotransferase 45 IU l^{-1} (10 to 30 IU l^{-1}), alkaline phosphatase 144 IU l^{-1} (32 to 104 IU l^{-1}) and gamma-glutamyl transferase 532 IU l^{-1} (6 to 39 IU l^{-1}). Standard American Society of Anesthesiologists' monitoring was applied and general anaesthesia was performed. To monitor neuromuscular transmission we used train-of-four (TOF) stimulation of the left ulnar nerve at the wrist and recorded the response of the thumb using a Mechanosensor neuromuscular transmission module (GE Healthcare, Finland Oy Helsinki, Finland). Temperature was not measured. Anaesthesia was induced with fentanyl 0.15 mg and propofol 150 mg. After calibration of the neuromuscular transmission monitor, rocuronium 50 mg (0.8 mg kg^{-1}) was administered and the trachea was intubated after TOF responses were abolished. Anaesthesia was maintained with desflurane according to bispectral index monitoring (range between 40 and 60), with a median end-tidal concentration of 5% during anaesthesia. Cefazoline 2 g was injected before surgery started. During the procedure, we administered a total doses of fentanyl 0.35 mg, paracetamol 1 g and tramadol 100 mg for analgesia. Droperidol 0.625 mg and dexamethasone 4 mg were administered as prophylaxis against postoperative nausea and vomiting. During the procedure, a total of 1 l of a crystalloid solution was infused.

At the end of surgery, 100 min after administration of a single dose of rocuronium, there were no responses to either TOF or Post tetanic Count (PTC) stimulation. To ensure against malfunction of the monitor, another monitor was applied [TOF Watch (Organon Teknika, the Netherlands)], and the same result was obtained (no responses to TOF or PTC stimulation).

The original neuromuscular monitor was reapplied, and 110 min after neuromuscular relaxant administration 2 PTC responses were recorded. At this time we administered sugammadex 4 mg kg^{-1} (a total of 240 mg). Recovery of NM function to a TOF ratio more than 0.9 was reached after 8 min. The trachea was then extubated and the patient was transferred to the postanaesthetic care unit where no signs nor symptoms of residual paralysis were seen during the 90-min stay. She was discharged the day after surgery, with no adverse events registered.

The duration of action of NMBdrugs is variable and depends on the drug, dosage and individual characteristics. Case reports have previously shown that prolonged duration of action of rocuronium happens.[4,6] It is not possible to predict the duration of NMB after the administration of a NMBdrug, unless NM monitoring is used. In addition, the two classes of drugs clinically used to reverse NMB have precise indications for their administration and dosage based on the degree of neuromuscular block.

Many authors have described the importance and the advantages of using NM monitoring to prevent PORC.[7,8]

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In a recent editorial about this topic, the author highlighted the fact that, despite the potential contribution of sugammadex to reduce PORC, there is still a risk of recurarisation when insufficient doses are used, corroborating the need for NM monitoring.[9] Despite all the evidence, the use of neuromuscular monitoring is far from routine.[10] In our institution, quantitative monitoring of NMB is part of our routine clinical practice.

In our patient, prolonged and unpredicted NMB prevailed 100 min after the administration of rocuronium 0.8 mg kg^{-1}.[11] If a NM monitor is not used potentially harmful scenarios could present. We could have assumed that, after 100 min, there was no residual neuromuscular block and discontinued desflurane, waiting for the patient to awaken. Another option could be the administration of a 'standard' dose of neostigmine 2.5 mg or even 'low' dose sugammadex (2 mg kg^{-1}). In either of these three scenarios we would face PORC, certainly with awareness and all its consequences[5,12] in the first scenario, and possibly in the other two scenarios too, depending when the desflurane was turned off. Neostigmine would not be helpful for reversal of neuromuscular block at this depth of blockade. In the case of reversal with the lower dose of sugammadex, reversal may also be inadequate at this depth of NMB.[13,14] Any of these possible scenarios would lead to a higher risk of complications that could be easily avoided with the use of quantitative neuromuscular monitoring.

Several factors may have contributed to the prolonged duration of action of rocuronium in this patient. A large variability in the duration of action of rocuronium is well described and the sensitivity to NMBdrugs may be 30% higher in female patients.[15] Anaesthesia was maintained with desflurane, which has been shown to prolong the duration of effect of rocuronium.[11] In addition, this patient probably had a partial obstruction to biliary excretion, the main route for excretion of rocuronium, and this may have contributed to prolonged NMblock.

With this case report, we attempt to show that NM monitoring should be used whenever neuromuscular blocking drugs are is administered. Moreover, the use of sugammadex does not preclude the need for NM monitoring.

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