Interdisciplinary intraoperative communication and collaboration needed for optimal neuromuscular blockade management

Sir,

We would like to thank Dr. Lamberg and Dr. Answine for their case report, " A surgeon's assessment of inadequate neuromuscular antagonism in a case of prolonged neuromuscular block. April-June 2013 29(2):244-247."[1] In this case an additional 10 mg dose of neuromuscular blocking agent (NMBA) was given 75 min after an intubation dose of rocuronium at the request of a surgeon based on "feel" of the surgical site during a hemicolectomy on an 82-year-old 74 kg woman. Although it is unusual that this patient's neuromuscular blocking (NMB) lasted as long as it did (5.5 h), the preceding scenario is typical. We have all experienced the surgeon's statements of: "The patient is getting tight," "I need more relaxation" and request of "can you give more muscle relaxant?"

As this case shows, this request still requires more thorough assessment by the anesthesia provider. This speaks to the need for improved communication between anesthesia and surgical teams. Often, experienced surgeons can assess ("feel") the return of slight motor function that is reflected by increased muscle tension translating into restricted access to the surgical field, restricted visualization, or difficult extremity manipulation.[2,3] In some instances deeper levels of NMB may be needed such as with femur pinning, laparoscopic abdominal cases and open abdomen or chest procedures. Deeper levels of NMB require more in-depth assessment than offered by train-of-four (TOF) or double burst stimulation. As the authors state the use of post-tetanic count (PTC) is useful when assessing and managing deep (profound) levels of NMB.

The authors share their use of objective assessment of neuromuscular function using TOF watch accelerometry that is superior to subjective peripheral twitch monitors for assessing neuromuscular block.[4] The use of PTC after confirmation of TOF ratio of 0/4 is appropriate to quantify the level of profound NMB. A PTC of 1 out 8 reflects many more NMBA molecules available to immediately occupy acetylcholine receptors than a PTC of 7 twitches out 8. The latter predicting a sooner return to <100% receptor blockade and beginning return of a TOF count. Unfortunately, many anesthesia providers still do not use peripheral twitch monitors and likely less use accelerometry despite its usefulness. The algorithm provided is useful to encourage clinicians to fully assess NMB when surgeons make requests for deeper levels. We would like to add a few suggestions and expound upon a very useful algorithm that we believe should be promoted whenever NMBAs are used.

The authors direct initial assessment of neuromuscular function at the adductor pollicis or orbicularis oculi muscles. We note that the authors first used the orbicularis oculi and afterward the corrugator supercilii when discussing motor assessment from facial nerve monitoring. We would like to clarify for readers who may not be familiar with the nuances between these two assessment sites. Initially in the algorithm assessment is at the adductor pollicis or orbicularis oculi. If no TOF count is present further assessment is directed at the corrugator supercilii. Historically and certainly in many textbooks, the orbicularis oculi is the taught muscle for which we assess motor function off of the facial nerve.[5] The orbicularis oculi is only one of two assessment muscle groups. The orbicularis oculi is a more susceptible muscle to NMBA paralysis than the corrugator supercilii. It is possible to lose orbicularis oculi motor function yet still have corrugator supercilli contractions to supramaximal stimuli. The corrugator supercilii correlates better with the degree of NMB at the more resistant muscle groups.[6]

As the authors address the assessment of NMB when a surgeon requests more we would like to remind readers about the importance of neuromuscular function assessment at the beginning and end of surgery. At the beginning of the case, use of the ulnar nerve to assess adductor pollicis twitch responses may give the false assurance of complete NMB (TOF 0/4) as the adductor pollicis does not necessarily correlate with motor function at the larynx or diaphragm. We suggest initial placement of nerve monitor should be considered on the facial nerve to assess corrugator supercilii response as this would better correlate not only with intubating conditions but also may represent any motor function/tone that the surgeon may be perceiving The corrugator supercilii tends to better reflect the diaphragm and certainly the abdominal rectus muscles response to NMBAs. This use of the facial nerve to assess corrugator supercilii responses assures not only optimal intubation conditions but also surgical conditions depending on type and location of surgery.

Toward the conclusion of surgery when assessing the degree of spontaneous recovery from NMB, the neuromuscular function monitor should be moved to the peripheral ulnar nerve to assess the adductor pollicis muscle that tends to be a more susceptible muscle to NMB. The rationale for this is to assure a certain level of spontaneous recovery of motor function before reversal. We believe it is better to reverse NMB based on the assessment of the degree of spontaneous recovery of an easily paralyzed muscle group as opposed to one that may be more resistant to block. Considering that TOF and sustained tetanus alone cannot assess neuromuscular block less than approximately 50%, the assurance that the more susceptible muscle is reversed will likely reflect a higher degree of motor function in the more resistant muscle groups and possibly less residual paralysis effects.

It is unusual that this patient's NMB lasted as long as it did. This case report describes a clinical situation with a unique response to typical doses of the NMBA rocuronium and offers all the opportunity to reflect deeper on the clinical scenario that preceded it. Expectation of typical NMBA metabolism or degradation times risks exactly what occurred in this case-the assumption of motor function return when it had not and the subsequent additional doses of unnecessary NMBA. We echo the take away message that neuromuscular function monitoring should always be performed when using NMBAs.

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References

1. Lamberg JJ, Answine JF. A surgeon's assessment of inadequate neuromuscular antagonism in a case of prolonged neuromuscular blockade. J Anaesthesiol Clin Pharmacol 2013;29:244-7.
2. Harris AM, Welliver M, Redfern R, Kalynych N, McDonough J. Orthopaedic surgery implications of a novel encapsulation process that improves neuromuscular blockade and reversal. Internet J Orthop Surg 2007;2.
3. Boon M, Martini CH, Aarts LP, Bevers RF, Dahan A. Effect of variations in depth of neuromuscular blockade on rating of surgical conditions by surgeon and anesthesiologist in patients undergoing laparoscopic renal or prostatic surgery (BLISS trial): Study protocol for a randomized controlled trial. Trials 2013;14:63.
4. Murphy GS, Szokol JW, Marymont JH, Greenberg SB, Avram MJ, Vender JS, *et al*. Intraoperative acceleromyographic monitoring reduces the risk of residual neuromuscular blockade and adverse respiratory events in the postanesthesia care unit. Anesthesiology 2008;109:389-98.
5. Morgan GE Jr, Mikahail MS, Murray MJ. Patient Monitors in Clinical Anesthesiology. 5th ed., Ch. 6. NY: Lange Medical Books/ McGraw-Hill; 2013.
6. Plaud B, Debaene B, Donati F. The corrugator supercilii, not the orbicularis oculi, reflects rocuronium neuromuscular blockade at the laryngeal adductor muscles. Anesthesiology 2001;95:96-101.

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