Measuring Success of Patient Safety Initiatives: The 2023 American Society of Anesthesiologists Practice Guidelines for Monitoring and Antagonism of Neuromuscular Blockade

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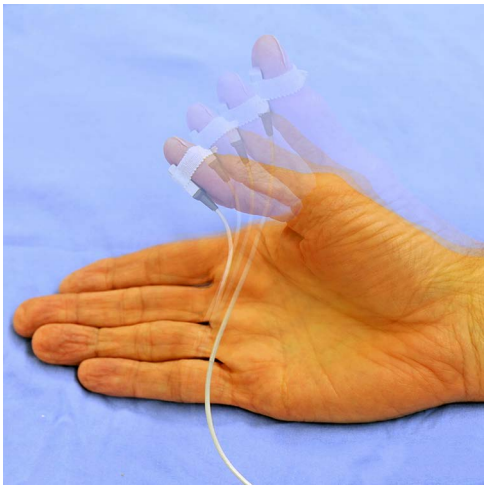
"An experiment is a question which science poses to Nature, and a measurement is the recording of Nature's answer." — Max Karl Planck (Nobel Prize in Physics laureate for discovery of energy quanta; 1858–1947)

This issue of Anesthesiology contains a long-awaited document: the 2023 American Society of Anesthesiologists Practice Guidelines for Monitoring and Antagonism of Neuromuscular Blockade.[1] Academic or "expert" suggestions regarding how best to administer and monitor neuromuscular blocking drugs in the clinical setting have often been at wide variance with what actually transpires in the typical operating room. Certainly, in the last two decades, new tools (acceleromyographic and electromyographic devices) and drugs (sugammadex) have given anesthesiologists important new options. Evidence-based data have continued to accumulate. The exhaustively researched and expertly presented practice guidelines report by the American Society of Anesthesiologists Task Force on Neuromuscular Blockade[1] encapsulates significant progress and should represent the basis for a consensus on safe administration and reversal of neuromuscular blocking drugs in daily practice. While it may be tempting to stop reading after absorbing the table of recommendations, we would urge the reader to delve deeper into this report. The comments and "fine print" in the latter half of the report are well worth the effort. To understand the significance of these guidelines, a bit of history may be helpful.



"[These practice guidelines…] should represent the basis for a consensus on safe administration and reversal of neuromuscular blocking drugs in daily practice."

Two decades ago, in response to accumulating evidence that undetected residual neuromuscular block was commonplace in patients arriving in postanesthesia care units, Lars Eriksson wrote a prophetic editorial in this journal.[2] To quote, "it is time to move from discussion to action and introduce objective neuromuscular monitoring in all operating rooms, not just those occupied by researchers and aficionados of muscle relaxants. I believe that objective neuromuscular monitoring is an evidence-based practice and should consequently be used whenever a nondepolarizing neuromuscular blocking agent is administered. Such monitoring is noninvasive and has little risk, and there are strong reasons to believe that its use can improve patient outcome." His suggestion, it is probably fair to say, was not generally warmly received, or followed. At the turn of the 21st century, even the use of conventional peripheral nerve stimulators was far from routine. Objective monitors based on acceleromyography or electromyography were not widely available. Equally important, there existed no outcome studies demonstrating reduced postoperative morbidity when quantitative monitors were used. Thus, in the absence

Image: J. P. Rathmell.

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of support from a respected professional society, Eriksson's *cri de coeur* was, to a large degree, ignored.

In the years immediately after Eriksson's editorial, the clinical use of quantitative neuromuscular monitoring was still far from universal. A quotation from the 2002 American Society of Anesthesiologists Guidelines for Postanesthetic Care perhaps illustrates the general consensus at that time: "Assessment of neuromuscular function primarily includes physical examination and, on occasion, may include neuromuscular blockade monitoring."[3] A survey by Naguib *et al.*[4] found that 10% of American anesthesiologists had never used a peripheral nerve stimulator and that most survey respondents felt that neither conventional nerve stimulators nor quantitative neuromusculat monitors should be part of minimum monitoring standards. However, opinion was starting to shift. In the 3 yr between 2008 and 2010, several prominent editorials[5–8] reiterated that residual neuromuscular block may have adverse consequences and that the rational management of muscle relaxant administration requires the use of intraoperative neuromuscular monitoring. Evidence that residual block had clinical consequences was no longer theoretical,[9–11] and there was proof that the risk of adverse respiratory events during early recovery from anesthesia could be reduced by intraoperative quantitative monitoring with acceleromyography.[12] Nevertheless, despite a plethora of review articles on neuromuscular monitoring (an unstructured search identified seven between 2002 and 2009), the results of the survey by Naguib *et al.*[4] were disheartening. Clearly, many clinicians were not getting the message. In an attempt to gently guide (and perhaps coerce) the anesthesia community forward, another 2010 editorial called for the American Society of Anesthesiologists to issue a set of practice guidelines regarding the clinical administration and monitoring of neuromuscular blocking drugs.[13]

The recommendations[1] are straightforward and, we would argue, scientifically sound and clinically obvious: it is impossible to accurately predict the depth of neuromuscular block or the adequacy of reversal by using clinical tests such as tidal volume, negative inspiratory force, ability to sustain head lift, or grip strength. Similarly, qualitative assessment of responses to peripheral nerve stimulators cannot be relied upon in deciding the appropriate time for tracheal extubation. Confirmation of a train-of-four ratio of 0.9 or higher obtained at the adductor pollicis muscle after ulnar nerve stimulation is critical before tracheal extubation. We, the authors of this editorial, are particularly gratified to see that the guidelines recommend against the unfortunately common practice of using the eye muscles for neuromuscular monitoring. The last three recommendations in the guidelines deal with antagonism of neuromuscular block using appropriate doses of sugammadex and neostigmine. The guidelines do not address two other patient populations in whom neuromuscular blocking agents are used routinely: pediatric and intensive care unit patients. It is our hope and expectation that clinical guidelines addressing these patient populations will be forthcoming.

Finally, we understand that some clinicians who have practiced anesthesia for decades without using quantitative monitoring may feel that the guidelines are an intrusion, and they may resent being told how to practice the art and science of anesthesia. However, the guidelines[1] represent evidence-based medicine, and the prejudices of 20 yr ago are now much less convincing: let us try to imagine where medicine would be today had we not accepted the progress afforded by new drugs, techniques, or technologies. It is time to internalize the recommendations of these guidelines.

Competing Interests

Dr. Brull has intellectual property assigned to Mayo Clinic (Rochester, Minnesota); is a consultant for Merck & Co., Inc. (Kenilworth, New Jersey); is a principal, shareholder and Chief Medical Officer in Senzime AB (publ; Uppsala, Sweden); and is an unpaid member of the Scientific/Clinical Advisory Boards for The Doctors Company (Napa, California), Coala Life Inc. (Irvine, California), NMD Pharma (Aarhus, Denmark), and Takeda Pharmaceuticals (Cambridge, Massachusetts). Dr. Kopman is not supported by, nor maintains any financial interest in, any commercial activity that may be associated with the topic of this article.

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