

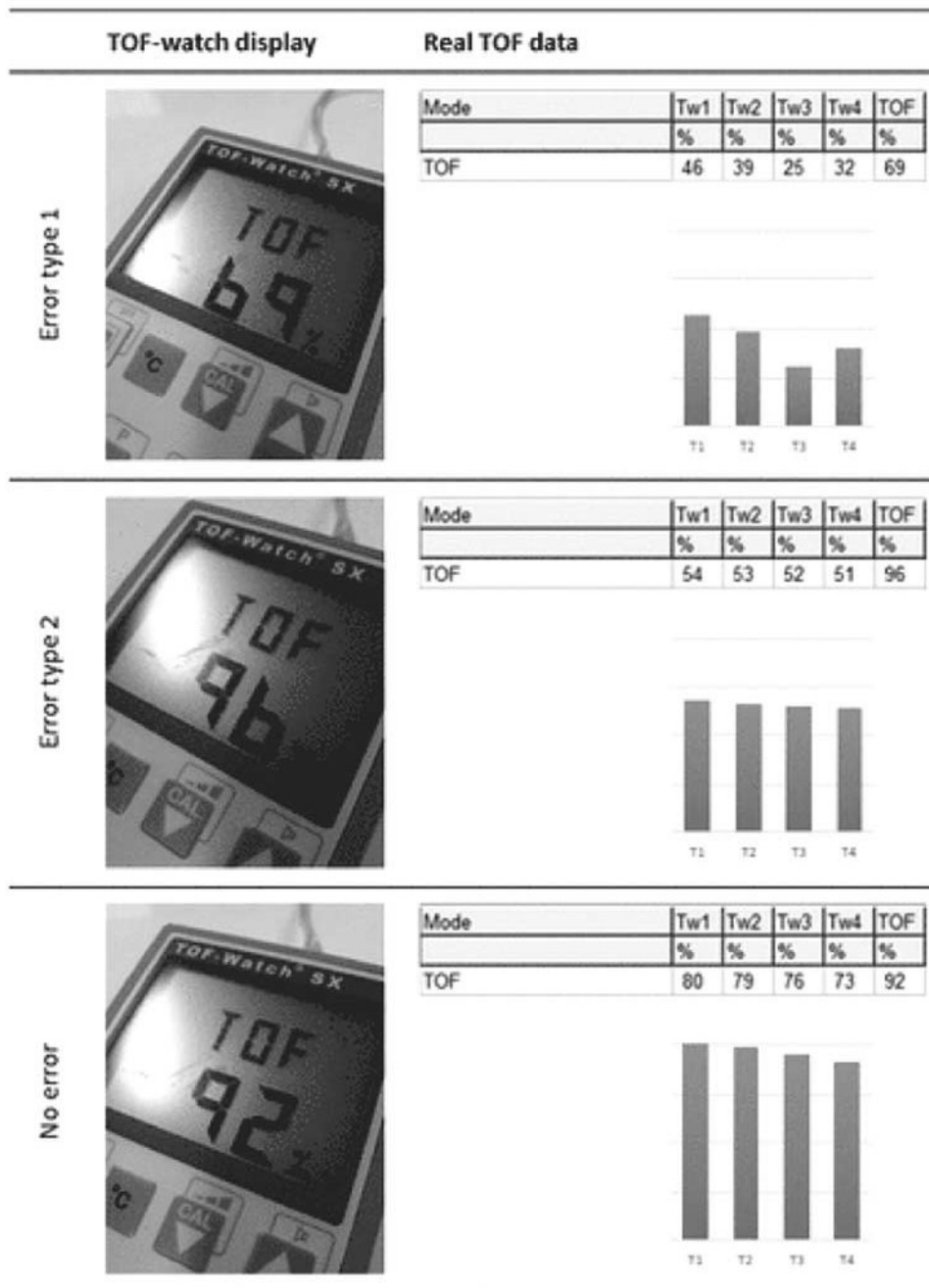
[SNACC-63] Neuromuscular Blockade Monitoring During Cranial or Spinal Surgeries may Contain A High Percentage of Errors that may Affect Adequate Maintenance and Reversal

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Anesthesia-related outcomes for endovascular stroke revascularization: a systematic review and meta-analysis. Neuromuscular blockade (NMB), an important component of general anesthesia, requires objective and accurate

monitoring for adequate titration in surgeries and assure full reversal. Most NMB monitors assess movement of the thumb by accelerometry in response to ulnar nerve electrical stimulation. The thumb must be allowed to move freely, however, in most neurosurgical procedures, patients' arms are positioned along the body, not accessible to direct observation. Movement restriction or other external artefacts, may interfere with the train-of-four (TOF). A TOF response is characterized by the progressive weakening of subsequent twitch responses, known as fade effect ($T1 > T2 > T3 > T4$). The result of dividing the amplitude of the fourth by the first response is the TOF-ratio ($T4/T1$), a parameter clinicians rely to guide dosing. A TOF-ratio > 0.9 is required to reliably

Fig. 1 - Illustration of error analysis for TOF-watch display versus real TOF data results.



guarantee adequate recovery and prevent residual NMB (1,2,3). To assess the occurrence of inaccurate and misleading TOF-ratio values displayed on the monitor, we defined 2 criteria for errors and studied their incidence in neurosurgical procedures. A total of 31 patients scheduled for routine spinal or cranial neurosurgeries under standard NMB, with propofol and remifentanyl TCI, were analyzed retrospectively. Rocuronium, 0.6 mg/kg, was given for tracheal intubation, with further bolus if required. After calibration, NMB monitoring was performed continuously with TOF stimuli every 15 seconds with a TOF-watch SX and data were acquired with TOF-link software. Two types of monitoring errors were studied: (1) display of a TOF value when fade effect on the 4 twitches is not present (invalid $T1 > T2 > T3 > T4$); (2) display, in the 30 minutes before extubation, of a TOF-ratio value > 0.9 (without error type 1) while $T1$ is still below 70%, potentially indicating incomplete recovery. Procedures had 361.2 ± 182.7 TOF stimulations per case, of which 276.2 ± 173.9 were "positive" TOF responses ($TOF > 0$). Error analysis showed: type 1 errors in $42.0 \pm 17.5\%$ of the measurements; type 2 errors were present in $63 \pm 45\%$ of measurements. In the last 30 minutes, it was possible to detect TOF-ratio > 0.9 in all cases, in which 39% of the patients had a persistent type 1 error, 32% had a type 2 error and only 9 patients presented no errors. Figure 1 shows errors detection. Neuroanesthesiologists should be aware of a possible high incidence of inaccurate/misleading TOF-ratio values displayed due to nonfaded TOF responses and low amplitude $T1$ values at recovery. Showing more information about fade effect and the real values of $T1$ - $T4$ is important, as in cases with no direct access to the patients' arms careful evaluation of the NMB is recommended. Additional features should be added to NMB monitors to improve the accuracy of NMB.

References:

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[SNACC-64] Outcomes After Implementation of a Code Stroke Protocol

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Introduction: In response to the 2015 AHA/ASA Guidelines for the Early Management of Patients with Acute Ischemic Stroke (AIS) Regarding Endovascular Treatment (EVT),¹ our institution implemented a Code Stroke protocol in August 2015 to ensure safe and timely treatment for these patients with appropriate level of anesthetic care. Here we present outcome data for patients who underwent EVT, comparing those who received monitored anesthesia care (MAC) with those receiving general anesthesia (GA).

Methods: Between August 2015 and December 2017 124 patients underwent EVT. Outcome measures were survival at discharge and at 90 days follow-up. Seven patients were excluded because of incomplete information, and an additional 5 patients were lost to follow-up at 90 days postdischarge. Outcomes were compared for patients receiving MAC and those receiving GA. MAC is defined as no anesthesia or sedation only and general anesthesia is defined as patients who required endotracheal intubation. Data were analyzed using a χ^2 test. The analysis was repeated after stratifying by National Institutes of Health Stroke Scale (NIHSS) score on presentation (NIHSS < 20 and NIHSS ≥ 20).

Results: The overall survival rate for patients undergoing EVT therapy was 79% (92/117) at discharge and 65% (73/112) at 90 days. A total of 62% received MAC and 38% received GA. The survival rate at hospital discharge for the MAC group was 85% versus 68% for the GA group ($P = 0.038$). The survival rate at 90 days follow-up was 72% for the MAC group and 52% for the GA group ($P = 0.043$). Of the 66 patients whose NIHSS was 0 to 19, survival at hospital discharge was 92% in the MAC group versus 71% in the GA group ($P = 0.03$). For this subset of patients survival at 90 days post-discharge was 88% for the MAC group and 57% for the GA group ($P = 0.04$). For the 51 patients whose NIHSS was 20+, survival at hospital

discharge was 74% for the MAC group versus 65% in the GA group ($P = 0.54$). Survival at 90 days follow-up for this subset was 52% for the MAC group and 47% for the GA group ($P = 0.99$).

Discussion: Initial studies suggested that patients undergoing EVT under GA had worse outcomes than patients who received MAC.² However, a recent meta-analysis of studies evaluating anesthetic techniques for EVT concluded that there is no significant difference in good neurological outcome rates between MAC and GA.³ This initial analysis of outcomes at our institution after implementation of a Code Stroke protocol suggests that patients who undergo EVT with MAC have better survival rates. However, when stratified by NIHSS at presentation the effect of anesthetic technique is only significant effect for patients with milder impairment (NIHSS < 20). For the patients with NIHSS 20 or above, there is no difference in survival between patients receiving MAC or GA. The interpretation of these results is of course limited by the small sample sizes and the statistical results might be impacted by the MAC group being 1.5 times as large as the GA group. Further collection and analysis of data is planned to try to elucidate the possible effects of anesthetic technique for these patients.

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[SNACC-65] Correct EMG Endotracheal Tube Placement in Recurrent Laryngeal Nerve Monitoring: Follow-up on Protocol Efficacy

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Background: Recurrent laryngeal nerve (RLN) injury during neck surgery can cause major morbidity due to vocal cord (VC) dysfunction. VC electromyogram (EMG) is frequently used to locate the RLN and reduce the probability of surgical injury. Errors in the placement of the specialized EMG endotracheal tube (ETT) can result in unreliable information, including false-negative responses. To optimize EMG (ETT) management and reliability of the EMG monitoring, an educational protocol for its proper use was developed and tested at our institution in 2013-2014. The protocol demonstrated a statistically significant difference in the rate of alerts during the testing period compared with the years before implementation. The protocol is the standard of care in our clinical practice since 2015. We hypothesized that the implemented protocol continues to decrease the number of ETT placement errors and the incidence of false alerts due to tube malposition since its incorporation in clinical practice.

Methods: After IRB approval, the University of Colorado Hospital intraoperative neuromonitoring database was queried for all neck surgeries requiring RLN monitoring between January 2015 and December 2018. Extracted data included the number of cases that required EMG monitoring for neck procedures, laryngoscope blade used, and number of patients with alerts. Free running and stimulated EMG (0.2 to 1.0 mA) with a response threshold of 100 V was monitored and continuously recorded by a certified technologist. An alert was defined as a failure to obtain an EMG response when stimulating an anatomically identified RLN. Alerts were compared between 2013-2014 and 2015-2018 using a 2-sample *t* test.

Results: A total of 1088 patients received RLN monitoring between January of 2015 and December of 2018 (Fig. 1). During this same period there was a significant increase in anesthesia personnel (residents, faculty, and CRNA/AA) from 128 to 218. Alerts decreased from 15% to 1.75% of patients as the frequency of video laryngoscope use increased from 15% to 91% of the monitored procedures during the testing period. During the 4 following years of incorporation of the protocol to clinical practice, the averaged alerts was 2.7% (SD=0.47) with a concomitant video laryngoscope use of 97%. Alerts were compared between 2013-2014 (mean=1.9, SD=0.57)