

A632

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Room Hall C-Area B

Subjective Evaluation of Discomfort to Train-of-Four Monitoring in Volunteers

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Background. The use of neuromuscular blocking agents (NMBAs) has revolutionized surgery by facilitating procedures that would not otherwise be possible. At the same time, the use of NMBAs has introduced significant patient safety issues, such as incomplete reversal and residual paralysis. Monitoring of neuromuscular responses has been advocated for > 60 years, yet adverse events (critical respiratory events, emergent re-intubation) continue to be reported as a result of failing to monitor (1). One of the limitations of testing of post surgical or intensive care unit (awake) patients is the discomfort associated with nerve stimulation. The aim of this IRB-approved investigation was to examine the subjective discomfort elicited by a prototype quantitative monitor that uses lower current intensities.

Methods. In 10 consenting volunteers (8F/2M, aged 26-44 yo, ASA 1-3, Wt. 122-215 lbs) single twitch (ST) and train-of-four (TOF) ratios were recorded by the prototype monitor. ST stimuli were delivered at varying currents, from threshold (Th, the lowest current eliciting a muscle contraction) to high amplitude (Max=Th+12 mA, the current level at which the evoked response usually reached plateau). TOF stimuli were delivered at 5 mA below Max current amplitude. For all stimulations, the stimulus pulse width was constant at 200 μ sec. Stimulating surface bar-type electrodes were placed along the ulnar and median nerves on the distal volar right and left forearms, and recording surface electrodes were placed on the thenar eminence to record responses of the adductor pollicis muscle (APM). ST stimulation was started at 1 mA, and increased in 2 mA steps until a distinct and reproducible EMG threshold (Th) response was observed. Then, ST responses were recorded while stimulus amplitude increased from Th in 3 mA increments. Monitoring of ST ended when the stimulus amplitude reached 12 mA above Th, at which point a plateau (Max) in the amplitude of evoked muscle response had generally been achieved. TOF stimuli were next delivered sequentially to both ulnar and median nerves of both left and right arms. The level of discomfort associated with ST and TOF stimulation was rated by the volunteers on an 11-point visual analog score (VAS) scale, anchored with 0 = no pain and 10 = worst pain ever experienced. Volunteers chose a number (0 to 10, whole numbers only) that best represented their level of discomfort. Data from one volunteer was replaced in the analysis because of misunderstanding of VAS rating instructions.

Results. The mean ST Th current delivered was 14.2 ± 4.7 mA (range, 6-27 mA), and the mean ST Max current delivered was 26.1 ± 4.5 mA (range, 18-39 mA). The mean TOF current was 22.1 ± 4.9 mA (range, 13-39 mA). The VAS scores for the ST Th, ST Max and TOF are shown in Fig 1.

Discussion. Previous investigations of the discomfort associated with neurostimulation reported median VAS values of 5.0 in response to TOF stimulation at 50 mA (range, 1-10), and reported that one volunteer discontinued participation because of the discomfort (2). None of the 10 volunteers in our pilot reported VAS scores >6, and none wished to discontinue the study. Data show that ST testing with Max current, and TOF testing at 5 mA below Max current elicit very mild discomfort, as evidenced by median VAS scores of 2.0 and 2.5, respectively (range, 0-6). The prototype monitor appears to elicit less neurostimulation discomfort in awake, unpremedicated volunteers than traditional nerve stimulators that employ higher current intensities (70 mA).

References

- 1) Anesth Analg 2008;107: 130-7
- 2) Anesth Analg 1990;70: 650

Figure 1



