Comparative Investigation of AMG and EMG Based Neuromuscular Monitors

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Background

An international panel of experts of neuromuscular (NM) monitoring has recently recommended that quantitative NM monitoring should be used whenever NM blocking agents are administered.[1] However, the authors also acknowledged that there are several obstacles to the universal application of quantitative NM monitoring at the moment. One of them is the paucity of easily applicable, reliable NM monitors. TetraGraph (Senzime AB, Uppsala, Sweden) is a new, easy to use electromyography-based (EMG) neuromuscular monitor. The aim of this pilot study was to compare the TetraGraph to the acceleromyography-based (AMG) Philips IntelliVue NMT module (Philips, Amsterdam, the Netherlands) in the clinical setting and examine the agreement between the train-of-four ratios (TOFR) obtained with the two devices.

Methods

After Institutional Review Board of Mayo Clinic, Florida (IRB#17-006680) approval, 50 patients were consented and recruited. When performing AMG, the ulnar nerve was stimulated via surface electrocardiography electrodes. A preload hand adaptor was applied and the piezoelectric probe was attached to the thumb. When performing EMG, the device's dedicated TetraSens strip electrode (Senzime AB, Uppsala, Sweden) was used. The stimulating electrodes were placed along the ulnar nerve on the volar forearm and the recording electrodes were placed over the adductor pollicis muscle and the interphalangeal joint of the thumb (Figure 1). After induction of anesthesia but prior to NM blocking agent administration, the devices were calibrated to determine the supramaximal stimulating current. The devices were allowed to run simultaneously in both arms in TOF mode until tracheal extubation. The variability of baseline measurements and the correlation between the two recovery TOFR data sets were examined.

Figure 1

Results

Due to technical difficulties, 13 patients' data were excluded from final analysis. The reasons for exclusion were failure to calibrate (AMG: 10 cases, EMG: 4 cases) and failure to operate (AMG: 8 cases, EMG: 2 cases). The demographic parameters of the 37 patients included in analysis were as follows: age: 50 ± 16 years; male: female ratio 17 : 20; BMI: 27 ± 5. The EMG derived baseline TOFRs were closer to the ideal 100 value and showed a narrower dispersion: EMG TOFR median (range) 102 (90 - 109) vs. AMG TOFR median (range) 106 (83 - 168), p = 0.006 (Figure 2). There was moderate agreement in the recovery TOFRs obtained with the two methods: the bias was -8.41 ± 1.4 SE with wide limits of agreement (-38.96 to +22.14) (Figure 3). Normalization of the recovery TOFRs to baseline values reduced the bias (-3.66 ± 2.33 SE) between the two methods, but the limits of agreement remained wide (-38.82 to +31.49). The EMG and AMG generally yielded reasonable. An example of one subject's TOFR values can be seen in Figure 4.

Conclusions

The TetraGraph monitor yielded comparable TOFR to the AMG-based Philips Intellivue monitor during recovery from NM blockade. The AMG monitor failed to calibrate and did not provide quantitative data more frequently than the TetraGraph device. Furthermore, we also found the TetraGraph setup time to be shorter as it auto-calibrates and does not require a preload hand adaptor.

Figure 2

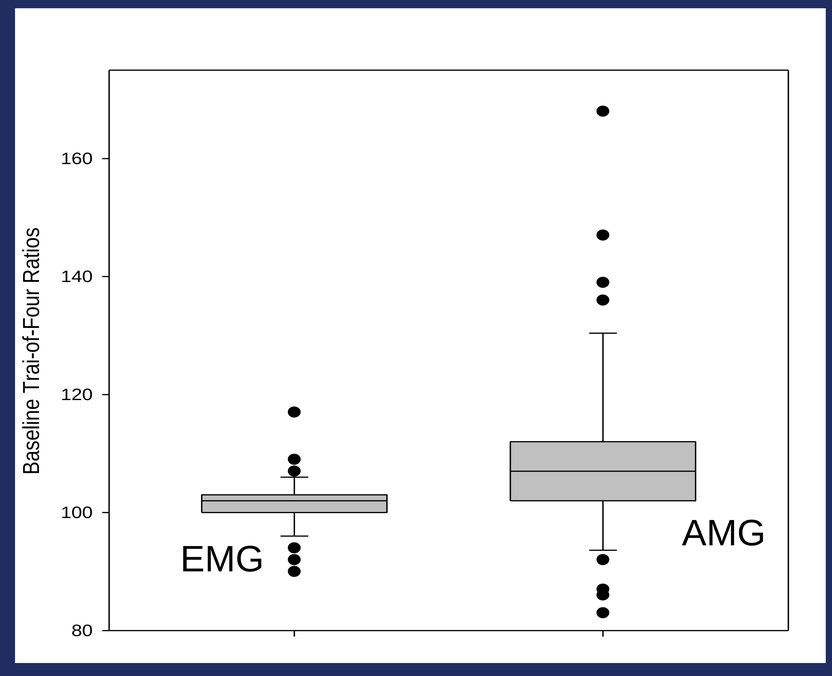

Figure 3

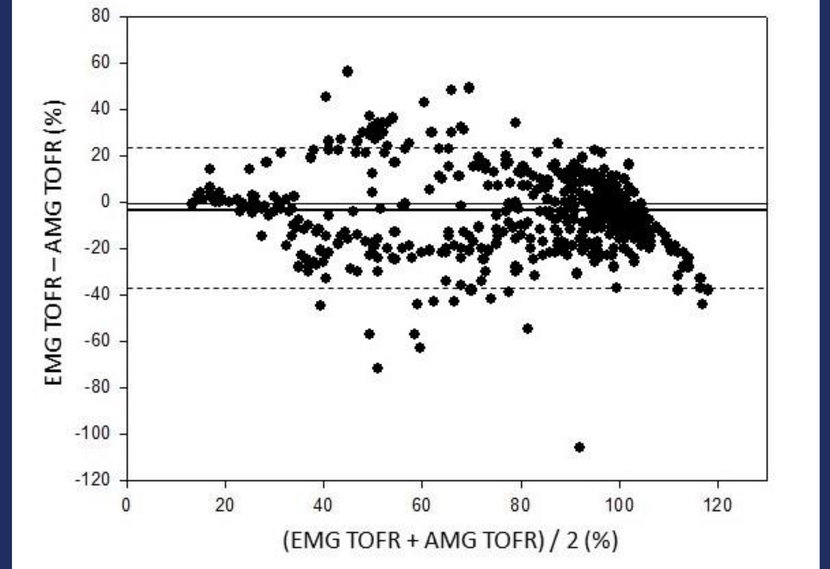

Figure 4

References

[1] Naguib M, et al. Consensus Statement on Perioperative Use of Neuromuscular Monitoring. Anesth Analg. 2018 Jul;127(1):71-80.