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The Influence of EMG-Based Quantitative TOF Monitoring on Clinical Decision Making

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INTRODUCTION

Adequate reversal of neuromuscular blockade (NMB) has been defined as a train-of-four (TOF) ratio ≥ 0.9 when assessed by quantitative means at the adductor pollicis. Quantitative TOF measurements based on mechanical motion of the thumb have not gained widespread acceptance in clinical practice due to several inherent limitations of the technique. As a result, qualitative TOF measurements remain the standard of practice despite the fact that clinicians are unable to detect differences in TOF ratio > 0.4 by visual or manual assessment.

Commercial electromyography (EMG) TOF monitors are now available which avoid many of the limitations of quantitative TOF measurements based on physical motion. The purpose of this study was to assess the impact of EMG-based quantitative TOF (EQTOF) monitoring on clinical decision making as part of a cost-benefit analysis.

METHODS

An EQTOF monitor was used to guide NMB management during 38 randomly selected general anesthetics requiring the administration of non-depolarizing NMB. Prior to each case the clinical team was instructed on the device function and the appropriate interpretation of results. During each case, the administration of reversal agents was guided by EMG TOFR with a goal of achieving a T4:T1 ratio > 0.9 prior to extubation. For each patient the administration of NMB and reversal agents was recorded in addition to basic patient demographics.

A survey was formulated using these 38 patient cases. For each patient, survey respondents were asked to make clinical decisions regarding NMB reversal based on the following factors: gender, age, weight, anesthetic duration, type and dose of NMB agent administered, and qualitative TOF assessment immediately prior to reversal. The respondents were blinded to the EQTOF measurements. Respondents included 30 randomly selected individuals from the department's clinical staff including the anesthesiology residents, CRNAs, and attending faculty (10 from each group).

The primary outcome involved a comparison of the clinical decisions made by each patient's care team who had access to the EQTOF data versus the clinical decisions of the survey respondents based on traditional parameters.

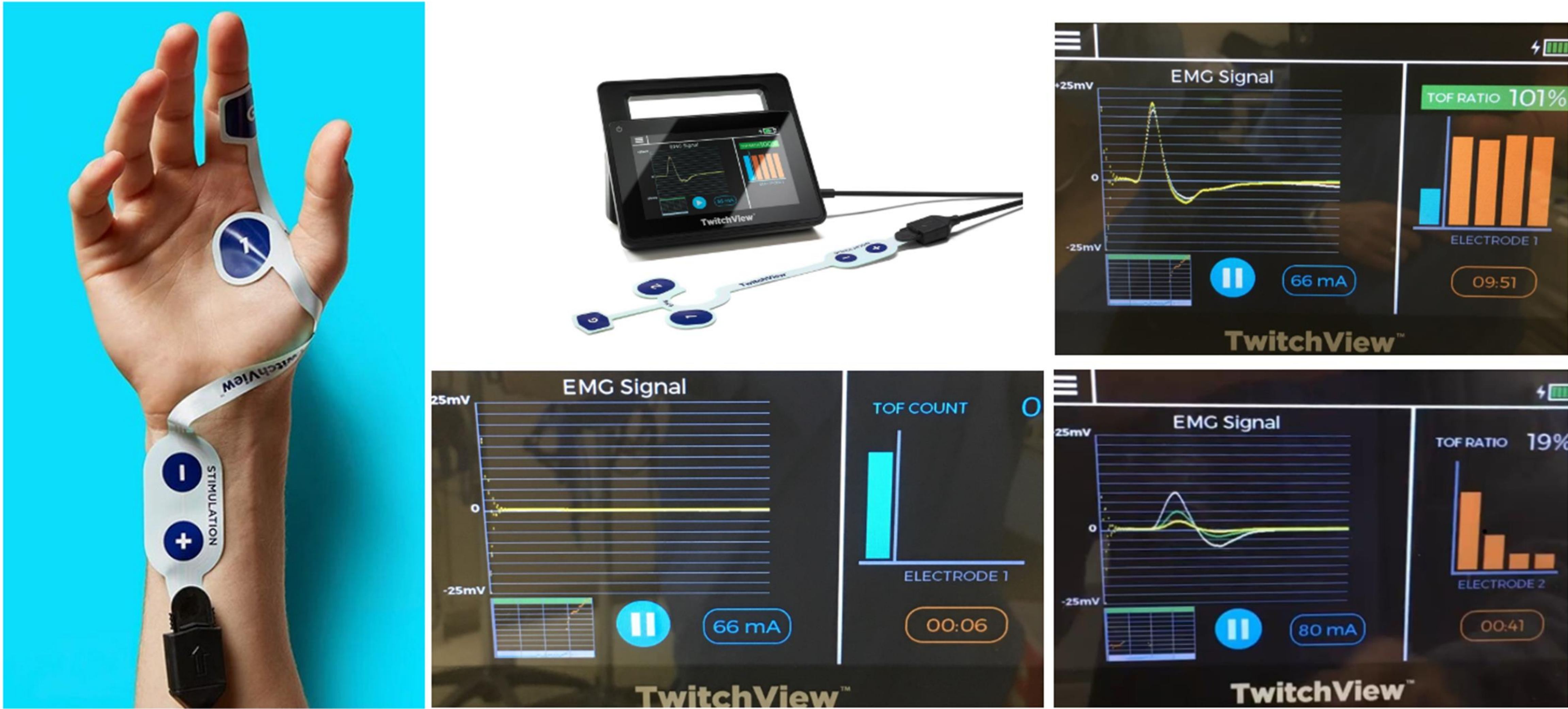**Figure 1: TwitchView EMG-Based Quantitative TOF Monitoring**

Table 1: Responses from blinded participants vs clinical providers

	Number	Percentage
Total # of EMG TOF Patients	38	
Total # of decisions (reverse vs not) amongst survey respondents	1140	
Overall agreement between survey respondents and EMG TOF	843 / 1140	74%
Appropriate administration of reversal by respondents (EMG TOF < 0.9)	843 / 900	94%
Appropriate withholding of reversal by respondents (EMG TOF > 0.9)	37 / 240	15%
Survey respondents indicating need for sugammadex	45 / 900	5%
Number of EMF TOF guided reversals using sugammadex	0	0%
Neostigmine dose: survey respondents versus EMG TOF		
Less than	247 / 843	32%
Equal to	231 / 843	30%
More than	259 / 843	34%

RESULTS

The total number of individual decisions to reverse or not reverse NMB amongst survey respondents was 1140. A total of 843 (74%) survey responses were in agreement regarding the need for reversal when compared to the clinical decision guided by EQTOF. When EQTOF indicated a need for reversal (T4:T1 < 0.9) a total of 94% of survey responses indicated that reversal would be given. Conversely, when EQTOF indicated that no reversal was necessary (T4:T1 > 0.9) only 15% of survey responses indicated that reversal would be withheld based on traditional parameters.

When both EQTOF based decision making and survey respondents agreed on the need for neostigmine administration, the dose provided by survey respondents was greater than (34%) or less than (32%) the dose provided when guided by EQTOF in the majority of patients.

Sugammadex administration was not deemed necessary in any of the cases managed clinically by EQTOF, but was selected as the reversal of choice in 45 survey responses.

CONCLUSIONS

The use of EQTOF results in more targeted use of NMB reversal and precise dosing of reversal agents. Traditional decision-making parameters may lead clinicians to forgo any NMB reversal in a small but clinically important number of cases where residual NMB persists. EQTOF also may also provide the confidence to avoid reversal agents in those cases where it is not required (T4:T1 > 0.9).

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