TETRAGRAPH

Clinical Summary

Intubating Conditions Guided by Quantitative Neuromuscular Monitoring

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Renew JR, Estevez M, Maramba M, Heckman MG, Fang ZJ, Brull SJ, Epstein RH.

Intubating conditions based on the time from rocuronium administration versus the train-of-four count: A randomized, prospective clinical trial.

Journal of Clinical Anesthesia. 2026;108:112066.

Background:

Quantitative neuromuscular monitoring is recommended to confirm adequate recovery from neuromuscular block, yet its role during induction of anesthesia has not been well described. In routine practice, the decision to proceed with tracheal intubation is often based on a fixed time interval after neuromuscular blocking agent (NMBA) administration rather than an objective measurement of neuromuscular effect. Given the known interpatient variability in NMBA onset, reliance on elapsed time alone may result in suboptimal intubating conditions.

Objective:

To compare intubating conditions when tracheal intubation is guided by quantitative train-of-four (TOF) monitoring versus a fixed time interval following rocuronium administration.

Methods:

Design: Prospective, randomized clinical trial

Population: 167 adult patients undergoing elective surgery requiring neuromuscular block. The stimulating electrodes were placed over the ulnar nerve proximally to the wrist crease.

Intervention: Rocuronium 0.6 mg/kg following induction of anesthesia

Groups:

- Time Group: Intubation initiated 2 minutes after rocuronium administration
- Count Group: Intubation initiated when quantitative TOF count ≤1

Monitoring: Quantitative electromyographic (EMG) neuromuscular monitoring applied prior to induction

Primary Endpoint: Proportion of patients achieving ideal intubating conditions (relaxed jaw, abducted vocal cords, no response to intubation)

Key Findings:

- Higher rate of ideal intubating conditions was achieved when intubation was guided by TOF count rather than elapsed time:
  - 73% in the TOF-guided group vs. 57% in the time-based group ($P = 0.036$)
- Overall intubating conditions were significantly better when guided by quantitative monitoring (lower composite intubation scores, $P = 0.016$)
- A significant correlation was observed between depth of neuromuscular block (T1/Tc ratio) and intubating conditions ($\rho = 0.34$, $P < 0.001$)
- Substantial interpatient variability was observed in time to adequate neuromuscular block, reinforcing the limitations of time-based decision-making

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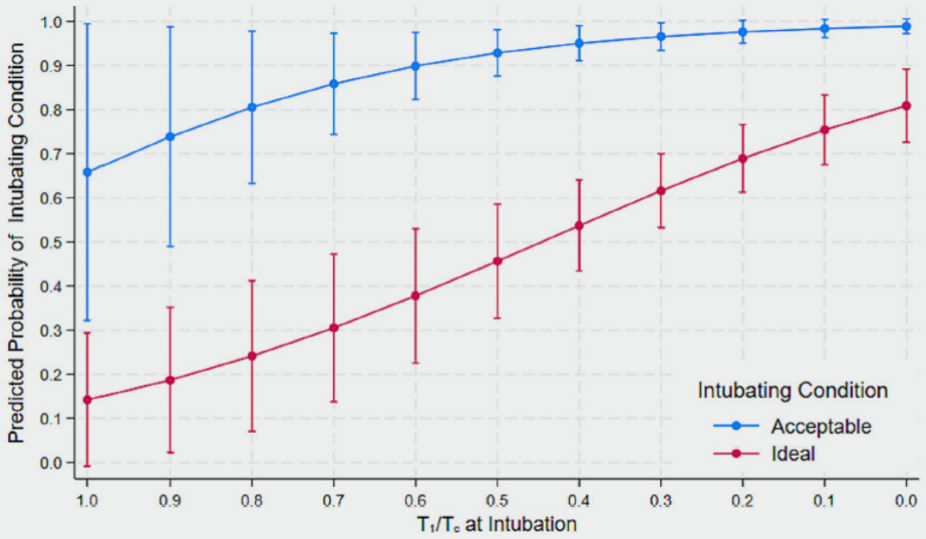

Credit: J.R. Renew et al. *JournalofClinicalAnesthesia*108(2026)112066

Relationship between T1/Tc and the Composite Intubating Score. At the time of intubation, the ratio of the amplitude of the first twitch (T1) in the train-of- four (TOF) sequence to the baseline first twitch amplitude (Tc) was compared to the predicted probability of ideal (composite intubation score of 3) or acceptable (composite intubating score between 3 and 6), as modeled by logistic regression. Acceptable conditions are plotted in blue and ideal conditions in red. Error bars are the 95 % confidence intervals.

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Conclusion

Guiding tracheal intubation using quantitative neuromuscular monitoring to confirm sufficient neuromuscular block resulted in significantly better intubating conditions compared with waiting a fixed time after rocuronium administration. These findings support extending the use of quantitative monitoring beyond recovery and into the induction phase of anesthesia.

Clinical Relevance

This study demonstrates that objective neuromuscular measurements, rather than elapsed time alone, better predict optimal intubating conditions. Incorporating quantitative monitoring at induction may improve airway conditions, reduce variability in clinical practice, and further align with guideline-supported, data-driven anesthesia management.

Next-Generation TetraGraph® with EMGINE™

Supporting Objective Readiness for Intubation

Building on evidence that quantitative neuromuscular data may facilitate assessment of intubation conditions, the next-generation TetraGraph® powered by EMGINE™ introduces the Intubation Readiness Indicator—a software-driven feature designed to help clinicians objectively assess when neuromuscular block is sufficient to proceed with airway management.

By integrating high-fidelity EMG signal acquisition with advanced signal processing, EMGINE provides clear, actionable insight into neuromuscular status during induction—supporting consistent, data-driven decision-making in a phase of anesthesia traditionally guided by time and subjective assessment.

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