



# QUANTITATIVE NEUROMUSCULAR MONITORING CAN REDUCE THE INCIDENCE AND SEVERITY OF RESIDUAL NEUROMUSCULAR BLOCK

POST-OPERATIVE RESIDUAL PARALYSIS (RP) IS UNDER RECOGNISED.

VISUAL OR TACTILE ASSESSMENTS OF NEUROMUSCULAR FUNCTION ARE NOT RELIABLE.



Adequate recovery from neuromuscular block = return of train-of-four ratio (TOFR) to >0.9.

**40-83 %** of cases don't reach this TOFR threshold and initial recovery is insufficient<sup>1</sup>.

### Consequences of RP:

- ↑ Increased post-operative complications, mortality and morbidity
- ↑ Increased length of hospital stay
- ⚙️ Patient distress
- 🫁 Risk of critical respiratory events in post-anaesthesia care
- 👤 Reintubation



Qualitative, subjective and dependent on the anaesthetist.



Residual block of TOFR >0.4 can't be reliably detected, even by an experienced anaesthetist<sup>2</sup>.



### Frequently misinterpreted as adequate recovery:



Ability to lift the head



Normal tidal volume possible with TOFR <0.1.



Firm handshake



Patients can lift the head and hold a firm handshake for five seconds with TOFR = 0.33.



Sufficient minute ventilation of an intubated patient

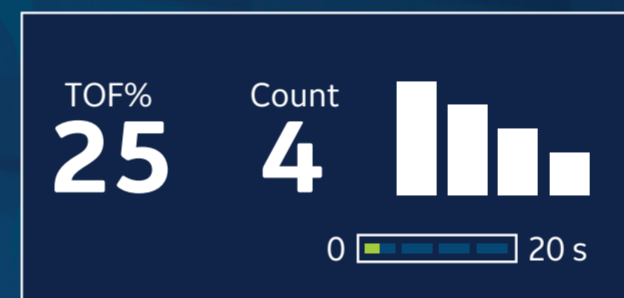


Normal vital capacity possible with TOFR = 0.6.

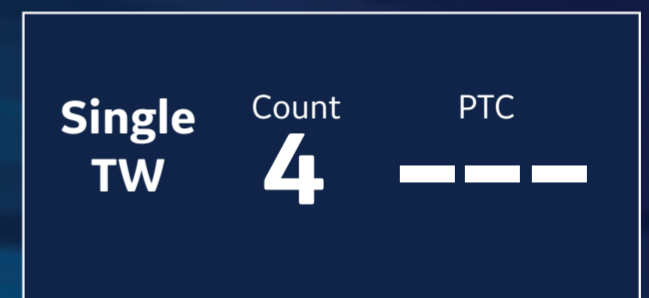
## QUANTITATIVE MONITORING IS NECESSARY TO ACCURATELY ASSESS NEUROMUSCULAR BLOCK.

- The only suitable method to identify low but clinically meaningful levels of residual neuromuscular block.
- The only suitable method to guide optimal dose and timing of reversal agents.
- Strongly recommended by the FSA, IC SFAR and APSF.
- Electromyography (EMG) is the gold standard:
  - high correlation with mechanomyography.
  - EMG devices offer advantages over other categories of monitoring devices<sup>1</sup>.
  - captures the very clean first electric signal available directly at the neuromuscular junction.

Specifically, two main stimulation modes are used for different phases of block: TOF and PTC.



TOFC = number of elicited contractions  
TOFR = ratio of 4<sup>th</sup>:1<sup>st</sup> twitch response



PTC (post-tetanic count)  
Used if there is no response to TOF or a single twitch (eg. in profound non-depolarising block)

Four stimulation pulses are generated at 0.5 second intervals. The response is measured after each stimulus, and the ratio of the fourth to the first response of the TOF sequence is calculated, resulting in TOF%.

Tetanic stimulation is a continuous stimulation of five seconds. After tetanic stimulation, single twitch stimulations are generated. The number of detected responses is counted and expressed as PTC. The fewer the responses, the deeper the relaxation.

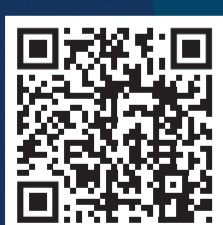


## QUANTITATIVE NEUROMUSCULAR MONITORING GIVES A RATIONAL BASIS FOR REVERSAL AGENT AND DOSE DECISIONS<sup>3,4</sup>.

- At TOFR <0.9, residual neuromuscular block is present and needs to be treated, either by waiting or by giving the patient a reversal drug such as neostigmine or sugammadex.
- Dose, timing and choice of reversal drug are crucial for achieving complete neuromuscular recovery and minimising side effects.

Depth of block	Quantitative measurement	Neostigmine (µg/kg)	Sugammadex (mg/kg)
Complete block	PTC = 0	Not effective	16
Deep block	PTC ≥ 1	Not effective	4
Moderate block	TOFC = 1-3	Not effective	2
Shallow block	TOFC = 4 TOFR <0.2	50-70	1*-2
Shallow/minimal block	TOFR: 0.2-0.5	40	0.75*-2
Minimal block	TOFR: 0.5-0.7	20	0.25*-2
Minimal block	TOFR: 0.7-0.9	10	

\*These doses have been determined in dose-finding studies, and have not been tested in comparative clinical trials. They are not recommended by the manufacturer. Please note that the use of low-dose sugammadex has been questioned, since elderly patients are at greater risk for recurarisation and residual muscle paralysis when low-dose sugammadex is administered.



## OUTCOMES



INCREASED LIKELIHOOD OF COMPLETE NEUROMUSCULAR RECOVERY<sup>5</sup>



OPTIMAL DOSE AND INJECTION TIME OF REVERSAL AGENT<sup>1</sup>



ENHANCED PATIENT EXPERIENCE<sup>6</sup>



COST-EFFECTIVE PATIENT THROUGHPUT<sup>3</sup>

References: 1. Naguib M, Bruhl SJ, Kopman AF, Hunter JM, Fulesdi B, Arkes HR, Elstein A, Todd MM, Johnson KB. Consensus Statement on Perioperative Use of Neuromuscular Monitoring. Anesth Analg 2018;127:71-80.  
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6. Benoit Plaud, Bertrand Debaene, François Donati, Jean Marty. Residual Paralysis after Emergence from Anesthesia, Anesthesiology 2010;1013-1022.