Quantitative TOF Monitoring

YOUR GUIDE TO

Clinical Society Guidelines
& Expert Recommendations

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Empowering safe, efficient patient care

Every year millions of patients are affected by postoperative respiratory complications. By using quantitative TOF neuromuscular monitoring, you can reduce the risk of complications, such as residual neuromuscular block (RNMB). This enables you to deliver safer, more efficient patient care.

Recommendations

Most society and clinical guidelines—including ASA and ESAIC—support the use of quantitative TOF neuromuscular monitoring.

Resources

Access	Access a clinical evidence bibliography on quantitative monitoring at senzime.com/clinical-bibliography.
Check out	Check out a blog, a video or a recent webinar about quantitative TOF monitoring at senzime.com/elevate-your-practice.
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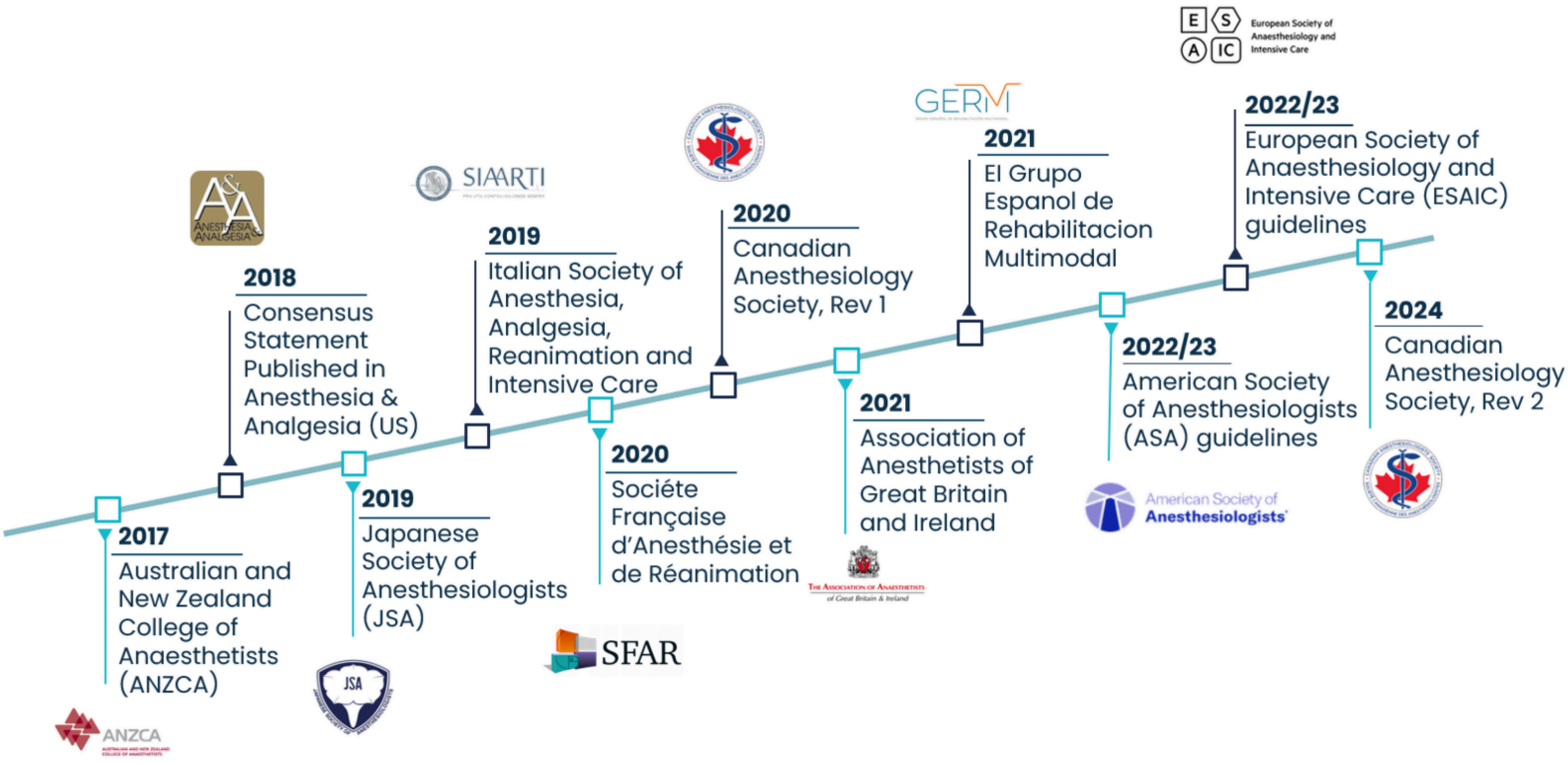
Widespread clinical guidelines in support of quantitative TOF neuromuscular monitoring



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Joint Letter to the Editor from the American Society of Anesthesiologists and the European Society of Anaesthesiology and Intensive Care on Management of Neuromuscular Blockade [1]

The two leading societies in anesthesiology, ASA and ESAIC, jointly recommends the following:

- Using stimulation of the ulnar nerve–one of the nerves in the hand–with quantitative neuromuscular monitoring at the thumb
- Confirming a TOF ratio greater than or equal to 0.9 before extubation
- Restructuring the clinical environment by placing quantitative monitors in all anesthetizing locations
- Appointing a local champion who is supported by leaders

To meaningfully improve patient care and outcomes, these guidelines must be implemented widely through a systematic approach.

Press release from ESAIC and ASA,
June 4, 2023

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American Society of Anesthesiologists (ASA) Guidelines [2]

1. When neuromuscular blocking drugs are administered, we recommend against clinical assessment alone to avoid residual neuromuscular blockade, due to the insensitivity of the assessment.

2. We recommend **quantitative monitoring over qualitative assessment to avoid residual neuromuscular blockade**.

3. When using quantitative monitoring, we recommend confirming a train-of-four ratio greater than or equal to 0.9 before extubation.

4. We recommend using the adductor pollicis muscle for neuromuscular monitoring.

5. We recommend against using eye muscles for neuromuscular monitoring.

6. We recommend sugammadex over neostigmine at deep, moderate, and shallow depths of neuromuscular blockade induced by rocuronium or vecuronium, to avoid residual neuromuscular blockade*.

7. We suggest neostigmine as a reasonable alternative to sugammadex at minimal depth of neuromuscular blockade.

8. To avoid residual neuromuscular blockade when atracurium or cisatracurium are administered and qualitative assessment is used, we suggest antagonism with neostigmine at minimal neuromuscular blockade depth. In the absence of quantitative monitoring, at least 10 min should elapse from antagonism to extubation. When quantitative monitoring is utilized, extubation can be done as soon as a train-of-four ratio greater than or equal to 0.9 is confirmed before extubation.

*Deep: post-tetanic count greater than or equal to 1 and train-of-four count 0; moderate: train-of-four count 1 to 3; shallow: train-of-four count 4 and train-of-four ratio less than 0.4; minimal: train-of-four ratio 0.4 to less than 0.9.

European Society of Anaesthesiology and Intensive Care (ESAIC) Guidelines [3]

R1. We recommend using a muscle relaxant to facilitate tracheal intubation (1A).

R2. We recommend the use of muscle relaxants to reduce pharyngeal and/or laryngeal injury following endotracheal intubation (1C).

R3. We recommend the use of a fast-acting muscle relaxant for rapid sequence induction intubation (RSII) such as succinylcholine 1mg kg-1 or rocuronium 0.9 to 1.2mg kg-1 (1B).

R4. We recommend deepening neuromuscular blockade if surgical conditions need to be improved (1B).

R5. There is insufficient evidence to recommend deep neuromuscular blockade in general to reduce postoperative pain or decrease the incidence of peri-operative complications (2C).

R6. We **recommend the use of ulnar nerve stimulation and quantitative neuromuscular monitoring** at the adductor pollicis muscle to exclude residual paralysis (1B).

R7. We recommend using sugammadex to antagonise deep, moderate and shallow neuromuscular blockade induced by aminosteroidal agents (rocuronium, vecuronium) (1A).

R8. We recommend advanced spontaneous recovery (i.e. TOF ratio >0.2) before starting neostigmine-based reversal and **to continue quantitative monitoring of neuromuscular blockade until a TOF ratio of more than 0.9 has been attained** (1C).

The 2024 revision of Norwegian Standard for the Safe Practice of Anaesthesia [4]

5 | MONITORING AND EQUIPMENT REQUIREMENTS IN ANAESTHESIA

The patient must be continuously monitored during and after anaesthesia. The monitoring must be adjusted to the patients' condition and the nature of the intervention, but as a minimum include the following:

In sedation:
1. Pulse oximeter.
2. Clinical assessment of level of consciousness, respiration and circulation.

Capnography or similar must be considered for use in nonconscious sedation.

Regional anaesthesia (central or peripheral) also includes:

1. ECG.
2. Blood pressure measurement.

In addition, general anaesthesia monitoring includes:

1. Oxygen alarm in the ventilation system.
2. Capnography.
3. Disconnection alarm when using a ventilator.
4. Multi-gas analysis when using inhaled anaesthestics.
5. Neuromuscular monitoring when using non-depolarising muscle relaxants.

Canadian Guidelines to the Practice of Anesthesia - Revised Edition 2024 [5]

5.5 Required Monitoring Equipment

Monitoring equipment is classified as follows:

- Required: these monitors must be in continuous use throughout the administration of all anesthetics.
- Exclusively available for each patient: these monitors must be available at each anesthetic workstation so that they can be used with no delay.
- Immediately available: these monitors must be available to facilitate their use without undue delay.

The following monitoring equipment is required:

- Pulse oximeter
- Apparatus to measure blood pressure, either directly or noninvasively
- Electrocardiography
- **Neuromuscular blockade monitor when neuromuscular blocking drugs are used**
- Capnography for general anesthesia and to assess the adequacy of ventilation for moderate or deep procedural sedation
- Agent-specific anesthetic gas monitor, when inhalational anesthetic agents are used
- Tidal volume and airway pressure monitoring.

Guideline from the Association of Anaesthetists [6]

Recommendations for standards of monitoring during anaesthesia and recovery 2021

1. Adequate supervision requires that an anaesthetist should be present throughout the conduct of anaesthesia or the administration of procedural sedation*.

2. General anaesthesia requires minimum monitoring of ECG, SpO2, NIBP and capnography, which should be checked for correct function and begun before induction of anaesthesia and continue throughout anaesthesia, transfer to the post-anaesthesia care unit (PACU) and recovery. Age-adjusted minimum alveolar concentration (MAC) should be monitored during use of inhaled anaesthetic drugs. Capnography should be continued until any artificial airway is removed and a response to verbal contact re-established.

3. Regional anaesthesia requires minimum monitoring of ECG, NIBP and SpO2 which should begin before the procedure, and should be continued for at least 30 min after block completion.

4. Procedural sedation requires minimum monitoring of ECG, SpO2 and NIBP. Capnography should be used during procedural sedation whenever there is loss of response to verbal contact.

5. Transfer requires minimum monitoring of ECG, SpO2 and NIBP. If an airway device remains in place capnography should be used during the transfer of anaesthetised or sedated patients, including from the operating theatre to the PACU.

6. **Quantitative neuromuscular monitoring should be used whenever neuromuscular blocking (NMB) drugs are administered, throughout all phases of anaesthesia from before initiation of neuromuscular blockade until recovery of the train-of-four ratio to > 0.9 has been confirmed.**

7. Processed electroencephalogram (pEEG) monitoring should be used when total intravenous anaesthesia (TIVA) is administered together with a NMB drug. It should start before induction and continue at least until full recovery from the effects of the neuromuscular blockade has been confirmed. It should be considered during other anaesthetic techniques including inhalational anaesthesia and for the high-risk patient.

8. Capillary blood glucose and ketone monitoring should be immediately accessible in every location where patients are anaesthetised and blood glucose should be measured at least hourly in patients with treated diabetes.

9. Alarm limits for all equipment should be set to patient specific values before use. Audible alarms should be enabled during anaesthesia.

10. An anaesthetic record should be made with an accurate summary of information provided by all monitoring devices. We recommend automated electronic anaesthetic record systems and that these be integrated into the hospital's electronic health record system.

11. Additional equipment and monitoring that anaesthetists should have access to should include blood gas analysis and haemoglobin measurement and flexible bronchoscopy (for confirmation of tube placement in the airway).

CONSENSUS STATEMENT: Perioperative Neuromuscular Blockade. 2020 update of the SEDAR recommendations [7]

SEDAR, Sociedad Española de Anestesiología y Reanimación (Spanish Society of Anesthesiology and Intensive Care)

The authors presented an update of the 2020 Recommendations on neuromuscular blockade of the SEDAR. The previous ones were dated 2009.

Methods: A modified Delphi consensus analysis (experts, working group, and previous extensive bibliographic revision) was performed and 10 recommendations were produced:

1. Neuromuscular blocking agents are recommended for endotracheal intubation and to avoid pharyngo-laryngeal and tracheal lesions, including in critical care patients.

2. We recommend not to use neuromuscular blocking agents for routine insertion of supraglottic airway devices, and to use it only in cases of airway obstruction or endotracheal intubation through the device.

3. We recommend the use of a rapid action neuromuscular blocking agent with a hypnotic for rapid sequence induction of anesthesia.

4. We recommend profound neuromuscular block in laparoscopic surgery.

5. We **recommend quantitative monitoring of neuromuscular blockade during the entire surgical procedure**, provided neuromuscular blocking agents have been used.

6. We recommend quantitative monitoring through ulnar nerve stimulation and response evaluation of the adductor pollicis brevis, acceleromyography being the clinical standard.

7. We recommend recovery of neuromuscular block of at least TOFr ≥0.9 to avoid postoperative residual neuromuscular blockade.

8. We recommend drug reversal of neuromuscular block at the end of a general anesthetic, before extubation, provided a TOFr ≥0.9 has not been reached.

9. We recommend choosing anticholinesterases for neuromuscular block reversal only if TOF ≥2 and a TOFr ≥0.9has not been attained.

10. We recommend choosing sugammadex instead of anticholinesterases for reversal of neuromuscular blockade induced with rocuronium.

Guidelines on muscle relaxants and reversal in anaesthesia [8]

SFAR, Société Française d'Anesthésie et de Réanimation (French Society of Anaesthesia and Intensive Care)

The panel of experts focused on eight questions:

(1) In the absence of difficult mask ventilation criteria, is it necessary to check the possibility of ventilation via a facemask before muscle relaxant injection? Is it necessary to use muscle relaxants to facilitate facemask ventilation?

R1.1 – It is probably not recommended to verify the possibility of mask ventilation before administering a muscle relaxant.

R1.2 – It is probably recommended to administer a muscle relaxant to facilitate facemask ventilation.

(2) Is the use of muscle relaxants necessary to facilitate tracheal intubation?

R2.1 – The use of a muscle relaxant is recommended to facilitate tracheal intubation.

R2.2 – The use of a muscle relaxant is recommended to reduce pharyngeal and/or laryngeal injury.

R2.3 – Administration of a short-acting muscle relaxant for rapid-sequence induction is probably recommended.

(3) Is the use of muscle relaxants necessary to facilitate the insertion of a supraglottic device and management of related complications?

R3.1 – Routine use of a muscle relaxant to facilitate the insertion of a supraglottic device is probably not recommended.

R3.2 – Administration of a muscle relaxant in case of airway obstruction related to a supraglottic device is probably recommended.

(4) Is it necessary to monitor neuromuscular block for airway management?

R4.1 – No recommendation – Data in the literature are insufficient to establish any recommendations on the use of instrumental (quantitative) monitoring of neuromuscular block during tracheal intubation.

(5) Is the use of muscle relaxants necessary to facilitate interventional procedures, and if so, which procedures?

R5.1 – The use of muscle relaxants is recommended to facilitate interventional procedures in abdominal laparotomy or laparoscopy surgery.

R5.2 – The use of muscle relaxants is probably recommended to facilitate interventional procedures in ENT laser surgery.

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R5.3 – Data in the literature are insufficient to be able to establish a recommendation on the required intensity of neuromuscular block (moderate vs. deep) in abdominal laparotomy or laparoscopy surgery.

(6) Is intraoperative monitoring of neuromuscular blockade necessary?

R6.1 – Monitoring of neuromuscular block intraoperatively is recommended.

R6.2 – The use of train-of-four stimulation of the ulnar nerve at the adductor pollicis is probably recommended to monitor intraoperative neuromuscular block.

(7) What are the strategies for preventing and treating residual neuromuscular blockade?

R7.1 – The use of quantitative adductor pollicis monitoring of the neuromuscular block is probably recommended for diagnosing a residual neuromuscular block and obtaining a ratio of ≥0.9 for the first to fourth response (T4/T1 ratio) at the adductor pollicis to eliminate the possibility of diagnosing a residual neuromuscular block.

R7.2 – After administering a non-depolarizing muscle relaxant, it is recommended to await spontaneous reversal equal to four muscle responses at the adductor pollicis following TOF stimulation of the ulnar nerve before administering neostigmine.

R7.3 – It is recommended to administer neostigmine with neuromuscular block monitoring at the adductor pollicis, at a dose between 40 and 50 µg/kg adapted to ideal body weight, but not to increase the dose beyond this level, and not to administer it in the absence of residual block.

R7.4 – In the event of a very slight residual block, it is probably recommended to reduce the neostigmine dose by half.

R7.5 – It is recommended to pursue quantitative monitoring of neuromuscular block after administration of neostigmine until a TOF ratio of ≥0.9 has been obtained.

R7.6 – It is recommended to adjust the dose of sugammadex according to ideal body weight and the intensity of neuromuscular block induced by rocuronium.

R7.7 – After administering sugammadex it is probably recommended to pursue quantitative monitoring of the neuromuscular block to detect a possible increase in neuromuscular block.

(8) What are the indications and precautions for use of both muscle relaxants and reversal agents in special populations (e.g. electroconvulsive therapy, obese patients, children, neuromuscular diseases, renal/hepatic failure, elderly patients)?

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R8.1 – It is probably recommended to administer a short-acting muscle relaxant for electroconvulsive therapy.

R8.2 – For severely obese patients (BMI ≥40 kg/m2) it is probably recommended to administer a short-acting muscle relaxant to facilitate tracheal intubation.

R8.3 – It is probably recommended to administer suxamethonium (succinylcholine) at a dose of 1.0 mg/kg based on the actual body weight of the obese patient.

R8.4 – No recommendation can be made because there are insufficient data concerning the indication of deep block for laparoscopic surgery in obese patients.

R8.5 – The use of sugammadex adjusted to ideal body weight in severely obese patients (BMI ≥40 kg/m2) is probably recommended given the increased recovery time and the risk of reappearance of neuromuscular block after neostigmine.

R8.6 – Other than situations for which rapid-sequence induction or the use of depolarizing muscle relaxants are indicated, the use of a non-depolarizing muscle relaxant is probably recommended to improve intubating conditions during anesthesia in children by intravenous induction.

R8.7 – In rapid-sequence induction, use of a rapid-onset muscle relaxant is recommended in children.

R8.8 – In conventional rapid-sequence induction, it is probably recommended that suxamethonium be given as a first-line drug for rapid-sequence induction in children. Where suxamethonium is contraindicated, use of rocuronium is probably recommended.

R8.9 – The use of suxamethonium is not recommended in cases of primary muscle damage (myopathies) or up-regulation of nicotinic acetylcholine receptors at the motor end plate (chronic motor deficit).

R8.10 – Monitoring of neuromuscular blockade is probably recommended following muscle relaxant use in patients with neuromuscular disease.

R8.11 – Administration of sugammadex is probably recommended for reversal of a residual neuromuscular blockade following the use of a steroidal muscle relaxant in patients with neuromuscular disease.

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R8.10 – Monitoring of neuromuscular blockade is probably recommended following muscle relaxant use in patients with neuromuscular disease.

R8.11 – Administration of sugammadex is probably recommended for reversal of a residual neuromuscular blockade following the use of a steroidal muscle relaxant in patients with neuromuscular disease.

R8.12 – The use of a benzylisoquinoline muscle relaxant (atracurium/cisatracurium) is probably recommended in cases of renal/hepatic failure.

R8.13 – It is recommended not to modify the initial dose in renal/hepatic failure patients, irrespective of the type of muscle relaxant used.

R8.14 – When using sugammadex in cases of renal failure, it is probably recommended to administer it at the usual dose.

All questions were formulated using the Population, Intervention, Comparison and Outcome (PICO) model for clinical questions and evidence profiles were generated. The results of the literature analysis and the recommendations were then assessed using the GRADE1 system.

Recommendations from the Italian intersociety consensus on Perioperative Anesthesia Care in Thoracic Surgery (PACTS) part 2: intraoperative and postoperative care [9]

Methods: A multidisciplinary expert group, the Perioperative Anesthesia in Thoracic Surgery (PACTS) group, was established to develop recommendations for anesthesia practice in patients undergoing elective lung resection for lung cancer.
The quality of evidence and strength of recommendations were graded using the United States Preventive Services Task Force criteria.

Results: Recommendations for intraoperative care focus on airway management, and monitoring of vital signs, hemodynamics, blood gases, neuromuscular blockade, and depth of anesthesia.

Conclusions: These recommendations should help clinicians to improve intraoperative and postoperative management, and thereby achieve better postoperative outcomes in thoracic surgery patients.

Recommendation: **We recommend monitoring neuromuscular blockade in all patients receiving neuromuscular blocking agents during general anesthesia for thoracic surgery.**

Level of Evidence: Good.

Strength of Recommendation: A.

PG18(A) Guideline on Monitoring During Anaesthesia 2017, Australian and New Zealand College of Anaesthetists (ANZCA) [10]

M1. Purpose
Clinical observation and assessment by a vigilant anaesthetist is essential for safe patient care during anaesthesia. The purpose of this guideline is to guide practitioners on monitoring standards that should be applied to clinical management in order to optimise patient safety and quality care.

4. Principles
4.1 Monitoring of fundamental physiological variables during anaesthesia is essential. Clinical judgment will determine how long this monitoring should be continued following completion of anaesthesia.

C6. Monitoring equipment
In general, monitoring equipment aids the clinical assessment of a patient and the following equipment should be available for use during anaesthesia. However, depending on the type of anaesthesia, some of these monitors are mandatory (please refer to those specific monitors).

6.7 - Neuromuscular function monitor – **Quantitative neuromuscular function monitoring should be available for every patient in whom neuromuscular blockade has been induced** and should be used whenever the anaesthetist is considering extubation following the use of non-depolarising neuromuscular blockade.

Consensus Statement on Perioperative Use of Neuromuscular Monitoring [11]

A panel of clinician scientists with expertise in neuromuscular blockade (NMB) monitoring was convened with a charge to prepare a consensus statement on indications for and proper use of such monitors.

The aims of the consensus statement are to: (a) provide the rationale and scientific basis for the use of quantitative NMB monitoring; (b) offer a set of recommendations for quantitative NMB monitoring standards; (c) specify educational goals; and (d) propose training recommendations to ensure proper neuromuscular monitoring and management.

RECOMMENDATIONS:

1. Quantitative (objective) NMB monitoring should be used whenever a nondepolarizing NMBD is administered:

a. Quantitative monitoring is defined as an objective real-time measurement of the train-of-four ratio (TOFR). The difference between quantitative and qualitative assessments of NMB is in their ability to objectively measure the TOFR.

Qualitative (subjective) assessments using peripheral nerve stimulator (PNS) devices depend on the anesthesia practitioner estimating the strength of muscle contractions in response to train-of-four (TOF) stimulation by visual or tactile means only, and thus are prone to error.

b. The panel recognizes that replacing conventional PNS devices with quantitative monitoring equipment will take time and education. During this interim period, the use of a PNS in any patient receiving a NMBD is mandatory.

2. Subjective or clinical tests of NMB are not predictive of adequate neuromuscular recovery and are not sensitive to the presence of residual neuromuscular weakness; their use should be abandoned in favor of objective monitoring:

a. After the TOFR recovers to >0.40, clinicians can no longer detect the presence of fade by tactile or visual observation (subjectively). Therefore, clinicians may assume complete recovery from NMB (ie, TOFR ≥0.9) despite the actual presence of minimal or shallow degrees of NMB (Table 1).

b. After emergence from anesthesia and tracheal extubation, undetected minimal or shallow levels of NMB (Table 1) can lead to adverse airway or pulmonary complications.

c. Clinical signs (such as the 5-second head lift or sustained handgrip) and clinical tests (such as presence of spontaneous respiration) do not guarantee complete resolution of NMB and no longer have a place as the sole determinant of adequate recovery of neuromuscular function (Table 2).

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3. Professional organizations should develop practice standards and guidelines detailing how best to monitor and manage perioperative administration of NMBDs.

4. Terms that describe the levels of NMB should be standardized. This consensus statement provides proposed definitions of complete, deep, moderate, shallow, and minimal NMB based on quantitative NMB monitoring criteria (Table 1).

Table 1

Level of Block	Depth of Block	Objective Measurement (Quantitative Monitor) at the Adductor Pollicis Muscle	Subjective Evaluation (PNS) at the Adductor Pollicis Muscle
Level 5	Complete block	PTC = 0	PTC = 0
Level 4	Deep block	PTC ≥ 1, TOFC = 0	PTC ≥ 1, TOFC = 0
Level 3	Moderate block	TOFC = 1–3	TOFC = 1–3
Level 2b	Shallow block	TOFR < 0.4	TOFC = 4; TOF fade is present
Level 2a	Minimal block	TOFR = 0.4–0.9	TOFC = 4; TOF fade is not detectable
Level 1	Acceptable recovery	TOFR ≥ 0.9	Cannot be determined

Level 2a: This level of block encompasses a wide spectrum of signs and symptoms. At a TOF of 0.40, vital capacity is reduced by 26% (8%–41%) and handgrip by 80%.1 A TOFR in the range of 0.60–0.80 is associated with significant impairment of the swallowing mechanism and the potential for pulmonary aspiration of gastric contents.2,3 At a TOFR of 0.70, grip strength is reduced by >40%, and jaw apposition is often impossible (inability to retain a tongue depressor between incisor teeth).4 After the TOFR exceeds 0.85, only very mild symptoms of residual weakness should be anticipated, although diplopia and subjective weakness may persist for several hours.4

Abbreviations: NMB, neuromuscular blockade; PNC, peripheral nerve stimulator; PTC, posttetanic count; TOF, train of four; TOFC, train-of-four count; TOFR, train-of-four ratio.

*Subjective evaluation of NMB is not recommended, but it is included as an interim transition from current practice to the preferred, objective monitoring-based practice.

Table 2

Quantitative (Objective) Evaluation	Qualitative (Subjective) Evaluation
Requires the use of a device that measures, analyzes, and displays the TOFR in real time.	Clinicians subjectively estimate (guess) the strength of muscle contractions in response to TOF stimulation by visual or tactile means using a PNS—or clinicians infer adequate return of neuromuscular function from clinical signs, such as 5-s head lift, tidal volume, grip strength.

Abbreviations: PNC, peripheral nerve stimulator; TOF, train of four; TOFR, train-of-four ratio

References

1. Thomas Fuchs-Buder, Edoardo De Robertis, Stephan R. Thilen, Michael W. Champeau; Joint Letter to the Editor from the American Society of Anesthesiologists and the European Society of Anaesthesiology and Intensive Care on Management of Neuromuscular Blockade. *Anesthesiology* 2023; 139:366–367 doi: https://doi.org/10.1097/ALN.0000000000004630
2. Thilen SR, Weigel WA, Todd MM, Dutton RP, Lien CA, Grant SA, Szokol JW, Eriksson LI, Yaster M, Grant MD, Agarkar M, Marbella AM, Blanck JF, Domino KB. 2023 American Society of Anesthesiologists Practice Guidelines for Monitoring and Antagonism of Neuromuscular Blockade: A Report by the American Society of Anesthesiologists Task Force on Neuromuscular Blockade. Anesthesiology. 2023 Jan 1;138(1):13-41. doi: 10.1097/ALN.0000000000004379.
3. Fuchs-Buder T, Romero CS, Lewald H, Lamperti M, Afshari A, Hristovska AM, Schmartz D, Hinkelbein J, Longrois D, Popp M, de Boer HD, Sorbello M, Jankovic R, Kranke P. Peri-operative management of neuromuscular blockade: A guideline from the European Society of Anaesthesiology and Intensive Care. Eur J Anaesthesiol. 2023 Feb 1;40(2):82-94. doi: 10.1097/EJA.0000000000001769. Epub 2022 Nov 15. PMID: 36377554.
4. Leonardsen AL, Haugen AS, Raeder J, Finjarn TJ, Isern E, Aakre EK, Bruun AMG, Hennum K, Ramstad JP, Sand T, Monsen SA. The 2024 revision of the Norwegian standard for the safe practice of anaesthesia. Acta Anaesthesiol Scand. 2024 Apr;68(4):567-574. doi: 10.1111/aas.14381. Epub 2024 Feb 6. PMID: 38317613.
5. Dobson G, Chau A, Denomme J, Frost S, Fuda G, Mc Donnell C, Milkovich R, Milne AD, Sparrow K, Subramani Y, Young C. Guidelines to the Practice of Anesthesia-Revised Edition 2024. Can J Anaesth. 2024 Jan;71(1):8-54. English. doi: 10.1007/s12630-023-02675-0. PMID: 38253968.
6. Klein AA, Meek T, Allcock E, Cook TM, Mincher N, Morris C, Nimmo AF, Pandit JJ, Pawa A, Rodney G, Sheraton T, Young P. Recommendations for standards of monitoring during anaesthesia and recovery 2021: Guideline from the Association of Anaesthetists. Anaesthesia. 2021 Sep;76(9):1212-1223. doi: 10.1111/anae.15501. Epub 2021 May 20. PMID: 34013531.
7. Díaz-Cambronero O, Serrano A, Abad-Gurumeta A, Garutti Martinez I, Esteve N, Alday E, Ferrando C, Mazzinari G, Vila-Caral P, Errando Oyonarte CL; Grupo de Trabajo de Bloqueo Neuromuscular de la SEDAR. Perioperative neuromuscular blockade. 2020 update of the SEDAR (Sociedad Española de Anestesiología y Reanimación) recommendations. Rev Esp Anestesiol Reanim (Engl Ed). 2023 Jan;70(1):37-50. doi: 10.1016/j.redare.2022.02.005. Epub 2023 Jan 5. PMID: 36621572.
8. Plaud B, Baillard C, Bourgain JL, Bouroche G, Desplanque L, Devys JM, Fletcher D, Fuchs-Buder T, Lebuffe G, Meistelman C, Motamed C, Raft J, Servin F, Sirieix D, Slim K, Velly L, Verdonk F, Debaene B. Guidelines on muscle relaxants and reversal in anaesthesia. Anaesth Crit Care Pain Med. 2020 Feb;39(1):125-142. doi: 10.1016/j.accpm.2020.01.005. Epub 2020 Jan 8. PMID: 31926308.
9. Piccioni F, Droghetti A, Bertani A, Coccia C, Corcione A, Corsico AG, Crisci R, Curcio C, Del Naja C, Feltracco P, Fontana D, Gonfiotti A, Lopez C, Massullo D, Nosotti M, Ragazzi R, Rispoli M, Romagnoli S, Scala R, Scudeller L, Taurchini M, Tognella S, Umari M, Valenza F, Petrini F; AIPO, Associazione Italiana Pneumologi Ospedalieri; SIAARTI, Società Italiana di Anestesia Analgesia Rianimazione Terapia Intensiva; SIC, Società Italiana di Chirurgia; SICT, Società Italiana di Chirurgia Toracica; SIET, Società Italiana di Endoscopia Toracica; SIP, Società Italiana di Pneumologia. Recommendations from the Italian intersociety consensus on Perioperative Anesthesia Care in Thoracic surgery (PACTS) part 2: intraoperative and postoperative care. Perioper Med (Lond). 2020 Oct 23;9:31. doi: 10.1186/s13741-020-00159-z. PMID: 33106758; PMCID: PMC7582032.
10. Australian and New Zealand College of Anaesthetists. PG18(A) Guideline on monitoring during anaesthesia 2017. Available at: https://www.anzca.edu.au/getattachment/0c2d9717-fa82-4507-a3d6-3533d8fa844d/PG18(A)-Guideline-on-monitoring-during-anaesthesia. Last accessed: March 17, 2024.
11. Naguib M, Brull SJ, Kopman AF, Hunter JM, Fülesdi B, Arkes HR, Elstein A, Todd MM, Johnson KB. Consensus Statement on Perioperative Use of Neuromuscular Monitoring. Anesth Analg. 2018 Jul;127(1):71-80. doi: 10.1213/ANE.0000000000002670. PMID: 29200077.

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