Quantitative neuromuscular monitoring
Now way around?

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Poison discovered by the Amazonian Indians

Neuromuscular blocking agents (NMBA) in modern clinical practice:

the benefits

General anaesthesia: **400** million/year worldwide

- ✓NMBA: **70%** of elective surgeries

Intensive care:

- ✓NMBA: **30** to **60%** of patients

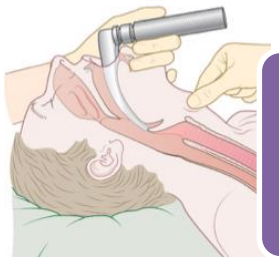
Thus, **the safe use of muscle relaxants** has become a public health issue.

400 MILLION!

Intercontinental Marketing Services (IMS) Health, Multinational Integrated Data Analysis System (MIDAS), September 2010

Robotic surgery
Laparascopie
ENT/NC

Ventilation
in Anaesthesia



Intubation

Curarization

Intensive
care:
ARDS
Status asthmaticus
ICP: easy sedation

Facilitates intubation conditions, reduces risks

Improves conditions for robotic, laparascopic surgery

Allows ENT operations on vocal cords, trachea

Facilitates mask ventilation, Lung protective ventilation, Jet ventilation

Critical care: ARDS

1. Czarnetzki C , Rehberg B, Walder B, **Moderne Anästhesie,** Therapeutische Umschau, 2017,
2. deBacker J, Hart N, Fan E. **Neuromuscular Blockade in the 21st Century, Management of the Critically Ill Patient**. Chest, 2017

A STUDY OF THE DEATHS ASSOCIATED WITH ANESTHESIA AND SURGERY*

BASED ON A STUDY OF 599,548 ANESTHESIAS IN TEN INSTITUTIONS 1948–1952, INCLUSIVE

HENRY K. BEECHER, M.D., AND DONALD P. TODD, M.D.

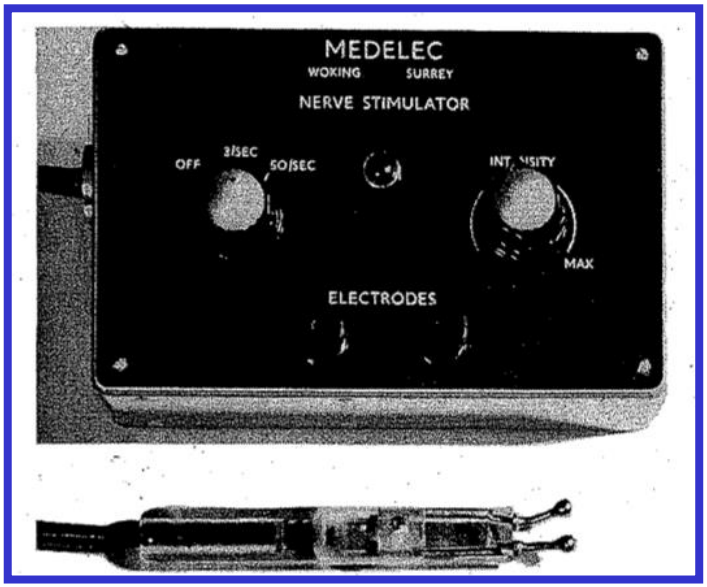
Annals of Surgery
July, 1954

TABLE XIII. *Total Incidence of "Curare" Use and Associated Death.*

Total Number Anesthesias	44,100
Number Anesthesias in which "Curare" Used (1	
Frequency of Death Related to Anesthesia	
Anesthesias Which Did Not Include "Curare" (66)	1 : 2100
Anesthesias Which Included "Curare" (118)	1 : 370

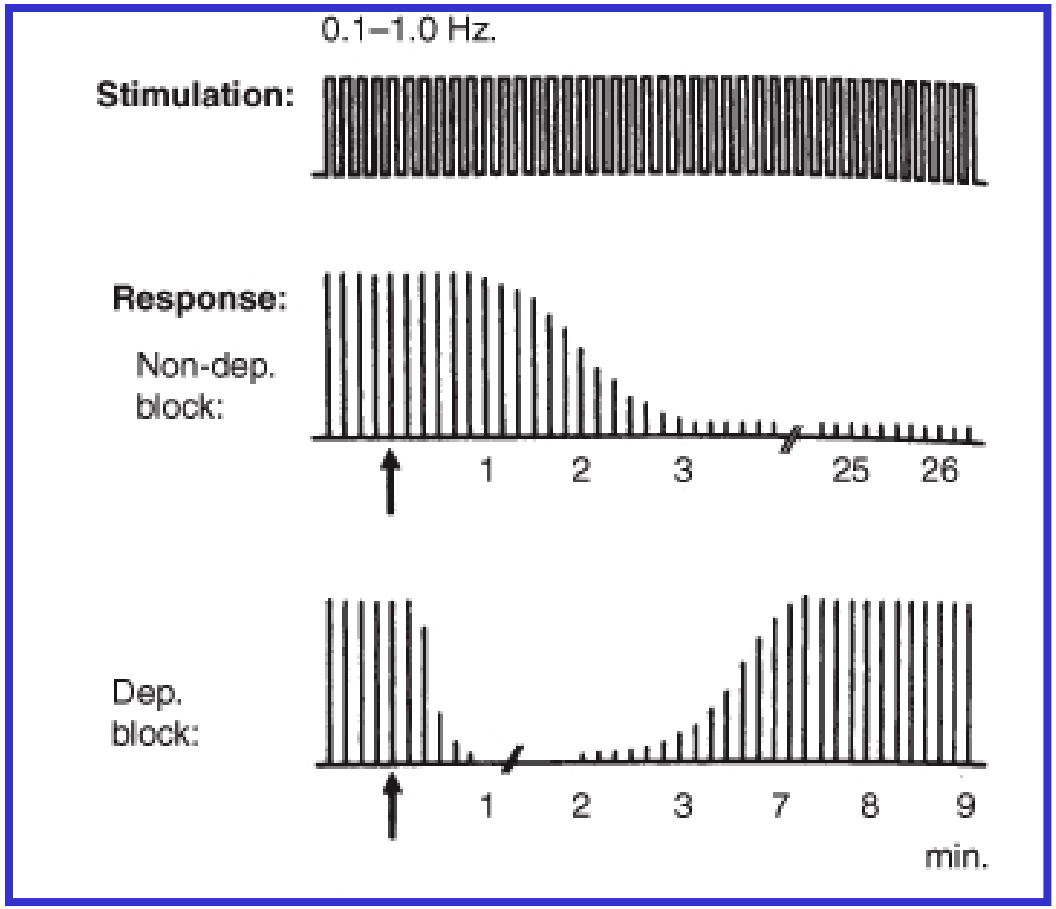
New Inventions

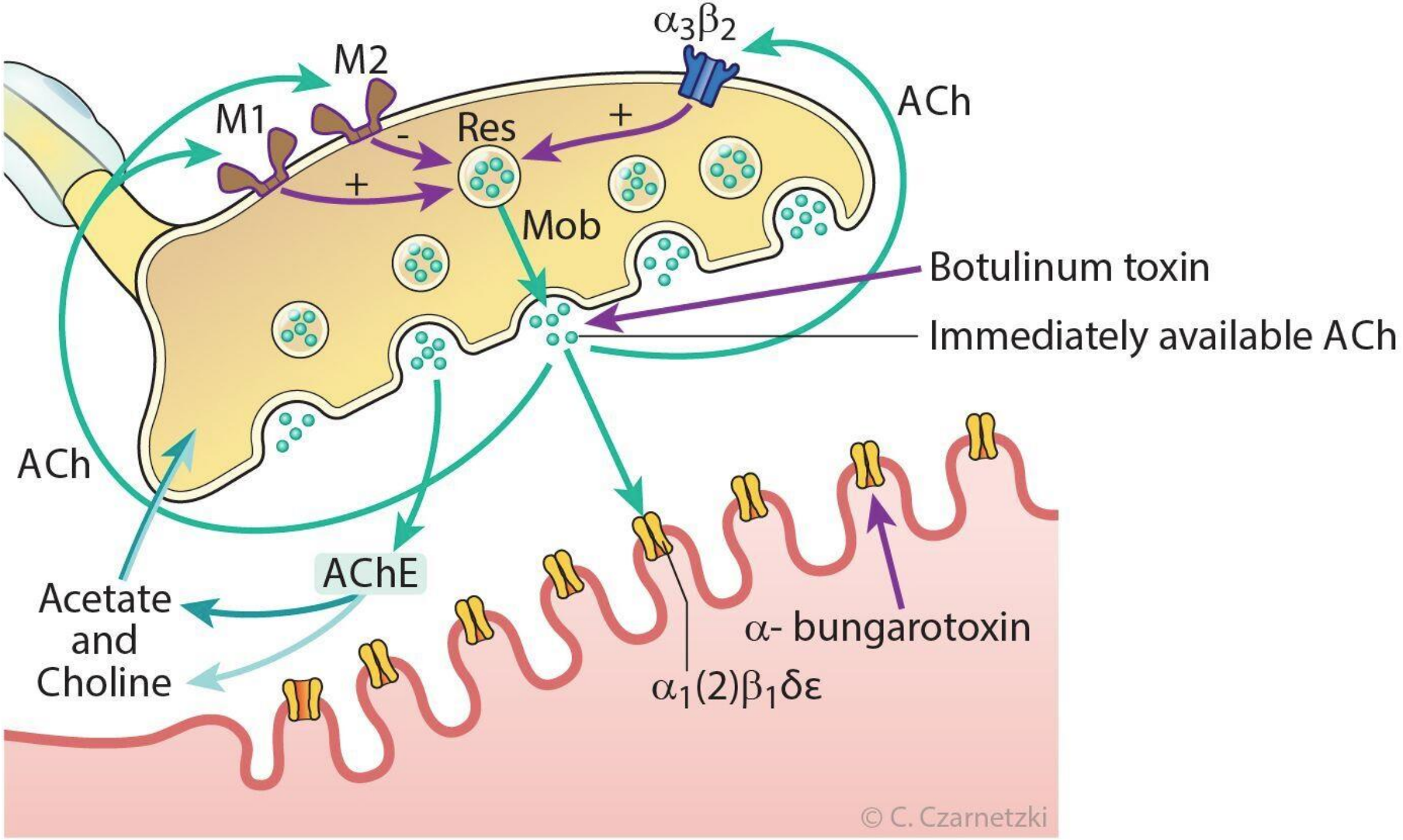
THE ST. THOMAS'S HOSPITAL NERVE STIMULATOR IN THE DIAGNOSIS OF PROLONGED APNŒA



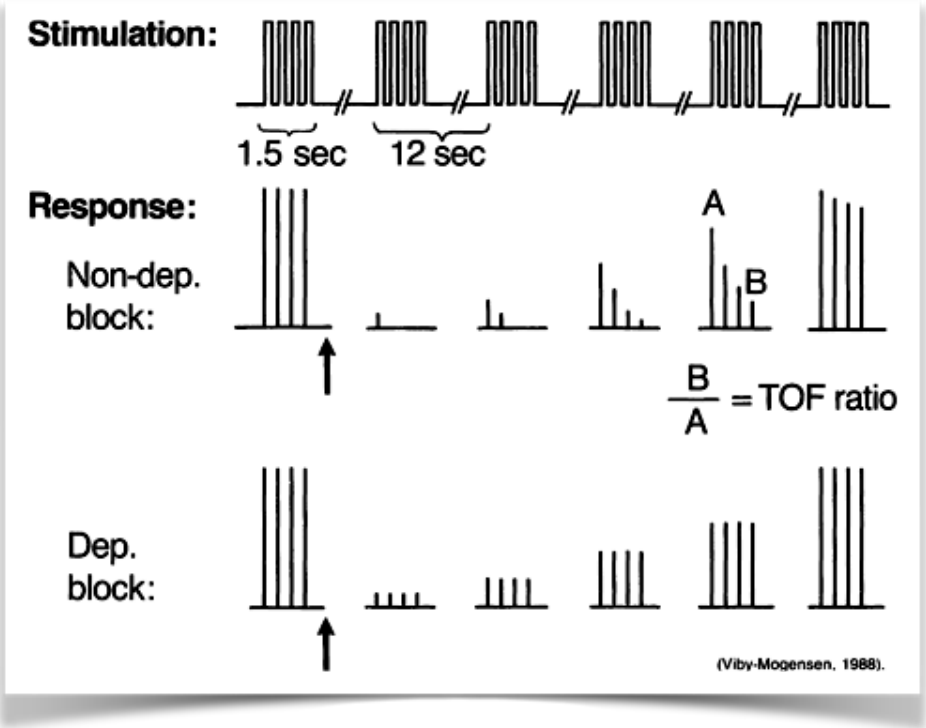
Christie and Churchill-Davidson, Lancet 1958

SINGLE TWITCH

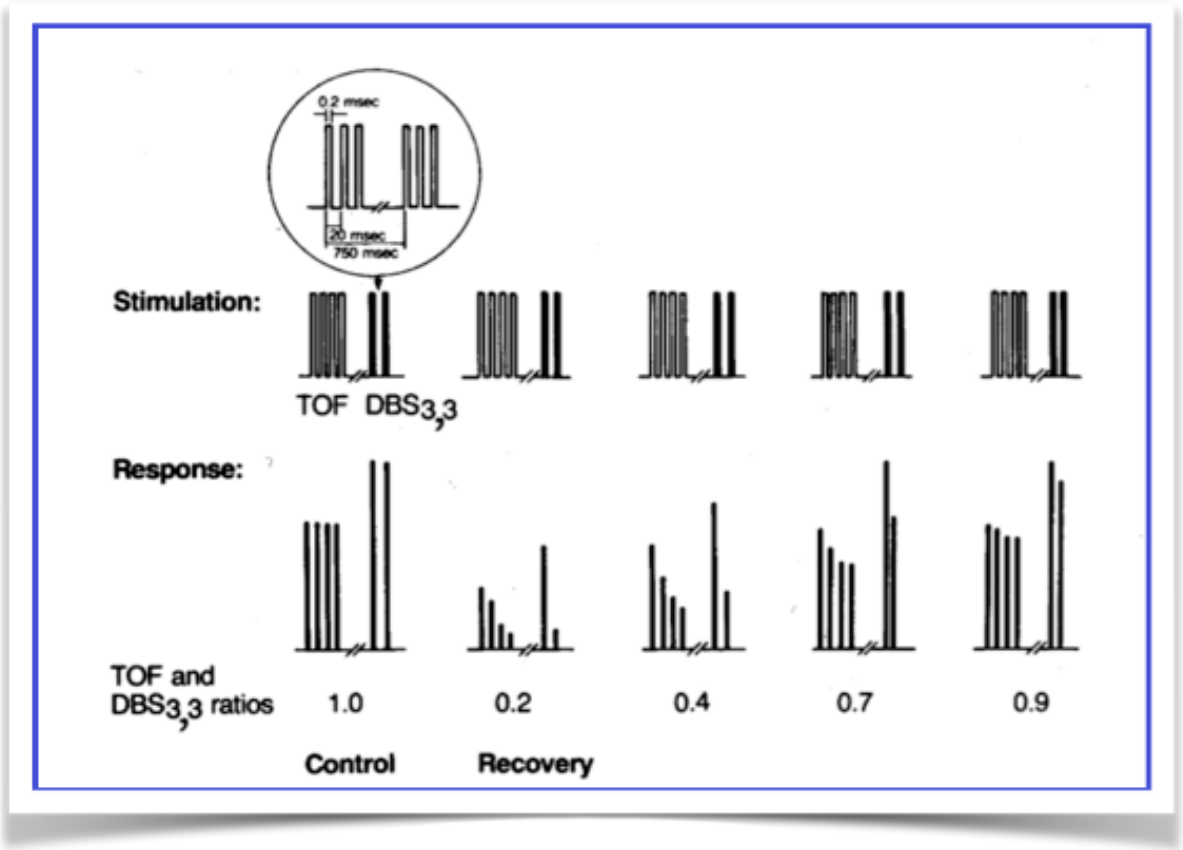



$\alpha_3\beta_2$
M2
M1
ACh
-
Res
+
+
Mob
Botulinum toxin
Immediately available ACh
ACh
AChE
Acetate
and
Choline
α- bungarotoxin
$\alpha_1(2)\beta_1\delta\varepsilon$
© C. Czarnetzki

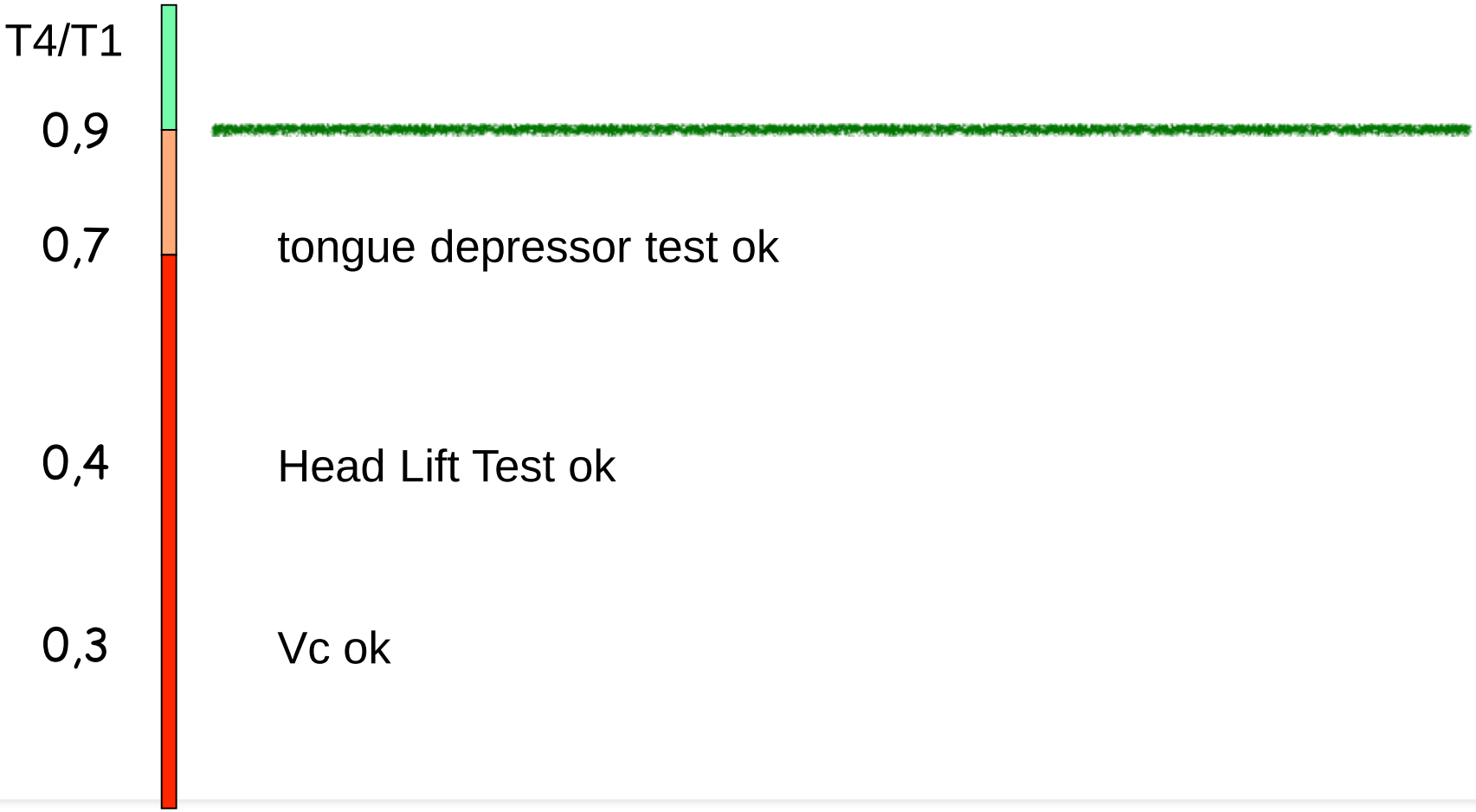
TRAIN DE QUATTRE



DOUBLE BURST ET TRAIN DE QUATRE (TOF)

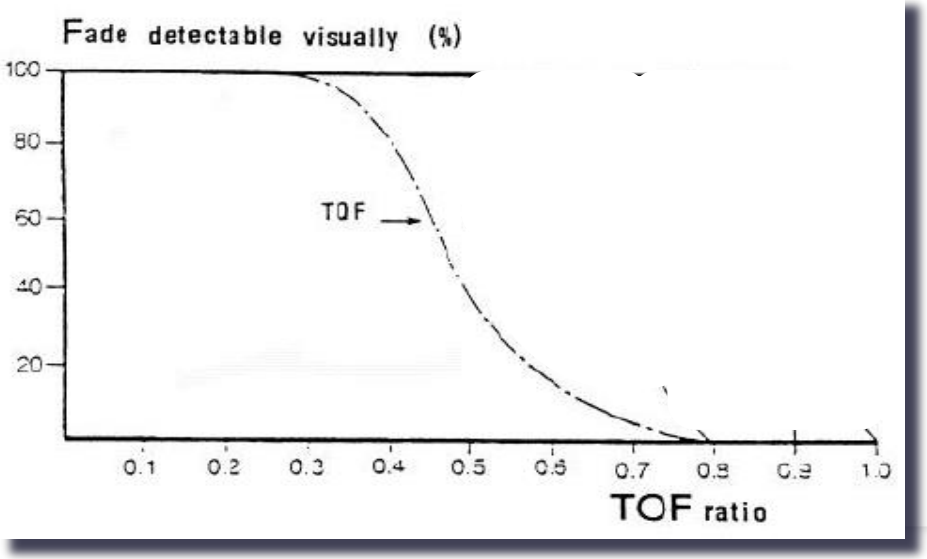


CLINICAL SIGNS



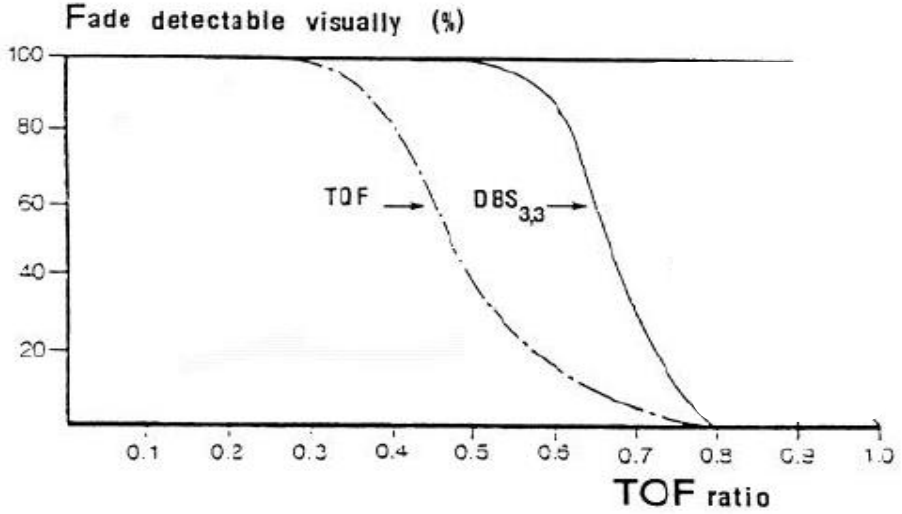
PERIPHAL NERVE STIMULATOR (PNS)

PERIPHAL NERVE STIMULATOR (PNS)



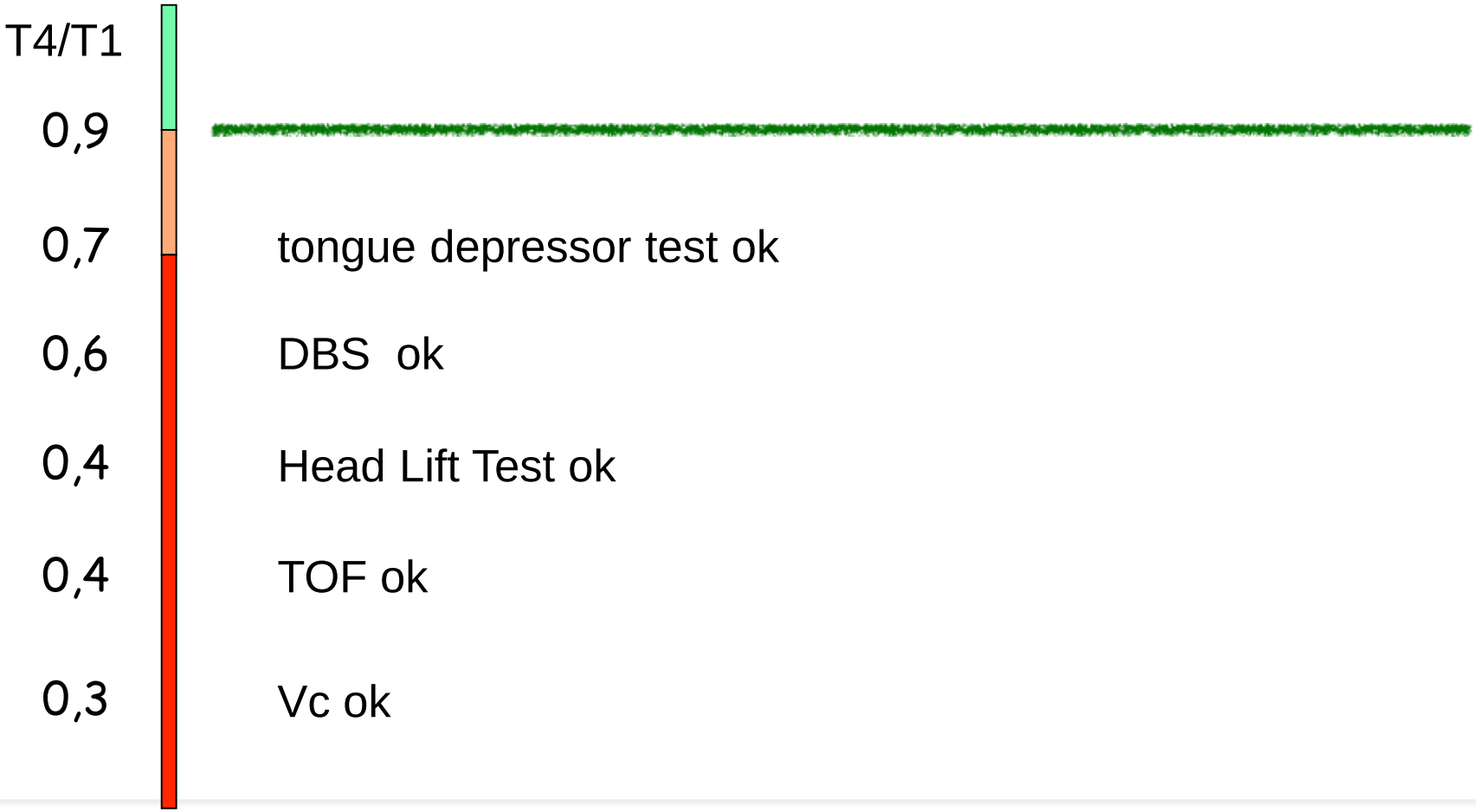
Baurain et al Anesth & Analg 1998

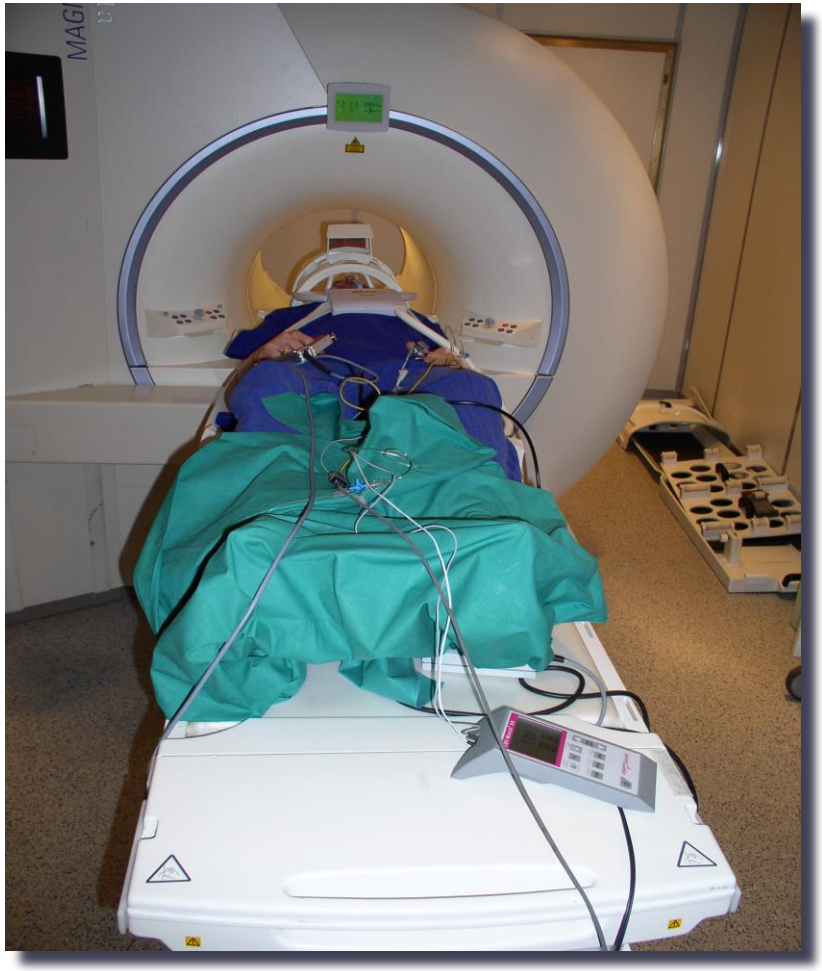
PERIPHAL NERVE STIMULATOR (PNS)

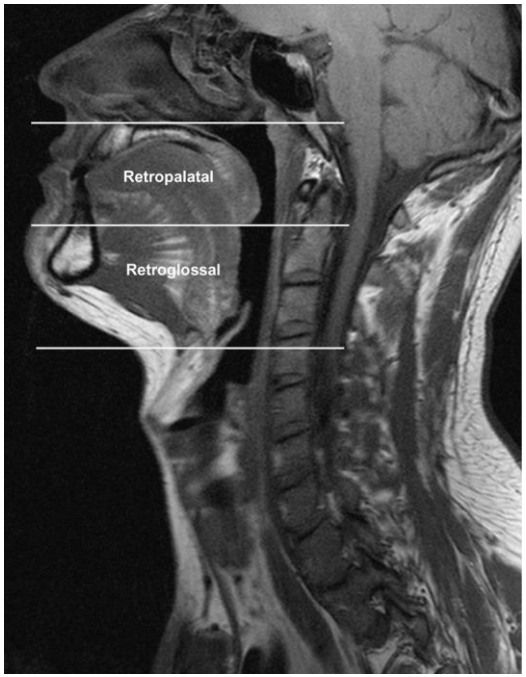


Baurain et al Anesth & Analg 1998

CLINICAL SIGNS OR PNS



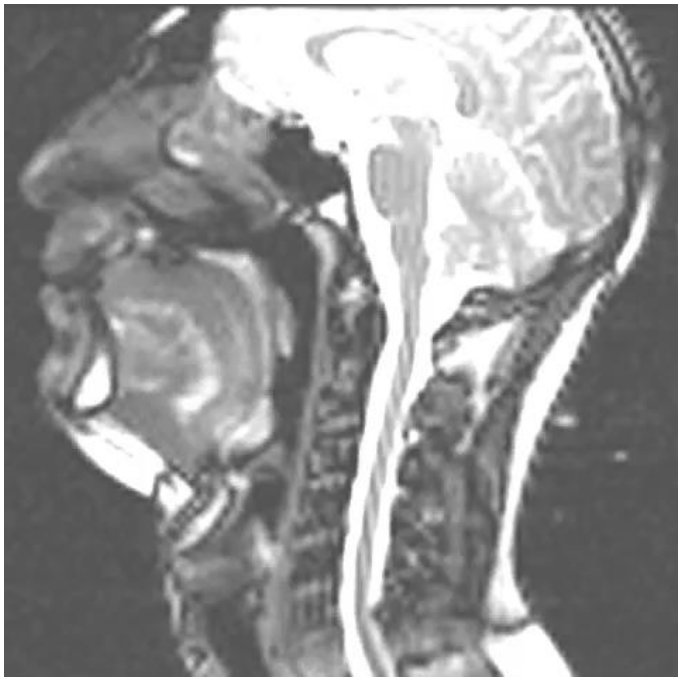




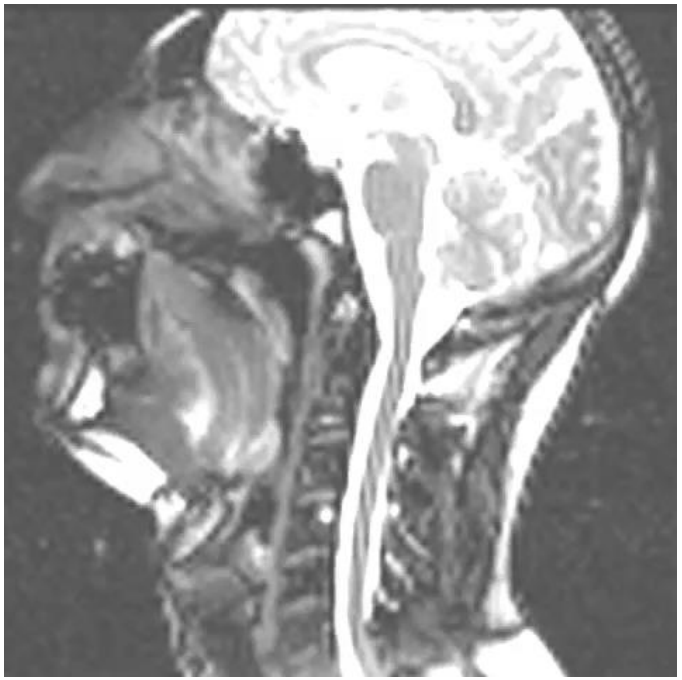
Upper airway permeability

Eikermann et al Am J Respir Crit Care Med 2007

TOF-RATIO ≥ 0.9?



no RP



TOF-ratio: 0.8

Upper airway permeability

Eikermann et al Am J Respir Crit Care Med 2007

TOF-RATIO ≥ 0.9?

Tabelle 1

Quantifizierung klinisch relevanter Effekte einer partiellen neuromuskulären Blockade mit der TOF-Ratio des M. adductor pollicis

Monitoring M. adductor pollicis	TOF-Ratio		
	0,5	0,8	1
Tidalvolumen	Normal	Normal	Normal
Forcierte Vitalkapazität	Häufig beeinträchtigt	Häufig normal	Normal
Pharyngeale Funktion (Schluckakt)	Sicher beeinträchtigt	Meist beeinträchtigt	Meist normal
Integrität des oberen Atemwegs	Sicher beeinträchtigt	Meist beeinträchtigt	Meist normal
Hypoxische Atemantwort	Häufig beeinträchtigt	Häufig normal	Normal

Die Angaben basieren auf Ergebnissen von Untersuchungen zweier Arbeitsgruppen (Eikermann et al. [17, 18, 21] und Eriksson [22] sowie Eriksson et al. [23]) an wachen, gesunden Probanden während partieller neuromuskulärer Blockade.

$T_4/T_1 > 0,9$

Fuchs-Buder et al, Anaesthesist 2006

CLINICAL CONSEQUENCES OF RESIDUAL PARALYSIS

Residual Neuromuscular Blockade and Critical Respiratory Events in the Postanesthesia Care Unit

- clinical evaluation of CRE s during 15 min after arrival in the PACU
- CRE: hypoxia, VAS obstruction, dyspnea, deglutition disorders, reintubation, etc;
- if CRE: measurement of T4/T1 (case) and matched patients (control)
- 7459 patients included, 61 (0.8%) with CRE in PACU (neostigmine!)
- analyzed: 2 x 42 patients

Murphy et al, Anesth & Analg 2008

CLINICAL CONSEQUENCES OF RESIDUAL PARALYSIS

Residual Neuromuscular Blockade and Critical Respiratory Events in the Postanesthesia Care Unit

n: 2 x 42	Residual Paralisis	Control
T4/T1 (%)	0,62 ± 0,2	0,98 0.07
> 0,9 (n)	4 (9,5%)	38 (95%)
< 0.7 (n)	31 (73,8%)	0
0.7 - 0.9 (n)	7 (16,4%)	4 (90,5%)
Severe hypoxia	22 (52,4%)	-
Moderate hypoxia	10 (23,8%)	-
Upper airway obstruction	15 (35,7%)	-

Murphy et al, Anesth & Analg 2008

Table 2 Selected reports of postoperative residual paralysis, 2006–2016.

Study	Intermediate-acting NMBA	Reversal	TOF Threshold	Monitoring modality	Residual paralysis	Comments
Cammu et al. [26]	Atrac/Cis/Miv/Roc		0.9	Clinical		One of 320 inpatients
	Outpatients	In 26%		(49% of cases)	38%	required re-intubation
	Inpatients	In 25%			47%	in PACU; Subjective assessment did not decrease incidence of residual paralysis
Maybauer et al. [88]	Cis	None	0.9	AMG	57%	Variability in duration
	Roc		0.9	AMG	44%	of action of Roc greater than Cisatrac
Murphy et al. [89]	Roc	Yes	0.9	AMG	5%	AMG lowers RNMB risk
				Subjective	30%	
Butterly et al. [14]	Vec/Cis	Yes	0.9	Subjective	22%	Less RNMB with Cis
Yip et al. [90]	Atrac/Vec/Roc	In 65%	0.9	Not reported	31%	21% of patients with RNMB required airway support
Murphy et al. [7]	Roc	Yes	0.9	AMG	15%	AMG monitoring lowers
			0.9	Subjective	50%	RNMB
Cammu et al. [91]	Atrac/Roc/Miv		0.9	Subjective		Body mass index we an
		None		(38% of cases)	15%	independent predictor
		Neo			15%	of desaturation in PACU
		SGX			2%	
Kumar et al. [92]		Yes in 100%	0.9	Not performed		RNMB resulted in
	Vec				66%	reductions in forced
	Atrac				60%	vital capacity and peak
	Roc				46%	expiratory flow
Norton et al. [93]			0.9		30%	CRE present in 51% with RNMB
Esteves et al. [94]	Atrac/Cis/Roc/Vec	Yes (67% of patients)	0.9	Subjective	26%	Incomplete recovery more frequent after reversal than no reversal (31% vs. 17%)
Kotake et al. [17]	Roc		0.9	Clinical		RNMB as high as 9%
		None			13%	with SGX without
		Neo			24%	monitoring
		SGX			4%	
Pietraszewski et al. [95]	Roc	None	0.9	Not used	44%	Incidence of RNMB was 44% in elderly and 20% in young patients
Fortier et al. [96]	Roc	Yes	0.9	Optional	64%	Incidence of RNMB was 56% on PACU arrival
Xara et al. [97]	NMBAs used in 66% of patients	Yes	0.9	Optional	18%	CRE more common (46%) in patients with RNMB
Ledowski et al. [98]	Atrac/Roc/Vec	Yes (48% of patients)	0.9	Optional (used in 23% of patients)	28%	RNMB after neo reversal was twice as high as no reversal in paediatric patients
Brueckmann et al. [99]	Roc			Subjective		OR discharge shorter in
		Yes-Neo	0.9		43%	SGX-treated patients
		Yes-SGX	0.9		0%	
Batistaki et al. [18]	Roc/Cis			Clinical		Female gender and
		Yes-Neo	0.9		14.6%	co-morbidities increased
		Yes-SGX	0.9		9.5%	incidence of RNMB

NMBA, neuromuscular blocking agent; TOF, train-of-four; RNMB, residual neuromuscular block; Atrac, atracurium; Cis, cisatracurium; Vec, vecuronium; Roc, rocuronium; Miv, mivacurium; PACU, post-anaesthesia care unit; AMG, acceleromyography; CRE, critical respiratory events; SGX, sugammadex; OR, operating room.

Naguib et al, Anaesthesia 2017

Post-anaesthesia pulmonary complications after use of muscle relaxants (POPULAR): a multicentre, prospective observational study

Eva Kirmeier, Lars I Eriksson, Heidrun Lewald, Malin Jonsson Fagerlund, Andreas Hoeft, Markus Hollmann, Claude Meistelman, Jennifer M Hunter, Kurt Ulm, Manfred Blobner, and the POPULAR Contributors

- *data from 211 hospitals in 28 European Countries*
- *17150 patients received a NMBA*
- *10282 had no neuromuscular monitoring (59.9%!)*
- *8355 received no reversal agent (47.8%)*
- *extubation based of clinical criteria: 11789 (68.7%)*
- *only 4182 were monitored with objective neuromuscular monitoring (24.3%)*
- *1343 of them were extubated before reaching a TOFR ≥ 0.9 (32.1%)*
- *just 2839 patients extubated with a documented TOFR ≥ 0.9 (16.5% of those exposed to NMBA)*

Lancet Respir Med Sept 2018

Table 3 Incidences and ORs_{adj} of postoperative pulmonary complications according to seven key factors in neuromuscular management

	Postoperative pulmonary complications		OR_{adj} (95% CI)	p values
	Key factor does not apply	Key factor applies		
Use of any NMBA	131/4001 (3·3%)	1527/17 693 (8·6%)	1·86 (1·53–2·26)	<0·0001
High dose of NMBA*	936/13 697 (6·8%)	505/3453 (14·6%)	1·03 (0·88–1·20)	0·75
NMM used	676/9927 (6·8%)	765/7223 (10·6%)	1·31 (1·15–1·49)	<0·0001
Reversal agent given	645/8223 (7·8%)	796/8927 (8·9%)	1·23 (1·07–1·41)	0·0028
Quantitative (*vs* qualitative) NMM	292/2686 (10·9%)	441/4182 (10·5%)	1·07 (0·90–1·29)	0·44
Extubated at TOFR ≥0·9	157/1343 (11·7%)	284/2839 (10·0%)	1·03 (0·82–1·31)	0·78
Sugammadex (*vs* neostigmine)	567/6805 (8·3%)	213/1990 (10·7%)	1·03 (0·85–1·25)	0·74

Data are n/N (%), unless otherwise specified. OR_{adj}=adjusted odds ratio. NMBA=neuromuscular blocking agent. NMM=neuromuscular monitoring. TOFR=train-of-four ratio.

* Defined as a dose of an expected duration of 159 min or more (5th quintile of dose).

Use of a train-of-four ratio of 0.95 *versus* 0.9 for tracheal extubation: an exploratory analysis of POPULAR data

Manfred Blobner[1,*], Jennifer M. Hunter[2], Claude Meistelman[3], Andreas Hoeft[4], Markus W. Hollmann[5], Eva Kirmeier[1], Heidrun Lewald[1] and Kurt Ulm[6]

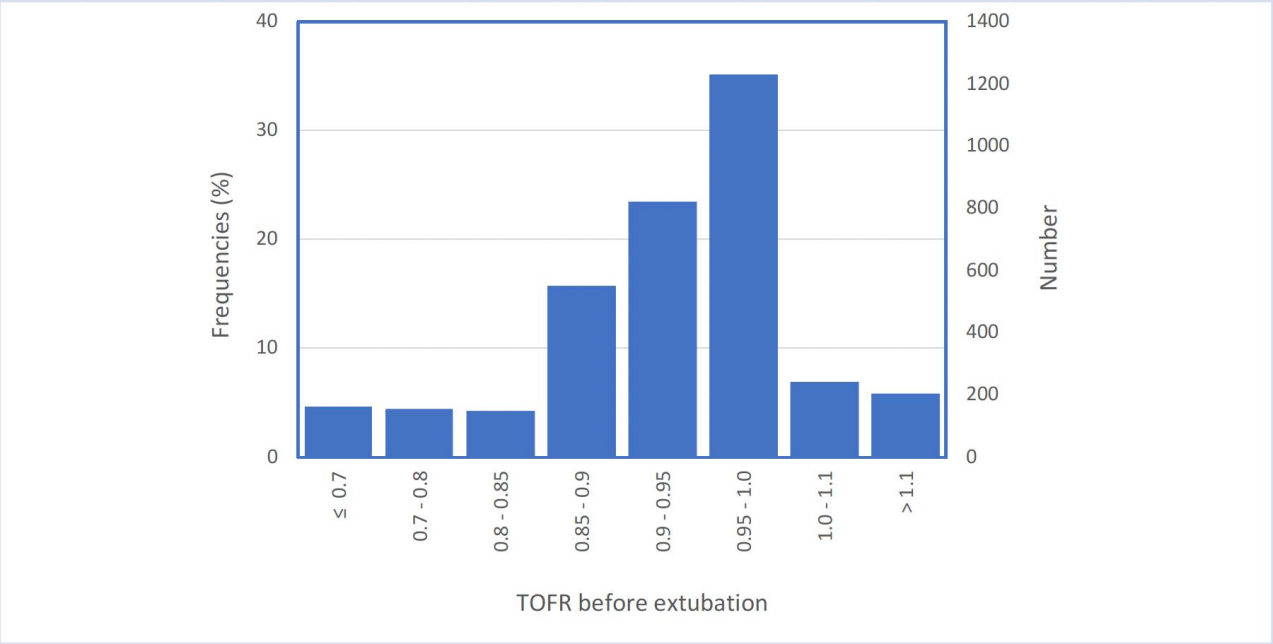
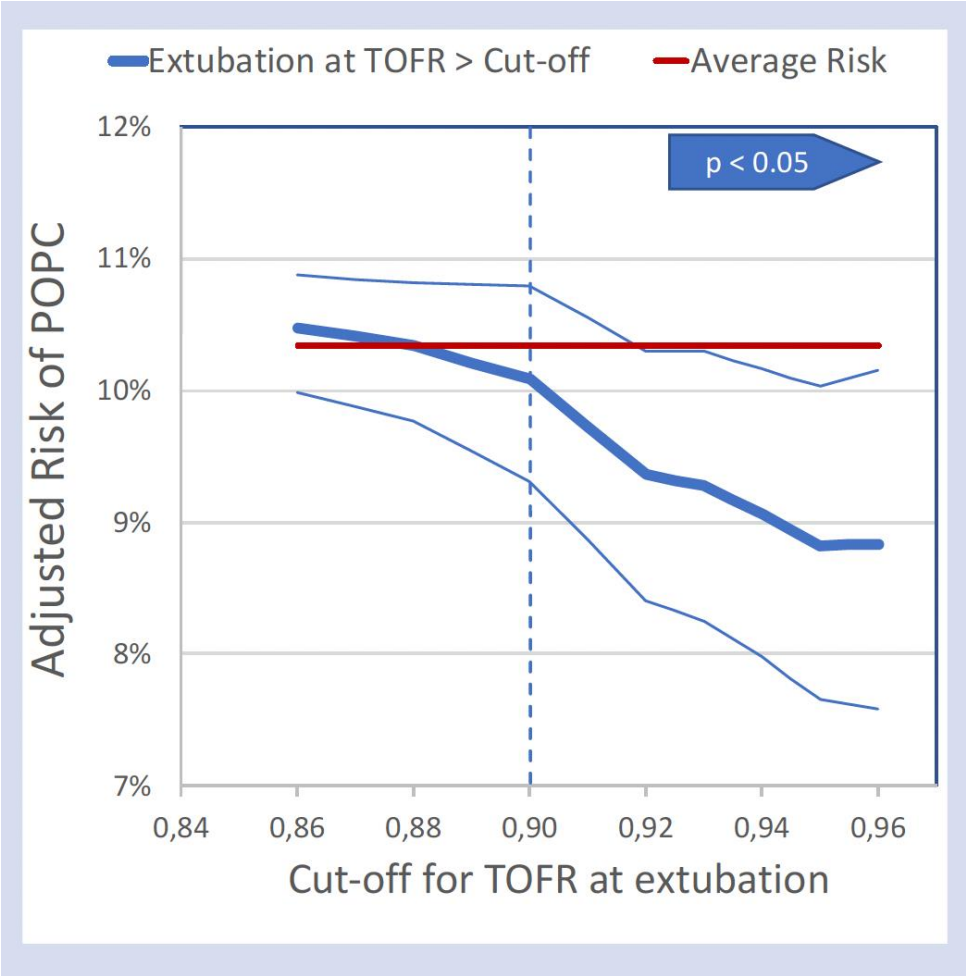


Fig 2. Histogram of the recorded train-of-four ratios (TOFR) before extubation in 3510 patients who underwent quantitative neuromuscular monitoring.

British Journal of Anaesthesia, 124 (1): 63e72 (2020)

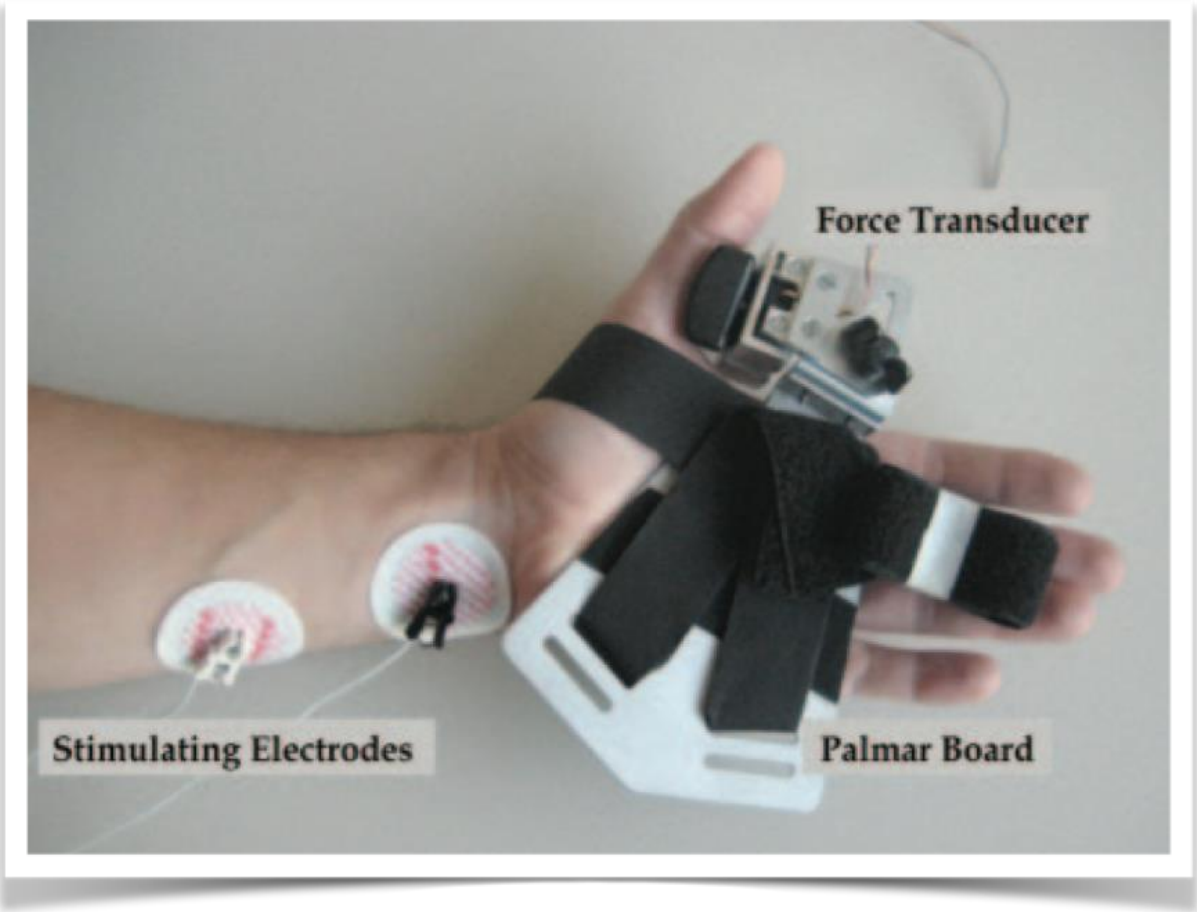
Absolute risk reduction by 4.9% (1.2 - 8.5%) when patients extubated at TOFR > 0.95 compared to 0.9 and 0.95.



Blobner et al. BJA 2020

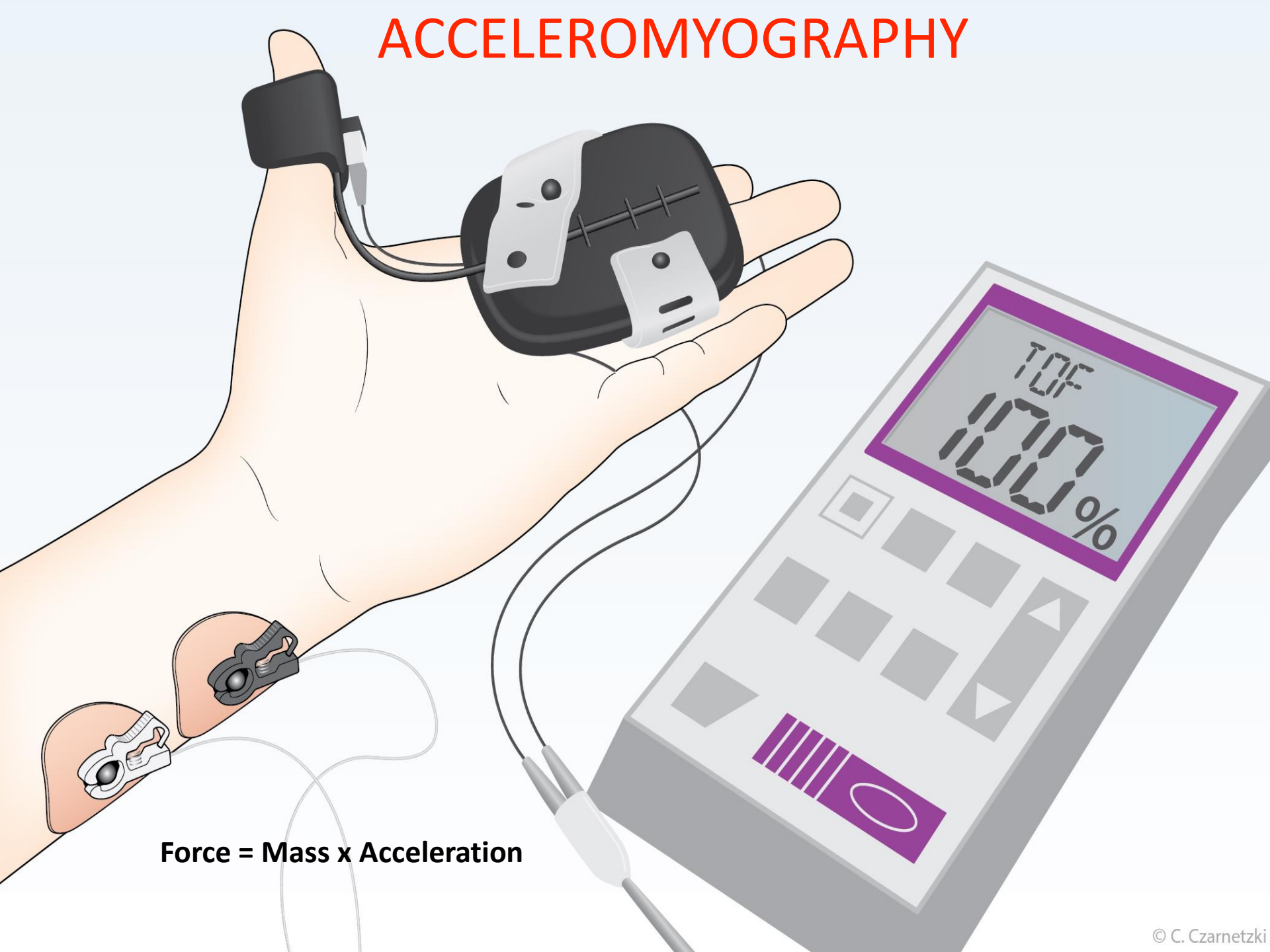
87% acceleromyographs

MECANOMYOGRAPHY



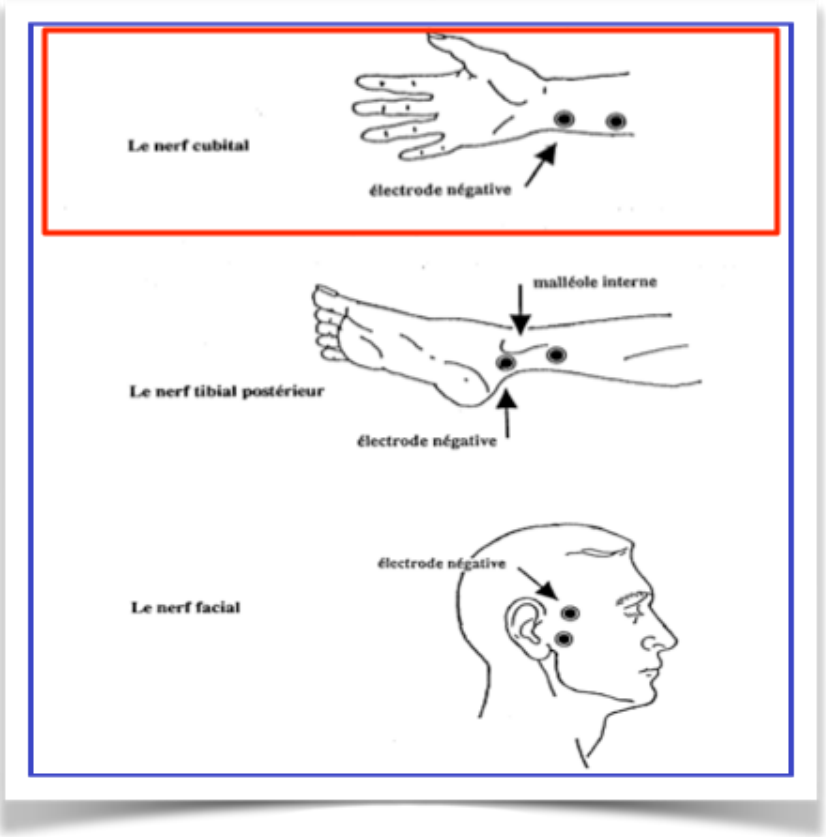
Brull SJ, Anesthesiology 2010

ACCELEROMYOGRAPHY

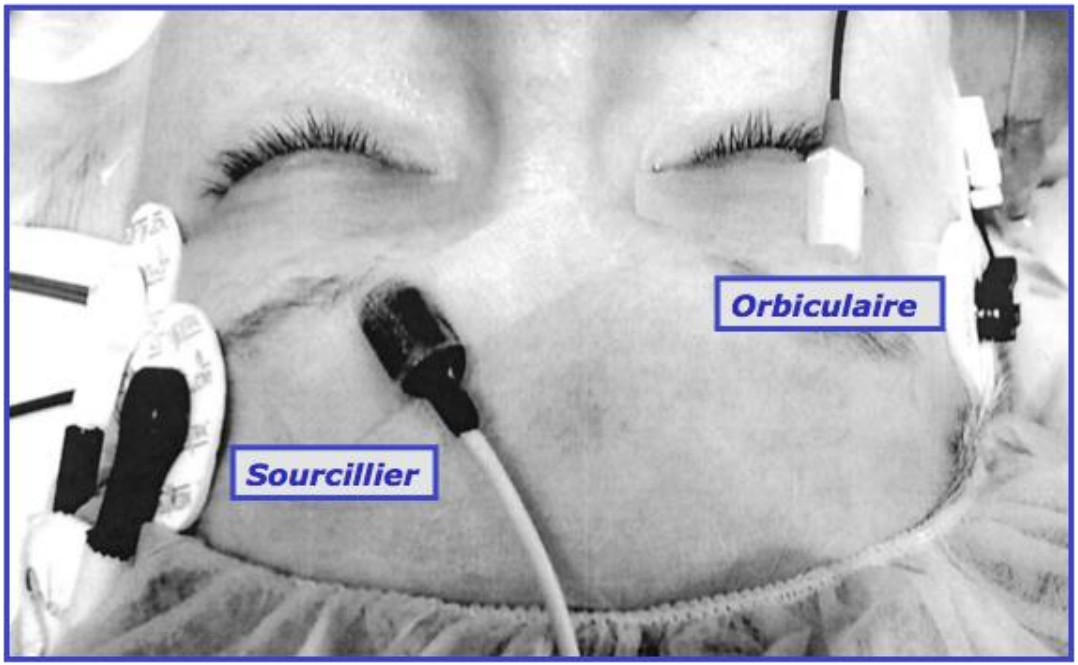


Force = Mass x Acceleration

SITES OF STIMULATION

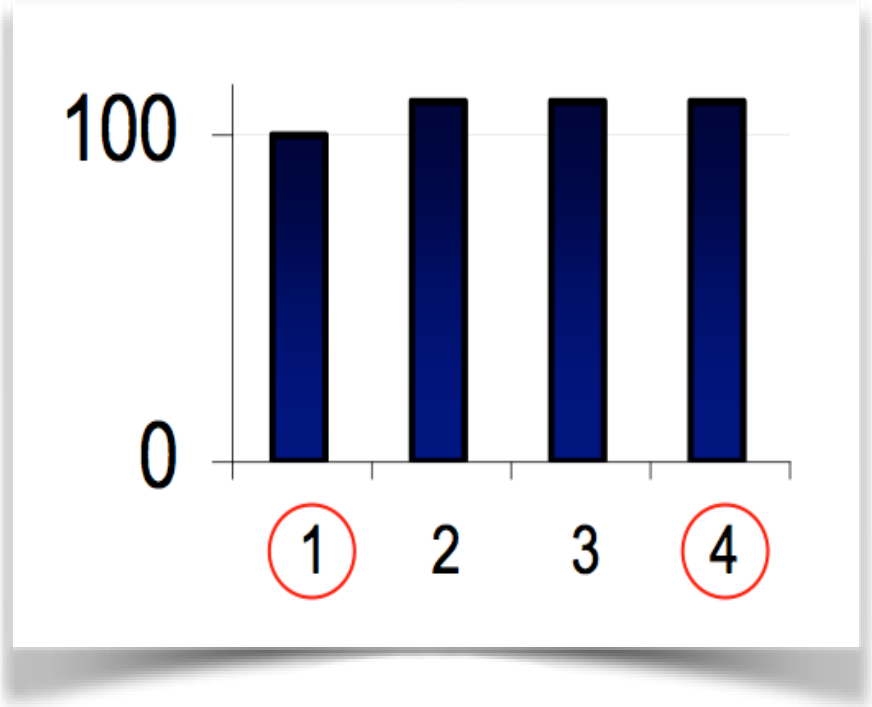


MONITORING AU NIVEAU DU VISAGE



Donati F, Anesthesiology 2001

CONTROL TOF > 100%



Kopman AF, Anesthesiology 2002

NORMALISATION

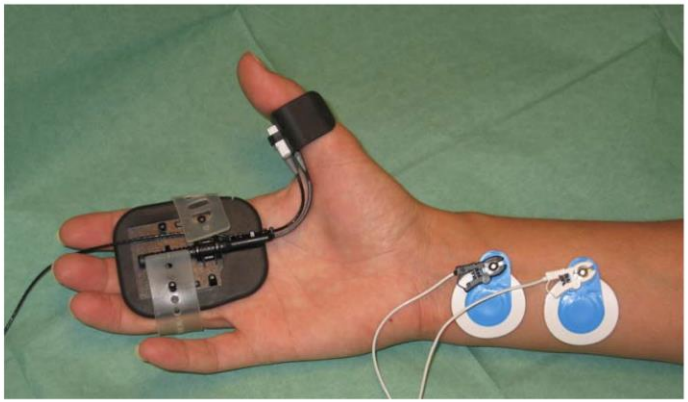
- TOF ratio during recovery is referred to the control TOF ratio
- E.g. control TOF value is 1.20
- A TOF 0.9 during recovery corresponds to a normalized TOF ratio of 0.75 (90% of 1.20)

Kopman AF, Anesthesiology 2002

Increasing precision of AMG

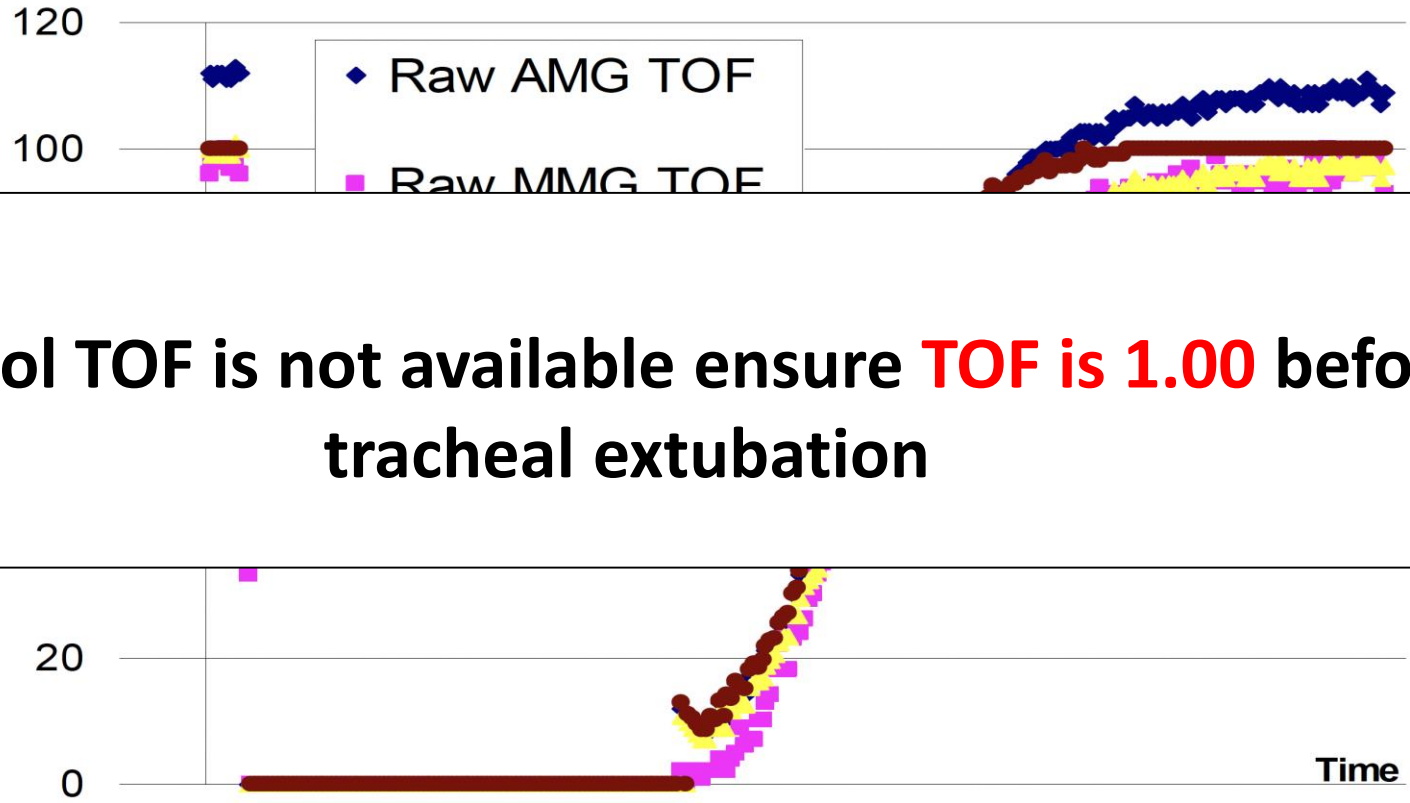
- Hand Adapter applied to AMG increases the precision

- However, the TOF ratio is increased as well



Claudius C. et al: Is the performance of acceleromyography improved with preload and normalization? A comparison with mechanomyography. Anesthesiology 2009; 110: 1261-70

Simultaneously obtained AMG TOF and MMG TOF data in one patient



If control TOF is not available ensure TOF is 1.00 before tracheal extubation

Claudius C. et al: Anesthesiology 2009

Comparison of the TOFscan and the TOF-Watch SX during Recovery of Neuromuscular Function

Glenn S. Murphy, M.D., Joseph W. Szokol, M.D., Michael J. Avram, Ph.D.,
Steven B. Greenberg, M.D., Torin D. Shear, M.D., Mark Deshur, M.D.,
Jessica Benson, B.S., Rebecca L. Newmark, B.A., Colleen E. Maher, B.S.

« *Conclusions: Good agreement between the TOF-Watch SX with calibration and preload application and the uncalibrated TOFscan was observed throughout all stages of neuromuscular recovery.* »

TOF3D

The Future is back!

MIPM präsentiert den TOF3D

Von den Machern des TOF-Watch*.

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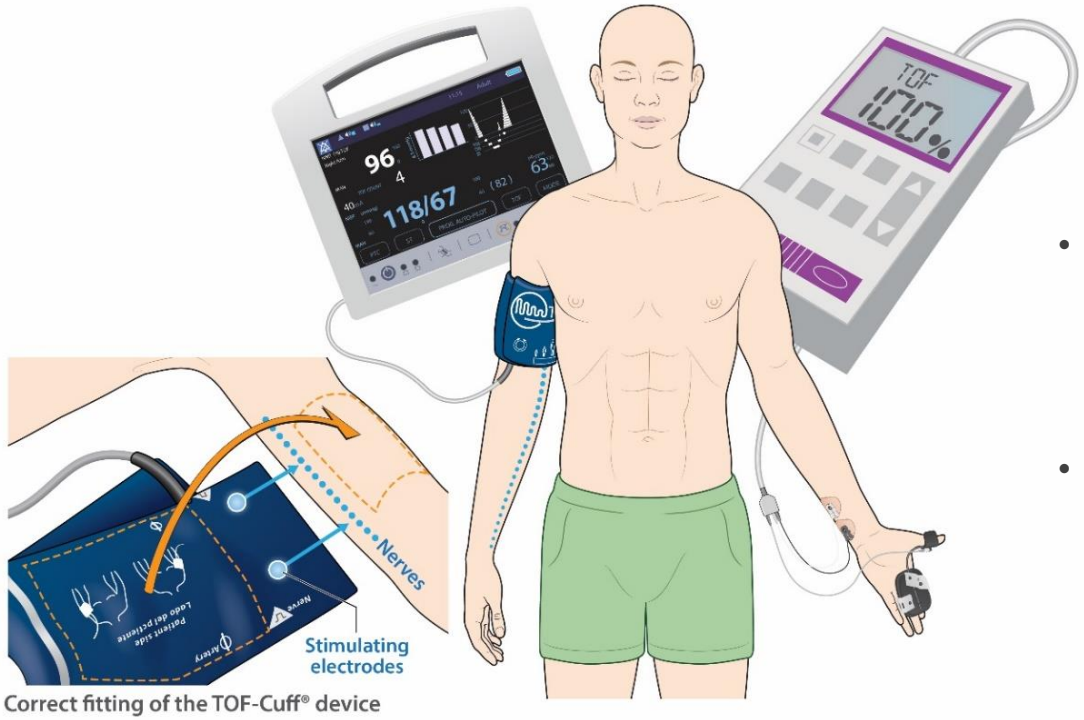
DOI: 10.1111/aas.13487

ORIGINAL ARTICLE

Assessment of spontaneous neuromuscular recovery: A comparison of the TOF-Cuff® with the TOF Watch SX®

Eve Sfeir Machado[1] | Gleicy Keli-Barcelos[1] | Elise Dupuis-Lozeron[2] | Martin R. Tramèr[1,3] | Christoph Czarnetzki[1,3]



Correct fitting of the TOF-Cuff® device

- The primary outcome was total recovery time (time in minutes from the injection of rocuronium to a normalized TOF ratio of 90%).
- Agreement between the two devices was calculated using mean difference and limits of agreement.

Acta Anaesthesiol Scand. 2019;00:1–7

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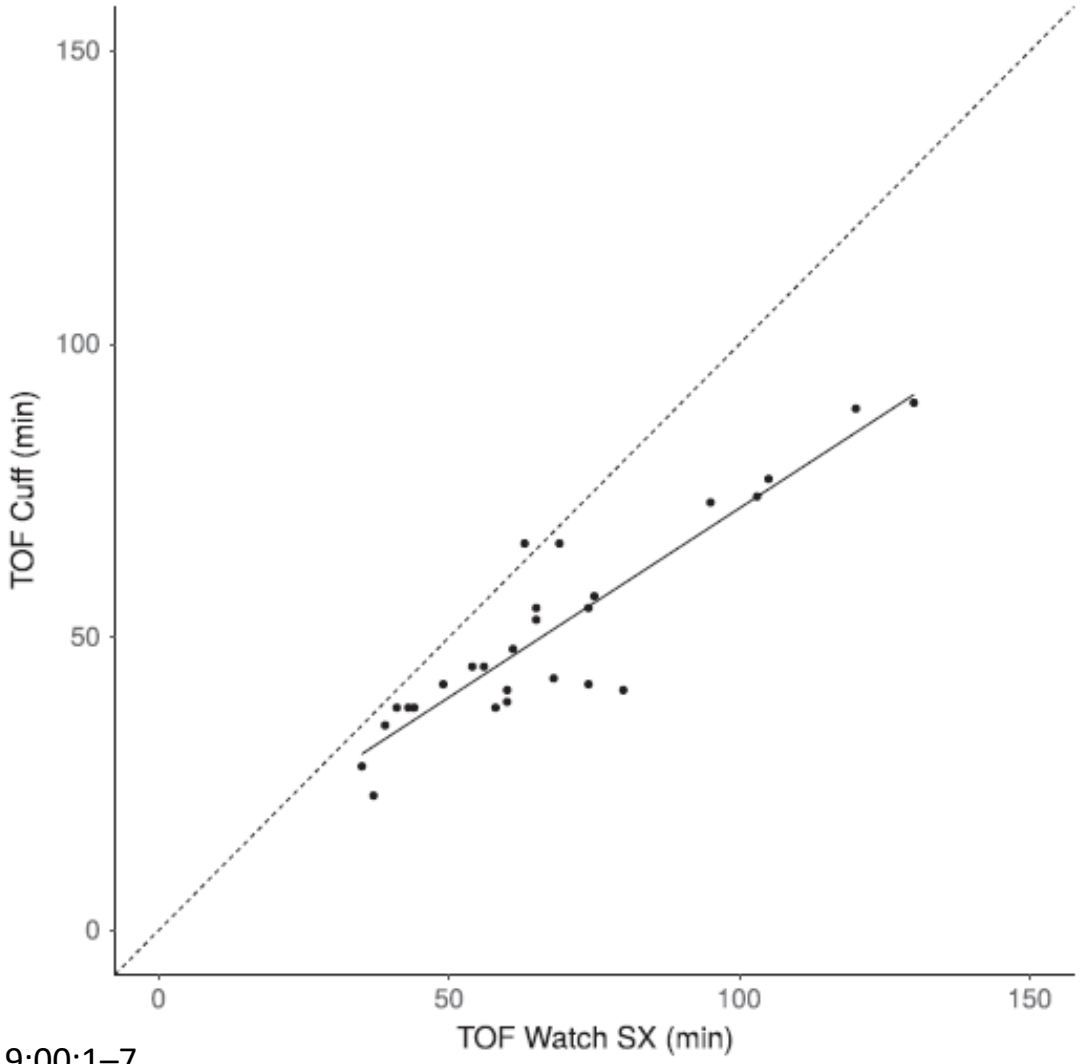
Results

- The primary outcome could be **analysed in 27 patients** because of 13 exclusions due to neuromuscular block reversal for shorter procedure surgical time, necessity of reinjection of rocuronium or technical failures of one of the two devices.
- Median total recovery time:
  - **test device:** 45 minutes (interquartile range [IQR] 38.5-61.5)
  - **reference device:** 63 minutes (IQR 51.1-74.5).
- Total recovery time with **the test device was on average 16.4 minutes shorter** (limits of agreement, **−6.1 to 39**)
  - increasing total recovery time was associated with increasing difference.

Sfeir et al. Acta Anaesthesiol Scand. 2019;00:1–7

Results

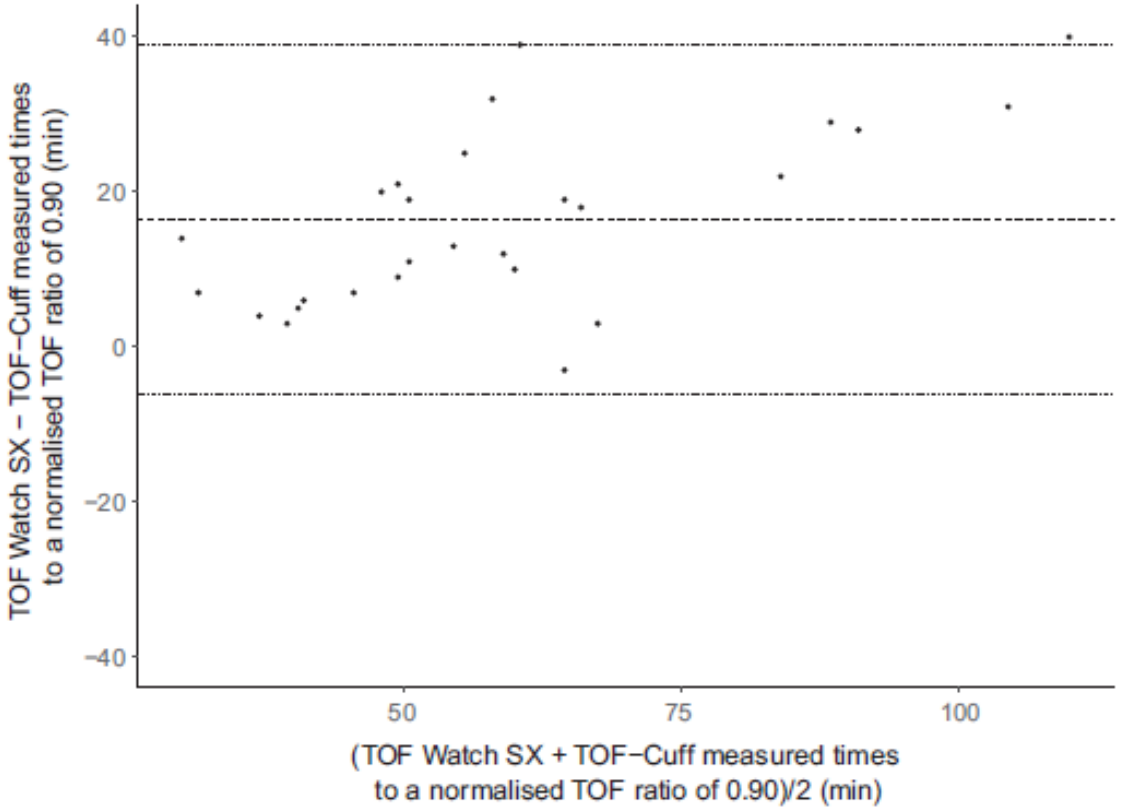
FIGURE 3 Scatter plot showing total recovery times with both devices in individual patients. In all but one patient, total recovery times were shorter with the TOF-Cuff® compared with the TOF Watch SX® and differences were increasing with increasing recovery times. Dotted line: line of equality, straight line: linear regression



Sfeir et al. Acta Anaesthesiol Scand. 2019;00:1–7

Results

FIGURE 2 Bland and Altman plot showing the degree of agreement between TOF Watch SX® and TOF-Cuff® regarding total recovery times in minutes from the injection of rocuronium to a normalised TOF ratio of 90% (n = 27). Recovery times were on average 16.4 min shorter with the TOF-Cuff® compared with the TOF Watch SX® (dashed line). Lower and upper limits of agreement (95% confidence interval [CI]; dotted lines) were −6.1 and +39.0 min. TOF = train of four



Sfeir et al. Acta Anaesthesiol Scand. 2019;00:1–7

Least sensitive

Diaphragm

↓ Corrugator supercilii muscle

↓ Laryngel muscles

↓ Orbicularis oculi muscle

↓ Abdominal muscles

Adductor pollicis

↓ Genioglossus muscle

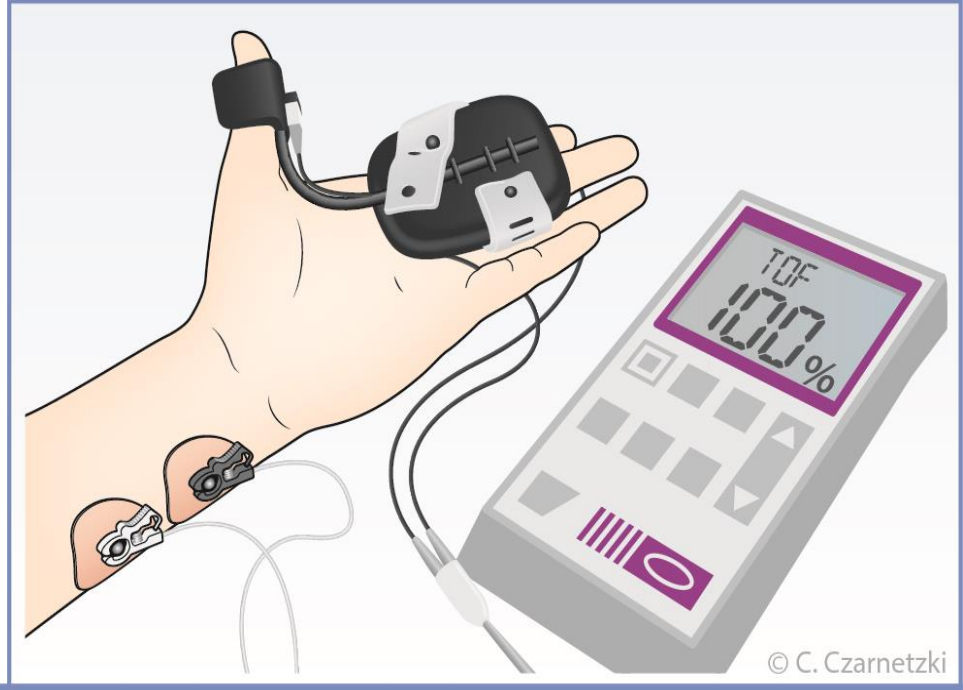
↓ Geniohyoideus muscle

↓ Masseter muscle

↓ Upper oesophagel sphincter

Pharyngeal muscles

Most sensitive



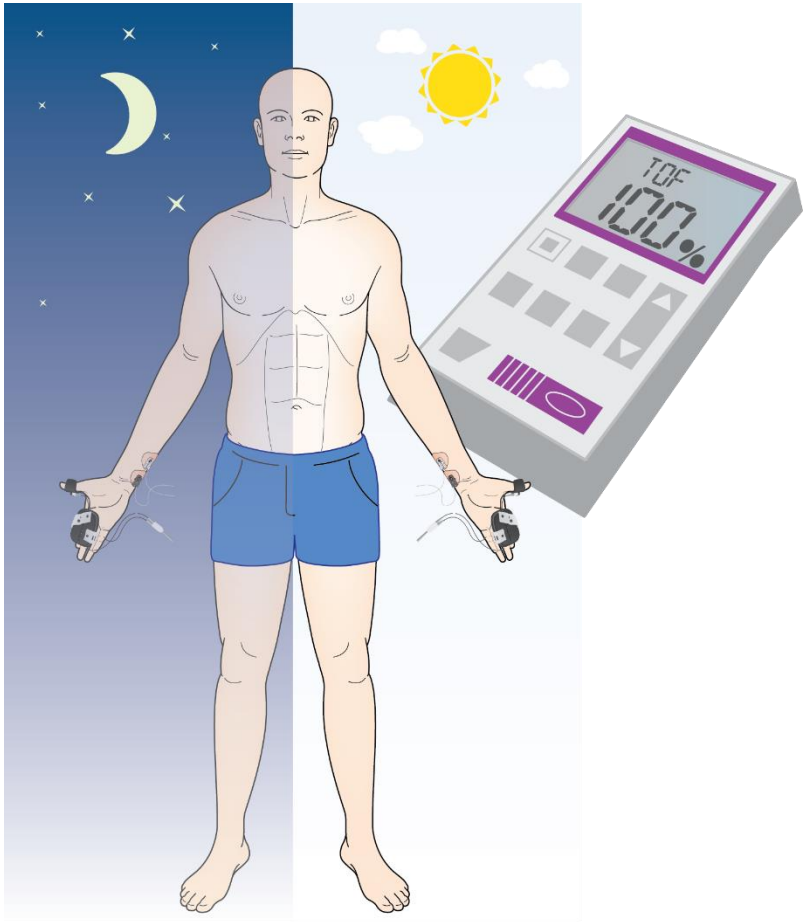
Standard monitoring

The validity and tolerability of awake calibration of the TOF Watch SX® monitor:

An interventional prospective multicenter study

Silvia Pozza M.D.; Daniele Speciale M.D.; Sina Grape M.D.; Sander MJ van Kuijk, Ph.D.;

Sorin J Brull M.D.; Christoph Czarnetzki, M.D., M.B.A.



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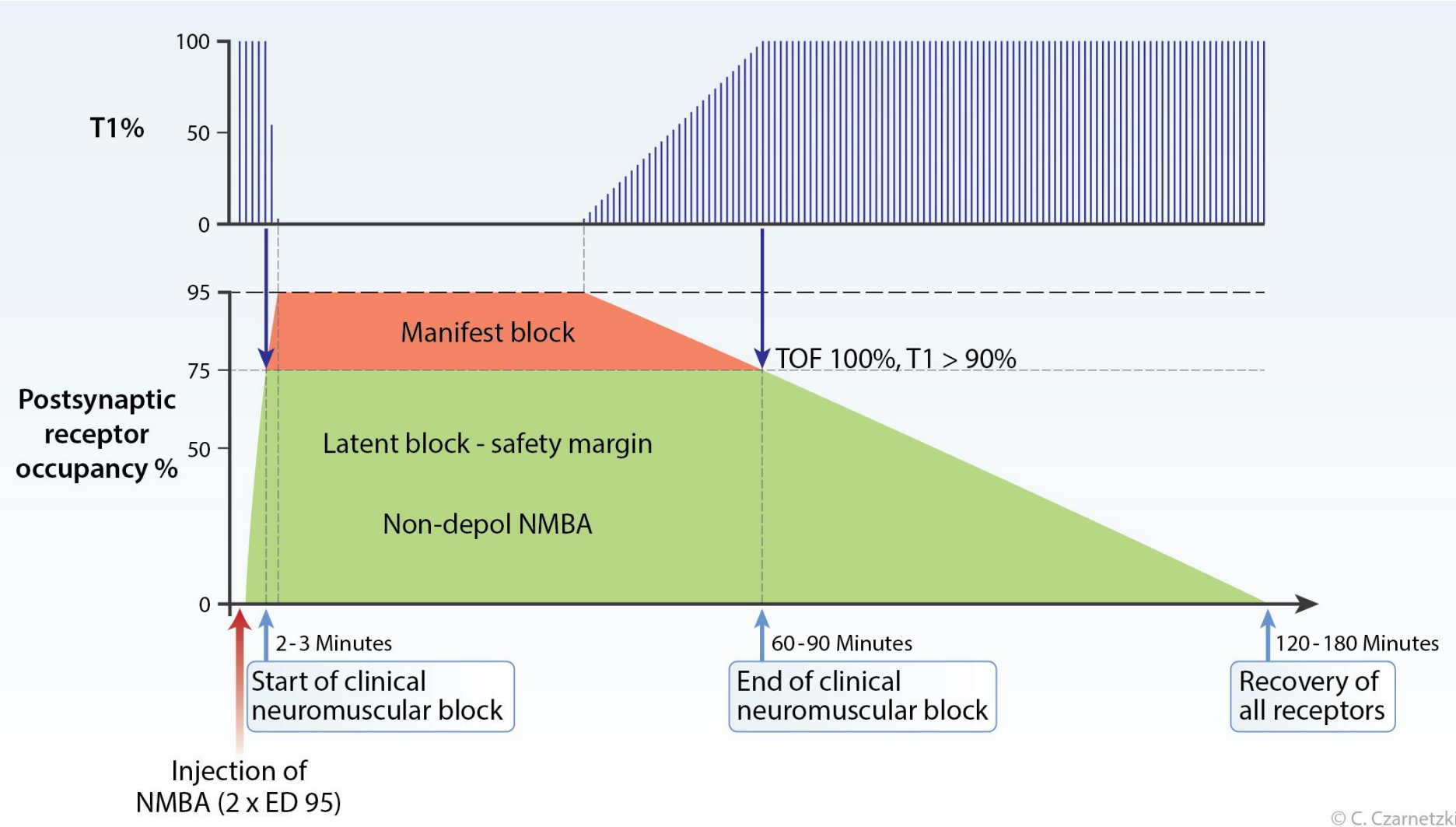
Results: The primary outcome was total recovery time (time in minutes from the injection of rocuronium to a normalized TOF ratio of 90%). It could be analyzed in 33 patients due to a monitoring failure in one patient. Mean total recovery time with awake calibration was 51 min (standard deviation (SD) 14) and with the asleep calibration 51 min (SD 14). There was no systematic difference (-0.37, 95% CI: -1.88; 1.14, p = 0.624). The intraclass correlation between both measures was 0.96 (95% CI: 0.92; 0.98). The mean pain rated during the awake calibration on a 0 to 10 NRS was 3.2 (SD 1.9), range: 0 to 8.

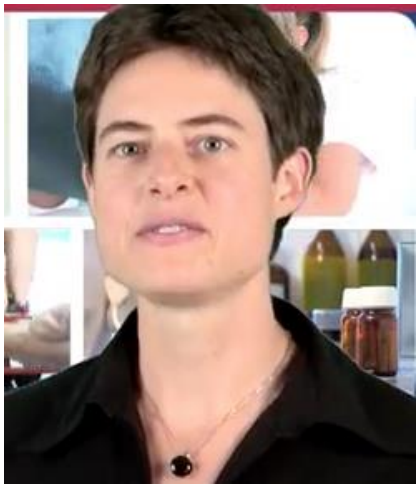
Conclusions: Awake calibration of the TOF Watch SX is in general well tolerated and produces valid results. It might be used before rapid sequence induction.

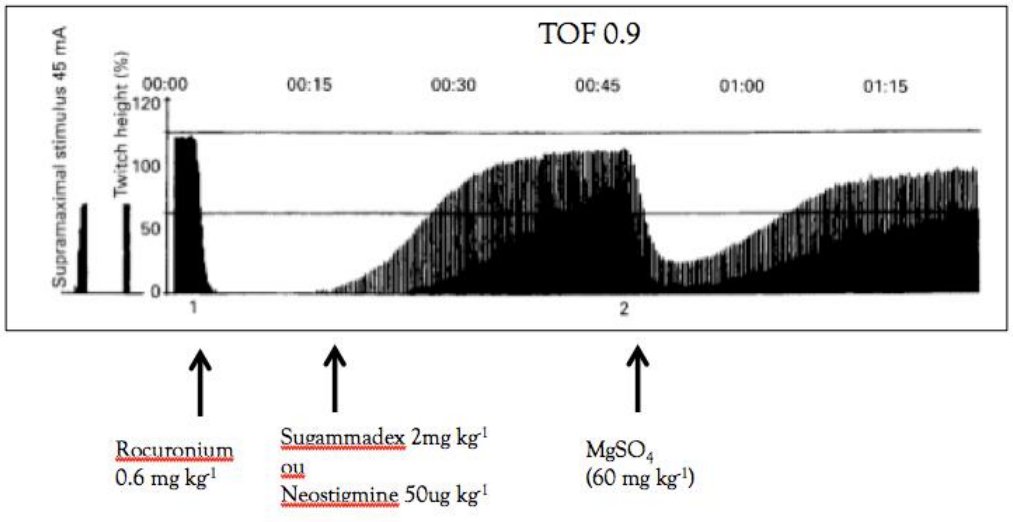
Future studies should be designed to document the feasibility of performing an automated monitor calibration and selection of maximal stimulating current in the clinical setting of rapid induction of anesthesia and intubation.



MagNeoSug study

Interaction entre le sulfate de magnésium intraveineux et la néostigmine ou le sugammadex pour l'antagonisation d'un bloc neuromusculaire induit par le rocuronium - Une étude électrophysiologique randomisée double aveugle



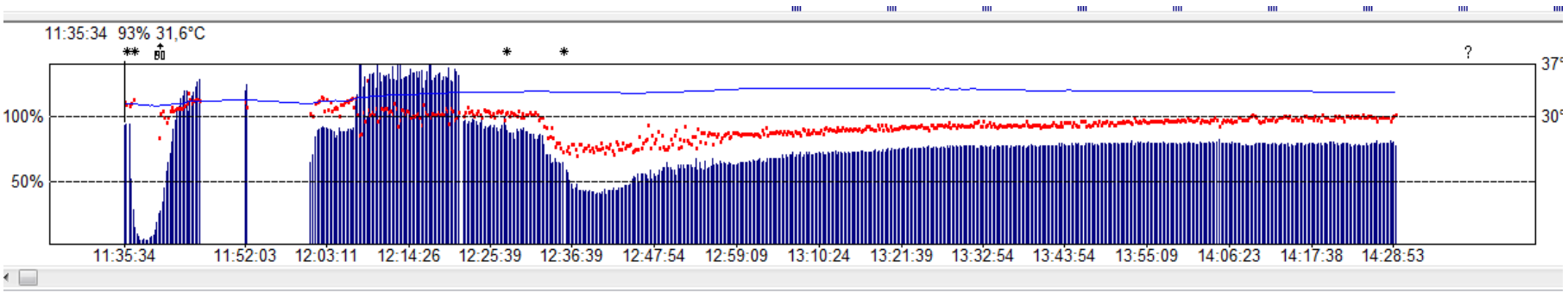


Sina Grape, Hôpital du Valais Sion

18 patients à randomiser.
Début prévu 1.2018

Clinical Study Protocol

Interaction between intravenous magnesium sulfate and volatile anesthetics compared to propofol. A multi-center prospective randomized single-blinded electrophysiological study



Lugano – Sion

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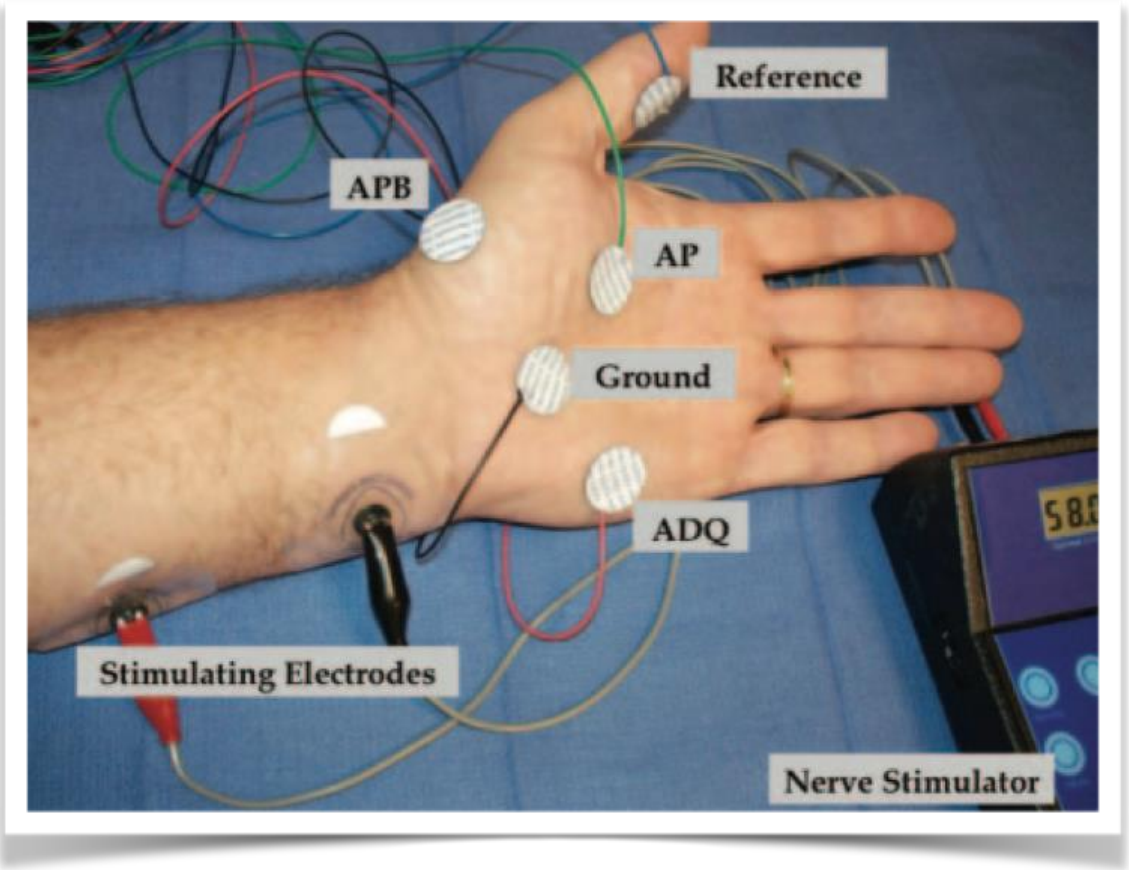
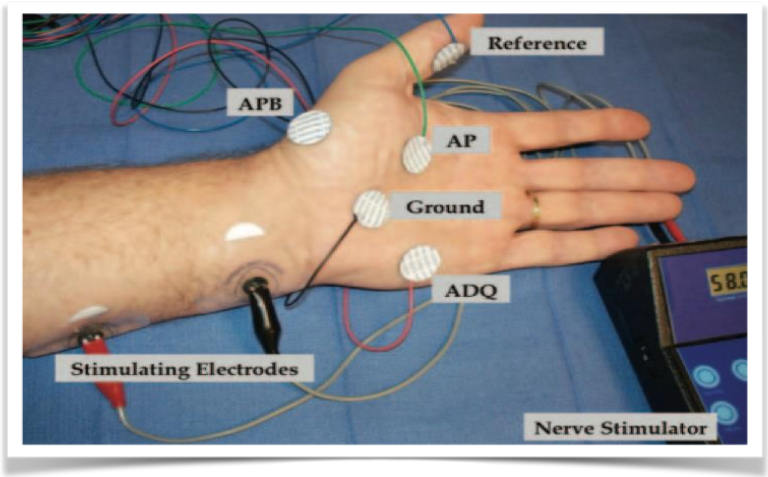
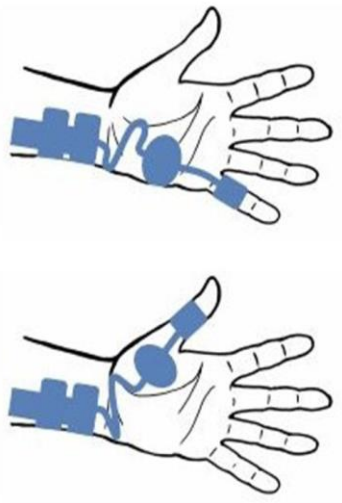
ELECTROMYOGRAPHIE



Brull SJ, Anesthesiology 2010

ELECTROMYOGRAPHIE





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ANESTHESIOLOGY

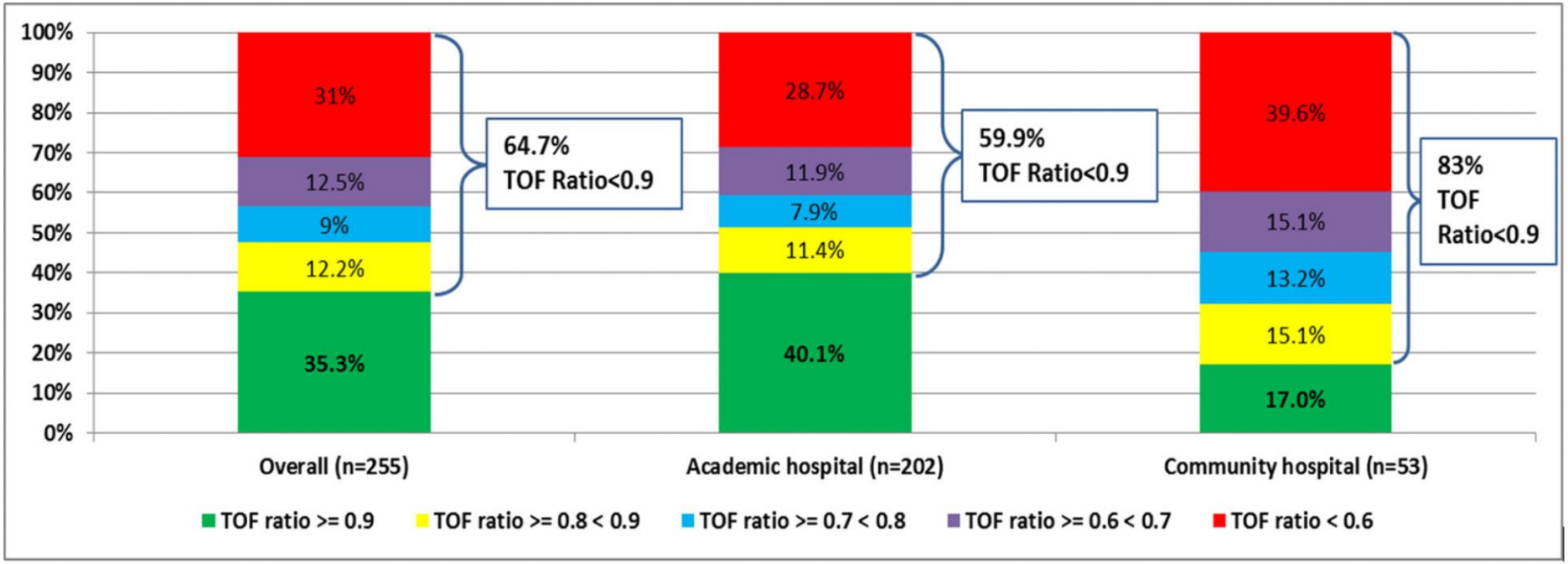
Ipsilateral and Simultaneous Comparison of Responses from Acceleromyography- and Electromyography-based Neuromuscular Monitors

Réka Nemes, M.D., Szabolcs Lengyel, Ph.D., D.Sci.,
György Nagy, M.D., David R. Hampton, Ph.D.,
Martyn Gray, B.Eng. (Hons), C.Eng. M.I.E.T.,
J. Ross Renew, M.D., Edömér Tassonyi, M.D., Ph.D., D.Sci.,
Béla Fülesdi, M.D., Ph.D., D.Sci.,
Sorin J. Brull, M.D., F.C.A.R.C.S.I. (Hon)

ANESTHESIOLOGY 2021; 135:597–611

Conclusions: Bias was lower than in previous studies. Limits of agreement were wider than expected because acceleromyography readings varied more than EMG both at baseline and during recovery. The EMG-based monitor had higher precision and greater repeatability than acceleromyography. This difference between monitors was even greater when EMG data were compared to raw (nonnormalized) acceleromyography measurements. The EMG monitor is a better indicator of adequate recovery from neuromuscular block and readiness for safe tracheal extubation than the acceleromyography monitor.

Incidence of residual neuromuscular block at tracheal extubation



Saager L, et al. J Clin Anesth. 2019 Aug;55:33-41

SPECIAL ARTICLE

Consensus Statement on Perioperative Use of Neuromuscular Monitoring

Mohamed Naguib, MB BCh, MSc, FCARCSI, MD,* Sorin J. Brull, MD, FCARCSI (Hon),†
Aaron F. Kopman, MD,‡ Jennifer M. Hunter, MBE, MB ChB, PhD, FRCA, FCARCSI (Hon),§
Béla Fülesdi, MD, PhD, DSci,‖ Hal R. Arkes, BA, PhD,¶ Arthur Elstein, PhD,#
Michael M. Todd, MD,** and Ken B. Johnson, MD††

The panel believes **that whenever a neuromuscular blocker is administered, neuromuscular function must be monitored** by observing the evoked muscular response to peripheral nerve stimulation. Ideally, this should be done at the **hand muscles** (not the facial muscles) with a **quantitative (objective) monitor**. Objective monitoring (documentation of **train-of-four ratio ≥0.90**) is the **only method of assuring that satisfactory recovery of neuromuscular function has taken place**. The panel acknowledges **that publishing this statement per se will not result in its spontaneous acceptance,** adherence to its recommendations, or change in routine practice. Implementation of objective monitoring will likely **require professional societies** and **anesthesia department leadership** to champion its use to change anesthesia practitioner behavior.

Anesth Analg 2018;127:71–80

Anaesthesia 2021, 76, 1212–1223 doi:10.1111/anae.15501

Guidelines

Recommenda
anaesthesia a

Guideline from the A

A. A. Klein,[1] **T. Meek,**[2]
J. J. Pandit,[8] **A. Pawa,**

1 Consultant, Department o
Association of Anaesthetists
2 Consultant, Department o
Association of Anaesthetists
3 Consultant, Department o
4 Consultant, Royal United H
5 Consultant, Department o
6 Consultant, Royal Derby H
7 Consultant, Department o
8 Professor, University of Ox
9 Consultant, Department o
Regional Anaesthesia UK (RA
10 Consultant, Department
11 Consultant, Department

Summary
This guideline updates a
of this document is to pr
anaesthesia or sedation
anaesthetists practising i
other areas of the world.
phase are included. Ther
There are new sections sp
indications for processed

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.

1212–1223

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Raccomandazioni per la curarizzazione e "antagonizzazione"

Ente Ospedaliero Cantonale

Suxamethonium | **Rocuronium** | **Atracurium**

Monitoraggio

Ogni curarizzazione necessita di un monitoraggio quantitativo.
Per una misura con accelerometrica affidabile, il pollice deve essere libero di muoversi.
(Non necessario Con electromyografia)

DECURARIZZAZIONE

No antagonizzazione

*

Blocco profondo TOF=0 PTC=1 a 5	Blocco moderato TOF =1 a 3	Blocco superficiale TOF = 4
Sugammadex 4mg/kg peso reale	Sugammadex 2mg/kg peso reale	Neostigmina 0,04 mg/kg peso reale

* **Al termine di una chirurgia elettiva, conviene sempre aspettare la decurarizzazione spontanea salvo nelle seguenti situazioni:**

- Obesità con BMI ≥ 35
- Patologie neuromuscolari
- Necessità operatorie *(es: curarizzazione profonda fino a fine intervento)*

Rescue inhibition

- **Can't intubate, can't ventilate** *(dopo Rocuronium)*
- **Shock anafilattico presunto** *(al Rocuronium)*

Sugammadex 16 mg/kg peso reale

Blocco superficiale TOF = 4

Neostigmina 0,04 mg/kg peso reale

Estubazione

ESTUBAZIONE appena T4/T1 ≥ 1

References:

1. A systematic review of sugammadex vs neostigmine for reversal of neuromuscular blockade. Abad-Gurumeta A, et al. Anaesthesia review group. 2015;70:1441-52
2. *Secondo la Conferenza di attualizzazione ® 2018 Sfar (Società francese d'anestesia e reanimazione)* https://sfar.org/wp-content/uploads/2018/10/2_RFE-CURARE-3.pdf
3. *Thèse de Privatdocent Christoph Czarnetzki 2017 Drug interactions in the context of neuromuscular blockade: clinical implications and safety issues https://archive-ouverte.unige.ch/unige:100276*

Redazione: Modificato dal Originale linea guida HUG Ginevra Marzo 2017. Tradotto dal francese: I. Baudracco, Agosto 2019. Modificazioni C. Czarnetzki settembre 2019

Thanks for your attention