Miorelaxantele și blocul rezidual

Călin Mitre

UMF Cluj-Napoca

ATI1

- **Sunt necesare miorelaxantele în practica curentă?**
- **Ce miorelaxante vom folosi în practică?**
- **Efectele clinice ale miorelaxantelor**
- **Blocul rezidual**
- **Este necesară reversia blocului neuromotor ?**

- **Sunt necesare miorelaxantele în practica curentă ?**

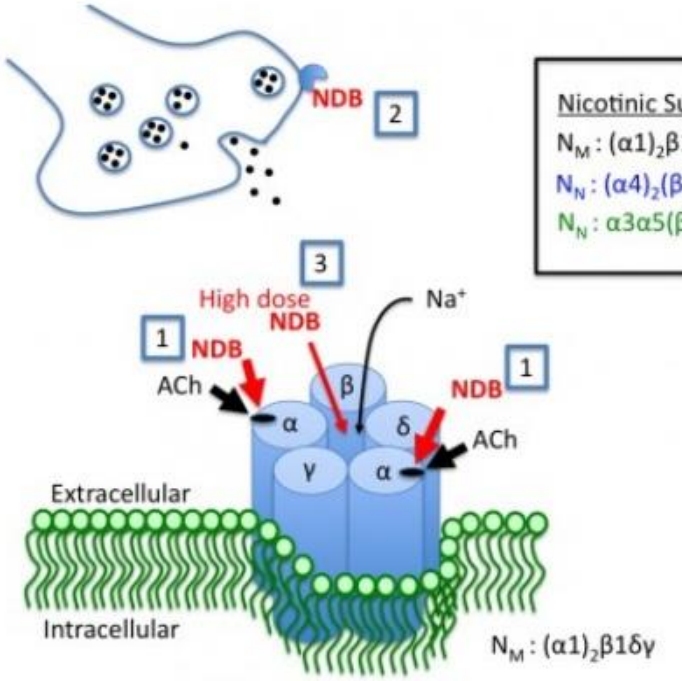
- Înainte de introducerea curarelor
  - Relaxarea musculară – aprofundarea anesteziei– risc de depresie respiratorie și cardiovasculară

- 1942 Griffith and Johnson – a introdus curarele în practica anestezică (Balanced anaesthesia).

Clasificarea miorelaxantelor

Clasificare clinică	Clasificare chimică
Depolarizante	
Succinilcolina	
Nedepolarizante	
Acțiune lungă durată	
•Pancuronium	Aminosteroid
•Doxacurium	Aminosteroid
•Pipercuronium	Aminosteroid
Acțiune intermediară	
•Atracurium	Benzylisoquinoline
•Vecuronium	Aminosteroid
•Rocuronium	Aminosteroid
•Cisatracurium	Benzylisoquinoline
Acțiune de scură durată	
•Mivacurium	Benzylisoquinoline

Nondepolarizing Block in Muscles



Nicotinic Subunit Composition:

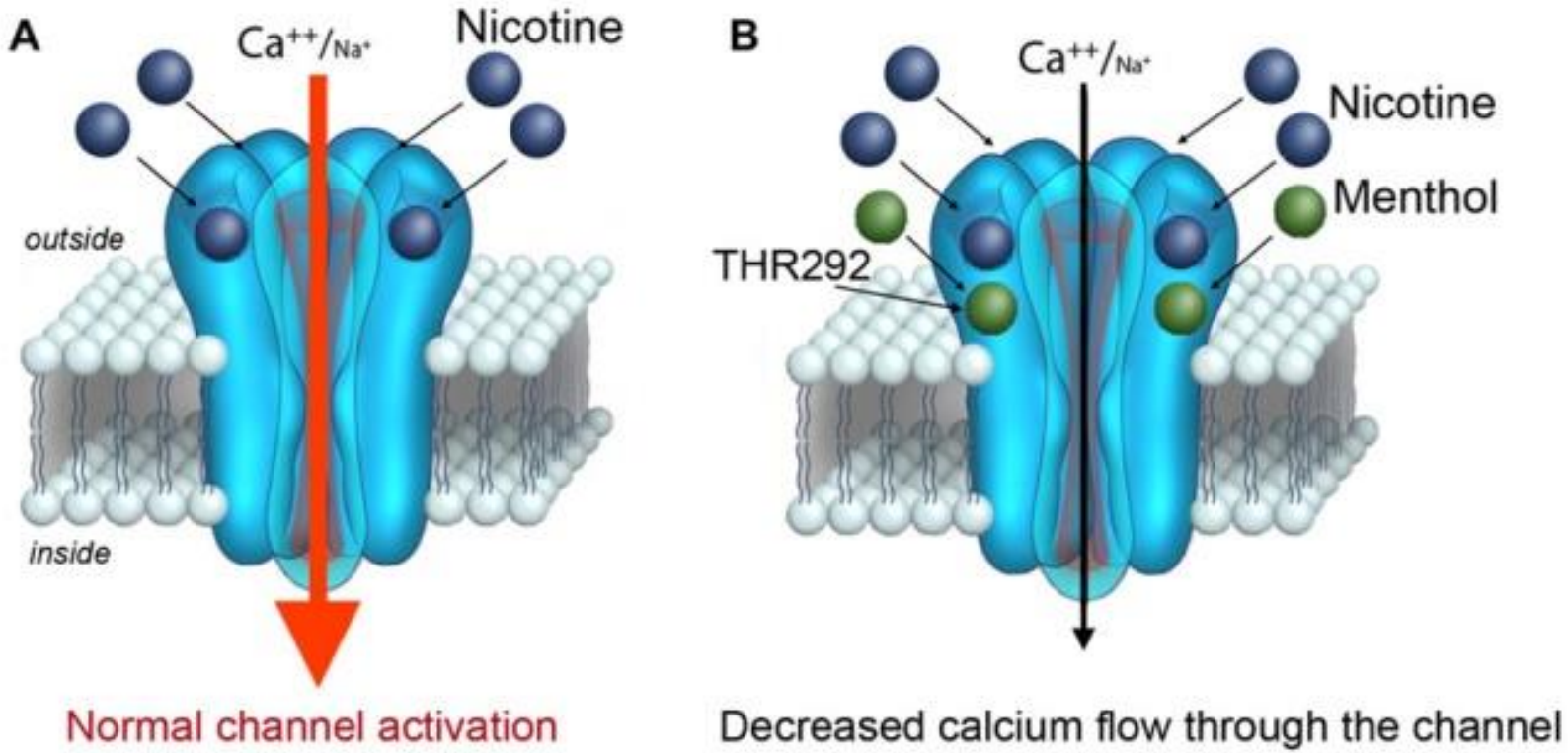
N_M : $(\alpha1)_2\beta1\delta\gamma$ (Motor Endplate)

N_N : $(\alpha4)_2(\beta2)_3$ (CNS)

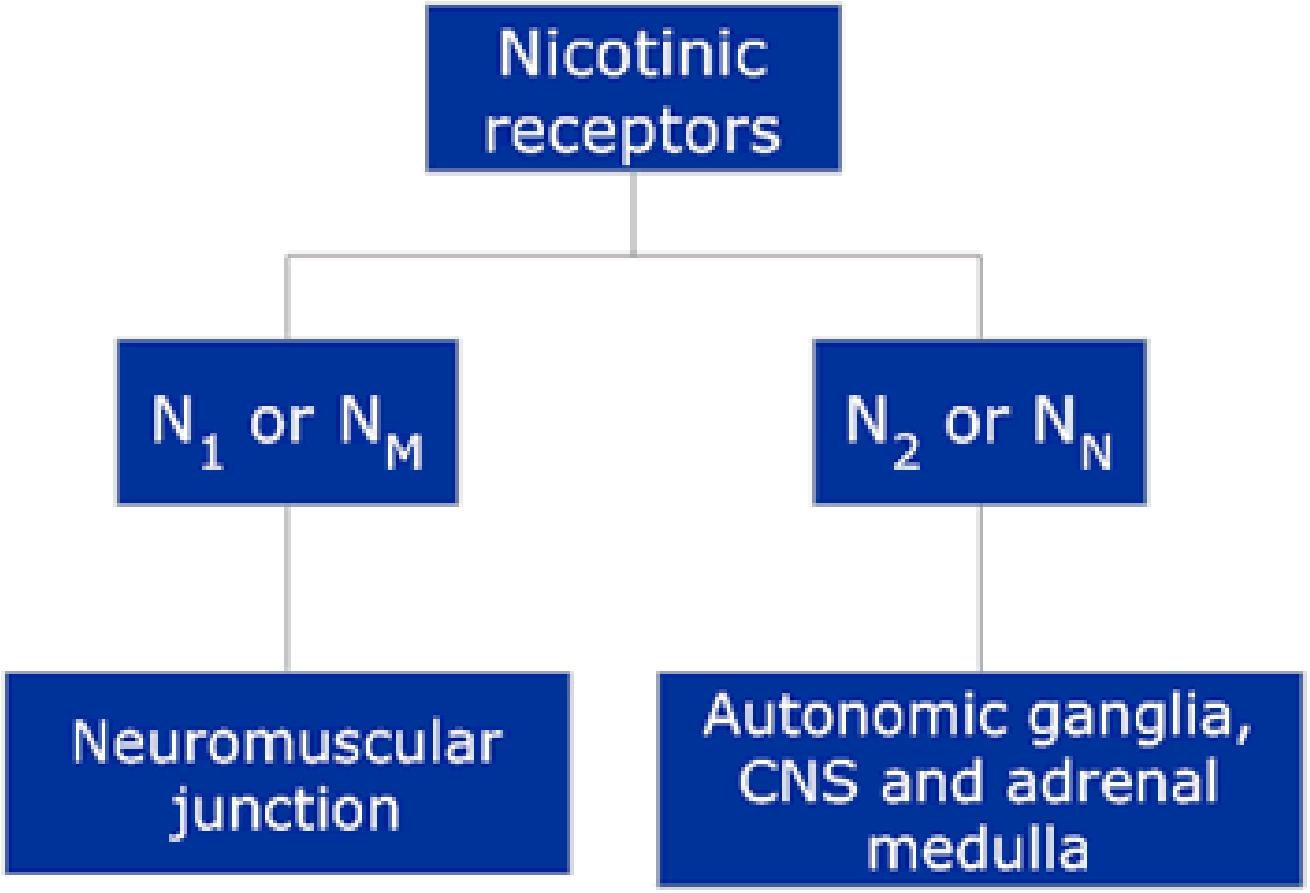
N_N : $\alpha3\alpha5(\beta2)_3$ (Ganglia)

Drawing Adapted from: Karlin A: Nature Reviews Neuroscience 3, 102-114 (February 2002)

Pentameric data from: Millar NS: Assembly and subunit diversity of nicotinic acetylcholine receptors. Biochem Soc Trans 31:869, 2003.


A
Ca++/Na+
Nicotine
outside
inside
Normal channel activation
B
Ca++/Na+
Nicotine
Menthol
THR292
Decreased calcium flow through the channel

Efecte sistemice ale miorelaxantelor



Metabolism

- Hepatic cu eliminare renal;
- Degradarea Hofmann (mecanism chimic de eliminare) -degradarea spontană a amidelor la amine și a sărurilor quaternare de amoniu în terțiare (ex. atracurium se transformă în laudanosine la nivelul plăcii neuromusculare).
- Hidroliză esterică (enzimele plasmatice-pseudocolinesterază) (mecanism biologic).

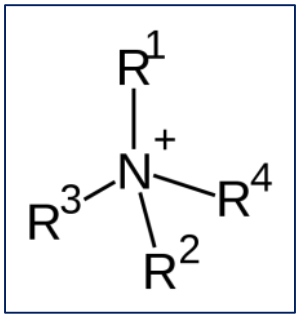
- **Avantaje :**
- Relaxare musculară în câmpul operator și absența mișcărilor spontane.

- **Dezvantaje:**
- Lipsa reacției clinice atenționare awareness .
- Uneori nu este necesară paralizia completă a pacientului- leziuni de decubit.

Complicațiile miorelaxantelor

- **Reacția alergică - anafilactică sau anafilactoidă** - amoniu quaternar - component antigenic
- **Efecte sistemice.**
- **Post Operative Residual Curarisation - PORC**

Miorelaxante



- **Complicații:**

1. **Reacția anafilactică-igE**
   - Benzylisoquinolines mult mai puternic eliberatori de histamină comparativ cu miorelaxantele aminosteroizi;
   - Reacția este de tip încrucișat pentru toate medicamentele care conțin amoniu în structura lor;
   - Sensibilizarea inițială - contact inițial la alte produse care conțin antigen de amoniu quaternar,

- **Reacția de tip anafilactoid -** eliberare de histamină (atracurium)

- RK Stoelting Pharmacology and Physiology in Anesthetic practice, 2006.pag.208-250.

- **Ce miorelaxante vom folosi în practică?**

Table I Pharmacodynamic properties of neuromuscular blocking drugs

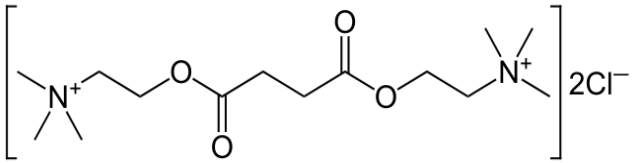
Drug	ED_{95}[a] (mg kg^{-1})	Intubating dose (mg kg^{-1})	Onset time[b] (s)	Clinical duration[c] (min)
Succinylcholine	0.3	1.0[d]	60	10
Benzylisoquinolines				
Tubocurarine	0.5	0.5-0.6	220	80 +
Atracurium	0.23	0.5	110	43
Mivacurium	0.08	0.15-0.2	170	16
Doxacurium	0.025	0.05	250	83
Cisatracurium	0.05	0.1	150	45
Aminosteroids				
Pancuronium	0.07	0.1	220	75
Vecuronium	0.05	0.1	180	33
Pipecuronium	0.045	0.08	300	95
Rocuronium	0.3	0.6	75	33
Rapacuronium	1.2	1.5	<75	15

[a]The dose that depresses the twitch height by 95%.
[b]Time to 95% depression of first twitch of train-of-four.
[c]Time to 25% recovery of first twitch of train-of-four.
[d]This is about three times the ED_{95}.

Miorelaxante depolarizante

- **Suxamethonium:** Analog de acetilcolină – singurul reprezentant.

- 1951 Bruke et al.- în Europa
- 1952 Foldes et al . – în USA
- Popularitate maximă 1980-1981



- **Mod de acțiune** se fixează pe subunitățile alfa ale receptorilor nicotinici, mimând acțiunea acetilcolinei.
- **Avantaje:**
  - Debut rapid : **30-60 s**
  - Acțiune scurtă: **10-15min.**
  - Metaboliți inactivi
  - Ieftin
- **Doza:** 1-1.5mg/kg
- **Nu se repetă administrarea**

- **Contraindicații:**
- Istoric personal sau familial de hipertermie malignă,
- Risc crescut de hiperpotasemie
- Boli neuromusculare care implică denervare , distrofii musculare,
- Accident vascular cerebral,arsuri, traumatisme prin strivire peste 72 de ore = rabdomioliză

Succinilcolina Efecte secundare

Table 3 Some adverse effects of suxamethonium.

Adverse effect	Risk factors	Management
Cardiovascular		
Increase in blood pressure and/or heart rate	High dose of suxamethonium	
Decrease in blood pressure and/or heart rate	Low dose of suxamethonium	
Bradycardia	Usage in children	Administration of atropine or glycopyrrolate
Cardiac arrest	Repeated doses of suxamethonium	
Arrhythmias	Pre-existing heart disease	
Acute rhabdomyolysis (risk of hyperkalaemia and cardiac arrest)	Skeletal muscle myopathies such as Duchenne's muscular dystrophy	
Hyperkalaemia	Extensive burn injury, multiple trauma, extensive denervation of skeletal muscles and upper motor neuron injury Risk highest 7–19 days after injury	Suxamethonium contraindicated
Myalgia	High dose of suxamethonium Usage in young adults and females Most pronounced in muscles in neck, back and shoulders	Pre-treatment with a non-depolarising NMB (10% ED_{95}) Peri-operative treatment with non-steroidal anti-inflammatory drugs
Fasciculations	Not related to myalgia	Pre-treatment with a non-depolarising NMB (10% ED_{95})
Trismus/masseter spasm*	Usage in children	
Increase in intragastric pressure	Might be related to fasciculations Hypothetical risk of pulmonary aspiration is not proven	
Increase in intra-ocular pressure	Pre-existing increased intraocular pressure Open eye injury	Suxamethonium relatively contraindicated
Malignant hyperthermia	Only NMB that may trigger hyperthermia Genetic predisposition Combination with potent inhalational anaesthetics	

*May be a sign of malignant hyperthermia.

Fasciculații- Mecanism

Suxamethonium

- **Indicații actuale:**
- **Inducție “stomac plin”**
- **Intubație dificilă**
- **Intervenții de scurtă durată**

Goodbye Suxamethonium !
C.LeeAnaesthesia 2009;64:73-81

- Suxamethonium vs. Rocuronium + Sugammadex

- Lee C, Jahr JS, Candiotti K, Warriner V, Zornow MH. Reversal of profound rocuronium NMB with sugammadex is faster than recovery from succinylcholine. Anesthesiology.2007;107:A988

Nr total de pacienți =110	Suxamethonium (1mg/kg)	Rocuronium + sugammadex (3min.) (1.2mg/kg +16mg/kg)
Debut	1min.	1min.
Revenire	7.1min (T1= 10%) 10.9 min T1= 90%)	4.4min (T1 = 10%) 6.2 min T1 = 90%)

Efecte secundare ale miorelaxantelor nedepolarizante

- **Gg. SNV:**
- Blocarea parțială a nr. de gg
  - hTA
  - Tahicardie

- **Eliberare de histamină:**
  - hTA
  - Bronhospasm
  - Hipersecreție bronșică

- **Sistemul cardio-vascular:**
  - hTA
  - Reducerea întoarcerii venoase
  - Tahicardie

} **Excepție noua generație de NMB**

- **TGI: ileus paralitic**

- **Efectele miorelaxantelor – acțiune clinică previzibilă ?**

Suxamethonium

Debut rapid - 30-60s

Durata de acțiune depinde de hidroliza plasmatică efectuată de colinesterază

Timpul de acțiune -**Variabil**

Phenotype	Time to first response to train-of-four stimulation; min	Time to sufficient recovery (train-of-four ratio ≥ 0.9); min
Normal	5–10	10–15
Heterozygous for the usual and at least one of the abnormal genes	10–15	15–25
Homozygous for two abnormal genes	40–60	120–180

Suxamethonium

- **Cauze genetice:**
  - Biosinteza de colinesterază este controlată de peste 40 de genotipuri diferite -modificări enzimatice.
  - În populația Caucaziană **24%** din persoane prezintă cel puțin una din variantele de colinesterază modificate.
  - Clinic nu se cunoaște de la început genotipul sau varianta de colinesterază.

- **Cauze non-genetice:**
  - Modificări fiziologice : sarcină, nou-născut,
  - Patologice: arsuri, afecțiuni hepatice sau renale, malignitate
  - Iatrogene: neostigmina, contraceptivele hormonale
  - Intoxicații : organofosforice.

Post-Operative Residual Curarization (PORC): A Big Issue for Patients' Safety

A. Castagnoli, M. Adversi, G. Innocenti, G.F. Di Nino and R.M. Melotti
Anesthesiology and Intensive Care, S. Orsola-Malpighi Hospital, University of Bologna, Italy

www.intechopen.com 25.04.2012

Molecule	ED95 (mcg/kg)	Onset (min)	Time for the recovery of T1 (min)
Atracurium (B)	200	5-6	20-25
Cis-Atracurium (B)	50	5-6	20-25
Vecuronium(S)	80	5-6	20
Rocuronium (S)	300	2-3	20
Mivacurium (B)	80-150	2-3	20
Pancuronium (S)	60	4-5	60

Table 1. Main non depolarizing blocking agents – curares. ED95 = effective dose (ED) that will produce a specified response (neuromuscolar block) in 95 percent of a population. S = aminosteroid; B = benzylisoquinolinium

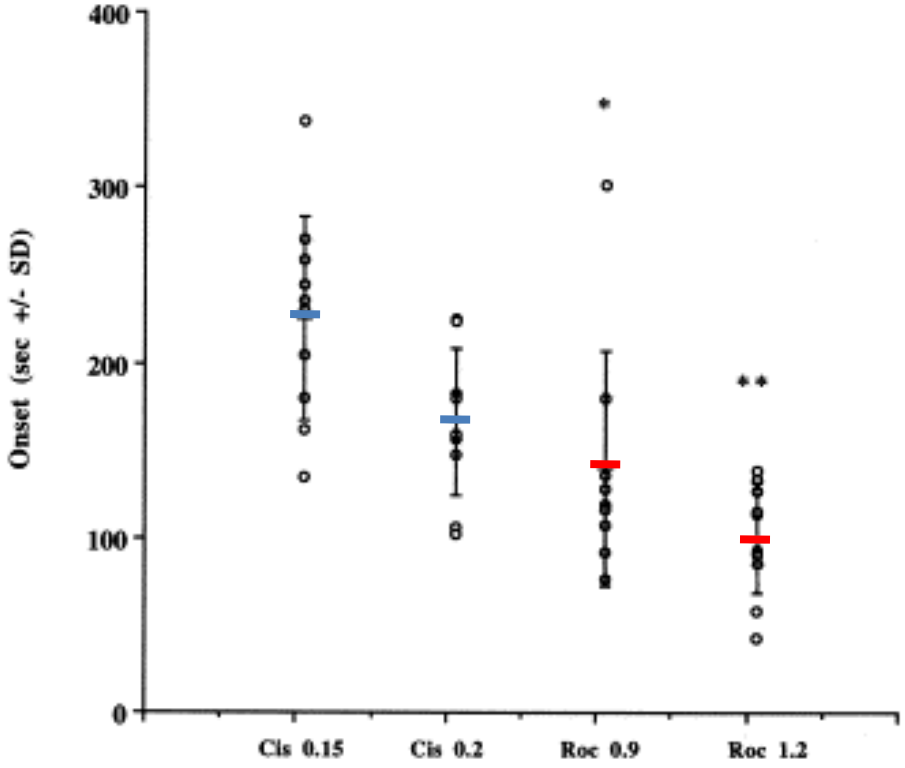
Geoffrey K. Lighthall, MD, PhD,*
Mark A. Jamieson, MD,† Jadwiga Katolik, MD,‡
John G. Brock-Utne, MD, PhD§

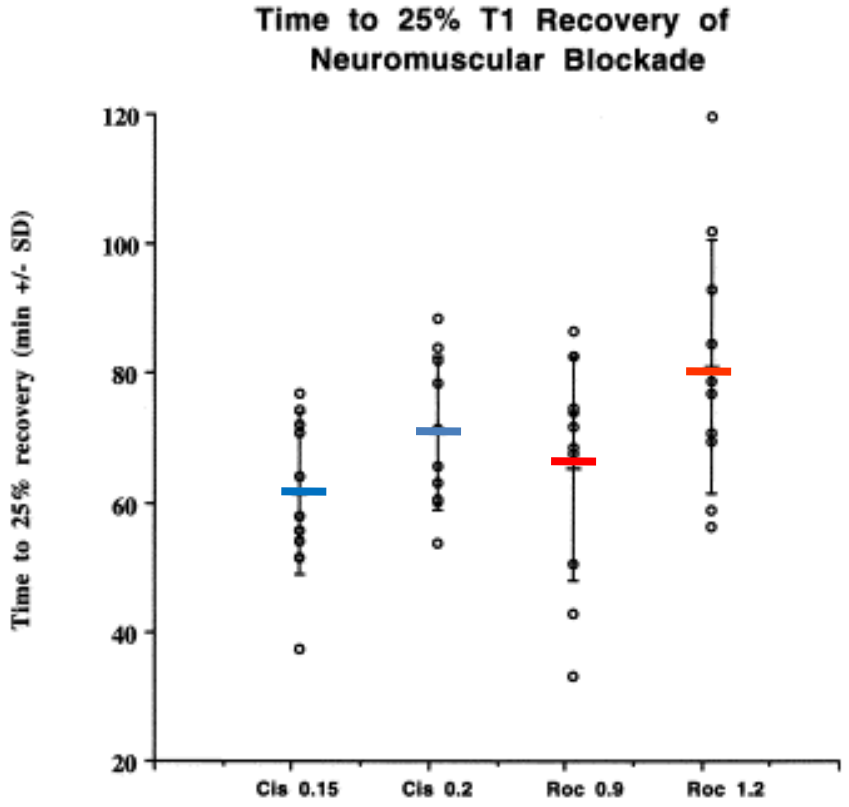
Journal of Clinical Anesthesia 11:220–225, 1999

A Comparison of the Onset and Clinical Duration of High Doses of Cisatracurium and Rocuronium

1996

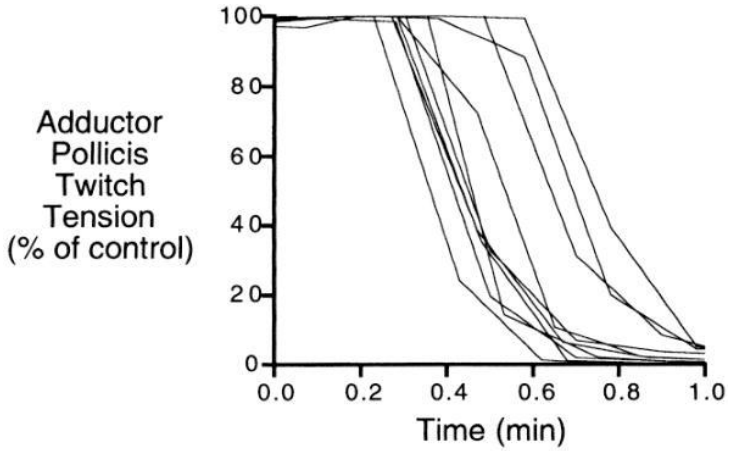
Variabilitate în debut și timp de acțiune



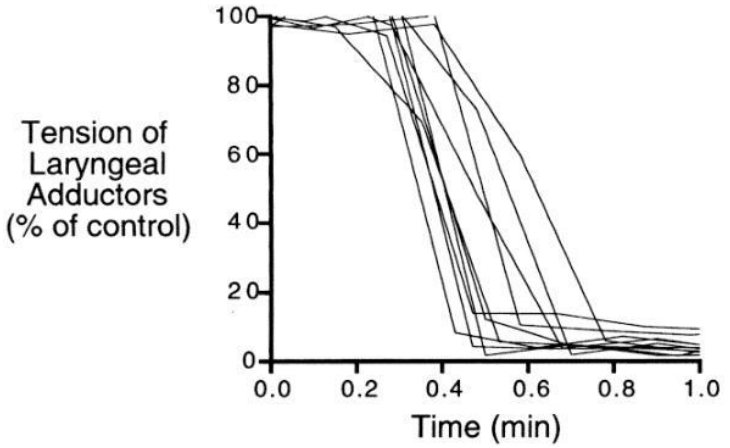


A Pharmacodynamic Explanation for the Rapid Onset/Offset of Rapacuronium Bromide.

Wright, Peter; Brown, Ronald; Lau, Marie; Fisher, Dennis
Anesthesiology. 90(1):16-23, January 1999.



Debut variabil



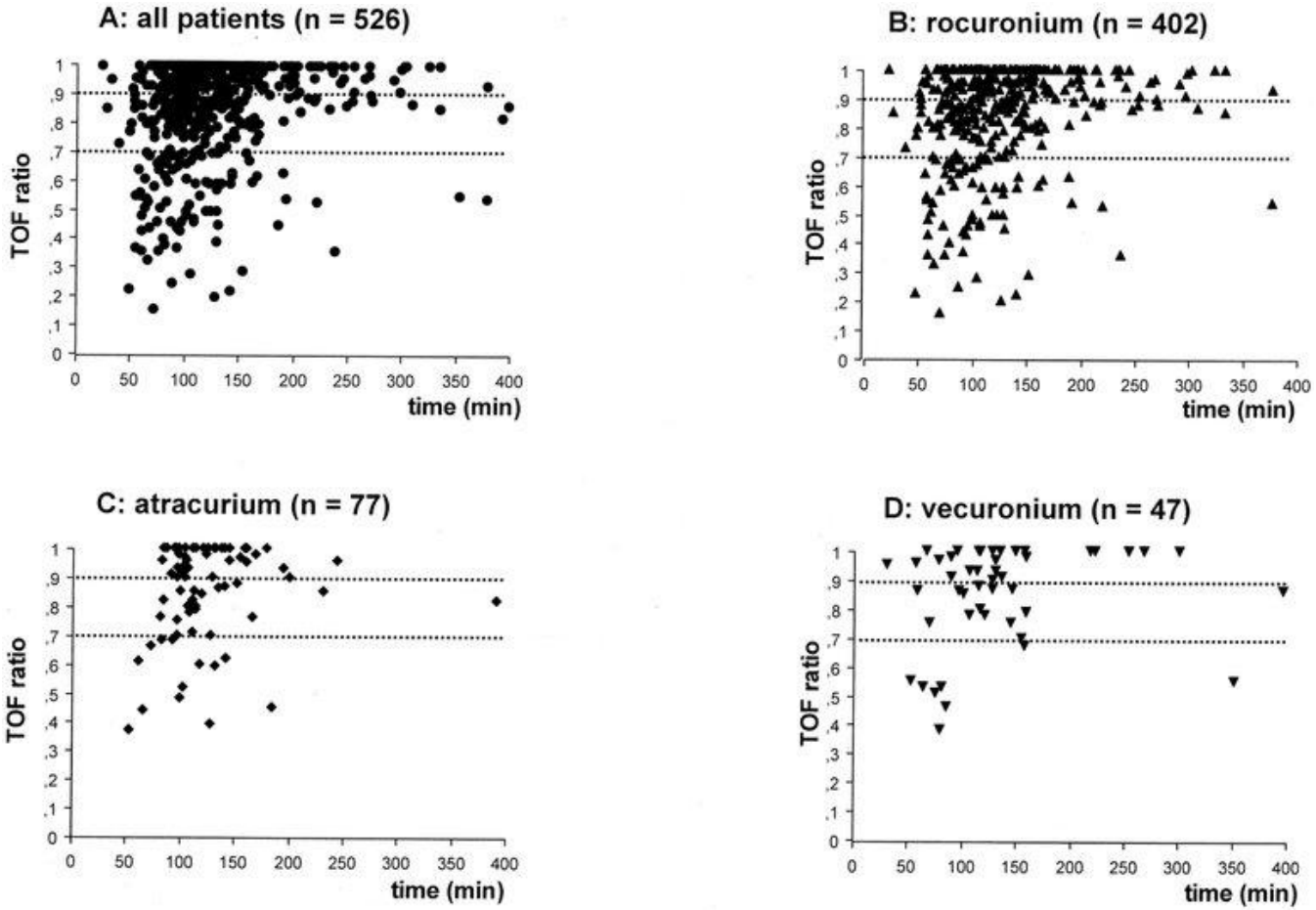
Fiecare linie reprezintă un pacient

Residual Paralysis in the PACU after a Single Intubating Dose of Nondepolarizing Muscle Relaxant with an Intermediate Duration of Action

2003

Bertrand Debaene, M.D., Benoît Plaud, M.D.,† Marie-Pierre Dilly, M.D.,‡ François Donati, Ph.D., M.D., F.R.C.P.C.§*

Anesthesiology 2003; 98:1042–8



Durată de acțiune variabilă

British Journal of Anaesthesia 97 (2): 160–3 (2006)

Neostigmine-induced reversal of vecuronium in normal weight, overweight and obese female patients

T. Suzuki[1]*, G. Masaki[2] and S. Ogawa[1]

Table 2 Comparison in onset and duration of vecuronium-induced neuromuscular block. Data are presented as mean (SD) (range). *$P<0.05$ compared with the measurements of the normal weight group. #$P<0.05$ compared with the measurements of the overweight group

	Normal weight	Overweight	Obese
Lag time (s)	48.0 (6.2) (45–60)	40.0 (10.9)* (30–60)	39.6 (7.5)* (30–45)
Onset (min)	2.1 (0.2) (1.8–2.5)	1.9 (0.4)* (1.3–2.5)	1.7 (0.2)* (1.3–2.0)
DUR25% (min)	41.0 (9.0) (27.5–59.5)	49.3 (6.2)* (39.8–60.8)	68.4 (16.3)*# (39.8–110.8)

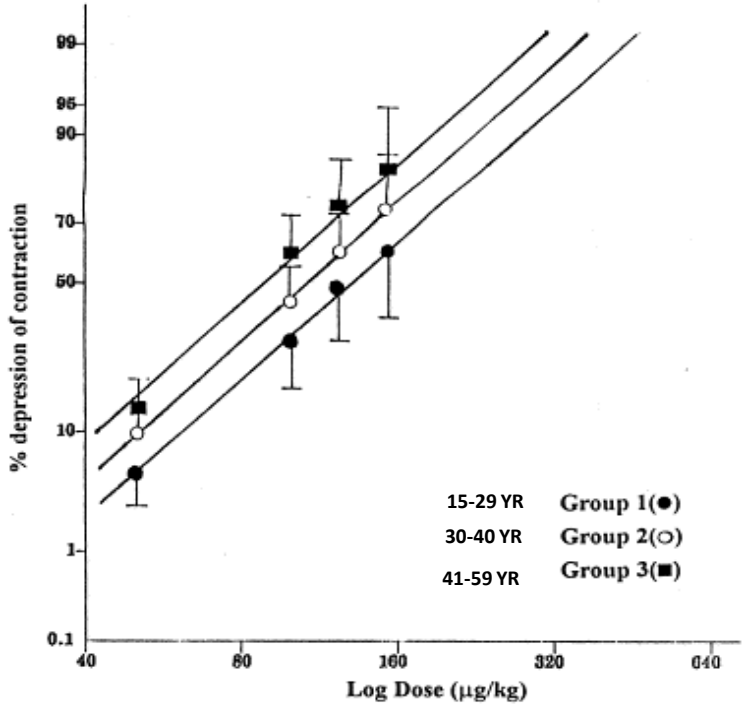
Results. The time from administration of vecuronium to spontaneous recovery of T1 to 25% of control was significantly longer in the obese [mean (SD, range); 68.4 (16.3, 39.8–110.8) min] and the overweight groups [49.3 (6.2, 39.8–60.8) min] as compared with the normal weight group [41.0 (9.0, 27.5–59.5) min]. The times for facilitated recovery with neostigmine to a TOF ratio of

Vecuronium are un efect prelungit la obezi

Journal of Clinical Anesthesia 11:397–405, 1999

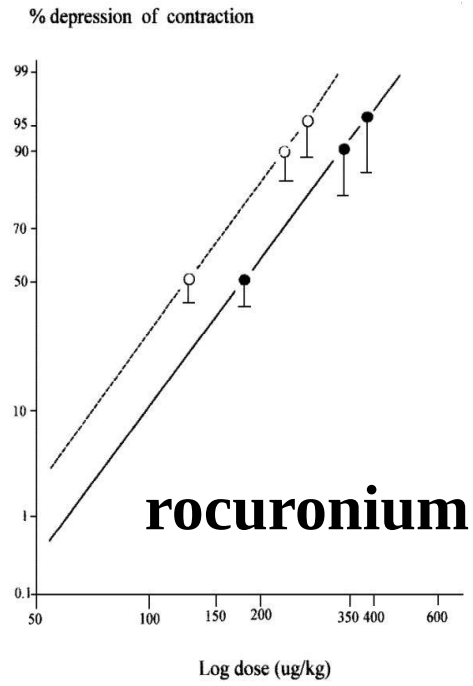
Influences of Age and Gender on Dose Response and Time Course of Effect of Atracurium in Anesthetized Adult Patients

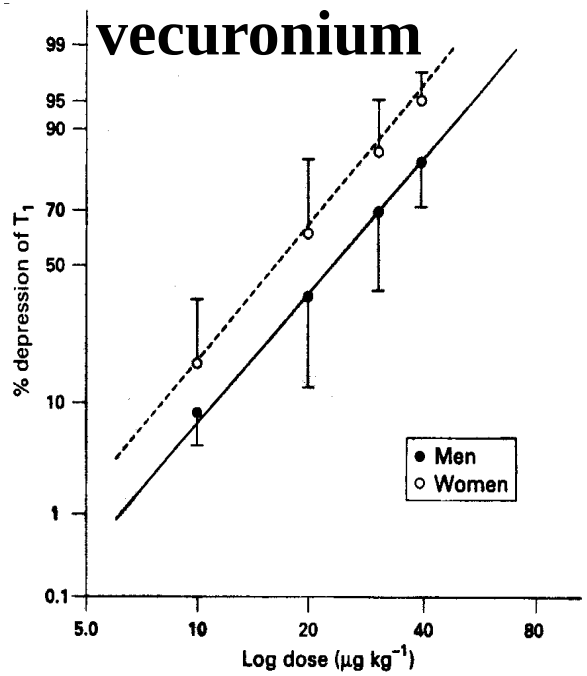
Fu S. Xue, MD,* Yan M. Zhang, MD,† X. Liao, MD,‡
Jian H. Liu, MD, Gang. An, MD§

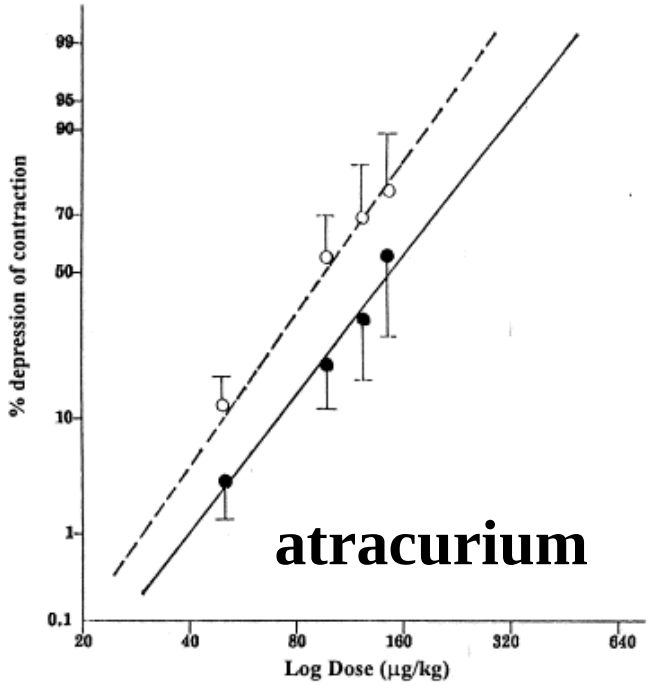


Vârstnicul are nevoie de doze mai mici

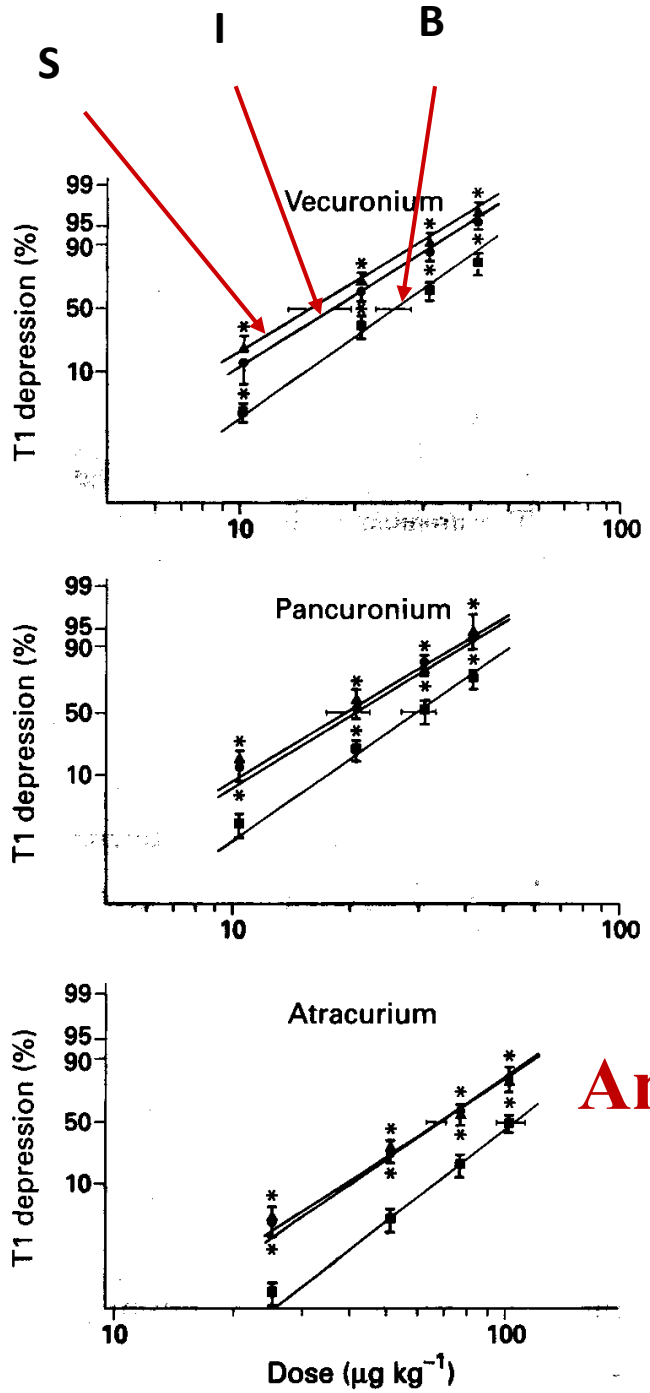
Xue et al: în trei articole 1997, 1998, 1999







Femeile au nevoie de doze cu 30% mai mici



British Journal of Anaesthesia 1996; **76**: 389–395

Effect of isoflurane and sevoflurane on the magnitude and time course of neuromuscular block produced by vecuronium, pancuronium and atracurium†

L. E. H. VANLINTHOUT, L. H. D. J. BOOIJ, J. VAN EGMOND AND E. N. ROBERTSON

Anestezia inhalatorie mai puțin relaxant

Neuro-muscular blockers - Interactions

1. Thiopentone Sodium – same syringe
2. General anaesthetics – potentiate blockers
3. Anticholinesterases – Neostigmine
4. Antibiotics – Aminoglycosides
5. Calcium Channel blockers: potentiate blockers (Verapamil) – both competitive and non-competitive
6. Diuretics – hypokalemia: enhances competitive block

Miorelaxantele au efect variabil în funcție de :

- Diferențele farmacologice (acț. lungă, medie, scurtă etc.)
- Pacient: disfuncții organice(hepatice, renale), vârstă, sex, greutate, sepsis, medicație, modificări hemodinamice, acido-bazice, temperatură
- Tehnica anestezică
- Interacțiuni medicamentoase

Post Operative Residual Curarisation

- **Ce este blocul rezidual ?**

- **Blocul rezidual** (Bloc neuromuscular rezidual)
  - Curarizare postoperatorie reziduală

PORC

- La sfârșitul anesteziei o parte din efectul miorelaxantelor este încă prezent și activ
- **Definiție:**
- Train -of –four (TOF) = 0.7 a fost considerat suficient pentru a exclude PORC
- Semne clinice: capul ridicat 5s; strângerea pumnului; scoaterea limbii, revenirea la tonusul inițial al pleoapelor și mandibulei, Vt normal,capacitate vitală normală (15-20ml/kg), forță inspiratorie normală (> -25 cm H2O)

- **Prevenirea PORC - TOF ≥ 0. 9**

- Viby – Mogensen J. Postoperative residual curarisation and evidence – based anaesthesia. British Journal of Anaesthesia 2000; 84: 301-3.
- Eriksson LI. Evidence-based practice and neuromuscular monitoring it's time for routine quantitative assessment. Anesthesiology 2003; 98:1037-9
- Kopman AF. Undetected residual neuromuscular block has consequences. Anesthesiology 2008; 109: 363-4

Post Operative Residual Curarisation - PORC

- **Definiție:**
- Apariția blocului neuromuscular, măsurat prin monitorizare obiectivă corectă.
- Definiție mai recentă:
- Trezire inadecvată la un" train- of - four" mai mic de 0.9.
- **TOF < 0.9 = bloc neuromuscular residual.**

- Variabilitate între persoane
- Recuperare completă TOF < 0.9
- Recuperare incompletă TOF < 0.9
- Recuperare incompletă TOF > 0.9

Murphy GS, Brull SJ. Residual neuromuscular block: lessons learned. Part 1: definitions, incidence, and adverse physiologic effects of residual neuromuscular block. Anesth Analg . 2010;111:120-8.

2%-64%

Chang Gung Med J 2008;31:364-8

Postoperative Residual Curarization: Clinical Observation in the Post-anesthesia Care Unit

25%

Chih-Chung Tsai[1,2], MD; Ham-See Chung[1], MD; Po-Liang Chen[1], MD; Chong-Ming Yu[1], MD; Ming-Shan Chen[1], MD; Chian-Lang Hong[1], MD

British Journal of Anaesthesia 84 (3): 394–5 (2000)

BJA

SHORT COMMUNICATIONS

42%

Residual curarization in the recovery room after vecuronium†

C. Baillard[1]*, G. Gehan[1], J. Reboul-Marty[2], P. Larmignat[1], C. M. Samama[1] and M. Cupa[1]

Blocul rezidual

- **Este dificil de diagnosticat clinic**
  - **70-80 %** dintre receptorii nicotinici din membrana postsinaptică pot fi ocupați de miorelaxant fără aparent nici o reacție adversă prezentă.

    Paton WD, Waud The Journal of Physiology 1967; 191: 59-90

  - O mare varietate de răspuns la miorelaxante, mai ales la aminosteroizi, - imposibil de evaluat care pacient va suferi o curarizare postoperatorie reziduală

Table 1: Physiological changes

ATOTW 290-D MOI,26,08,2013

Impaired muscle tone and coordination	Upper airway pharyngeal and oesophageal muscles	Increased risk of aspiration Increased risk of airway obstruction
	Laryngeal muscles	Increased risk of aspiration Impaired phonation Impaired cough
	Respiratory muscles	Impaired ventilation and oxygenation
	Impaired function of other muscles throughout the body	

Table 2: Clinical implications

Symptoms and signs of muscle weakness	Difficulty breathing Generalised weakness Difficulty speaking Visual disturbances Patient distress
Immediate critical respiratory events in PACU	Post-operative hypoxaemia Upper airway obstruction
Later respiratory events	Prolonged ventilator weaning Post-operative pulmonary complications (eg. atelectasis, pneumonia)

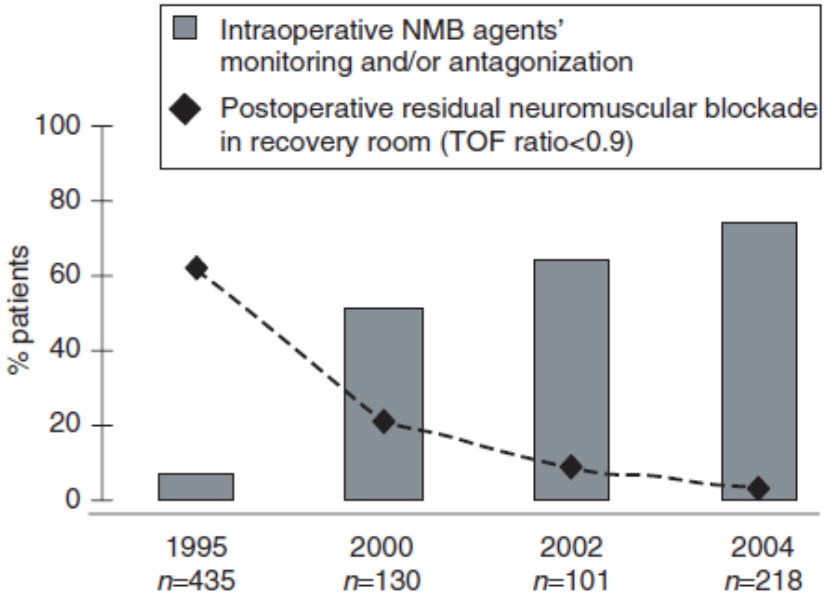
PORC = implicat în mortalitatea și morbiditatea postoperatorie din T.I.

- **Prevenirea PORC:**
  - **Monitorizarea NMB**
  - **Reversia NMB**
  - **Tipul de miorelaxant utiliat**

British Journal of Anaesthesia 95 (5): 622–6 (2005)

Postoperative residual neuromuscular block: a survey of management

C. Baillard*, C. Clec'h, J. Catineau, F. Salhi, G. Gehan, M. Cupa and C. M. Samama



Conclusion

During the last decade the incidence of residual neuromuscular block after intermediate-acting NMB agents' use strongly decreased in our institution. This study confirms the interest of changing our attitude towards monitoring and reversal of NMB agents in routine anaesthetic practice.[10]

Monitorizarea duce la scăderea incidenței PORC

Journal of Critical Care (2009) **24**, 11–20

Neuromuscular monitoring: Old issues, new controversies

Aaron F. Kopman MD*

Monitorizare :

UK	**38%**
Denmark	**43%**
Germany	**28%**
Mexico	**2%**

- **Cum monitorizăm blocul rezidual ?**

D. MOI. ATOTW 290-, 26th, 08, 2013

Table 3: Diagnostic attributes of clinical tests of neuromuscular recovery

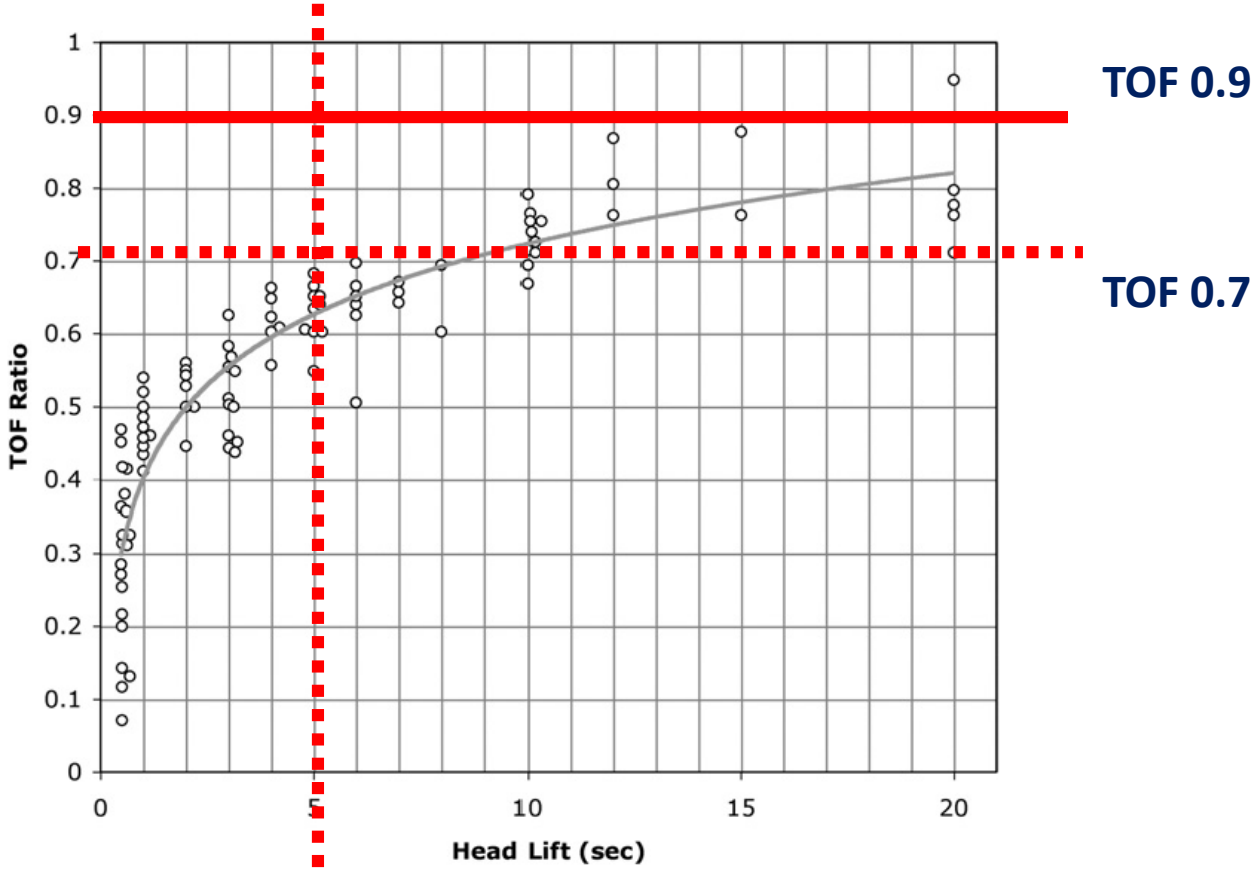
	Sensitivity	Specificity	Positive predictive value	Negative predictive value
Inability to lift head for 5 seconds	0.19	0.88	0.51	0.64
Inability to perform sustained hand grip for 5 seconds	0.18	0.89	0.51	0.63

- **Semnele clinice nu sunt eficiente**

Journal of Critical Care (2009) **24**, 11–20

Neuromuscular monitoring: Old issues, new controversies

Aaron F. Kopman MD*



Capul ridicat 5s nesemnificativ !!

Anesthesiology 2003; 98:1037–9

Evidence-based Practice and Neuromuscular Monitoring

It's Time for Routine Quantitative Assessment

Lars I. Eriksson, M.D., Ph.D.

The message is short and clear—it is time to move from discussion to action and introduce objective neuromuscular monitoring in all operating rooms, not just those occupied by researchers and aficionados of muscle relaxants. I believe that objective neuromuscular monitoring is an evidence-based practice and should consequently be used whenever a nondepolarizing neuromuscular blocking agent is administered. Such monitoring is noninvasive and has little risk, and there are strong reasons to believe that its use can improve patient outcome.

Monitorizarea obiectivă = ”evidence based practice” !!!

- **To reverse or not to reverse: that is the question !**

1965 Churchill-Davidson

- Nu trebuie antagonizare fiind suficientă ventilația prelungită (Cullen SC. Anesthesiology 1944;5:166-73)

- Întotdeauna trebuie antagonizare
- - Liverpool School (T Cecil Gray, G Jackson Rees)-anestezie balansată

- Când trebuie administrat antagonistul ?
  - Administrarea de neostigmină la pacientul complet treaz- accentuează blocul neuromotor (scade tonusul m. căii aeriene superioare, scade Vt)

- **Brull SJ, Murphy GS. Anesth Analg 2011;111:129-40.**

Reversal with objective neuromuscular monitoring

- TOFC 0 or 1 = delay reversal
- TOFC 2 or 3 = give reversal
- TOFC 4 with < 0.4 = give reversal
- TOFC 4 with 0.4-0.9 = give reversal, consider low dose neostigmine
- TOFC 4 and >0.9 = withhold reversal

Table 5: Train of four count and physiological correlation

Train of four count	% neuromuscular blockade at muscle
4	0 – 75%
3	75%
2	80%
1	90%
0	100%

Reversia blocului neuromotor

- **Inhibitori de acetilcolinesterază:**
- **Neostigmină**
- **Pyridostigmină**
- **Edrophonium**

”Golden standard of reversion”

- **Neostigmina (**inhibitor de acetilcolinesterază)

Argumente pentru a nu utiliza reversia BNM de rutină:

- **Europa (Germania)– NU**
- Efecte secundare ale Neostigminei
- Utilizarea miorelaxantelor cu scurtă durată de acțiune
- Administrarea unei singure doze de miorelaxant previne apariția blocului rezidual

Bradycardia and asystole following atropine-neostigmine administration after caesarean section in a parturient receiving methyldopa for pregnancy-induced hypertension

J. Rodríguez, J. Cortiñas, M. Bárcena, V. Ginesta, J. Alvarez

International Journal of Obstetric Anesthesia (1995) **4**, 55–57

In conclusion, we describe a case of bradycardia followed by cardiac arrest after the administration of atropine and neostigmine following urgent caesarean section. This reaction was due, in our opinion, to the concomitant use of methyldopa for the treatment of pregnancy-induced hypertension. It is possible that drugs such as methylergonovine and fentanyl may also have contributed to this reaction.

Necesită administrare de atropină/glicopirolat

Dysrhythmia from neostigmine

British Journal of Anaesthesia 83 (5): 815–18 (1999)

BJA

CASE REPORTS

Development of rapid atrial fibrillation with a wide QRS complex after neostigmine in a patient with intermittent Wolff–Parkinson–White syndrome

T. Kadoya[1], A. Seto[1], K. Aoyama[2] and I. Takenaka[1]*

The Effects of Reversal of Neuromuscular Blockade on Autonomic Control in the Perioperative Period

Janet M. van Vlymen, MD, and Joel L. Parlow, MD, MSc, FRCP(C)
Department of Anaesthesia, Queen's University, Kingston, Ontario, Canada

Anesth Analg 1997;84:148–54

Gen. Pharmac. Vol. 27, No. 5, pp. 861–872, 1996

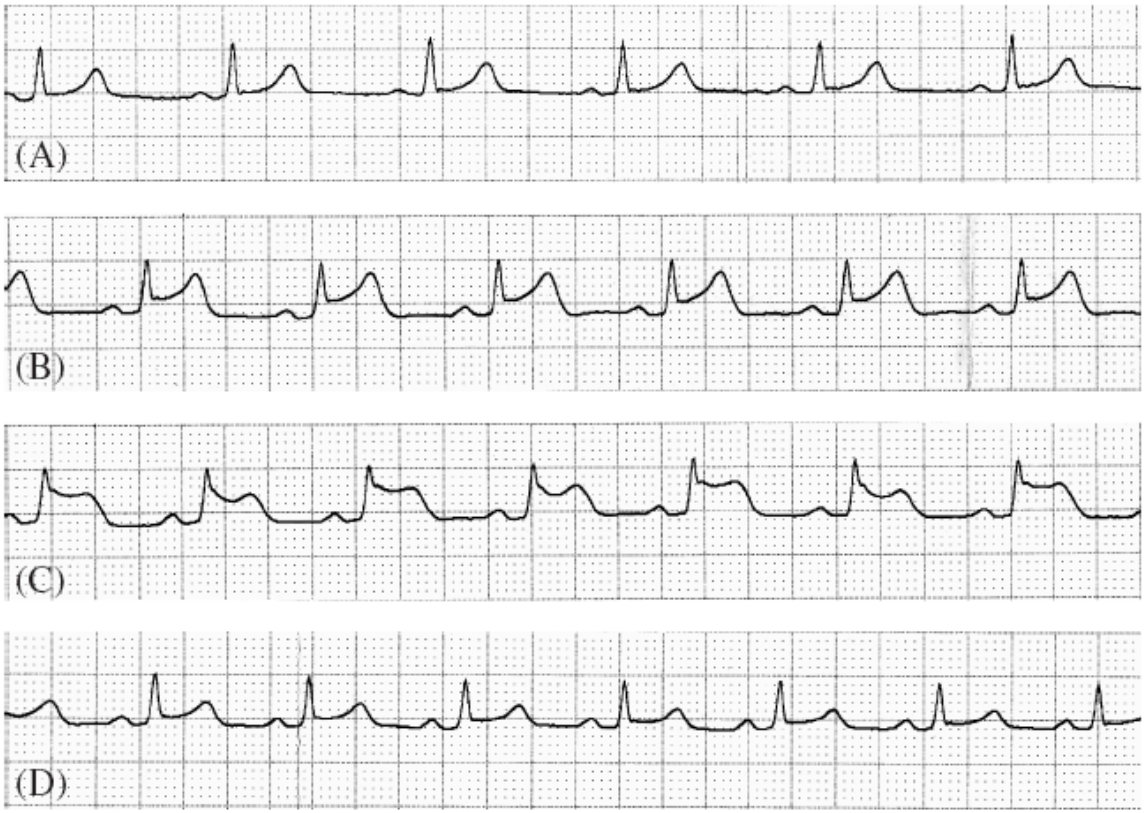
Blockade of Cardiac Nicotinic Responses by Anticholinesterases

Brian M. Paddle and Margaret H. Dowling*
Department of Defence, DSTO, Aeronautical and Maritime Research Laboratory, P.O. Box 4331, Melbourne VIC 3001, Australia

K. Kido
K. Mizuta
F. Mizuta
M. Yasuda
T. Igari
M. Takahashi

*Acta Anaesthesiol Scand 2005; **49**: 1395*

Coronary vasospasm during the reversal of neuromuscular block using neostigmine



Nonetheless, awareness of the possible involvement of increased synaptic Ach by anticholinesterases in intra-anesthetic coronary spasm may be needed, especially in patients suspected of having impaired endothelial function.

A. Hazizai. A. Hatiia

Bronchospasm caused by neostigmine

European Journal of Anaesthesiology 23:

We present a case of a patient who developed acute bronchospasm 10 s after the administration of neostigmine 0.05 mg kg^{-1} and atropine sulfate 0.015 mg kg^{-1} intravenously.

advice that neostigmine should be used with caution in patients with asthma even when given in conjunction with atropine [4].

Neostigmina poate produce bronhospasm

R. Mollema
J. Jaap Spijkstra
K. H. Polderman
H. P. M. M. Gelissen
A. R. J. Girbes

Perforation of the colon after administration of neostigmine

Intensive Care Med (2004) 30:730

An abdominal X-ray revealed no mechanical colonic obstruction, only coprostasis. Neostigmine infusion (0.6 mg/hour) was initiated to promote bowel movement. The patient responded favorably with massive stool within 4 h, and neostigmine was discontinued. However, the patient subsequently complained of abdominal pain. Initial physical examination revealed no abnormalities. However, the next day the patient became septic. A laparotomy was performed for suspected bowel ischemia. This revealed a perforated diverticulitis of the sigmoid with no signs of ischemia. This

Crește motilitatea intestinală

- **NEUROMUSCULAR BLOCKADE BY NEOSTIGMINE IN ANAESTHETIZED MAN**
- **J. P. PAYNE, R. HUGHES, S. AL AZAWI Anaesthesia 1980; 52:69-76**
- The tetanic and single twitch responses of the adductor pollicis muscle were used to study the neuromuscular effects of neostigmine in 26 patients anaesthetized with thiopentone and nitrous oxide. Neostigmine 2.5 mg i.v. given 5 min after exposure to halothane antagonized non-depolarizing neuromuscular block, whereas **a second dose given 2–5 min later** depressed the peak tetanic contraction and re-established tetanic fade.
- **These findings indicate that neostigmine in clinical doses can produce an acetylcholine-induced block which would be a potential hazard in anaesthetic practice**
- **UNWARRANTED ADMINISTRATION OF ACETYLCHOLINESTERASE INHIBITORS CAN IMPAIR GENIOGLOSSUS AND DIAPHRAGM MUSCLE FUNCTION**
- **MATTHIAS EIKERMANN, PHILIPP FASSBENDER, ATUL MALHOTRA ET AL. ANESTHESIOLOGY 2007; 107:621–9**
- **ChEI-based reversal agents, in high doses can *cause neuromuscular* transmission failure when administered to patients who have already recovered from NB.** ChEIs may cause neuromuscular transmission failure by desensitization of acetylcholine receptors, depolarization block of neuromuscular transmisssion,or open channel block. Neuromuscular transmission impairment of respiratory muscles could increase the risk of developing respiratory complications.

British Journal of Anaesthesia **90** (**1**): 48–52 (2003)

Assessment of a simple artificial neural network for predicting residual neuromuscular block†

J. G. Laffey, É. Tobin, J. F. Boylan and A. J. McShane*

Toți pacienții au primit neostigmină

Of the 40 patients, 26 had a train-of-four ratio less than or equal to 0.7 at the time of tracheal extubation.

Reversia nu exclude apariția PORC

Reversia blocului neuromotor nu exclude apariția PORC

C.McCAUL et al. Br.J.Anaesth. 2002; 89:766-769
65% TOF <0.7 AT EXTUBATION AFTER ATRACURIUM.

R. APPELBOAM et al/ Br.J.Anaesth. 2003; 90:523.
36 % TOF < 0.8 AFTER ATRACURIUM ON ARRIVAL PACU.

MR. GÄTKE et al. Acta Anaesthesiol.Scand. 2002; 46:207-213.
16.7% TOF < 0.8 AFTER ROCURONIUM AT EXTUBATION.

JG. LAFFEY et al. Br.J.Anaesth. 2003; 90:48-52.
26/40 (65%) PATIENTS TOF<0.7

AH. HAYES et al. Anaesthesia 2001; 56:312-318.
49% TOF <0.8 DESPITE REVERSAL OF VECURONIUM, ATRACURIUM, ROCURONIUM

Conduită recomandată pentru reversia cu inhibitori de acetilcoliesterază

- **Antagonizare:**
- TOF < 0.9 – se dorește extubarea
- Dacă nu avem monitorizare:
  - Dacă putem evidenția oboseală în contracție, vizual sau tactil, atunci trebuie antagonizat.
- Dacă intervenția a fost lungă de câteva ore și am folosit un agent cu durată intermediară reversia este rareori necesară, dar nu este regulă.
- De elecție la toți pacienții curarizați
- Doza de neostigmină nu se repetă și nu se administrează la TOF > 0.9

- **Ce miorelaxante vom folosi ?**

- **Miorelaxante cu durată scurtă de acțiune:**
  - Mivacurium derivat de benzylisoquinoline
- **Miorelaxante cu durată medie de acțiune:**
  - Atracurium derivat de benzylisoquinoline
  - Cisatracurium derivat de benzylisoquinoline
  - Vecuronium derivat de aminosteroid
  - Rocuronium derivat de aminosteroid
- **Miorelaxante cu durată lungă de acțiune:**
  - Pancuronium derivat de aminosteroid

Anesthesiology
50:539–541, 1979

42%

Residual Curarization in the Recovery Room

Jørgen Viby-Mogensen, M.D.,* Bent Chraemmer Jørgensen, M.D.,† Helle Ørding, M.D.‡

Anaesthesia, 2001, **56**, pages 312–318

Postoperative residual block after intermediate-acting neuromuscular blocking drugs

39-52-64%

A H. Hayes,[1] R. K. Mirakhur,[2] D. S. Breslin,[3] J. E. Reid[3] and K. C. McCourt[4]

Anesthesiology 2003; 98:1042–8

Residual Paralysis in the PACU after a Single Intubating Dose of Nondepolarizing Muscle Relaxant with an Intermediate Duration of Action

Bertrand Debaene, M.D., Benoît Plaud, M.D.,† Marie-Pierre Dilly, M.D.,‡ François Donati, Ph.D., M.D., F.R.C.P.C.§*

Anesth Analg 2006;102:426–9

Postoperative Residual Paralysis in Outpatients Versus Inpatients

Guy Cammu, MD, PhD*, Jan De Witte, MD*, Jan De Veylder, RN*, Geert Byttebier, MSc†, Dirk Vandeput, MD*, Luc Foubert, MD, PhD*, Geert Vandenbroucke, MD*, and Thierry Deloof, MD*

Acta Anaesthesiol Scand 1997; 41: 1095–1103

Residual neuromuscular block is a risk factor for postoperative pulmonary complications

H. BERG, J. VIBY-MOGENSEN, J. ROED, C. R. MORTENSEN, J. ENGBÆK, L. T. SKOVGAARD and J. J. KRINTEL

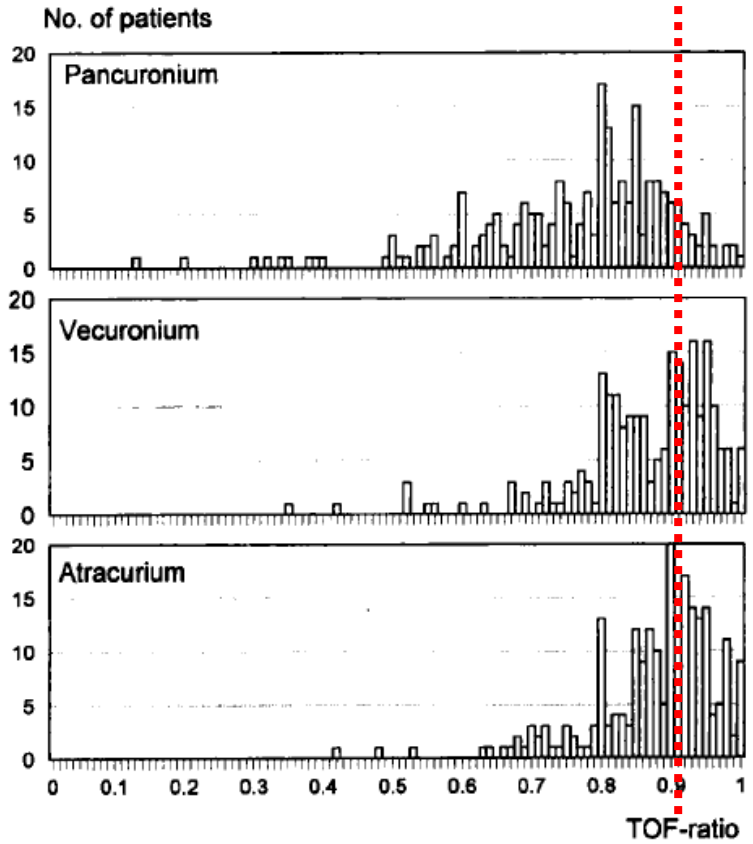


Fig. 2. TOF ratios at first postoperative mechanomyographic recording in the 3 groups of patients.

Our data indicate that the use of pancuronium is a significant risk factor for development of POPC, in particular after abdominal surgery and in old age. A logical conclusion would therefore be to abandon the use of pancuronium (and probably other long-lasting neuromuscular blocking agents as well), and instead use only the short- or intermediate-acting neuromuscular blocking agents even for long-lasting surgery. However, considering the economic re-

PORC este mai rar cu miorelaxantele cu durată scurtă și medie

Berg H, Viby- Mogensen J, Roed J et al. Residual neuromuscular block is a risk factor for postoperative pulmonary complications Acta Anaesthesiologica Scandinavica 1997; 41: 1095-103

Nr. total pacienți = 691	Pancuronium (n= 226)		Atracurium sau Vecuronium (n=450)	
	Nr. pacienți	Pacienți cu POPC (%)	Nr. pacienți	Pacienți cu POPC (%)
TOF ≥ 0.70	167	8 (4.8)	426	23 (5.4)
TOF ≤ 0.70	59	10 (16.9)*	24	1 (4.2)

Concluzie : PORC produs de NMB cu durată lungă reprezintă un risc semnificativ pentru complicații pulmonare postoperatorii

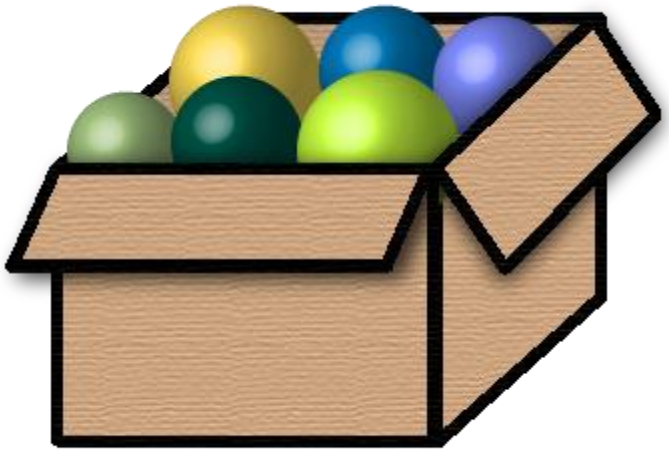
- **Concluzie:**
- Blocul neuromuscular incomplet este un important factor de risc pentru complicații respiratorii postoperatorii în T.I.

- Antagonizarea blocului neuromotor trebuie făcută în majoritatea situațiilor

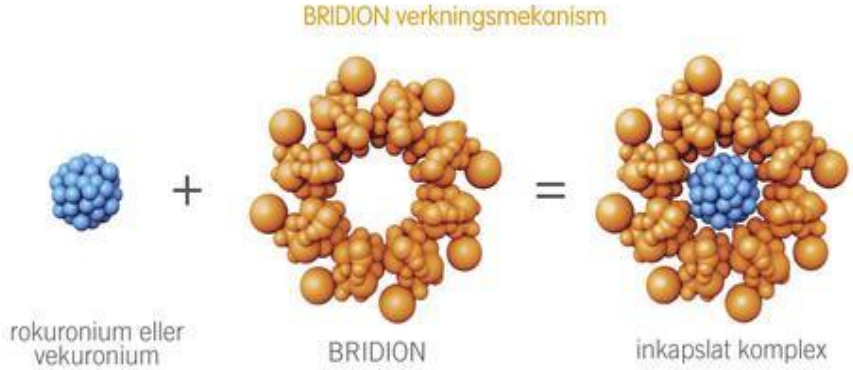
- Monitorizarea blocului neuromotor indferent dacă este antagonizat sau nu trebuie să fie o practică generală

- Se vor utiliza miorelaxante cu acțiune scurtă și medie indiferent de durata intervenției chirurgicale

- **În privința antagonizării NMB nici un progres în ultimii 20 de ani !!**



Sugammadex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BRIDION
inkapslat komplex


Vă mulțumesc pentru atenție

- **1. Care dintre următoarele situații este mai sigură în evaluarea blocului neuromuscular ?**
- a. Train of four ratio < 0.7
- b. Train of four ratio < 0.9
- c. Train of four ratio > 0.9
- d. Semnele clinice de monitorizare
- e. Prezența semnelor de oboseală musculară

- Răspuns : c

- **2. Selectați afirmațiile false de mai jos:**
- a. Miorelaxantele cu durată lungă de acțiune reprezintă un risc scăzut de apariție a PORC
- b. Pentru a avea siguranța antagonizării PORC, neostigmina se va administra la oricare dintre valorile train of four
- c. Sugammadexul oferă beneficii în plus în antagonizarea blocului neuromotor
- d. PORC este o problemă rar întîlnită cu consecințe minore.
- e. Suxamethoniul este o curară sigură și predictibilă lentu inducția anestezică

- Răspuns: