SUGAMMADEX

- je snížení ceny důvodem pro jeho používání bez monitorace nervosvalové blokády?

Satelitní symposium ČSARIM s podporou společnosti MEDISTA

Aktuální otázky monitorace a antagonizace nervosvalové blokády

Čtvrtek 19. 9.2024, 16:30–17:30 Sál E1b, Pavilon E, Brněnské výstaviště

1. Svalová relaxace – proč to je stále aktuální téma oboru? - Vladimír Černý
2. Metody monitorace svalové relaxace – update 2024 – Tomáš Tyll
3. Reziduální nervosvalová blokáda – update 2024 – Michael Stern
4. Sugamadex – je snížení ceny důvodem pro jeho používání bez monitorace nervosvalové blokády? – Jan Bláha
5. Kdy sugamadex nefunguje? – Michal Horáček
6. Jak lze definovat správnou klinickou praxi na základě současné evidence? – Vladimír Černý
7. Diskuze

JAN BLÁHA

KLINIKA ANESTEZIOLOGIE, RESUSCITACE A INTENZIVNÍ MEDICÍNY

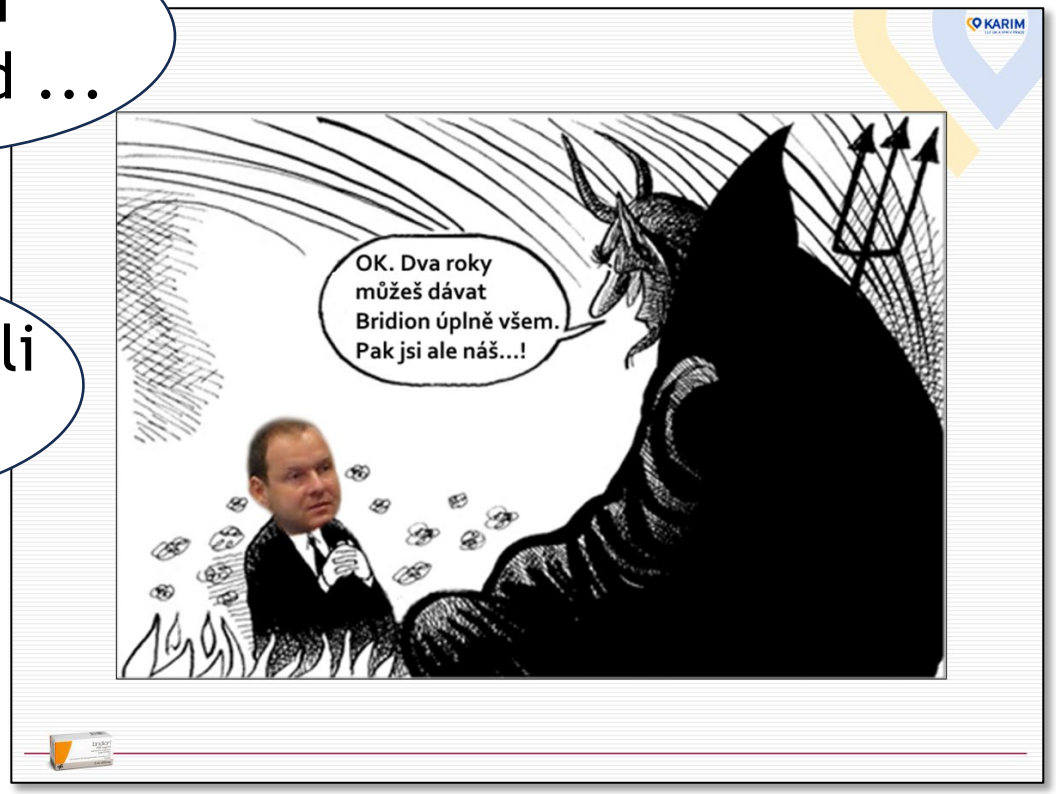
1. LÉKAŘSKÁ FAKULTA Univerzita Karlova

VŠEOBECNÁ FAKULTNÍ NEMOCNICE V PRAZE

jan.blaha@vfn.cz

Tak kdysi možná snad ...

... ale to tu byli jiní šíbři :)



Předvánoční setkání
s BRIDIONEM
10. prosince 2012 – 17:00
Hotel Maximus Resort

bridion®
sugammadex
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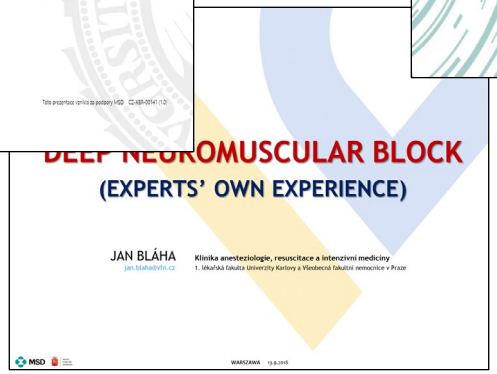
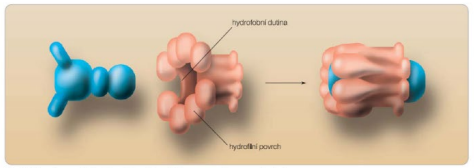
COST nebo BENEFIT ?

Jan Bláha

Klinika anesteziologie, resuscitace a intenzivní medicíny
1. lékařská fakulta Univerzity Karlovy v Praze
Všeobecná fakultní nemocnice v Praze

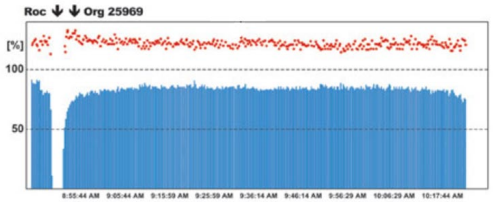




Obr. 1 Enkapsulace molekuly rokuronia (modře) molekulou sugammadexu v poměru 1 : 1.

2007

SUGAMMADEX



Raft J. et al. 51e congrès national d'anesthésie et de réanimation, France.

The salient characteristics of RSI were delineated by Stept and Safar in 1970 [3].

- Preoxygenation
- Predetermined doses of thiopental and SCh
- Cricoid force
- Avoidance of ventilation by bag and mask
- Tracheal intubation

Sharp LM, Levy DM. Current Opinion in Anaesthesiology 2009, 22:357-361

The Response of Newborns to Succinylcholine and d-Tubocurarine

Leonard F. Wolfs, M.D., and John B. Dillon, M.D.†*

Anesthesiology. 1969 Jul;31(1):35-8.

Results

Mean age of the 60 adult patients was 41 years. The group given succinylcholine received an average of 68 mg (range 54–83) of drug. All patients had 100 per cent depression in twitch force. Recovery times to 10, 50 and 90 per cent of control values averaged 7.0, 8.5, and 10 minutes, respectively.

0,6 mg/kg

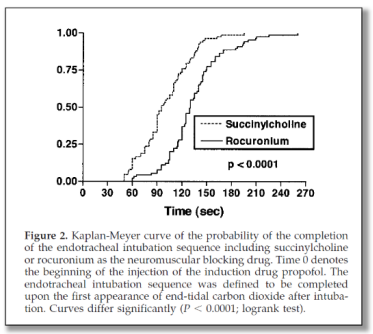


Figure 2. Kaplan-Meyer curve of the probability of the completion of the endotracheal intubation sequence including succinylcholine or rocuronium as the neuromuscular blocking drug. Time 0 denotes the beginning of the injection of the induction drug propofol. The endotracheal intubation sequence was defined to be completed upon the first appearance of end-tidal carbon dioxide after intubation. Curves differ significantly ($P < 0.0001$; logrank test).

Sluga M et al. Anesth Analg 2005;101:1356 –61

1 mg/kg

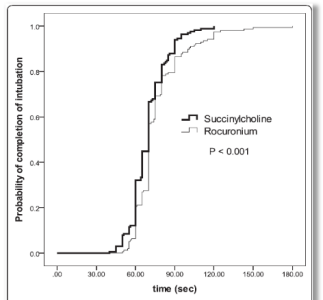
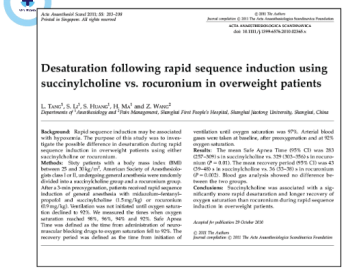
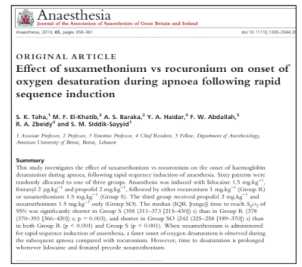


Figure 2 Intubating times. Kaplan-Meyer curve of the probability of the completion of the endotracheal intubation sequence including succinylcholine or rocuronium in patients successfully intubated in the first attempt. The x-axis denotes the time interval after the beginning of the injection of the induction drug. The intubation sequence was defined to be completed upon the first appearance of end-tidal carbon dioxide after intubation.

Stephan C Marsch, et al. Crit Care. 2011;15(4):R199-R199



Desaturation following rapid sequence induction using succinylcholine vs. rocuronium in overweight patients



ORIGINAL ARTICLE

Effect of suxamethonium vs rocuronium on onset of oxygen desaturation during apnoea following rapid sequence induction

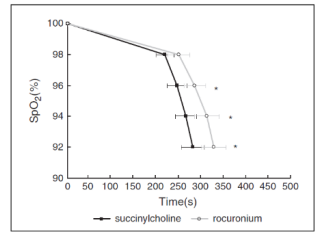


Fig. 2. Changes in oxygen saturation (S_pO_2) with time during non-hypoxic apnoea in the succinylcholine or the rocuronium group. Mean values (points) for both groups are shown. The vertical lines indicate 95% CI. The curves were smooth before S_pO_2 reach 98%, but afterward fell straightly to 92% S_pO_2.
**P < 0.05 compared with succinylcholine.*

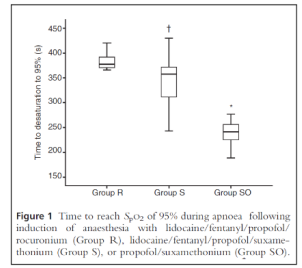


Figure 1 Time to reach S_pO_2 of 95% during apnoea following induction of anaesthesia with lidocaine/fentanyl/propofol/rocuronium (Group R), lidocaine/fentanyl/propofol/suxamethonium (Group S), or propofol/suxamethonium (Group SO).

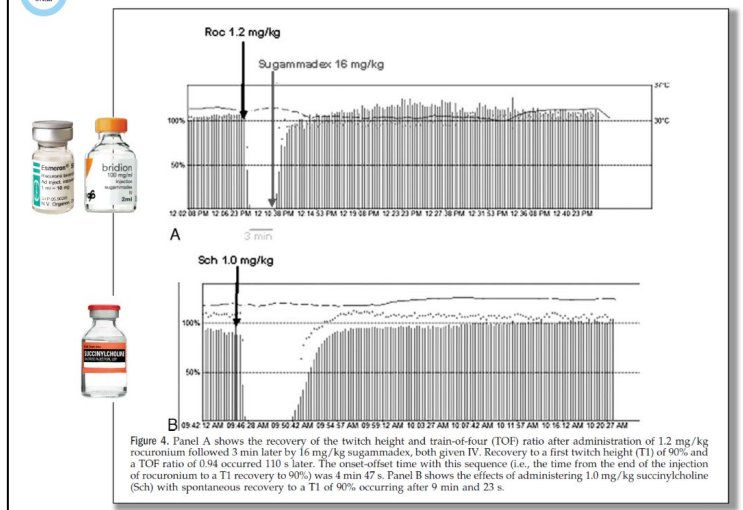


Figure 4. Panel A shows the recovery of the twitch height and train-of-four (TOF) ratio after administration of 1.2 mg/kg rocuronium followed 3 min later by 16 mg/kg sugammadex, both given IV. Recovery to a first twitch height (T1) of 90% and a TOF ratio of 0.94 occurred 110 s later. The onset-offset time with this sequence (i.e., the time from the end of the injection of rocuronium to a T1 recovery to 90%) was 4 min 47 s. Panel B shows the effects of administering 1.0 mg/kg succinylcholine (Sch) with spontaneous recovery to a T1 of 90% occurring after 9 min and 23 s.

Naguib M. Anesth Analg 2007;104:575–81

RESIDUÁLNÍ NMB…

Umím to
i bez toho…

Myth #2

IF YOU KNOW THE PHARMACOKINETICS OF MUSCLE RELAXANTS, NEUROMUSCULAR MONITORING AND REVERSAL DRUGS ARE NOT NECESSARY

Myth #3

THE CLINICAL EFFECTS OF POST-OPERATIVE RESIDUAL CURARIZATION (PORC) IS COMPLETELY OVERRATED

On to až
takový problém
není…

The RECITE Study: A Canadian Prospective, Multicenter Study of the Incidence and Severity of Residual Neuromuscular Blockade

Louis-Philippe Fortier, MSc, MD, FRCPC,* Dolores McKeen, MD, MSc, FRCPC,†
Kim Turner, BScPhm, MSc, MD, FRCPC,‡§ Étienne de Médicis, MD, FRCPC,‖ Brian Warriner, MD,
FRCPC,¶ Philip M. Jones, MD, FRCPC, MSc,#** Alan Chaput, BScPhm, PharmD, MD, MSc, FRCPC,††
Jean-François Pouliot, PhD,‡‡ and André Galarneau, MSc, PhD‡‡

BACKGROUND: Postoperative residual neuromuscular blockade (NMB), defined as a train-of-

The RECITE Study

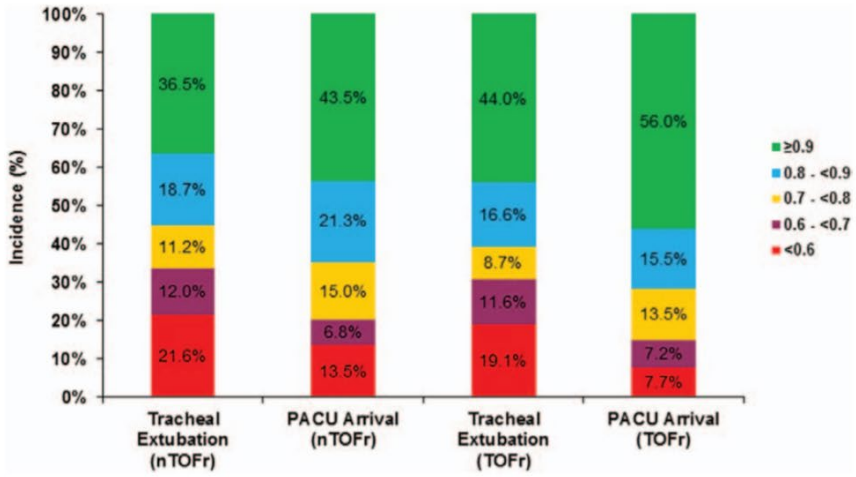


Figure 2. Incidence of residual neuromuscular blockade. nTOFr = normalized train-of-four ratio; TOFr = nonnormalized train-of-four ratio.

CONCLUSIONS: Residual paralysis is common at tracheal extubation and PACU arrival, despite qualitative neuromuscular monitoring and the use of neostigmine. More effective detection and management of NMB is needed to reduce the risks associated with residual NMB. (Anesth Analg 2015;XXX:00–00)

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 RNMB
			0.9	Subjective	50%	
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

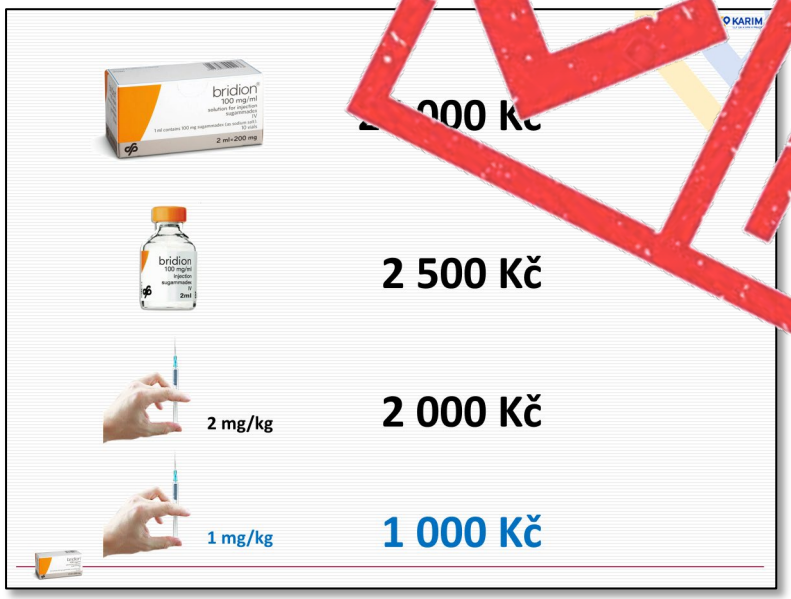
NMBA, neuromuscular blocking agent; TOF, train-of-four; RNMB, residual neuromuscular block; Atrac, atracurium; Cis, cisatracurium; Vec, vecuronium; Roc, rocuronium; Miv, mivacurium; PACU, post-anaesthesia care unit; AMG, acceleromyography; CRE, critical respiratory events; SGX, sugammadex; OR, operating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


Esmeron®
Rocuronii bromid
Ad inject. intraven
1 ml = 10 mg
OIP 05.502/B
N.V. Organon,
bridion
100 mg/ml
injection
sugammadex
IV
2ml

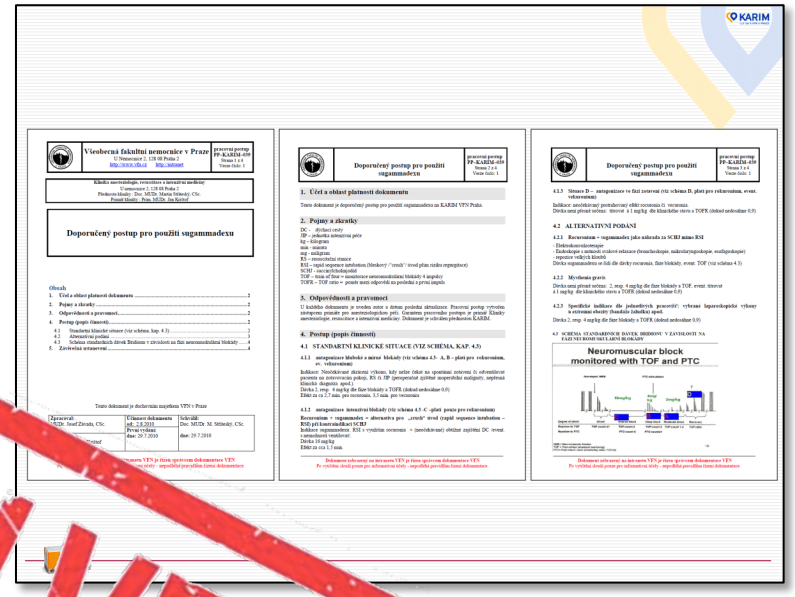
vs.


RELAXANS
5 mL
Neostigmine
2.5 mg/mL 1:400


HURRICANE SHLTR
4099
BEST NEW ANCHOR TEAM


bridion
100 mg/ml
2 ml=200 mg
2 500 Kč
2 mg/kg
2 000 Kč
1 mg/kg
1 000 Kč

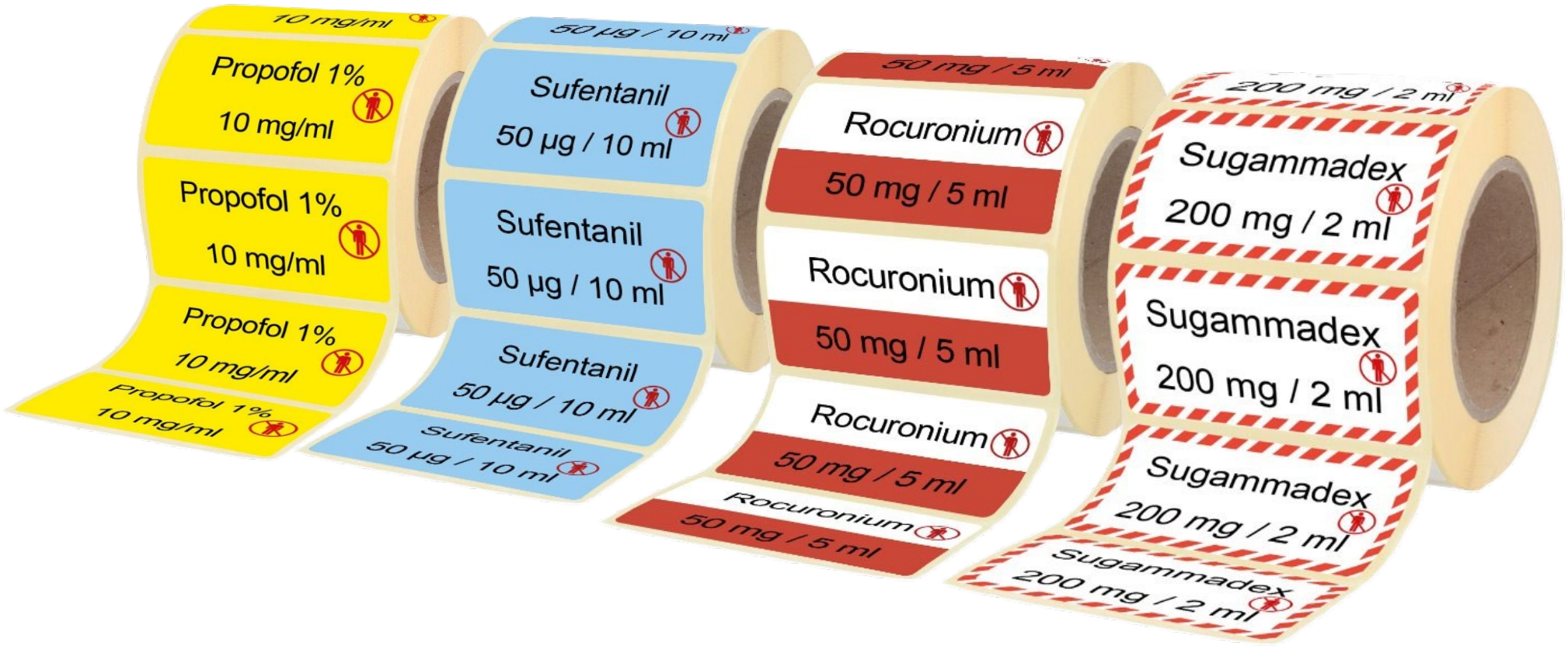

SBÍRKA ZÁKONŮ
Sbírka zákonů č. 372 / 2011
ZÁKON
ze dne 6. listopadu 2011
o zdravotních službách a podmínkách jejich poskytování
(zákon o zdravotních službách)
(1) Zdravotní služby lze pacient
pouze s jeho svobodným a informovaným
nestanoví-li tento zákon jinak.
(2) Pacient má právo na poskytování zdravotních
služeb na náležité odborné úrovni.


Všeobecná fakultní nemocnice v Praze
Doporučený postup pro použití sugammadexu
Obsah
1. Účel a oblast platnosti dokumentu
2. Pojmy a zkratky
3. Odpovědnosti a pravomoci
4. Postup (popis činností)
Neuromuscular block monitored with TOF and PTC

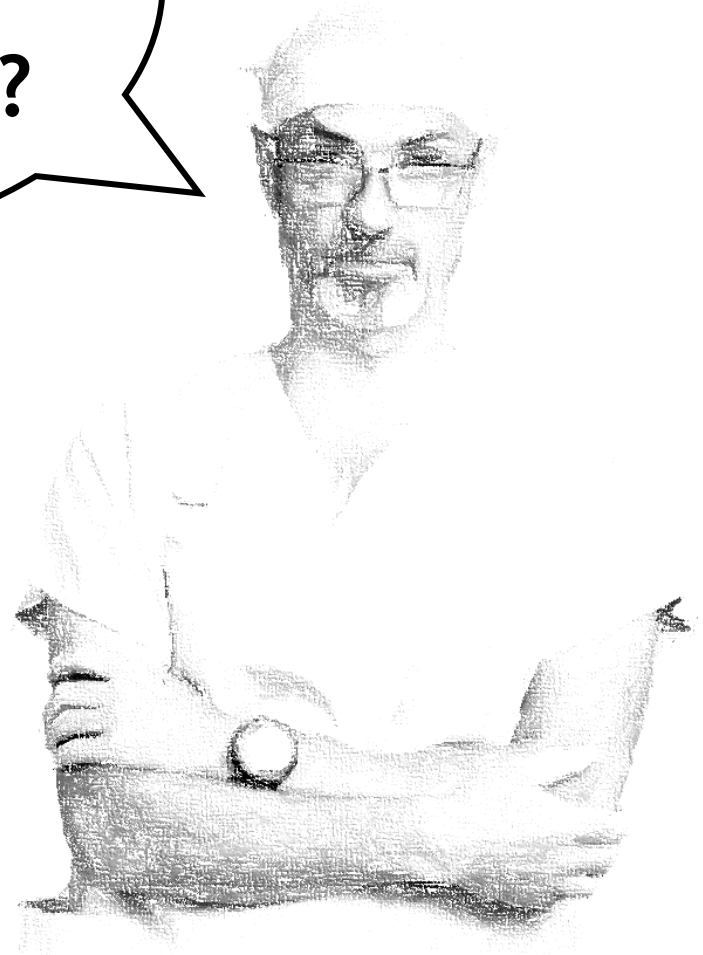
PROBLEM SOLVED

SUGAMMADEX

- je snížení ceny důvodem pro jeho používání bez monitorace nervosvalové blokády?



PROČ DÁVÁME SVALOVÁ RELAXANCIA?



PROČ DÁVÁME ANESTEZII ?

ABYCHOM ZAJISTILI BEZPEČNOST VÝKONU …

ABYCHOM PACIENTA PROVEDLI OPERACÍ

ABYCHOM ZAJISTILI HEMODYNA-MICKOU STABILITU PACIENTA…

ABYCHOM PACIENTOVI ZAJISTILI ANALGEZII …

ABYCHOM OHLÍDALI CHIRURGY

ABY CHIRURG MOHL BEZPEČNĚ OPEROVAT

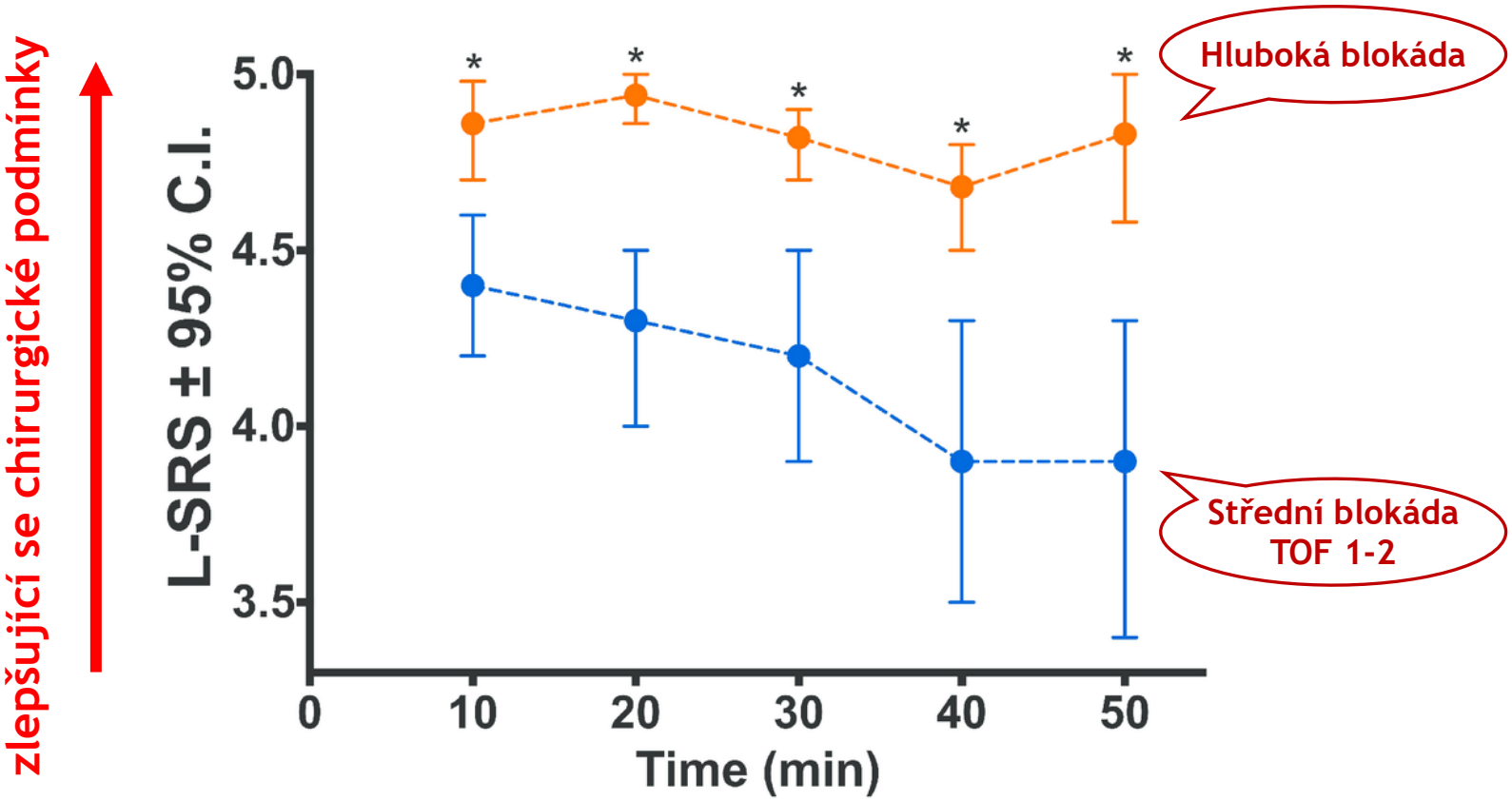
PROČ DÁVÁME SVALOVÁ RELAXANCIA?

ZAJIŠTĚNÍ DC INTUBACÍ

OPTIMALIZACE UPV

DOBRÉ CHIRURGICKÉ PODMÍNKY

Deep Neuromuscular Block Improves Surgical Conditions during Bariatric Surgery and Reduces Postoperative Pain: A Randomized Double Blind Controlled Trial



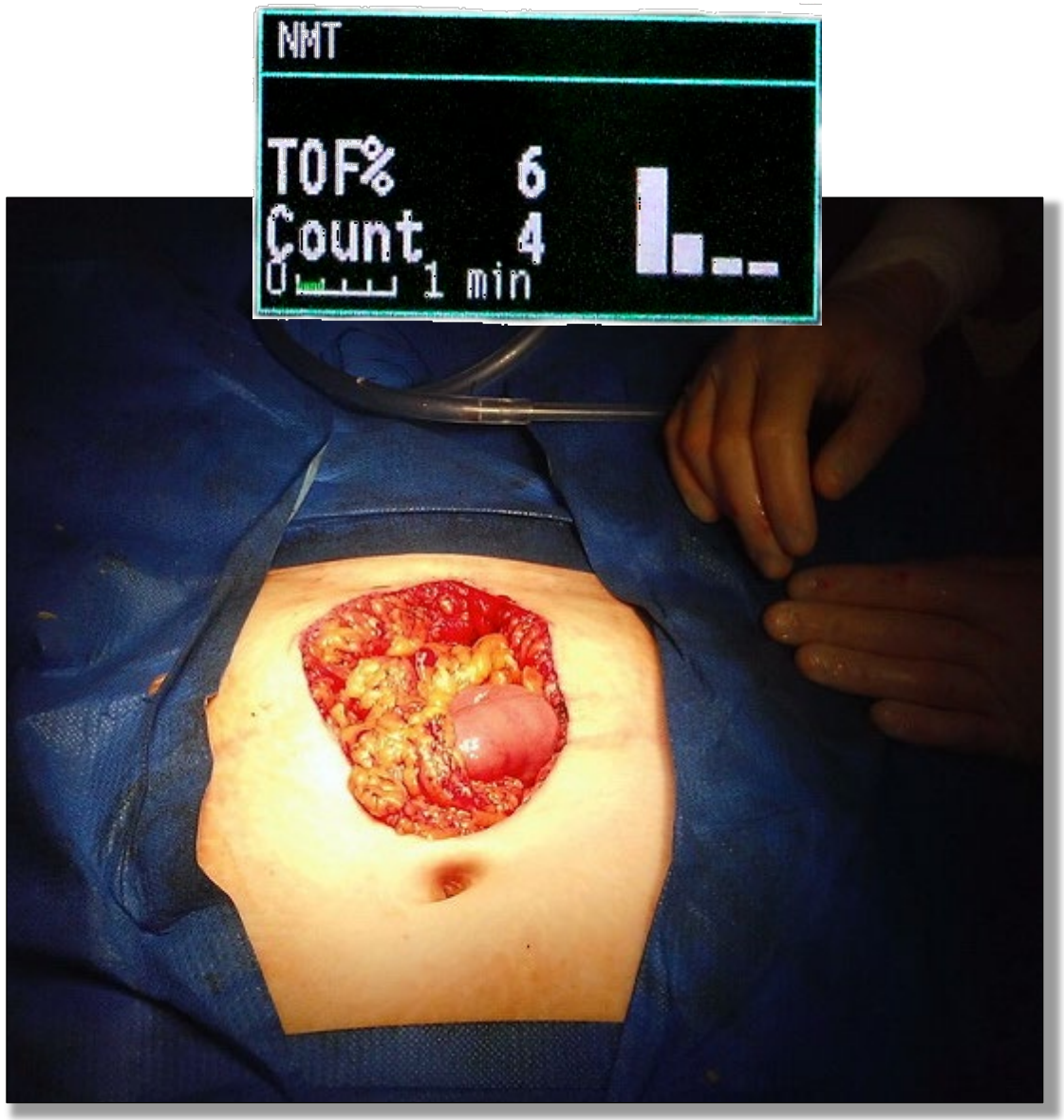
Influence of deep relaxation on surgical conditions. Leiden-surgical rating scale (L-SRS) values of patients during a deep neuromuscular block (target PTC 2–3; orange, n = 50) and during a moderate neuromuscular block (target TOF 1–2; blue, n = 50). Values are mean (95% confidence interval) with confidence intervals derived from bootstrap analyses. * Mann-Whitney-U test $p < 0.01$ versus moderate block.
doi:10.1371/journal.pone.0167907.g002

Torensma B. PLoS ONE 11(12): e0167907.

Score	Interpretation	Treatment group	
		Moderate block	Deep block
5	Optimal conditions	10%	70%
4	Good conditions	20%	20%
3	Acceptable conditions	55%	10%
2	Poor conditions	10%	0%
1	Extremely poor conditions	5%	0%

Discussion: We aim to show that under the right conditions the perceived opposing goals of surgeons and anesthesiologists (optimal surgical conditions vs. optimal postoperative conditions) may be met without compromise to either.

Boon et al. Trials. 2013 Mar 1;14:63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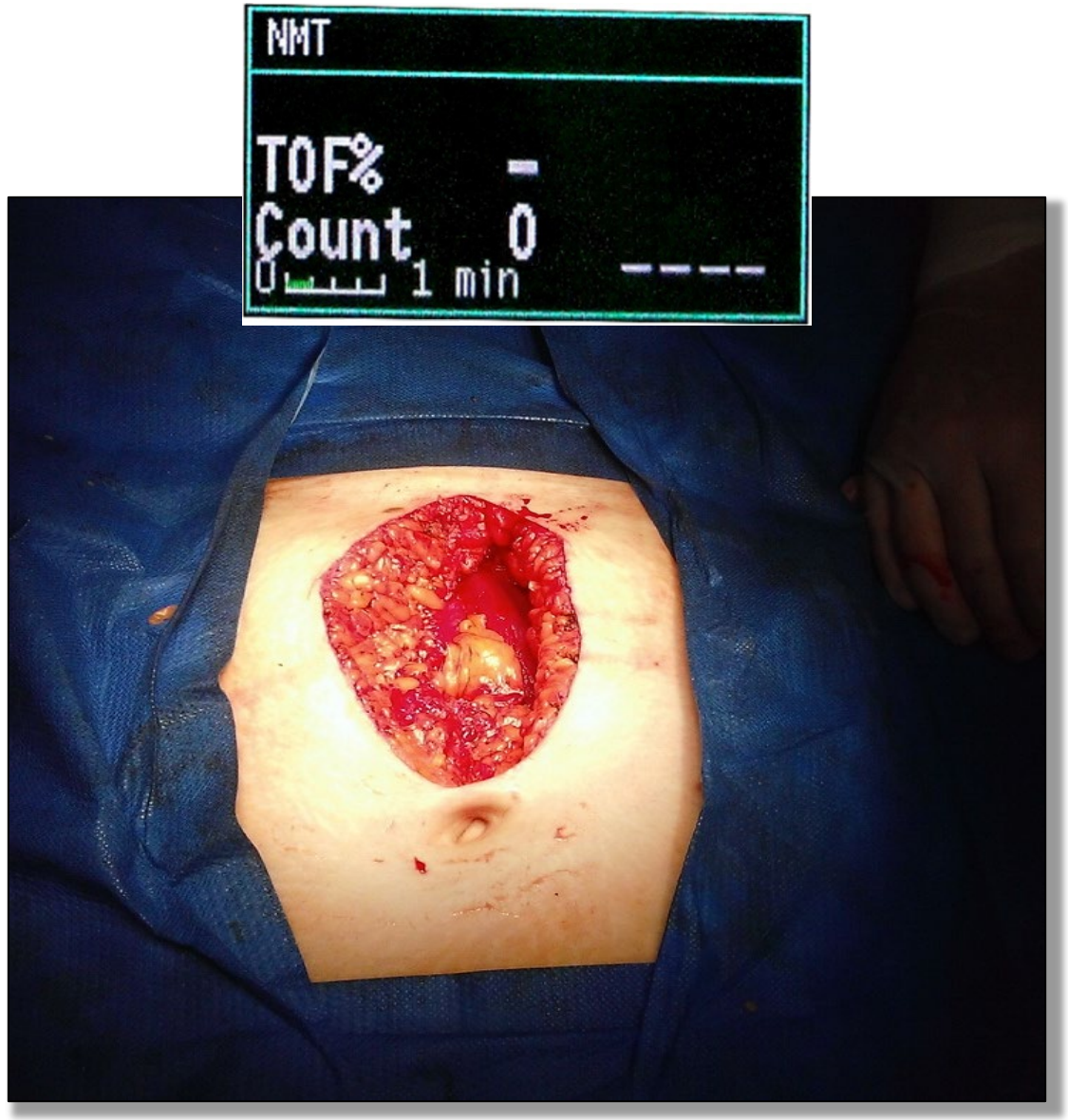
NMT
TOF% -
Count 0
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ARTICLE IN PRESS

International Journal of Obstetric Anesthesia (2019) xxx, xxx–xxx
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https://doi.org/10.1016/j.ijoa.2019.08.005

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www.obstetanesthesia.com

ORIGINAL ARTICLE

Surgical conditions with rocuronium versus suxamethonium in cesarean section: a randomized trial

J. Bláha,[a,†] P. Nosková,[a,†] K. Hlinecká,[b] V. Krakovská,[c] V. Fundová,[a] T. Bartošová,[a] P. Michálek,[a] M. Stříteský[a]

[a]*Department of Anesthesiology, Resuscitation and Intensive Medicine, 1st Faculty of Medicine, Charles University and General University Hospital in Prague, Czech Republic*

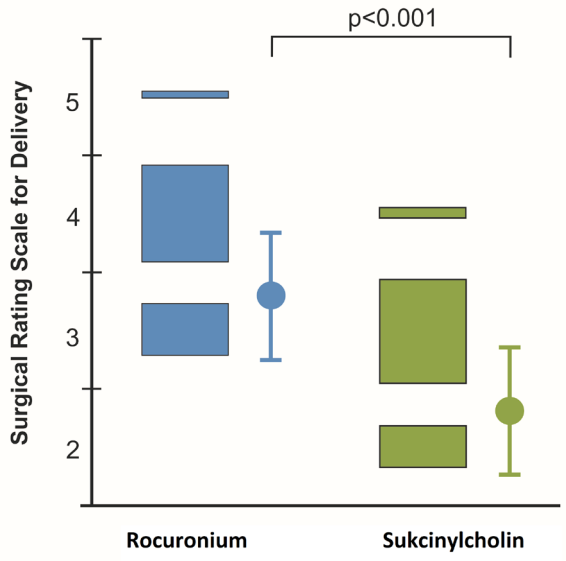


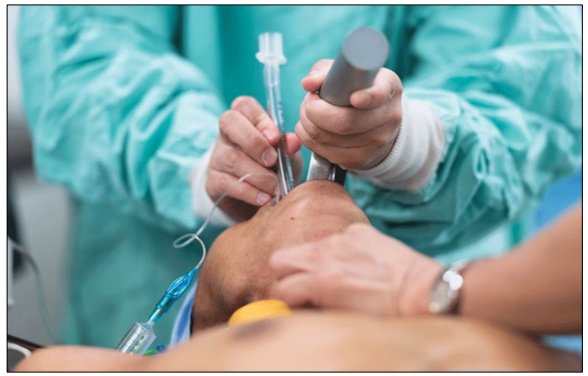
Table 2 Times from induction of anesthesia to end of surgery; and induction characteristics.

	Rocuronium group		Suxamethonium group		*Difference in means*	*P-value*
	Mean	*Median*	*mean*	*median*		
Induction – delivery interval (s)	268.4 (72.9)	265 (223–330)	275.6 (63.4)	267 (239–400)	−7.2 (−39.5 to 19.3)	0.62
Induction – intubation interval (s)	105.8 (33.7)	108 (77–134)	67.6 (32.1)	63 (50–123)	38.2 (24.4 to 52.0)	<0.001
Incision – delivery interval (s)	146.6 (68.3)	130 (99–179)	196.2 (50.7)	201 (167–277)	−49.7 (−74.8 to −24.4)	0.0002
Intubation – incision interval (min)	15.8 (6.9)	15 (11–18)	11.7 (6.4)	10 (3–29)	4.1 (0.4 to 7.8)	0.061
Length of surgery (min)	39.3 (8.9)	39 (27–53)	39.4 (9.6)	38 (26–54)	0.1 (−4.0 to 3.8)	0.976
End of surgery to extubation (min)	5.2 (4.6)	4 (0–13)	8.8 (5.8)	8 (2–19)	−3.5 (−5.8 to 1.4)	0.002
SRSD (points)	3.73 (0.53)	4 (3–5)	2.77 (0.55)	3 (2–4)	1.0 (−0.01 to 0.20)	<0.001
Blood loss (mL)	533 (75)	500 (500–600)	538 (98)	500 (500–650)	−5 (−38 to 28)	0.859
Thiopental (mg/kg)	4.7 (0.16)	4.7 (4.5–5.1)	4.7 (0.21)	4.7 (4.5–5.3)		0.471
Muscle relaxant dose (mL/kg)	0.092 (0.01)	0.093 (0.090–0.106)	0.095 (0.00)	0.094 (0.09–0.106)		0.072
Muscle relaxant dose (mg/kg)	0.55 (0.05)	0.56 (0.54–0.65)	0.95 (0.04)	0.94 (0.9–0.11)		0.177

Data are presented as mean (SD) or median (range). Difference between the groups is expressed as median (95% confidence interval). SRSD: Surgical rating scale for delivery.

čas incize - porod


TEĎ JSEM PŘIDAL …
TEĎ NA KONCI ? TO VÍŠ ŽE JO…!
!!!
TLAČÍ !



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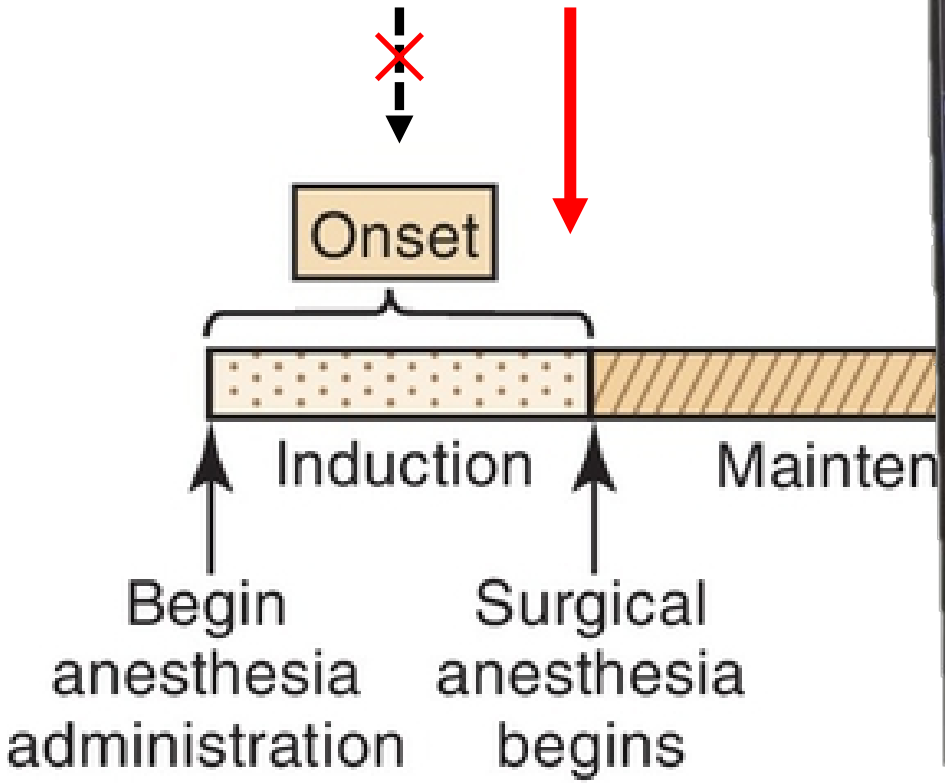
Plná anestezie
plná analgezie
Hluboká NMB!
AoA
1 min status
Monit. filtr
HR /min
77
EKG
ST mm
0.3
Entropie
RE 33
SE 33
SPI
14
SpO2 %
98
NMT
TOF%
Count
0
NIBP mmHg
SYS
DIA
95 / 52
(70)
Tepl
T1
T2
Tblood
Časovače
Odpočítáv.
Uplynulý
00:00:00
Nastavení alarmů
Nastavení monitoru
Procedury
Data a stránky
Trendy
Tisk křivek
Zmrazit/ Snímek
NIBP Start
NIBP Auto Stop
Nulování všech tlaků


Onset
Induction
Mainten
Begin anesthesia administration
Surgical anesthesia begins

REVIEW ARTICLE

Is Anesthesia Dangerous?

André Gottschalk, Hugo Van Aken, Michael Zenz, Thomas Standl

TABLE 2

Association between anesthesia-related deaths and age or patients' ASA status (adapted from [5])

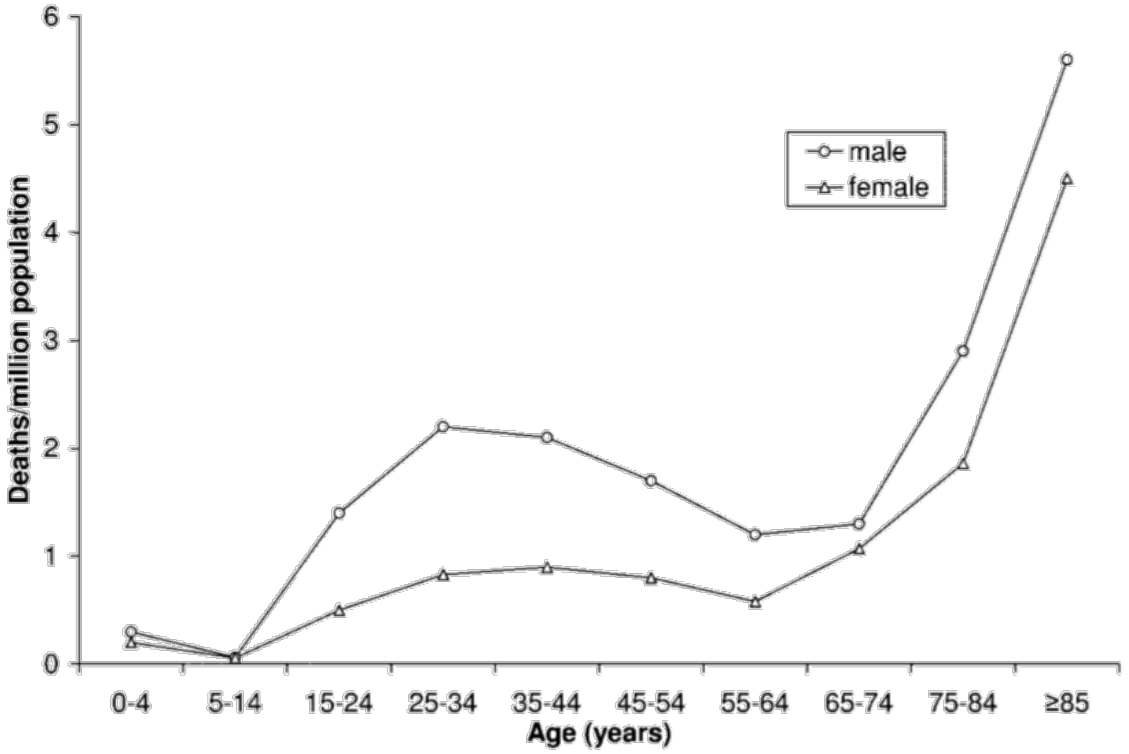
	Mortality/100 000 anesthesiological procedures	95% confidence interval
Age		
0–7 years	0.6	0.12–3.2
8–15 years	1.2	0.3–3.2
16–39 years	0.52	0.24–0.93
40–75 years	5.2	2.7–8.1
≥ 75 years	21	8.3–34
ASA classification		
ASA I	0.4	0.12–0.81
ASA II	5	1.6–9.1
ASA III	27	12–44
ASA IV	55	1.1–130

Gottschalk _Is anesthesia dangerous? Dtsch Arztebl Int 2011; 108(27): 469–74.

Anesthesiology 2009; 110:759–65

Epidemiology of Anesthesia-related Mortality in the United States, 1999–2005

Guohua Li, M.D., Dr.P.H., Margaret Warner, Ph.D.,† Barbara H. Lang, B.S.,‡ Lin Huang, M.S.,§ Lena S. Sun, M.D.‖*



Anesthesiology 2009; 110:759–65

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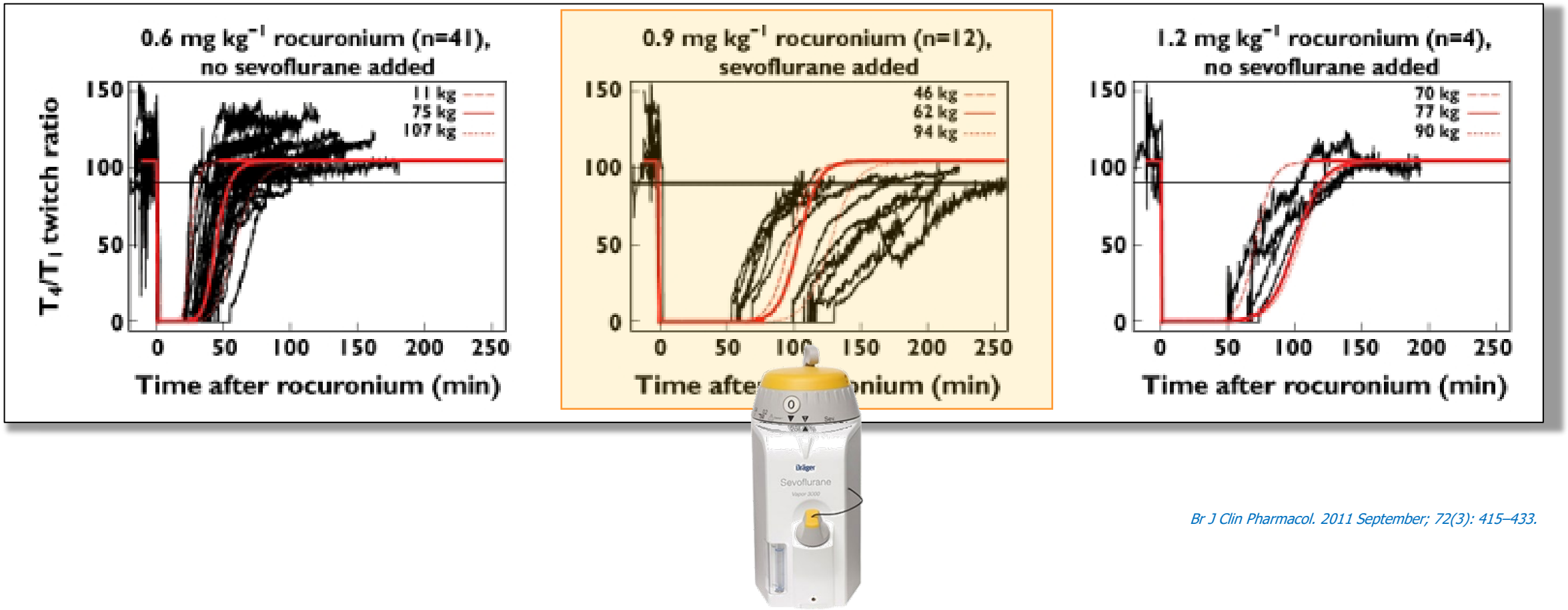
Table 2. Anesthesia-related Deaths by Type of Complication, United States, 1999–2005

Type of Complication	Number of Deaths	%
Complications of anesthesia during pregnancy, labor, and puerperium	79	3.6
Cardiac complications	60	2.7
Overdose of anesthetics	1,030	46.6
Inhaled anesthetics	233	10.5
Intravenous anesthetics	419	19.0
Other and unspecified general anesthetics	254	11.5
Local anesthetics	86	3.9
Unspecified anesthetics	38	1.7
Adverse effects of anesthetics in therapeutic use	940	42.5
Opioids and related analgesics	439	19.9
Benzodiazepines	42	1.9
Other and unspecified general anesthetics	40	1.8
Local anesthetics	137	6.2
Unspecified anesthetics	257	11.6
Other complications of anesthesia	162	7.3
Malignant hyperthermia	22	1.0
Failed or difficult intubation	50	2.3
Total	2,211	100.0

ICD-10 = *International Classification of Diseases*, 10th Revision.

Figure 5. Graphs show the observed T4/T1 twitch ratio upon spontaneous neuromuscular blockade reversal following rocuronium administration, conditioned on administered dose and use of sevoflurane anaesthesia (n = 59).



Br J Clin Pharmacol. 2011 September; 72(3): 415–433.

The Prolonged Duration of Rocuronium in Chinese Patients

Linda M. Collins, MB, BCh, BAO, FFARCSI*, Joan C. Bevan, MD, FRCA†, David R. Bevan, MB, MRCP, FRCA*, Giselle C. P. Villar, MD†, Raymond Kahwaji, MD, FRCPC†, Michael F. Smith, MD, FRCPC†, and François Donati, PhD, MD, FRCPC‡

Departments of Anesthesia, *Vancouver General Hospital and †British Columbia's Children's Hospital, University of British Columbia, Vancouver, British Columbia, and ‡Université de Montréal, Montréal, Québec, Canada

We compared the potency and duration of action of rocuronium in Chinese and Caucasian patients during general anesthesia. Thirty-six women (18 Caucasian and 18 Chinese) and 36 children (18 Caucasian and 18 Chinese) were evaluated during the administration of propofol/fentanyl anesthesia. Patients in each age group were randomized into three subgroups to receive single doses of 0.06, 0.12, or 0.18 mg/kg rocuronium (adults) or 0.12, 0.18, or 0.24 mg/kg rocuronium (children). Neuromuscular blockade was assessed by electromyography of the adductor pollicis after train-of-four (TOF) stimulation of the ulnar nerve. Dose response curves were constructed when maximum neuromuscular depression of the first twitch of the train (T_1) was obtained. A second bolus dose of rocuronium was then administered to a total dose of 0.6 mg/kg. The times of spontaneous recovery to T_1 10%, 25%, and 90% of control and to TOF 0.25, 0.50, and 0.70 were recorded. For both adults and children, recovery occurred later in Chinese than in Caucasian patients ($P < 0.05$ for T_1 of 10%, 25%, 75%, and 90% and TOF to 0.7). The 50% effective dose was smaller in Chinese adults (125 ± 63 vs 159 ± 66 μg/kg) and Chinese children (171 ± 43 vs 191 ± 46 μg/kg) than in Caucasian adults and children, but the difference was not statistically significant. In adults, time to 25% T_1 recovery was 43 ± 13 min in Chinese patients and 33 ± 10 min in Caucasian patients ($P < 0.05$). The corresponding values were more rapid for children: 30 ± 10 and 24 ± 6 min ($P < 0.05$). We conclude that the recovery from rocuronium neuromuscular blockade was longer in Chinese compared with Caucasian patients and in adults compared with children.

(Anesth Analg 2000;91:1526–30)

Table 2. Pharmacodynamic parameters.

	men *(n = 121)*	women *(n = 124)*
ONSET TIME (seconds)	104.7 (12.2)	92.5 (14.2)***
CLINICAL DURATION (minutes)	31.3 (5.5)	43.1 (7.9)***
RECOVERY INDEX (minutes)	14.8 (4.0)	14.7 (5.0)

Data are means (SD – standard deviation), ***p < 0.0001

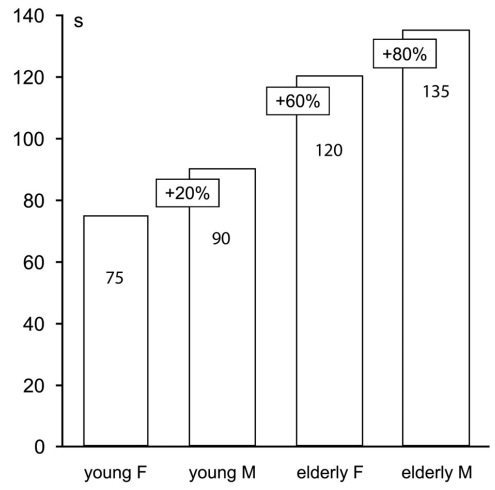


Fig. 2. Onset time in seconds (= time interval from the completion of the intravenous injection of rocuronium to maximal T_1 depression in TOF-stimulation).
Data are medians. The percentage values describe the increase compared to young females.
M = males, F = females, Young = age 20-40 yrs, Elderly = 60-75 yrs

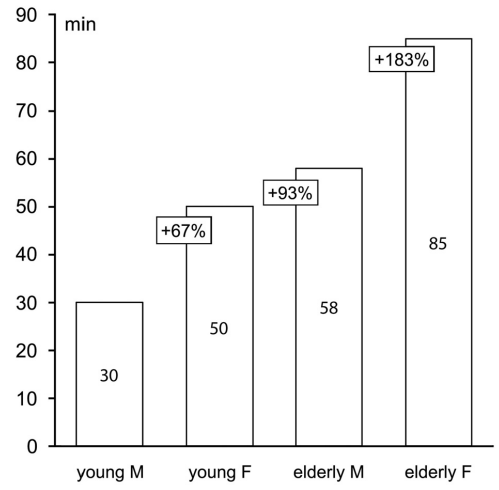


Fig. 3. Clinical duration in minutes (= time interval from the completion of the intravenous injection of rocuronium to spontaneous recovery of T_1 to 25% of the control value in TOF-stimulation).
Data are medians. The percentage values describe the increase compared to young males.
M = males, F = females, Young = age 20-40 yrs, Elderly = 60-75 yrs

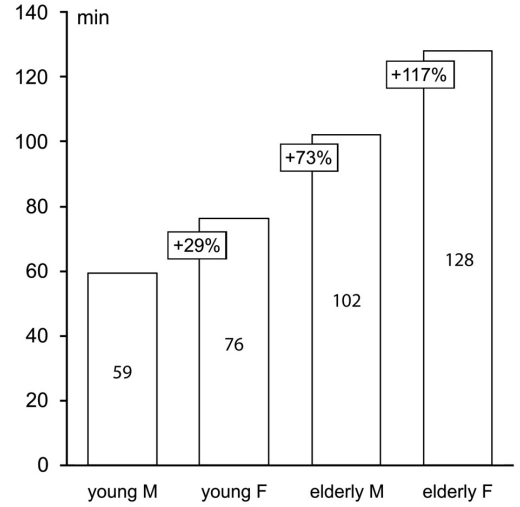


Fig. 4. Interval to full recovery in minutes (= interval from the completion of the intravenous injection of rocuronium to spontaneous recovery to TOF-ratio 0.90, which reflects complete recovery from the block).
Data are medians. The percentage values describe the increase compared to young males.
M = males, F = females, Young = age 20-40 yrs, Elderly = 60-75 yrs

Adamus et al. Biomed Pap Med Fac Univ Palacky Olomouc Czech Repub. 2011 Dec; 155(4):347–354.

TABLE 24-1 COMMON WEIGHT SCALARS

Name	Equations
Ideal body weight	Male: 50 kg + 2.3 kg for each 2.54 cm (1 in) over 152 cm (5 ft) Female: 45.5 kg + 2.3 kg for each 2.54 cm (1 in) over 152 cm (5 ft)
Lean body mass	Male: $1.1 \times TBW - 128 \times (TBW \div Ht)^2$ Female: $1.07 \times TBW - 148 \times (TBW \div Ht)^2$
Fat free mass[35]	Male: $(9.27 \times 10^3 \times TBW) \div (6.68 \times 10^3 + 216 \times BMI)$ Female: $(9.27 \times 10^3 \times TBW) \div (8.78 \times 10^3 + 244 \times BMI)$
Pharmacokinetic mass[36,37]	$52 \div [1 + (196.4 \times e^{-0.025\ TBW} - 53.66) \div 100]$ (fentanyl only)
Corrected body weight[38,39]	IBW + 0.4* (IBW − FFM)

BMI, Body mass index; FFM, fat-free mass; *Ht,* height in centimeters; *IBW, ideal body weight; LBM,* lean body mass; *MFFM,* modified fat-free mass; *TBW,* total body weight in kg.

*The dose/kg using IBW, TBW, or FFM in an obese person are all less than the dose/kg using TBW in a nonobese patient.

TABLE 24-2 DOSING WEIGHTS BASED ON VARIOUS DOSING SCALARS

	176-cm (6-ft) Male	
	68 kg (BMI = 22)	185 kg (BMI = 66)
Dosing Scalar	Dosing Weight (kg)	Dosing Weight (kg)
Total body weight (TBW)	68	185
Ideal body weight (IBW)	71	71
Lean body mass (LBM)	55	62
Fat-free mass (FFM)	55	87
Corrrected body weight (CBW)	68	115

BMI, Body mass index (kg/m²).

British Journal of Anaesthesia **105** (S1): i16–i23 (2010)
doi:10.1093/bja/aeq312

BJA

Dose adjustment of anaesthetics in the morbidly obese

J. Ingrande and H. J. M. Lemmens*

Department of Anesthesia, Stanford University School of Medicine, 300 Pasteur Drive, Room H3576, Stanford, CA 94305, USA

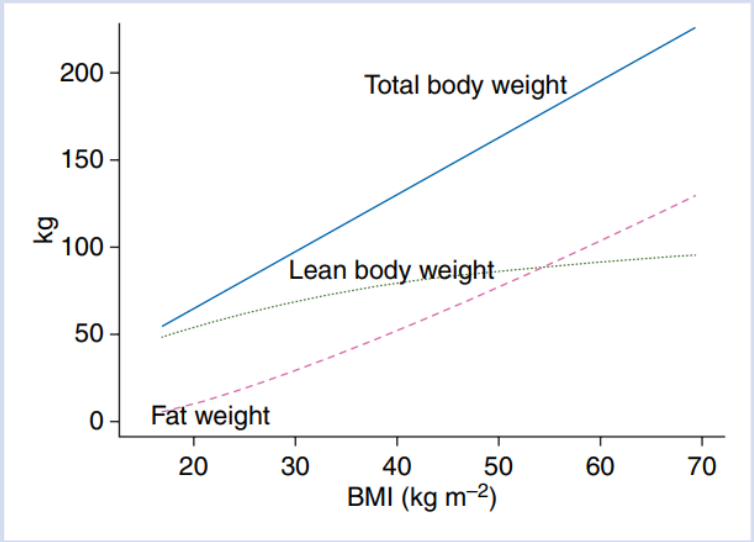


Fig 1 Relationship of TBW, fat weight, and LBW to BMI in a standard height male. LBW and fat weight were derived from the equations of Janmahasatian *et al.*[11]

Table 1 Weight-based dosing scalar recommendation for commonly used i.v. anaesthetics. CO, cardiac output; IBW, ideal body weight; LBW, lean body weight; TBW, total body weight

Drug	Dosing scalar	Comments
Thiopental	Induction: LBW Maintenance: TBW	Simulations showed a 60% decrease in peak plasma concentration in MO subjects compared with lean subjects after a 250 mg dose.[26] Induction dose adjusted to LBW results in same peak plasma concentration as dose adjusted to CO.[26] Volumes and clearances increase proportionally with TBW.[25]
Propofol	Induction: LBW Maintenance: TBW	MO subjects given an induction dose based on LBW required similar amounts of propofol and similar times to loss of consciousness compared with lean subjects given propofol based on TBW.[29] Volume of distribution and clearance at steady state increases with increasing TBW.[28]
Fentanyl	LBW	Clearance increases linearly with 'PK mass', an arbitrary scalar highly correlated to LBW.[46]
Remifentanil	LBW	An infusion based on LBW results in similar plasma concentrations as normal weight subjects were given an infusion based on TBW.[51]
Succinylcholine	TBW	Administration of 1 mg kg^{-1} based on TBW resulted in a more profound block and better intubating conditions compared with doses based on IBW or LBW.[67]
Vecuronium	IBW	Doses based on TBW result in a prolonged duration of action in obese *vs* non-obese subjects.[69 70]
Rocuronium	IBW	There is an increased duration of action when the drug is given based on TBW *vs* IBW.[71]
Atracurium, Cisatracurium	IBW	The duration of action is prolonged in obese subjects when given on the basis of TBW *vs* IBW.[73 74]

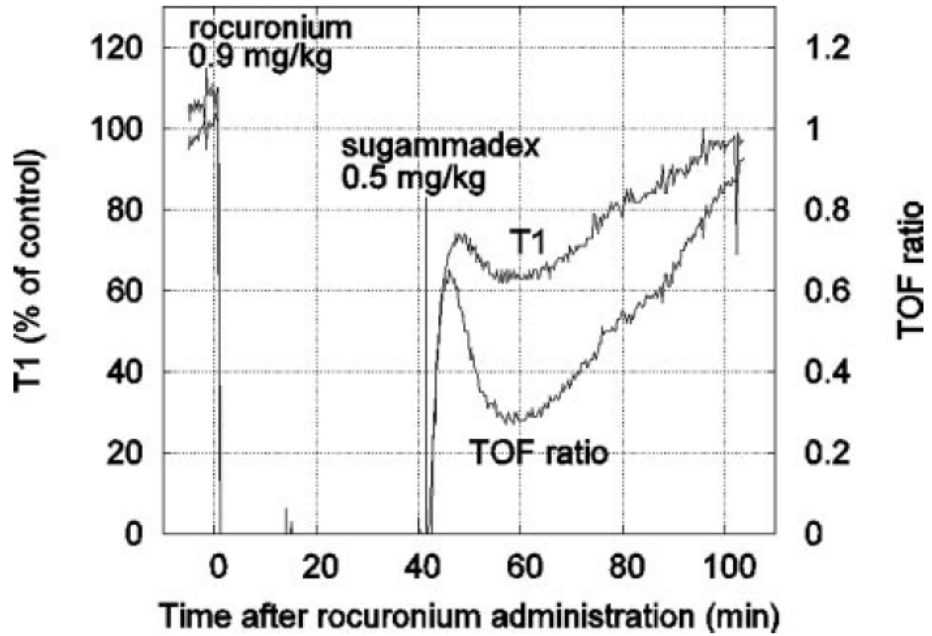


Figure 1. Temporary decrease in train-of-four (TOF) ratio and T1 during reversal of rocuronium-induced muscle relaxation (0.9 mg/kg) with sugammadex (0.5 mg/kg administered 42 min after rocuronium). At the time of sugammadex administration the posttetanic-count (PTC) value was 1.

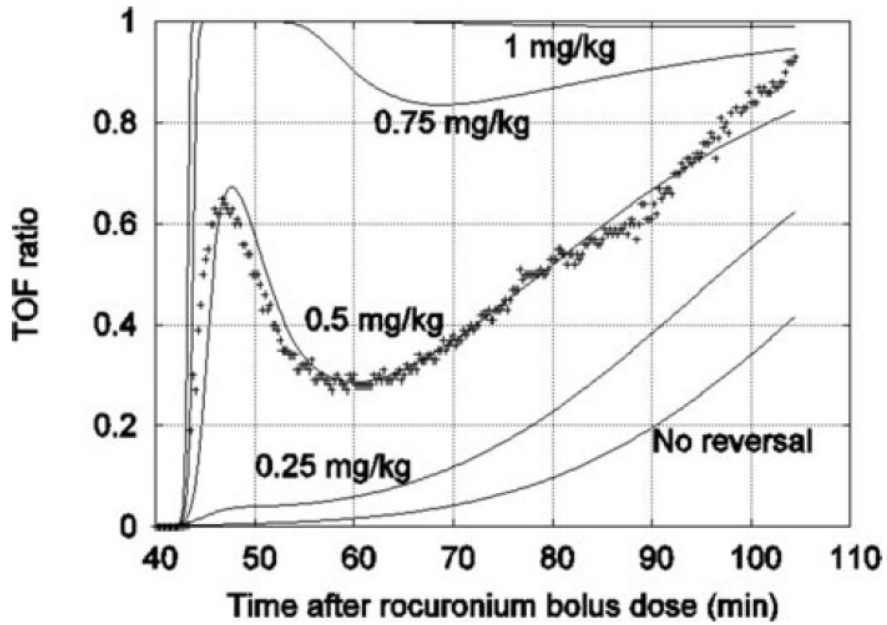


Figure 2. Observed train-of-four (TOF) data (+) and the results of simulations (solid lines) of various sugammadex dosing amounts. Muscle relaxation rebound only occurs for sugammadex doses in a limited range. The simulations indicate that for this patient, doses larger than about 1 mg/kg are sufficient to achieve rapid muscle relaxation reversal and avoid muscle relaxation rebound.

Eleveld DJ et al. Anesth Analg 2007;104:582–4

Deep block	Dose
If spontaneous recovery of the twitch response has **reached 1–2 PTCs, no twitch responses** to TOF	**4 mg/kg**

Moderate block	Dose
If spontaneous recovery has reached the **reappearance of the second twitch (T_2)** in response to TOF stimulation	**2 mg/kg**

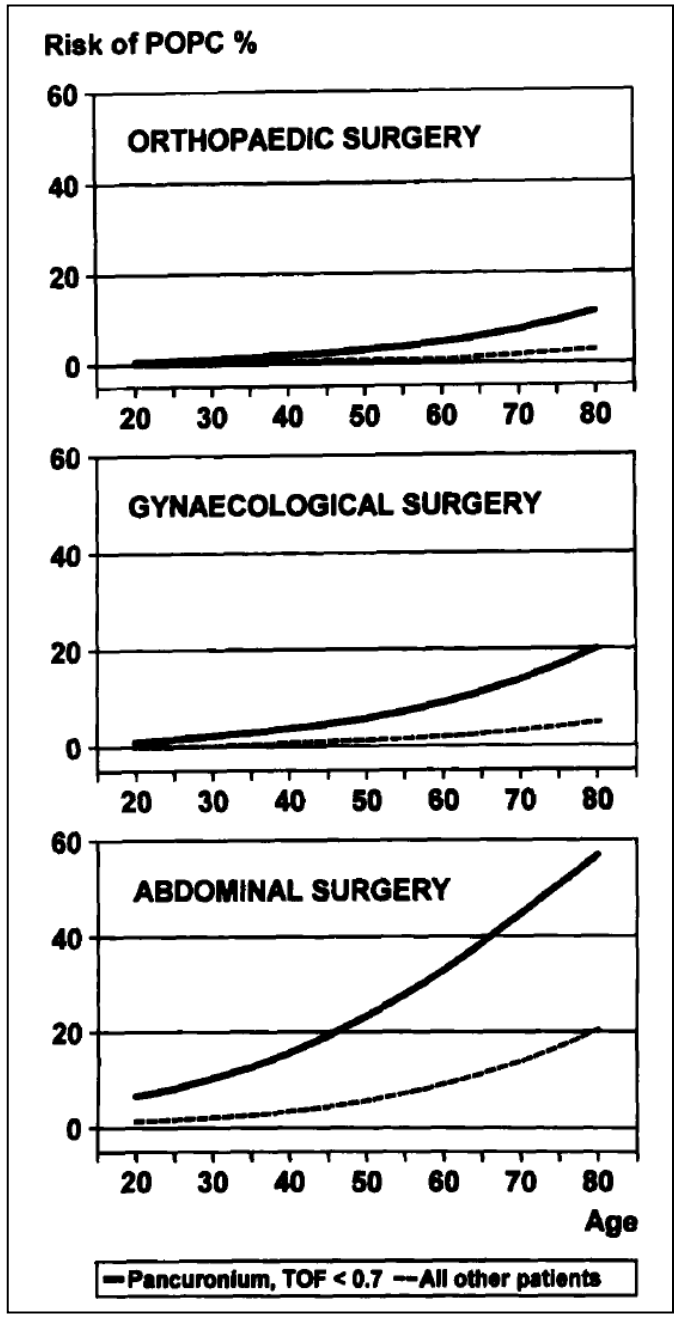


Fig. 4. Predicted probabilities of postoperative pulmonary complications in different age groups in orthopaedic, gynaecological, and major abdominal surgery with a duration of anaesthesia of less than 200 min. The full lines represent patients having residual neuromuscular block (TOF <0.70) following the use of pancuronium, the broken lines patients with TOF ≥0.70 following pancuronium and all atracurium and vecuronium patients, independent of the TOF ratio at end of anaesthesia (see text for further explanation).

Berg H et al. Acta Anaesthesiol Scand. 1997 Oct;41(9):1095-1103

Table 5

Comparison between patients with and without POPC. Median values and 25th–75th percentiles are given.

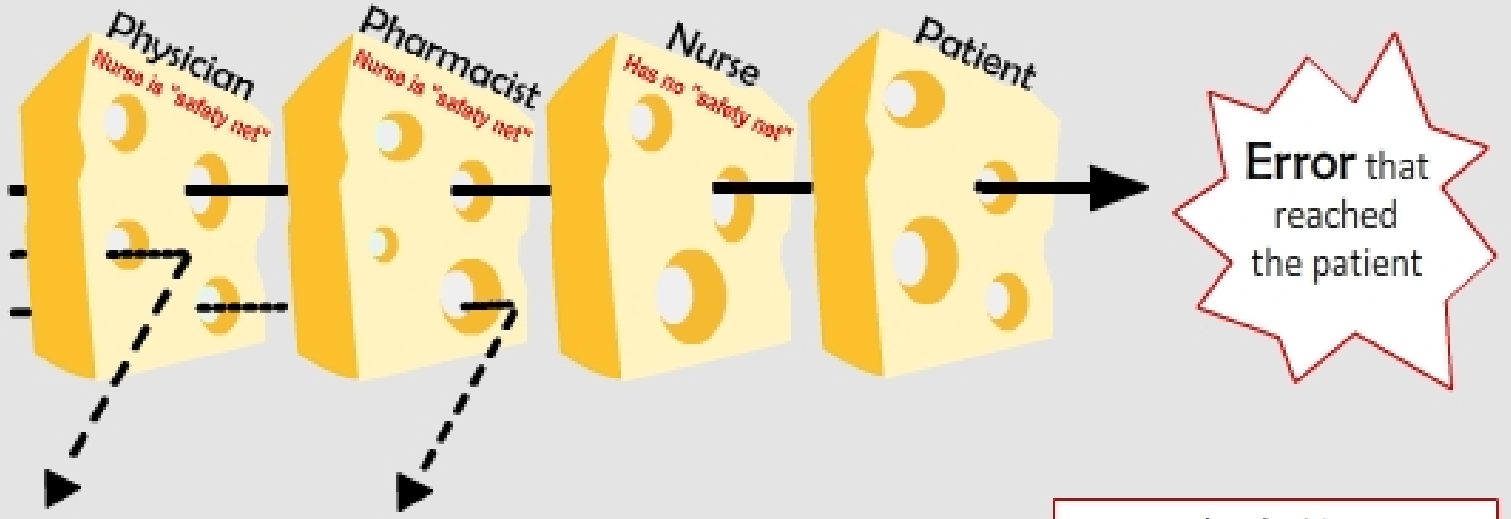
	Patients without POPC (n=644)	Patients with POPC (n=46)	Significance level *P*
Age in years	51.6 (38–66)	65.0 (56–76)	0.000011
Duration of anaesthesia	150 (115–190)	193 (160–230)	0.000027
Duration of surgery	92 (65–130)	121 (90–165)	0.00028
Central temperature at end of anaesthesia (°C)	36.0 (35.6–36.5)	35.7 (35.2–36.2)	0.00084

Medication Error

The Swiss Cheese Model

Originator: Reason

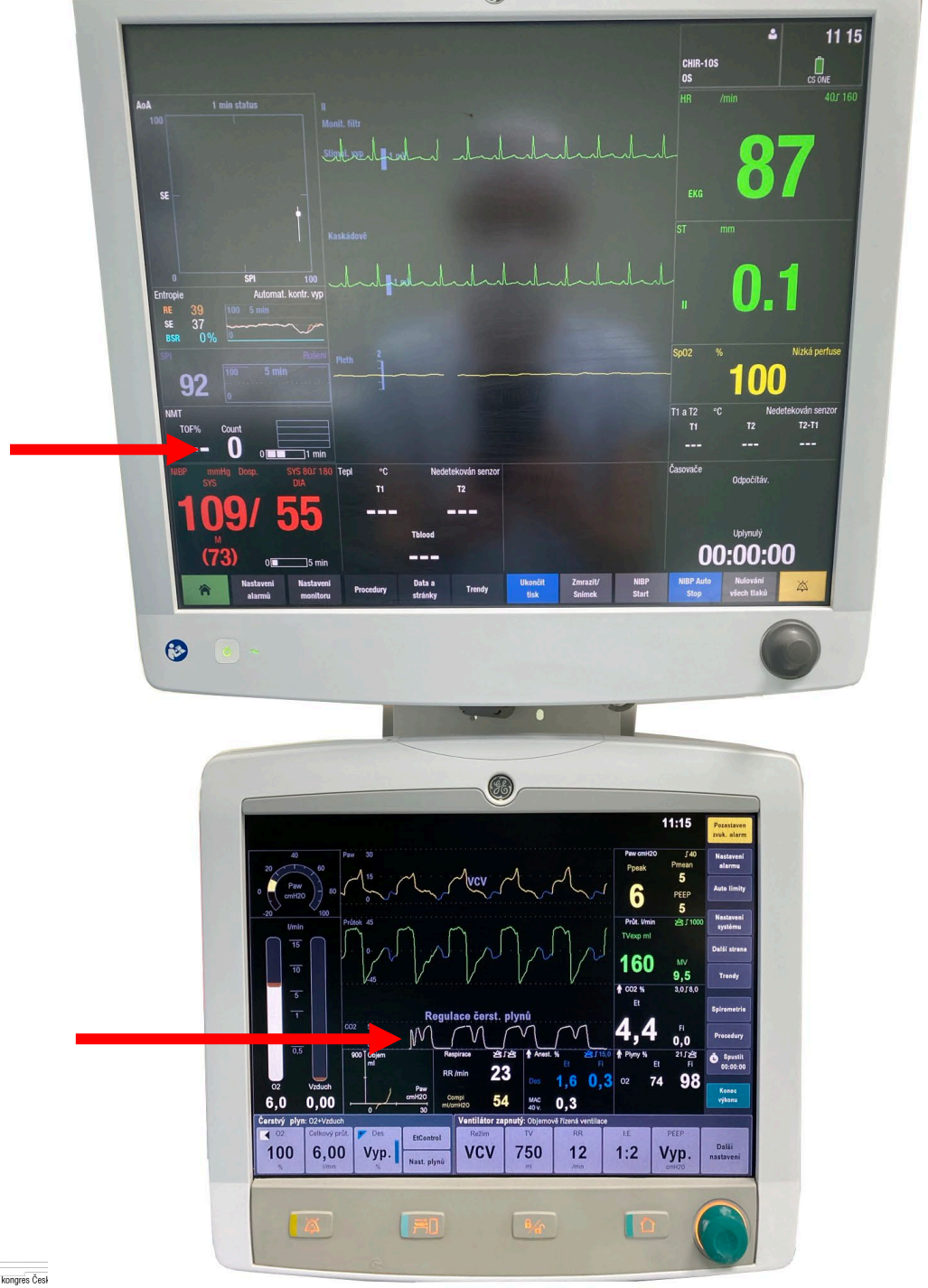
High Reliability Organizations (HROs) deploy "Independent Redundancies"

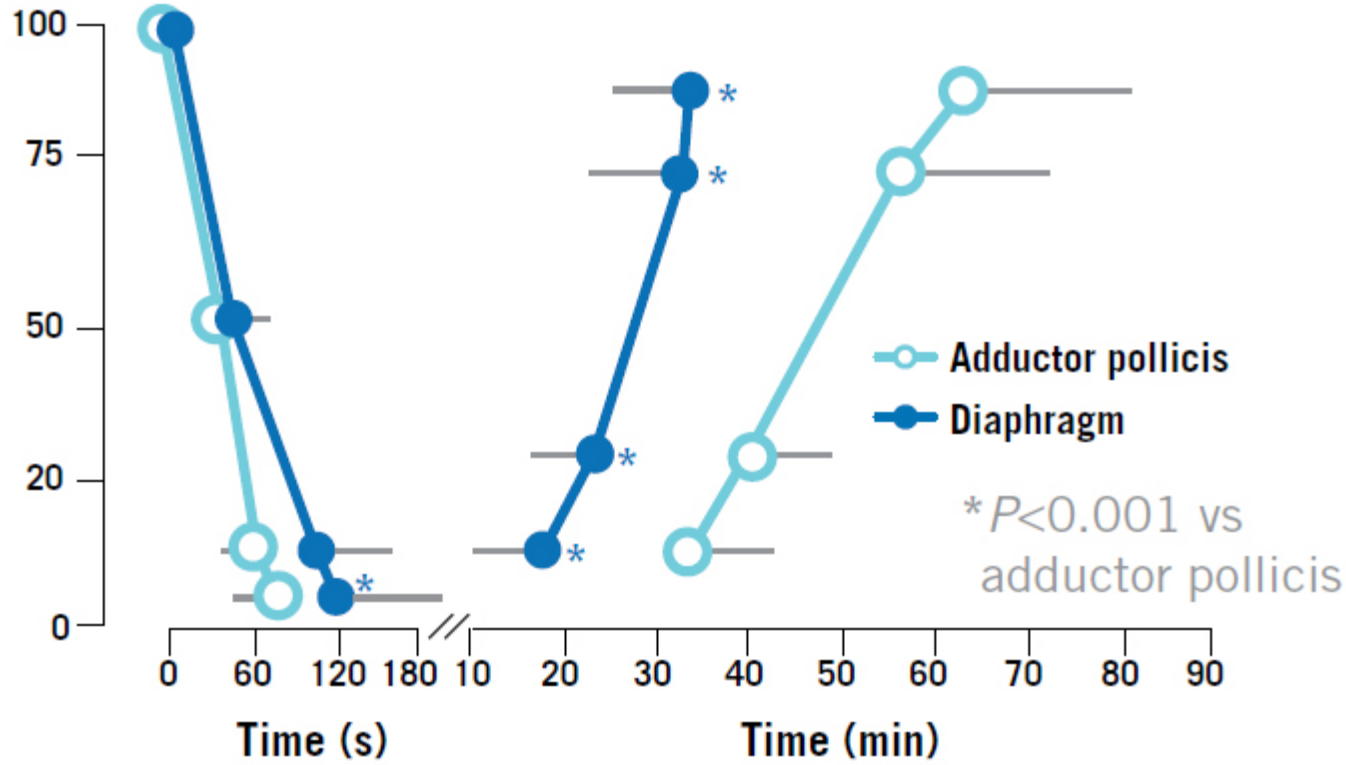


"Near Miss"
Error that was intercepted

Latent Errors (examples)

- Poor handwriting
- Incomplete information
- Unclear labeling
- High workload





Cantineau et al. Anesthesiology. 1994;81(3):585–590.

CO NENÍ INDIKOVANÉ,

JE KONTRAINDIKOVANÉ!

Nástup anestezie:
propofol 1.5 - 2 µg/kg

Nástup analgezie:
sufentanil 0.4 µg/kg

Nástup relaxace:
rocuronium 1 mg/kg

OBYČEJNÁ ANESTEZIE

DOBRÁ ANESTEZIE

jan.blaha@vfn.cz