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# *Rapid sequence induction: up to date*

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# Terminologie RSI

- ✓ *rapid sequence induction*
- ✓ *bleskový úvod do anestezie*
- ✓ *crash induction (intubation)*
- ✓ *crush induction (intubation)*

# *Sémantika RSI*

✓ *rapid sequence* **induction**

VS.

✓ *rapid sequence* **intubation**

# Sémantika RSI

*Dronen S. Rapid-sequence intubation: a safe but ill-defined procedure. Acad Emerg Med 1999; 6:1–2.*

✓ *rapid sequence induction*  
(of anesthesia)

*cíl:*

*minimalizovat riziko aspirace u chirurgických nemocných s předpokladem plného žaludku*

*lokalizace: operační sál*

*end-point: nemocný je intubován pro CA*

# Sémantika RSI

*Dronen S. Rapid-sequence intubation: a safe but ill-defined procedure. Acad Emerg Med 1999; 6:1–2.*

## ✓ *rapid sequence intubation*

*cíl:*

*minimalizovat riziko aspirace u nemocných vyžadujících emergentní zajištění DC*

*lokalizace: OUP, mimo nemocnici*

*end-point: nemocný je uveden do CA,  
aby mohla být provedena intubace*

# *RSI – indikace*

## *(rapid sequence induction)*

*Rasmussen LS, Viby-Mogensen J. Rapid sequence intubation – how? Acta Anaesthesiol Scand 2007; 51:787–8.*

*nutnost podání celkové anestezie navzdory významnému riziku aspirace žaludečního obsahu*

*Typicky:*

- ✓ emergentní situace*
- ✓ nemocný není nalačno*
- ✓ GERD*
- ✓ ileózní stavy*
- ✓ těhotenství – 3. trimestr, S.C.*

# *RSI – fáze*

## *(rapid sequence induction)*

*Kovacs G, Law JA. Airway Management in Emergencies. Mc Graw-Hill Companies: 2008, 298 p.*

- ✓ *personál (RSI is not one-person job)*
- ✓ *příprava nemocného, vybavení*
- ✓ *IV přístup*
- ✓ *polohování (lékař, nemocný)*
- ✓ *preoxygenace*
- ✓ *Sellickův hmat?*
- ✓ *indukce CA*
- ✓ *svalová relaxace*
- ✓ *intubace + ověření uložení rourky*
- ✓ *management po intubaci*

# *RSI – fáze*

*(rapid sequence induction)*

*Kovacs G, Law JA. Airway Management in Emergencies. Mc Graw-Hill Companies: 2008, 298 p.*

- ✓ *successful RSI is all about planning*
- ✓ *your first shot is your best shot*
- ✓ *anticipate the unanticipated*



# *RSI – vybavení*

*(odpovídá vybavení pro DI)*

*Kovacs G, Law JA. Airway Management in Emergencies. Mc Graw-Hill Companies: 2008, 298 p.*

## *STOP "IC" BARS*

*S*uction (rigid vs suction catheter)

*T*ubes

*O*xygen and positive pressure

*P*harmacology – indukce, relaxace, treat hypotension

*I*V access

*C*onnect to circuit, Confirmation (clinical, objective –  $E_T\text{CO}_2$ )

*B*lades and Bougie

*A*lternative intubation device (LMA Fastrach, fibro, Trachlight)

*R*escue oxygenation technique (druhy LMA, Combitube)

*S*urgical access

# Vývoj koncepce RSI (většinou CA pro s.c.)

## původní (1959)

Hodges RJ, Bennett JR, Tunstall ME, Knight RF.

General anaesthesia for operative obstetrics: with special reference to the use of thiopentone and suxamethonium. *Br J Anaesth* 1959; **31**:152–63.

- pre-oxygenace
- rychlý IV úvod (thiopental, sux)
- prodýchávání během apnoe (BMV – bag and mask ventilation)
- oxid dusný/kyslík ana partes do vybavení dítěte

## doplňená (1961)

Sellick BA. Cricoid pressure to control regurgitation of stomach contents during induction of anaesthesia. *Lancet* 1961; **2**:404–6.

- tlak na prstencovou chrupavku (Sellickův manévr)

## klasická (1970)

Stept WJ, Safar P. Rapid induction-intubation for prevention of gastric-content aspiration. *Anesth Analg* 1970; **49**:633-6.

- pre-oxygenace
- předem určená indukční dávka – bez titrace (thiopental, sux)
- Sellickův hmat
- bez BMV
- tracheální intubace

- ✓ polohování
- ✓ žaludeční sonda – ano/ne?, ponechat/extrahovat?

- ✓ *personál (RSI is not one-person job)*
- ✓ *příprava nemocného, vybavení*
- ✓ *IV přístup*
- ✓ *polohování (lékař, nemocný)*
- ✓ *preoxygenace*
- ✓ *Sellickův hmat?*
- ✓ *indukce CA*
- ✓ *svalová relaxace*
- ✓ *intubace + ověření uložení rourky*
- ✓ *management po intubaci*

# RSI

✓ *preoxygenace*

*opomenutí preoxygenace je považováno  
za postup non lege artis*

# Preoxygenace (How?)

Chiron B, Laffon M, Ferrandiere M, Pittet J-F, Marret H, Merciera C. Standard preoxygenation technique versus two rapid techniques in pregnant patients. *Int J Obstet Anesth* 2004;13:11–4.

*spontánní ventilace*

*dokonale těsnící maska!*

*bez zpětného vdechování*

*dostatečný FGF*

*efektivita podle  $F_{ET}O_2 (\geq 0,9)$*

✓ *standardní postup*

- *3–5 minut,  $V_T$ , 9 LPM, snaha o  $FiO_2 = 1,0$*

✓ *alternativní postup (rychlejší)*

- *4 (8) vdechů maximální hloubky (VC), 9 (15) LPM*

## ORIGINAL ARTICLE

# *Efektivita preoxygenace:*

- $V_T$  - 3 min
- 8 DB (VC) - 1 min

*je srovnatelná*

breathing ( $V_T \times 3$  min), 8 deep breaths (8 DB) and 4 deep breaths (4 DB). Twenty pregnant volunteers without pulmonary diseases were studied during the third trimester (36–38 weeks' gestation). Women were preoxygenated using a non-rebreathing respiratory circuit with a 3-L reservoir bag and a *Capnomac Ultima* calibrated before each patient to monitor  $F_{ET}O_2$  continuously. The three preoxygenation techniques were investigated in random order:  $V_T \times 3$  min using an oxygen flow of  $9 \text{ L min}^{-1}$ , 4 DB within 30 s using an oxygen flow of  $9 \text{ L min}^{-1}$ , and 8 DB within one minute using an oxygen flow of  $15 \text{ L min}^{-1}$ . Between each technique, 5-min room air breathing was allowed to return to baseline  $F_{ET}O_2$  assessed by the *Capnomac Ultima*. An  $F_{ET}O_2 \geq 90\%$  was achieved more frequently with the  $V_T \times 3$  min and the 8 DB techniques (76%) than with the 4 DB technique (18%) ( $P < 0.05$ ). The average time required for obtaining an  $F_{ET}O_2 \geq 90\%$  was  $107 \pm 37$  s. Both the  $V_T \times 3$  min and the 8 DB techniques are therefore more effective for preoxygenation in pregnant patients than the 4 DB technique. In an acute obstetric emergency before rapid-sequence induction of general anaesthesia, 8 DB preoxygenation technique could be recommended.

*RSI*

✓ *Sellickúv hmat*  
(*cricoid pressure*)

# Brian Sellick (1918–1996)

## *Sellickův hmat (cricoid pressure)*

*Sellick BA. Cricoid pressure to control regurgitation of stomach contents during induction of anaesthesia. Lancet 1961; 2:404–6.*



- ✗ kontroverzní názory*
- ✗ tradicionalismus*
- ✗ efektivita není podpořena EBM*
- ✗ nespolehlivý při prevenci aspirace*
- ✗ jícen neleží vždy mezi prstencovou chrupavkou a páteří*
- ✗ tlak na prstencovou chrupavku nevytvoří vždy okluzi jícnu*
- ✗ zhoršení laryngoskopického obrazu*
- ✗ většinou nedokonalé provedení*
- ✗ chybná výuka*



EXPERT OPINION

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## Cricoid pressure: an expert's opinion

Priebe HJ. Cricoid pressure: an expert's opinion. *Minerva Anesthesiol* 2009; **75**:710–714.

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and knowledge has advanced. By today's standards, cricoid pressure can no longer be considered an evidence-based practice. This is why more and more anesthesiologists (including myself) no longer apply cricoid pressure.

*RSI*

✓ *svalová relaxace*

*NMBA pro RSI*  
*(4 × ED<sub>95</sub>)*

✓ *suxamethonium (SUX)*

dávka: 1,0–1,5 mg kg<sup>-1</sup> (3–5 × ED<sub>95</sub>)

✓ *rokuronium (ROC)*

dávka: 1,2 mg kg<sup>-1</sup> (4 × ED<sub>95</sub>)

✗ *NE rokuronium (ROC)*

dávka: 0,6 mg kg<sup>-1</sup> (2 × ED<sub>95</sub>)

*SUX je v oblibě pro RSI pro rychlost:*

- *nástupu účinku*
- *odeznění účinku*

*Domněnka o bezpečnosti SUX během RSI je založena na předpokladu, že zotavení z jeho efektu nastane dříve než se vyvine desaturace v případě CICV.*

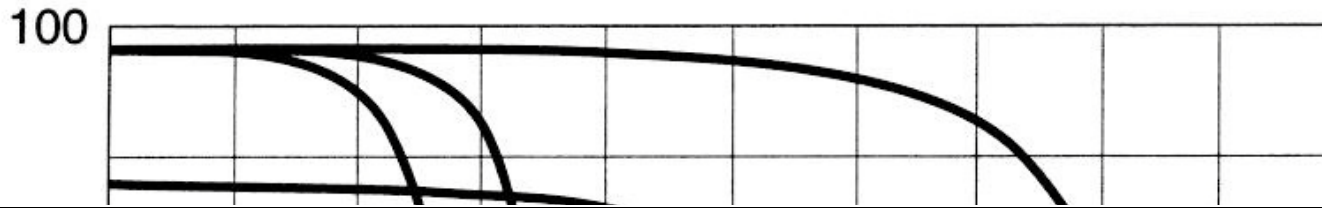
*Spontánní zotavení ventilace není po SUX natolik rychlé aby zabránilo poškození nemocného při stavu can't intubate, can't ventilate.*

*Hayes AH, Breslin DS, Mirakhur RK, Reid JE, O'Hare RA. Frequency of haemoglobin desaturation with the use of succinylcholine during rapid sequence induction of anaesthesia. Acta Anaesthesiol Scand 2001; 45:746–749.*

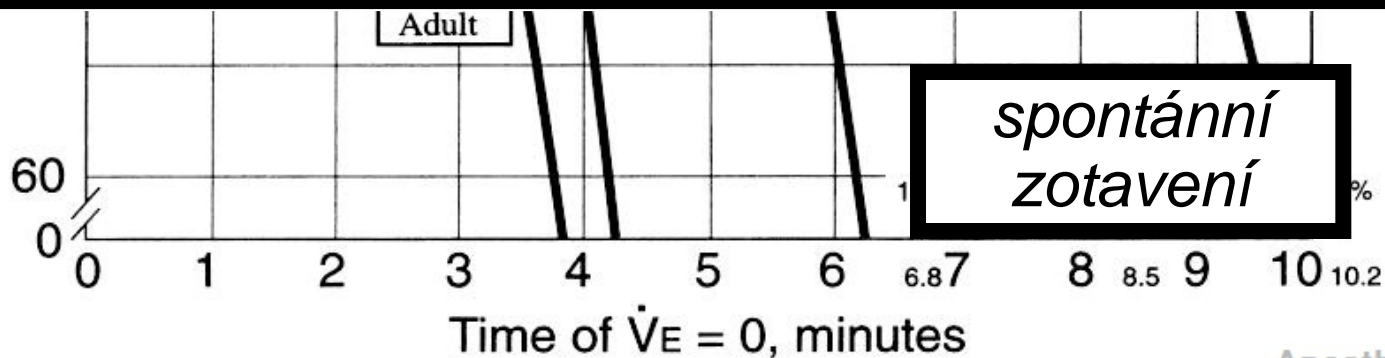
*Naguib M, Samarkandi AH, Abdullah K, Riad W, Alharby SW. Succinylcholine dosage and apnea-induced hemoglobin desaturation in patients. Anesthesiology 2005; 102:35-40.*

*Levy DM. Traditional rapid sequence induction is an outmoded technique for caesarean section and should be modified. Int J Obstet Anesth 2006; 15:227–229*

## TIME TO HEMOGLOBIN DESATURATION WITH INITIAL $F_{A}O_2 = 0.87$



*Po IV podání SUX ( $1 \text{ mg kg}^{-1}$ ) se objevuje kritická desaturace Hb dříve, než se obnoví adekvátní spontánní ventilace.*



Benumof JL, Dagg R, Benumof R. Critical hemoglobin desaturation will occur before return to an unparalyzed state following 1 mg/kg intravenous succinylcholine. *Anesthesiology* 1997; **87**:979-982.

*Pokud se během RSI  
vyskytne stav CICV,  
nezabrání použití SUX ( $1 \text{ mg kg}^{-1}$ )  
nástupu hypoxémie  
před obnovením dostatečné  
spontánní ventilace.*

is based on the fact that recovery from its effects will occur before oxygen desaturation occurs in case of failure to intubate or ventilate. The purpose of this study was to examine the incidence of oxygen desaturation after the use of succinylcholine prior to resumption of spontaneous ventilation following four different preoxygenation techniques.

**Methods:** Twenty-five patients each were randomly allocated to preoxygenation with 4 deep breaths of 100% oxygen or by breathing oxygen for 1, 3 or 5 min following which they received a rapid sequence induction of anaesthesia with fentanyl  $1 \mu\text{g kg}^{-1}$ , a sleep dose of thiopentone and succinylcholine  $1 \text{ mg kg}^{-1}$ . Oxygen saturation was monitored continuously using a finger probe. Ventilation was not assisted unless the saturation decreased to  $\leq 90\%$ .

oxygen saturation to  $\leq 90\%$  before the resumption of effective spontaneous ventilation irrespective of the technique of preoxygenation.

**Conclusion:** We conclude that use of succinylcholine may not always prevent desaturation if there is a failure to intubate and ventilate during a rapid sequence induction of anaesthesia.

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**Key words:** Neuromuscular relaxants, succinylcholine; anaesthesia, rapid sequence induction; safety, preoxygenation.

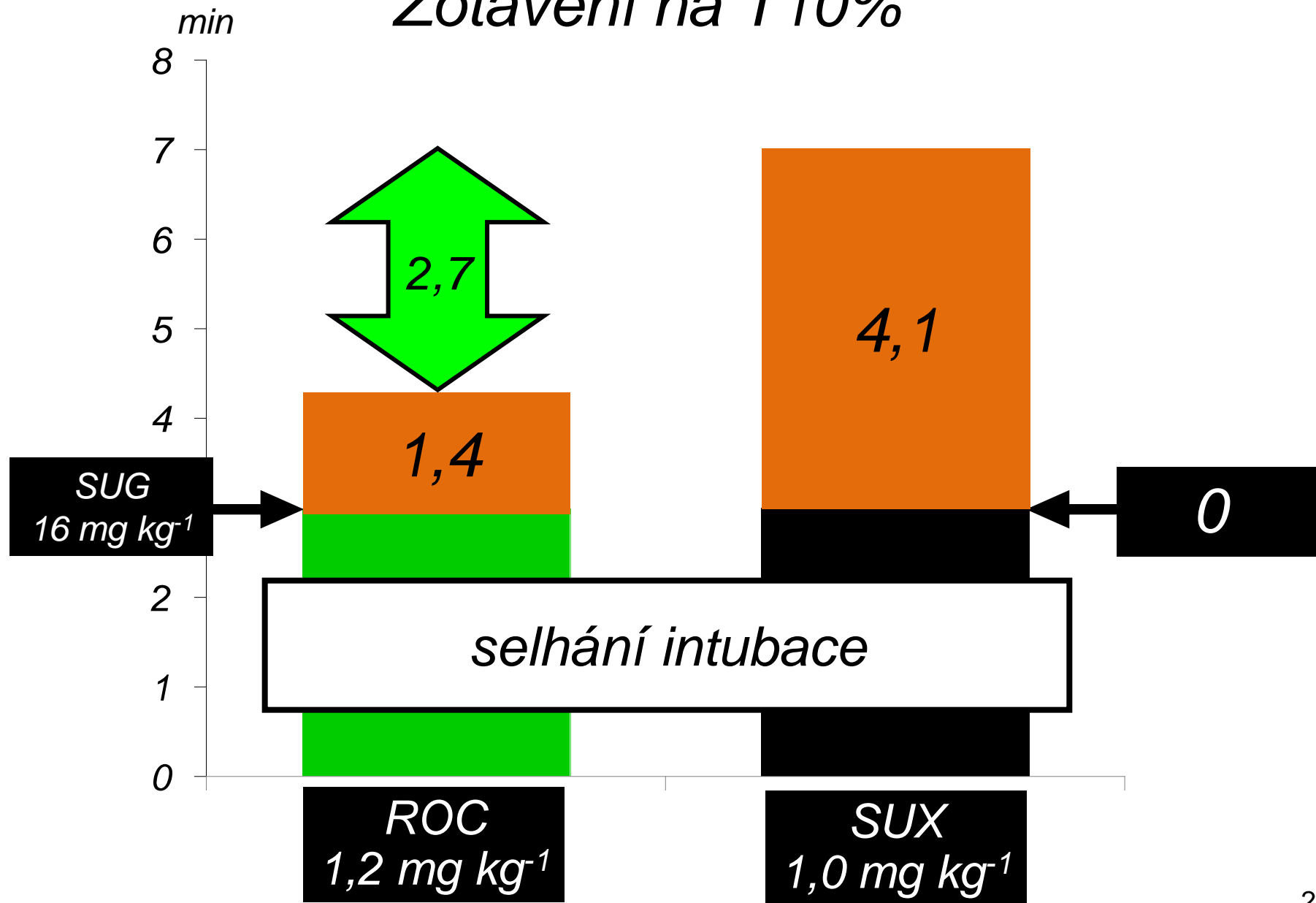
*Srovnání časového průběhu  
odeznění blokády:*

*spontánně (SUX)*

*vs.*

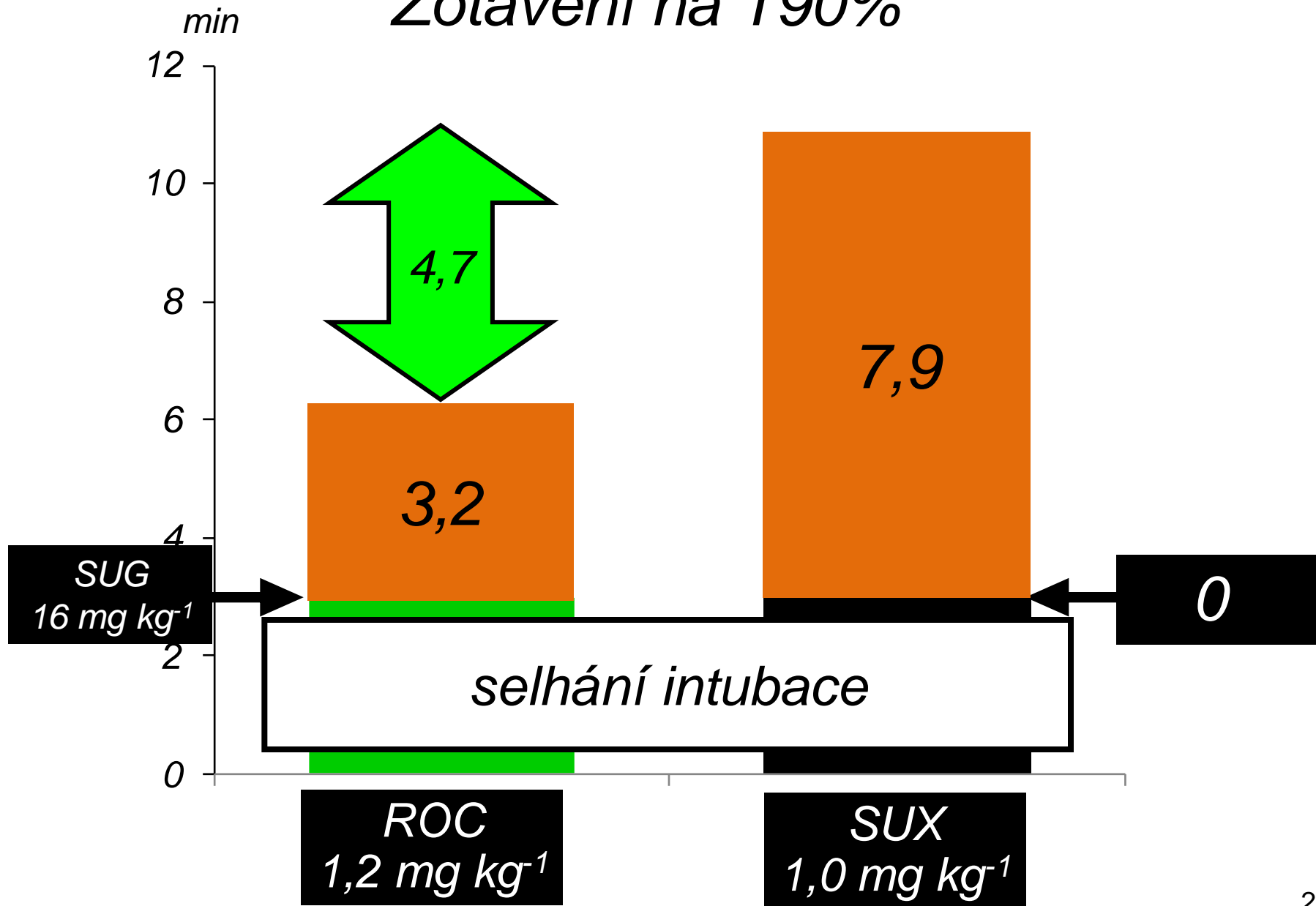
*reverze (ROC + SUG)*

## Zotavení na T10%





## Zotavení na T90%



# ***Reversal of Profound Neuromuscular Block by Sugammadex Administered Three Minutes after Rocuronium***

## ***A Comparison with Spontaneous Recovery from Succinylcholine***

Chingmuh Lee, M.D.,\* Jonathan S. Jahr, M.D.,† Keith A. Candiotti, M.D.,‡ Brian Warriner, M.D.,§ Mark H. Zornow, M.D.,|| Mohamed Naguib, M.D.#

***Background:*** Rocuronium in intubation doses provides similar intubation conditions as succinylcholine, but has a longer duration of action. This study compared time to sugammadex reversal of profound rocuronium-induced neuromuscular block with time to spontaneous recovery from succinylcholine.

***Conclusion:*** Reversal of profound high-dose rocuronium-induced neuromuscular block (1.2 mg/kg) with 16 mg/kg sugammadex was significantly faster than spontaneous recovery from 1 mg/kg succinylcholine.

***Zvrat hlubokého bloku po podání vysoké dávky ROC (1,2 mg kg<sup>-1</sup>) sugammadexem (16 mg kg<sup>-1</sup>) je signifikantně rychlejší, než spontánní zotavení z bloku po SUX (1 mg kg<sup>-1</sup>)***

# Take Home Message

- ✓ RSI - riziková situace pro nemocného i anesteziologa
- ✓ polohování, derivace žaludku, ovlivnění žal. obsahu
- ✓ preoxygenace:
  - 3 min ( $FiO_2 = 1,0$ )
  - 8 vdechů maximální hloubky během 60 sec
  - 4 vdechy maximální hloubky během 30 sec
- ✓ Sellickův hmat???
- ✓ iv indukce - thiopental, propofol, ketamin, etomidát
- ✓ bez BMV
- ✓ svalová relaxace:
  - SUX ( $1,0$  až  $1,5 \text{ mg kg}^{-1}$ )
  - ROC ( $1,2 \text{ mg kg}^{-1}$ ) + SUG v záloze
- ✓ počítat s možností "cannot intubate, cannot ventilate"
- ✓ "failed-intubation drill" - primární: zajistit oxygenaci