



PORODNICKÁ ANESTEZIE: CO JE PODSTATNÉ



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VOLBA ANESTEZIE

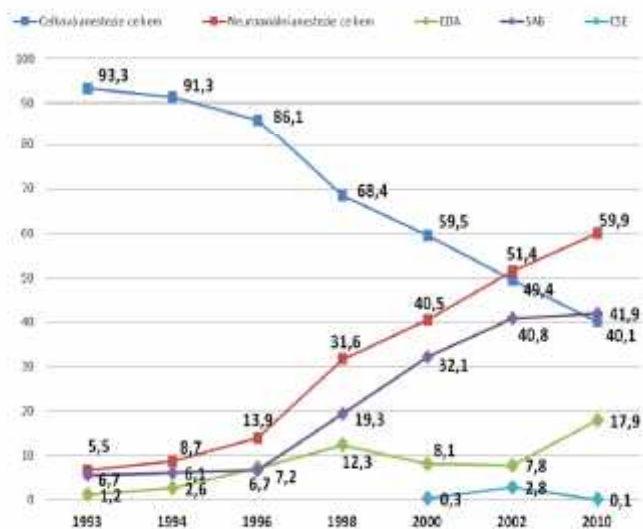


CELKOVÁ ANESTEZIE je u císařského ezu indikována pouze tehdy, je-li **REGIONÁLNÍ ANESTEZIE** kontraindikována.



VOLBA ANESTEZIE

Zastoupení anesteziologických technik u císařského řezu v ČR v roce 2009 (%)



“Apolinář “

	2006	2009	2010
Porody	4134	4541	4436
Císařské řezy	1133 (27%)	1476 (33%)	1596 (36%)
Celková anestezie	474 (42%)	367 (25%)	430 (27%)
Regionální anestezie	659 (58%)	1109 (75%)	1166 (73%)
EPID	497 (75%)	870 (78%)	1066 (91%)
SAB	162 (25%)	239 (22%)	110 (9%)



VOLBA ANESTEZIE

Pro koho je regionální anestezie lepší ?



A: PRO ANESTEZIOLOGA

B: PRO PORODNÍKA

C: PRO DÍT

D: PRO MATKU



VOLBA ANESTEZIE

Apgar score v 1. min > 7 bylo po epidurální v 96%, po spinální v 93% a po celkové anestézii v 75%.

Rozdíl mezi epidurální a spinální anestézií byl statisticky významný ($p < 0.05$).

Am J Obstet Gynecol. 1993 May;10(3):175-81

Za normálních podmínek
stejný vliv na pohodu

Za podmínek stresu p
anestézie.



epidurální anestézie

epidurální než celkové

Am J Obstet Gynecol. 1995 May;59 Suppl:S61-7

Retrospektivní 3letá stu
anestézii z hlediska res

epidurální a spinální

Nebyl nalezen signifikantní rozdíl mezi jednotlivými typy anestézie.

Sigalas et al: Clin Exp Obstet Gynecol. 2006; 33(1):10-12



Anaesthesia for Caesarean section and neonatal acid-base status: a meta-analysis[★]

F. Reynolds¹ and P. T. Seed²

¹ *Visiting Professor of Obstetric Anaesthesia, Department of Anaesthesia, St Thomas' Hospital, London SE1 7EH, UK*

² *Lecturer in Medical Statistics, Division of Reproductive Health, Embryology and Development, King's College, London SE1 7EH, UK*

Table 8 Difference between umbilical artery acid-base values with type of anaesthesia for Caesarean section: results of meta-analysis.

Comparison	All studies					Randomised trials only				
	#	Difference	95% CI	p	#	Difference	95% CI	p		
pH	spinal – general	13	-0.015	-0.029 to -0.001	0.038	5	-0.027	-0.051 to -0.002	0.034	
	spinal – epidural	11	-0.013	-0.024 to -0.002	0.025	7	-0.010	-0.022 to 0.01	0.074	
Base deficit (mEq.l ⁻¹)	epidural – general	13	-0.006	-0.016 to 0.005	0.317	4	0.001	-0.023 to 0.025	0.938	
	spinal – general	7	1.109	0.434 to 1.784	0.001	2	1.235	-0.821 to 3.290	0.239	
	spinal – epidural	7	0.910	0.222 to 1.598	0.010	4	0.834	-0.192 to 0.859	0.111	
	epidural – general	8	0.137	-0.198 to 0.471	0.424	2	-0.018	-1.026 to 0.990	0.972	

= number of studies.

Summary

Spinal anaesthesia is generally preferred for Caesarean section, but its superiority for the baby is often assumed. Umbilical artery acid-base status provides a valid index of fetal welfare. Twenty-seven studies reporting neonatal acid-base data with different types of anaesthesia were used to compare umbilical artery or vein pH and base deficit, using random-effect meta-analysis. Cord pH was significantly lower with spinal than with both general and epidural anaesthesia. Larger doses of ephedrine contributed to the latter effect ($p = 0.023$). Sixteen studies reported a base deficit, which was significantly higher for spinal than for general and epidural anaesthesia.

Spinal anaesthesia cannot be considered safer than epidural or general anaesthesia for the fetus.



VOLBA ANESTEZIE

Doba od rozhodnutí o SC do vybavení plodu:

stejný čas

epidurálního katetru
(7.7±3.0 min)

Singapore 2005; 34:606-10



Audit „Green code 44“

Celková anestezie
Přidání do epidurálního katetru
Spinální anestezie

plodu:



Intensive Care. 2007;35:74-9

Doba do nástupu účinnosti

1:

stejný 2-chlorprocain vs. lidocain+adrenalin = stejný 8 min (4-13 min)

Bjornestad et al: Acta Anaesthesiol Scand 2006;50:358-63



VOLBA ANESTEZIE

REGIONÁLNÍ vs. CELKOVÁ ANESTÉZIE U CÍSAŘSKÉHO CÉZU

PRO REGIONÁLNÍ ANESTEZII:

- ❖ menší krevní ztráty
- ❖ nižší rozdíl před a pooperačního HCT
- ❖ méně častý pooperační tetanus

PRO CELKOVOU ANESTEZII:

- ❖ nižší výskyt nevolnosti a zvracení

Není signifikantní rozdíl mezi Apgar skóre v 1. a 5. minutě, stejně tak není rozdíl v nutnosti resuscitace novorozence kyslíkem.



VOLBA ANESTEZIE



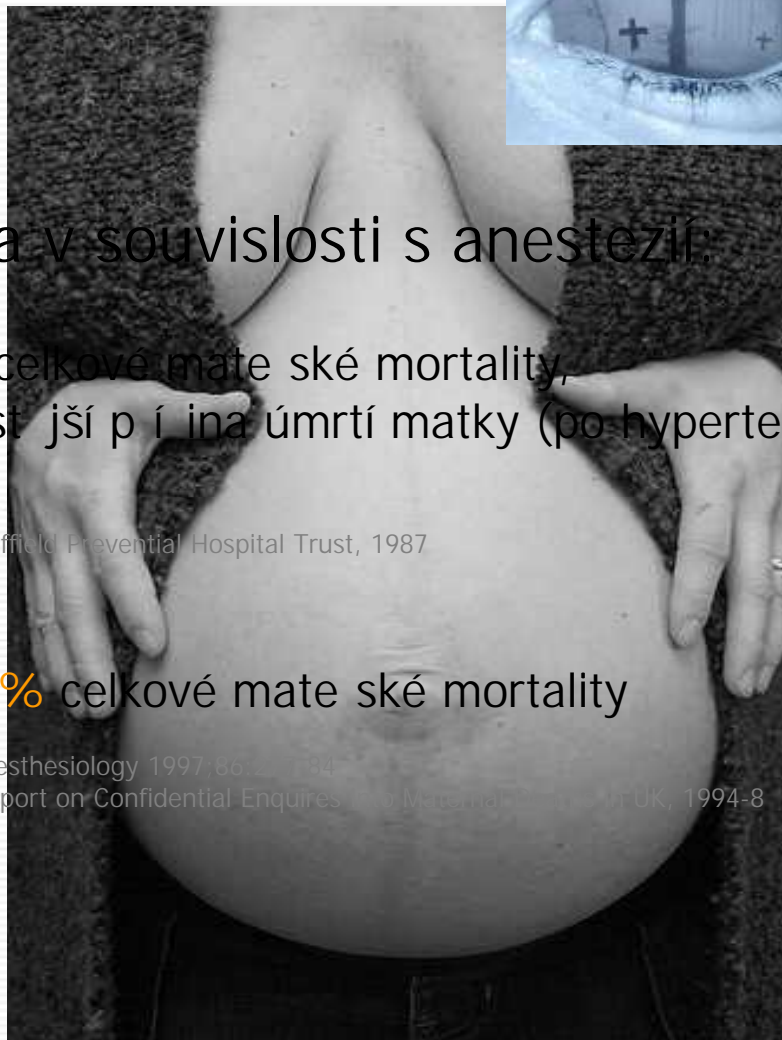
Mateřská mortalita v souvislosti s anestezií:

50. - 80.léta až 13% celkové mateřské mortality,
3. nejastější příčina úmrtí matky (po hypertensi a plicní embolisaci)

Buck N, The Nuffield Prevential Hospital Trust, 1987

80. - 90.léta 3.2 - 4.4% celkové mateřské mortality

Hawkins JL, Anesthesiology 1997; 86: 20-84
Hibbard BM, Report on Confidential Enquiries into Maternal Deaths in UK, 1994-8



PERINATÁLNÍ MORTALITA

Table 1

Numbers and rates per 100,000 maternities of maternal deaths reported to the Enquiry by cause; United Kingdom: 1985-2005.

Cause of death	1985-87	1988-90	1991-93	1994-96	1997-99	2000-02	2003-05	1985-87	1988-90	1991-93	1994-96	1997-99	2000-02	2003-05
	Numbers							Rates per 100,000 maternities						
Direct deaths														
Thrombosis and thromboembolism	32	33	35	48	35	30	41	1.41	1.40	1.51	2.18	1.65	1.50	1.94
Pre-eclampsia and eclampsia*	27	27	20	20	16	14	18	1.19	1.14	0.86	0.91	0.75	0.70	0.85
Haemorrhage*	10	22	15	12	7	17	14	0.44	0.93	0.65	0.55	0.33	0.85	0.66
Amniotic fluid embolism	9	11	10	17	8	5	17	0.40	0.47	0.43	0.77	0.38	0.25	0.80
Early pregnancy deaths	16	24	17	15	17	15	14	0.71	1.02	0.73	0.68	0.80	0.75	0.66
Ectopic	11	15	9	12	13	11	10	0.48	0.64	0.39	0.55	0.61	0.55	0.47
Spontaneous miscarriage	4	6	3	2	2	1	1	0.18	0.25	0.13	0.09	0.09	0.05	0.05
Legal termination	1	3	5	1	2	3	2	0.04	0.13	0.22	0.05	0.09	0.15	0.09
Anaesthetic	6	4	8	1	3	6	6	0.26	0.17	0.35	0.05	0.14	0.30	0.28
Cardiac	23	18	37	39	35	44	48	1.01	0.76	1.60	1.77	1.65	2.20	2.27



MATEŘSKÁ MORTALITA / SECTIO CESAREA

70.-80. léta celková anestézie má **17x** vyšší mortalitu než regionální

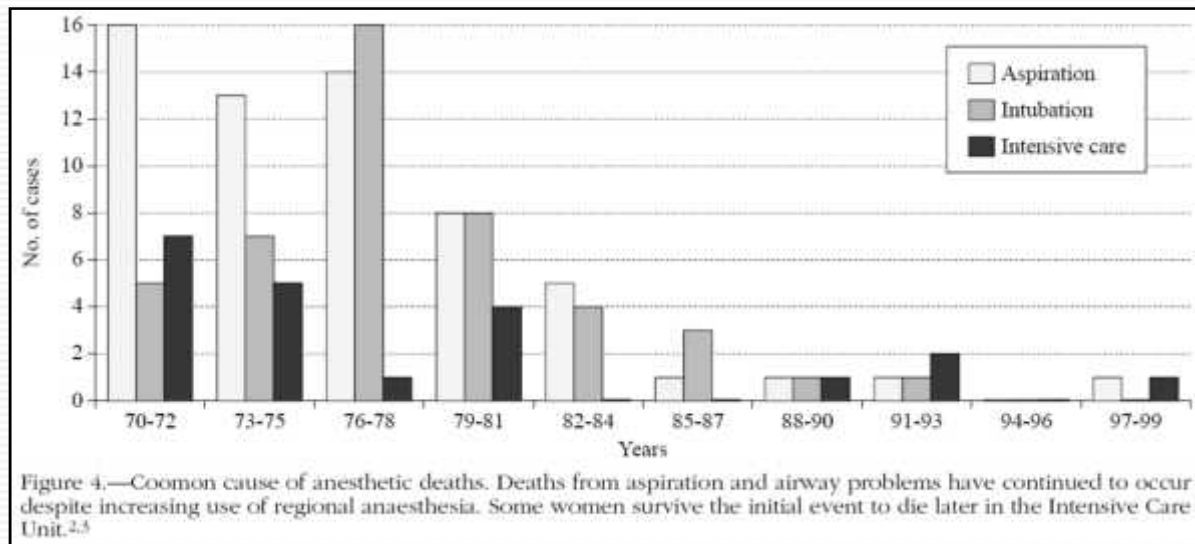
Hawkins JL, Anesthesiology 1997;86:277-84

90. léta již "pouze" **6x** vyšší mortalita u CA proti RA

Hawkins JL, Clin Obstet Gyn 2003; 46: 679-87

21. století není mortalitní rozdíl mezi celkovou a regionální anestezií

Cochrane Database of Systematic Reviews 2010



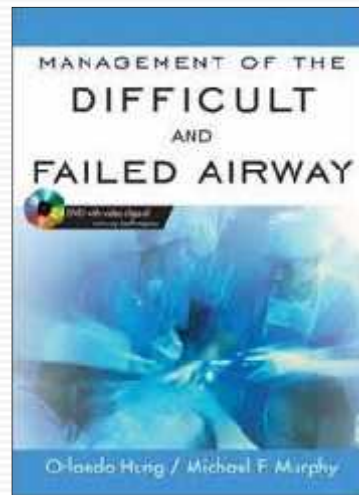
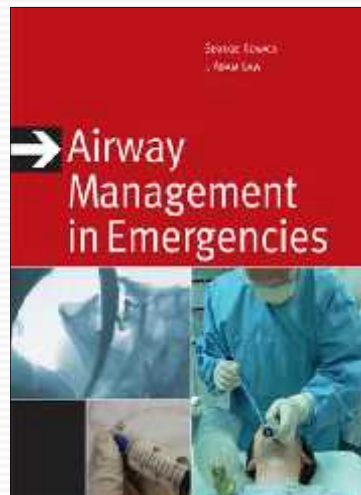
Lyons. Minerva Anesthesiol 2005;71:27-38



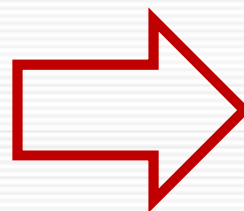
OBTÍŽNÁ INTUBACE



OBTÍŽNÁ INTUBACE

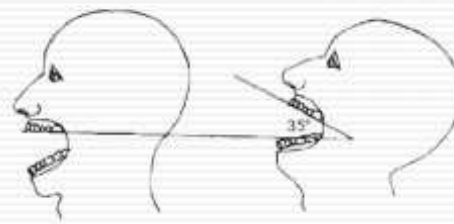
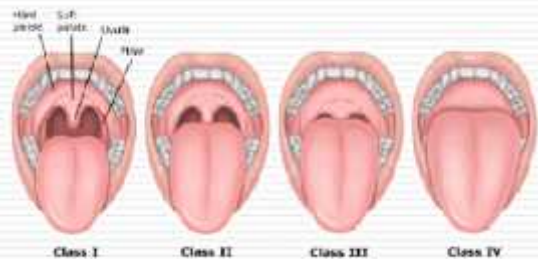


OBTÍŽNÁ INTUBACE

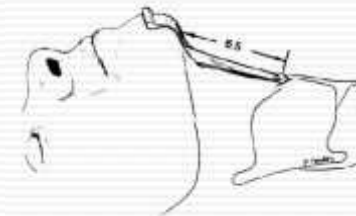


⇒ 10x vyšší riziko obtížné intubace u t hotných !!!

Lyons. Anaesthesia 1985; 40:759-62	1:300
Barnardo. Anaesthesia 2000; 55:685-94	1:249
Rahman. Anaesthesia 2005; 60:168-71	1:238
McDonnell. Int J Obst Anest 2009; 17:292-7	1:274



Rozsah pohybu v AO skloubení



Vzdálenost thyreo-mentální



CO JE U T H OTNÉ JINAK ...

Table 1 Typical examples of duration of apnea without desaturation (DAWD) in different patients

	FRC (mL)	F _{EO₂} after preoxygenation	F _{EO₂} at SpO ₂ = 90%	O ₂ consumption (mL · min ⁻¹)	DAWD (min)
No preoxygenation	2500	16	10	250	0.6
Normal preoxygenation	2500	90	10	250	8.0
Poor preoxygenation	2500	60	10	250	5.0
Obese	1250	90	10	350	2.9
Obese head-up	1500	90	10	350	3.4
Pregnant	1000	90	10	400	2.0
Elderly	2250	90	10	200	9.0

Examples only. Actual values may vary. The DAWD is calculated as $FRC (F_{EO_2} - F_{EO_2} \text{ at } SpO_2 = 90\%) / O_2 \text{ consumption}$

FRC = functional residual capacity

DAWD = duration of apnea without desaturation

F_{EO₂} = expired fraction of oxygen

SpO₂ = oxygen saturation





RIZIKO OBTÍŽNÉ INTUBACE ...?



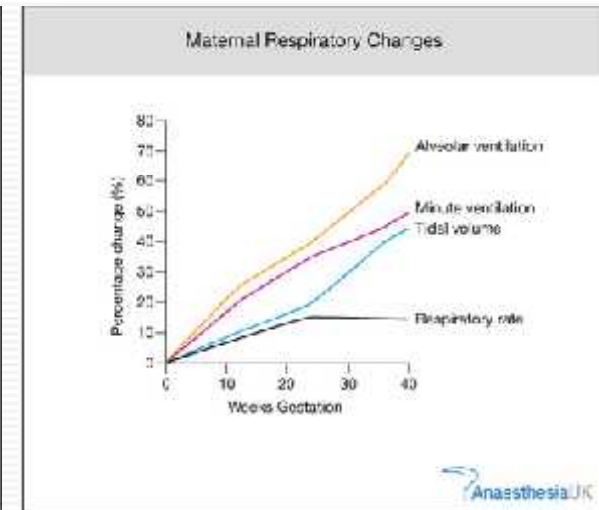
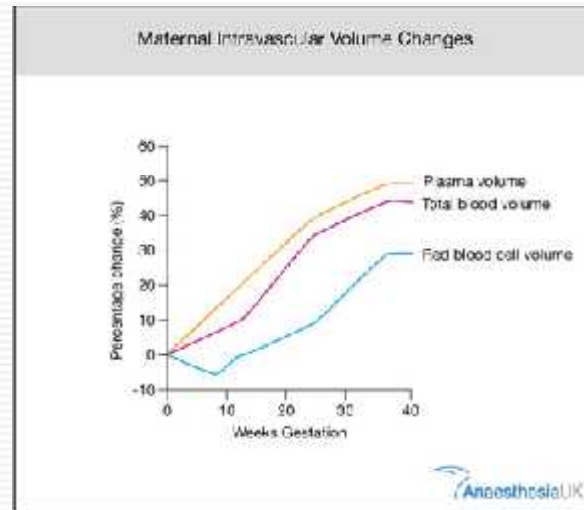
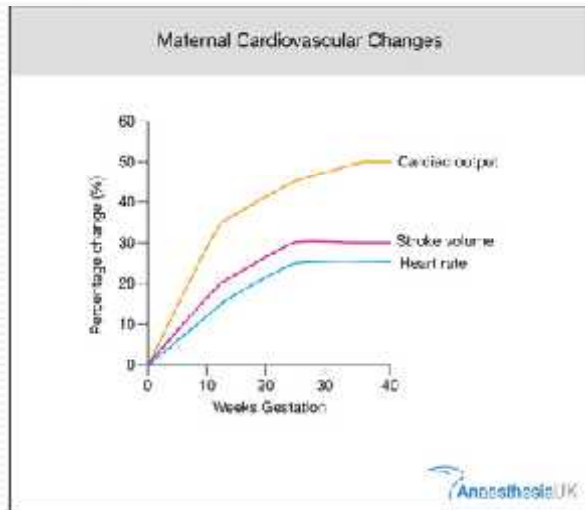
CO JE U T HORNÉ JINAK ...

- ❖ primární změny spojené s gestací (progesteron)
 - ❖ prosoáknutí tkání při zvýšené permeabilitě kapilár
 - ❖ zvýšená fragilita kapilár
 - ⇒ zúžení HCD a hlasivkových vaz
 - ❖ astá obezita/velká prsa
 - ❖ snížený tonus sfinkter
 - ❖ zvýšený obsah žaludečního obsahu
 - ❖ vyšší acidita
- ❖ sekundární změny spojené se zvláštěm dýcháním

⇒ **10x vyšší riziko obtížné intubace**



CO JE U T HOTTNÉ JINAK ...



Farmery AD, Roe PG. Br J Anaesth 76: 284, 1996



CO JE U T H OTNÉ JINAK ...

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FRC = functional residual capacity

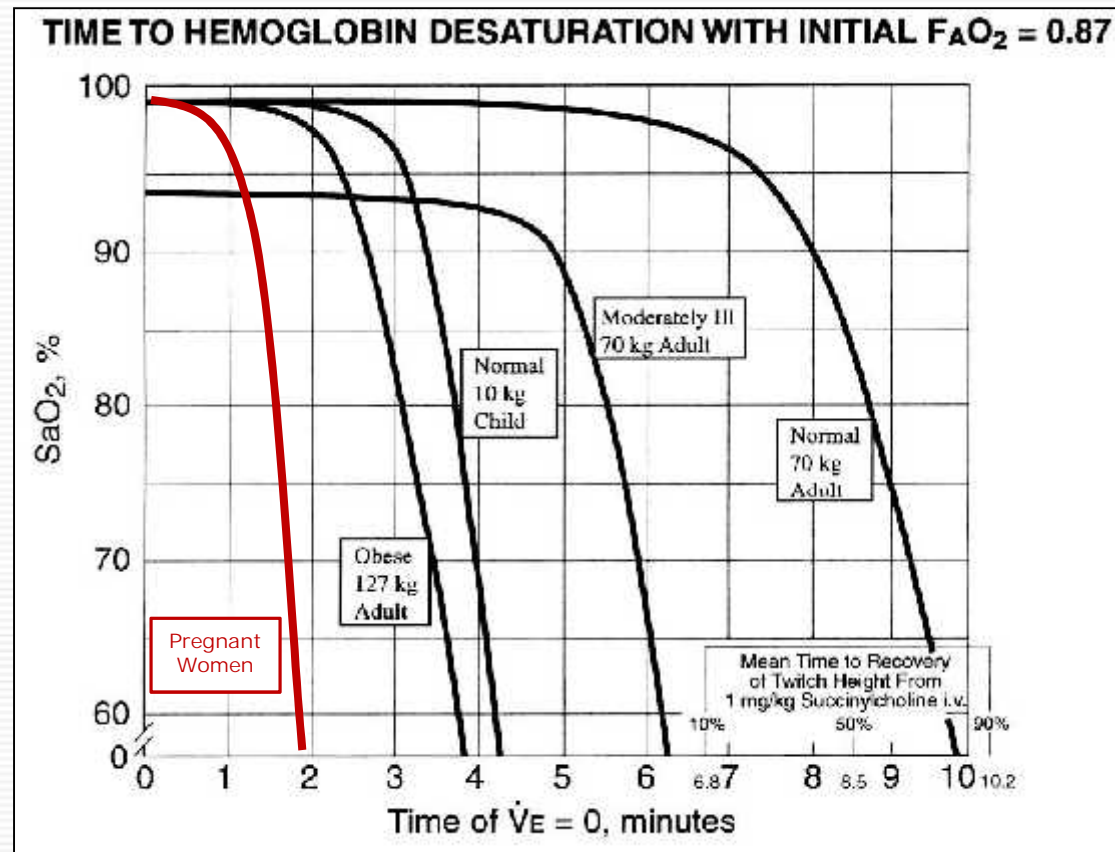
DAWD = duration of apnea without desaturation

F_{EO₂} = expired fraction of oxygen

SpO₂ = oxygen saturation



CO JE U T HOTNÉ JINAK ...



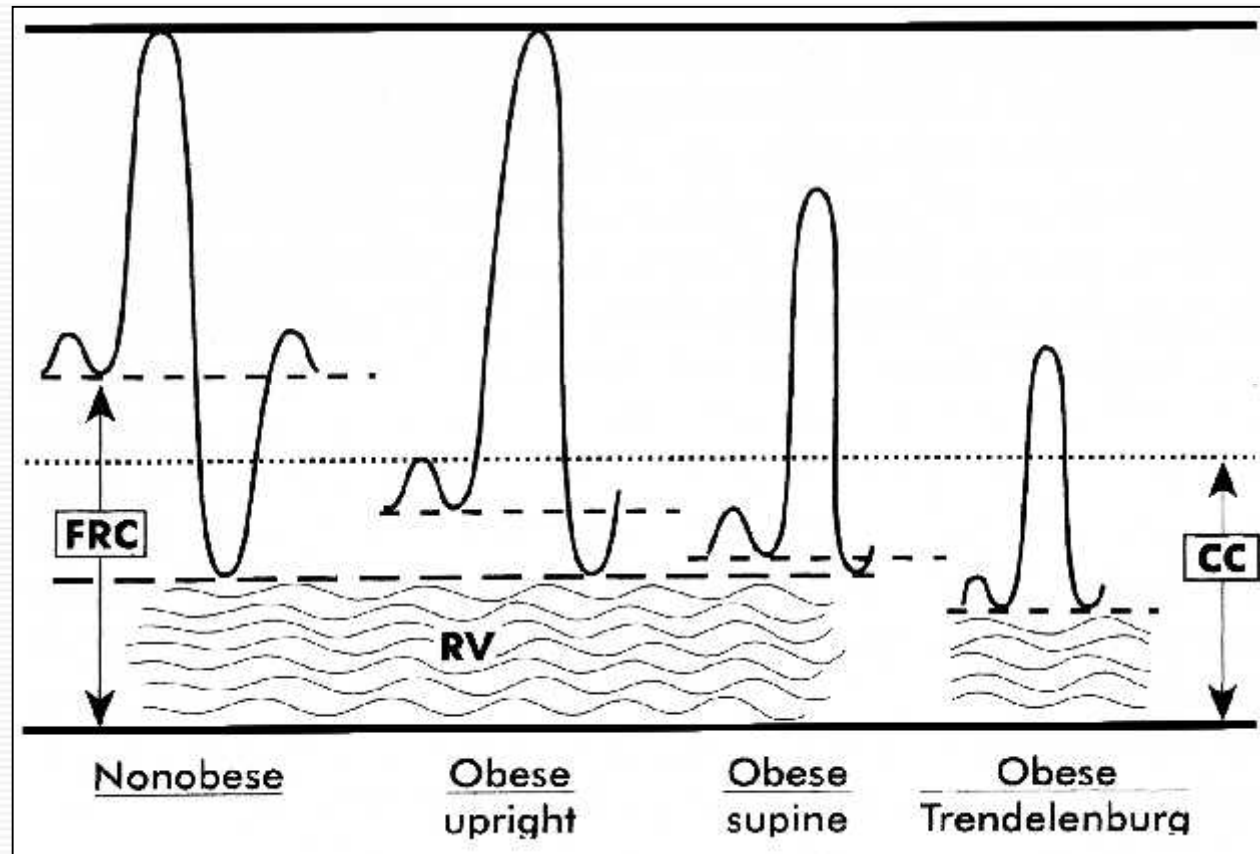
Benumof JL et al. Anesthesiology 1997; 87:979-82

Díky zvýšenému metabolismu nastává u rodičky (**i plodu !**)

desaturace krve a rozvoj kritické hypoxie nesrovnatelně rychleji než u netěhotných pacientek.



EFFECT OF POSITION ON LUNG VOLUMES



In Brown BR, editor. Anesthesia and the Obese Patient. Philadelphia, FA Davis 1082:26.





PREOXYGENACE !!!



PREOXYGENACE



- A. lehká obličejová kyslíková maska
5-8 minut dýchání (100%) O_2 normálním objemem

- B. plnětá obličejová kyslíková maska
3-8 vdechů v objemu vitální kapacity (100% O_2)



PREOXYGENACE

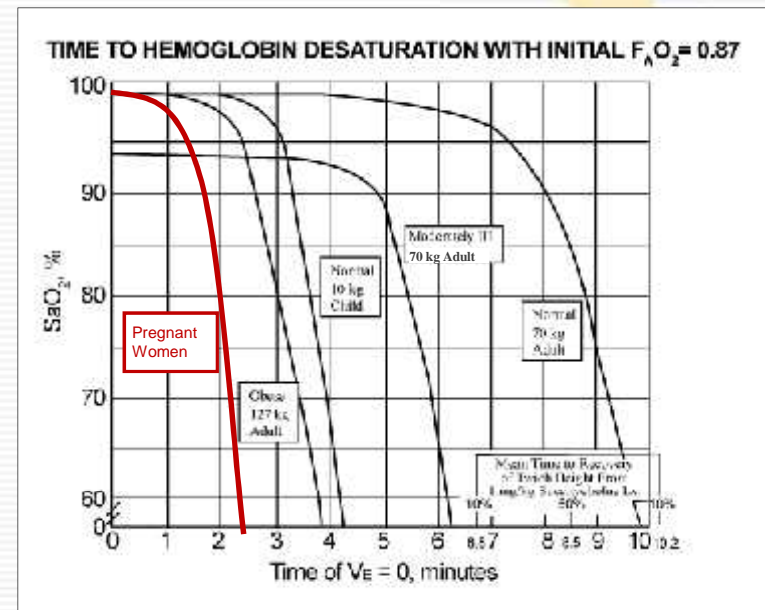
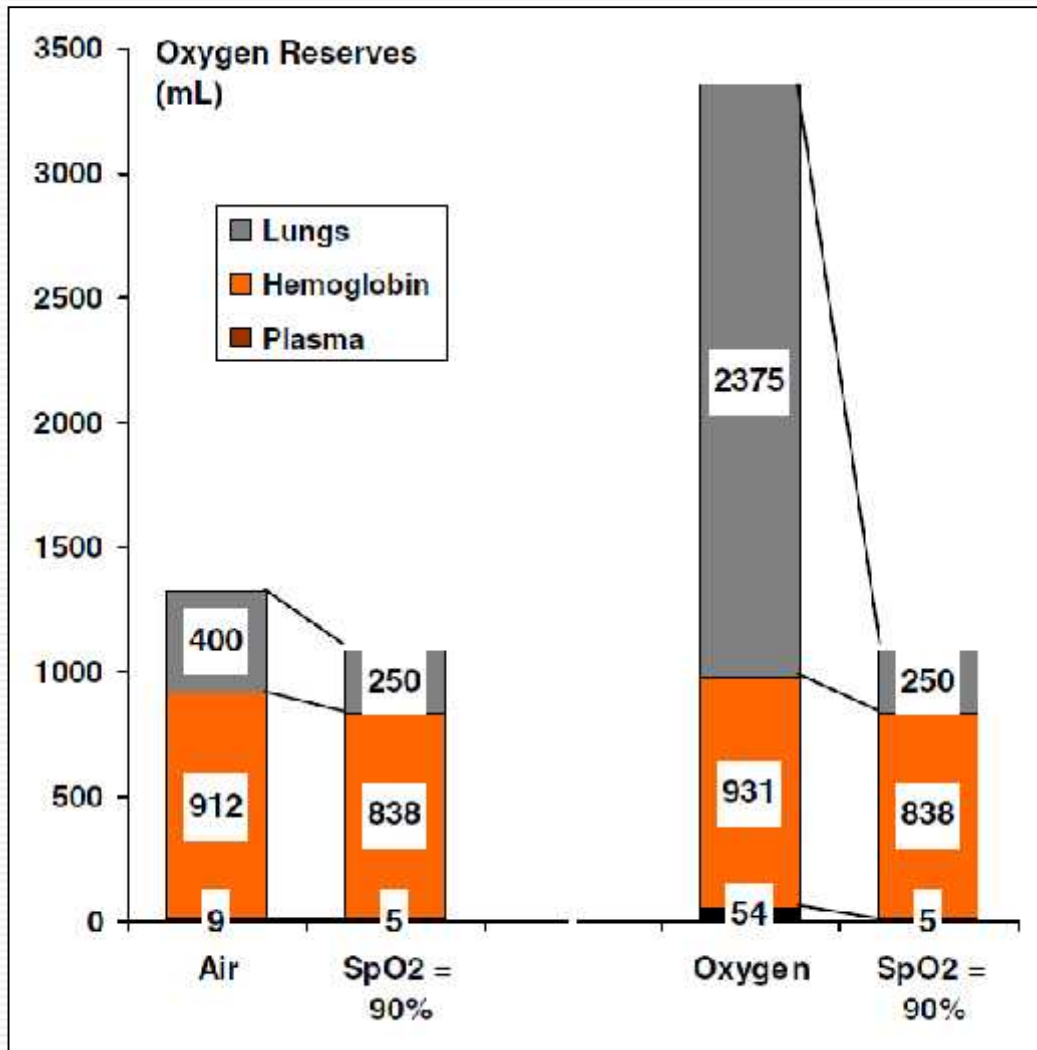


Fig. 1 Oxygen reserves in a normal healthy adult when breathing room air (left), after breathing 100% oxygen (right), at onset of apnea, and when reaching an oxygen saturation (SpO₂) of 90%. In this example, the oxygen available for consumption during the apneic period amounts to 228 mL when breathing air and 2267 mL when breathing oxygen. Calculations are based on a functional residual capacity of 2500 mL, hemoglobin concentration 140 g · L⁻¹, SpO₂ = 98% on air, SpO₂ = 100% on oxygen, and blood volume 5 L. In this example, a subject with an oxygen consumption of 250 mL · min⁻¹ could sustain a period of apnea of 228/250 = 0.9 min after breathing air and 2267/250 = 9 min after breathing oxygen



Pre-oxygenation in the obese patient: effects of position on tolerance to apnoea

F. R. Altermatt*, H. R. Muñoz, A. E. Delfino and L. I. Cortinez

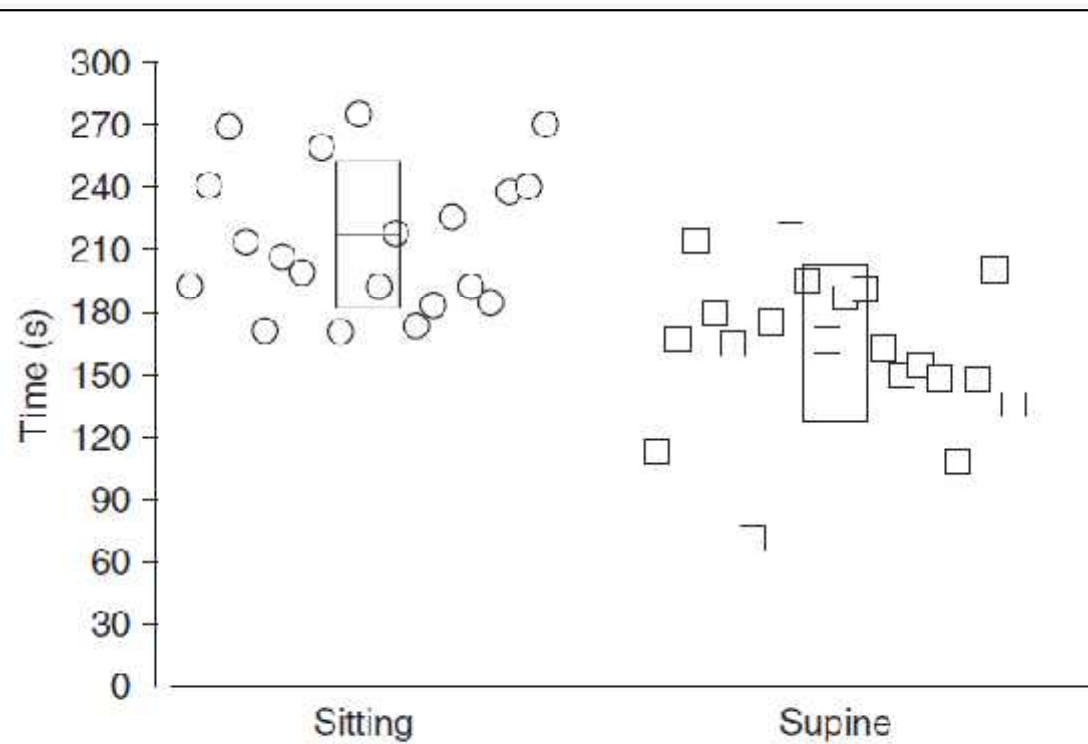


Fig 1 The individual times to peripheral desaturation to 90% in both groups.



PROČ MÁME V TĚŽKÉM PROBLÉMY?

1. Přecenění vlastních schopností.
2. Pozdě zavolaná pomoc.
3. Nedostatečná komunikace s kolegy o daném případě.
4. Nedomyšlený postup bez žádného záložního plánu.



ZLATÁ PRAVIDLA INTUBACE

1. Zhodno riziko obtížné intubace znovu před každým úvodem do anestezie.
2. Kontroluj vybavení pro obtížnou intubaci denně a nauč se jej používat.
3. Před úvodem do anestezie ulož pacienta do optimální pozice, zajisti si dostatek prostoru.
4. Pamatuj, že oxygenace je důležitější než intubace.
5. O pomoc si zavolej včas.
6. Vždy měj připraven plán B.



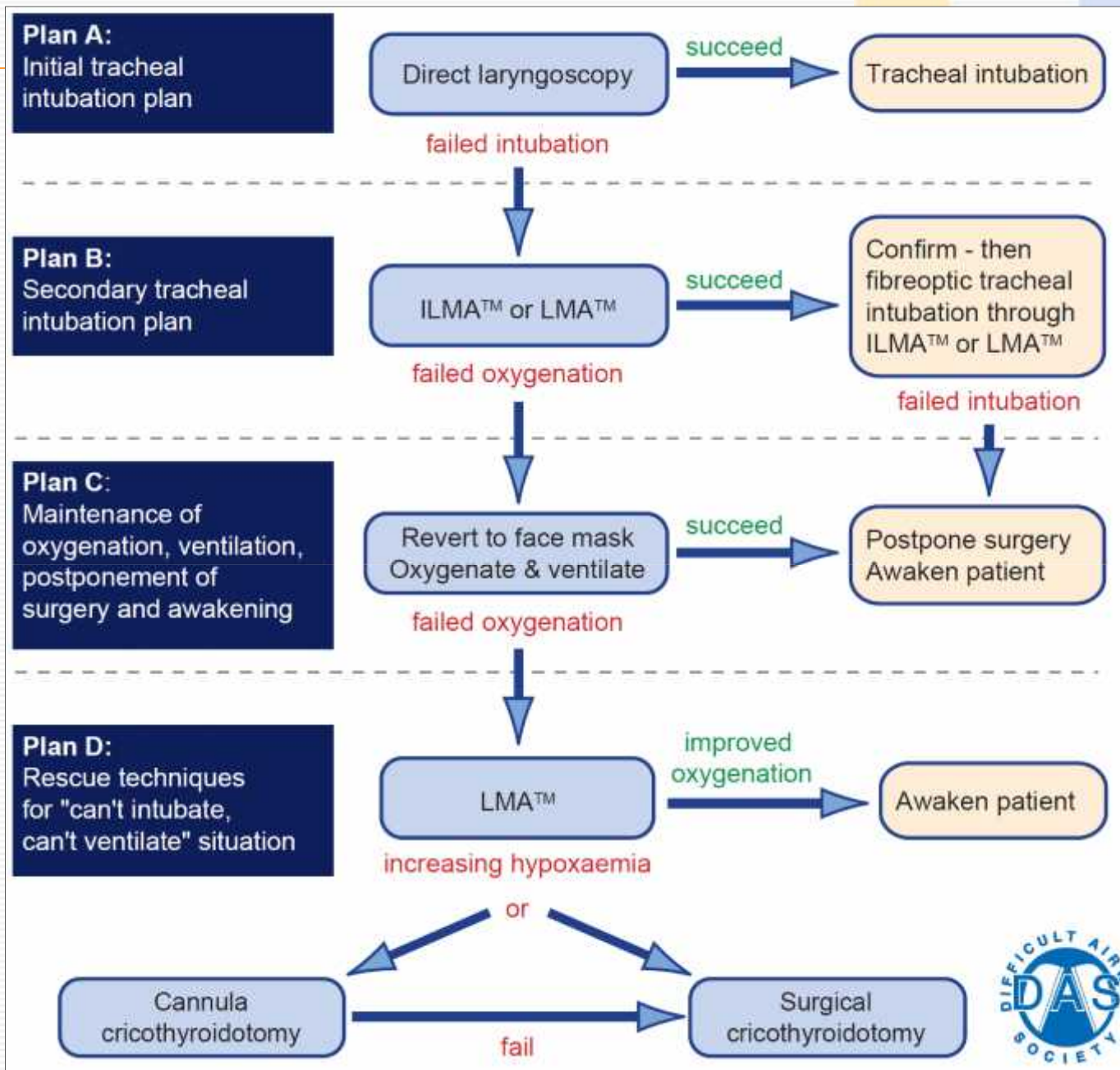
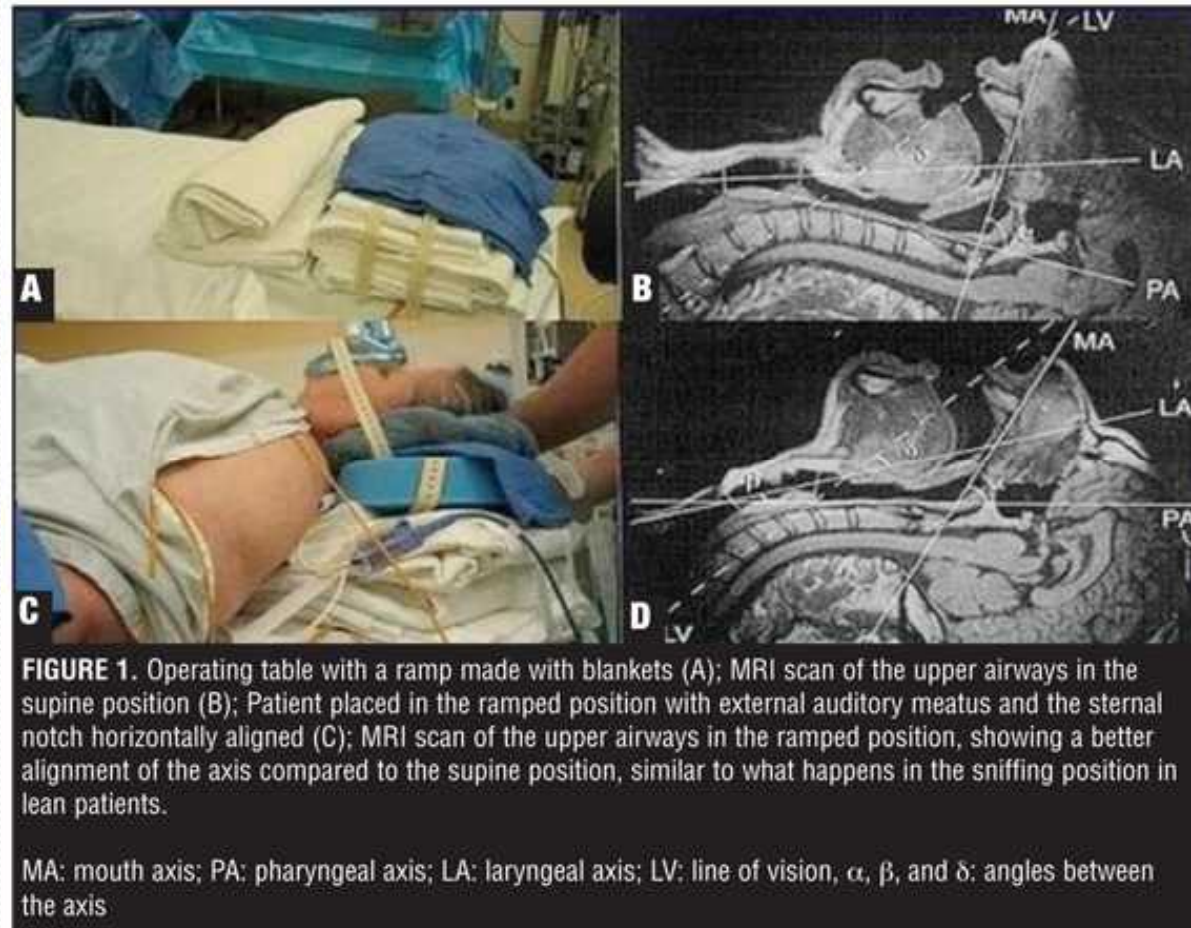




Fig. 3. Demonstrates the change in airway when ramp is utilized.

Soens MA et al. Acta Anaesthesiol Scand 2008; 52: 6–19





<http://emsbasics.com>

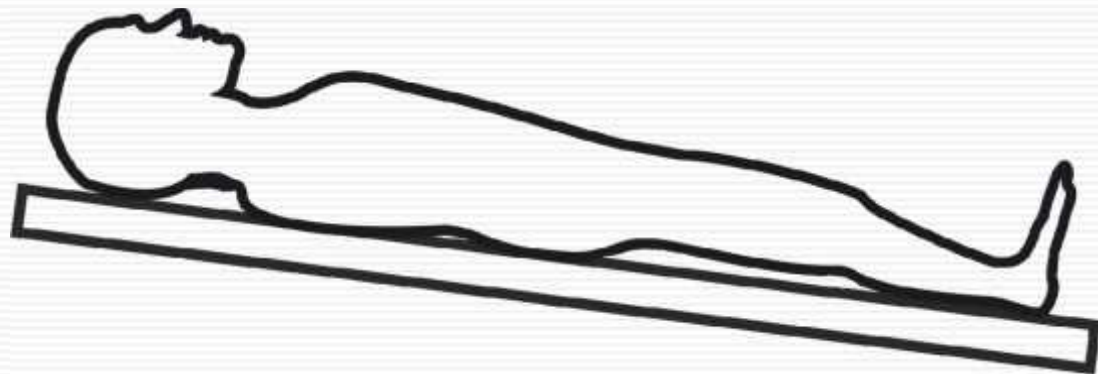


POLOHA

ANTITRENDELENBURGOVA POLOHA

= zvýšení polohy trupu o 5-15 stup

- ❖ prevence vzduchové embolie
- ❖ prevence aspirace
- ❖ zvýšení FRC plic



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



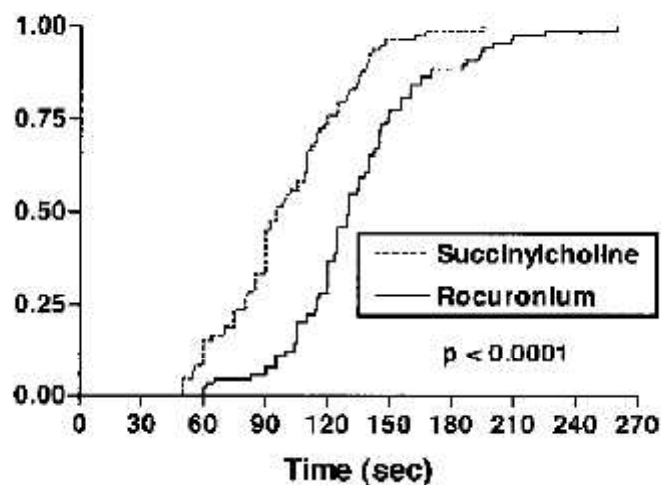


Figure 2. Kaplan-Meier curve of the probability of the completion of the endotracheal intubation sequence including succinylcholine or rocuronium as the neuromuscular blocking drug. Time 0 denotes the beginning of the injection of the induction drug propofol. The endotracheal intubation sequence was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

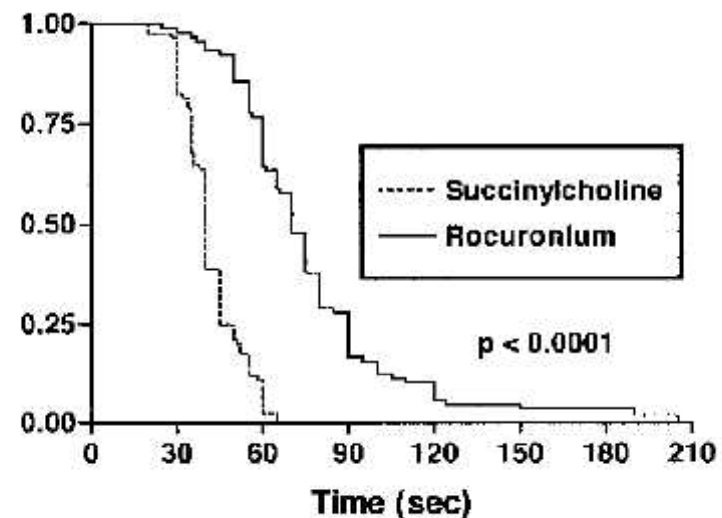


Figure 1. Kaplan-Meier curve of the probability of the disappearance of a visible motor response to a continuous single-twitch stimulation of the ulnar nerve after injection of succinylcholine or rocuronium. Time 0 denotes the injection of the neuromuscular blocking drug. Curves differ significantly ($P = < 0.0001$; logrank test).



The Response of Newborns to Succinylcholine and d-Tubocurarine

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

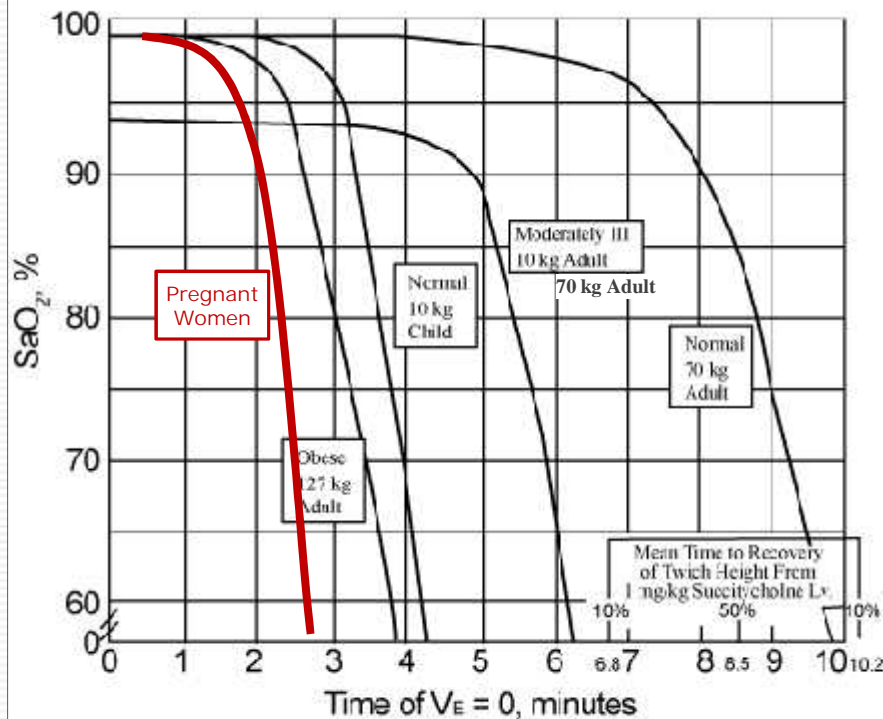
Anesthesiology. 1969 Jul;31(1):35-8.

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.



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



Comparison of Time to Critical Hemoglobin Desaturation with Time to Functional Recovery

The mean time to 50% of control single twitch height (functional recovery) was 8.5 min; for the best case example of a healthy 70-kg adult (*i.e.*, longest time to hemoglobin desaturation) SaO₂ equals 83% at 8.5 min (fig. 1); half of this population will be more and half will be less hypoxemic at this time. Beyond 9 min, the SaO₂ rapidly approaches zero for the healthy 70-kg group of patients. Use of any greater time for functional recovery (*e.g.*, return to 75% or 90% of control twitch height) results in predictions of much greater degrees of hypoxemia and periods of danger. With a mean functional recovery (50% of control twitch height) time of 8.5 min, all other types of patients in figure 1 (10-kg child, obese 127-kg adult, and moderately ill 70-kg patient) are either profoundly hypoxemic or, in all likelihood, dead at this time.



Table 3. Onset Times and Durations of Neuromuscular Block

Succinylcholine dose (mg/kg)	Onset time(s)	Duration of block (min)	n
0.3	72 ± 30	4.4 ± 1.4	13
0.5	68 ± 44	5.2 ± 1.8	27
1.0	53 ± 23	5.9 ± 1.9†	30
1.5	56 ± 31	7.2 ± 2*	30
2.0	52 ± 21	7.5 ± 1.7*	30

Values are means ± SD.

**P* < 0.01 versus succinylcholine 0.3, 0.5, and 1.0 mg/kg groups; †*P* < 0.05 versus succinylcholine 0.5 mg/kg group.

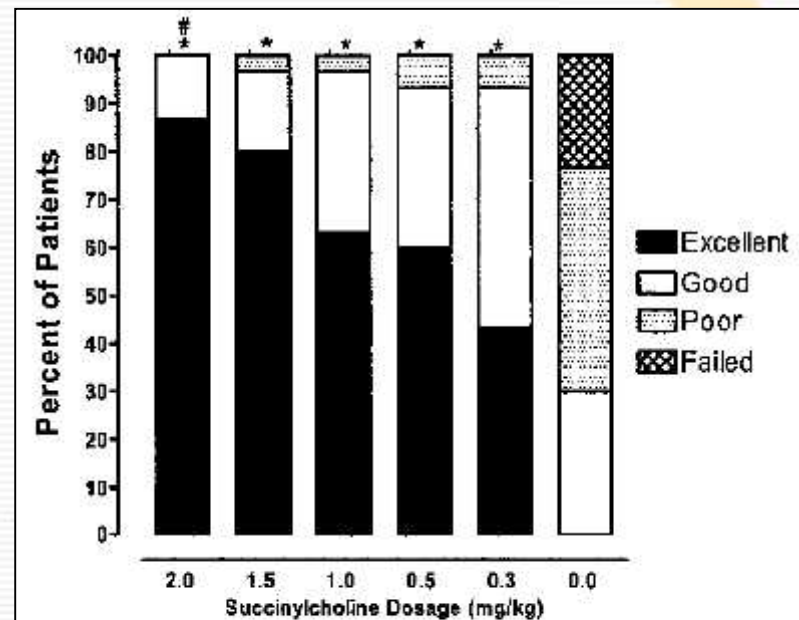


Figure 1. Intubating conditions with different doses of succinylcholine (*n* = 30 in each group). The incidence of excellent intubating conditions was significantly more frequent (**P* < 0.001) in patients receiving succinylcholine than in those of the control group and in the 2.0 mg/kg succinylcholine group ([#]*P* < 0.05) than in the 0.3 mg/kg succinylcholine group (Kruskal-Wallis test for multiple comparisons).

Naguib M et al. Anesth Analg 2006;102:151-5





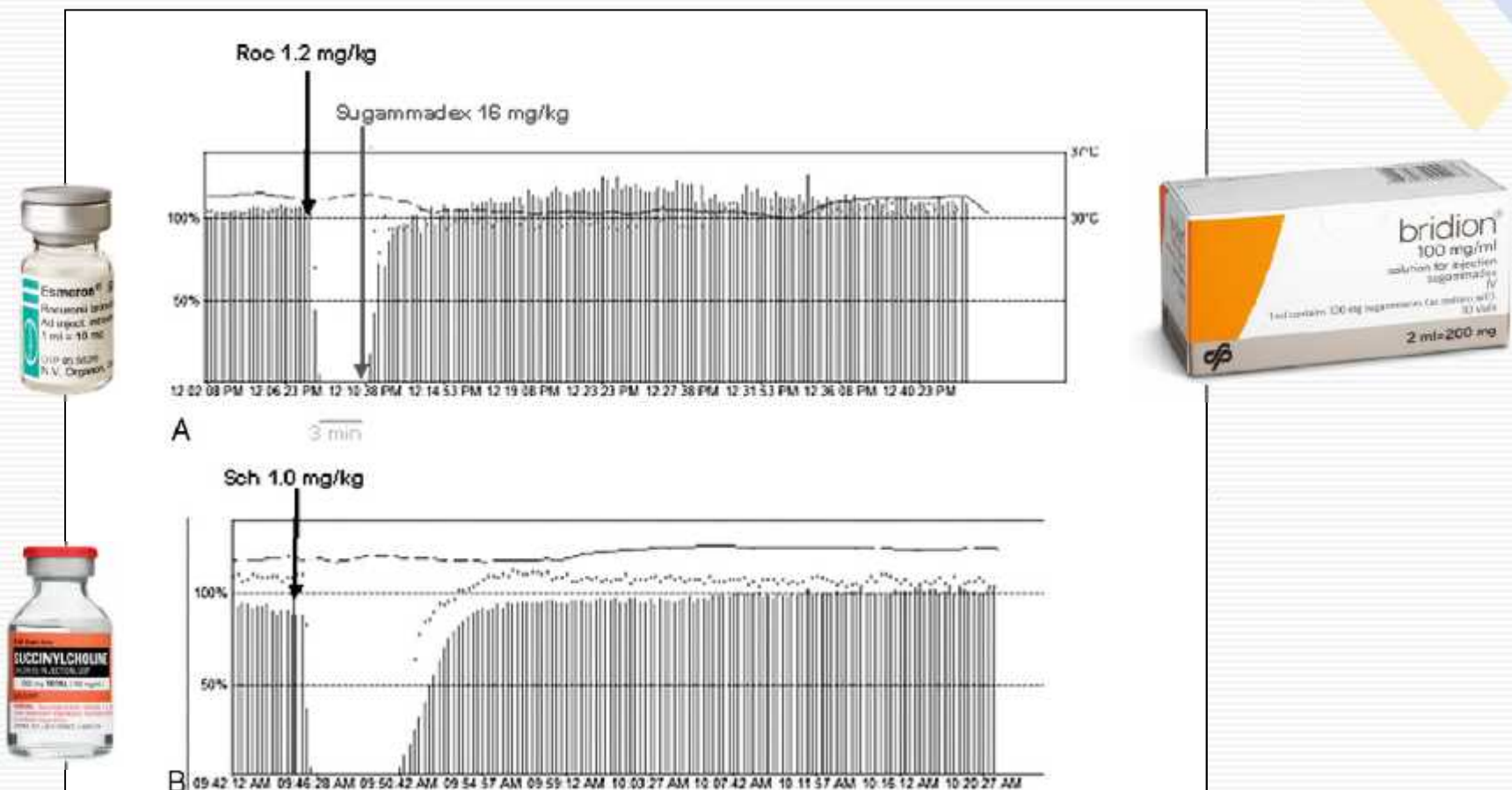
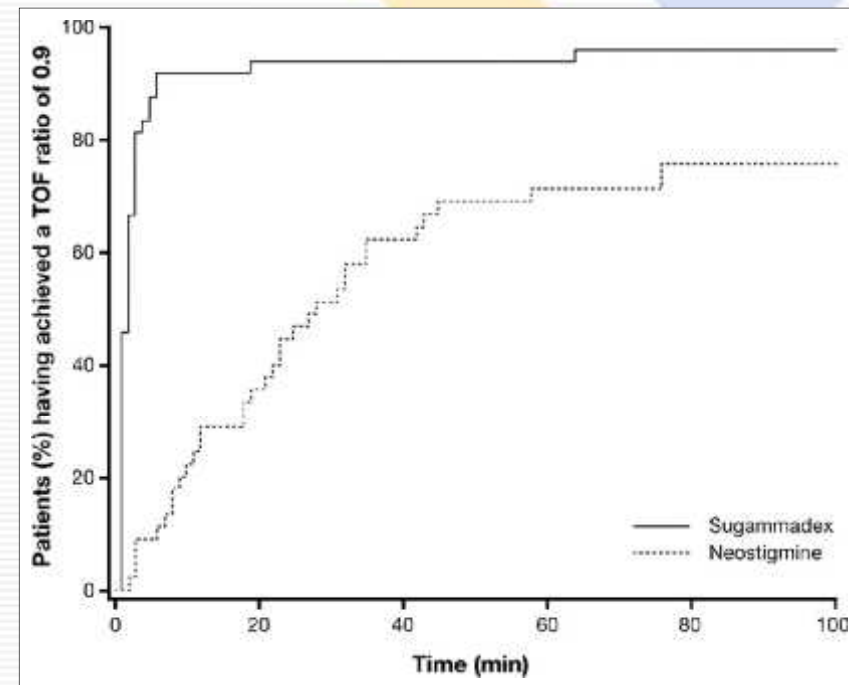
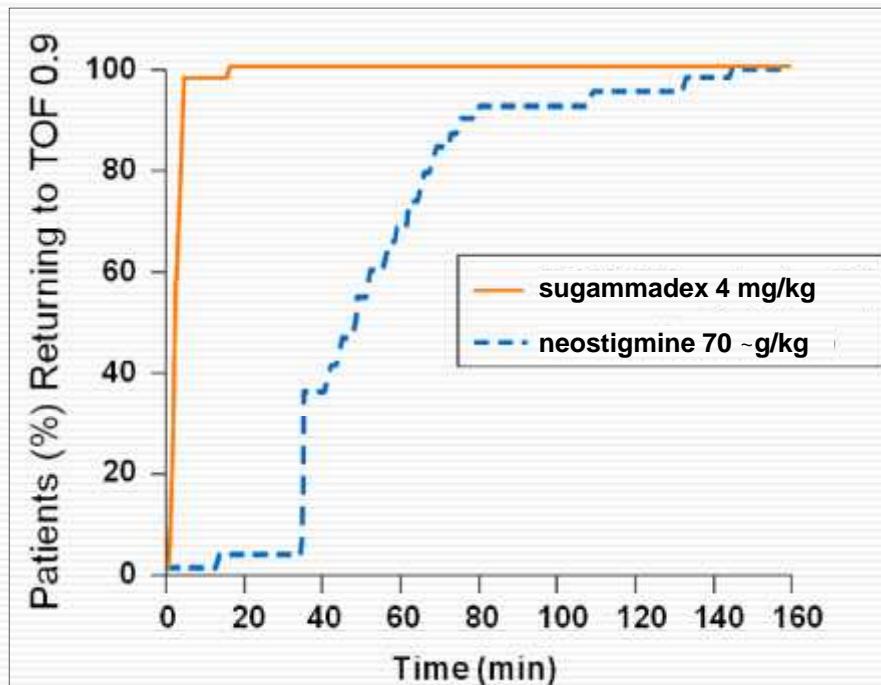


Figure 4. Panel A shows the recovery of the twitch height and train-of-four (TOF) ratio after administration of 1.2 mg/kg rocuronium followed 3 min later by 16 mg/kg sugammadex, both given IV. Recovery to a first twitch height (T1) of 90% and a TOF ratio of 0.94 occurred 110 s later. The onset-offset 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.



OBTÍŽNÁ INTUBACE



Routine reversal - deep NMB

Time (min) from administration of sugammadex or neostigmine at deep NMB (1-2 PTCs) after rocuronium to recovery of the T_4/T_1 ratio to 0.9: **2.7** for sugammadex (4 mg/kg) and **49.0** for neostigmine (70 µg/kg).

Khuenl-Brady et al. *Anesth Analg* January 2010 110:64-73

Jones RK et al. *Anesthesiology*. 2008;109:816–824
Blobner M et al. *Eur J Anaesthesiol*. 2010;27:874–881



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

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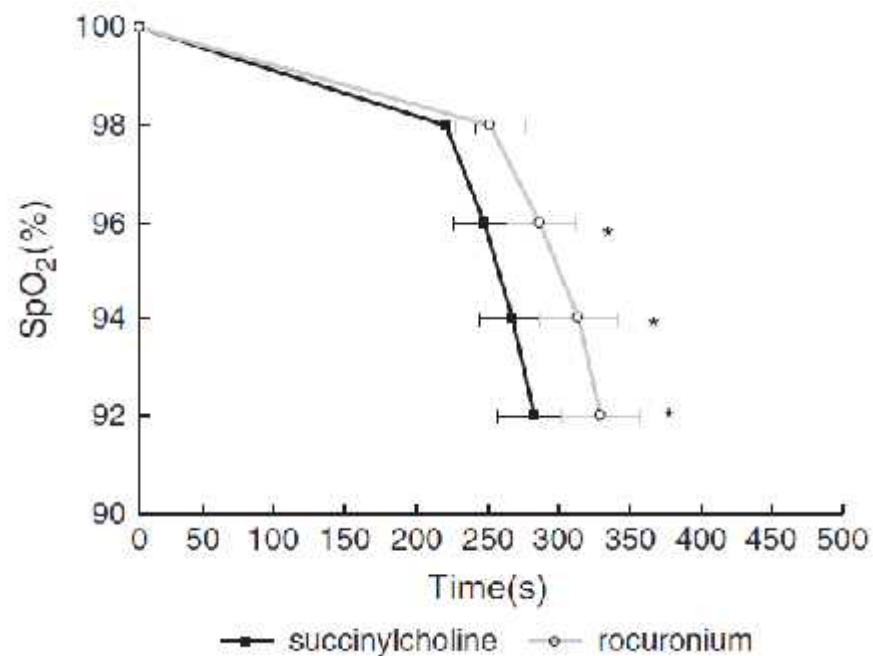


Fig. 2. Changes in oxygen saturation (S_pO_2) with time during non-hypoxic apnea in the succinylcholine or the rocuronium group. Mean values (points) for both groups are shown. The vertical lines indicate 95% CI. The curves show smooth before S_pO_2 reach 98%, but afterward fall straightly to 92% S_pO_2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

Table 2

Desaturation time after succinylcholine or rocuronium.

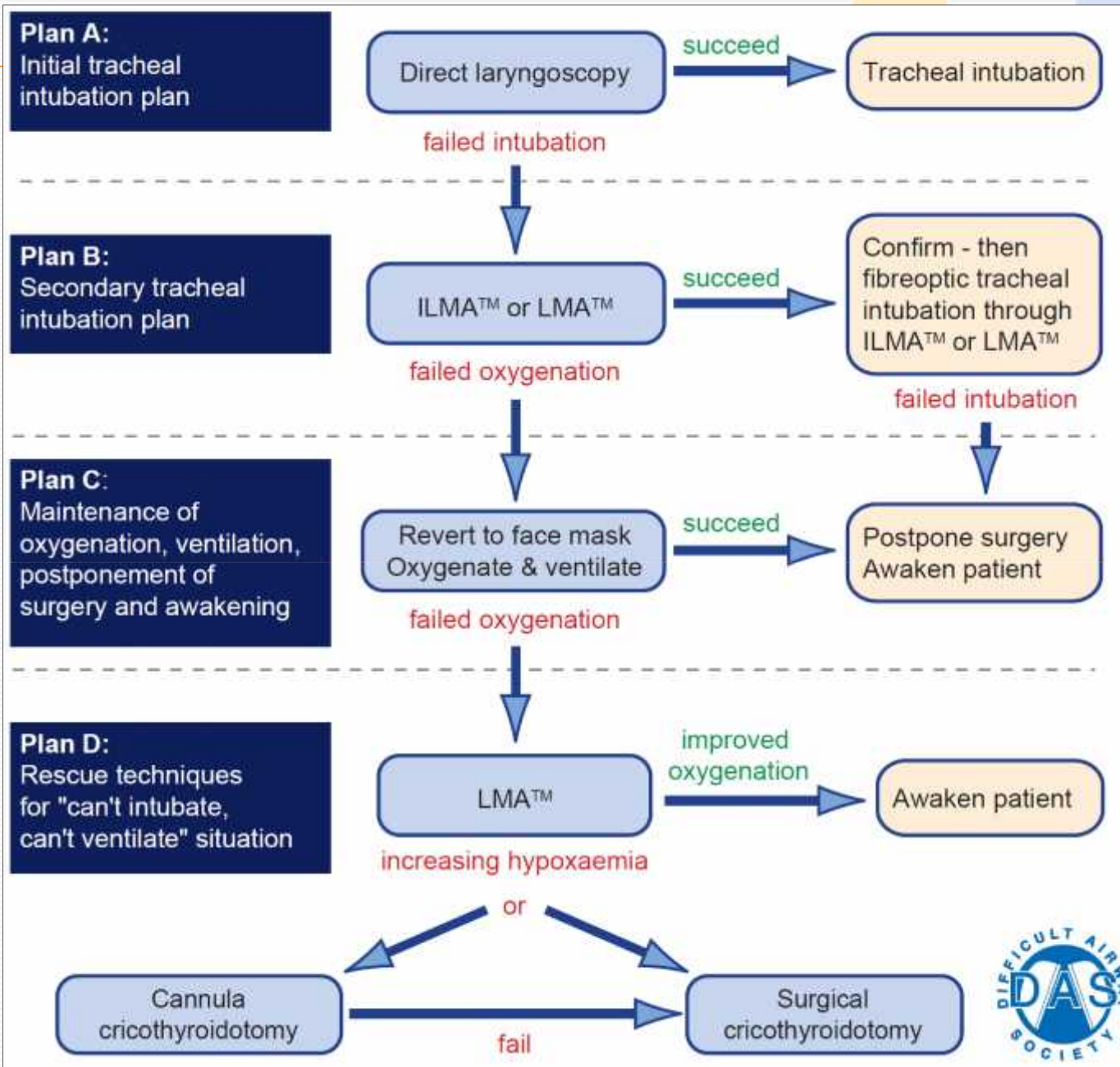
	Succinylcholine ($n = 30$)	Rocuronium ($n = 30$)	P value
T_{98}	221 ± 55	252 ± 65	0.06
T_{96}	248 ± 58	287 ± 65*	0.02
T_{94}	268 ± 64	314 ± 72*	0.01
T_{92}	283 ± 70	329 ± 71*	0.01

Values are mean ± SD.

* $P < 0.05$ compared with succinylcholine (between-group comparison).

T_{98} , time to S_pO_2 of 98%; T_{96} , time to S_pO_2 of 96%; T_{94} , time to S_pO_2 of 94%; T_{92} , time to S_pO_2 of 92%.





WORLD'S FIRST INTUBATION ROBOT - the Kepler Intubation System



McGill University Health Centre



PEROPERACE NÍ SUPLEMENTACE O₂

- rutinní oxygenoterapie (FiO₂ 0,4-0,5) lehkou maskou v pr b hu elektivního císa ského ezu v RA je na v tšin pracoviš standardem
- dle sou asných dat je to nejen zbyte né a neefektivní, a dokonce s možnými negativními d sledky

Cogliano MS et al. Anaesthesia 2002, 57(1):66-9

Khaw KS et al. Br J Anaesth 2002, 88(1):18-23

Khaw KS et al. Curr Opin Anaesthesiol 2004, 17(4):309-13

Buhimschi IA et al. Am J Obstet Gynecol 2003, 189(1):181-8

Thorp JA et al. Am J Obstet Gynecol 1995, 172(2 Pt 1):465-74

Van de Velde M. Br J Anaesth 2009;102:1-2.



PEROPERATIVNÍ SUPLEMENTACE O₂

- nadměrná dodávka O₂ vede k zvýšené tvorbě reaktivních forem kyslíku
- volné kyslíkové radikály vyvolávají peroxidaci lipidů, alteraci enzymatických buněčných funkcí a poškození buněčné DNA
- tyto negativní účinky se zvláště uplatní při reperfuzi po fázi ischemie (ischemicko-reperfuzní poškození), například u protražovaného porodu s intermitentním útlakem pupečníku
- mohou vést až k neonatální retinopatii i bronchopulmonální dysplazii
- a to především u předčasně narozeného porodu, termínový plod se s touto zátěží dokáže pomocí kompenzačních zvýšených antioxidantů vypořádat
- užití vysokého FiO₂ zlepšuje dodávku kyslíku u hypoxického plodu, ale pouze po limitované dobu (cca 10 min), poté pokračující hyperoxie vede ke zvýšené tvorbě reaktivních forem kyslíku, k placentární vasokonstrikci a fetální acidóze



PEROPERA NÍ SUPLEMENTACE O₂

Table 2 Maternal characteristics and arterial blood gas (ABG) data. Mean (SD), median (range). n.s. = not significant

	Air group (n=22)	Oxygen group (n=22)	<i>P</i>
Characteristics			
Age (yr)	31.5 (23–38)	32.1 (25–43)	n.s.
Height (cm)	154.7 (4.7)	155.9 (4.7)	n.s.
Weight (kg)	64.2 (6.6)	66.8 (7.7)	n.s.
ABG baseline			
pH	7.42 (0.02)	7.43 (0.02)	n.s.
<i>P</i> O ₂ (kPa)	14.3 (2.1)	14.8 (9.9)	n.s.
<i>P</i> CO ₂ (kPa)	4.1 (0.3)	4.0 (0.4)	n.s.
Base excess (mmol litre ⁻¹)	-2.1 (1.3)	-2.5 (1.4)	n.s.
ABG during surgery			
pH	7.43 (0.04)	7.44 (0.03)	n.s.
<i>P</i> O ₂ (kPa)	14.3 (2.5)	31.8 (5.9)	<0.001
<i>P</i> CO ₂ (kPa)	4.3 (2.3)	4.0 (2.4)	n.s.
Base excess (mmol litre ⁻¹)	-1.8 (1.4)	-2.0 (1.5)	n.s.
ABG at birth			
pH	7.41 (0.04)	7.43 (0.03)	n.s.
<i>P</i> O ₂ (kPa)	14.2 (1.9)	30.0 (6.3)	<0.001
<i>P</i> CO ₂ (kPa)	4.4 (0.7)	4.1 (0.5)	n.s.
Base excess (mmol litre ⁻¹)	-2.1 (1.8)	-2.6 (1.9)	n.s.



Table 3 Fetal characteristics, timed intervals, Apgar scores and umbilical cord blood gas data. Values are mean (SD), median (range) or number (%). I-D = interval from skin incision to delivery. U-D = interval from uterine incision to delivery. n.s. = not significant

	Air group (n=22)	Oxygen group (n=22)	P
Fetal characteristics			
Maturity (wk)	38.1 (37–40.3)	38.1 (37–39.4)	n.s.
Birth weight (kg)	3.08 (2.9–3.7)	3.14 (2.6–3.9)	n.s.
Timed intervals			
I-D (min)	7.2 (6.2–7.6)	7.5 (6.3–8.1)	n.s.
U-D (s)	68 (52–75)	69 (55–85)	n.s.
Duration of O ₂ exposure (min)	52.7 (35–70)	53.2 (33–150)	n.s.
Apgar score			
1 min	9 (7–10)	9 (8–10)	n.s.
5 min	10 (9–10)	10 (9–10)	n.s.
<7 at 1 min	0 (0%)	0 (0%)	n.s.
<7 at 5 min	0 (0%)	0 (0%)	n.s.
Umbilical arterial blood gases			
pH	7.25 (0.09)	7.24 (0.09)	n.s.
P _O ₂ (kPa)	2.4 (0.6)	2.4 (0.8)	n.s.
P _{CO} ₂ (kPa)	7.2 (1.7)	7.5 (1.38)	n.s.
Base excess (mmol litre ⁻¹)	-4.6 (3.4)	-4.7 (3.8)	n.s.
Umbilical venous blood gases			
pH	7.29 (0.08)	7.30 (0.07)	n.s.
P _O ₂ (kPa)	4.0 (1.1)	4.8 (1.0)	<0.05
P _{CO} ₂ (kPa)	6.1 (0.9)	6.0 (0.8)	n.s.
Base excess (mmol litre ⁻¹)	-4.4 (3.7)	-4.2 (3.3)	n.s.

Table 4 Maternal and umbilical lipid peroxide concentrations. Values are mean (SD); units are µmol litre⁻¹. n.s. = not significant; N/A—not available

	Air group (n=22)	Oxygen group (n=22)	P
Maternal arterial (baseline)			
Isoprostane	118.8 (21.3)	127.1 (28.5)	n.s.
Malondialdehyde	0.89 (0.13)	0.93 (0.12)	n.s.
Organic hydroperoxides	0.13 (0.02)	0.14 (0.02)	n.s.
Maternal arterial (during surgery)			
Isoprostane	N/A	N/A	N/A
Malondialdehyde	0.89 (0.16)	1.26 (0.22)	<0.001
Organic hydroperoxides	0.14 (0.02)	0.14 (0.03)	n.s.
Maternal arterial (at birth)			
Isoprostane	121.8 (23.8)	200.6 (54.3)	<0.001
Malondialdehyde	0.89 (0.16)	1.12 (0.32)	<0.05
Organic hydroperoxides	0.14 (0.02)	0.14 (0.02)	n.s.
Umbilical venous			
Isoprostane	135.3 (66.7)	403.0 (100.4)	<0.001
Malondialdehyde	0.47 (0.13)	0.78 (0.16)	<0.05
Organic hydroperoxides	0.15 (0.05)	0.50 (0.17)	<0.001
Umbilical arterial			
Isoprostane	122.1 (73.4)	215.2 (92.7)	<0.001
Malondialdehyde	0.40 (0.06)	0.48 (0.10)	<0.001
Organic hydroperoxides	0.18 (0.09)	0.39 (0.10)	<0.001

Khaw KS et al. Br J Anaesth 2002; 88:18–23

- dle sou asných dat je nejen zbyte ná a neefektivní, ale i s možnými negativními d sledky
Cogliano, Anaesthesia 2002; Khaw, Curr Opin Anaesthesiol 2004. Buhimschi, Am J Obstet Gynecol 2003. Van de Velde, Br J Anaesth 2009



RIZIKO ASPIRACE

Mendelson CL. The aspiration of stomach contents into the lungs during obstetric anesthesia. *Am J Obstet Gynecol* 1945;49:554–66.

Table 7 Reported incidence of aspiration in obstetric and general surgical populations

Study	No. of cases	Patient group characteristics	Incidence of aspiration [no. of cases]
This study	1870	Obstetric; peripartum; nonintubated	0.053% [1]
Kranz & Edwards [3]	37 282	Obstetric; vaginal delivery; nonintubated	0.013% [5]
Kranz & Edwards [3]	3076	Obstetric; Caesarean section; intubated	0.228% [7]
Olsson <i>et al.</i> [2]	2643	Obstetric; Caesarean section; intubated	0.15% [4]
Olsson <i>et al.</i> [2]	111 215	General surgery; nonintubated	0.018% [20]
Olsson <i>et al.</i> [2]	74 143	General surgery; intubated	0.085% [63]
Cohen <i>et al.</i> [5]	112 000	General surgery; intubated and nonintubated	0.064% [72]
Kallar [6]	529 150	Outpatients; intubated and nonintubated	0.017% [90]
Warner <i>et al.</i> [4]	13 427	General surgery; emergency	0.112% [15]
Warner <i>et al.</i> [4]	202 061	General surgery; elective	0.0257% [52]

Ezri *et al.* *Anaesthesia* 2000; 55:421-426

Regurgitace u 8/1095 pacientek SC v CA (0.7%) - 4x p i úvodu, 4x p i extubaci, pouze 1x aspirace (0.1%)

McDonnell *et al.* *Int J Obst Anest* 2009; 17:292-7



RIZIKO ASPIRACE

- při příjmu kyselých tekutin není vyprázdnění žaludku ani na konci těhotenství významně zpomaleno

Wong CA. Anesth Analg 2007, 105(3):751-755
Wong CA. Anesthesiology 2002, 96(6):1395-1400

- je proto je doporučován příjem tekutin (nesycených CO₂) až do doby 2 hodin před plánovaným výkonem
- množství by mohlo být malé, ale dostatečné, tj. asi 2 dcl během 1 hodiny

Chestnut DH (ed.): Obstetric Anesthesia: Principles and Practice, 2009
Anesthesiology 2007, 106(4):843-63

- výjimkou s nutným individuálním přístupem jsou rodilky s extrémní obezitou, diabetem, anamnézou obtížné intubace apod.



RIZIKO ASPIRACE

- ❖ zvýšení pH žaludku

H₂ blokátory (ranitidin) > inhibitory protonové pumpy (omeprazol)

Lin CJ. Acta Anaesthesiol Sin. 1996 Dec;34(4):179-84

CAVE: neovlivní to, co v žaludku již je!

antacida - irá, nekorpuskulární (natrium citrát)

- ❖ snížení žalude ního objemu
metoclopramid (zrychlená evakuace žaludku, zvyšuje tonus dolního jícnového sv ra e)



Interventions at caesarean section for reducing the risk of aspiration pneumonitis

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^b *Department of Anaesthesia, Royal Women's Hospital, Parkville, Australia*

^c *Cochrane Pregnancy and Childbirth Group, School of Reproductive and Developmental Medicine, Division of Perinatal and Reproductive Medicine, University of Liverpool, Liverpool Women's NHS Foundation Trust, Liverpool, UK*

^d *Maternity Services Department, Royal Sussex County Hospital, Brighton, UK*

ABSTRACT

Int J Obstet Anesth. 2011 Apr;20(2):142-8

Background: Various interventions are used as prophylaxis for aspiration pneumonitis in obstetric anaesthesia. This review, based on a Cochrane systematic review currently being updated, examines whether interventions given before caesarean section reduce the risk of aspiration pneumonitis.

Methods: Twenty-two studies, involving 2658 women providing data in a usable format for meta-analysis were identified.

Results: Compared to no treatment or placebo, there was a significant reduction in the risk of intra-gastric pH <2.5 with antacids (risk ratio (RR) 0.17, 95% confidence interval (CI) 0.09–0.32), H₂ antagonists (RR 0.09, 95% CI 0.05–0.18) and proton-pump antagonists (RR 0.26, 95% CI 0.14–0.46). H₂ antagonists were associated with a reduced risk of intra-gastric pH <2.5 when compared with proton-pump antagonists (RR 0.39, 95% CI 0.16–0.97), but compared with antacids the findings were unclear. Combined use of antacids plus H₂ antagonists was associated with a significant reduction in the risk of intra-gastric pH <2.5 when compared with placebo (RR 0.02, 95% CI 0.00–0.15) or compared with antacids alone (RR 0.12, 95% CI 0.02–0.92).

Conclusion: The quality of evidence was weak and may not reflect a reduction in the risk of aspiration pneumonitis since none of the studies assessed substantive clinical outcomes or potential adverse effects. Further work is required to validate the suitability of surrogate markers of pH and gastric volume for clinical outcomes in the context of aspiration pneumonitis.



RIZIKO ASPIRACE

Oral sodium citrate increases nausea amongst elective Cesarean delivery patients

[Le citrate de sodium oral augmente les nausées pendant la césarienne réglée]

Klaus Kjaer MD, Michele Comerford MD, Linda Koadlis BA, Lauren DiMara BA, Sharon Abramovitz MD, Michael Kiselev MD, Jon Samuels MD, Farida Cadalla MD, Barbara L. Leighton MD

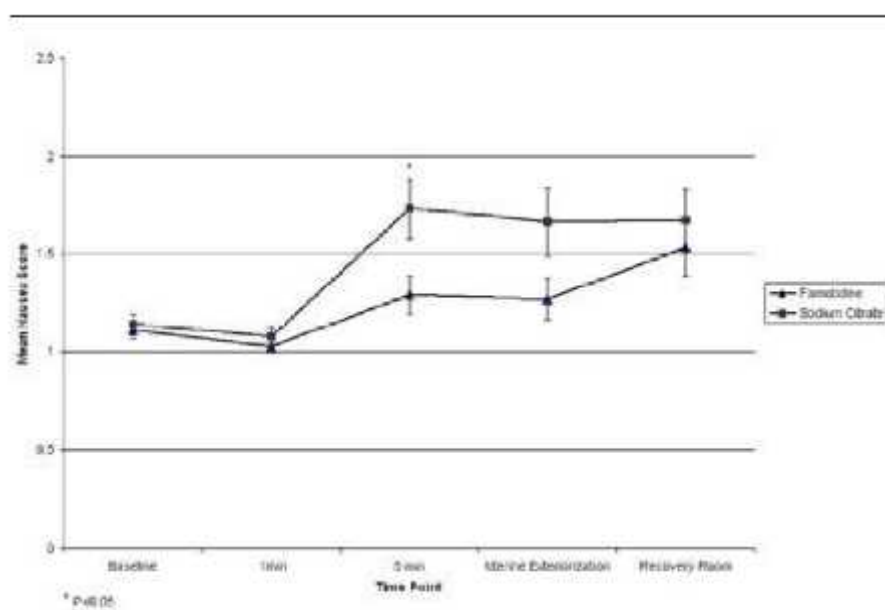


FIGURE 1 Average degree of nausea over time.

TABLE II Occurrence of nausea and hypotension

	Sodium citrate	Control	P-value
1 min after spinal			
Nausea	4/60 (7%)	2/63 (3%)	0.43
Hypotension	4/59 (7%)	4/61 (7%)	1
5 min after spinal			
Nausea	22/60 (37%)	9/63 (14%)	0.006
Hypotension	13/60 (22%)	11/63 (17%)	0.65
Uterine exteriorization			
Nausea	14/53 (26%)	7/52 (13%)	0.14
Hypotension	1/53 (2%)	2/53 (4%)	1
Recovery room			
Nausea	17/58 (29%)	15/62 (24%)	0.54
Hypotension	5/60 (8%)	9/63 (14%)	0.39

Nausea = 2-5 on a scale of 1-5, with 1 being no nausea and 5 being vomiting. Hypotension = systolic blood pressure \leq 100. Compared with Pearson Chi-square test.

Kjaer K et al. Can J Anaesth. 2006 Aug;53(8):776-80.



RIZIKO ASPIRACE

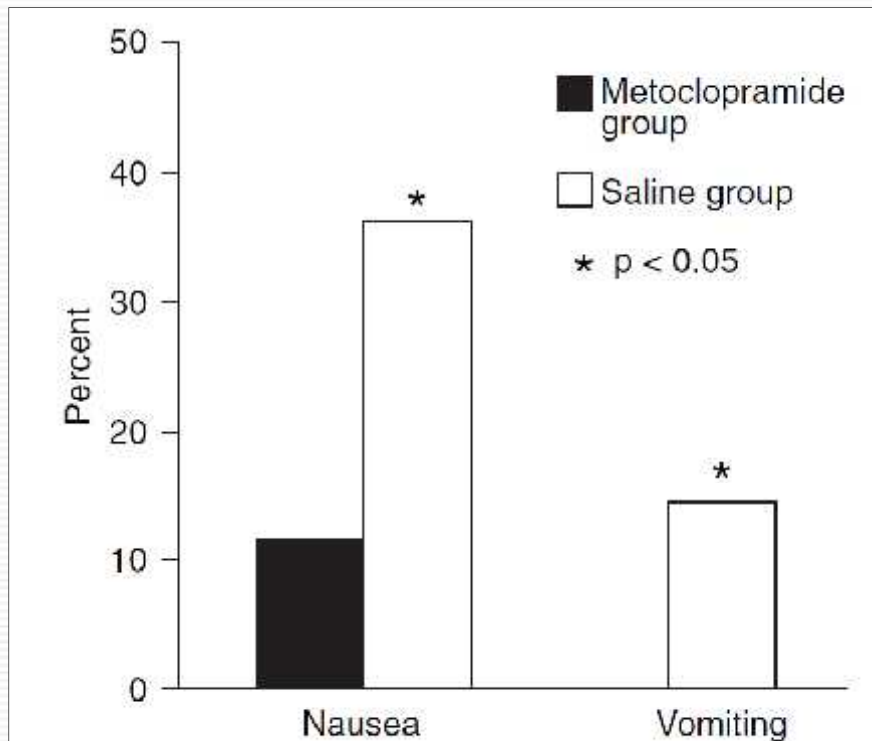


Figure 12-3. Incidence of nausea and vomiting with intravenous metoclopramide following delivery of the fetus during cesarean section. (Adapted from Chestnut DH, Vandewalker GL, Owen CI: *Anesthesiology* 1987; 66:563.)

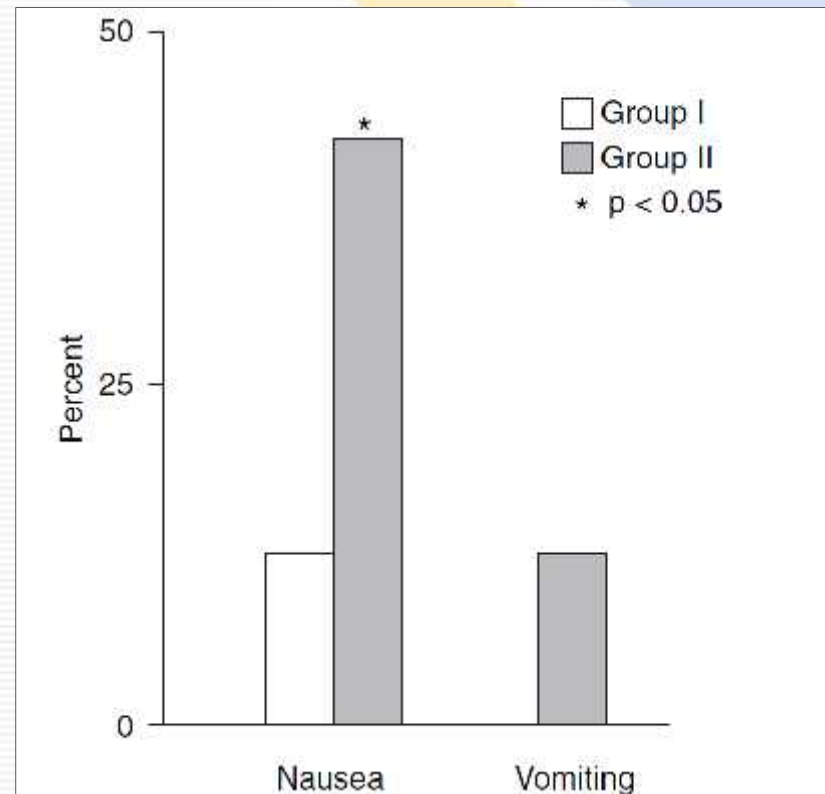
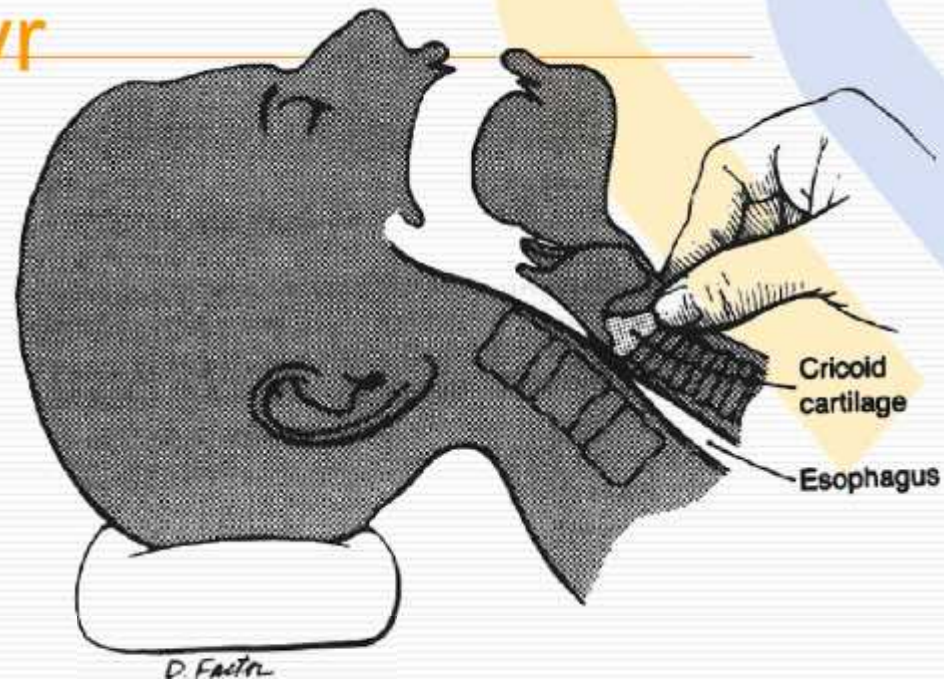


Figure 12-2. Incidence of nausea and vomiting with intravenous droperidol following delivery of the fetus during cesarean section.



Sellick v manévr



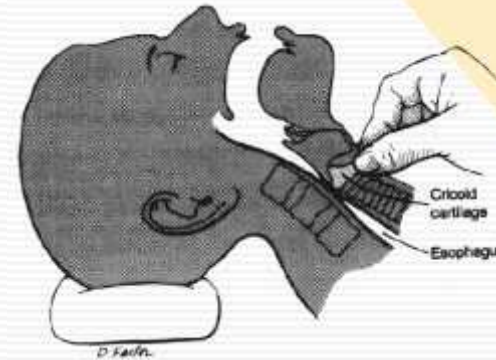
- tlakem na štítnou chrupavku dojde k obturaci jícnu stlačením proti krční páteři
- manévr je zahájen při vdomí pacienta středním velkým tlakem (10 kg.m.s^2)
- po ztrátě vdomí již plným tlakem (30 kg.m.s^2)
- manévr je ukončen teprve po kontrole správného zavedení ET kanyly

Chestnut DH (ed.): Obstetric Anesthesia: Principles and Practice, 2009
 Herman NL et al. Anesth Analg. 1996 Oct;83(4):859-63



Sellick v manévr

Sharp LM. Curr Opin Anaesthesiol 2009, 22(3):357-61
 Priebe HJ. Minerva Anesthesiol 2009, 75(12):710-4
 Smith KJ. Anesthesiology 2003, 99(1):60-4
 Garrard A. Anaesthesia 2004, 59(5):435-9
 Haslam N. Anaesthesia 2005, 60(1):41-7
 Quigley P. Emerg Med Australas 2007, 19(3):218-22.



- současná data ale univerzální použití Sellickova manévru příliš nepodporují
- tlakem na štítný prsteneček nedojde k spolehlivé okluzi jícnu, který neleží dle sledných studií mezi chrupavkou a krční páteří
- tlak na štítnou chrupavku může významně snížit laryngoskopický pohled a tím zvyšovat riziko selhání intubace
- situace je tím horší, čím méně je zkušená osoba aplikující Sellick v manévr



HYPOTENZE

- nejvýznamnější komplikací neuroaxiální anestezie je rychlý nástup útlaku s bloádou sympatiku, s výraznou vasodilací a rozvojem hypotenze
- často proto bývá před vlastní aplikací vyžadována prehydratace (preload), obvykle 1000-1500 ml krystaloidu jako prevence (i snížení závažnosti) hypotenze
- prehydratace krystaloidy není spolehlivým prostředkem prevence, sníží výskyt hypotenze spíše v řádu procent, než desítek procent

Rout CC et al. Anesthesiology 1993, 79(2):262-9

- prehydratace sama o sobě nestačí, ale ani není zbytečná, protože už sám tekutinový preload zlepšuje uteroplacentární perfuzi

Crino JP et al. Am J Obstet Gynecol 1993, 168(5):1603-9

- i rychlá infuze krystaloidů (20 ml/kg) zahájená v době aplikace lokálního anestetika (tzv. co-load) má stejný efekt jako podání krystaloidů předem (preload)

Dyer RA et al. Anaesth Intensive Care 2004, 32(3):351-7

Anesthesiology 2007, 106(4):843-6

Teoh WH. Anesth Analg 2009;108:1592-8

Carvalho B et al. Int J Obstet Anesth 2009;18:150-5

Siddik-Sayyid SM et al. Anesth Analg 2009;109:1219-24

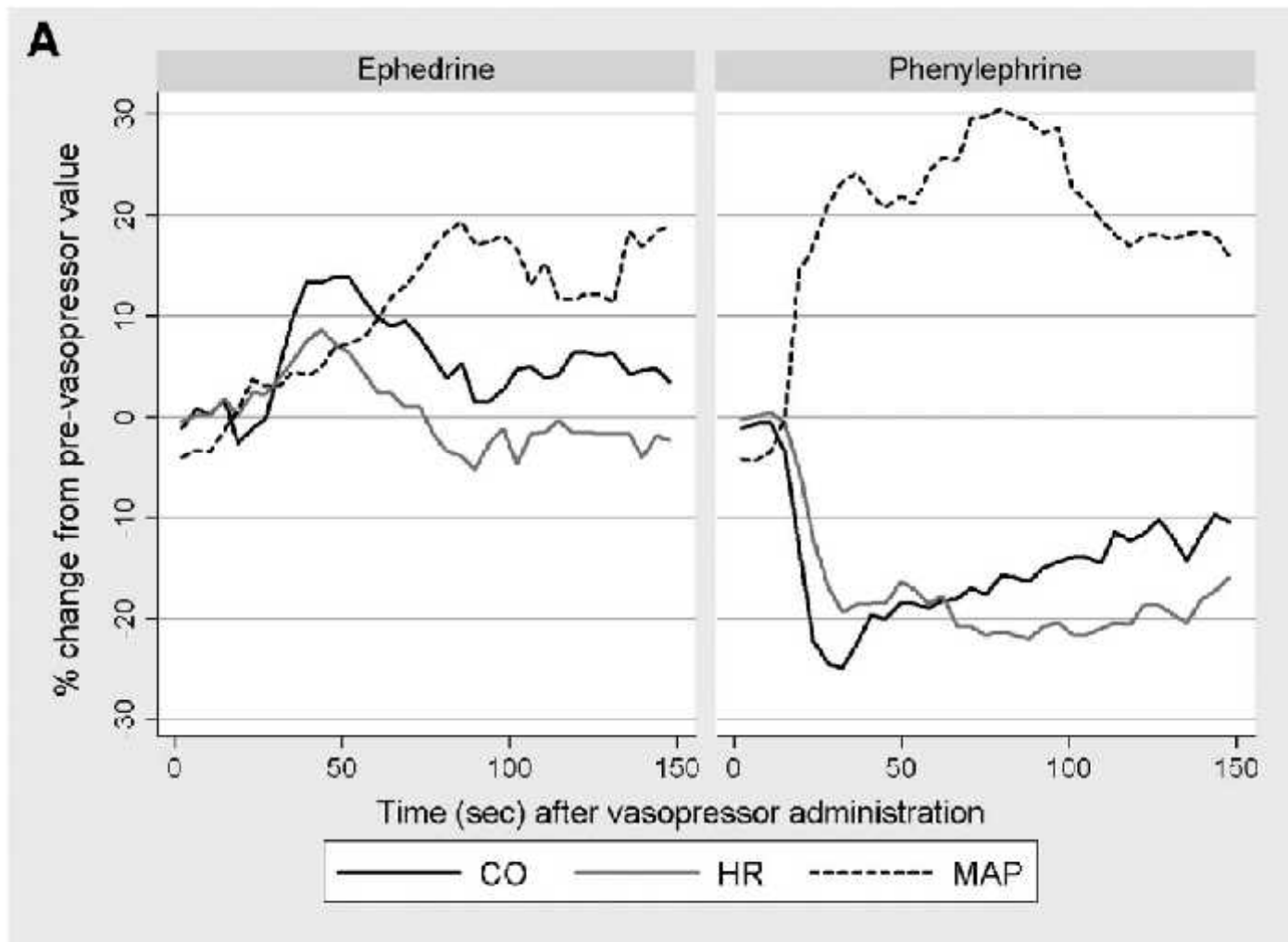


HYPOTENZE

- vzhledem k nedostatečnému efektu preloadu i co-loadu je ve většině případů vhodné současné podání vasopresor (efedrin, phenylephrin)
- lékem volby je **efedrin** (bolus 5-15 mg iv.)
- nebo **phenylephrin** (bolus 0,05-0,15 mg iv.)



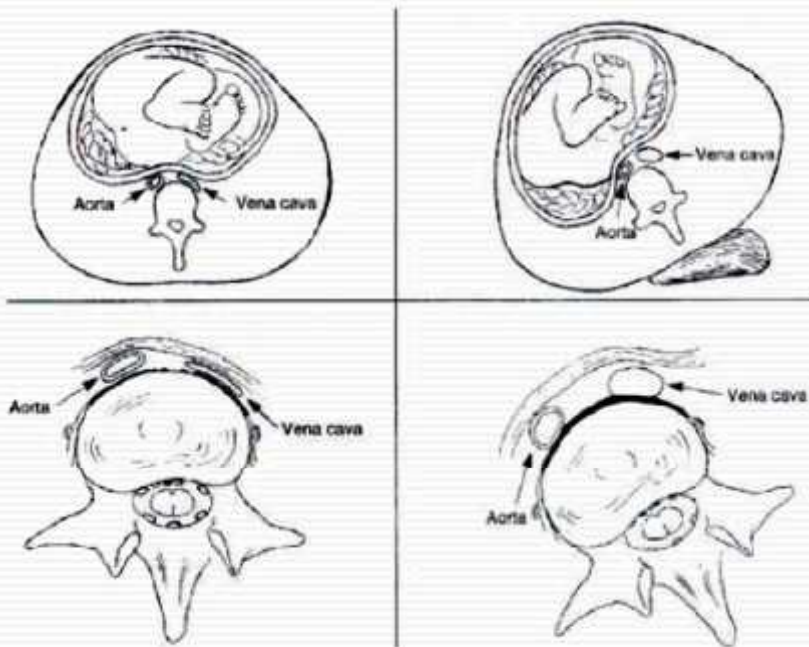
HYPOTENZE



Dyer RA et al. Anesthesiology. 2009 Oct;111(4):753-65



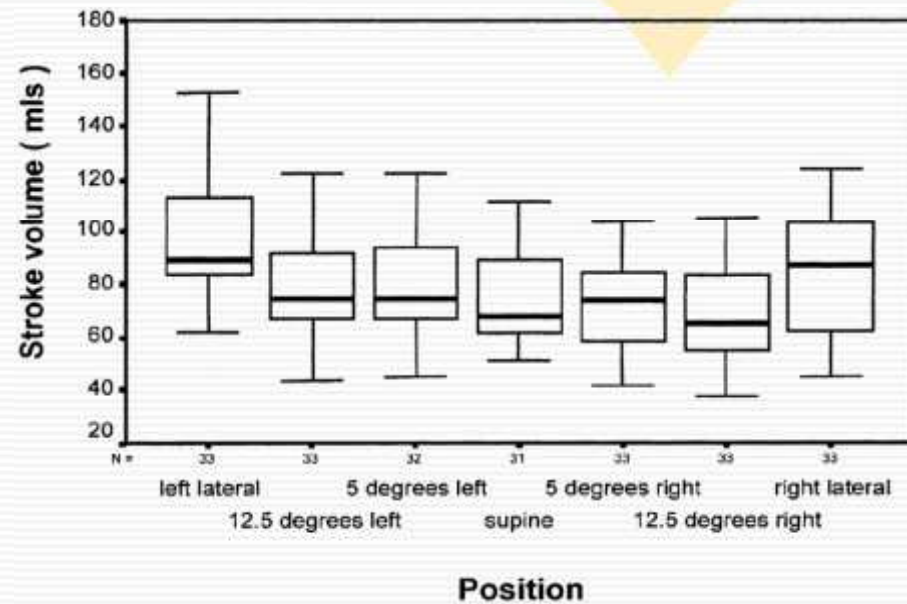
HYPOTENZE



SEMILATERÁLNÍ POLOHA

naklon ní trupu o 5-15 stup

= **prevence aortokavální komprese**

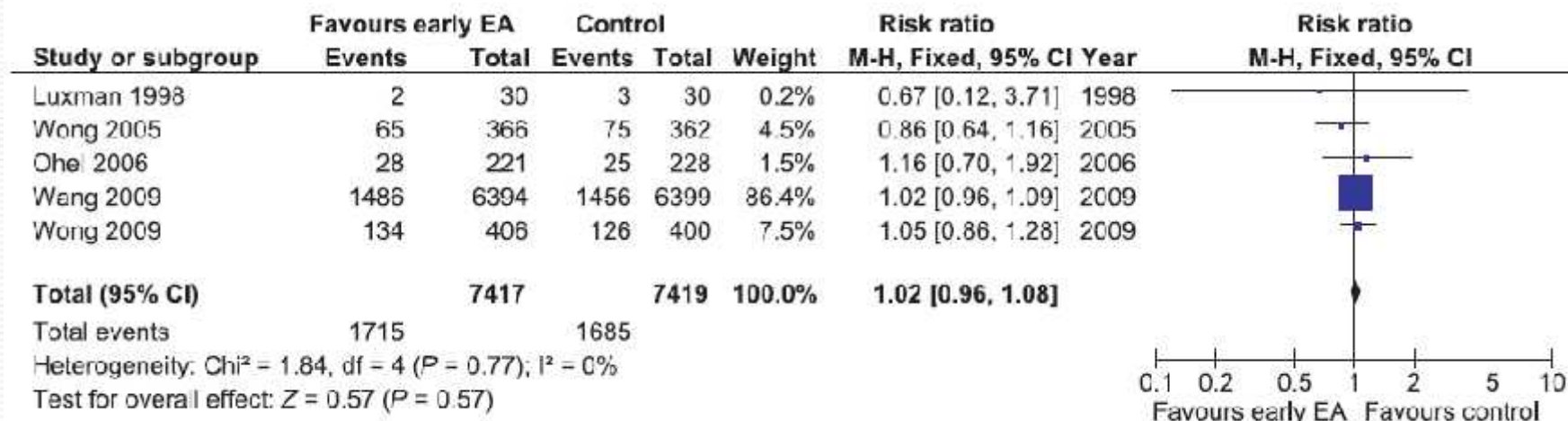


Bamber, J. H. et al. Anesth Analg 2003;97:256-258



Early versus late epidural analgesia and risk of instrumental delivery in nulliparous women: a systematic review

MMLH Wassen,^a J Zuijlen,^b FJME Roumen,^c LJM Smits,^d MA Marcus,^e JG Nijhuis^a





Everybody lies.

HOUSE^{MD}

D KUJI ZA POZORNOST