Open lung concept/ Open lung approach

- jsou tyto principy aktuální i v roce 2018?

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Open lung concept/open lung approach

Editorial

Open up the lung and keep the lung open

B. Lachmann

Intensive Care Med (1992) 18:319–321

Department of Anesthesiology, Erasmus University Rotterdam, The Netherlands

Lachmann B, Danzmann E, Haendly B, Jonson B (1982) Ventilator settings and gas exchange in respiratory distress syndrome. In: Prakash O (ed) Applied physiology in clinical respiratory care. Nijhoff, The Hague, pp 141–176

Součásti koncepce

Why is it so important to ventilate lungs with as small as possible pressure amplitude?

Ventilace s nízký „driving pressure“

Why is it important to open up the lung and keep it open?

Předpokladem je zajištění vzdušné plíce, zlepšení oxygenace, eliminace CO_2 a snížení PVR

Why may intrinsic PEEP at pressure controlled ventilation be superior to external PEEP at volume controlled ventilation?

Intensive Care Med (1992) 18:319–321

Tlakově řízená ventilace, dynamický, intrinsický PEEP, nepoužívat objemovou ventilaci - .. Riziko poškození plic

….produce minimal pressure swings during the ventilatory cycle and keep **the lung volume equal to or just above the FRC level**….

Zjednodušený model

- Otevření plíce recruitment manévrem
- Hledání „uzávěrového tlaku“, obvykle postupným snižováním PEEP
  - PaO_2, compliance, EELV/FRC, impedanční tomografie, CT…
- Opětovné „otevření plic“
- Ponechání tlaku v dýchacích cestách nad uzávěrovým tlakem

Střet koncepcí I

„Optimální“, individualizovaný PEEP (MAP)

- Zlepšení oxygenace a eliminace CO_2
- Optimální úroveň není spojena se afterloadu PK
- Snížení rizika VALI
  - Atelektrauma
  - Nízký „driving pressure“
- Ovlivnění klinického výsledku

Minimální, resp. rutinní PEEP ve vazbě na FiO_2 nebo PaO_2/FiO_2

- Nástroj k zajištění minimální nezbytné oxygenace
- PEEP zvyšuje vždy riziko plicního poškození a oběhové selhání
- Incrementální PEEP, bez RM

Střet koncepcí II

Nízký vs vysoký PEEP

- ALVEOLI (Brower 2004)
- LOVS (Meade 2008)
- ExPRESS (Mercat 2008)

„Optimální“ vs „rutinní“

Open Lung Approach 1998 Amato (Pflex)

Open Lung Approach 1999 Ranieri (Pflex)

Open Lung Approach 2006 Villar (Pflex)

Talmor 2009 (Eso)

Huh 2009 (decremental C)

Kacmarek 2016 (decremental C)

Open Lung Approach for the Acute Respiratory Distress Syndrome: A Pilot, Randomized Controlled Trial*

(*Crit Care Med* 2016; 44:32–42)

Robert M. Kacmarek, PhD, RRT, FCCM[1,2]; Jesús Villar, MD, PhD, FCCM[3,4]; Demet Sulemanji, MD[1,2]; Raquel Montiel, MD[5]; Carlos Ferrando, MD, PhD[6];

Kliknutím na ikonu přidáte klipart.

After randomization settings	Open lung approach	Acute Respiratory Distress Syndrome network protocol
Ventilator mode	PC	VC
V_T target	6 mL/kg PBW	6 mL/kg PBW
V_T range	4–8 mL/kg PBW	4–8 mL/kg PBW
Respiratory rate	≤ 35 breaths/min	≤ 35 breaths/min
PEEP	Set using decremental PEEP trial	Set using F_{IO_2}-PEEP table
Recruitment maneuvers	Yes	No
Inspiration: expiration ratio	1:1–1:3	1:1–1:3
Arterial pH goal	≥ 7.30 and ≤ 7.45	≥ 7.30 and ≤ 7.45
Plateau pressure goal	≤ 30 cm H_2O	≤ 30 cm H_2O
Partial pressure of arterial oxygen goal	55–80 mm Hg	55–80 mm Hg
Oxygen saturation by pulse oximetry	88–95%	88–95%

Outcomes	Open Lung Approach	Acute Respiratory Distress Syndrome Network Protocol	*p*
28-d mortality, *n* (%)	22 (22)	27 (27)	0.51 F
60-d mortality, *n* (%)	28 (29)	33 (33)	0.54 F
ICU mortality, *n* (%)	25 (25)	30 (30)	0.53 F
Hospital mortality, *n* (%)	29 (30)	35 (35)	0.45 F
Length of ICU stay, d, median (IQR)	18 (10–28)	16 (11–28)	0.79 W
Length of hospital stay, d, median (IQR)	27 (16–46)	23 (14–41)	0.49 W
Ventilator-free days, d, median (IQR)	8 (0–20)	7 (0–20)	0.53 W
Primary cause of death in ICU–univariate analysis			
Progressive respiratory failure, *n* (% nonsurvivors)	3 (12)	10 (33)	0.11 F
Septic shock, *n* (% of nonsurvivors)	10 (40)	3 (10)	0.01 F
Multiple organ failure, *n* (% of nonsurvivors)	4 (16)	10 (33)	0.22 F
Cardiac failure, *n* (% of nonsurvivors)	1 (4)	1 (3)	0.99 F
Other, *n* (% of nonsurvivors)	6 (24)	4 (13)	0.48 F
Unknown cause of death, *n* (% of nonsurvivors)	1 (4)	2 (7)	

(*Crit Care Med* 2016; 44:32–42)

JAMA | Preliminary Communication | CARING FOR THE CRITICALLY ILL PATIENT

Effect of Intensive vs Moderate Alveolar Recruitment Strategies Added to Lung-Protective Ventilation on Postoperative Pulmonary Complications

A Randomized Clinical Trial

JAMA. 2017;317(14):1422-1432. doi:10.1001/jama.2017.2297

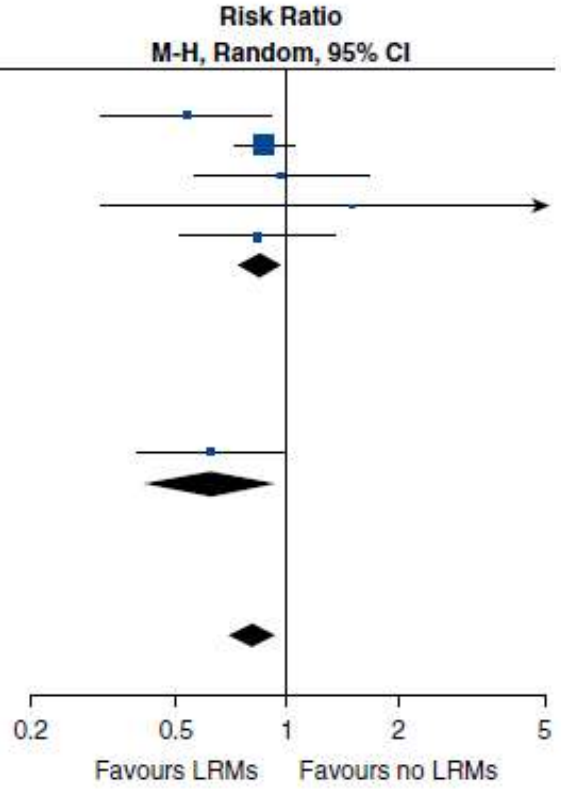
Variables	Recruitment Strategy: Intensive (n = 157)	Recruitment Strategy: Moderate (n = 163)	Odds Ratio (95% CI) or Absolute Difference, % (95% CI)	*P* Value Unadjusted
Primary outcome				
Pulmonary complication severity score	1.7 (1 to 2)	2 (1.5 to 3)	1.86 (1.22 to 2.83)[a]	.003[b]
Dichotomized as grade, No. (%)[c]				
≥2	99 (63)	122 (75)	−11.8 (−21.6 to −1.7)	
≥3	24 (15)	43 (26)	−11.1 (−19.8 to −2.2)	
≥4	4 (2.5)	8 (4.9)	−2.4 (−7.1 to 2.2)	
Secondary outcomes				
ICU stay, median (IQR), d	3.8 (3.4-4.3)	4.8 (4.2-5.3)	−1.0 (−1.6 to −0.2)	.01[d]
Hospital stay, median (IQR), d	10.9 (9.9-11.9)	12.4 (11.3-13.6)	−1.5 (−3.1 to −0.3)	.04[d]
Hospital death, No. (%)	4 (2.5)	8 (4.9)	−2.4 (−7.1 to 2.2)	.27[h]
Barotrauma, No. (%)[f]	0	1 (0.6)	−0.6 (−1.8 to 0.6)	.51[e]
Other outcomes				
Need of supplemental O_2>24 h within first 5 d, No. (%)[g]	93 (59)	125 (77)	−17.5 (−27.2 to −7.2)	.001[h]
Mechanical ventilation in ICU, mean (95% CI), h[g]	10.6 (9.6-11.3)	11.7 (10.8-12.5)	1.1 (−1.7 to −0.3)	.02[i]
Extended use of NIV, No. (%)[g,j]	6 (4)	25 (15)	−11.5 (−17.2 to −5.2)	<.001[h]

Lung Recruitment Maneuvers for Adult Patients with Acute Respiratory Distress Syndrome

A Systematic Review and Meta-Analysis

Ewan C. Goligher[1,2,3], Carol L. Hodgson[4], Neill K. J. Adhikari[1,5], Maureen O. Meade[6,7], Hannah Wunsch[1,5], Elizabeth Uleryk[8], Ognjen Gajic[9], Marcelo P. B. Amato[10], Niall D. Ferguson[1,2,3,11], Gordon D. Rubenfeld[1,5], and Eddy Fan[1,3,11]

Study or Subgroup	LRMs Events	LRMs Total	No LRMs Events	No LRMs Total	Weight	Risk Ratio M-H, Random, 95% CI	Year
Co-intervention with higher PEEP							
Amato 1998	11	29	17	24	8.9%	0.54 [0.31, 0.91]	1998
Meade 2008	145	475	178	508	59.3%	0.87 [0.73, 1.04]	2008
Huh 2009	14	30	13	27	8.4%	0.97 [0.56, 1.68]	2009
Hodgson 2011	3	10	2	10	1.1%	1.50 [0.32, 7.14]	2011
Kacmarek 2016	22	99	27	101	10.4%	0.83 [0.51, 1.36]	2016
Subtotal (95% CI)		**643**		**670**	**88.0%**	**0.84 [0.72, 0.98]**	
Total events	195		237				
Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 3.71$, df = 4 (P = 0.45); $I^2 = 0\%$							
Test for overall effect: Z = 2.16 (P = 0.03)							
No co-intervention with higher PEEP							
Xi 2010	18	55	29	55	12.0%	0.62 [0.39, 0.98]	2010
Subtotal (95% CI)		**55**		**55**	**12.0%**	**0.62 [0.39, 0.98]**	
Total events	18		29				
Heterogeneity: Not applicable							
Test for overall effect: Z = 2.06 (P = 0.04)							
Total (95% CI)		**698**		**725**	**100.0%**	**0.81 [0.69, 0.95]**	
Total events	213		266				
Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 5.30$, df = 5 (P = 0.38); $I^2 = 6\%$							
Test for overall effect: Z = 2.57 (P = 0.01)							
Test for subgroup differences: $Chi^2 = 1.58$, df = 1 (P = 0.21), $I^2 = 36.7\%$							



Ann Am Thorac Soc Vol 14, Supplement 4, pp S304–S311, Oct 2017

Effect of Lung Recruitment and Titrated Positive End-Expiratory Pressure (PEEP) vs Low PEEP on Mortality in Patients With Acute Respiratory Distress Syndrome

A Randomized Clinical Trial

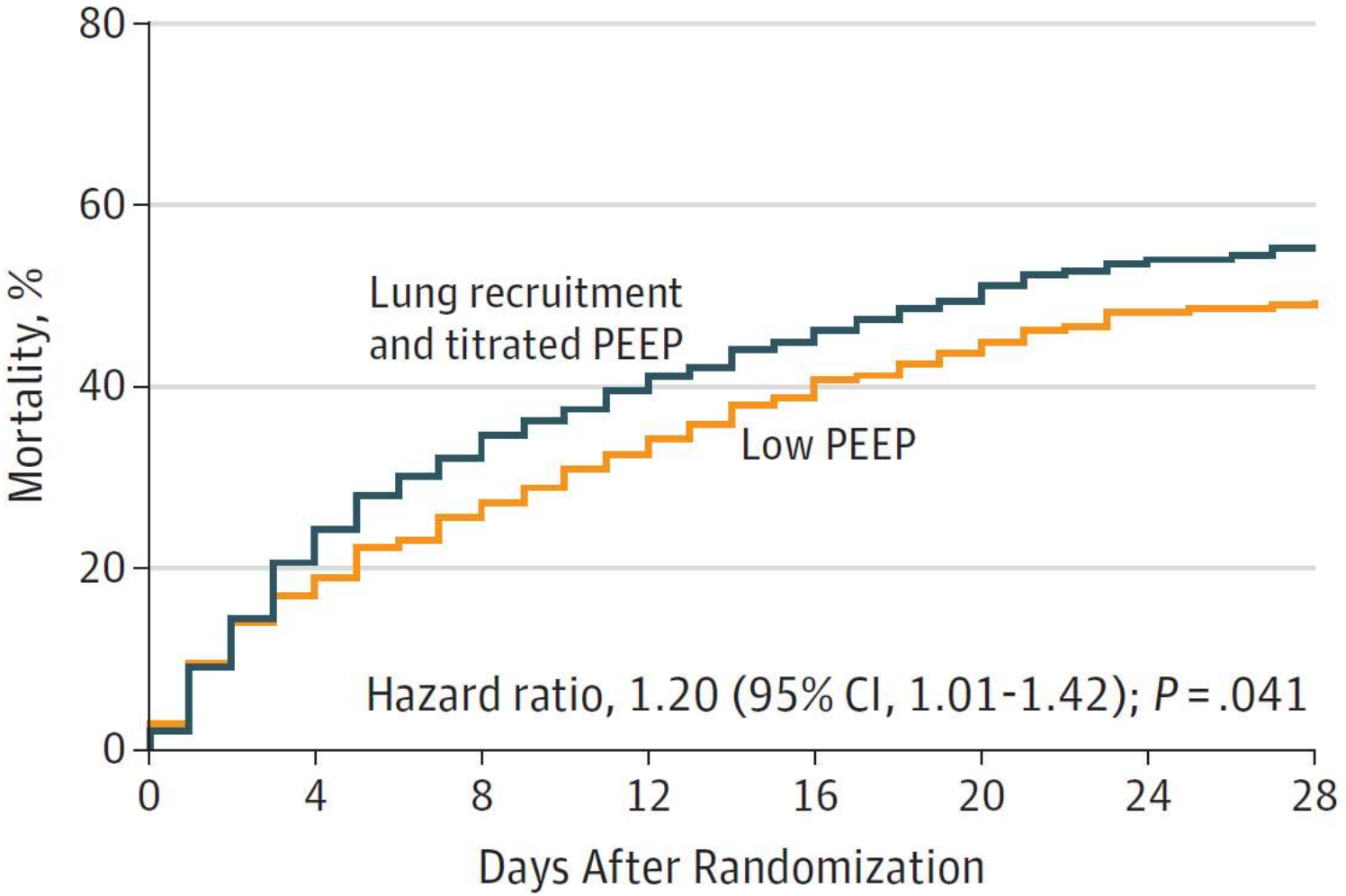
Writing Group for the Alveolar Recruitment for Acute Respiratory Distress Syndrome Trial (ART) Investigators

RESULTS A total of 1010 patients (37.5% female; mean [SD] age, 50.9 [17.4] years) were enrolled and followed up. At 28 days, 277 of 501 patients (55.3%) in the experimental group and 251 of 509 patients (49.3%) in the control group had died (hazard ratio [HR], 1.20; 95% CI, 1.01 to 1.42; *P* = .041). Compared with the control group, the experimental group strategy increased 6-month mortality (65.3% vs 59.9%; HR, 1.18; 95% CI, 1.01 to 1.38; *P* = .04), decreased the number of mean ventilator-free days (5.3 vs 6.4; difference, −1.1; 95% CI, −2.1 to −0.1; *P* = .03), increased the risk of pneumothorax requiring drainage (3.2% vs 1.2%; difference, 2.0%; 95% CI, 0.0% to 4.0%; *P* = .03), and the risk of barotrauma (5.6% vs 1.6%; difference, 4.0%; 95% CI, 1.5% to 6.5%; *P* = .001). There were no significant differences in the length of ICU stay, length of hospital stay, ICU mortality, and in-hospital mortality.

JAMA. 2017;318(14):1335-1345. doi:10.1001/jama.2017.14171

Characteristic	Lung Recruitment Maneuver With PEEP Titration Group (n = 501)	Low-PEEP Group (n = 509)
Age, mean (SD), y	51.3 (17.4)	50.6 (17.4)
Women, No. (%)	188 (37.5)	191 (37.5)
SAPS 3 score, mean (SD)[a]	63.5 (18.1)	62.7 (18.1)
No. of nonpulmonary organ failures, median (IQR)	2 (2-3)	2 (2-3)
Septic shock, No. (%)	336 (67.1)	331 (65.0)
Cause of ARDS, No. (%)		
Pulmonary ARDS	313 (62.5)	313 (61.5)
Pneumonia	280 (55.9)	276 (54.2)
Gastric aspiration	26 (5.2)	32 (6.3)
Lung contusion	7 (1.4)	4 (0.8)
Near drowning	0	1 (0.2)
Extrapulmonary ARDS	188 (37.5)	196 (38.5)
Nonseptic shock	9 (1.8)	12 (2.4)
Sepsis or septic shock	99 (19.8)	97 (19.1)
Trauma without lung contusion	5 (1.0)	5 (1.0)
Cardiac surgery	3 (0.6)	0
Other major surgery	20 (4.0)	23 (4.5)
Head trauma	4 (0.8)	6 (1.2)
Smoke inhalation	4 (0.8)	6 (1.2)
Multiple transfusions	8 (1.6)	3 (0.6)
Drug or alcohol abuse	1 (0.2)	2 (0.4)
Other	35 (7.0)	42 (8.3)
Prone position, No./total No. (%)[b]	31/304 (10.2)	30/303 (9.9)
Time since onset of ARDS, median (IQR), h	15 (7-34)	16 (7-30)
Days intubated prior to randomization, median (IQR)	2 (1-4)	2 (1-4)
Respiratory measures, mean (SD)		
Pao_2:FIo_2[c]	119.5 (43.5)	117.2 (41.9)
Tidal volume, mL/kg predicted body weight	5.8 (1.1)	5.8 (1.0)
Plateau airway pressure, cm H_2O	25.8 (4.7)	26.2 (5.2)
Minute ventilation, L/min	8.9 (2.5)	8.9 (2.4)
Respiratory rate, breaths/min	25.3 (6.4)	25.3 (6.4)
Driving pressure, cm H_2O[d]	13.5 (4.2)	13.5 (4.6)
Positive end-expiratory pressure, cm H_2O	12.2 (3.0)	12.7 (3.3)
Respiratory system static compliance, mL/cm H_2O[e]	29.2 (12.4)	30.3 (14.4)

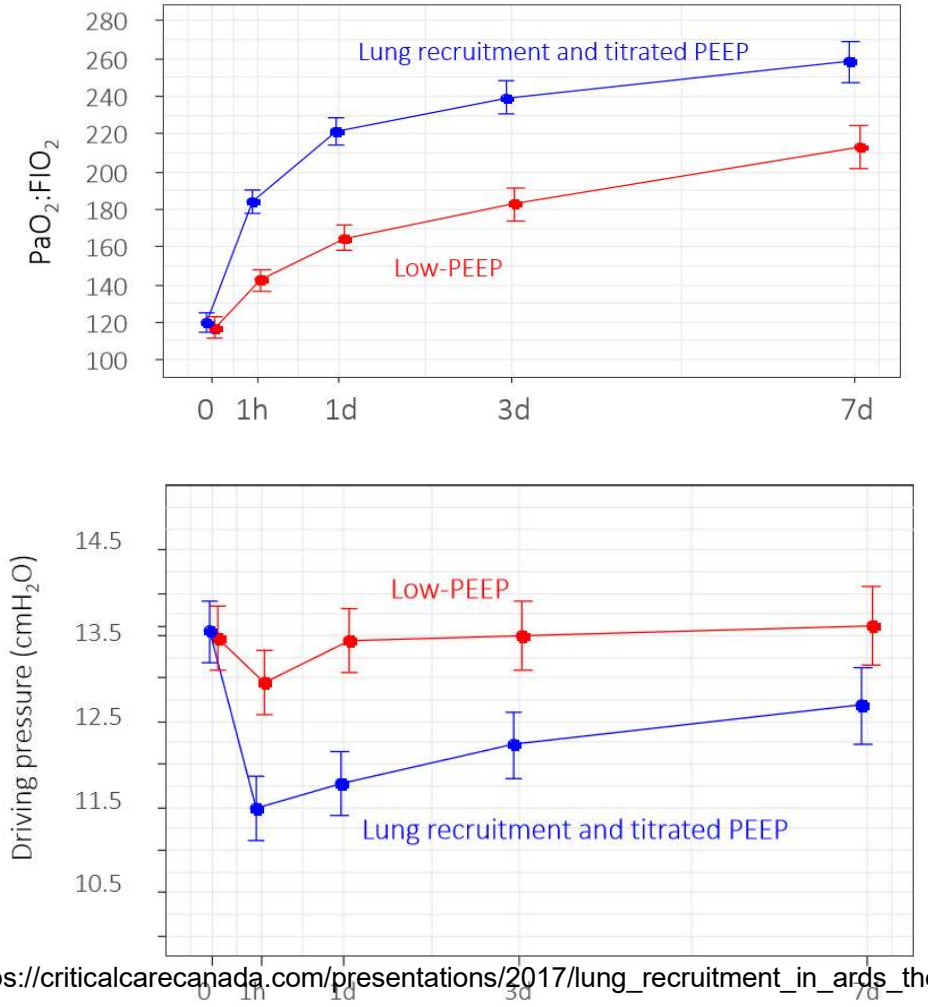
JAMA. 2017;318(14):1335-1345. doi:10.1001/jama.2017.14171



JAMA. 2017;318(14):1335-1345. doi:10.1001/jama.2017.14171

Outcome	Lung Recruitment Maneuver With PEEP Titration Group (n = 501)	Low-PEEP Group (n = 509)	Type of Effect Estimate	Effect Estimate (95% CI)	*P* Value
Primary Outcome					
Death ≤28 d, No. of events/total No. (%)	277/501 (55.3)	251/509 (49.3)	HR	1.20 (1.01 to 1.42)	.041
Secondary Outcomes					
Death, No. of events/total No. (%)					
In intensive care unit	303/500 (60.6)	284/509 (55.8)	RD	4.8 (-1.5 to 11.1)	.13
In hospital	319/500 (63.8)	301/508 (59.3)	RD	4.5 (-1.7 to 10.7)	.15
Within 6 mo[a]	327/501 (65.3)	305/509 (59.9)	HR	1.18 (1.01 to 1.38)	.04
Length of stay, d					
Intensive care unit, mean (SD)	18.2 (22.4)	19.2 (25.9)	MD	-1.0 (-4.0 to 2.0)	.51
Median (IQR)	12.0 (5.0 to 23.0)	14.0 (7.0 to 23.0)			
Hospital, mean (SD)	25.5 (32.3)	26.2 (31.7)	MD	-0.7 (-4.6 to 3.3)	.74
Median (IQR)	15.0 (5.0 to 32.0)	18.0 (7.0 to 35.0)			
No. of ventilator-free d from d 1 to d 28, mean (SD), d	5.3 (8.0)	6.4 (8.6)	MD	-1.1 (-2.1 to -0.1)	.03
Median (IQR)	0.0 (0.0 to 11.0)	0.0 (0.0 to 14.0)			
Pneumothorax requiring drainage ≤7 d, No./total No. (%)	16/501 (3.2)	6/509 (1.2)	RD	2.0 (0.2 to 3.8)	.03
Barotrauma ≤7 d, No./total No. (%)	28/501 (5.6)	8/509 (1.6)	RD	4.0 (1.5 to 6.5)	.001
Exploratory Outcomes, No./Total No. (%)					
Death					
Within 7 d	160/501 (31.9)	130/509 (25.5)	RD	6.4 (0.6 to 12.2)	.03
With refractory hypoxemia ≤7 d[b]	45/501 (9.0)	51/509 (10.0)	RD	-1.0 (-4.9 to 2.8)	.59
With refractory acidosis ≤7 d[c]	68/501 (13.6)	56/509 (11.0)	RD	2.6 (-1.7 to 6.8)	.25
With barotrauma ≤7 d[d]	7/501 (1.4)	0/509 (0.0)	RD	1.4 (0.2 to 2.6)	.007
Cardiorespiratory arrest on day 1[e]	5/501 (1.0)	2/509 (0.4)	RD	0.6 (-0.6 to 1.8)	.28
Need of commencement or increase of vasopressors or hypotension (MAP <65 mm Hg) within 1 h	174/500 (34.8)	144/508 (28.3)	RD	6.5 (0.5 to 12.4)	.03
Refractory hypoxemia (Pao_2<55 mm Hg) ≤1 h	8/496 (1.6)	10/506 (2.0)	RD	-0.4 (-2.2 to 1.5)	.81
Severe acidosis (pH<7.10) ≤1 h	65/496 (13.1)	55/506 (10.9)	RD	2.2 (-2.0 to 6.5)	.29

PaO_2/FiO_2 a Driving pressure



https://criticalcarecanada.com/presentations/2017/lung_recruitment_in_ards_the_art_trial.pdf

MANUAL OF OPERATIONS

Bedside Compact Version

ART Group

For patients randomized to the:

ART Group

1.

Hyperventilace před RM s rizikem autoPEEP, sporný postup hemodynamické optimalizace

If the patient is randomized to the ART strategy, prepare the patient to receive the maximum alveolar recruitment maneuver:

a) **Provide sedation and neuromuscular blockade (at the discretion of the medical team)**

b) **Keep patient in supine or prone position (the same position before the randomization)**

c) **Aspirate lower airways secretions**

d) **Install closed tracheal suction system (Trach-Care) and Heat and Moisture Exchanger (HME)**
- The ventilatory circuit CANNOT BE disconnected after maximum alveolar recruitment, because this will cause alveolar collapse and the maneuver will have to be repeated with additional risk for the patient. Therefore, the use of a closed tracheal suction system is mandatory

e) **Minimum monitoring recommended during the procedure:**
- Heart rate and rhythm
- SpO_2
- Mean blood pressure (invasive)

f) **Correct hypovolemia. Hypotension is the main cause for terminating the alveolar recruitment maneuver. Thus, it is essential to optimize volemic status before the maneuver**
- Use the end–expiratory occlusion test or variation in arterial pulse pressure (ΔPP) as a guide. Infuse crystalloids or colloids if there pulse pressure increase >5% after the end-expiratory occlusion test or if respiratory variation in pulse pressure (ΔPP) is > 13%.
- If you choose to measure ΔPP, PROVISIONALLY adjust tidal volume to 8 mL/kg for 15 minutes before measuring ΔPP
- If a end-expiratory occlusion test or ΔPP is not available, the goal is a central venous pressure (CVP) >10 cmH_2O

g) **Keep mean arterial pressure ≥75mmHg**
- If needed, start or increase vasopressor

h) **Adjust respiratory rate to 35 rpm for at least 20 minutes before recruitment**

i) **Disable backup or apnea ventilation**
- If this is not possible, reduce activation criteria to the minimum level

ART STRATEGY
MAXIMUM ALVEOLAR RECRUITMENT MANEUVER

Mechanical ventilation settings before Maximum Alveolar Recruitment Maneuver:

- Controlled Pressure mode (PCV)
- FiO_2 100%
- Respiratory rate of 15/min
- I:E ratio of 1:1 (Inspiratory time = 2 seconds)

2.

Step 1

- Start with PEEP of 25cmH_2O
- Delta pressure above PEEP of 15cmH_2O

Peak pressure of 40cmH_2O

Keep it for 1 minute (15 respiratory cycles)

Step 2

- Increase PEEP to 30cmH_2O
- Delta pressure above PEEP of 15cmH_2O

Peak pressure of 45cmH_2O

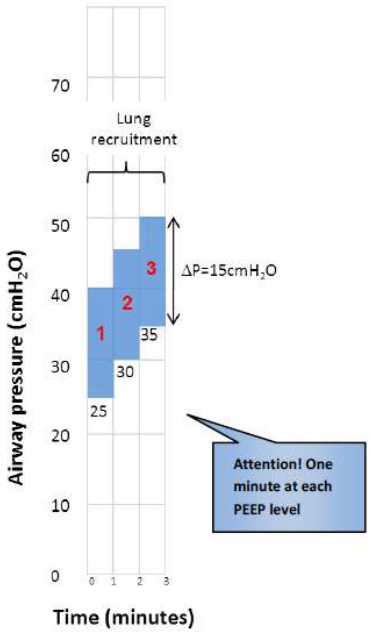
Keep it for 1 minute (15 respiratory cycles)

Step 3

- Increase PEEP to 35cmH_2O
- Delta pressure above PEEP of 15cmH_2O

Peak pressure of 50cmH_2O

Keep it for 1 minute (15 respiratory cycles)



After completing the maximum alveolar recruitment maneuver, IMMEDIATELY start PEEP titration as described in the section "**ART STRATEGY - PEEP TITRATION**"

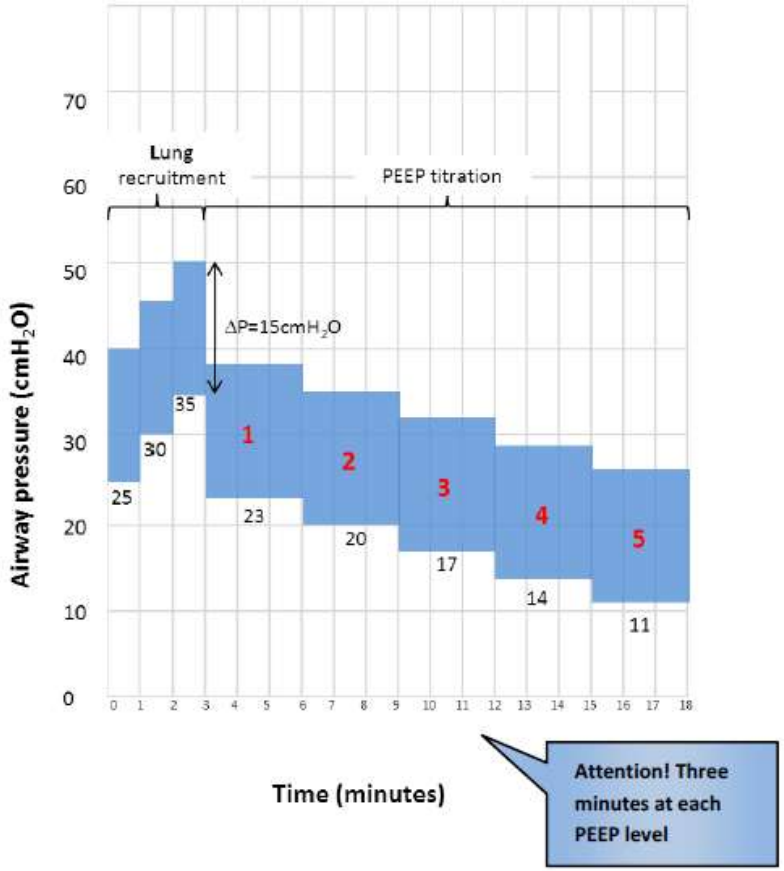
Opakované vystavení manévru i u nonresponderů!

ART STRATEGY - PEEP TITRATION

Mechanical ventilation settings for PEEP Titration:

- Reduce PEEP to 23cmH_2O
- Tidal volume of 5mL/kg (predicted body weight)
- Respiratory rate of 20/min
- Change ventilatory mode to controlled volume (VCV)
- Flow 30L/min (square wave flow)
- Keep FiO_2 100%

3.



Dlouhodobě vysoké tlaky a expozice 100% O_2

ART STRATEGY - PEEP TITRATION

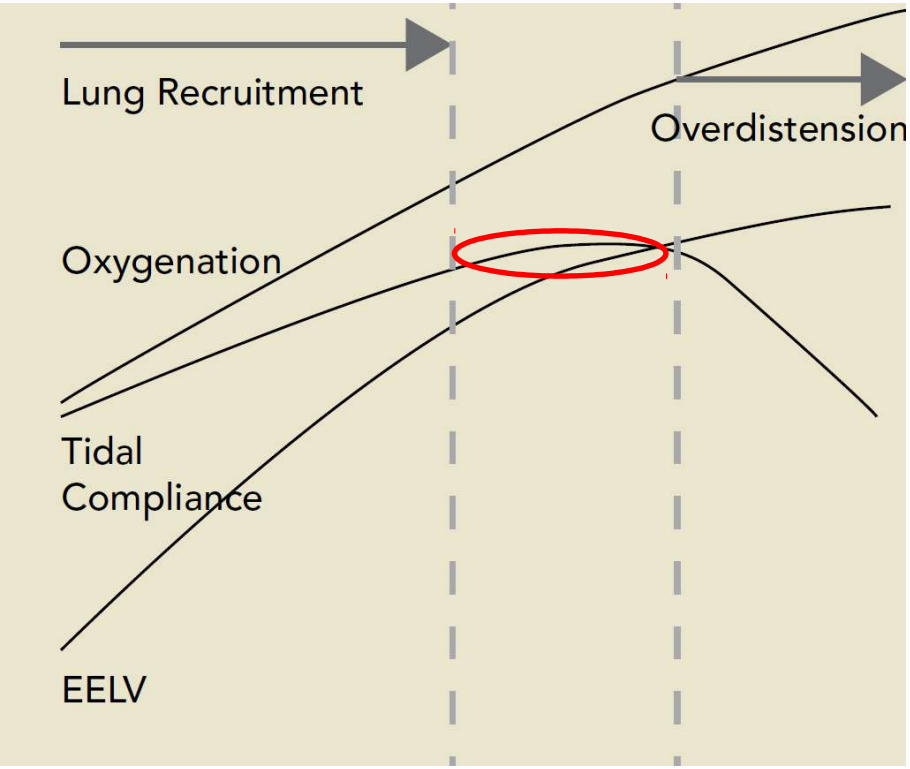
IMPORTANT

If compliance is decreased when PEEP is reduced (e.g., from 23cmH_2O to 20cmH_2O) and the decrease in compliance is maintained after the next PEEP decrement (from 20cmH_2O to 17cmH_2O), no further reduction in PEEP is required.

Compliance values showing difference of <1mL/cmH_2O are considered similar.

In some cases, compliance increases following PEEP decrements and reaches a plateau, that is, maximum value of compliance with difference <1mL/cmH_2O. In these cases, consider optimal PEEP as 2cmH_2O above the highest PEEP within the plateau range.

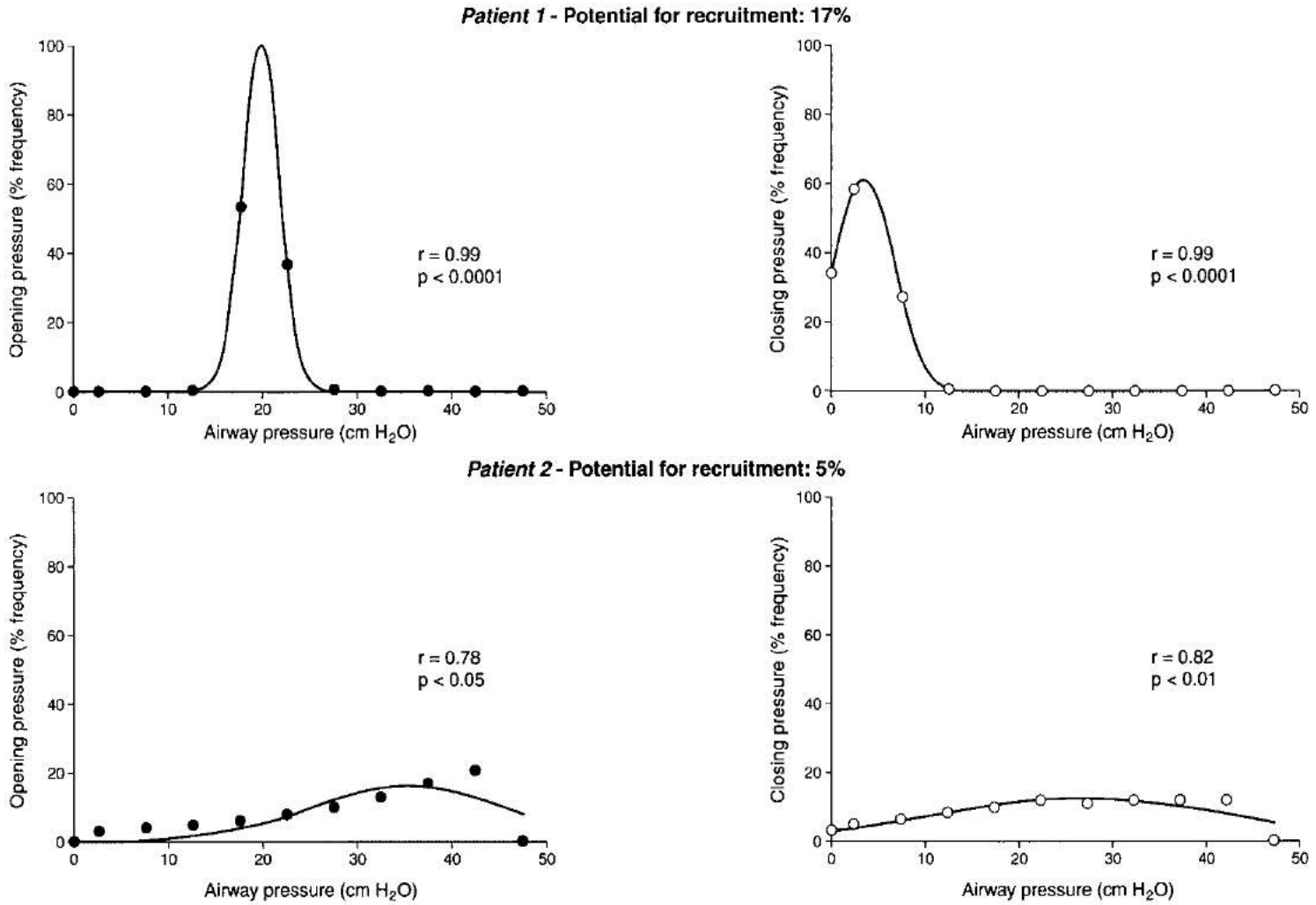
4.



PEEP v pásmu overdistenze

Adams A, Monitoring FRC in ventilated patiens, Critical Care Decisions

Recruitment a derecruitment

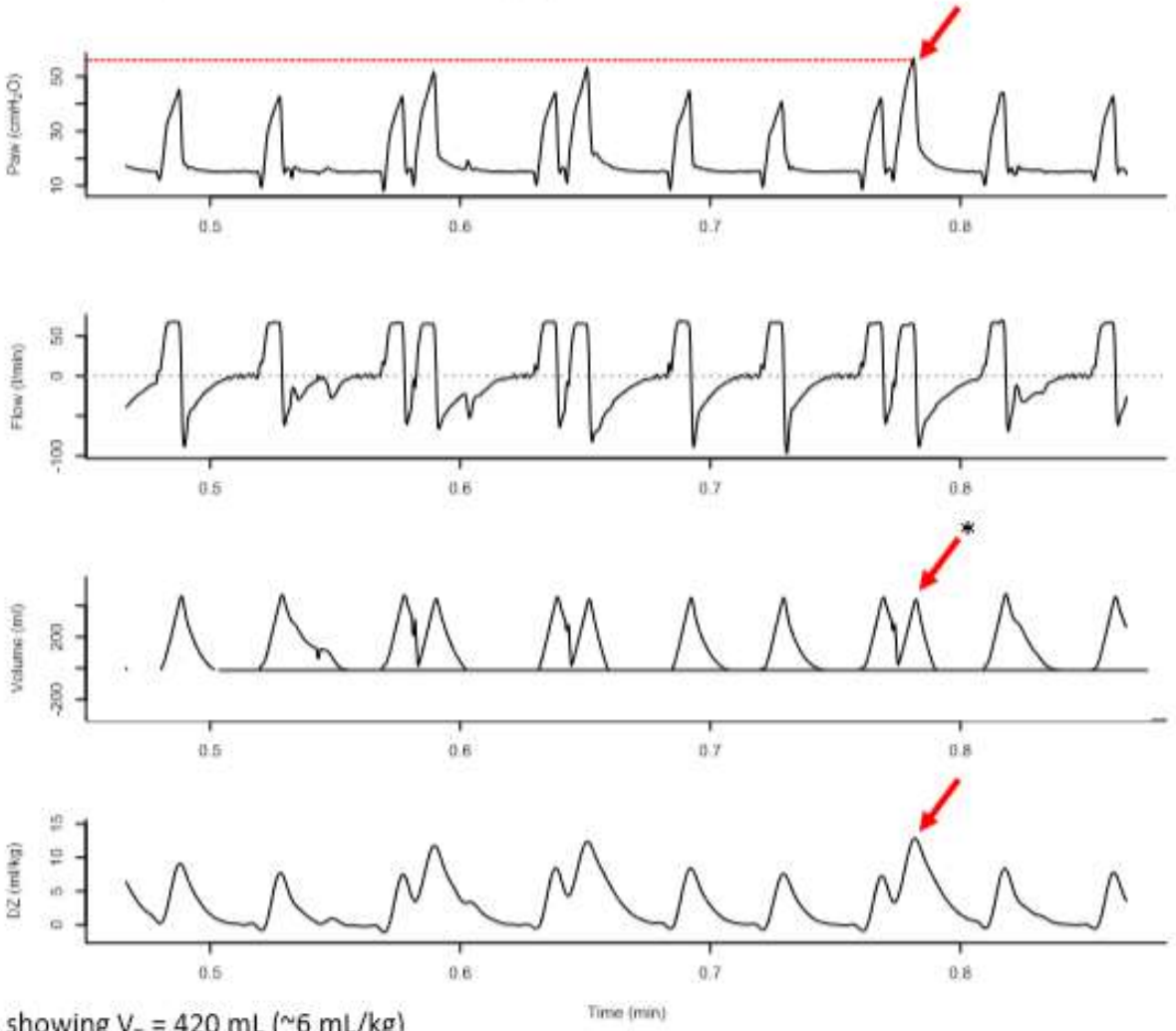


Crotti et al, AJRCCM, 2001, 164, 131-140

Patient enrolled: set V_T = 6 mL/kg – High PEEP (~16 cmH_2O)

Breath stacked breaths : V_T = 10-12 mL/kg and P_{PLAT} = 45cmH_2O (Peak ~ 55 cmH_2O)

5.

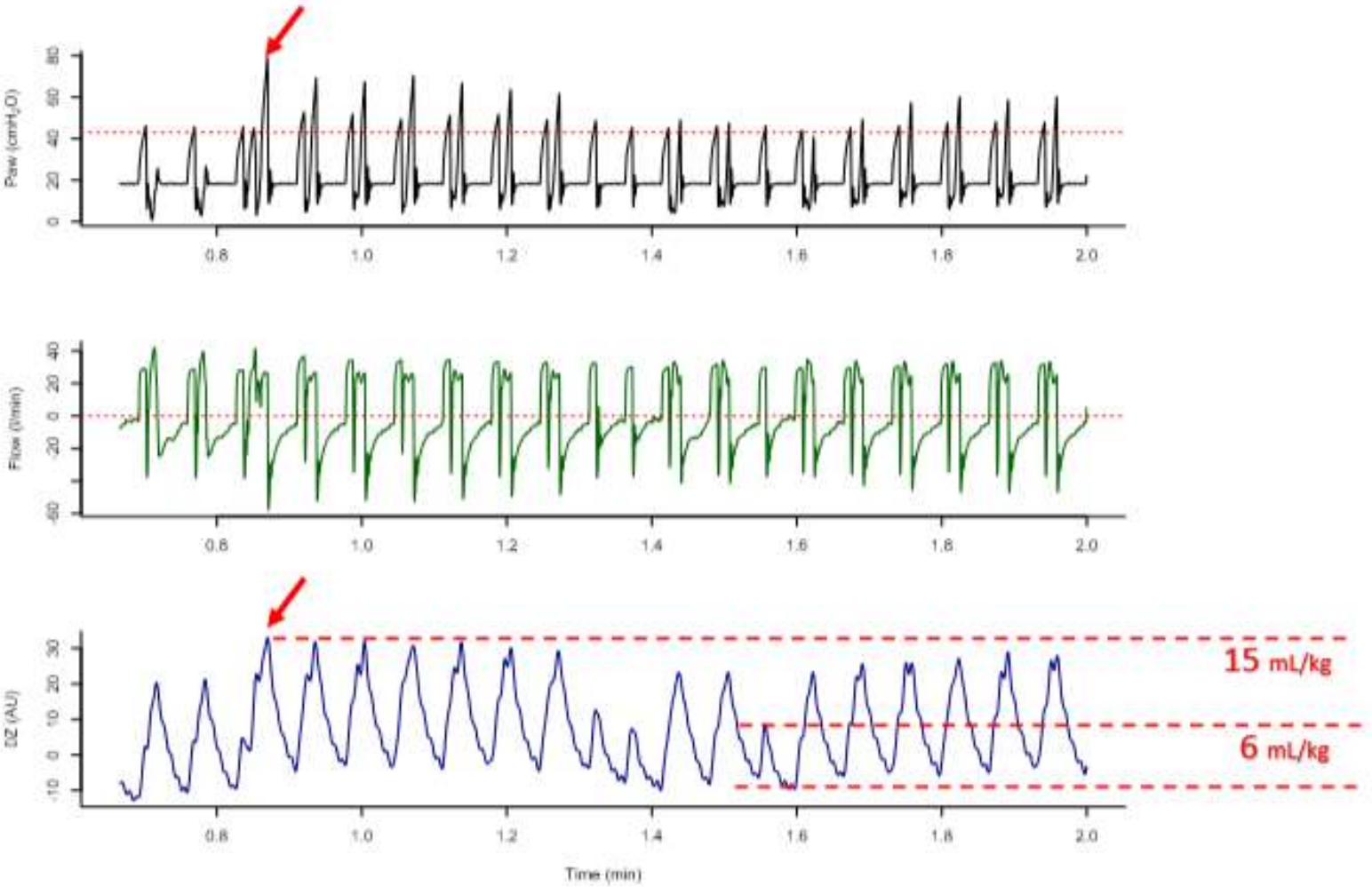


*: Ventilator display showing V_T = 420 mL (~6 mL/kg)

https://criticalcarecanada.com/presentations/2017/lung_recruitment_in_ards_the_art_trial.pdf

Patient ventilated with: V_T = 6 mL/kg – under High PEEP (~19 cmH_2O)

Breath stacked breaths generating V_T = 15 mL/kg and P_{PLAT} = 45-50 cmH_2O (Peak ~70 cmH_2O)

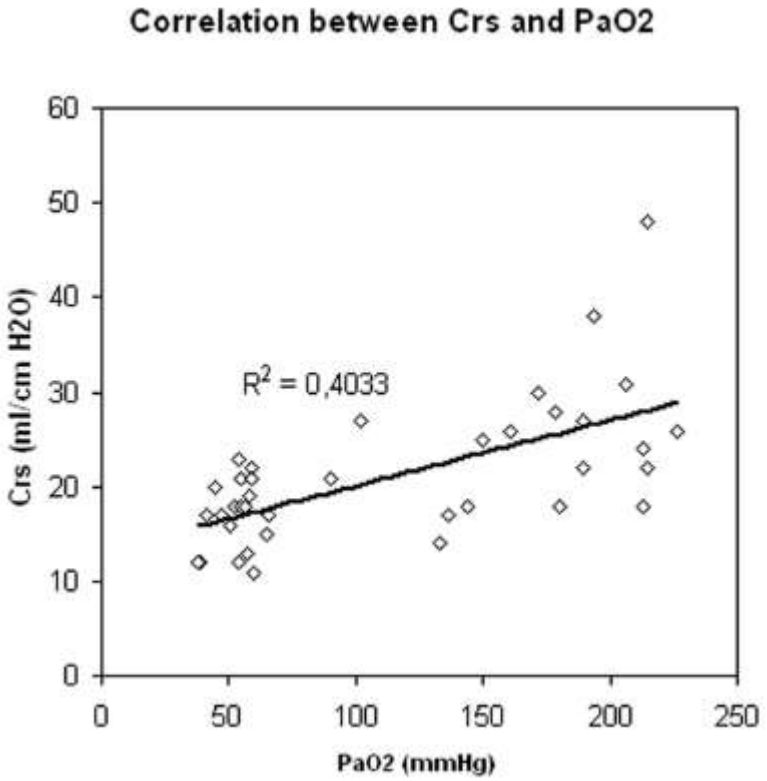


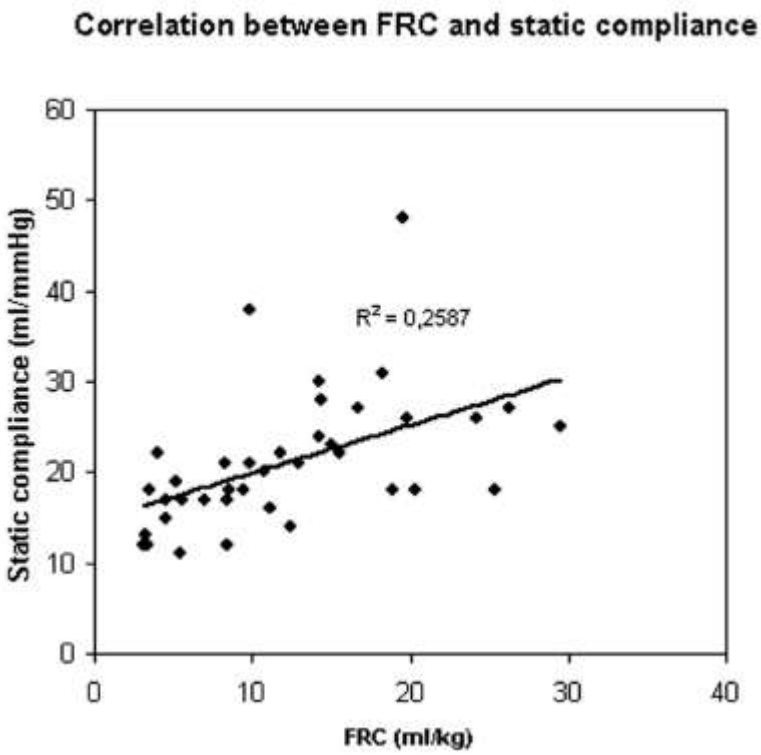
https://criticalcarecanada.com/presentations/2017/lung_recruitment_in_ards_the_art_trial.pdf

Limity postupů optimalizace podle mechanických vlastností respiračního systému

- Crs (Cdyn) ma pouze volný vztah k FRC/EELV
- PEEP s maximální Crs závisí na velikosti dechového objemu
- Plný recruitment a plná eliminace dechového recruitmentu nejsou při konvenční ventilaci u ARDS možné
- V některých situacích může být jiná priorita než „minimalizace dodávky energie“
  - Hemodynamika, oxygenace, eliminace CO_2
- „Nejlepší volba“ musí být hodnocena z pohledu poměru přínosu a rizika

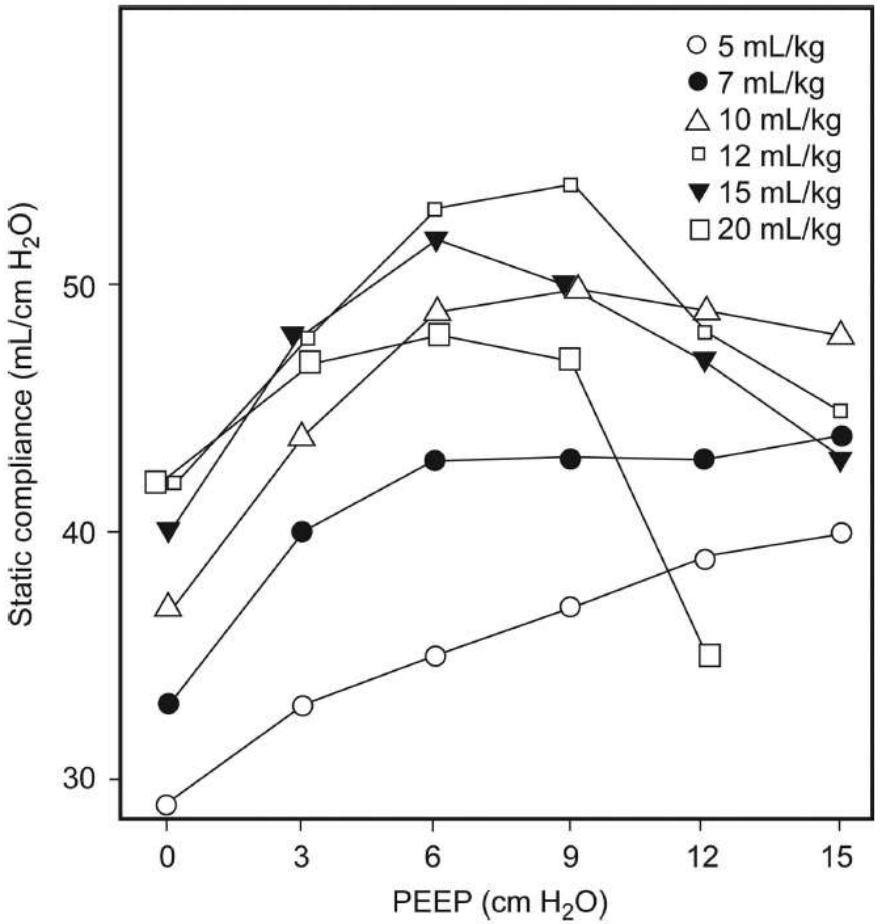
Vztah Crs, FRC a PaO_2





Critical Care 2008, **12**:R91 (doi:10.1186/cc6961)

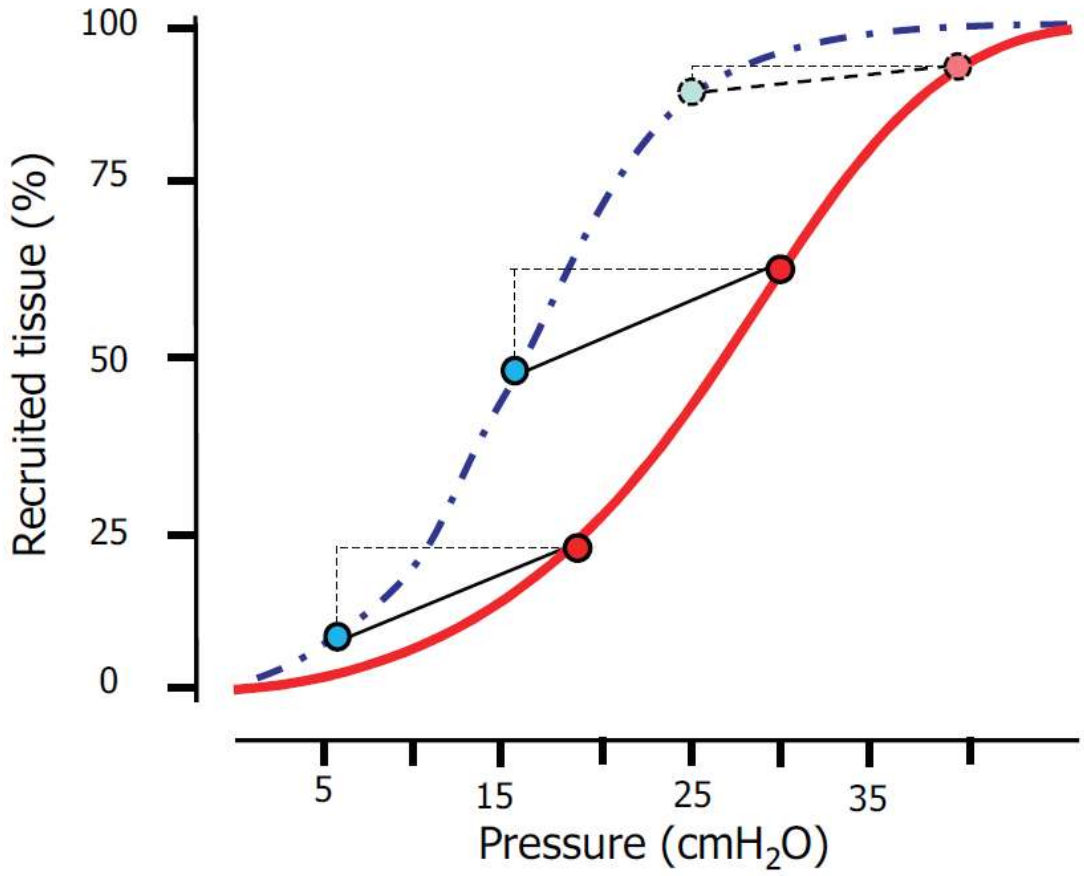
Vztah Crs a velikosti dechového objemu



Vliv endinspiračního objemu

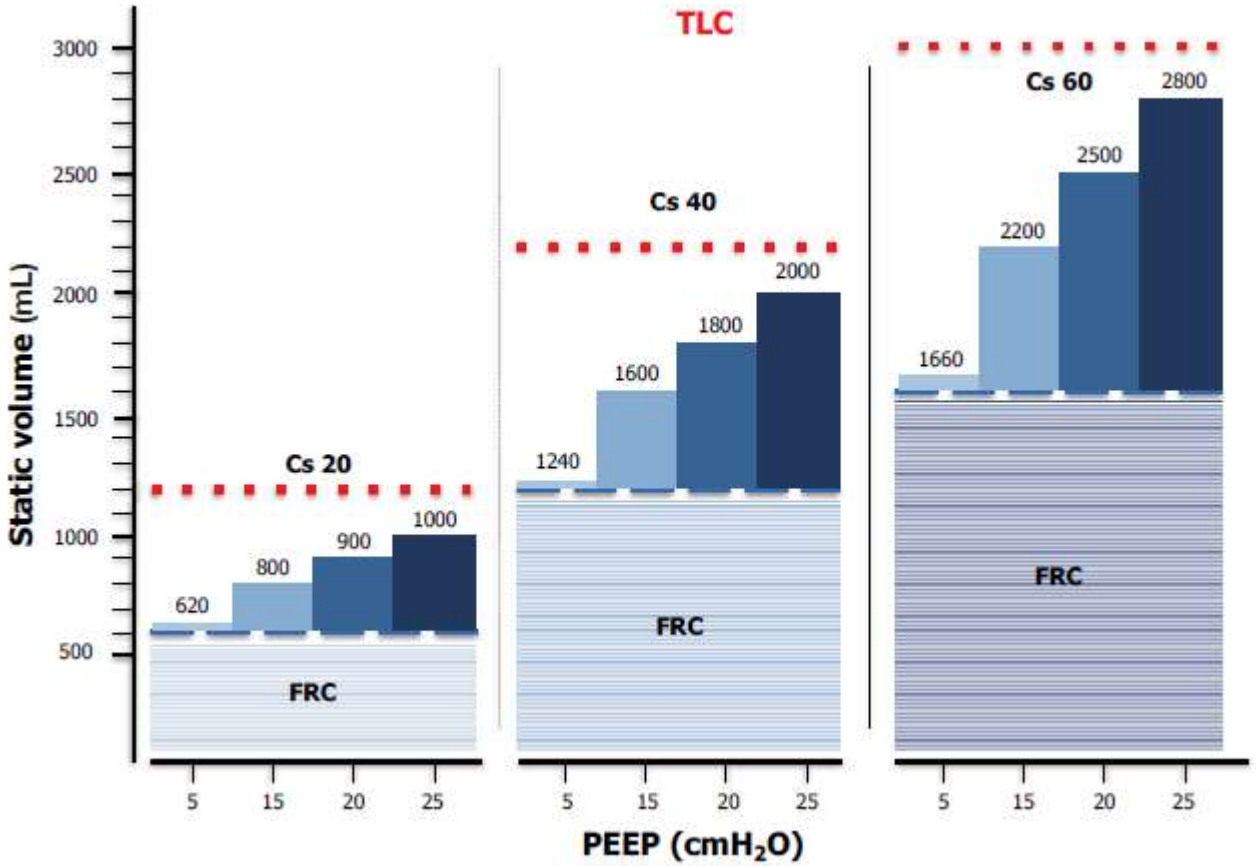
Respir Care 2016;61(6):876–890.

Vztah mezi provzdušněním a dechový recruitmentem



Ann Transl Med 2017;5(14):288

Riziko překročení TLC při zvýšení EELV po zařazení PEEP



Ann Transl Med 2017;5(14):288

Ventilace na vysokém plicním objemu

Měření TPP

- Univerzálně dostupné
- Znalosti limitů a cílů
- Nepřímé zjištění dynamického a statického strainu při znalosti specifické plicní elastance cca 13 cm

Měření EELV/FRC

- Vyžaduje speciální technologie
- Znalosti limitů a cílů
- Přímé měření strainu
- Širší potenciální využití

Zjištění „overdistenze“

- Zobrazovací metody (CT, EIT)
- Eliminace CO_2 (volumetrická kapnometrie, VD/VT)
- Pokles Crs
- Změna Crs v průběhu dechového cyklu

- Overdistension index C20/Cdyn < 0.8

Poměr přínos vs riziko

- PEEP 12 cm H_2O
- FiO_2 0,6
- TV 350 ml
- DP 14 cm H_2O, Ppl 26 cm H_2O,
- SpO_2 90%

- PEEP 16 cm H_2O
- FiO_2 0,6
- TV 350 ml
- DP 14 cm H_2O, Ppl 30 cm H_2O
- SpO_2 91%

Závěry I

- „**Plné otevření plic**“ není reálně možné (u nemocných s ARDS), nebyla by možná konveční ventilace
- **Plná eliminace dechového recruitmentu** není reálně možná (u nemocných s ARDS)
- Ventilace „v blízkosti“ TLC je vždy vysoce riziková a zajištění bezpečnosti vyžaduje rozšířené monitorování stressu nebo strainu
- Konkrétní nastavení je vždy kompromis mezi cíly (otevření plíce atd), rizikem (stress a strain) a tolerancí nemocného

Závěry II

- V platnosti nadále zůstává:
  - Ventilace s nejnižším tlakovým gradientem na NEJNIŽŠÍ možné úrovni PEEP (s určitou rezervou)
  - Otevření plíce, přináší-li zjevný a klinicky relevantní benefit
    - Driving pressure, oxygence, eliminace CO_2.
  - Využití PCV při ventilaci na vysokých plicních objemech
    - Rizikovost dvojitého triggerování

Přijměte pozvání na workshop!

IV. ročník

Akademie umělé plicní ventilace ČSIM

Hradec Králové, Hotel Tereziánský dvůr

17.-18.4.2018

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Česká Společnost
Intenzivní Medicíny

Děkuji za pozornost

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