22° Annual Meeting
Firenze, 25/26 Settembre 2019
Tuscany
Critical Care Group

Ventilazione protettiva: istruzioni per l'uso

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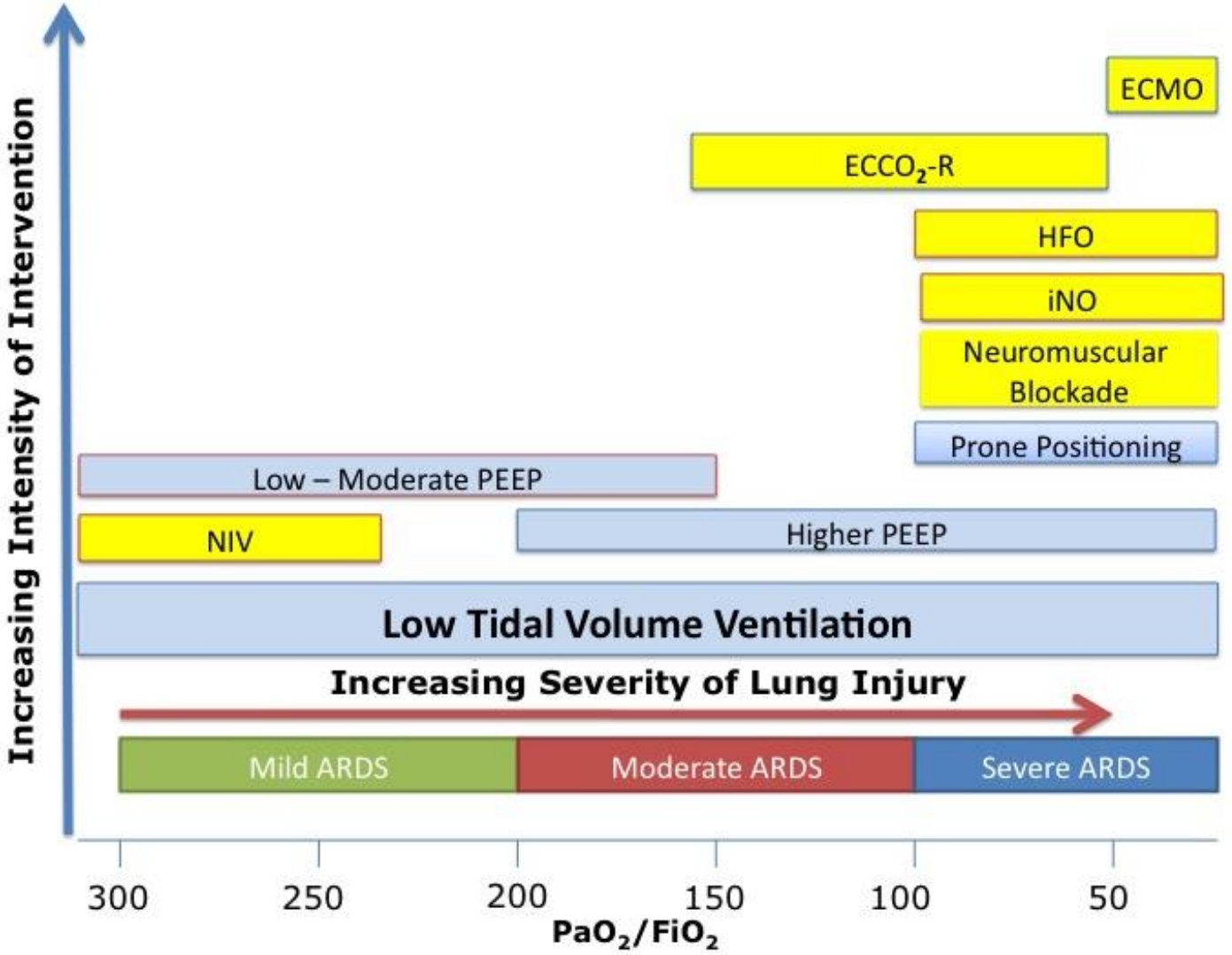
Conflicts of interest

- Draeger Medical
- GE Healthcare

Therapeutic options according to ARDS severity



Ferguson ND, et al. Intensive Care Med 2012; 38:1573-82

Guideline for mechanical ventilation in ARDS

AMERICAN THORACIC SOCIETY DOCUMENTS

An Official American Thoracic Society/European Society of Intensive Care Medicine/Society of Critical Care Medicine Clinical Practice Guideline: Mechanical Ventilation in Adult Patients with Acute Respiratory Distress Syndrome

Eddy Fan, Lorenzo Del Sorbo, Ewan C. Goligher, Carol L. Hodgson, Laveena Munshi, Allan J. Walkey, Neill K. J. Adhikari, Marcelo B. P. Amato, Richard Branson, Roy G. Brower, Niall D. Ferguson, Ognjen Gajic, Luciano Gattinoni, Dean Hess, Jordi Mancebo, Maureen O. Meade, Daniel F. McAuley, Antonio Pesenti, V. Marco Ranieri, Gordon D. Rubenfeld, Eileen Rubin, Maureen Seckel, Arthur S. Slutsky, Daniel Talmor, B. Taylor Thompson, Hannah Wunsch, Elizabeth Uleryk, Jan Brozek, and Laurent J. Brochard; on behalf of the American Thoracic Society, European Society of Intensive Care Medicine, and Society of Critical Care Medicine

This official clinical practice guideline of the American Thoracic Society (ATS), European Society of Intensive Care Medicine (ESICM), and Society of Critical Care Medicine (SCCM) was approved by the ATS, ESICM, and SCCM, March 2017

Background: This document provides evidence-based clinical practice guidelines on the use of mechanical ventilation in adult patients with acute respiratory distress syndrome (ARDS).

Methods: A multidisciplinary panel conducted systematic reviews and metaanalyses of the relevant research and applied Grading of Recommendations, Assessment, Development, and Evaluation methodology for clinical recommendations.

Results: For all patients with ARDS, the recommendation is strong for mechanical ventilation using lower tidal volumes (4–8 ml/kg predicted body weight) and lower inspiratory pressures (plateau pressure < 30 cm H_2O) (moderate confidence in effect estimates). For patients with severe ARDS, the recommendation is strong for prone positioning for more than 12 h/d (moderate confidence in effect estimates). For patients with moderate or severe ARDS, the recommendation is strong against routine use of high-frequency oscillatory ventilation (high confidence in effect estimates) and conditional for higher positive end-expiratory pressure (moderate confidence in effect estimates) and recruitment maneuvers (low confidence in effect estimates). Additional evidence is necessary to make a definitive recommendation for or against the use of extracorporeal membrane oxygenation in patients with severe ARDS.

Conclusions: The panel formulated and provided the rationale for recommendations on selected ventilatory interventions for adult patients with ARDS. Clinicians managing patients with ARDS should personalize decisions for their patients, particularly regarding the conditional recommendations in this guideline.

Fan E et al. Am J Respir Crit Care Med 2017;195:1253-1263

Protective ventilation in ARDS

An Official American Thoracic Society/European Society of Intensive Care Medicine/Society of Critical Care Medicine Clinical Practice Guideline: Mechanical Ventilation in Adult Patients with Acute Respiratory Distress Syndrome

Eddy Fan, Lorenzo Del Sorbo, Ewan C. Goligher, Carol L. Hodgson, Laveena Munshi, Allan J. Walkey, Neill K. J. Adhikari, Marcelo B. P. Amato, Richard Branson, Roy G. Brower, Niall D. Ferguson, Ognjen Gajic, Luciano Gattinoni, Dean Hess, Jordi Mancebo, Maureen O. Meade, Daniel F. McAuley, Antonio Pesenti, V. Marco Ranieri, Gordon D. Rubenfeld, Eileen Rubin, Maureen Seckel, Arthur S. Slutsky, Daniel Talmor, B. Taylor Thompson, Hannah Wunsch, Elizabeth Uleryk, Jan Brozek, and Laurent J. Brochard; on behalf of the American Thoracic Society, European Society of Intensive Care Medicine, and Society of Critical Care Medicine

THIS OFFICIAL CLINICAL PRACTICE GUIDELINE OF THE AMERICAN THORACIC SOCIETY (ATS), EUROPEAN SOCIETY OF INTENSIVE CARE MEDICINE (ESICM), AND SOCIETY OF CRITICAL CARE MEDICINE (SCCM) WAS APPROVED BY THE ATS, ESICM, AND SCCM, MARCH 2017

Strong recommendations FOR:

1. Low Vt (4-8 ml/kg PBW) and low Pplat (<30 cmH2O)
2. Prone position in severe ARDS (>12 h/day)

Conditional recommendations FOR:

1. Higher PEEP in moderate-severe ARDS
2. Recruitment maneuvers in moderate-severe ARDS

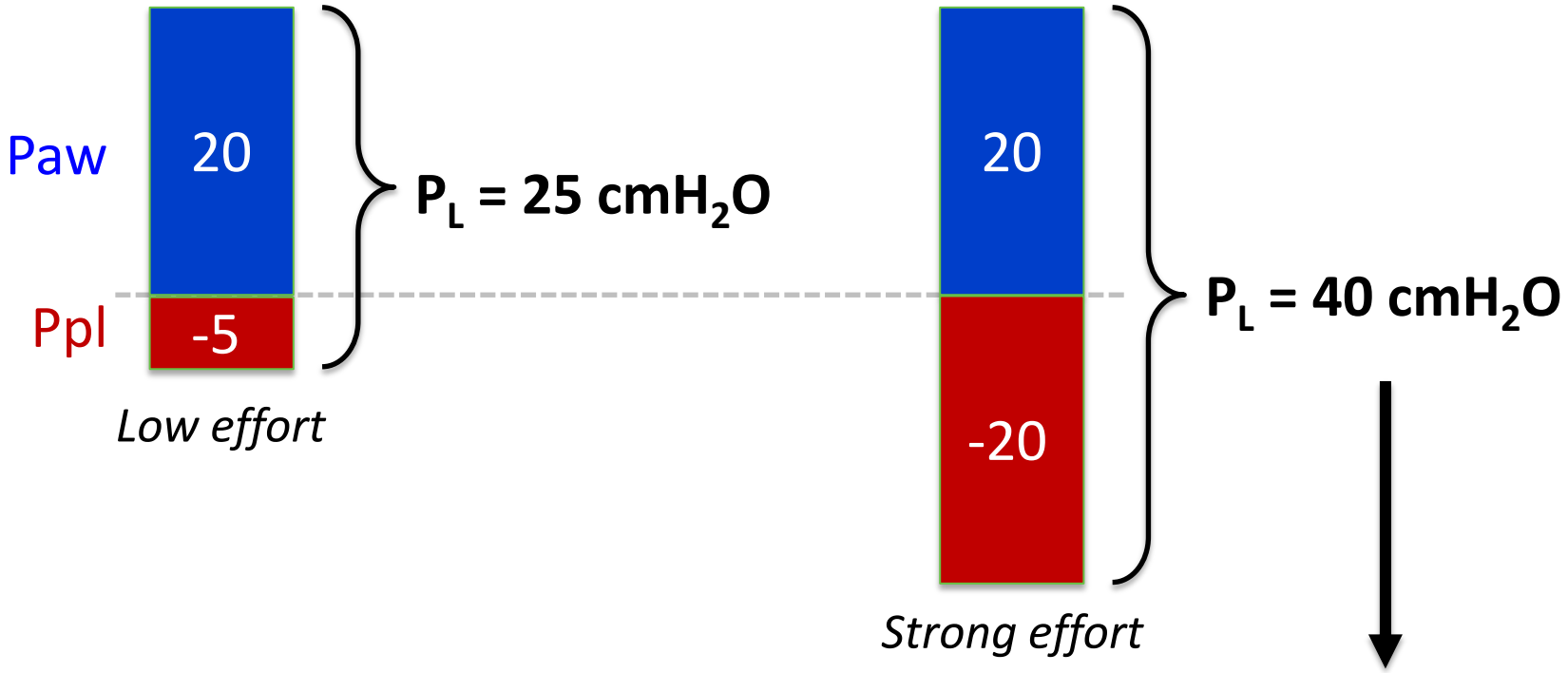
Fan E et al. Am J Respir Crit Care Med 2017;195:1253-1263

Should patients be paralyzed or kept breathing spontaneously?

Mechanisms of VILI: role of transpulmonary pressure (P_L)

$$P_L = Paw - Ppl$$

(ventilator) *(muscles)*

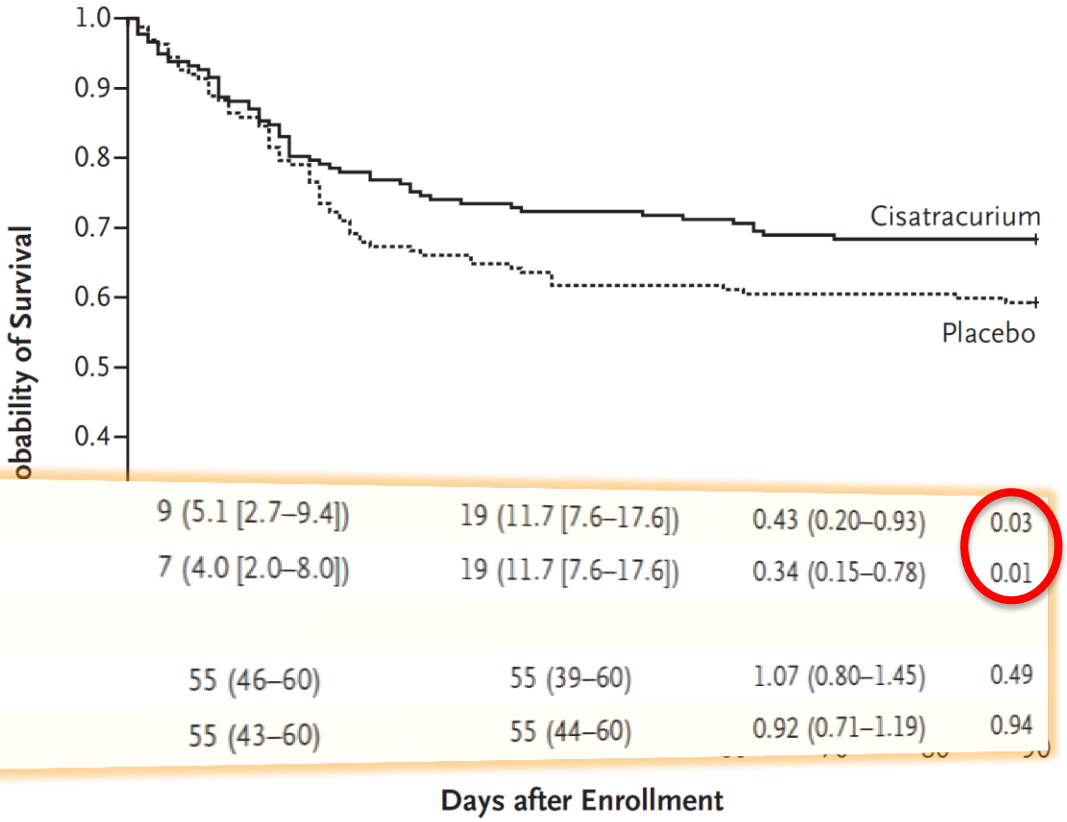


Paralysis may improve outcome in early, severe ARDS

Neuromuscular Blockers in Early Acute Respiratory Distress Syndrome

Laurent Papazian, M.D., Ph.D., Jean-Marie Forel, M.D., Arnaud Gacouin, M.D., Christine Penot-Ragon, Pharm.D., Gilles Perrin, M.D., Anderson Loundou, Ph.D., Samir Jaber, M.D., Ph.D., Jean-Michel Arnal, M.D., Didier Perez, M.D., Jean-Marie Seghboyan, M.D., Jean-Michel Constantin, M.D., Ph.D., Pierre Courant, M.D., Jean-Yves Lefrant, M.D., Ph.D., Claude Guérin, M.D., Ph.D., Gwenaël Prat, M.D., Sophie Morange, M.D., and Antoine Roch, M.D., Ph.D., for the ACURASYS Study Investigators*

- Multicenter, double-blind, RCT
- 340 pts with severe, early ARDS
- NMBA infusion for 48h (n=178) vs placebo (n=162)



Barotrauma — no. (% [95% CI])‡	9 (5.1 [2.7–9.4])	19 (11.7 [7.6–17.6])	0.43 (0.20–0.93)	0.03
Pneumothorax — no. (% [95% CI])	7 (4.0 [2.0–8.0])	19 (11.7 [7.6–17.6])	0.34 (0.15–0.78)	0.01
MRC score — median (IQR)§				
At day 28	55 (46–60)	55 (39–60)	1.07 (0.80–1.45)	0.49
At ICU discharge	55 (43–60)	55 (44–60)	0.92 (0.71–1.19)	0.94

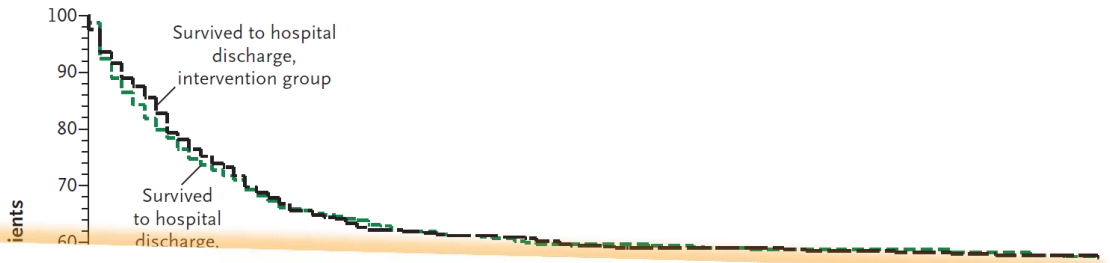
Papazian L, et al. NEJM 2010;363 (12):1107-1116

Paralysis does not improve outcome in early, severe ARDS

Early Neuromuscular Blockade in the Acute Respiratory Distress Syndrome

The National Heart, Lung, and Blood Institute PETAL Clinical Trials Network*

- Multicenter, RCT (1408 pts planned)
- **1006 pts with moderate-severe ARDS** (P/F<150 with PEEP 8), in the ea[illegible] ***[premature stop]***
- N[illegible]
48[illegible]
(n=[illegible]
- **P[illegible]**
m[illegible]



Serious adverse events — no. of events**	35	22	0.09
Serious cardiovascular adverse events — no. of events**	14	4	0.02
Atrial fibrillation or SVT during ICU stay — no. (%)	101 (20.2)	99 (19.6)	0.88
Barotrauma — no. (%)	20 (4.0)	32 (6.3)	0.12
Pneumothorax on days 0 through 2 — no. (%)	8 (1.6)	10 (2.0)	0.81
Pneumothorax on days 0 through 7 — no. (%)	14 (2.8)	25 (5.0)	0.10

National Heart, Lung, and Blood Institute PETAL Clinical Trials Network. NEJM 2019;380:1997-2008

Acurasys vs. Rose-Petal: comparison of ventilatory settings

Neuromuscular Blockers in Early Acute Respiratory Distress Syndrome

Laurent Papazian, M.D., Ph.D., Jean-Marie Forel, M.D., Arnaud Gacouin, M.D., Christine Penot-Ragon, Pharm.D., Gilles Perrin, M.D., Anderson Loundou, Ph.D., Samir Jaber, M.D., Ph.D., Jean-Michel Arnal, M.D., Didier Perez, M.D., Jean-Marie Seghboyan, M.D., Jean-Michel Constantin, M.D., Ph.D., Pierre Courant, M.D., Jean-Yves Lefrant, M.D., Ph.D., Claude Guérin, M.D., Ph.D., Gwenaël Prat, M.D., Sophie Morange, M.D., and Antoine Roch, M.D., Ph.D., for the ACURASYS Study Investigators*

Early Neuromuscular Blockade in the Acute Respiratory Distress Syndrome

The National Heart, Lung, and Blood Institute PETAL Clinical Trials Network*

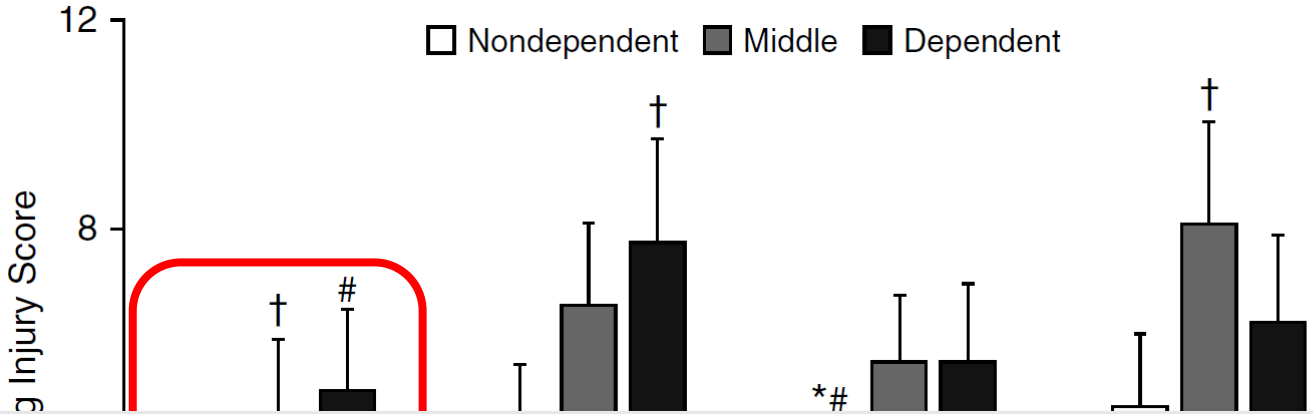
	ACURASYS 2010	ROSE-PETAL 2019
PaO2/FiO2	110.5	99.1
FiO2	78%	80%
Vt	6.5 ml/kg	6.3 ml/kg
PEEP	**Low (9.2 cmH2O)**	**High (12.5 cmH2O)**
Plateau pressure	24.7 cmH2O	25.6 cmH2O
Sedation control/intervention	**Deep**	**Light/Deep**

Higher PEEP decreases lung injury during SB

High Positive End-Expiratory Pressure Renders Spontaneous Effort Noninjurious

Caio C. A. Morais[1*], Yukiko Koyama[2*], Takeshi Yoshida[2,3*], Glauco M. Plens[1], Susimeire Gomes[1], Cristhiano A. S. Lima[1], Ozires P. S. Ramos[1], Sérgio M. Pereira[1], Naomasa Kawaguchi[4], Hirofumi Yamamoto[4], Akinori Uchiyama[2], João B. Borges[5], Marcos F. Vidal Melo[6], Mauro R. Tucci[1], Marcelo B. P. Amato[1], Brian P. Kavanagh[3],

- Research protocol in animals (rabbit, pig), observational data in ARDS patients
- High vs. low PEEP with and without spontaneous breathing (i.e., paralysis)

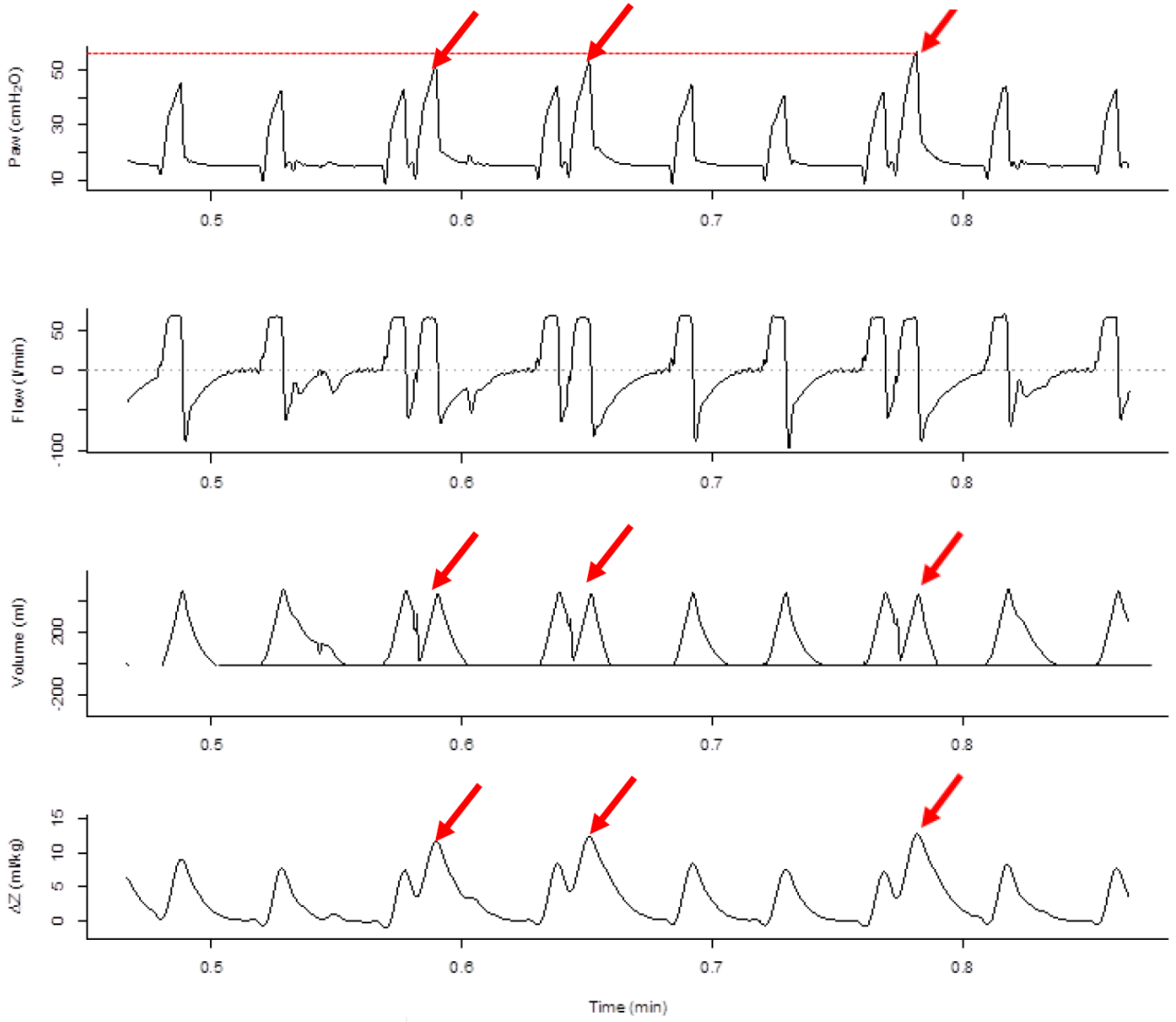


Conclusions: Strong effort increased dependent lung injury, where higher local lung stress and stretch was generated; effort-dependent lung injury was minimized by high PEEP in severe ARDS, which may offset need for paralysis.

Morais CCA et al. AJRCCM 2018;197:1285–1296

Any risk from low volume ventilation?

Low Vt promotes dyssynchrony



Cavalcanti AB et al. JAMA 2017; 318:1335-1345

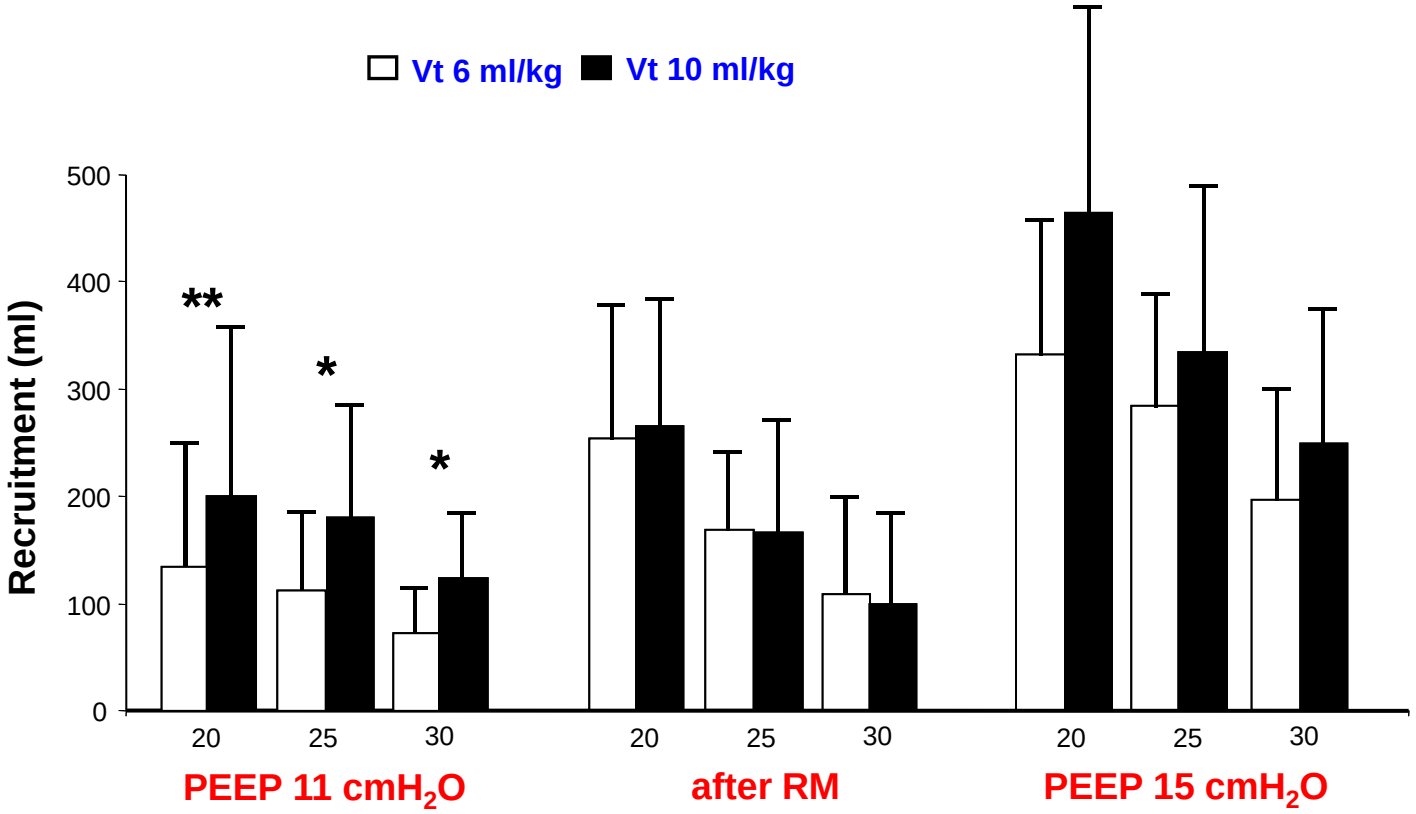
Low Vt causes lung derecruitment

Influence of Tidal Volume on Alveolar Recruitment

Respective Role of PEEP and a Recruitment Maneuver

JEAN-CHRISTOPHE RICHARD, SALVATORE M. MAGGIORE, BJORN JONSON, JORDI MANCEBO, FRANCOIS LEMAIRE, and LAURENT BROCHARD

Medical Intensive Care Unit and INSERM U 492, Henri Mondor Hospital, University Paris XII, Créteil, France



Richard JC, Maggiore SM et al. AJRCCM 2001;163:1609

Should we maximize lung recruitment?

Aggressive open lung approach increases mortality

JAMA | Original Investigation | CARING FOR THE CRITICALLY ILL PATIENT

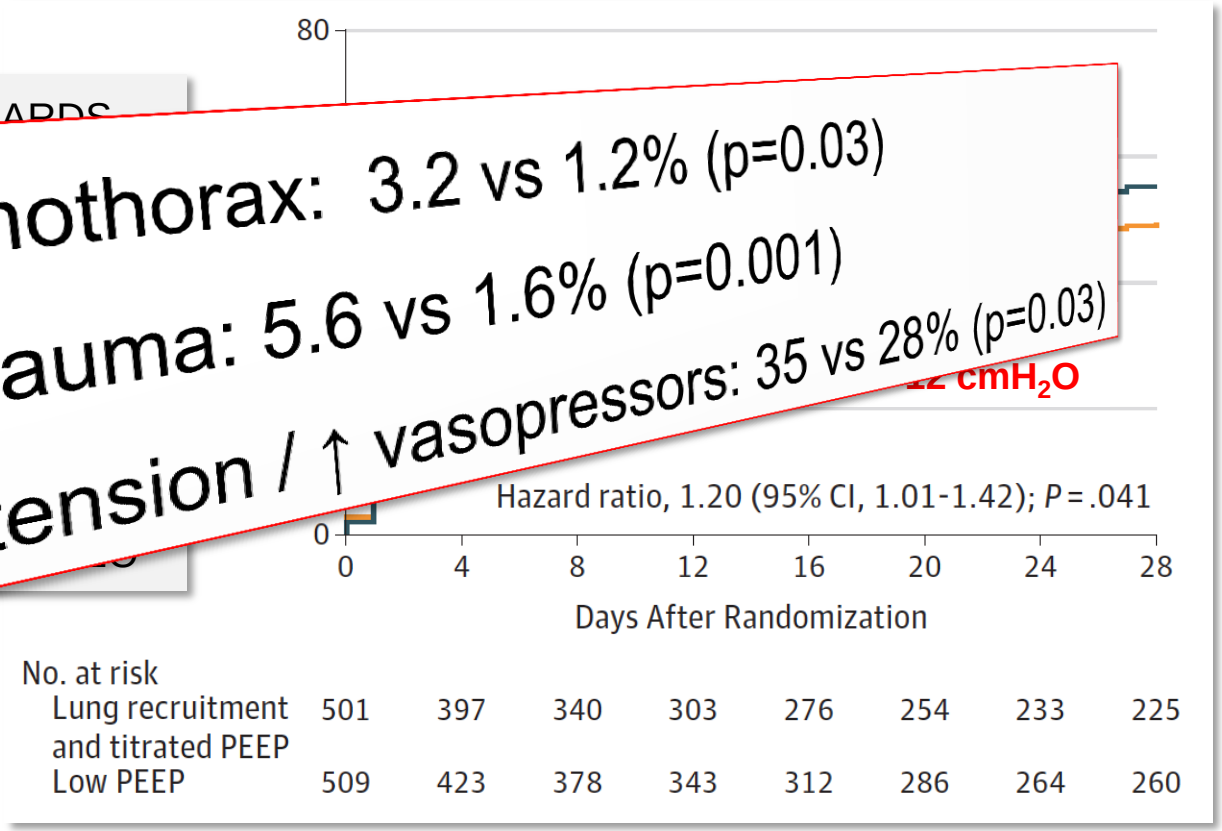
Effect of Lung Recruitment and Titrated Positive End-Expiratory Pressure (PEEP) vs Low PEEP on Mortality in Patients With Acute Respiratory Distress Syndrome

A Randomized Clinical Trial

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

- 1010 pts with moderate-severe ARDS
  (mean
- Low V
- Groups
  2) RM +
  (i.e., the
- **RM of 18**
- Highest n

- **Pneumothorax: 3.2 vs 1.2% (p=0.03)**
- **Barotrauma: 5.6 vs 1.6% (p=0.001)**
- **Hypotension / ↑ vasopressors: 35 vs 28% (p=0.03)**



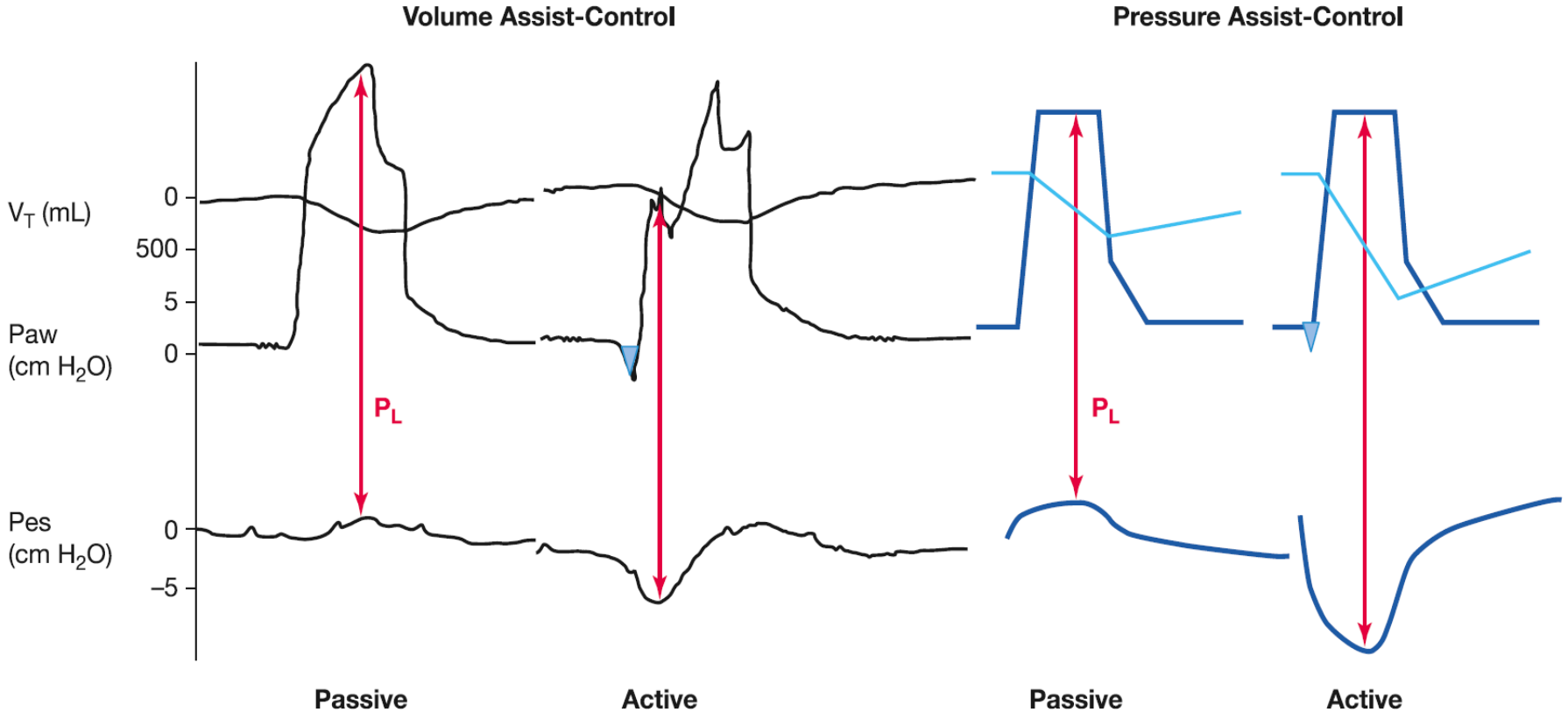
Cavalcanti AB et al. JAMA 2017; 318:1335-1345

Which strategy for PEEP setting?

Esophageal pressure to assess P_L

The Application of Esophageal Pressure Measurement in Patients with Respiratory Failure

Evangelia Akoumianaki[1], Salvatore M. Maggiore[2], Franco Valenza[3], Giacomo Bellani[4], Amal Jubran[5], Stephen H. Loring[6], Paolo Pelosi[7], Daniel Talmor[6], Salvatore Grasso[8], Davide Chiumello[9], Claude Guérin[10], Nicolo Patroniti[4], V. Marco Ranieri[11], Luciano Gattinoni[12], Stefano Nava[13], Pietro-Paolo Terragni[11], Antonio Pesenti[4], Martin Tobin[5], Jordi Mancebo[14], and Laurent Brochard[15]



Akoumianaki E, Maggiore SM et al. Am J Respir Crit Care Med 2014;189:520-531

Esophageal pressure to guide PEEP setting

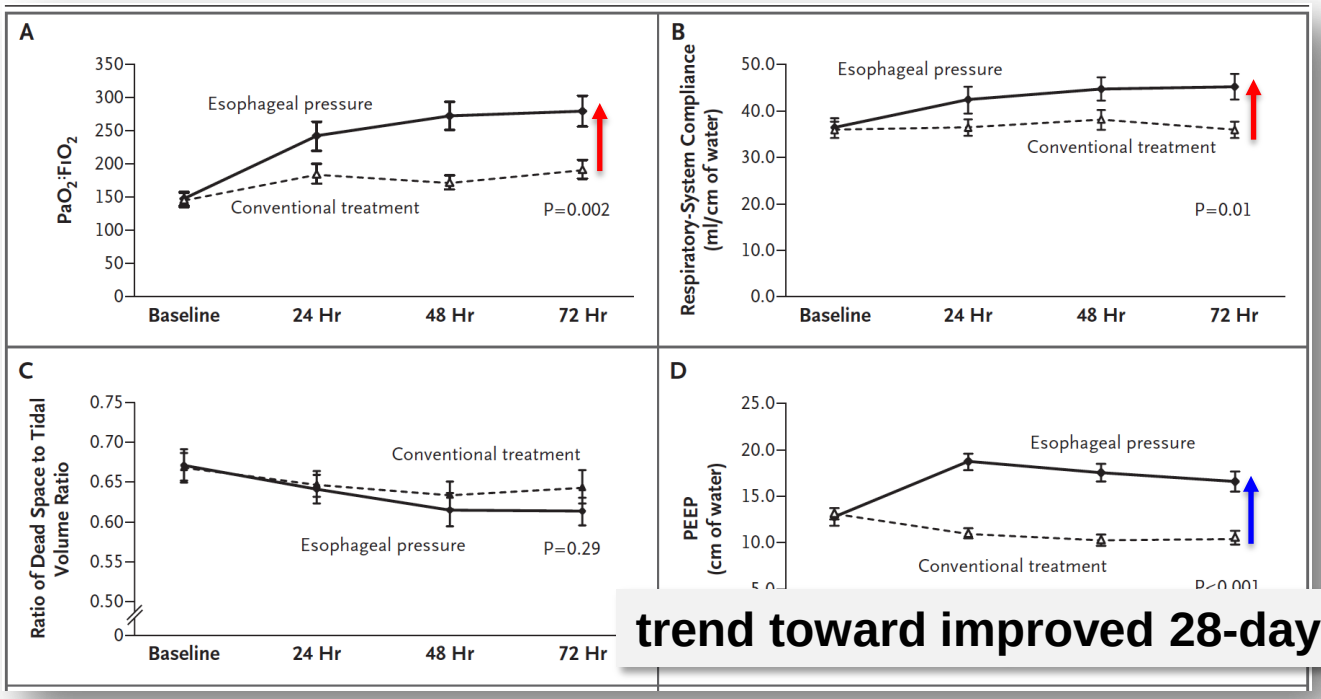
The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 NOVEMBER 13, 2008 VOL. 359 NO. 20

Mechanical Ventilation Guided by Esophageal Pressure in Acute Lung Injury

Daniel Talmor, M.D., M.P.H., Todd Sarge, M.D., Atul Malhotra, M.D., Carl R. O'Donnell, Sc.D., M.P.H., Ray Ritz, R.R.T., Alan Lisbon, M.D., Victor Novack, M.D., Ph.D., and Stephen H. Loring, M.D.

PEEP set to **0<$P_L$exp<10** cmH2O and **$P_L$insp<25** cmH2O



trend toward improved 28-day survival

Talmor D et al. NEJM 2008;359:2095-2104

Effect of a PEEP strategy according to P_L,exp

JAMA | Original Investigation | CARING FOR THE CRITICALLY ILL PATIENT

Effect of Titrating Positive End-Expiratory Pressure (PEEP) With an Esophageal Pressure–Guided Strategy vs an Empirical High PEEP-FIO_2 Strategy on Death and Days Free From Mechanical Ventilation Among Patients With Acute Respiratory Distress Syndrome

A Randomized Clinical Trial

Goal oxygenation	PaO_2: 55-80 mm Hg or SpO_2: 88%-93%		PaO_2: 55-80 mm Hg or SpO_2: 88%-93%	
Allowable combinations of FIO_2 and either end-expiratory P_L or PEEP to attain goal oxygenation[a]	FIO_2	P_L, cm H_2O	FIO_2	PEEP, cm H_2O
	0.3	0	0.3	5
	0.4	0	0.3	8
	0.5	0	0.3	10
	0.5	2	0.4	10
	0.6	2	0.4	12
	0.6	3	0.4	14
	0.7	3	0.4	16
	0.7	4	0.4	18
	0.8	4	0.5	18
	0.8	5	0.5	20
	0.9	5	0.6	20
	0.9	6	0.7	20
	1.0	6	0.8	20
			0.8	22
			0.9	22
			1.0	22
			1.0	24

- 200 pts with moderate-severe ARDS (mean P/F 93)
- Low VT in all cases
- Groups: 1) PEEP set on PEEP-FiO2 table vs. 2) PEEP set on P_L (0-6 cmH2O)
- **Highest PEEP: 24 vs 36 cmH2O**

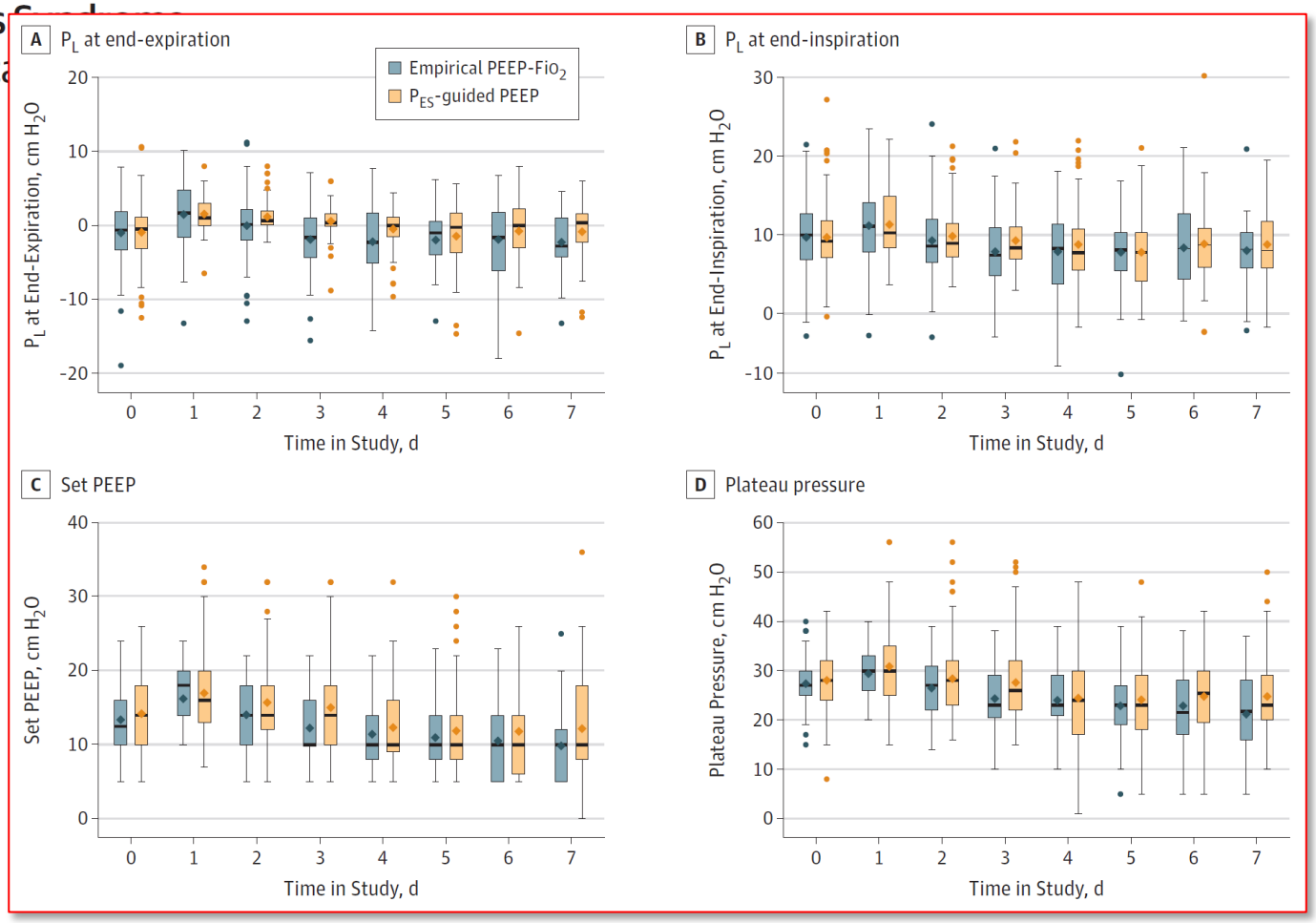
Beitler JR et al. JAMA 2019; doi:10.1001/jama.2019.0555 (published online February 18, 2019)

Effect of a PEEP strategy according to P_L,exp

JAMA | Original Investigation | CARING FOR THE CRITICALLY ILL PATIENT

Effect of Titrating Positive End-Expiratory Pressure (PEEP) With an Esophageal Pressure–Guided Strategy vs an Empirical High PEEP-FIO_2 Strategy on Death and Days Free From Mechanical Ventilation Among Patients With Acute Respiratory Distress

A Randomized Clinica



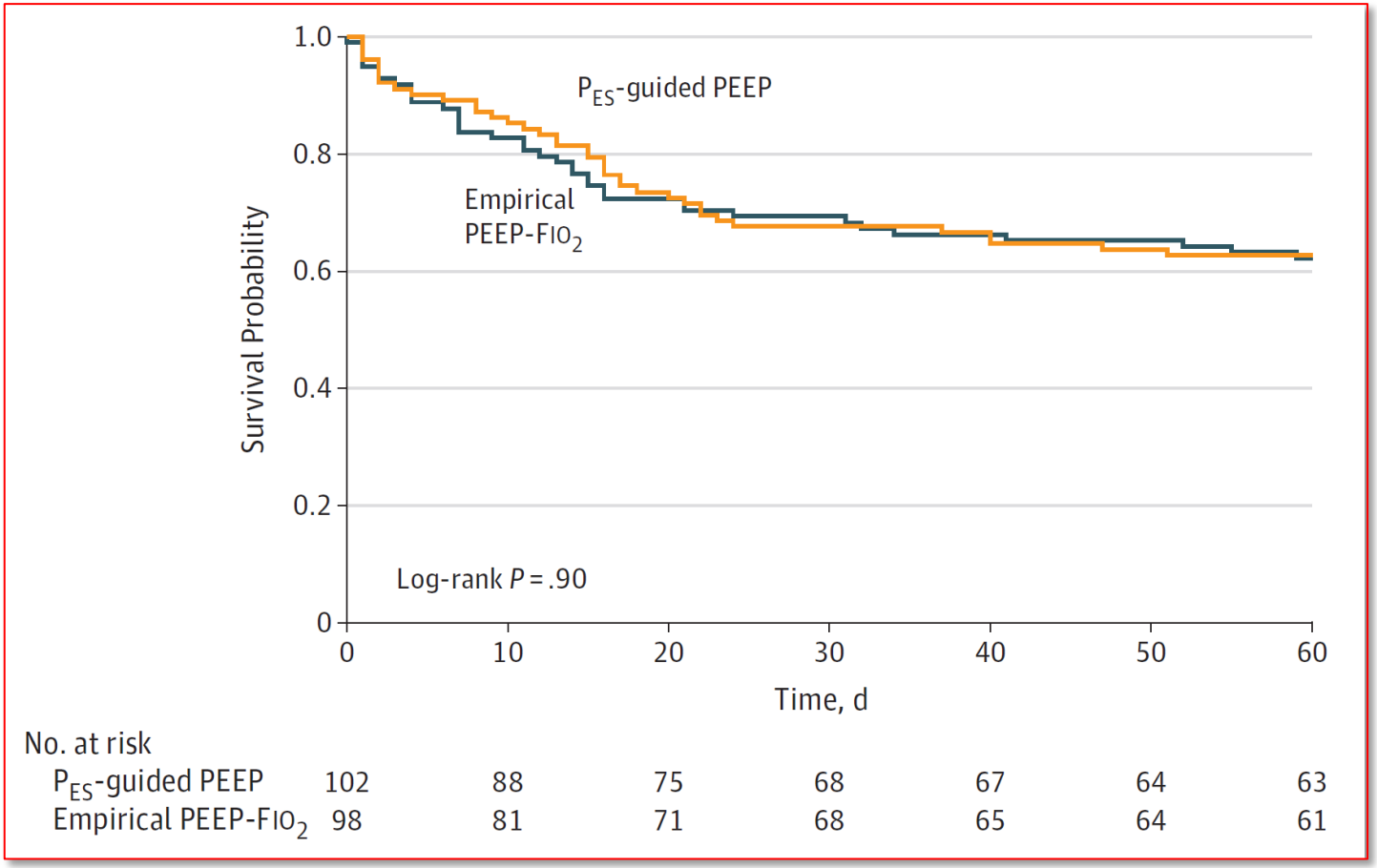
Beitler JR et al. JAMA 2019; doi:10.1001/jama.2019.0555 (published online February 18, 2019)

THIS PEEP strategy based on P_{eso} is not useful

JAMA | Original Investigation | CARING FOR THE CRITICALLY ILL PATIENT

Effect of Titrating Positive End-Expiratory Pressure (PEEP) With an Esophageal Pressure–Guided Strategy vs an Empirical High PEEP-FIO_2 Strategy on Death and Days Free From Mechanical Ventilation Among Patients With Acute Respiratory Distress Syndrome

A Randomized

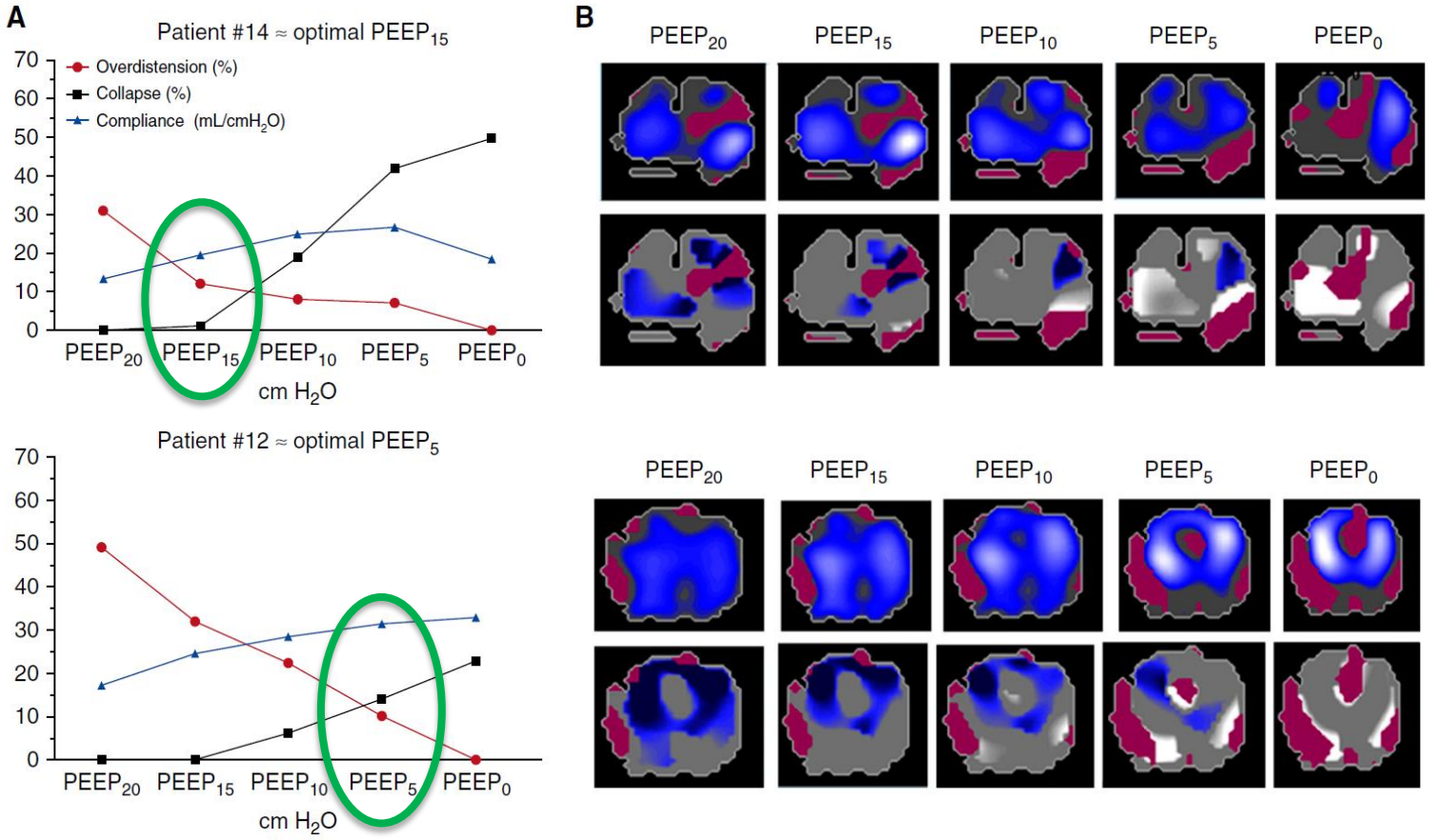


Beitler JR et al. JAMA 2019; doi:10.1001/jama.2019.0555 (published online February 18, 2019)

Assessing recruitment/overdistension at the bedside

Bedside Contribution of Electrical Impedance Tomography to Setting Positive End-Expiratory Pressure for Extracorporeal Membrane Oxygenation–treated Patients with Severe Acute Respiratory Distress Syndrome

Guillaume Franchineau[1,2], Nicolas Bréchot[1,2], Guillaume Lebreton[1,3], Guillaume Hekimian[1,2], Ania Nieszkowska[1,2],



Franchineau G, et al. Am J Respir Crit Care Med 2017;196:447–457

Personalization of mechanical ventilation

Personalised mechanical ventilation tailored to lung morphology versus low positive end-expiratory pressure for patients with acute respiratory distress syndrome in France (the LIVE study): a multicentre, single-blind, randomised controlled trial

Jean-Michel Constantin, Matthieu Jabaudon, Jean-Yves Lefrant, Samir Jaber, Jean-Pierre Quenot, Olivier Langeron, Martine Ferrandière, Fabien Grelon, Philippe Seguin, Carole Ichai, Benoit Veber, Bertrand Souweine, Thomas Uberti, Sigismond Lasocki, François Legay, Marc Leone, Nathanael Eisenmann, Claire Dahyot-Fizelier, Hervé Dupont, Karim Asehnoune, Achille Sossou, Gérald Chanques, Laurent Muller, Jean-Etienne Bazin, Antoine Monsel, Lucile Borao, Jean-Marc Garcier, Jean-Jacques Rouby, Bruno Pereira, Emmanuel Futier, for the AZUREA

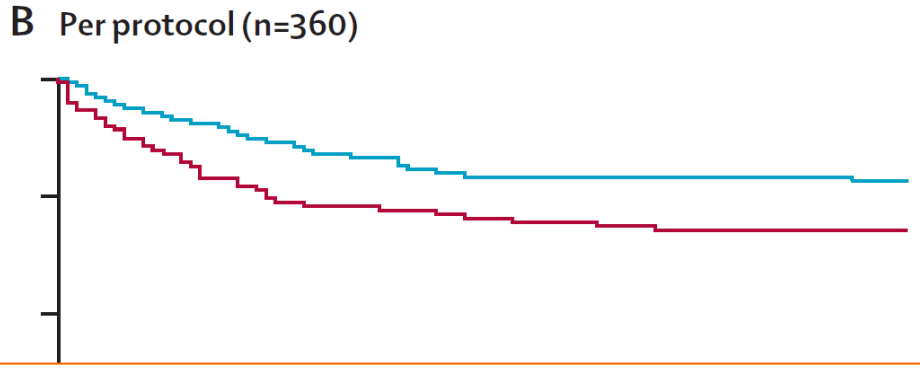
	Control group (n=204)		Personalised group (n=196)	
	Focal ARDS (n=102)	Non-focal ARDS (n=102)	Focal ARDS (n=98)	Non-focal ARDS (n=98)
Tidal volume (mL)	398 (71)	398 (89)	486 (74)	392 (78)
Tidal volume (mL/kg PBW)	6·0 (1·0)	6·2 (1·1)	7·3 (1·1)	6·3 (1·0)
Respiratory rate (breaths/min)	26 (4)	27 (4)	22 (5)	27 (5)
PEEP (cm water)	11 (2)	10 (2)	8 (2)	14 (3)
FiO_2 (%)	56 (16)	53 (17)	48 (19)	49 (15)
Respiratory system Pplat (cm water)	21 (4)	22 (6)	20 (5)	26 (6)
P_{max} (cm water)	33 (7)	35 (7)	35 (9)	37 (7)
Respiratory system Cst (mL/cm water)	41 (15)	36 (14)	40 (10)	34 (15)
Driving pressure (cm water)	9 (5)	11 (5)	11 (5)	12 (5)
SaO_2 (%)	95 (6)	96 (4)	97 (3)	97 (3)
PaO_2 (mm Hg)	94 (37)	92 (30)	94 (31)	110 (43)
PaO_2:FiO_2 (mm Hg)	179 (83)	189 (80)	217 (90)	240 (102)
$PaCO_2$ (mm Hg)	42 (8)	42 (8)	38 (10)	44 (10)
Arterial blood (pH)	7·35 (0·09)	7·38 (0·09)	7·39 (0·09)	7·35 (0·10)

Constantin J-M et al. Lancet Resp Med 2019;7:870-880

Personalization of mechanical ventilation

Personalised mechanical ventilation tailored to lung morphology versus low positive end-expiratory pressure for patients with acute respiratory distress syndrome in France (the LIVE study): a multicentre, single-blind, randomised controlled trial

*Jean-Michel Constantin, Matthieu Jabaudon, Jean-Yves Lefrant, Samir Jaber, Jean-Fabien Grelon, Philippe Seguin, Carole Ichai, Benoit Veber, Bertrand Souweine, Tho Nathanael Eisenmann, Claire Dahyot-Fizelier, Hervé Dupont, Karim Asehnoune, A Jean-Etienne Bazin, Antoine Monsel, Lucile Borao, Jean-Marc Garcier, Jean-Jacque Network**



- **Misclassified lung morphology in 85/400 pts (21%)**
- **High mortality in misclassified patients** (65% in the personalized group), **particularly in focal phenotype**

Added value of this study

This study reports that prospective assessment of ARDS phenotypes is not easy using routine techniques.

When mechanical ventilation and phenotypes are aligned, mortality might decrease. But when mechanical ventilation and phenotypes are misaligned, mortality increases substantially.

Constantin J-M et al. Lancet Resp Med 2019;7:870-880

How is mechanical ventilation applied in clinical practice?

ARDS is under-recognized

Original Investigation | CARING FOR THE CRITICALLY ILL PATIENT

Epidemiology, Patterns of Care, and Mortality for Patients With Acute Respiratory Distress Syndrome in Intensive Care Units in 50 Countries

Giacomo Bellani, MD, PhD; John G. Laffey, MD, MA; Tài Pham, MD; Eddy Fan, MD, PhD; Laurent Brochard, MD, HDR; Andres Esteban, MD, PhD; Luciano Gattinoni, MD, FRCP; Frank van Haren, MD, PhD; Anders Larsson, MD, PhD; Daniel F. McAuley, MD, PhD; Marco Ranieri, MD; Gordon Rubenfeld, MD, MSc; B. Taylor Thompson, MD, PhD; Hermann Wrigge, MD, PhD; Arthur S. Slutsky, MD, MASc; Antonio Pesenti, MD; for the LUNG SAFE Investigators and the ESICM Trials Group

Clinician recognition of ARDS:

- 60% of all ARDS (51%-79% in mild-severe)
- 34% at the time

ARDS is under-diagnosed and diagnosis is frequently delayed

recognition of ARDS:

- factors (pneumonia vs cardiac failure);
- organizational factors (nurse-patient ratio)

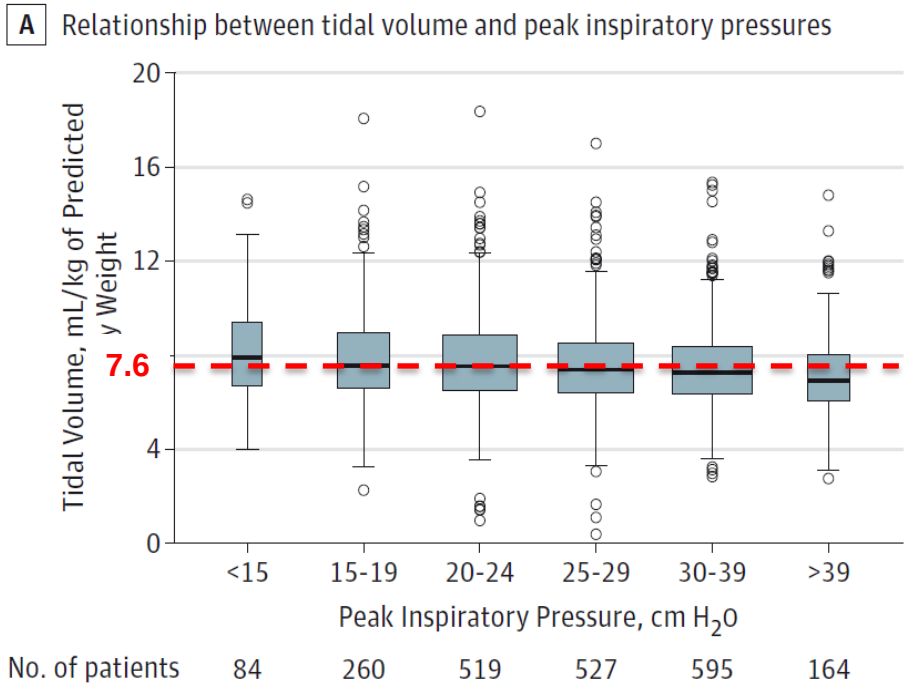
Bellani G et al. JAMA 2016;315:788-800

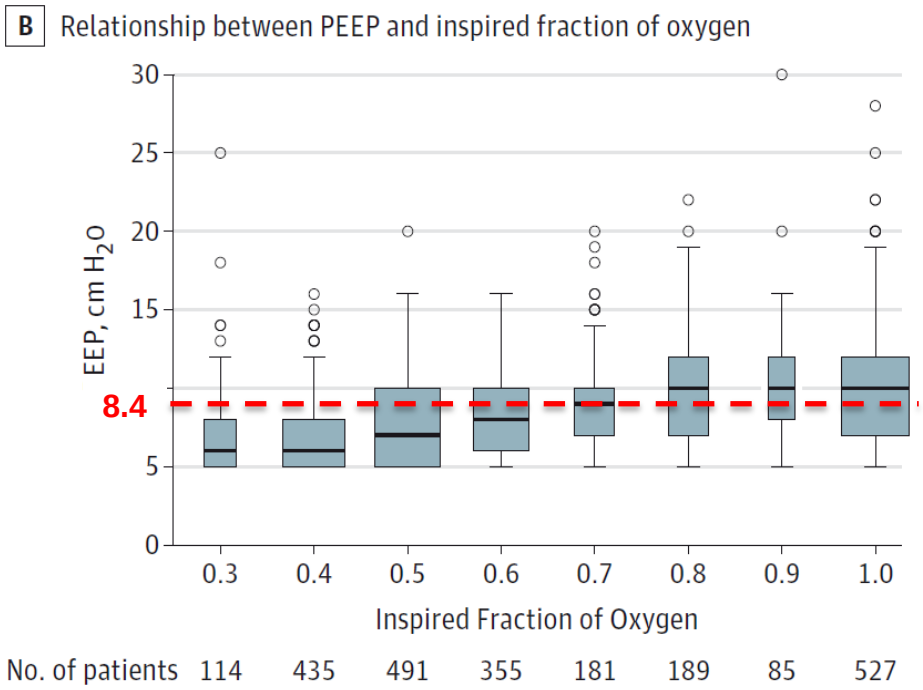
Vt and PEEP in clinical practice

Original Investigation | CARING FOR THE CRITICALLY ILL PATIENT

Epidemiology, Patterns of Care, and Mortality for Patients With Acute Respiratory Distress Syndrome in Intensive Care Units in 50 Countries

Giacomo Bellani, MD, PhD; John G. Laffey, MD, MA; Tài Pham, MD; Eddy Fan, MD, PhD; Laurent Brochard, MD, HDR; Andres Esteban, MD, PhD; Luciano Gattinoni, MD, FRCP; Frank van Haren, MD, PhD; Anders Larsson, MD, PhD; Daniel F. McAuley, MD, PhD; Marco Ranieri, MD; Gordon Rubenfeld, MD, MSc; B. Taylor Thompson, MD, PhD; Hermann Wrigge, MD, PhD; Arthur S. Slutsky, MD, MASc; Antonio Pesenti, MD; for the LUNG SAFE Investigators and the ESICM Trials Group





Bellani G et al. JAMA 2016;315:788-800

Prone position is largely underused

Evolution of Mortality over Time in Patients Receiving Mechanical Ventilation

Andrés Esteban[1], Fernando Frutos-Vivar[1], Alfonso Muriel[2], Niall D. Ferguson[3], Oscar Peñuelas[1], Victor Abraira[2], Konstantinos Raymondos[4], Fernando Rios[5], Nicolas Nin[1], Carlos Apezteguía[5], Damian A. Violi[6], Arnaud W. Thille[7], Laurent Brochard[8], Marco González[9], Asisclo J. Villagomez[10], Javier Hurtado[11], Andrew R. Davies[12], Bin Du[13], Salvatore M. Maggiore[14], Paolo Pelosi[15], Luis Soto[16], Vinko Tomicic[17], Gabriel D'Empaire[18], Dimitrios Matamis[19], Fekri Abroug[20], Rui P. Moreno[21], Marco Antonio Soares[22], Ya… Younsuck Koh[27], Michael A. Kuiper[28], Hans-Henrik Bülow[29], A…

- **927 participating ICUs, 660 ARDS pts**
- **9% in 1998, 5% in 2004, 7% in 2010**

Esteban A…Maggiore SM et al. AJRCCM 2013; 188:220–230

Original Investigation | CARING FOR THE CRITICALLY ILL PATIENT

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- **459 participating ICUs, 3,022 ARDS pts**
- **7.9% overall**

(1% in mild, 6% in moderate, 16% in severe)

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Mechanical ventilation in ARDS: conclusions

- **Low V_T (4-8 ml/Kg PBW)**
- **Low Pplat (<26-30 cmH_2O)**
- **Moderate-high PEEP (severity & morphology)**
- **ΔP <13-15 cmH_2O**
- **RR to keep pH >7.25 (avoiding PEEPi)**

In moderate-severe ARDS (P/F <150):

- **Neuromuscular blockade (if needed)**
- **PRONE POSITION !**

In severe ARDS (P/F <100)

- **Consider ECMO as a rescue therapy**