Questions non résolues dans le SDRA

Laurent Brochard
Toronto

UNIVERSITY OF TORONTO
Interdepartmental Division of Critical Care Medicine
the PLG
ReVA Réseau Européen

Conflicts of interest

- Our clinical research laboratory has received research grants or equipment for clinical studies from the following companies
  - Covidien (PAV+)
  - Maquet (NAVA)
  - General Electric (FRC)
  - Philips (sleep)
  - Fisher Paykel (high flow)
  - Air Liquide Medical System (Helium; CPR)

Background

- Mechanical factor appears to be the most relevant modifiable factors which can influence mortality in ARDS
- “Baby lung” concept

Questions non résolues dans le SDRA

- Diagnostic

Questions non résolues dans le SDRA

- Diagnostic (SDRA, VILI)

Research

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

Extent of ARDS Recognition	Mild (n=722; 30%)	Moderate (n=1110; 46%)	Severe (n=564; 24%)	P value [1]
Recognition at any time (%)	368 (51%)	723 (65%)	442 (78%)	<0.001

Diagnostic approach for ARDS

What's the PF ratio? Who has ARDS?

- FiO2 70 PaO2 80
- FiO2 40 PaO2 80
- FiO2 50 PaO2 125
- FiO2 30 PaO2 90

- 114
- 200
- 250
- 300

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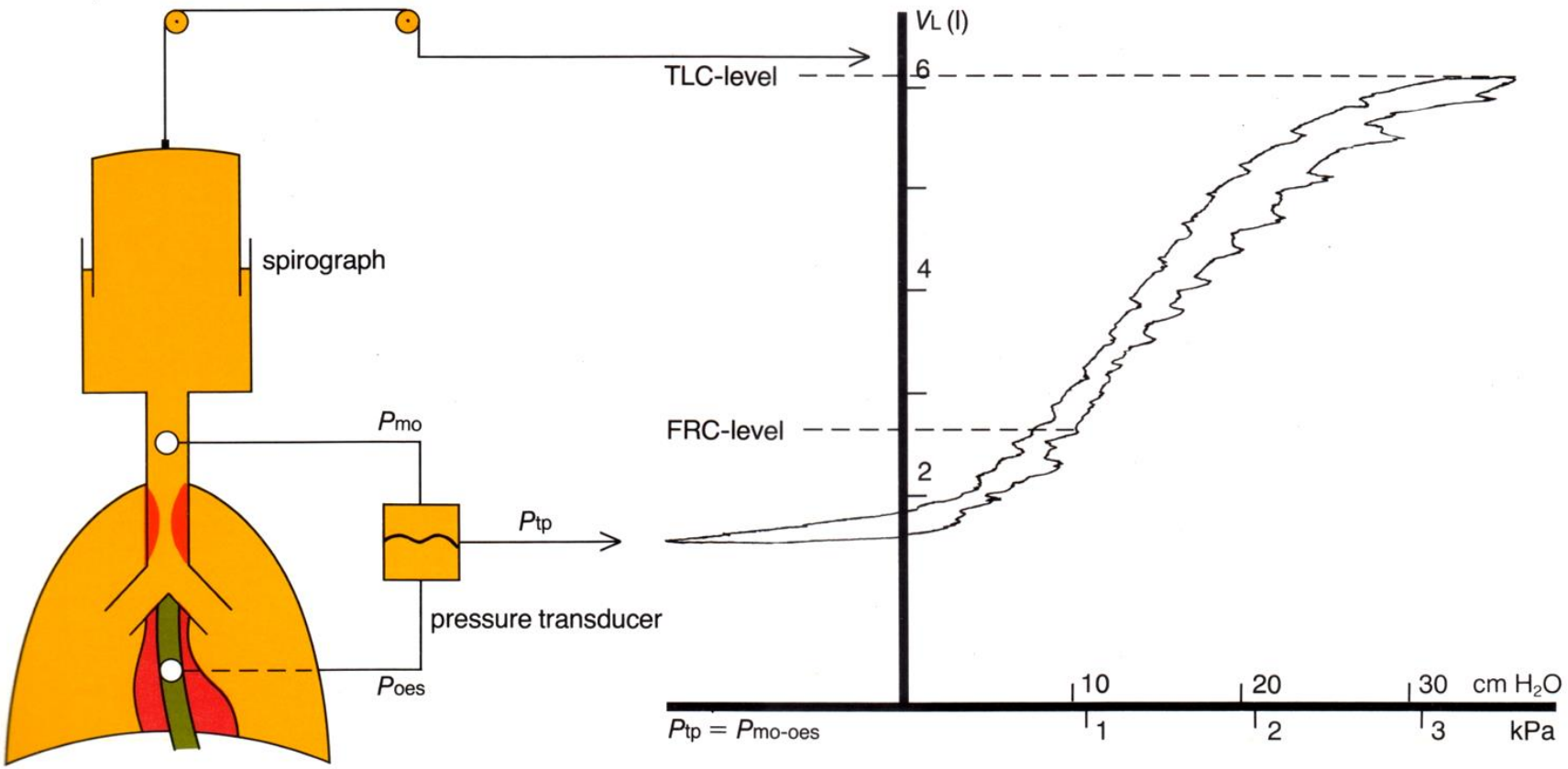
- Ventilation: limites de pression /volume sécurité



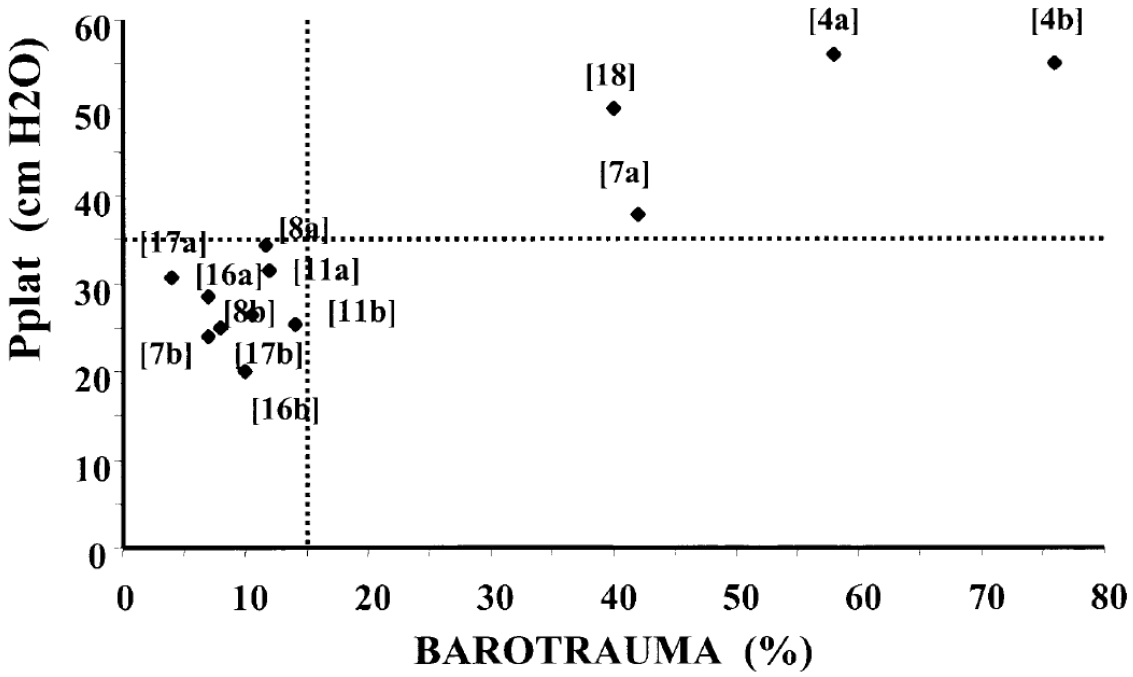
G.J. Tammeling, Philip H. Quanjer. Leiden, The Netherlands 1978

Intensive Care Med (2002) 28:406–413
DOI 10.1007/s00134-001-1178-1

ORIGINAL

Mohamed Boussarsar
Guillaume Thierry
Samir Jaber
Françoise Roudot-Thoraval
François Lemaire
Laurent Brochard

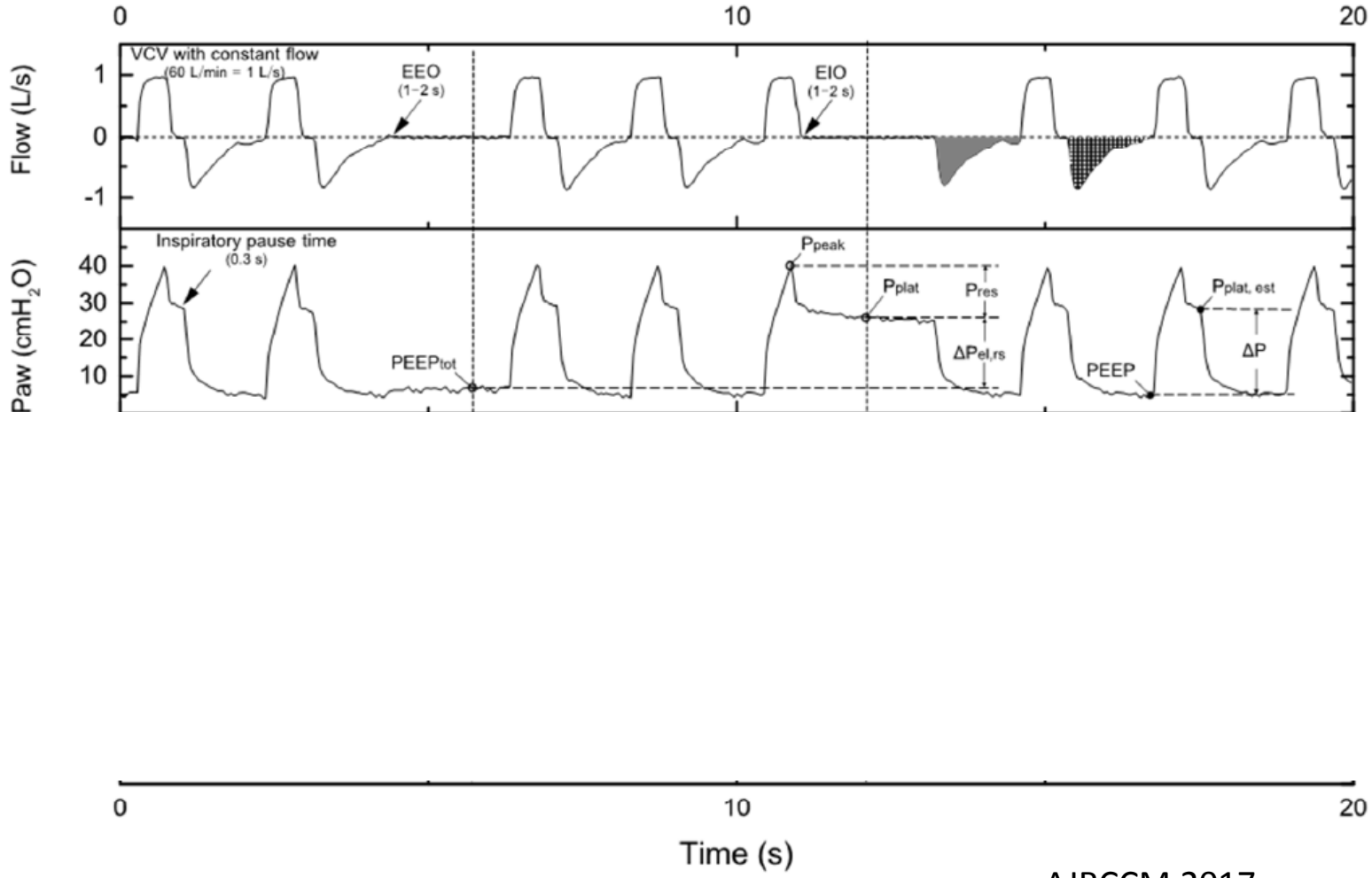
Relationship between ventilatory settings and barotrauma in the acute respiratory distress syndrome



American Journal of Respiratory and Critical Care Medicine/AJRCCM

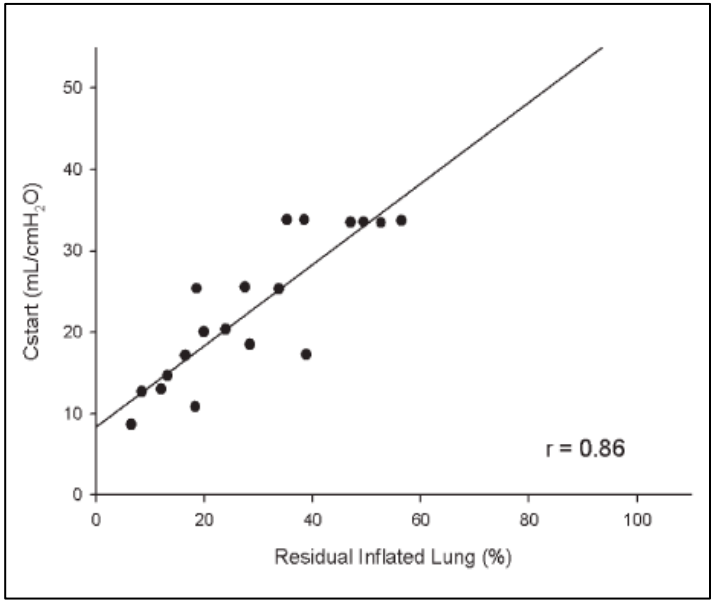
Respiratory Mechanics in Acute Respiratory Distress Syndrome

William R Henderson[1*], Lu Chen [2,3*], Marcelo B P Amato[4] and Laurent J Brochard[2,3]



AJRCCM 2017

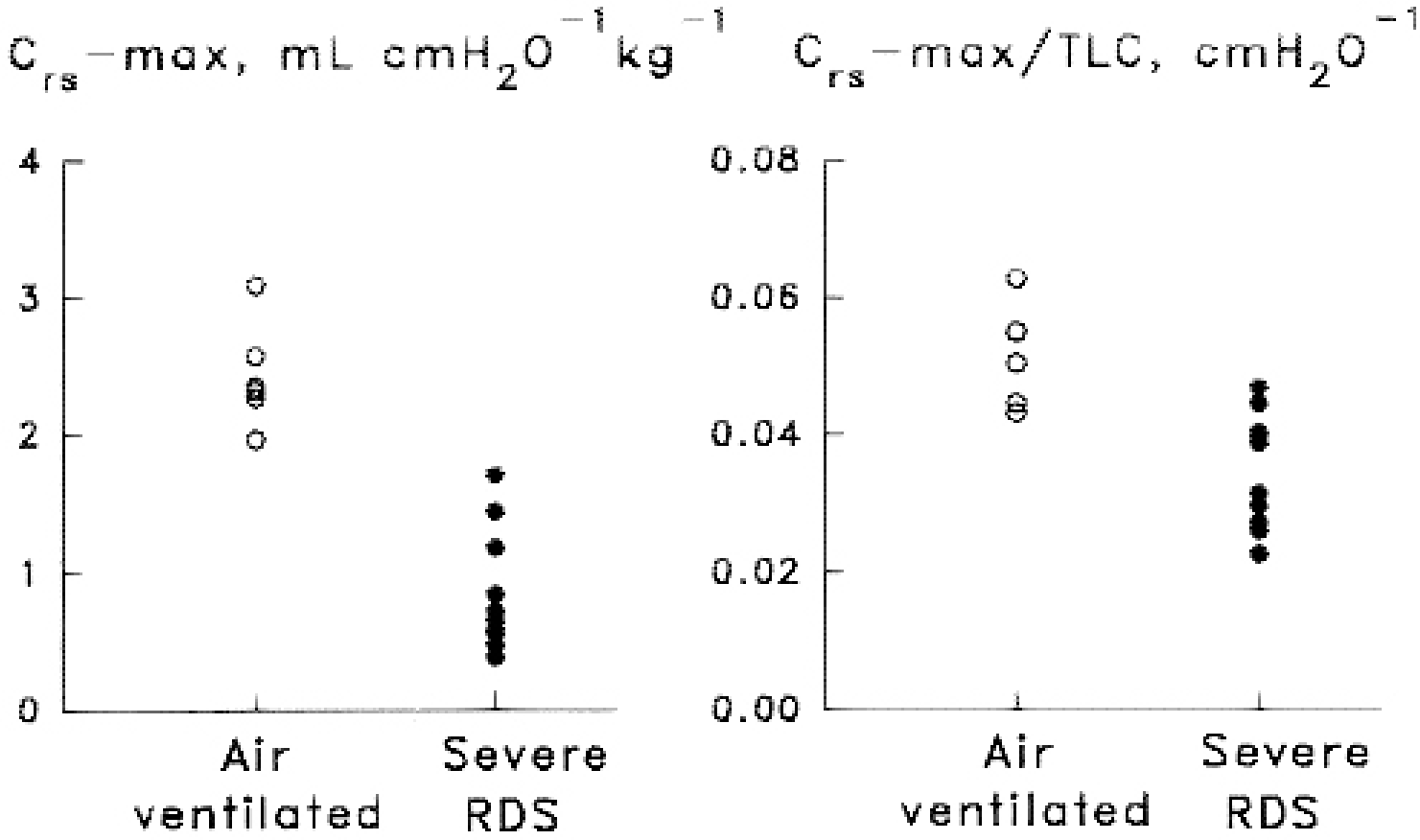
ARDS : “baby lung”



- **Low compliance in ARDS = small lung not stiff lung**

Gattinoni L and Pesenti A. The concept of « baby lung » ICM 2005

Lung Volumes and Pressure-Volume Relations of the Respiratory System in Small Ventilated Neonates with Severe Respiratory Distress Syndrome

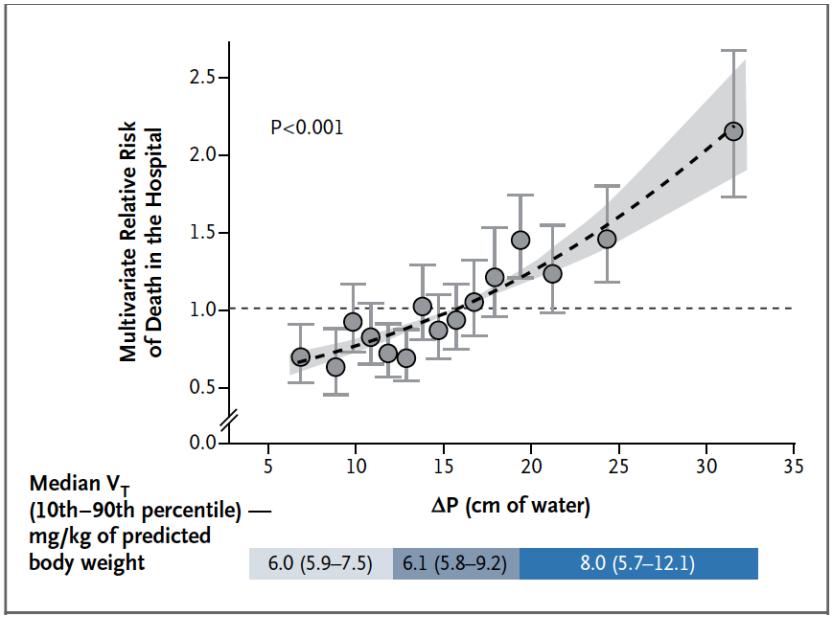


C T Vilstrup, L J Björklund, O Werner and A Larsson. Pediatric Research 1996

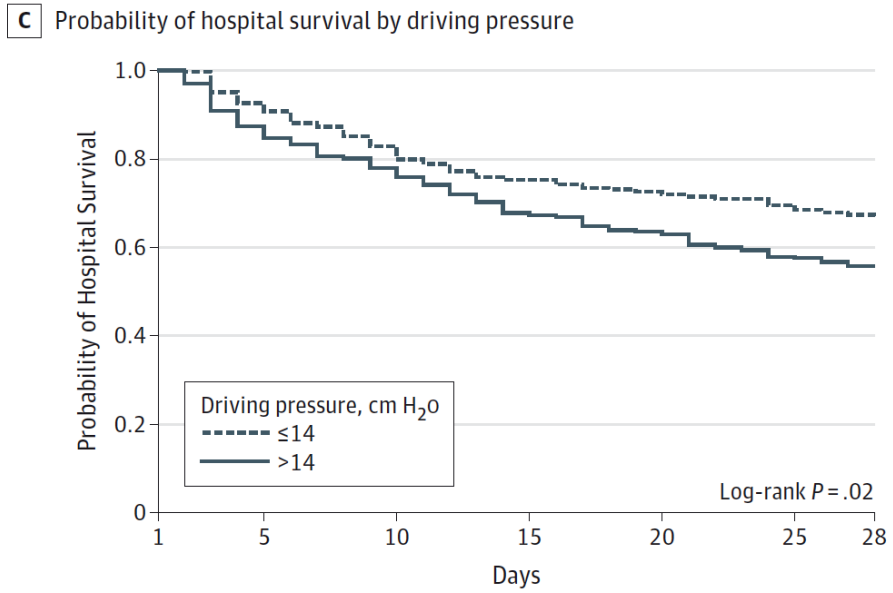
Compliance and Δ P

- C = α FRC
- C = Vol / Elastic pressure
- C = Vt / Driving pressure (Pplat-PEEP)
- Driving pressure = Vt / C
- Driving pressure $\approx$ Vt / α FRC

ΔP: clinical data



Amato NEJM 2015



Bellani JAMA 2016

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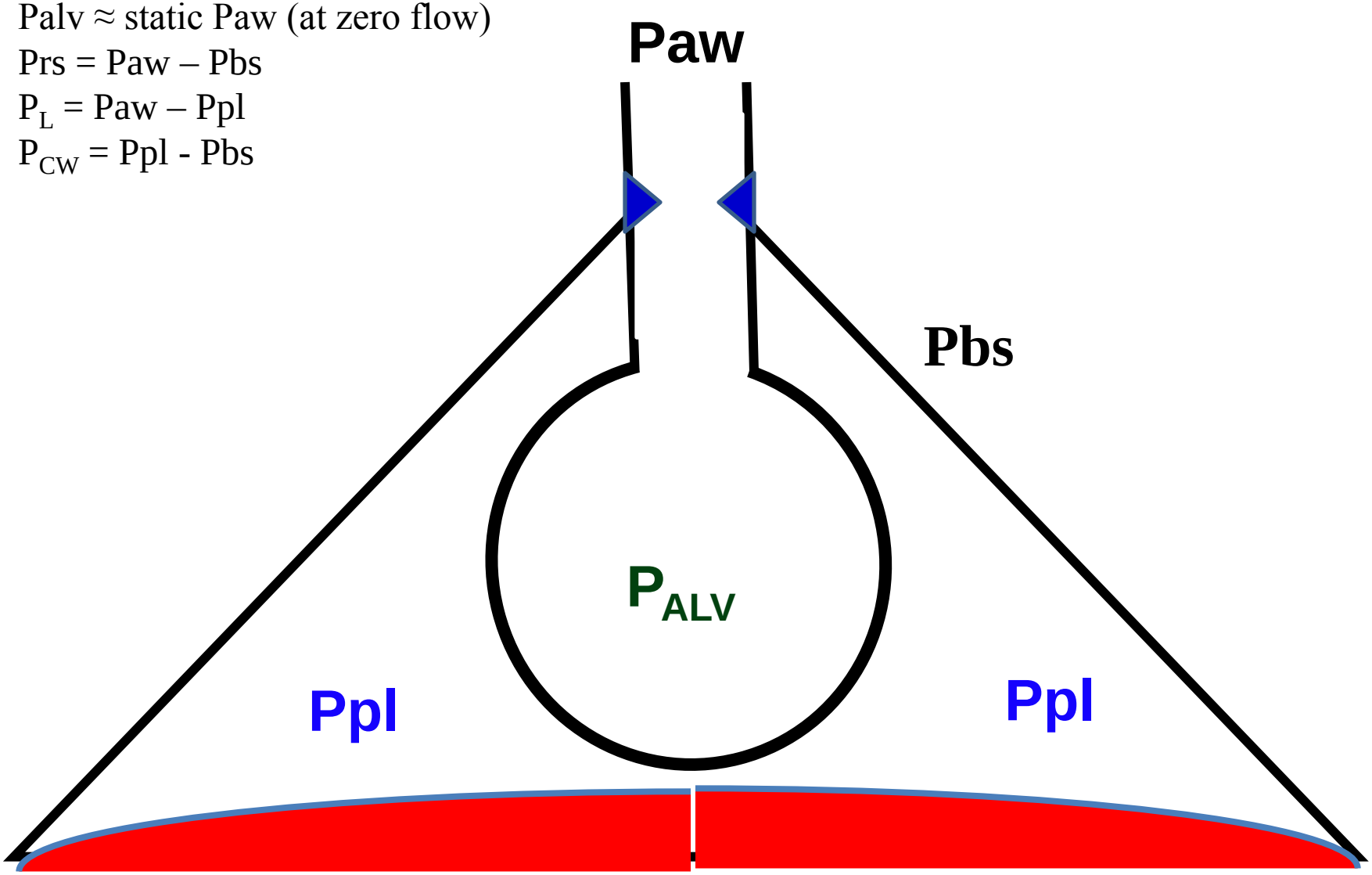
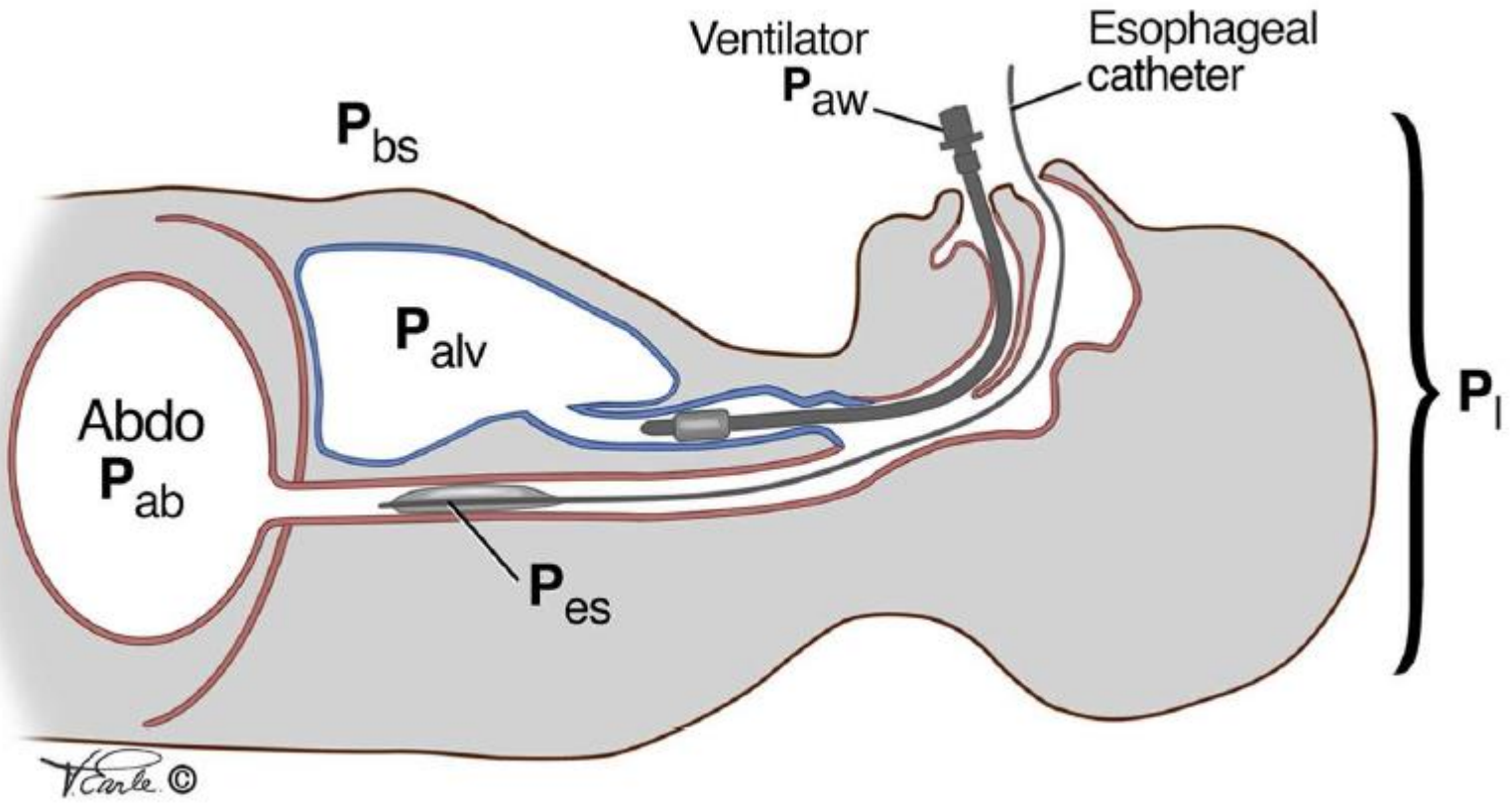
Palv ≈ static Paw (at zero flow)
Prs = Paw – Pbs
P_L = Paw – Ppl
P_{CW} = Ppl - Pbs



Akoumianaki E et al AJRCCM 2014



Henderson et al, AJRCCM 2017

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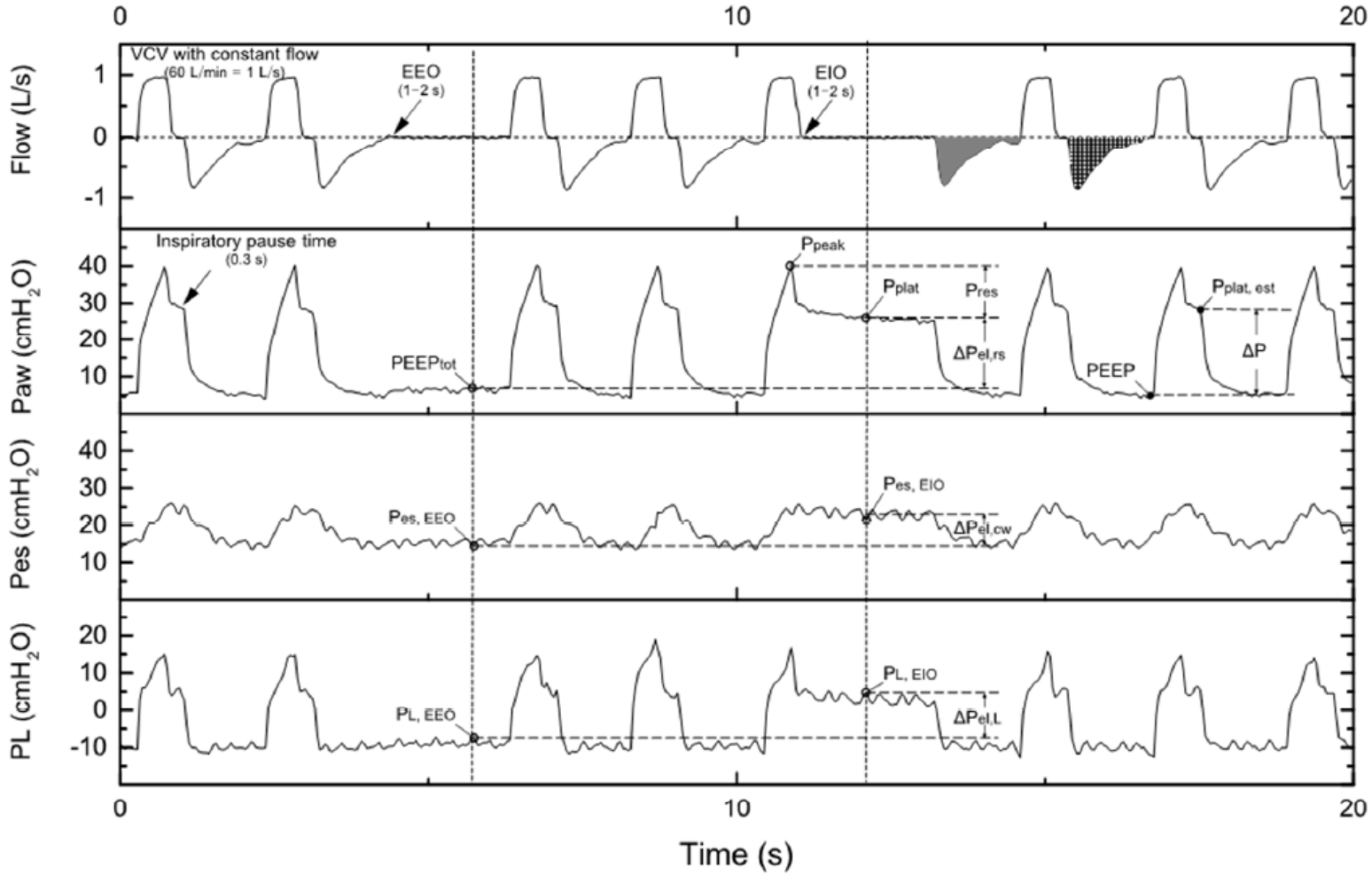
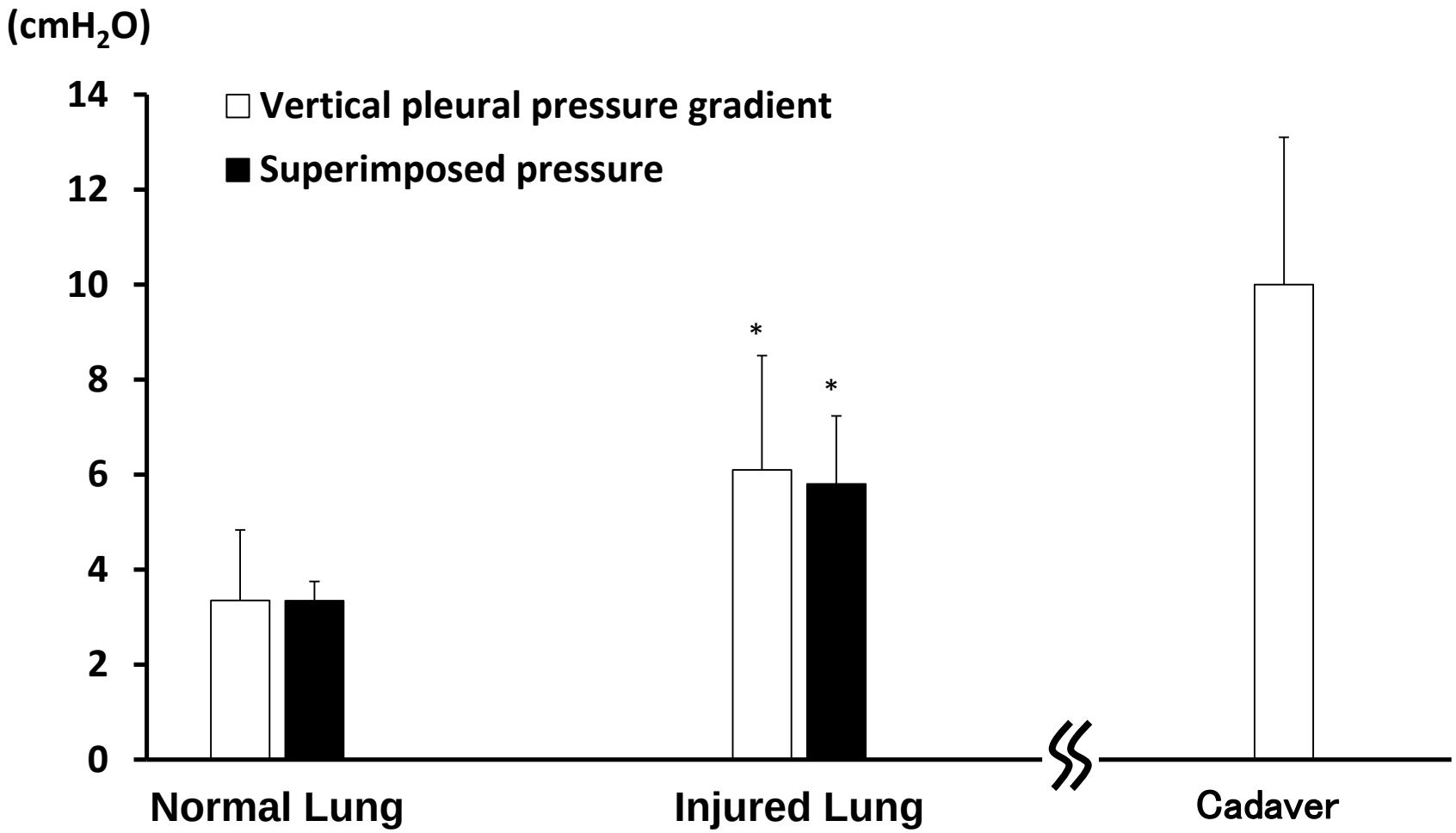
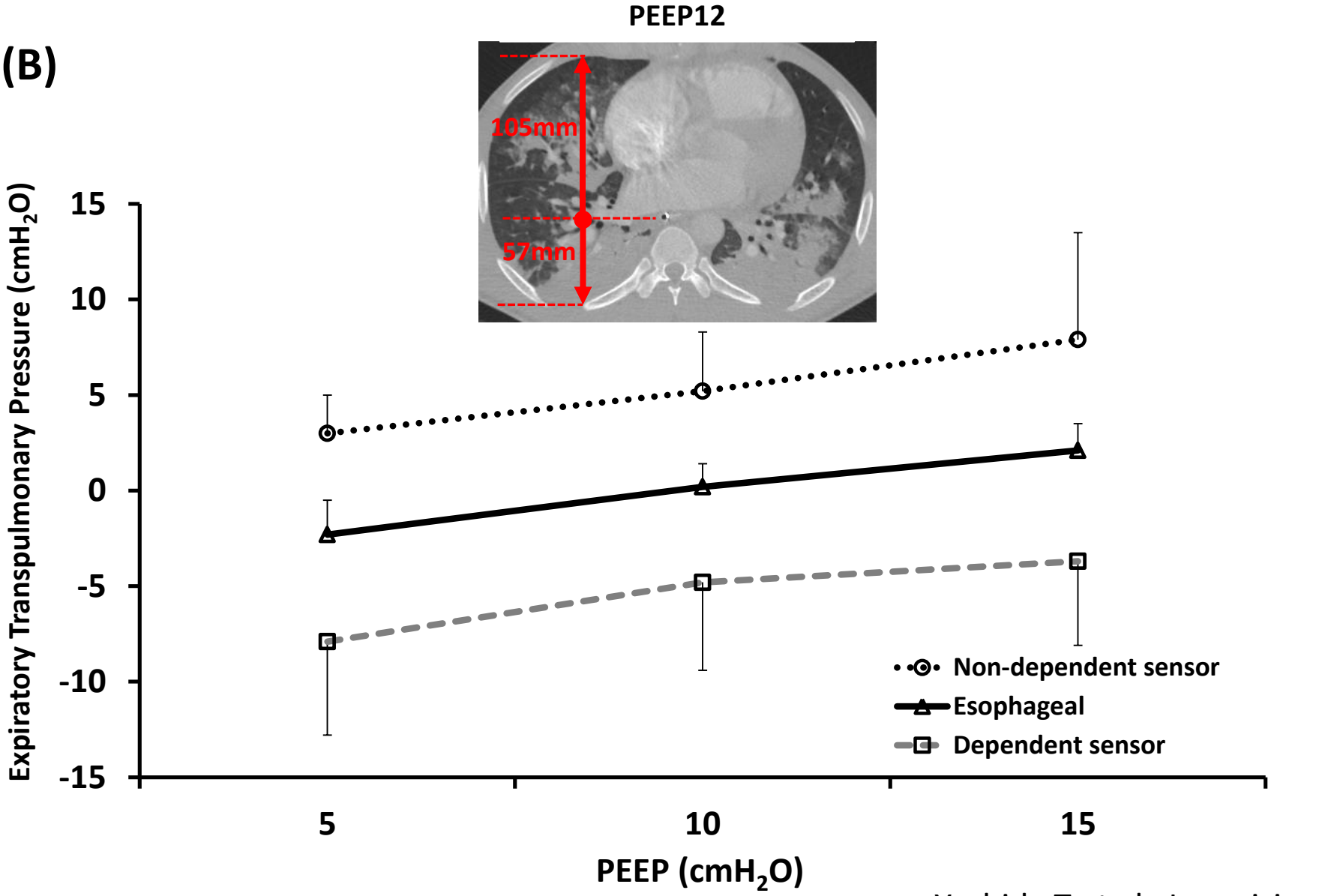


Henderson et al, AJRCCM 2017



Yoshida T et al . In revision

Figure 2

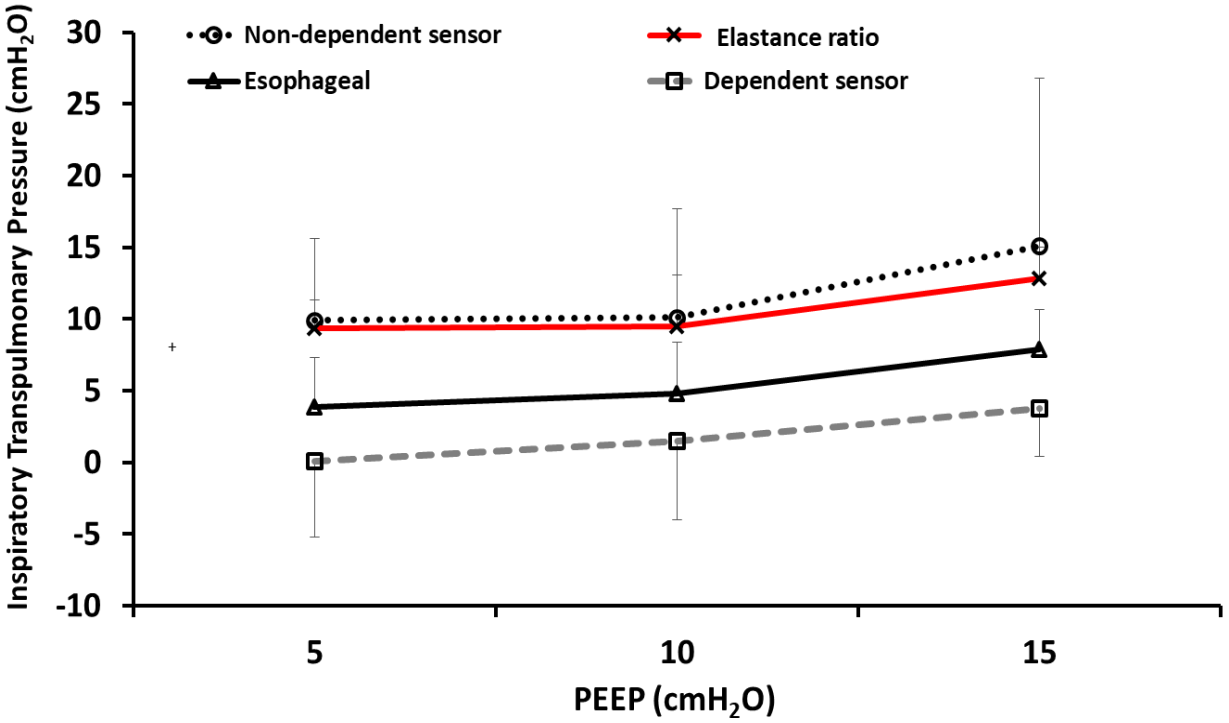


Yoshida T et al . In revision

PL= Paw x EL/ERS

cadavers

Transpulmonary plateau pressure calculated by elastance ratio



Yoshida , Grieco, Charbonney et al
manuscript submitted

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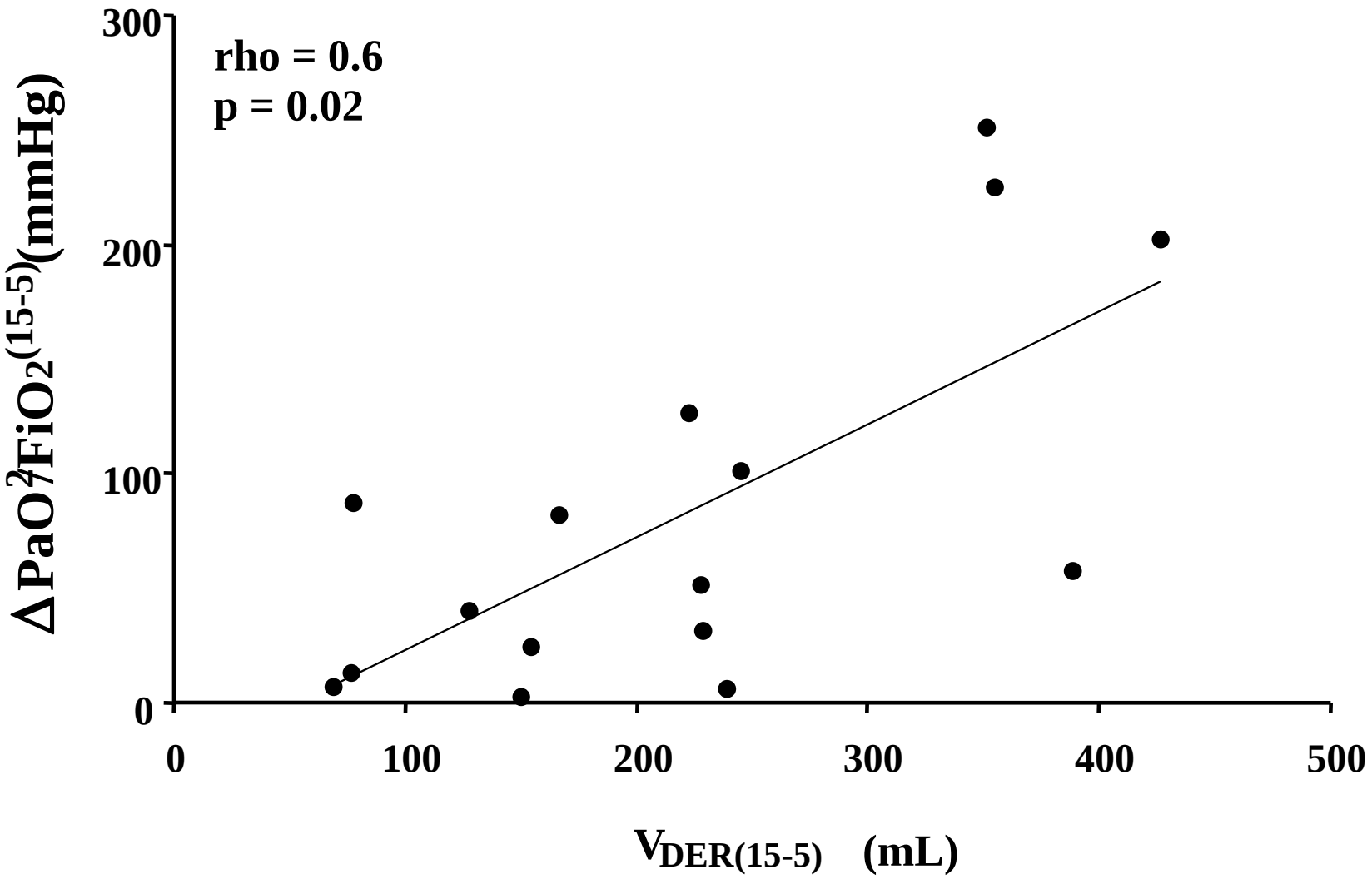
- Evaluation du recrutement

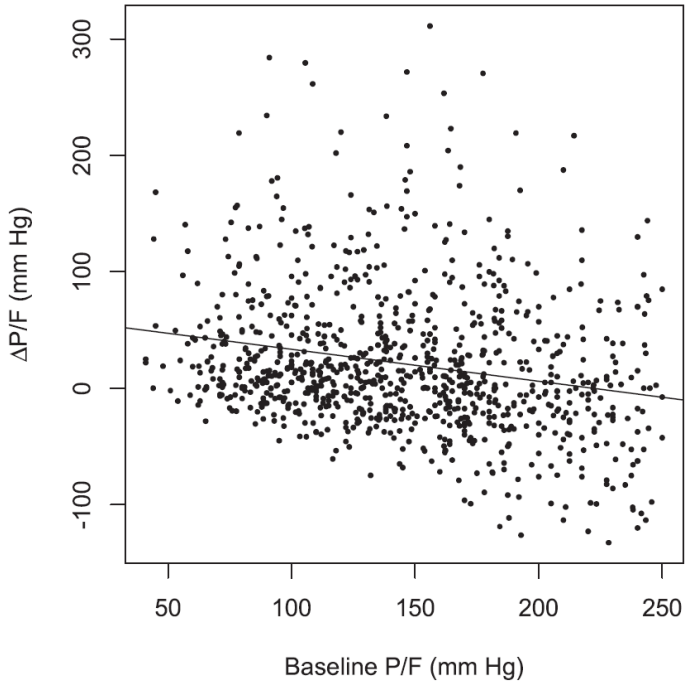


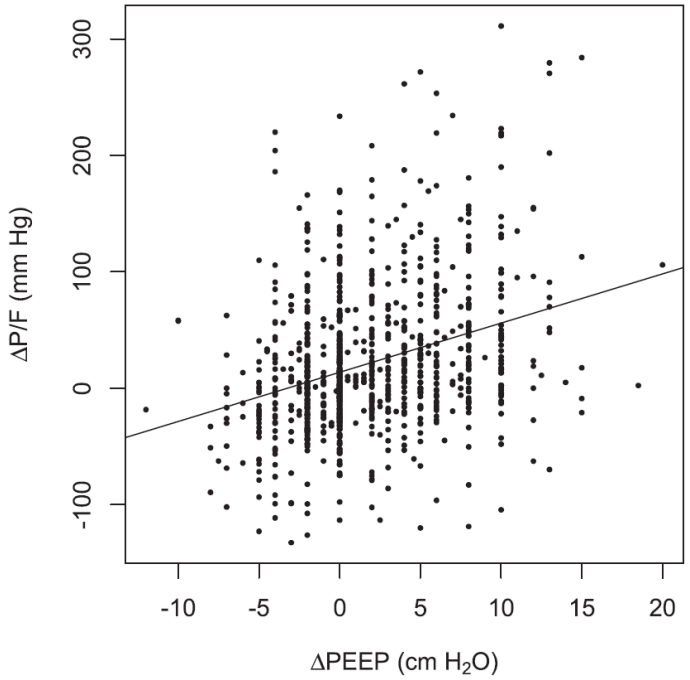
Maggiore S et al AJRCCM 2000

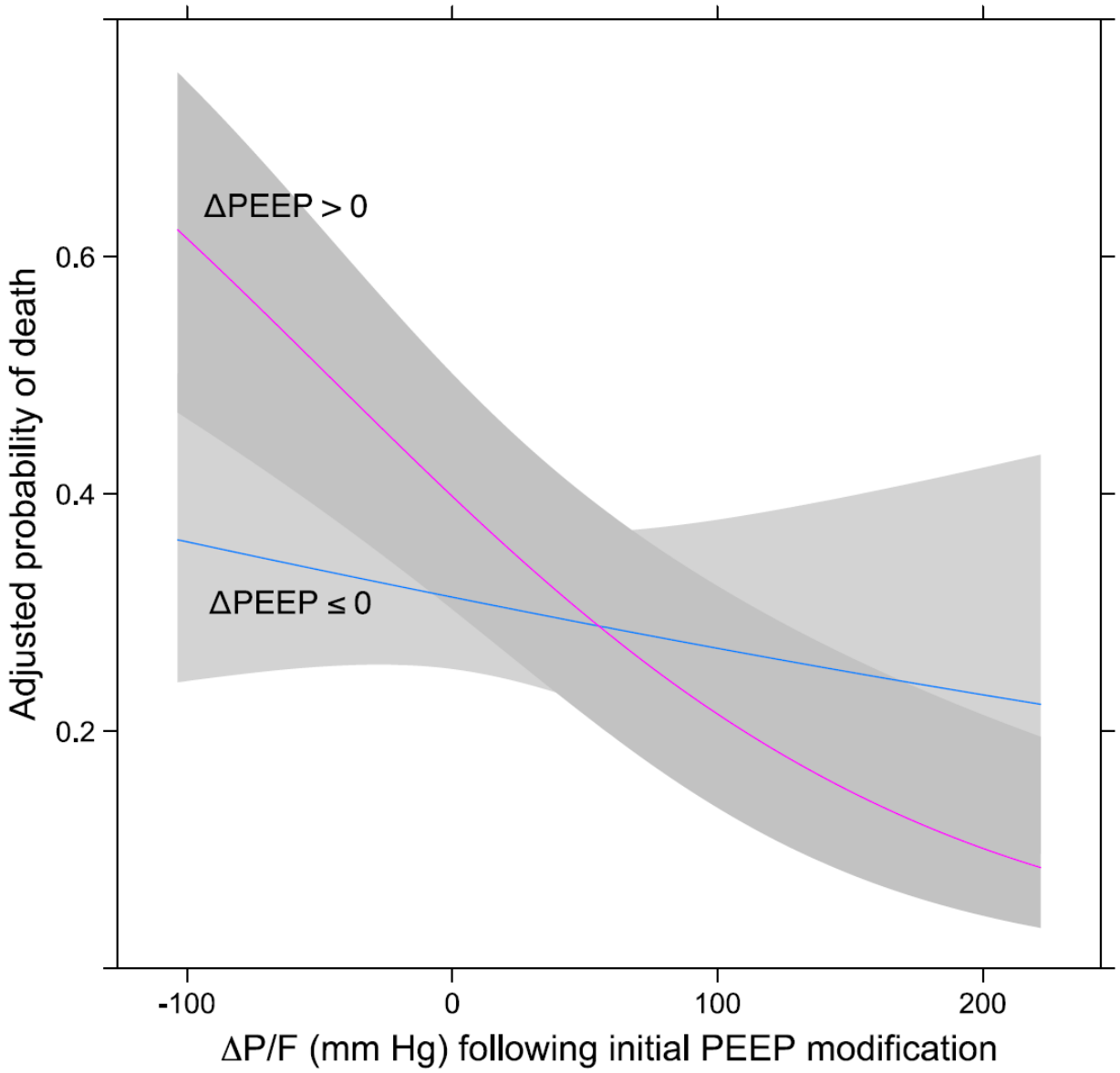
Oxygenation Response to Positive End-Expiratory Pressure Predicts Mortality in Acute Respiratory Distress Syndrome

A Secondary Analysis of the LOVS and ExPress Trials

Ewan C. Goligher[1,2,3,4], Brian P. Kavanagh[1,5,6], Gordon D. Rubenfeld[1,2,7], Neill K. J. Adhikari[1,2,7], Ruxandra Pinto[7], Eddy Fan[1,2,4], Laurent J. Brochard[1,2,8], John T. Granton[1,2,4], Alain Mercat[9], Jean-Christophe Marie Richard[10], Jean-Marie Chretien[11], Graham L. Jones[12], Deborah J. Cook[12,13], Thomas E. Stewart[1,2,4], Arthur S. Slutsky[1,2,4], Maureen O. Meade[12,13], and Niall D. Ferguson[1,2,3,4]

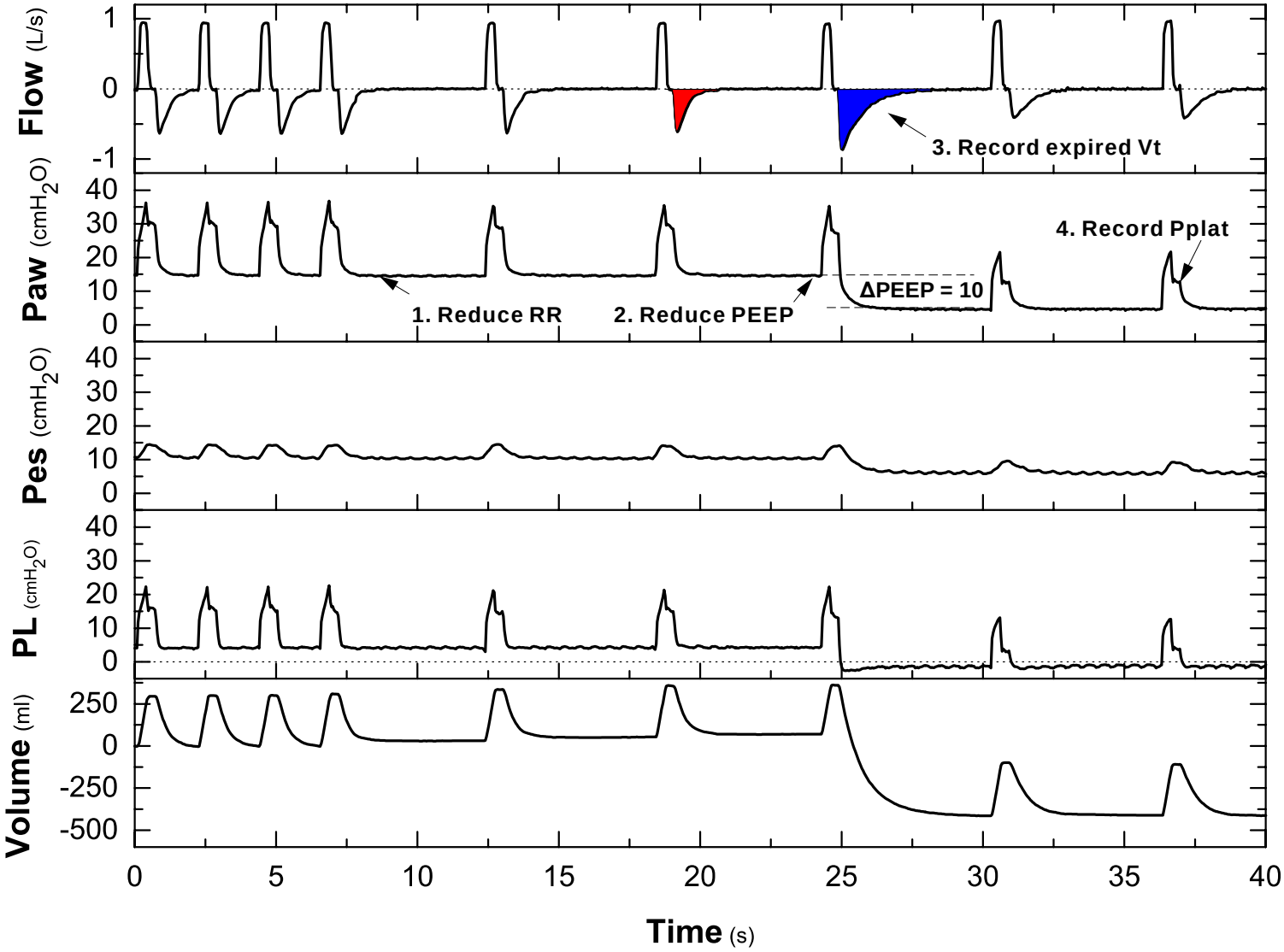






Goligher E et al AJRCCM 2014

Alveolar Derecruitment



Chen L. Crit Care 2017

Alveolar Recruitability

- Compare the expired volume to the predicted volume (C x Delta PEEP). The difference is derecruited volume.
- = a derecruited volume of at least 30% of Vt
- Validation study: our simplified method distinguish reasonably well ***recruitable*** vs poorly or ***non recruitable*** patients compared to the reference method (multiple P-V curves) (Chen L, CC 2017).

Feasibility of a Respiratory Mechanics Approach

Chen *et al. Critical Care* (2017) 21:84
DOI 10.1186/s13054-017-1671-8

Critical Care

RESEARCH Open Access

Implementing a bedside assessment of respiratory mechanics in patients with acute respiratory distress syndrome

Lu Chen[1,2], Guang-Qiang Chen[1,2,3], Kevin Shore[1], Orest Shklar[4], Concetta Martins[4], Brian Devenyi[4], Paul Lindsay[4], Heather McPhail[4], Ashley Lanys[2], Ibrahim Soliman[1], Mazin Tuma[1], Michael Kim[1], Kerri Porretta[4], Pamela Greco[4], Hilary Every[4], Chris Hayes[1,2], Andrew Baker[1,2], Jan O. Friedrich[1,2] and Laurent Brochard[1,2*]

Chen et al. Critical Care _####################_
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	Pre-measurement	Post-measurement	*P* Value
Ventilator Settings			
V_T/PBW – ml/kg	6.5 [6.2-7.0]	6.4 [6.2-6.7]	**0.006**
PEEP – cmH_2O	12 [10-14]	12 [10-14]	**0.077**
FiO_2	0.60 [0.50-0.70]	0.60 [0.50-0.70]	0.325
Physiological Variables			
$PaCO_2$ – mmHg	41 [38-50]	42 [38-50]	0.553
PaO_2/FiO_2 – mmHg	146±60	162±69	**0.020**
$P_{plat}^{\dagger}$ – cmH_2O	30±5	28±5	**0.004**
$\Delta P^{\dagger}$ – cmH_2O	18 [14-20]	15 [12-19]	**0.023**
OI[§] – cmH_2O/mmHg	15.2±7.4	13.8±8.3	**0.021**
O/SI[†] – mmHg/cmH_2O	7.5 [5.4-11.5]	8.2 [5.9-14.7]	**0.029**
$V_D/V_{T,\ est}$	0.63±0.10	0.62±0.12	0.494
$V_{E,\ corr}$ – L/min	13.0±3.2	12.8±3.3	0.421

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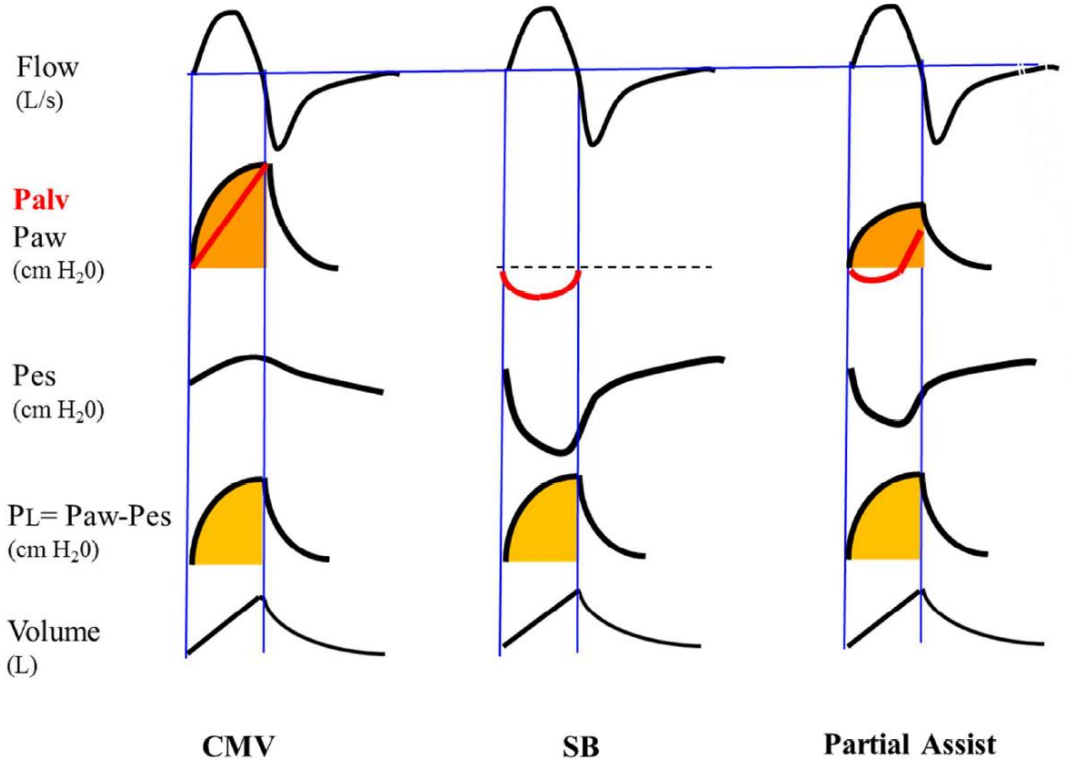
- Ventilation: limites de pression /volume sécurité
- Place de la pression transpulmonaire
- Evaluation du recrutement
- Place de la ventilation spontanée

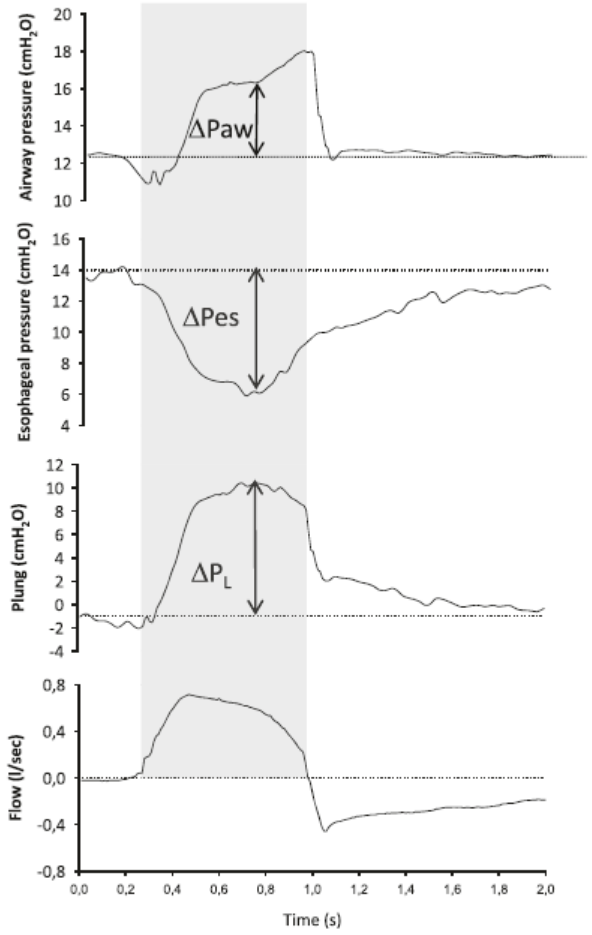
MECHANICAL VENTILATION TO MINIMIZE PROGRESSION OF LUNG INJURY IN ACUTE RESPIRATORY FAILURE

Laurent Brochard[1,2], Arthur Slutsky[1,2], Antonio Pesenti[3,4]

American Journal of Respiratory and Critical Care Medicine/AJRCCM



PL during spontaneous breathing



Bellani CC 2016

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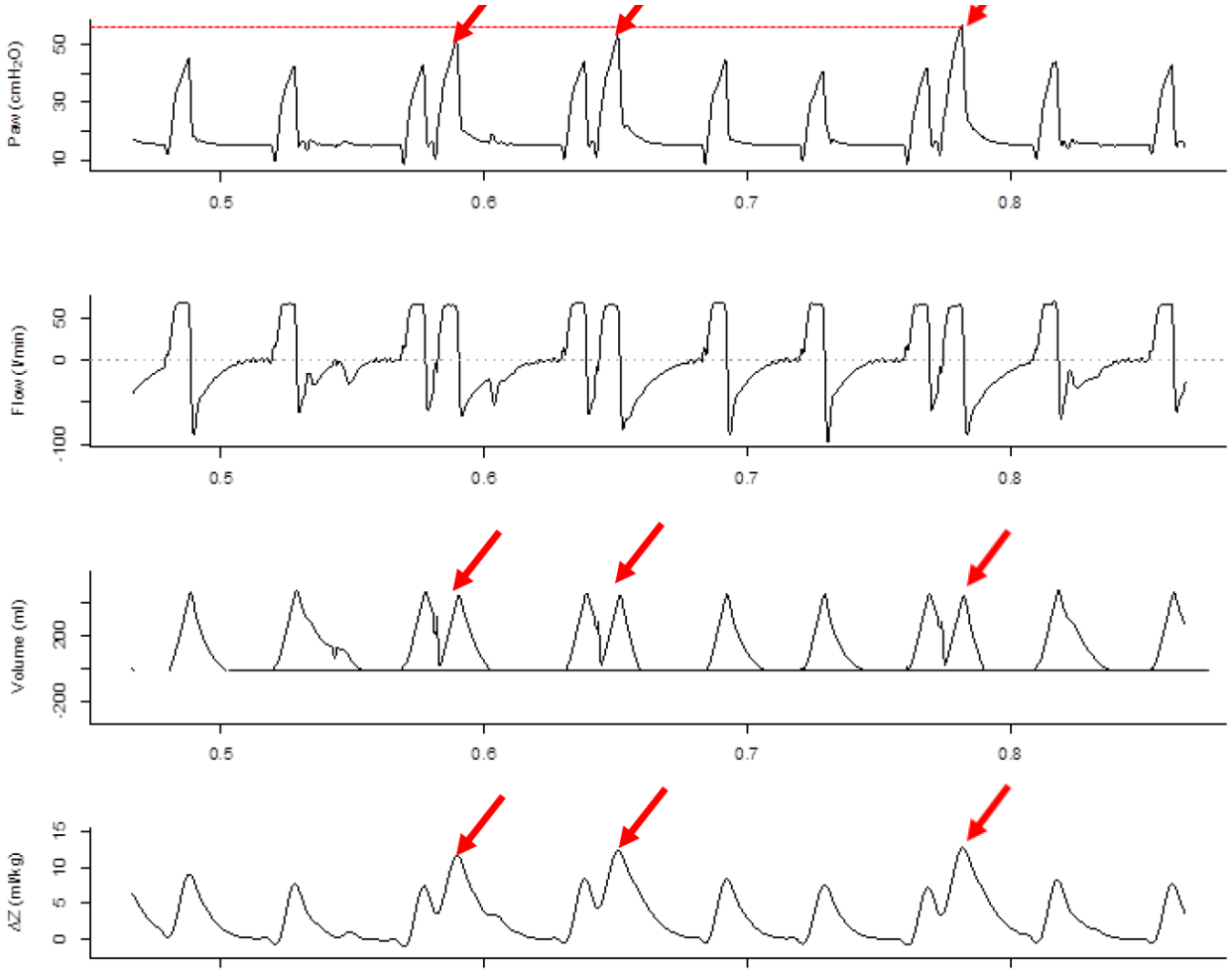
- Evaluation du recrutement
- Place de la ventilation spontanée
- Role des dyssynchronies

The Alveolar Recruitment for Acute Respiratory Distress Syndrome Trial



JAMA 2016

Thank You

brochardl@smh.ca

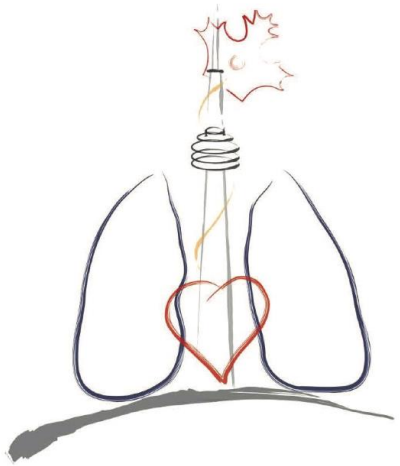
Mechanical Ventilation

From physiology to clinical practice

April 2018

Michener Institute, Toronto

critical care canada FORUM



Organized by the Interdepartmental Division of Critical Care Medicine, University of Toronto

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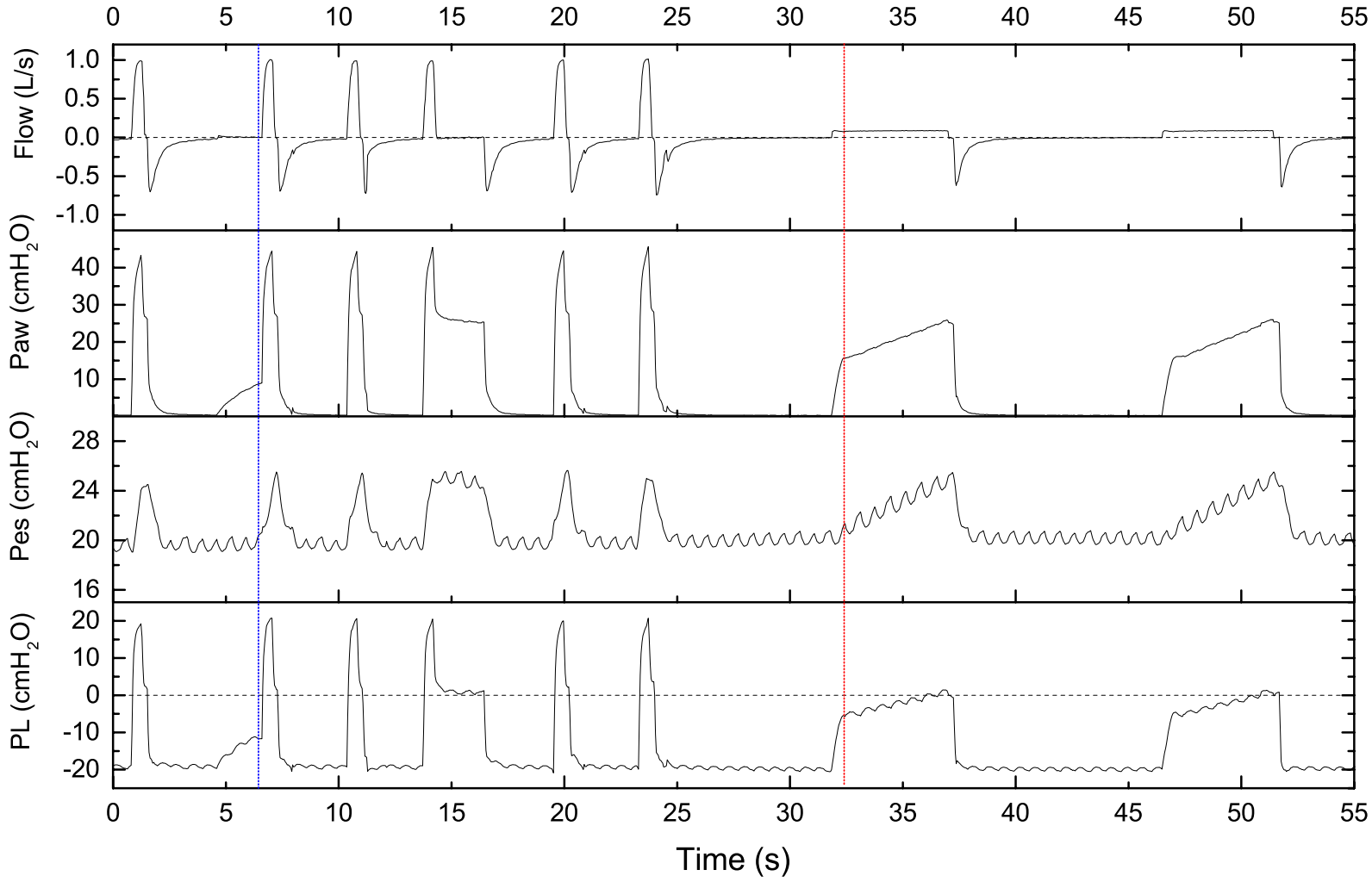
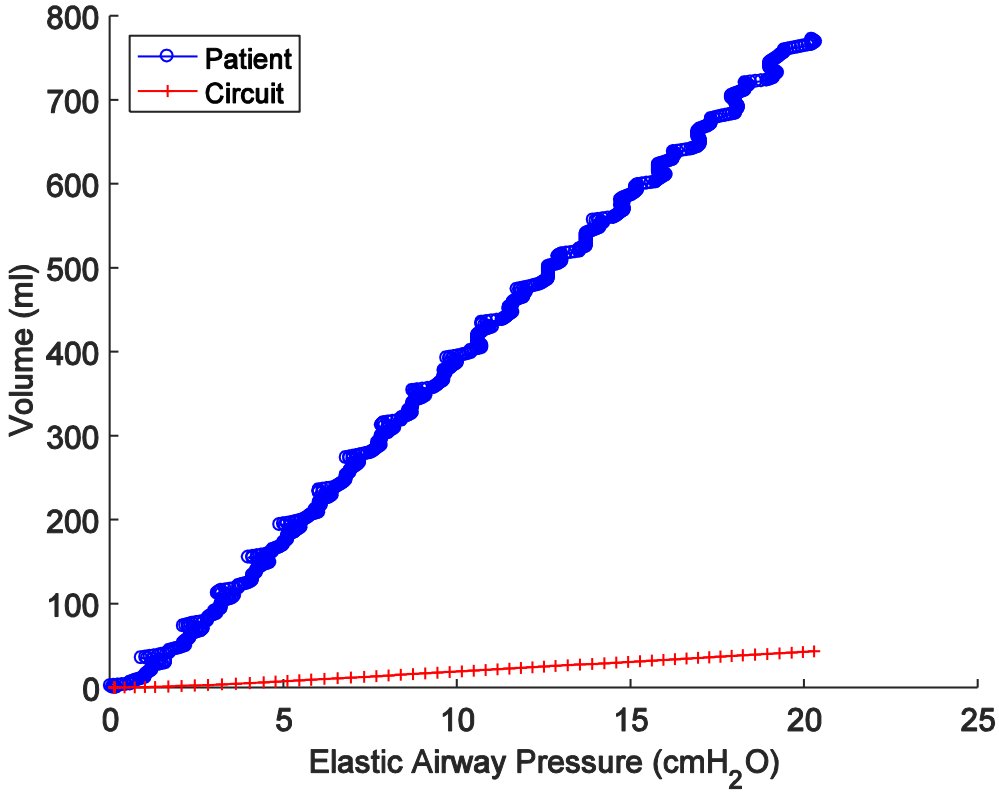
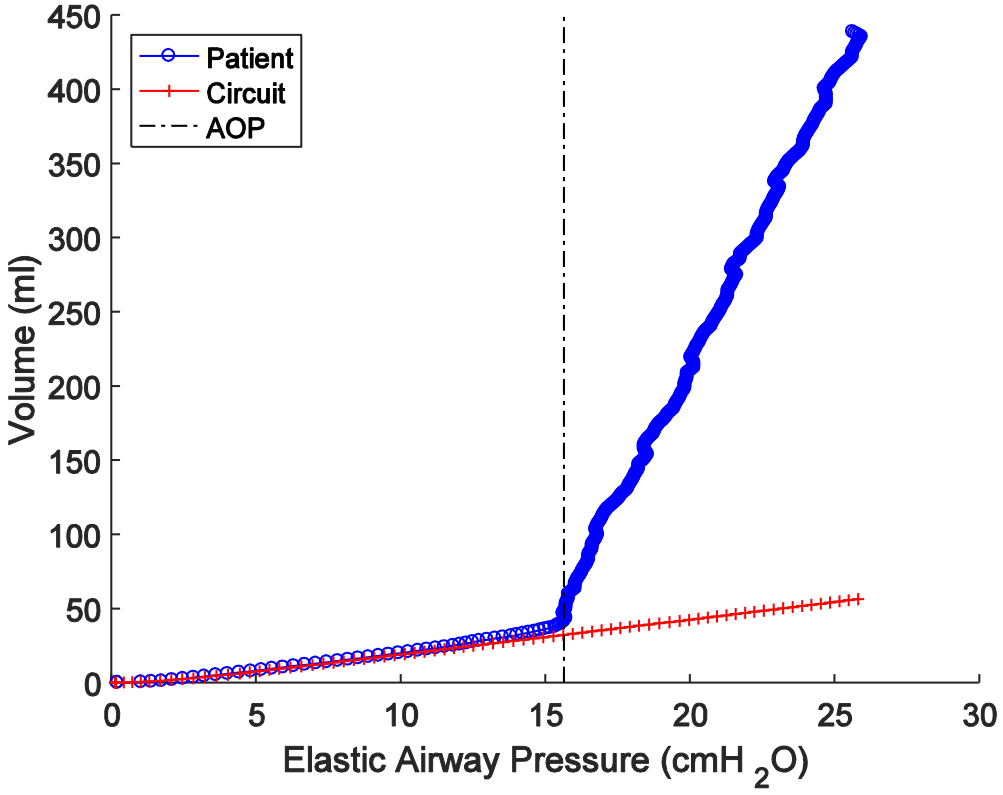

Flow (L/s)
Paw (cmH2O)
Pes (cmH2O)
PL (cmH2O)
Time (s)

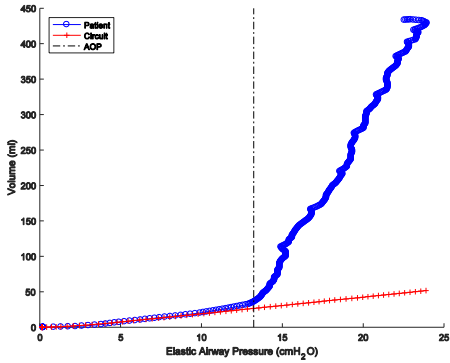
Pressure Volume curve
Majority of the patients (22/30)

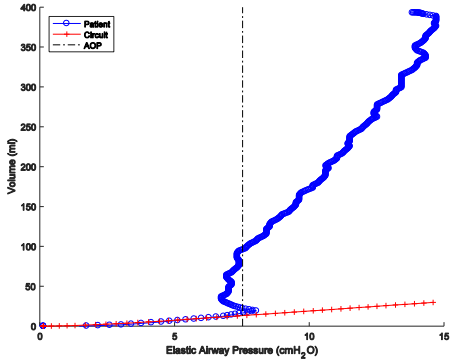


Airway Opening Pressure (AOP)

Chen L. AJRCCM 2017

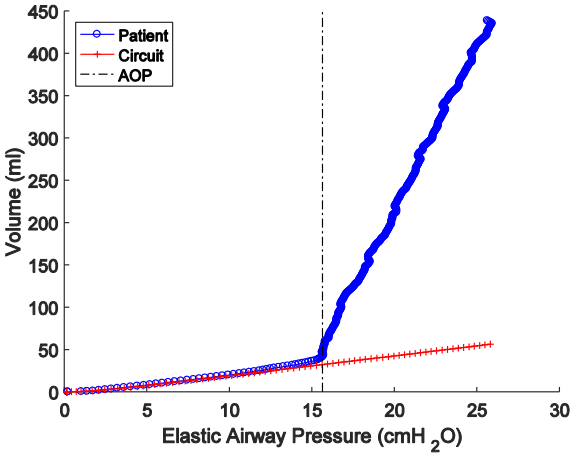




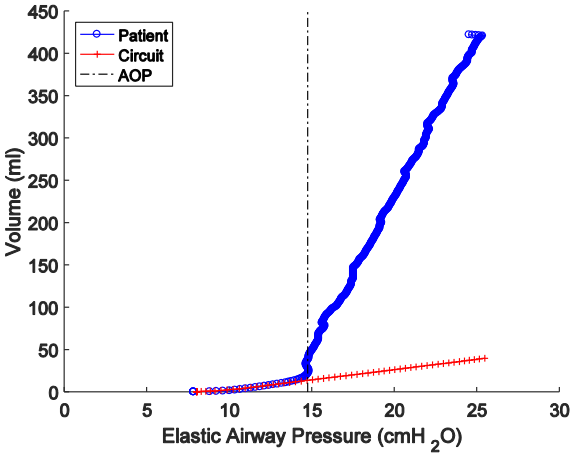


Pt#15

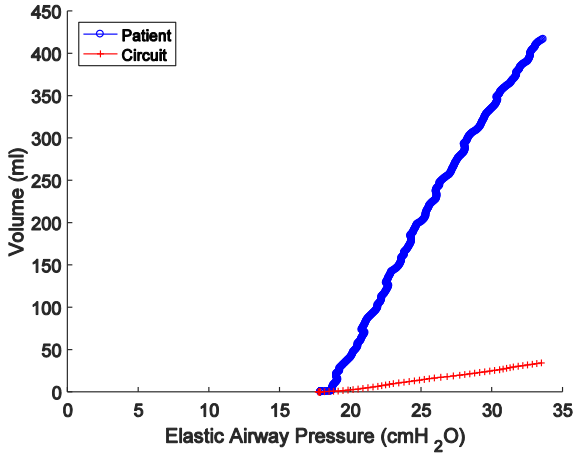
PEEP 0



PEEP 8



PEEP 18



Chen L. AJRCCM 2017