GESTION DES VOIES AÉRIENNES EN RÉANIMATION

SESSION 1

La ventilation invasive chez les patients SDRA COVID: spécificités et problématiques

Pf G. CARTEAUX — APHP H. Mondor

La ventilation invasive chez les patients SDRA COVID: spécificités et problématiques

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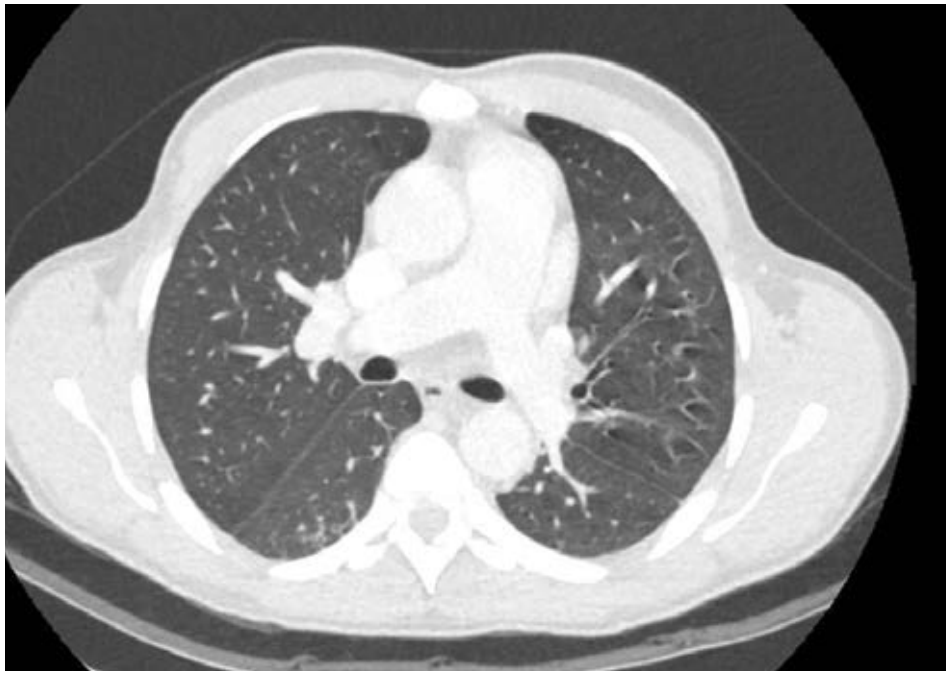
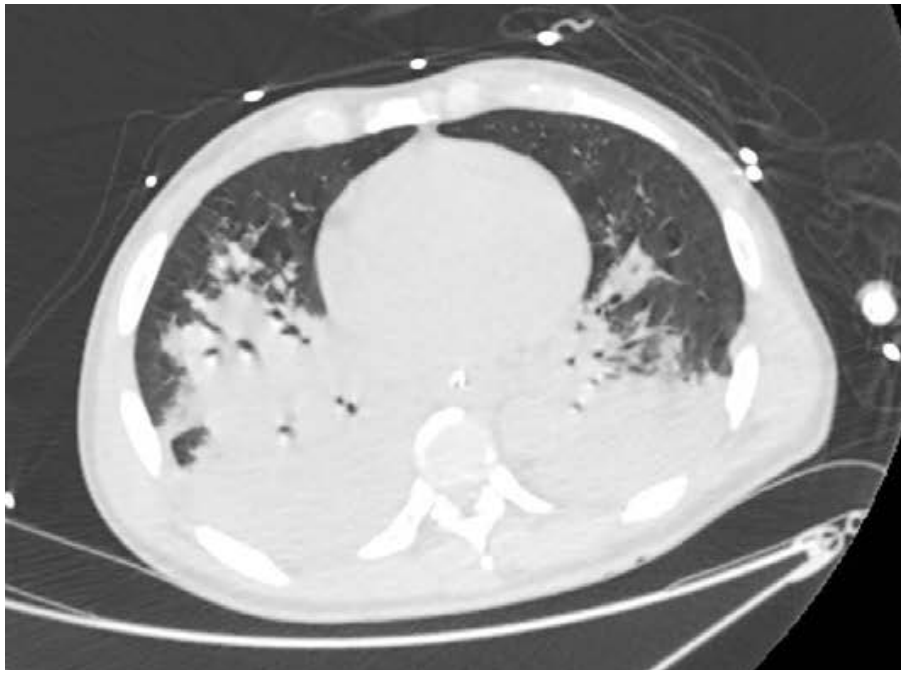
Conflicts of interest

- Fees and/or travel expanses
  - Medtronic
  - Fisher and Paykel
  - Air Liquide Medical System
  - Löwenstein
  - Dräger

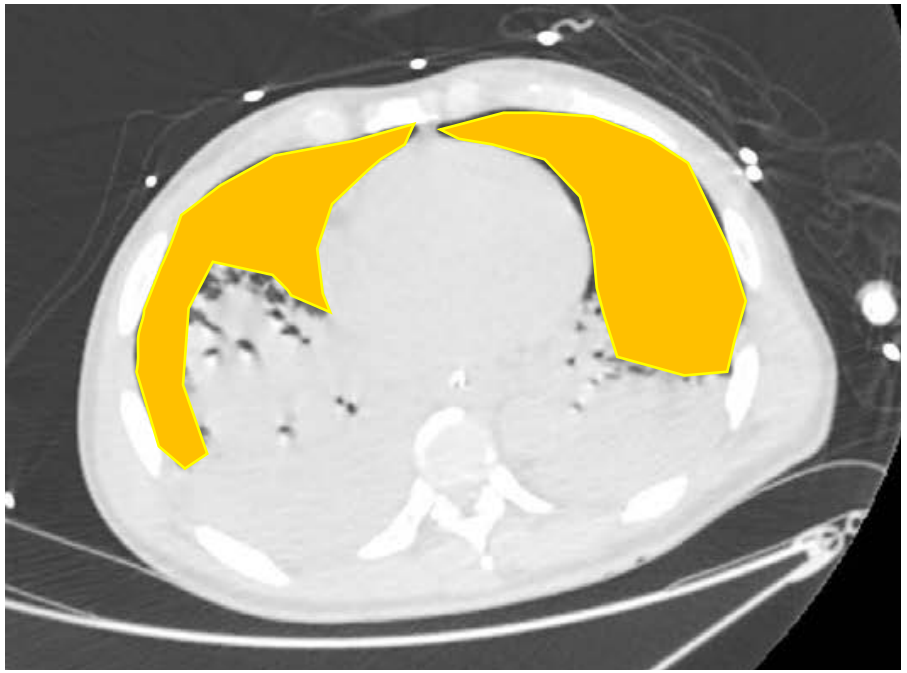
SDRA et ventilation protectrice





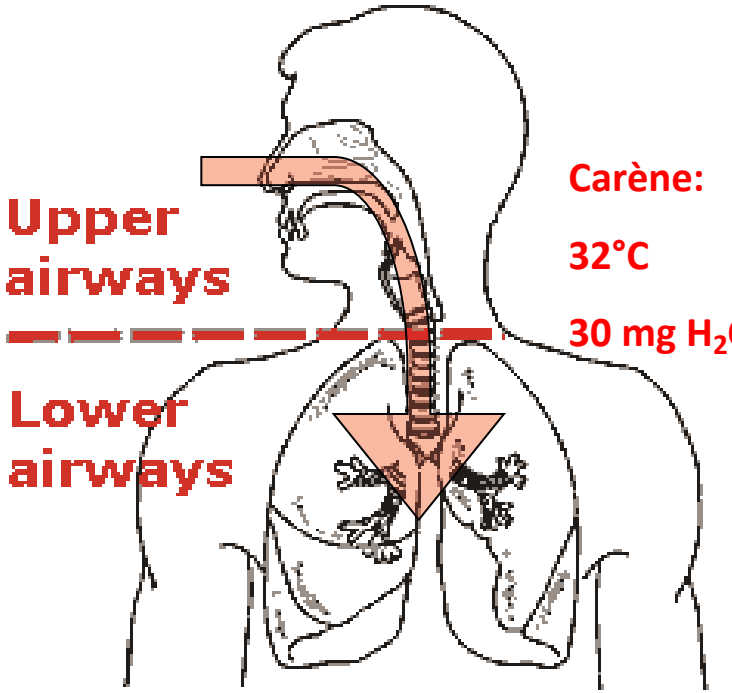
Syndrome de Détresse Respiratoire Aiguë

« Baby lung »



Syndrome de Détresse Respiratoire Aiguë

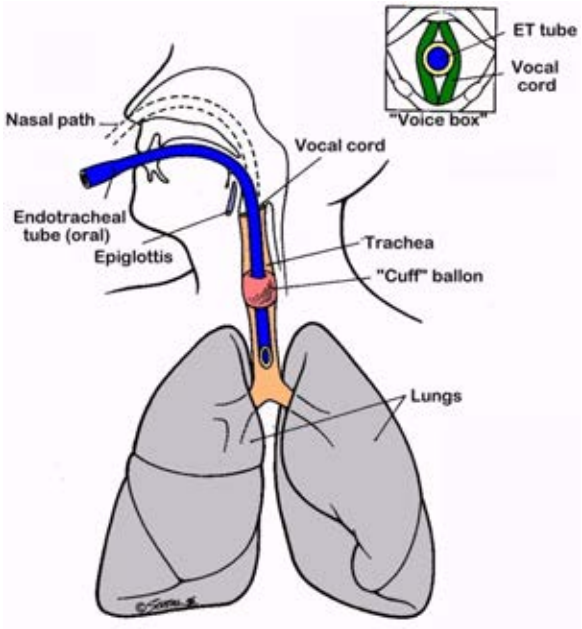
Humidification des gaz inspirés



Carène:

32°C

30 mg H_2O/l



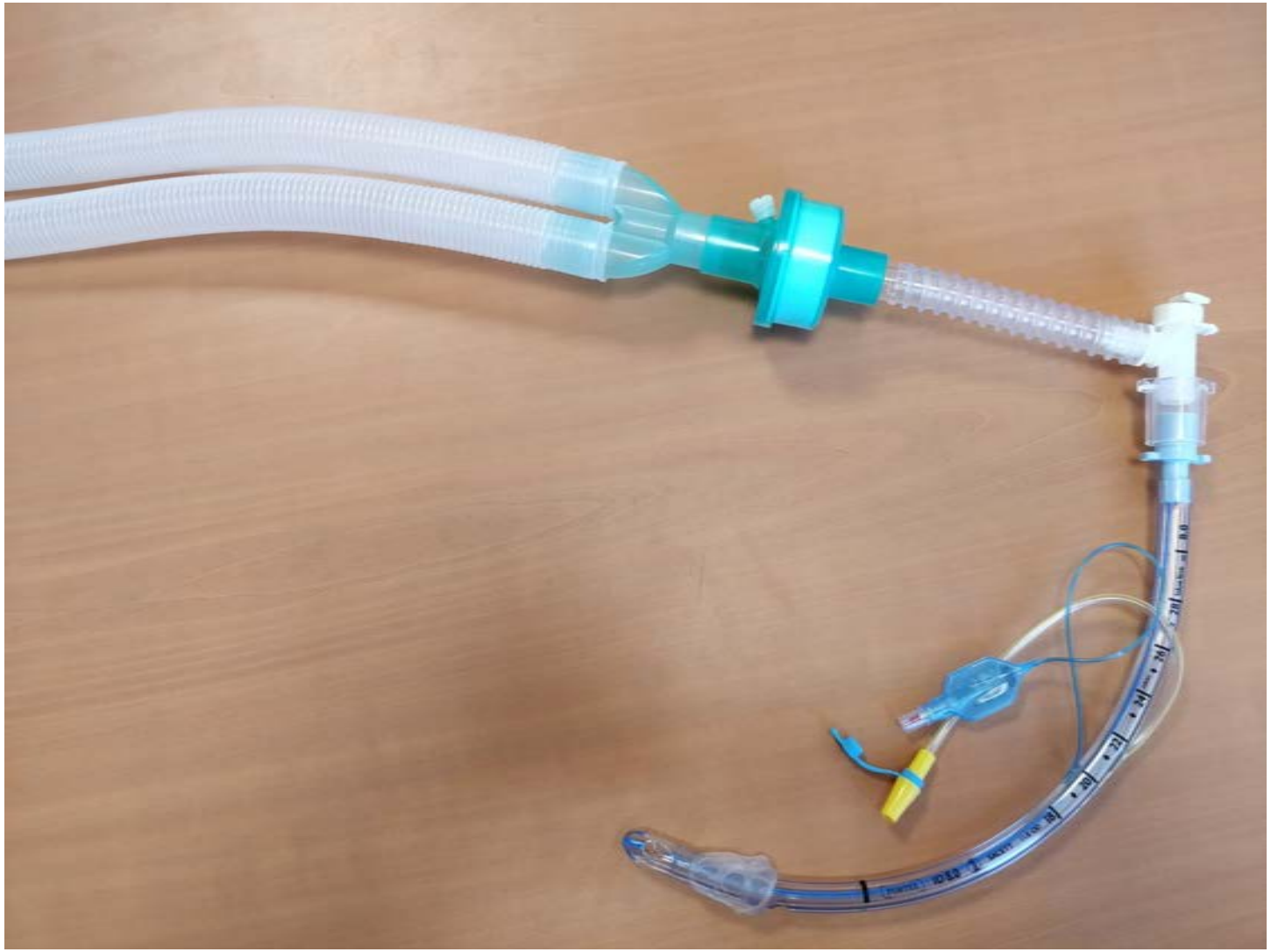
3e génération bronchique:

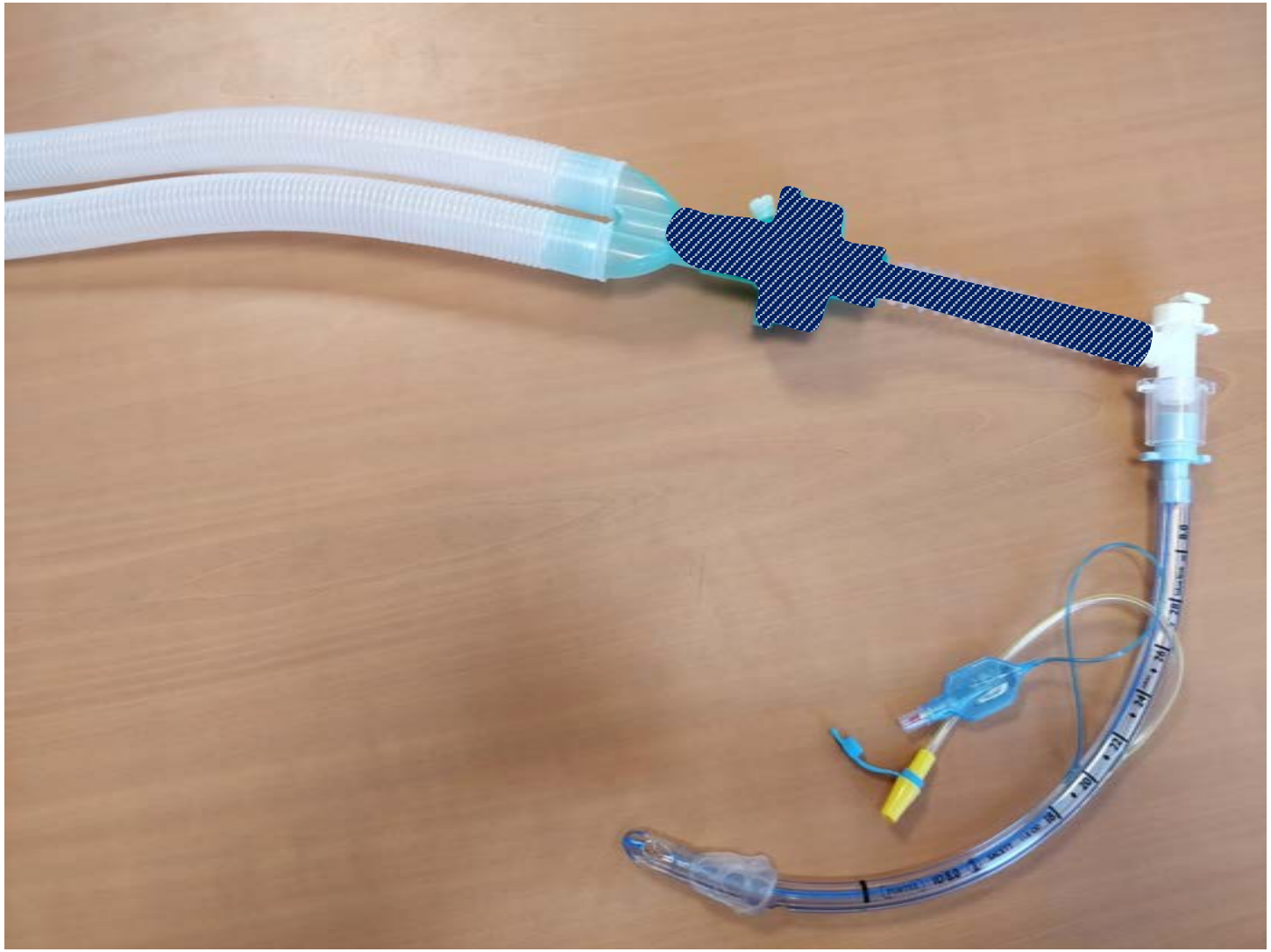
37°C

44 mg H_2O/l (humidité relative = 100%)


37.0

?



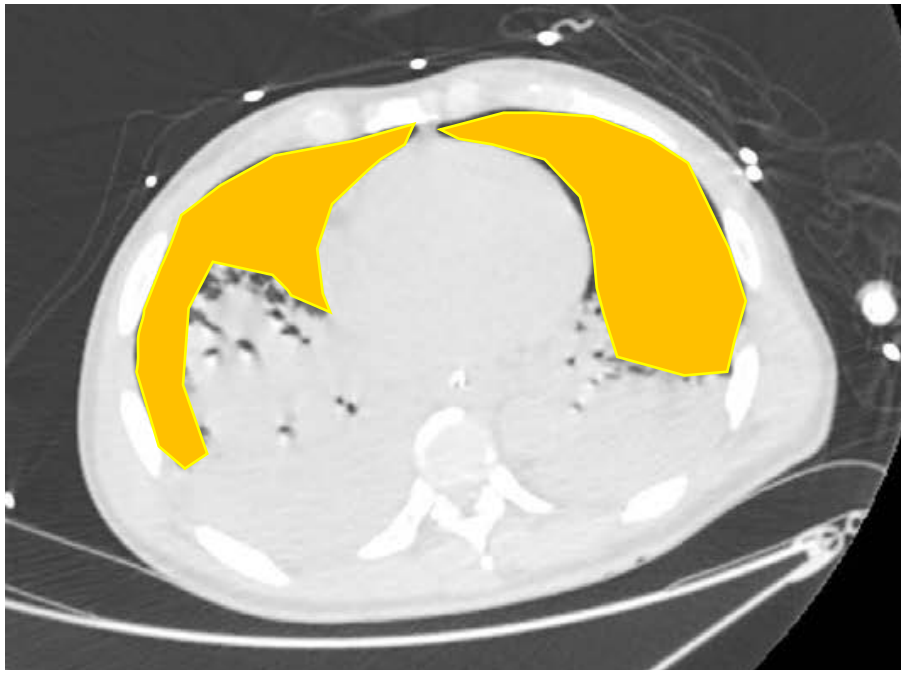



37.0

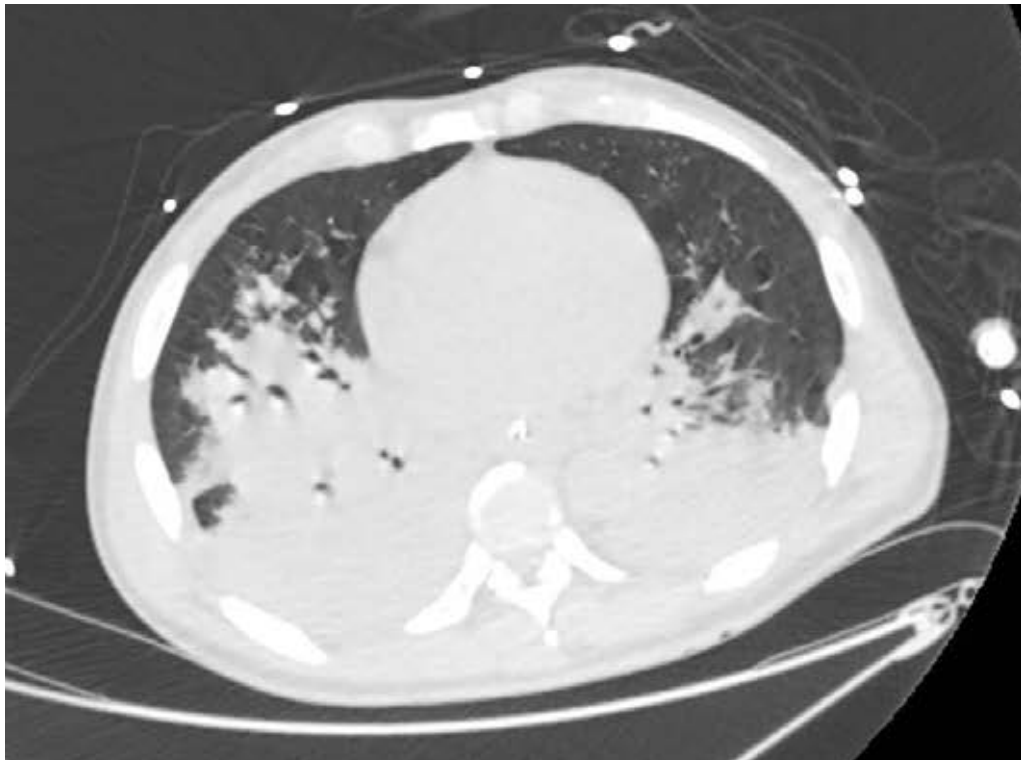
Branche expiratoire

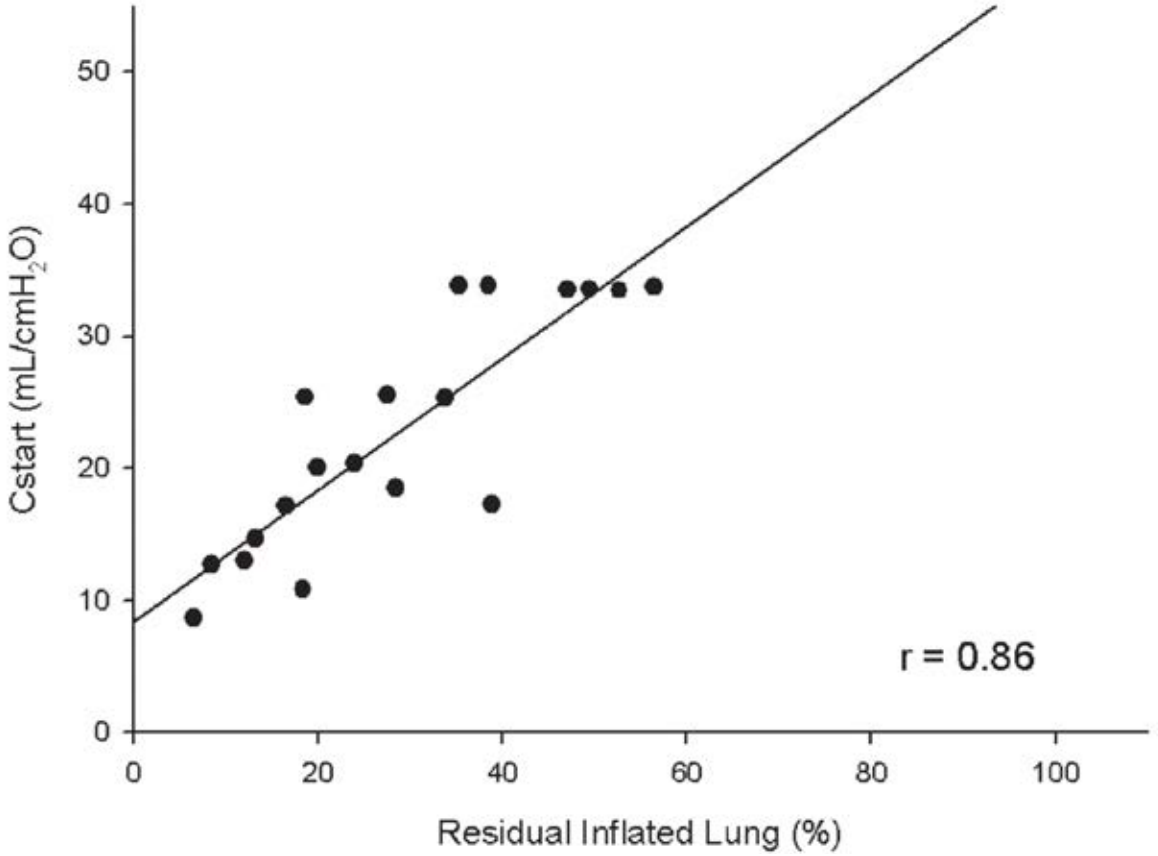
Branche expiratoire

« Baby lung »



Syndrome de Détresse Respiratoire Aiguë





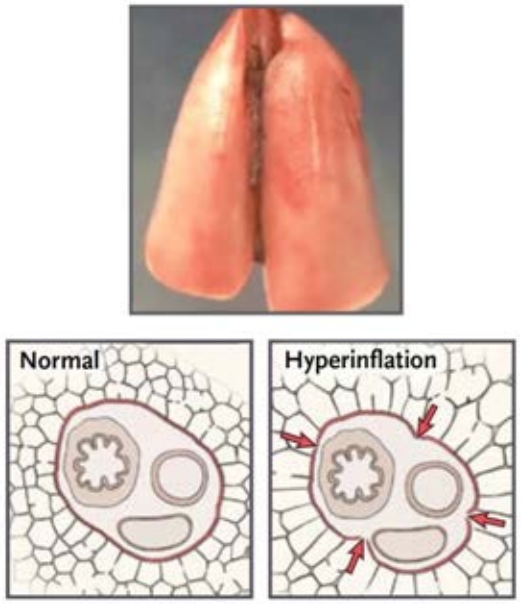
Luciano Gattinoni

Low compliance in ARDS: small lung not stiff lung

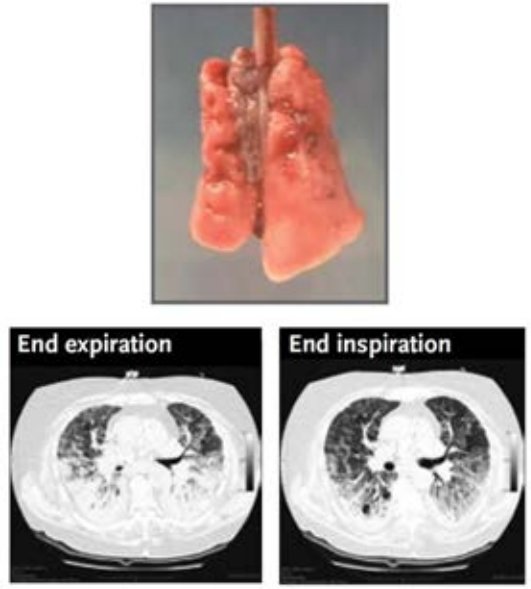
Gattinoni L, Pesenti A. *Intensive Care Med* 2005: The concept of « baby lung »

VILI

Ventilator induced lung injury



Overdistension



Atelectrauma

Biotrauma

IL-1β, IL-6, TNFα,…

A Slutsky, M Ranieri. N Engl J Med 2013;369:2126-36.

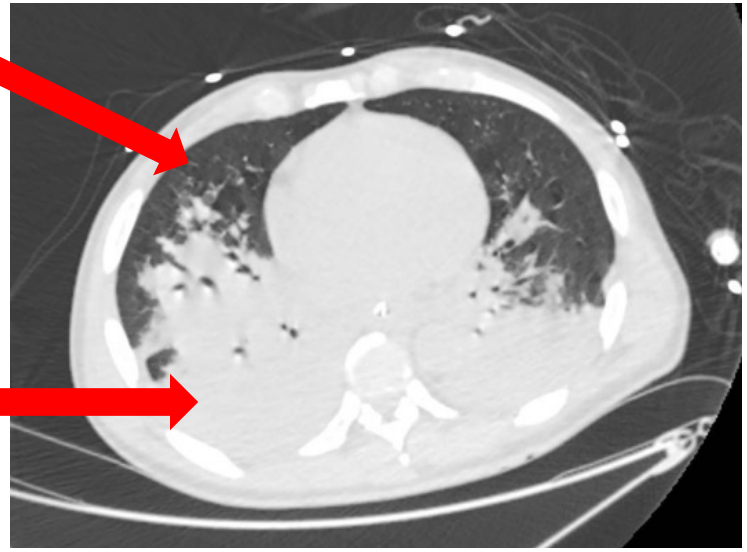
Prévention du VILI

Réduction de la surdistension

- *Réduire* du **volume courant**
- *Limiter* la **pression télé-inspiratoire**
  - *Limiter* le niveau de **PEP**

Réduction des lésions à bas volume

- Recrutement alvéolaire:
  - *Augmenter* le niveau de **PEP**
  - Décubitus ventral

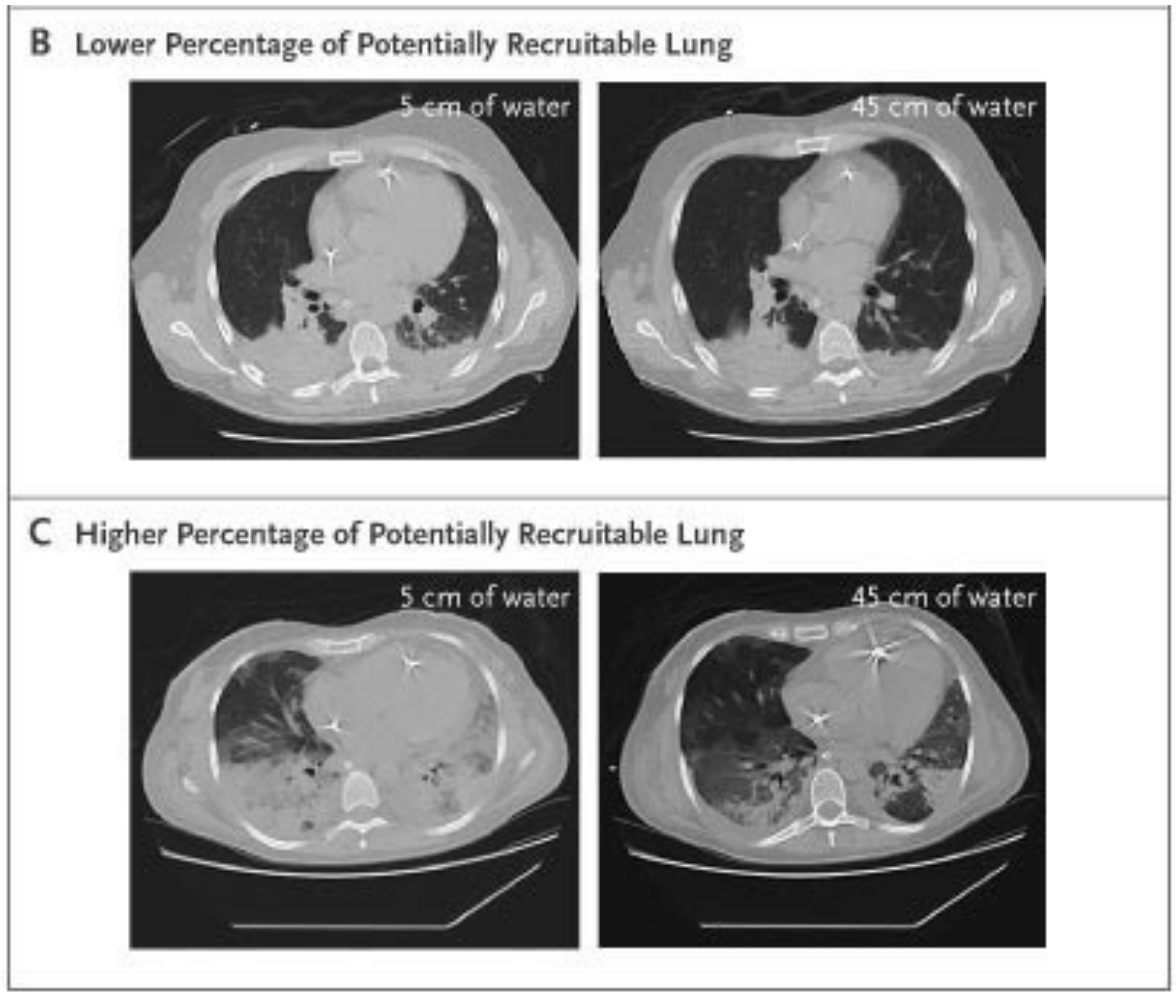


ORIGINAL ARTICLE

Lung Recruitment in Patients with the Acute Respiratory Distress Syndrome

Luciano Gattinoni, M.D., F.R.C.P., Pietro Caironi, M.D., Massimo Cressoni, M.D., Davide Chiumello, M.D., V. Marco Ranieri, M.D., Michael Quintel, M.D., Ph.D., Sebastiano Russo, M.D., Nicolò Patroniti, M.D., Rodrigo Cornejo, M.D., and Guillermo Bugedo, M.D.

2006



SDRA COVID: concernant la mécanique respiratoire et la recrutabilité, que diriez-vous?

- ❑ Tous les patients ont globalement les mêmes caractéristiques
- ❑ Il existe 2 phénotypes: le phénotype L et le phénotype H
- ❑ Il existe une grande variabilité inter-individuelle

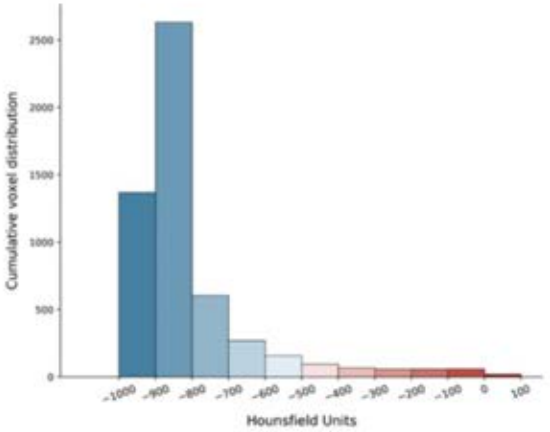
EDITORIAL

COVID-19 pneumonia: different respiratory treatments for different phenotypes?

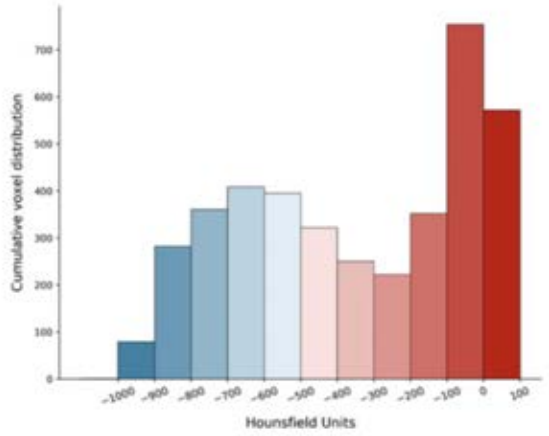
Luciano Gattinoni[1*], Davide Chiumello[2], Pietro Caironi[3,4], Mattia Busana[1], Federica Romitti[1], Luca Brazzi[5] and Luigi Camporota[6]

Intensive Care Med (2020) 46:1099–1102

PaO_2/FiO_2
95 mmHg



PaO_2/FiO_2
84 mmHg



COVID-19 pneumonia, Type L

At the beginning, COVID-19 pneumonia presents with the following characteristics:

- *Low elastance.* The nearly normal compliance indicates that the amount of gas in the lung is nearly normal [4].
- *Low ventilation-to-perfusion (VA/Q) ratio.* Since the gas volume is nearly normal, hypoxemia may be best explained by the loss of regulation of perfusion and by loss of hypoxic vasoconstriction. Accordingly, at this stage, the pulmonary artery pressure should be near normal.
- *Low lung weight.* Only ground-glass densities are present on CT scan, primarily located subpleurally and along the lung fissures. Consequently, lung weight is only moderately increased.
- *Low lung recruitability.* The amount of non-aerated tissue is very low; consequently, the recruitability is low [5].

COVID-19 pneumonia, Type H

The Type H patient:

- *High elastance.* The decrease in gas volume due to increased edema accounts for the increased lung elastance.
- *High right-to-left shunt.* This is due to the fraction of cardiac output perfusing the non-aerated tissue which develops in the dependent lung regions due to the increased edema and superimposed pressure.
- *High lung weight.* Quantitative analysis of the CT scan shows a remarkable increase in lung weight (>1.5 kg), on the order of magnitude of severe ARDS [12].
- *High lung recruitability.* The increased amount of non-aerated tissue is associated, as in severe ARDS, with increased recruitability [5].

EDITORIAL

COVID-19 pneumonia: different respiratory treatments for different phenotypes?

Luciano Gattinoni[1*], Davide Chiumello[2], Pietro Caironi[3,4], Mattia Busana[1], Federica Romitti[1], Luca Brazzi[5] and Luigi Camporota[6]

Intensive Care Med (2020) 46:1099–1102

Luciano Gattinoni

"Based on detailed observation of several cases and discussions with colleagues treating these patients, we hypothesize that the different COVID-19 patterns found at presentation in the emergency department…"

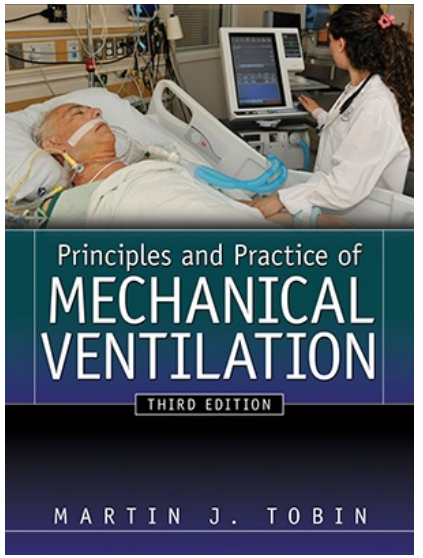
Luciano Gattinoni

“At this stage, dyspnea develops, which in turn leads to worsening P-SILI”

“As esophageal pressure swings increase (…) to above 15 cmH_2O, the risk of lung injury increases and therefore intubation should be performed as soon as possible”

L Gattinoni *et al. Intensive Care Med* 2020

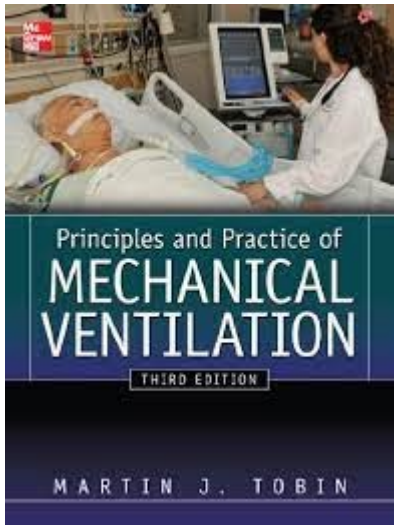
Martin J Tobin



“At this time, the existence of P-SILI is based only on the shakiest of circumstantial evidence and has yet to be exposed to the acid-wash of experimental testing by differing scientists.”

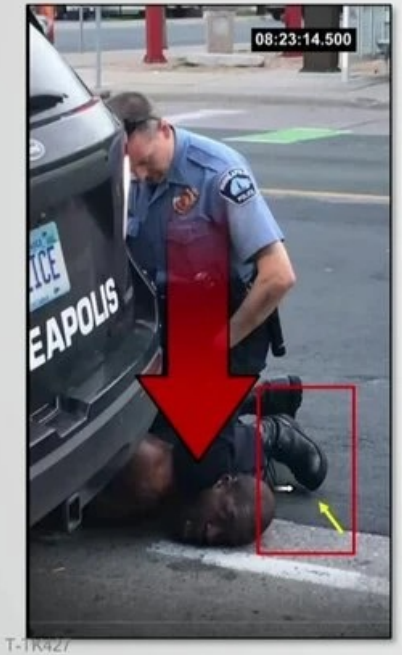
M J Tobin *et al. Ann Intensive Care* 2020

https://www.youtube.com/watch?v=6HGijfVyfIw



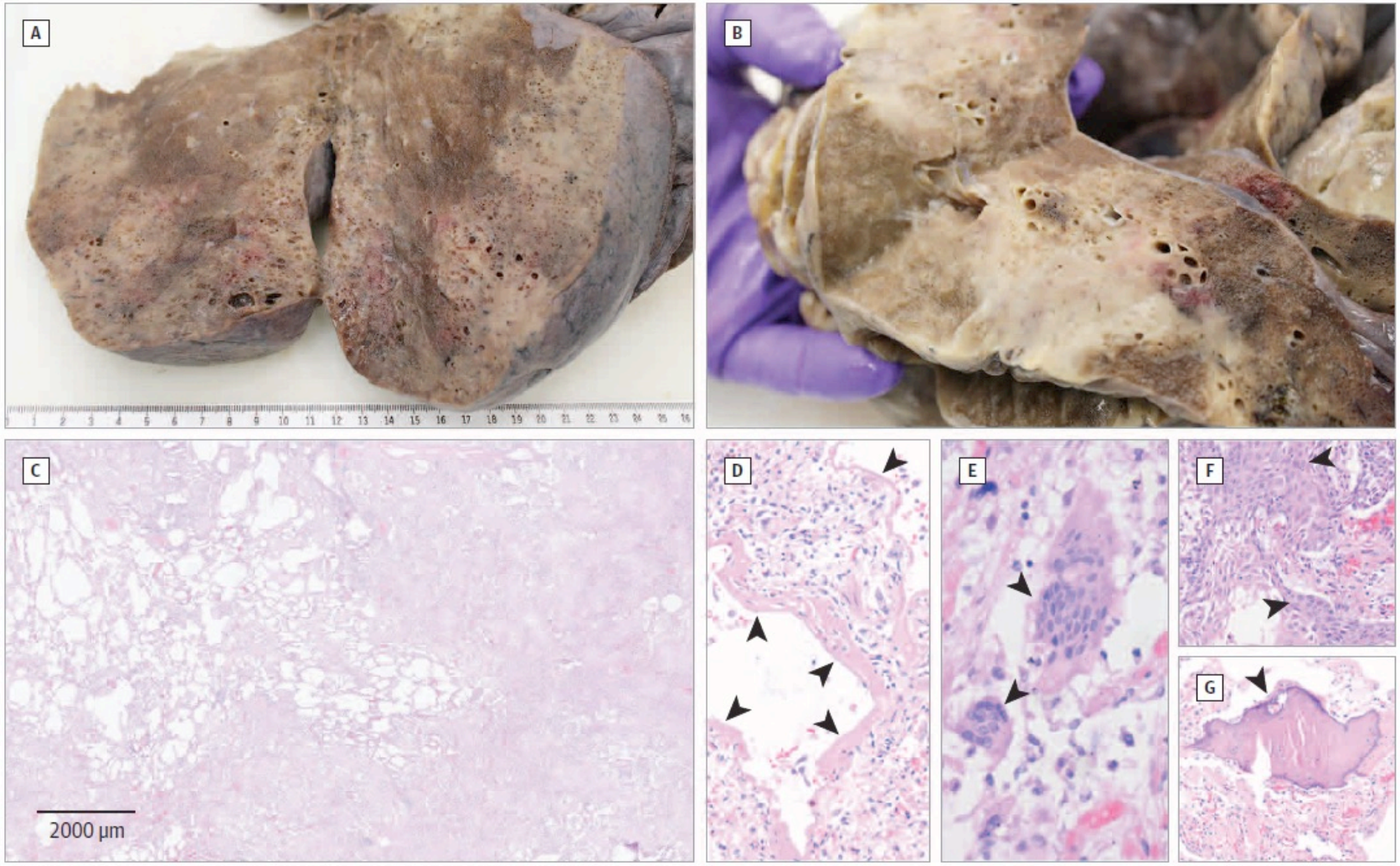
Officer Chauvin's Orientation

Officer Chauvin's is near vertical. His toes are off the ground, signifying half his body weight (91.5 lbs.) is directly compressing the neck; with his toes on the ground, the weight on the neck is 86.9 lbs. (half the shank's weight is supported by the toes).



Ex. 943

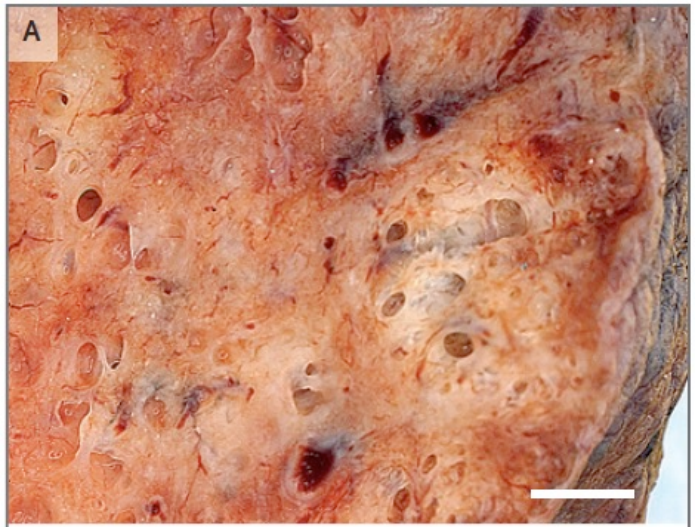
10 patients SDRA COVID, examen post-mortem



Macroscopic (A and B) and histologic (C) images of organizing and end-stage diffuse alveolar damage (hematoxylin-eosin staining) with hyaline membranes (D, arrowheads, ×100), multinucleated giant cells (E, arrowheads, ×400), and squamous/osseous metaplasia (F and G, arrowheads, ×200) in a patient with a fatal course of coronavirus disease 2019.

Schaller T *et al.* JAMA 2020

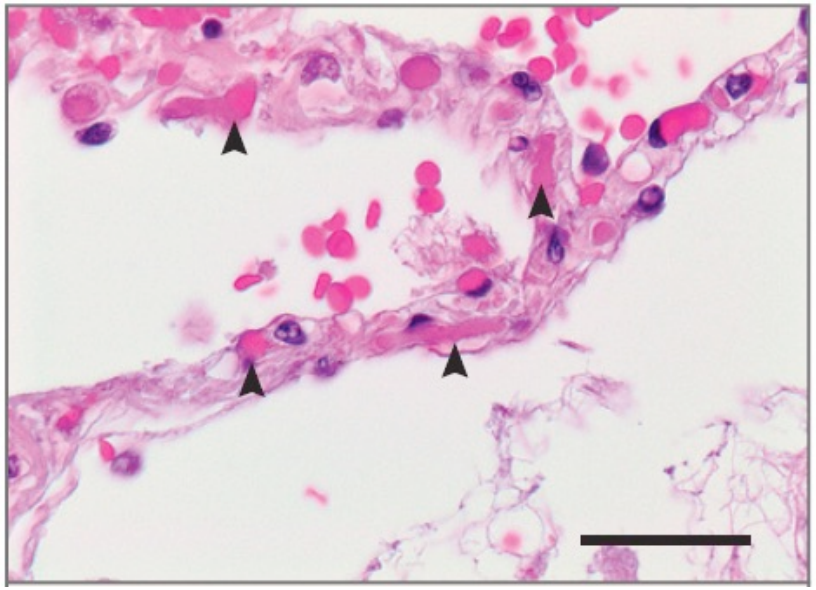
7 COVID *vs.* 7 H1N1 *vs.* 10 poumons normaux

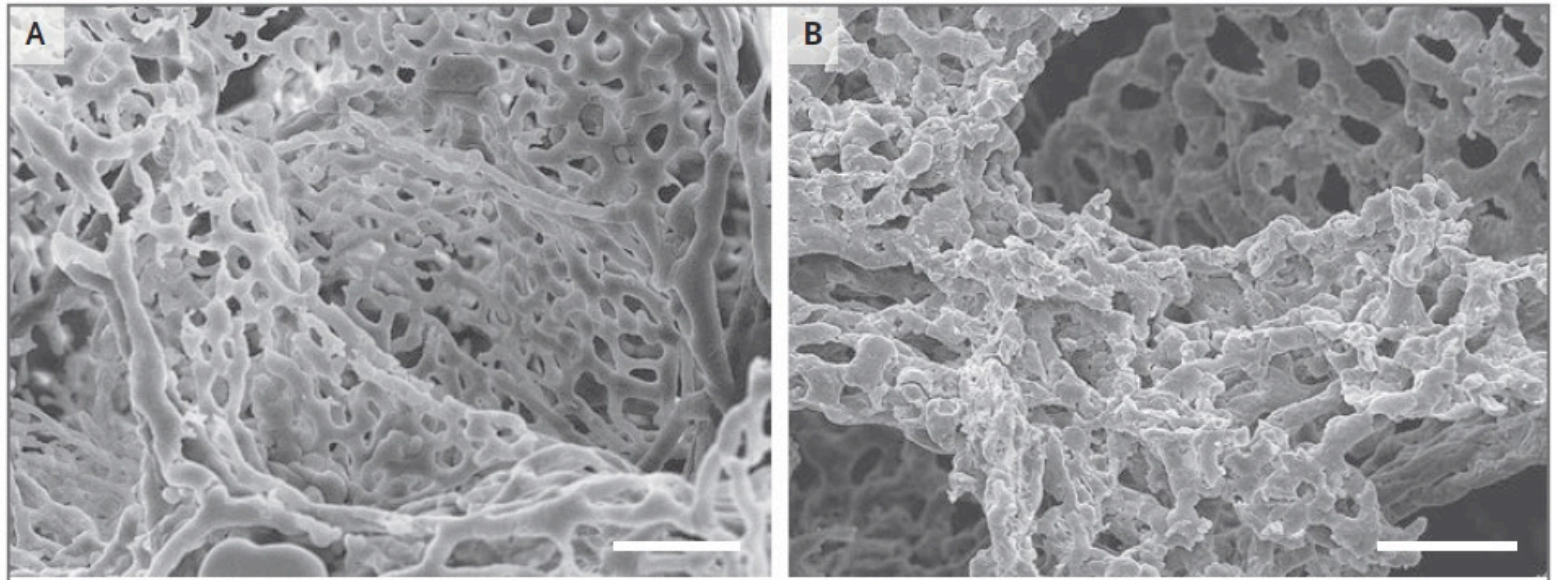


COVID et H1N1: DAD mais poids poumons H1N1 > COVID

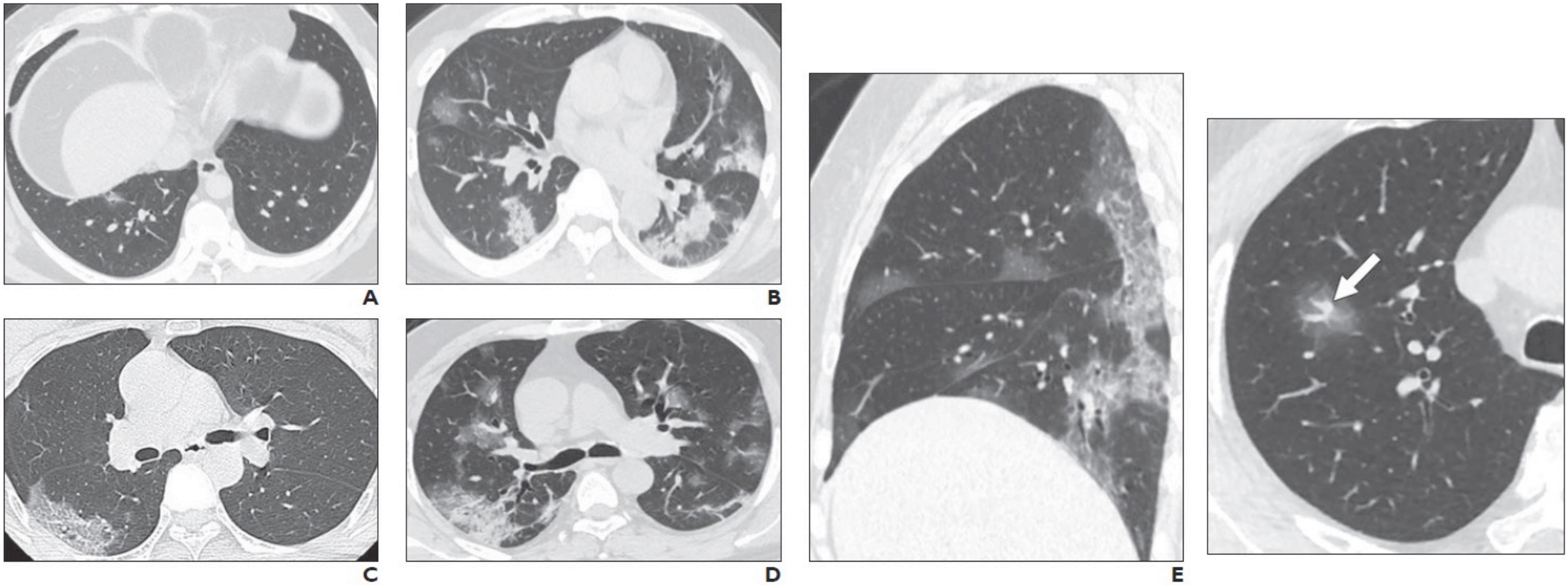
COVID: 9 x plus de microthrombi

COVID: distorsion, tortuosité du lit vasculaire; phénomènes angiogéniques

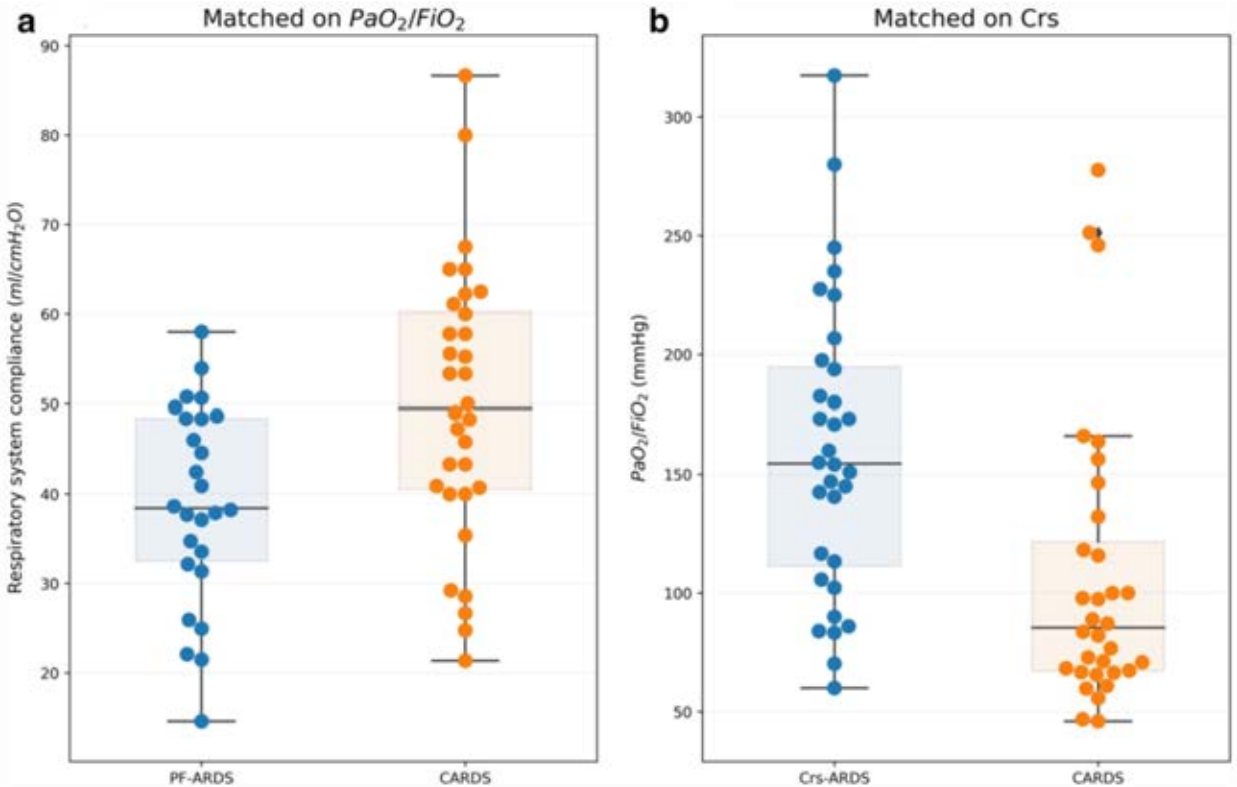




Ackermann M et al. NEJM 2020

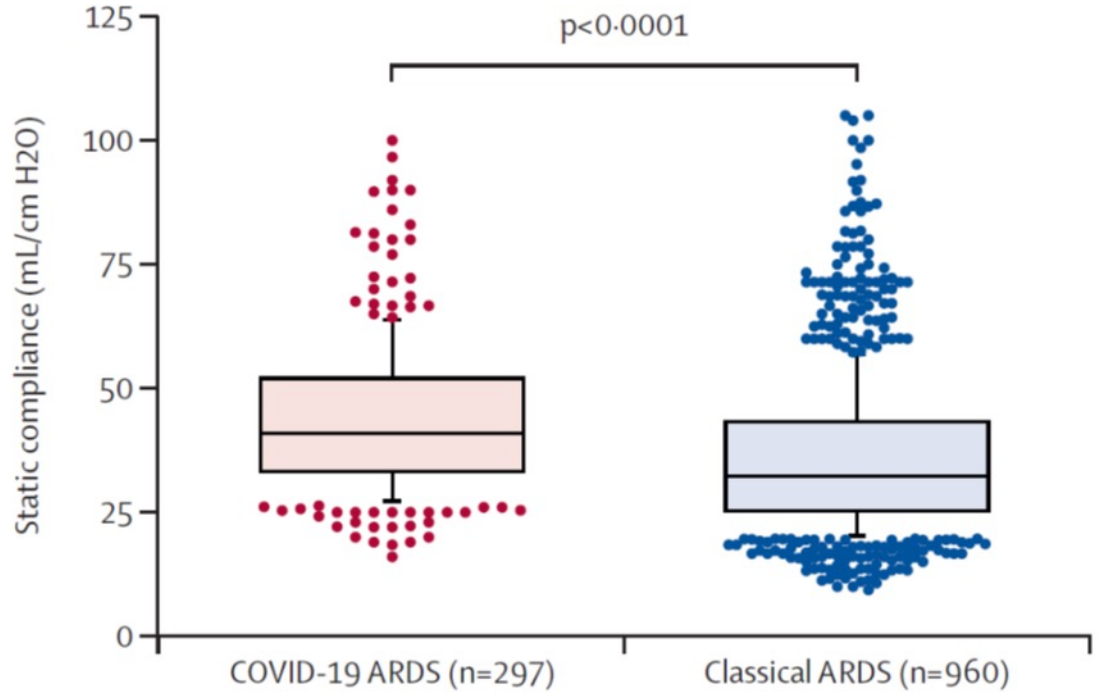


Zhou S *et al.* Radiology 2020



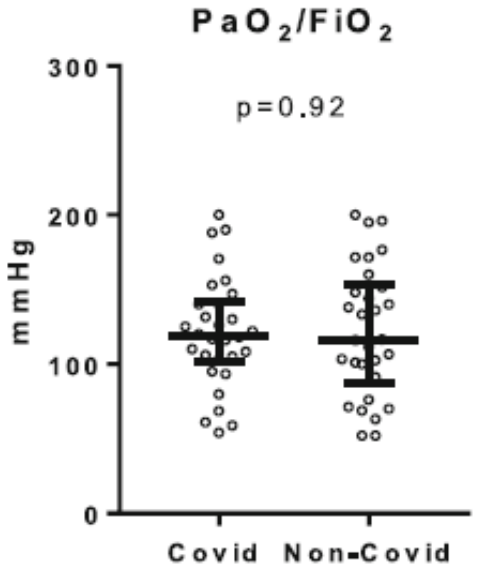
N = 32 CARDS

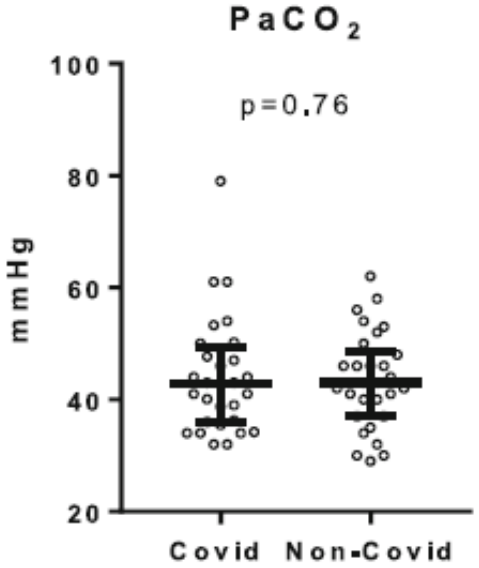
Chiumello D *et al. Intensive Care Med* 2020; 46:2187-2196

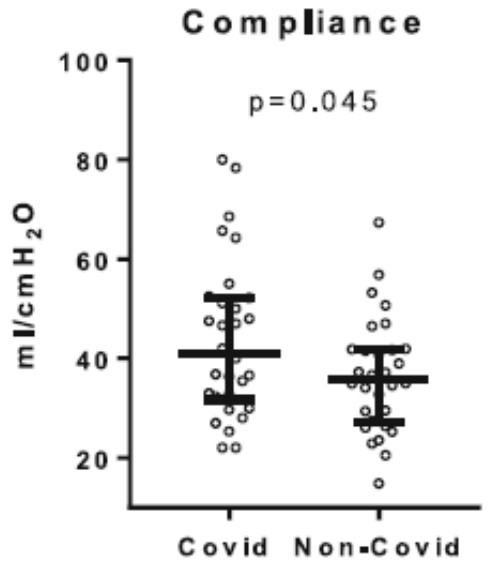


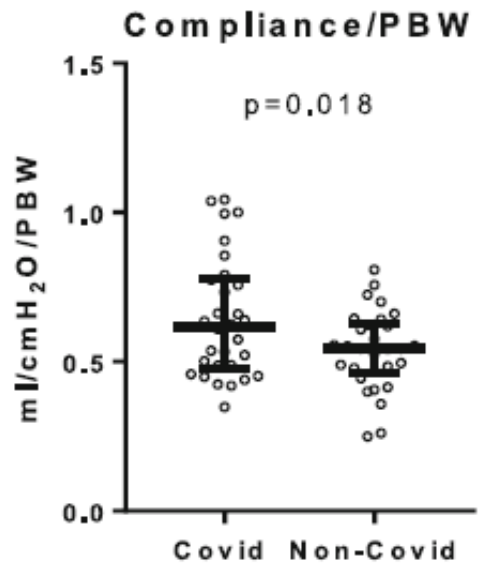
Grasseli *et al. Lancet Respir Med 2010*; 8:1201-1208

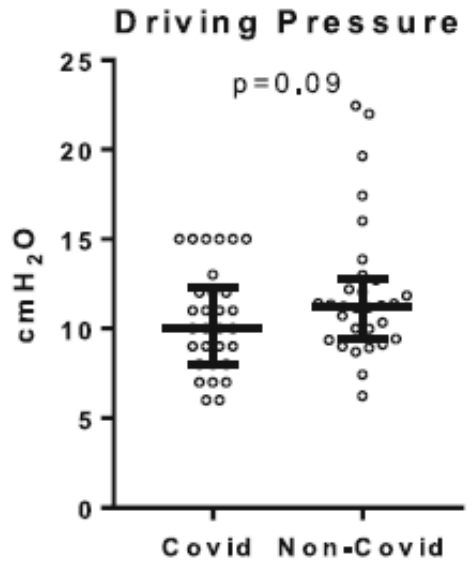
30 COVID-19 ARDS *vs.* 30 Non-COVID-19 ARDS, matching: P/F – FiO_2 - PEEP

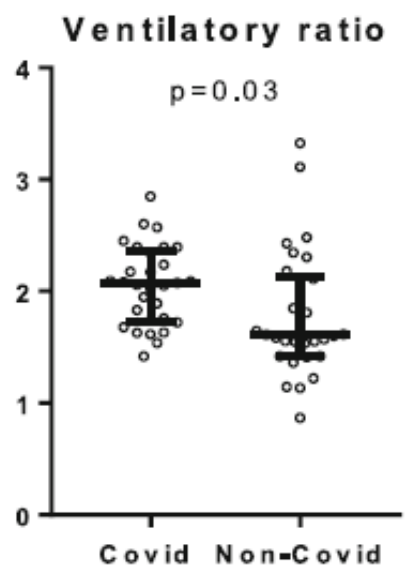


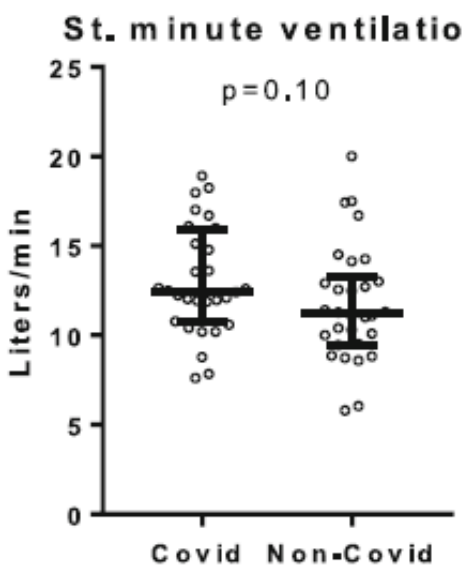


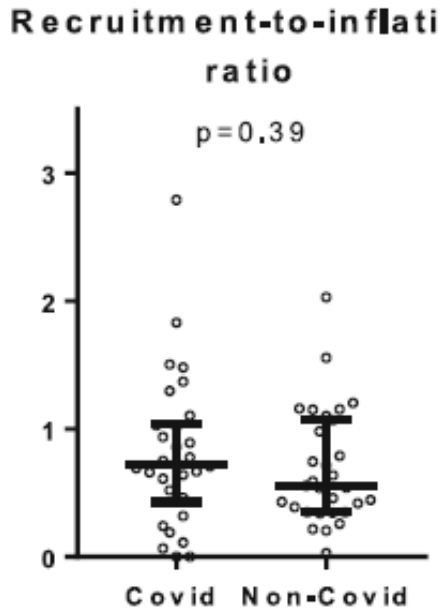








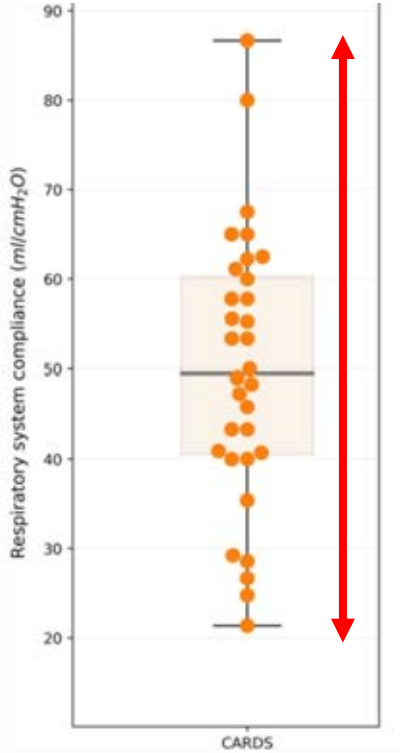


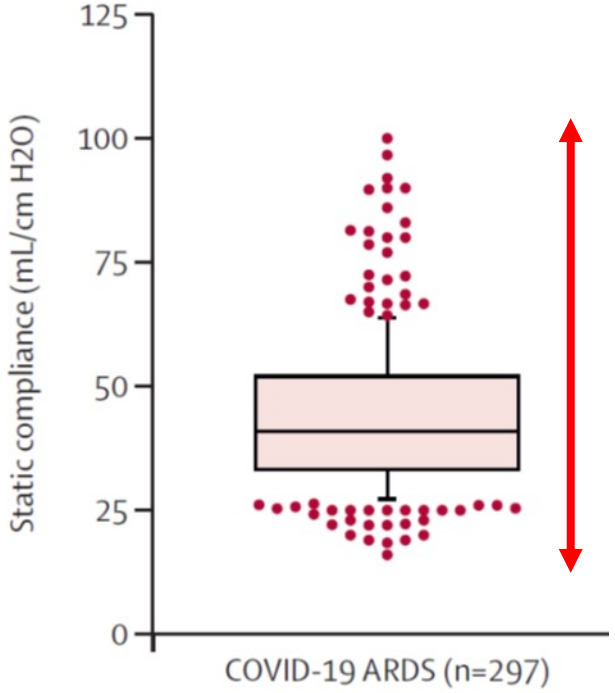


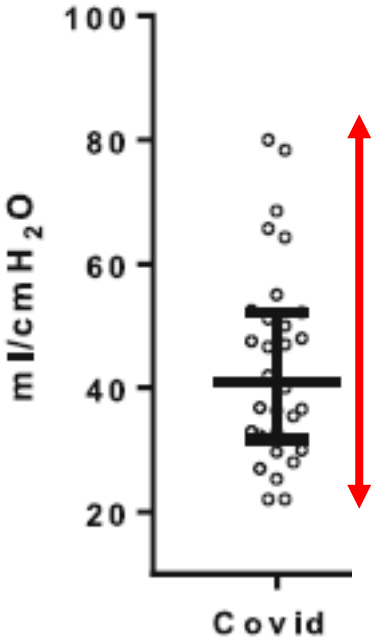
Grieco DL *et al*. Crit Care 2020

Study	Type of Study N	PaO_2/FiO_2 inclusion criteria	Baseline values Respiratory System Compliance	Plateau Pressure	Driving Pressure
LUNG SAFE **Bellani et al,** **JAMA 2016; 315:788**	Observational 2377	<=300	32	23.2	-
OLA **Kacmarek et al,** **Crit Care Med 2016; 44:32**	RCT 200	<=200	28.5	25.8	14.1
ART **Cavalcanti et al,** **JAMA 2017; 318:1335**	RCT 1010	<=200	29.7	26	13.5
PETAL **Moss et al,** **New Engl J Med 2019; 380:1997**	RCT 1006	<=200	-	25.6	12.9
PRONE **Guerin et al,** **New Engl J Med 2013; 368:2159**	RCT 466	<=150	35.5	23.5	-
AVERAGE			32.1	24.8	13.1
Our study **Ferrando et al.**	Observational 742	< =300	35.2 (32.0-35.8)	25.0 (24.0-26.0)	13.1 (12.0-13.4)
Comparison with the AVERAGE value (p-value)			0.062	0.404	0.808

Ferrando *et al.* Intensive Care Med 2020







Chiumello D *et al. Intensive Care Med* 2020

Grasseli *et al. Lancet Respir Med 2020*

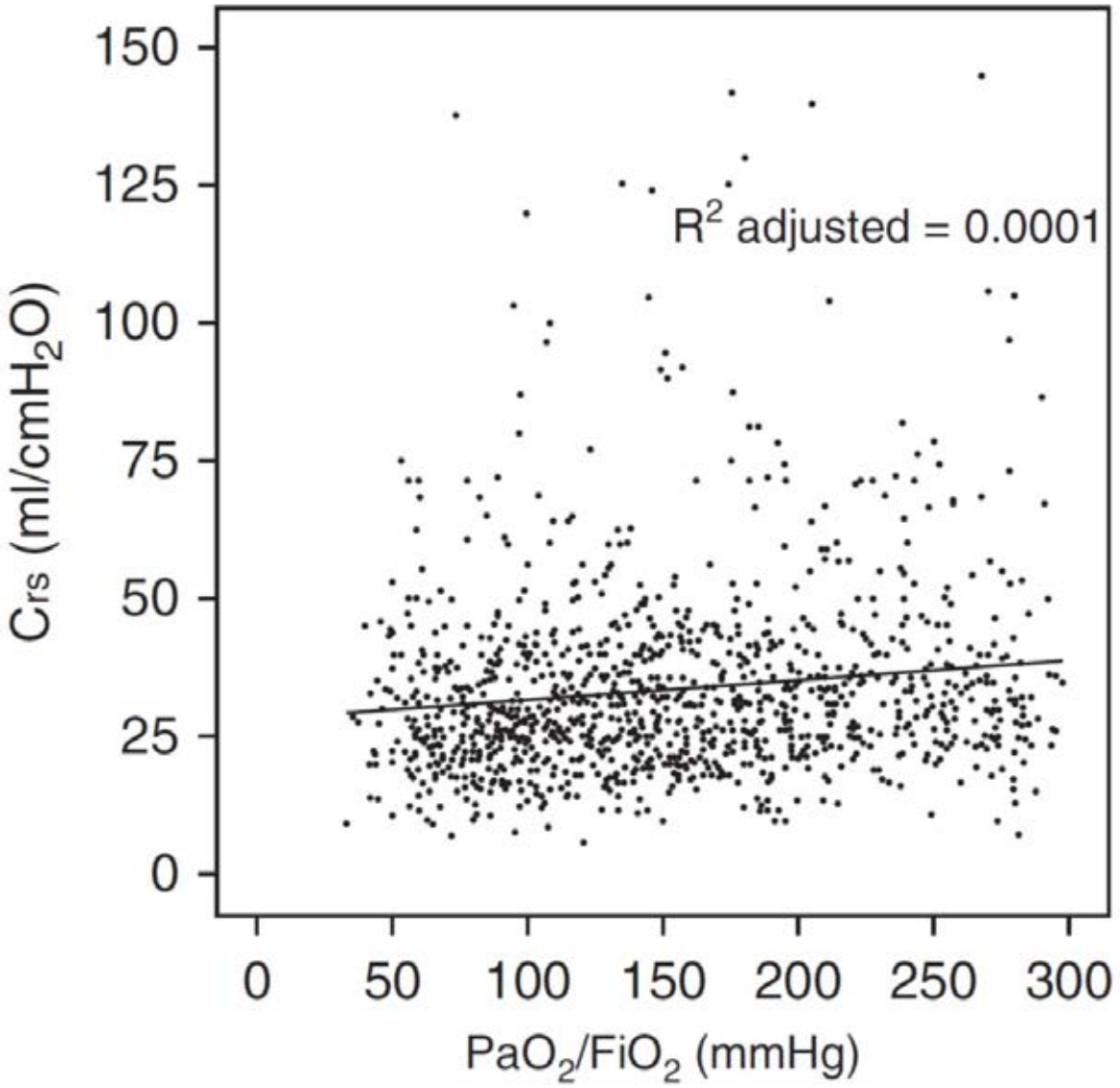
Grieco DL *et al*. Crit Care 2020

LUNG SAFE
N = 1 117 ARDS NON COVID

H Phenotype (CRS < 40): 74 %

L Phenotype (CRS ≥ 50): 12 %

Intermediate Phenotype
(40 ≤ CRS < 50): 14 %

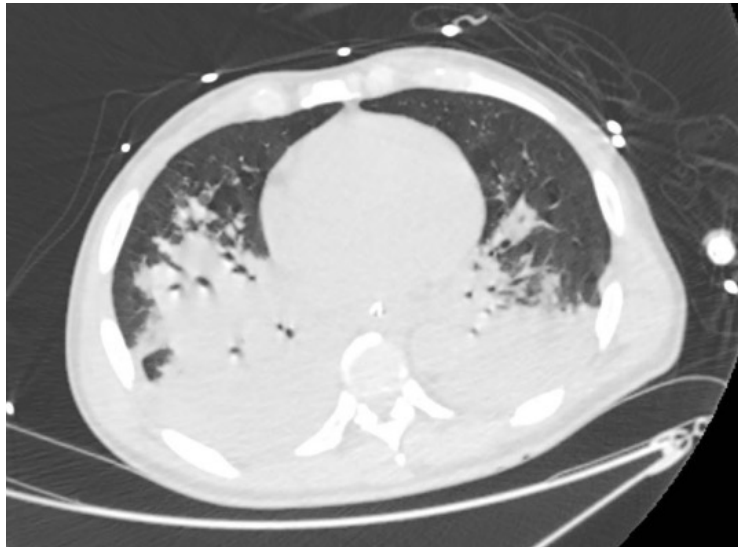


Panwar *et al. Am J Respir Crit Care Med* 2020

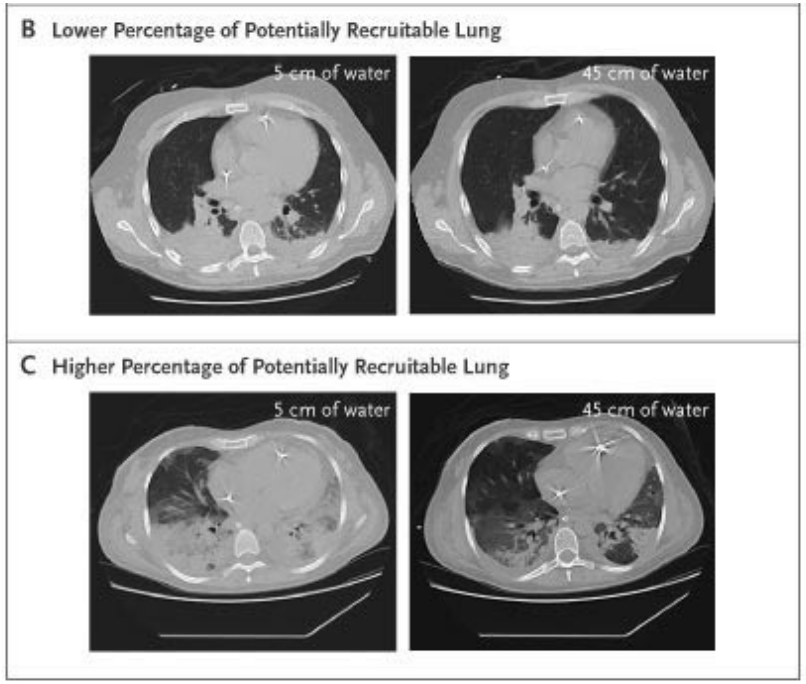
☑Volume courant ≈ 6 ml/kg de PPT

☑ ΔP < 15 cm H_2O

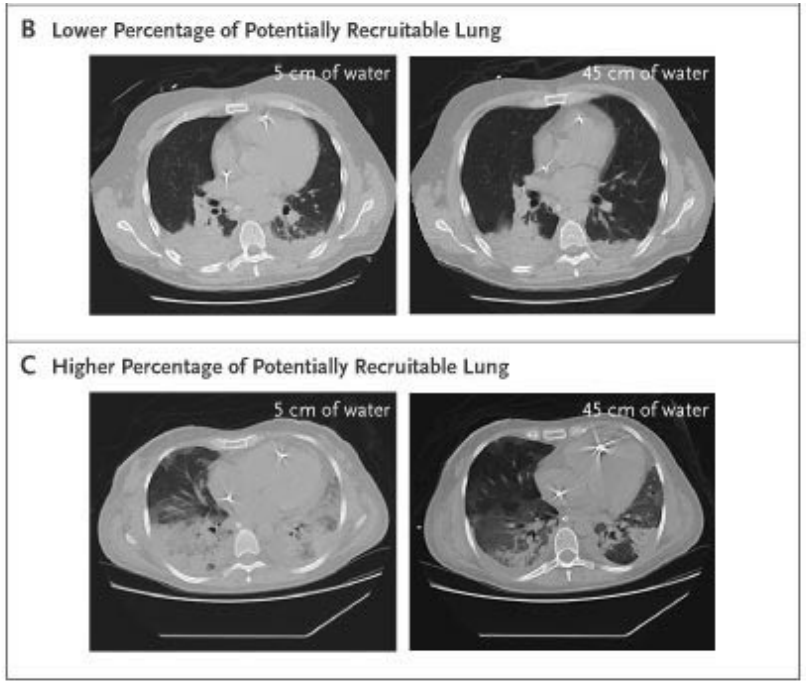
☑ Pression de plateau ≤ 30 cm H_2O




PEP


B Lower Percentage of Potentially Recruitable Lung
5 cm of water
45 cm of water
C Higher Percentage of Potentially Recruitable Lung
5 cm of water
45 cm of water


PEP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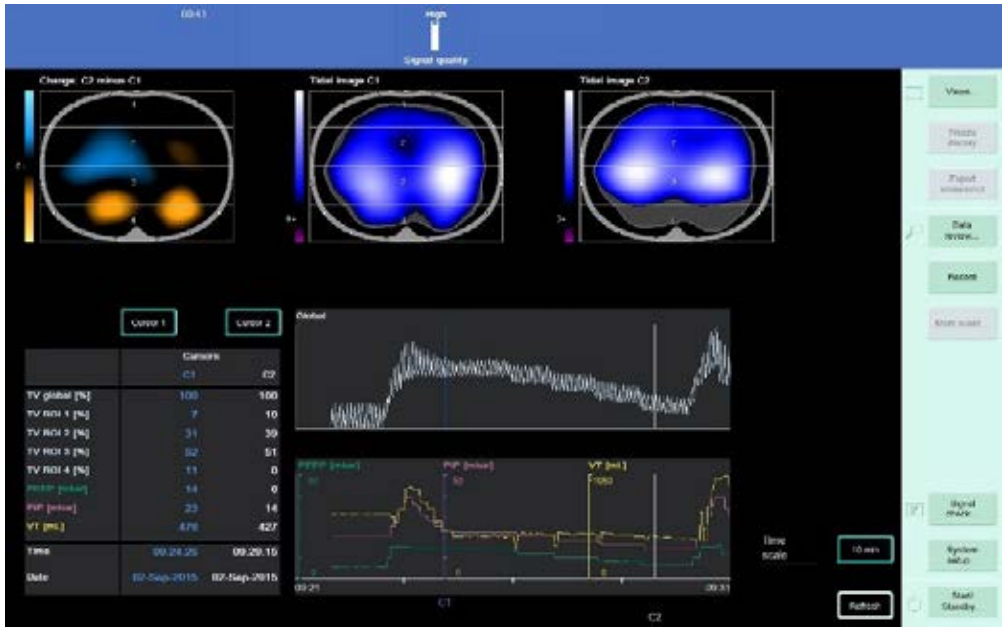
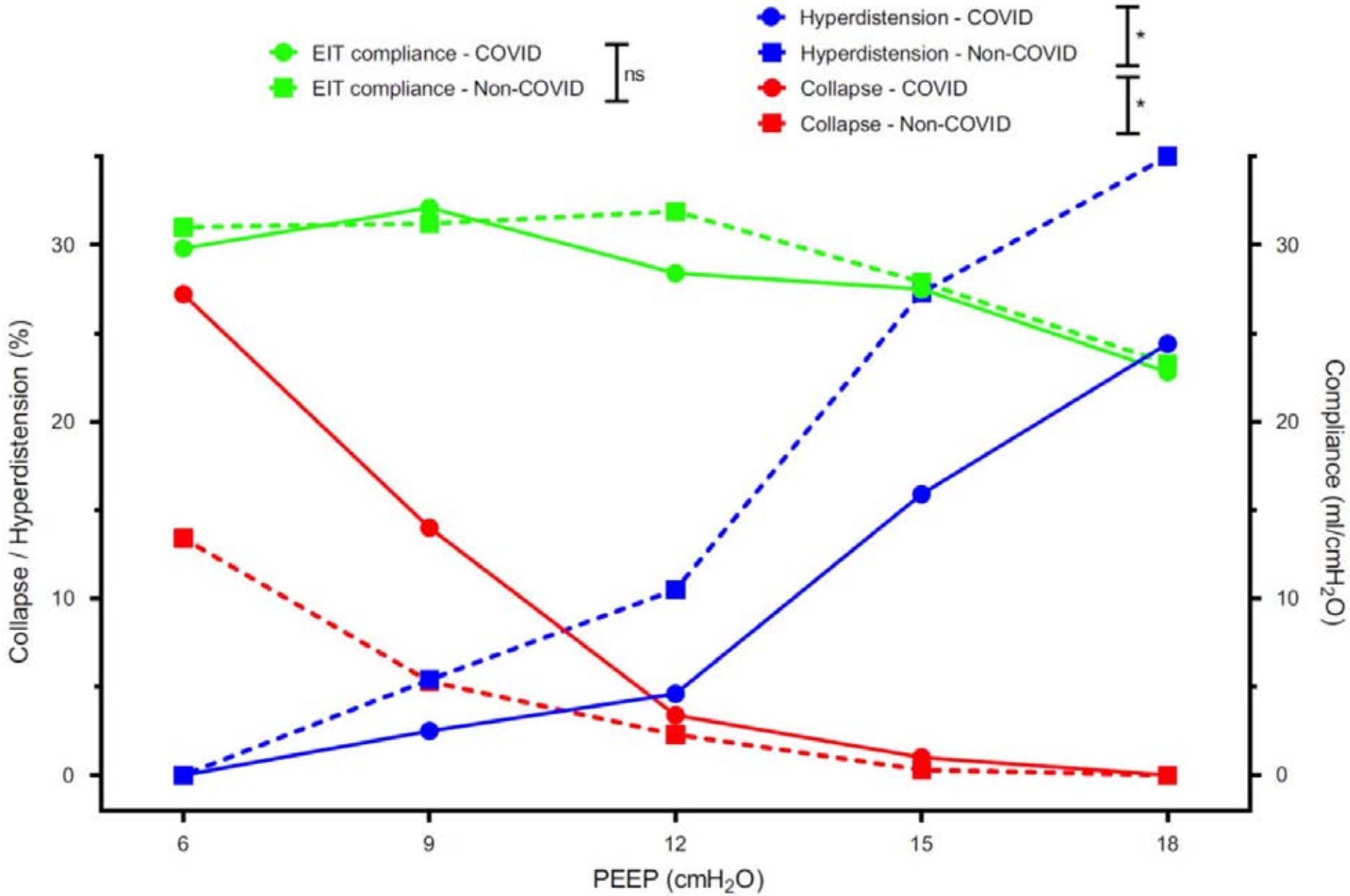
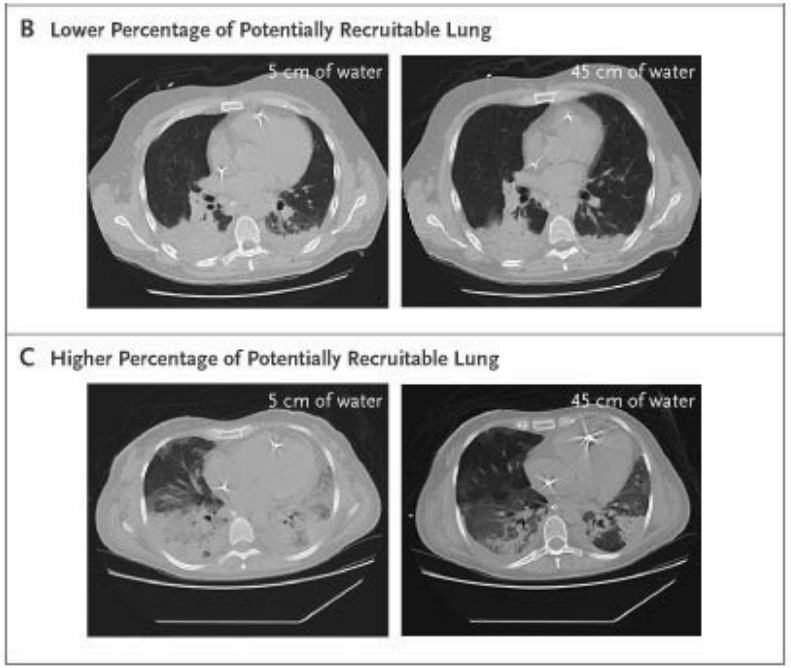
45 cm of water

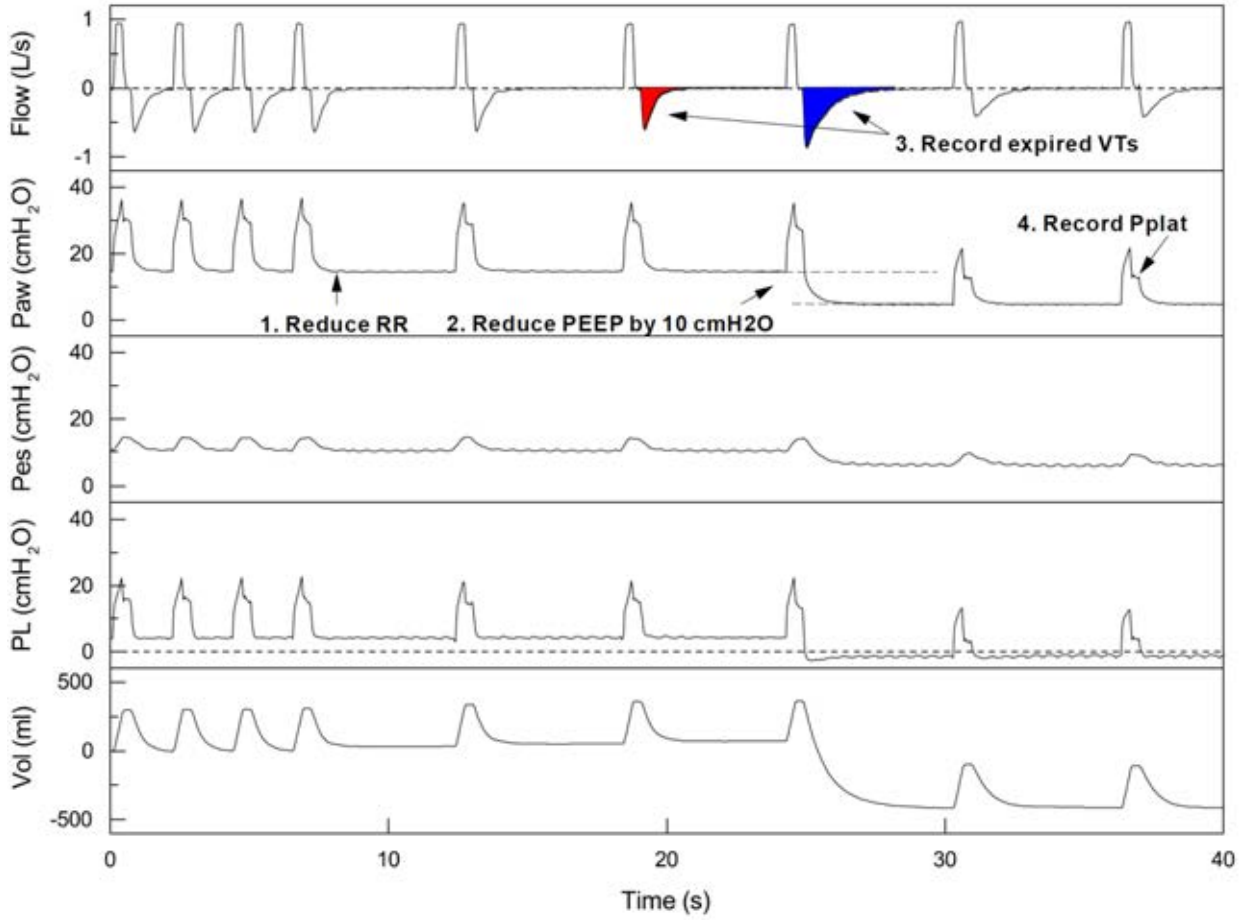




Perier *et al. Crit Care* 2020

R/I





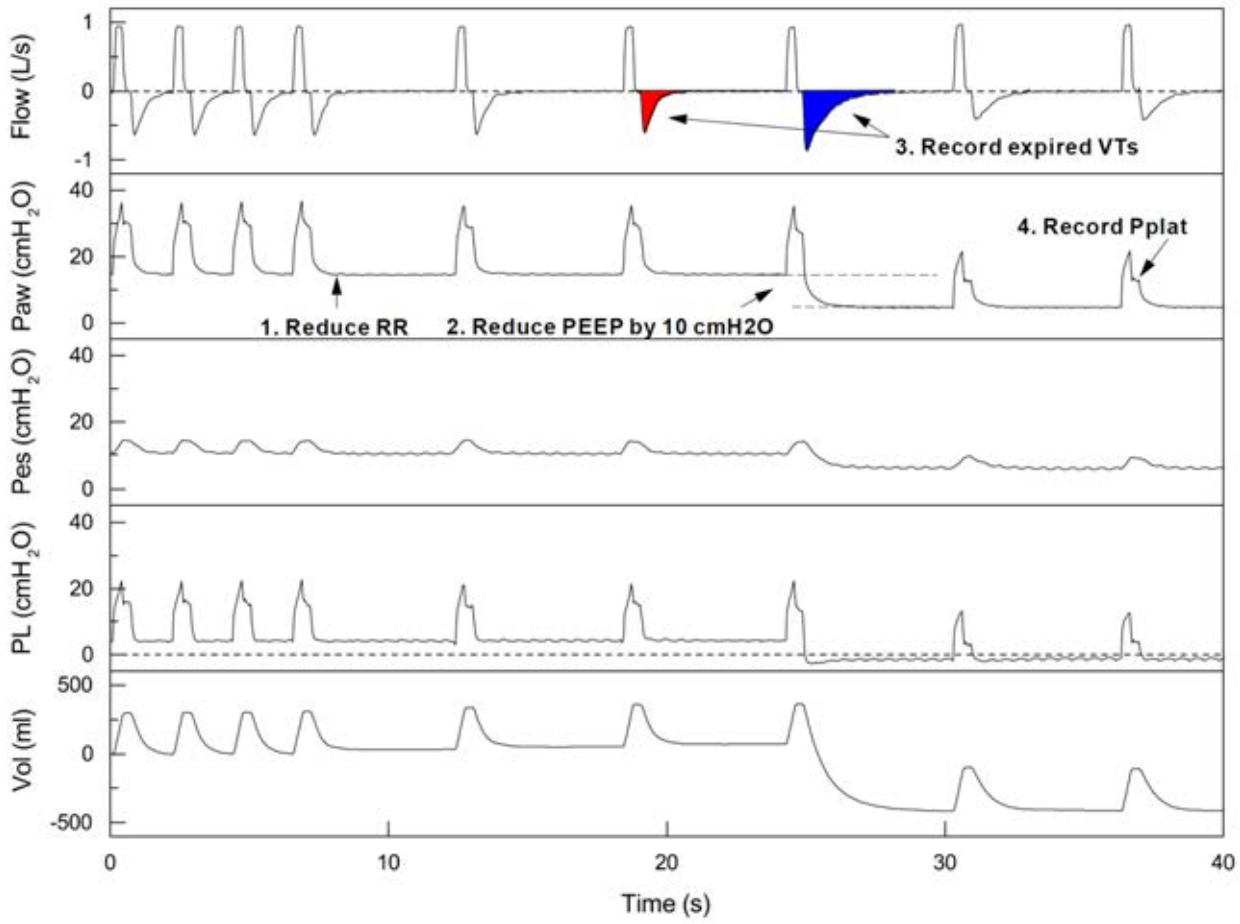
Chen L *et al.* AJRCCM 2019

R/I

SDRApps

www.sdrapps.fr

https://crec.coemv.ca/



Chen L *et al.* AJRCCM 2019

R/I

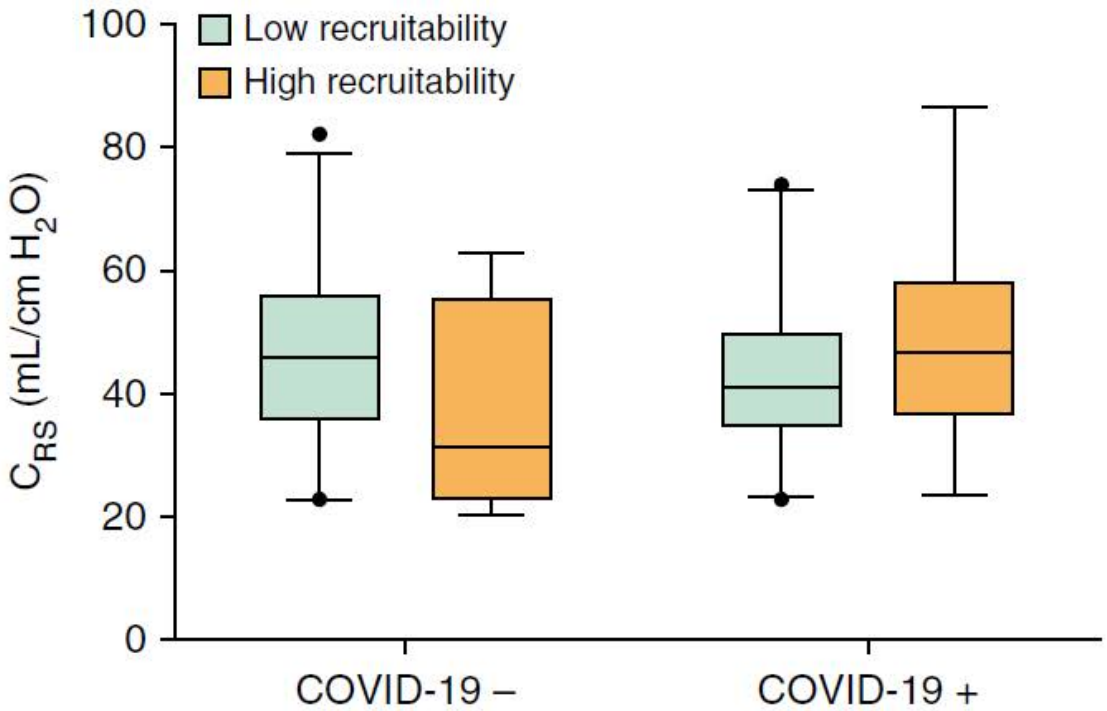
www.sdrapps.fr

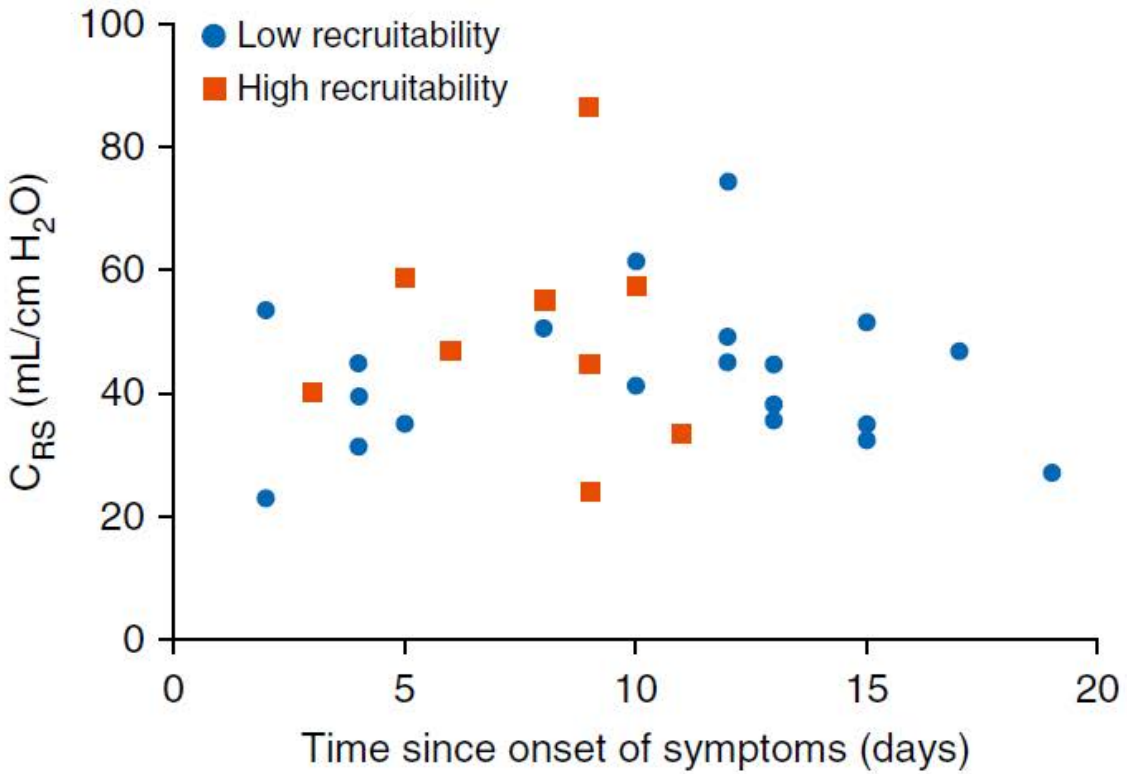
https://crec.coemv.ca/

R/I
Médiane

Faible potentiel de recrutement ⟵ 0,5 ⟶ Haut potentiel de recrutement

Chen L *et al.* AJRCCM 2019





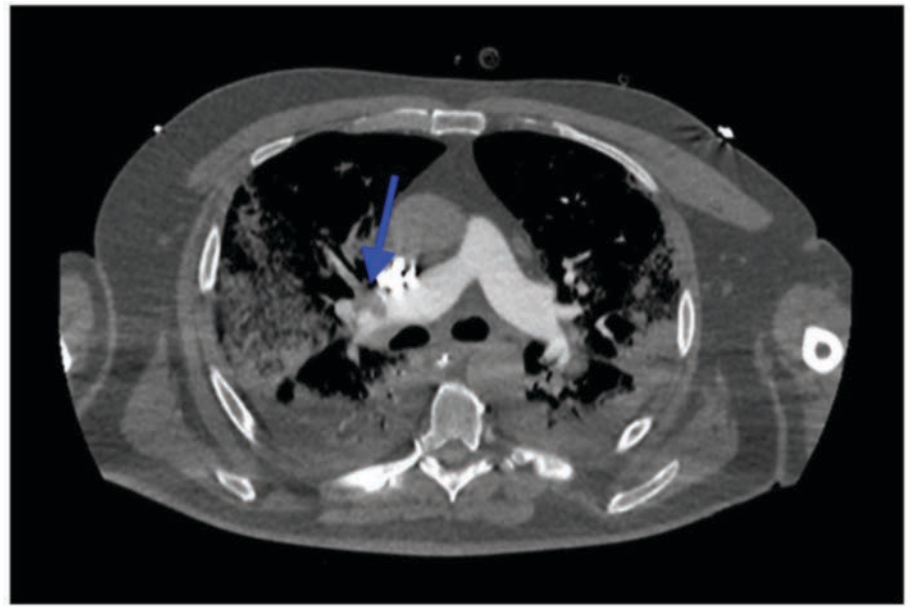
Haudebourg A-F *et al.* AJRCCM 2020

Intensive Care Med (2020) 46:1089–1098
https://doi.org/10.1007/s00134-020-06062-x

ORIGINAL

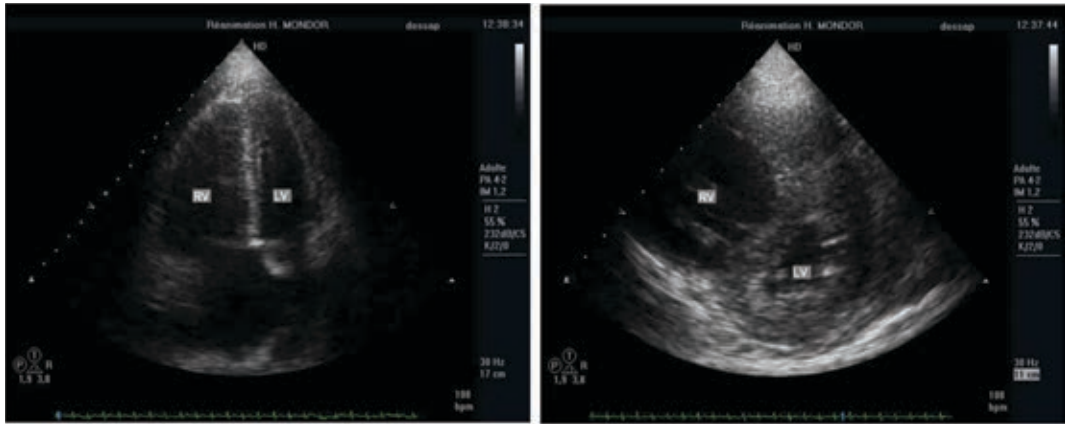
High risk of thrombosis in patients with severe SARS-CoV-2 infection: a multicenter prospective cohort study

Julie Helms[1,2], Charles Tacquard[3], François Severac[4], Ian Leonard-Lorant[5], Mickaël Ohana[5], Xavier Delabranche[3], Hamid Merdji[1,6], Raphaël Clere-Jehl[1,2], Malika Schenck[7], Florence Fagot Gandet[7], Samira Fafi-Kremer[2,8], Vincent Castelain[7], Francis Schneider[7], Lélia Grunebaum[9], Eduardo Anglés-Cano[10], Laurent Sattler[9], Paul-Michel Mertes[3], Ferhat Meziani[1,6*] and CRICS TRIGGERSEP Group (Clinical Research in Intensive Care and Sepsis Trial Group for Global Evaluation and Research in Sepsis)



	Population before matching ($n=383$)				Population after matching ($n=222$)			
	Non-COVID-19-ARDS ($n=233$)	COVID-19-ARDS ($n=150$)	OR [95% IC]	*p*-value	Non-COVID-19-ARDS ($n=145$)	COVID-19-ARDS ($n=77$)	OR [95% IC]	*p*-value
Thrombo-embolic complications—*n* (%)	14 (6)	27 (18)	3.4 [1.7–7.3]	< 0.001	7 (4.8)	9 (11.7)	2.6 [1.1–6.1]	0.04
Pulmonary embolisms—*n* (%)	3 (1.3)	25 (16.7)	15.2 [4.5–80.4]	< 0.001	3 (2.1)	9 (11.7)	6.2 [1.6–23.4]	0.01

CPA



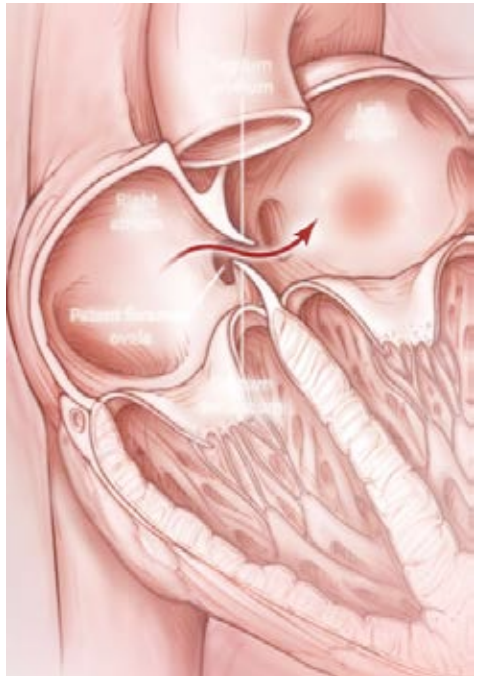
NC-ARDS: ≈ 22%

Mekontso Dessap A *et al. Intensive Care Med* 2016

C-ARDS: ≈ 38%

Cavaleiro P *et al. Crit Care* 2021

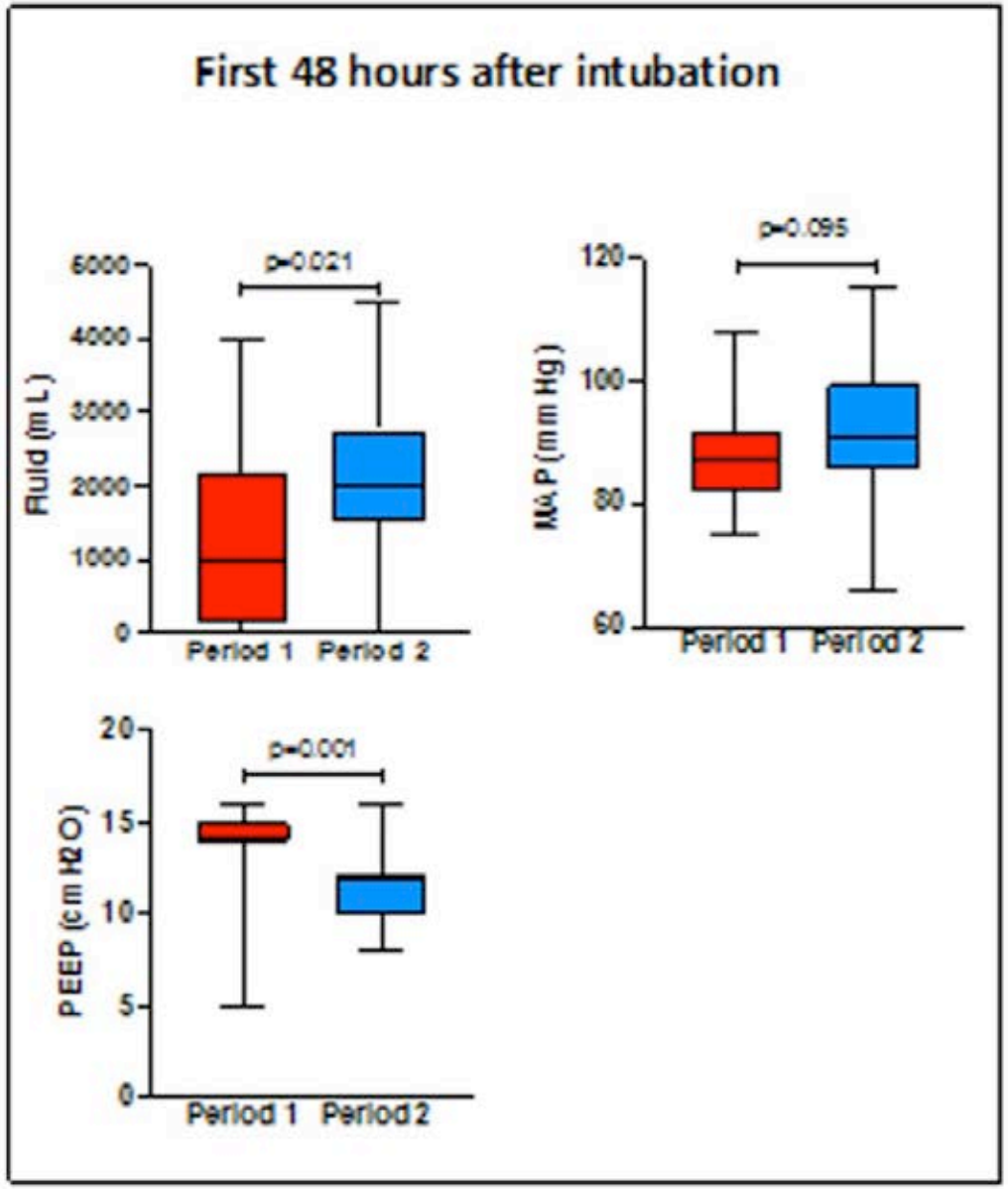
FOP

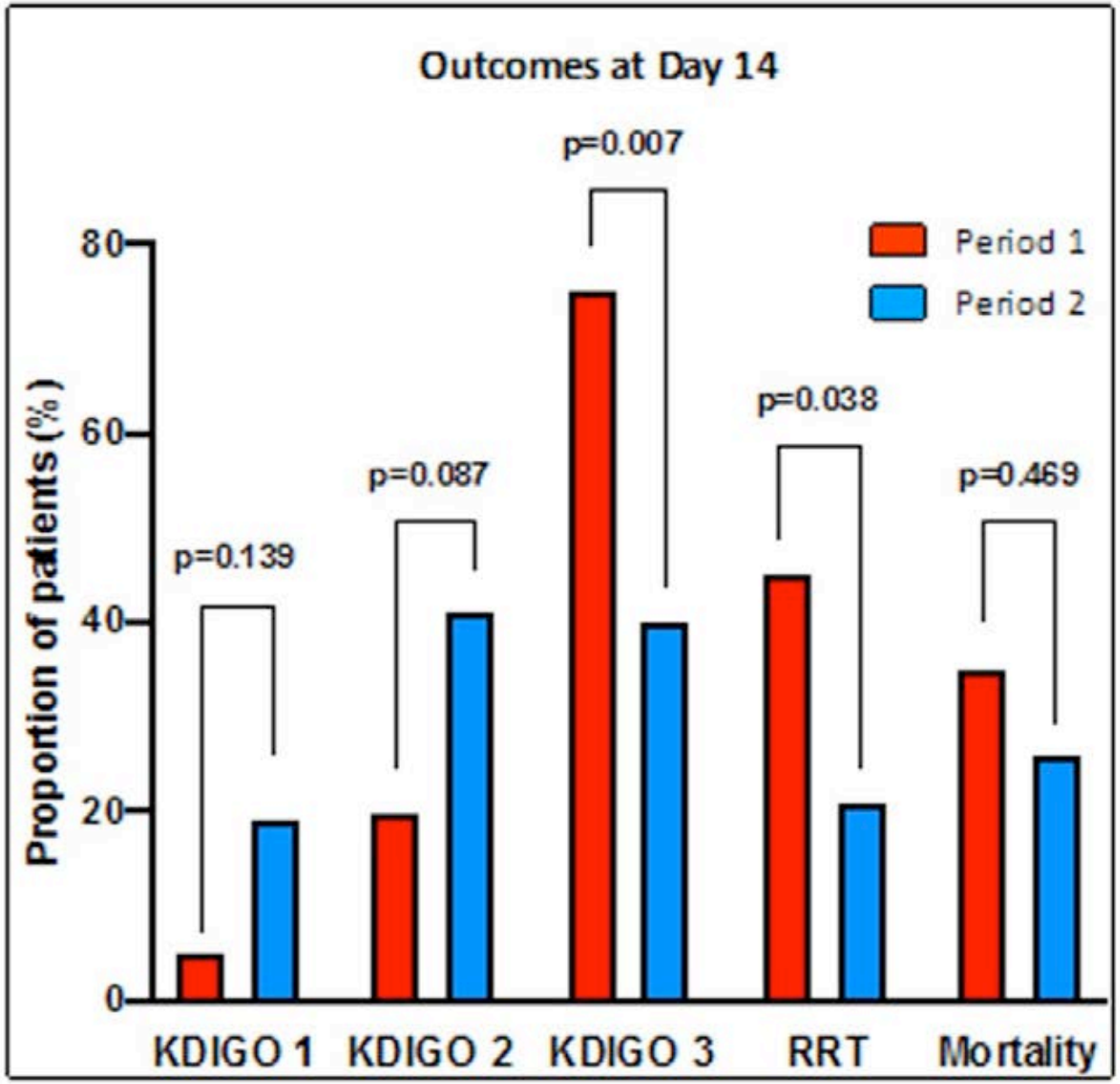


Prevalence and prognosis of shunting across patent foramen ovale during acute respiratory distress syndrome*

Armand Mekontso Dessap, MD, PhD; Florence Boissier, MD; Rusel Leon, MD; Serge Carreira, MD; Ferran Roche Campo, MD; François Lemaire, MD; Laurent Brochard, MD

Crit Care Med 2010 Vol. 38,





Beurton A *et al.* J Crit Care 2020

SDRA COVID : P/F 95 mm Hg, compliance = 30 ml / cm H_2O,
PEP = 10 cm H_2O

↑ PEEP 14 cm H_2O

Amélioration du P/F
R/I = 0,7
ETT: pas de FOP, pas de CPA

P/F stable
R/I = 0,1
ETT: CPA, VCI dilatée
Choc + Insuffisance rénale

COVID-19-associated acute respiratory distress syndrome: is a different approach to management warranted?

Eddy Fan, Jeremy R Beitler, Laurent Brochard, Carolyn S Calfee, Niall D Ferguson, Arthur S Slutsky, Daniel Brodie

treatment in ARDS. In this Viewpoint, we address ventilatory strategies in the context of recent discussions on phenotypic heterogeneity in patients with COVID-19-associated ARDS. Although early reports suggested that COVID-19-associated ARDS has distinctive features that set it apart from historical ARDS, emerging evidence indicates that the respiratory system mechanics of patients with ARDS, with or without COVID-19, are broadly similar. In the absence of evidence to support a shift away from the current paradigm of ventilatory management, we strongly recommend adherence to evidence-based management, informed by bedside physiology, as resources permit.

Lancet Respir Med 2020

En conclusion:
Personnalisation de la VAC du SDRA COVID

- Principes de ventilation protectrice
  - Vt ≈ 6 ml/kg PPT
  - Pplat ≤ 30 cm H_2O
  - ΔP < 15 cm H_2O
  - Personnalisation de la PEP
  - Décubitus ventral

- Phénotypage du patient
  - P/F $PaCO_2$
  - Mécanique respiratoire, Pplat, ΔP
  - R/I, AOP
  - Caractéristiques extra-respiratoires

⇨**Raisonnement multi-paramétrique**

⇨**Evaluation des interventions**