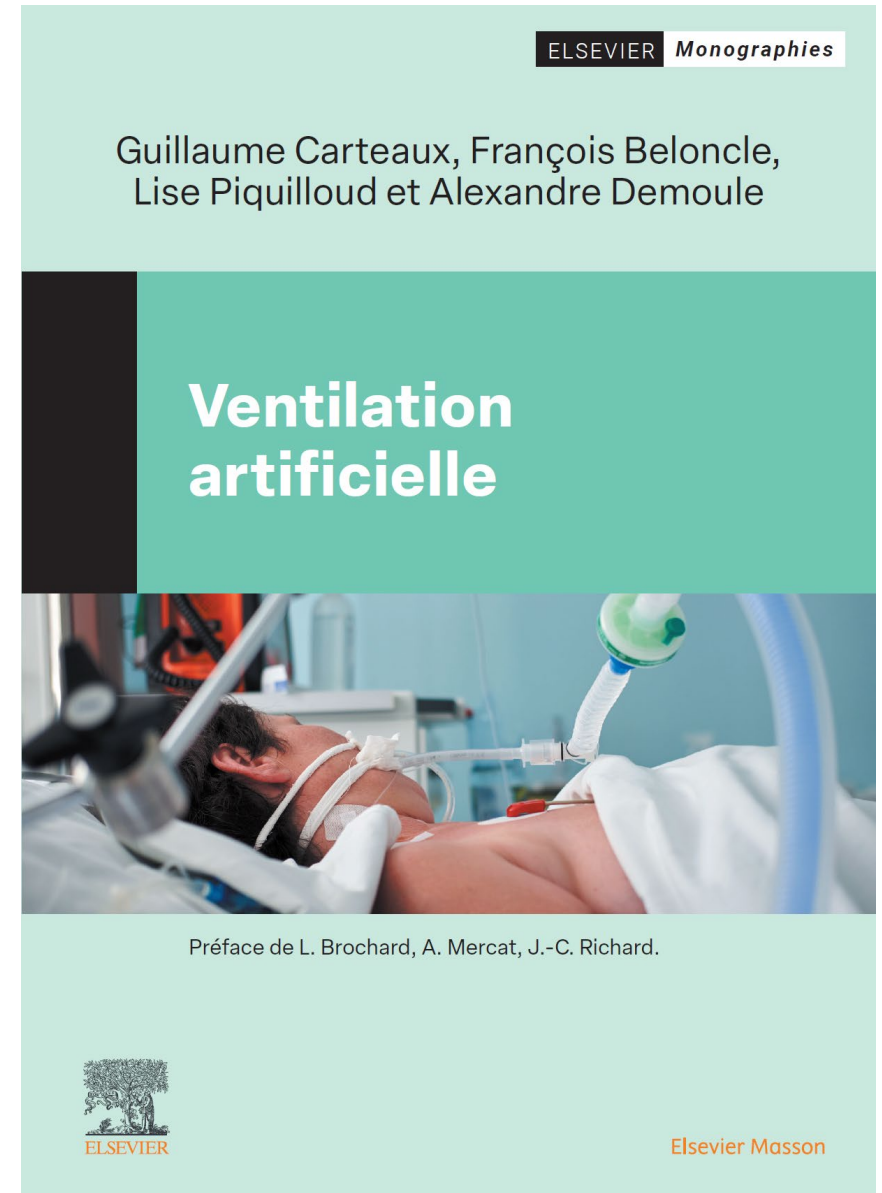


Physiologie recrutement / dérecrutement

Liens d'intérêts

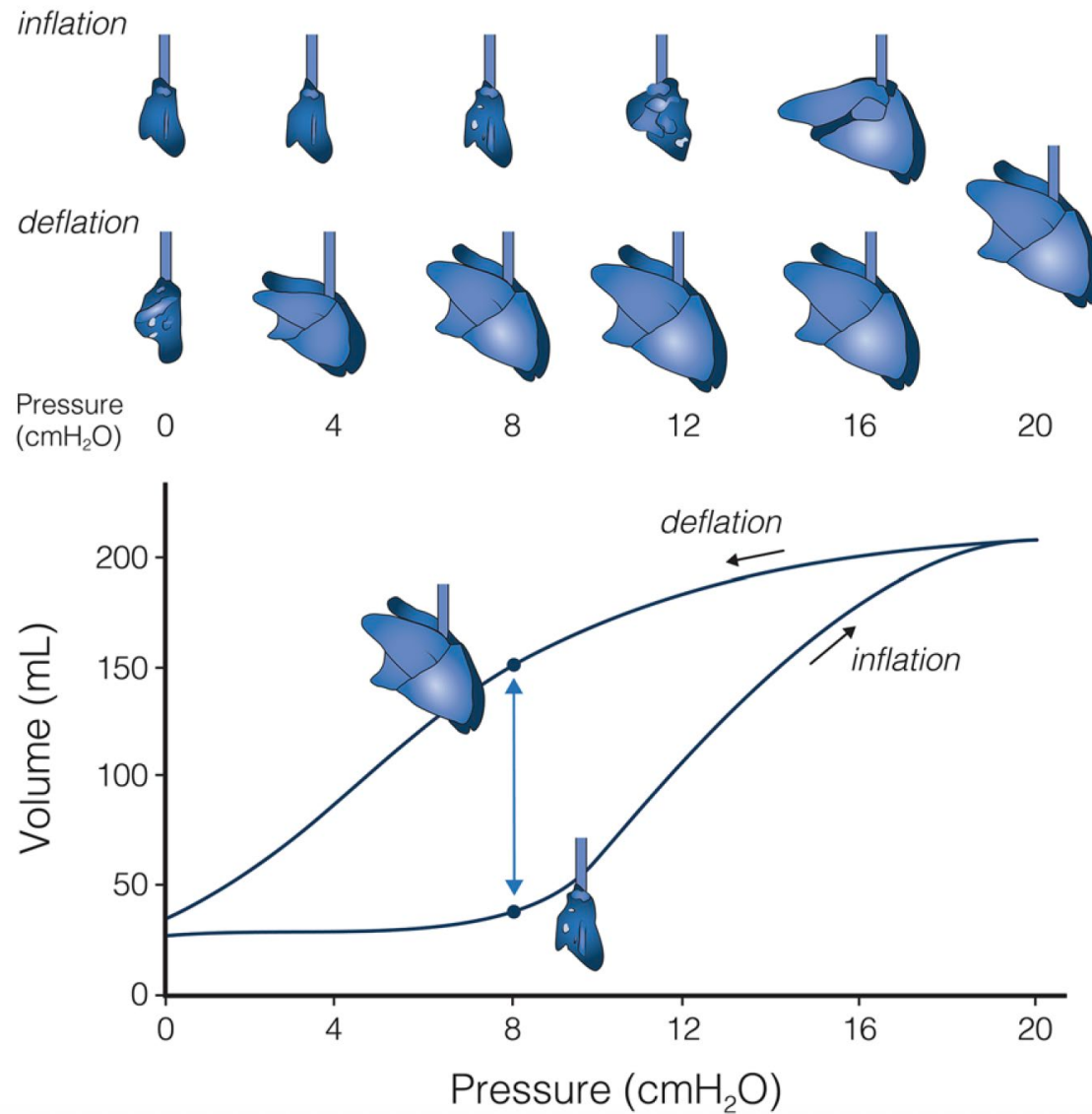
- Laboratoire (prêt de ventilateurs):
 - Fisher and Paykel
 - Medtronic
 - Air Liquide Medical Systems
- Conférencier:
 - Fisher and Paykel
 - Medtronic
 - Air Liquide Medical Systems
 - Dräger
 - GE Healthcare
- Honoraires pour activité de conseil:
 - Air Liquide Medical Systems
 - Löwenstein



Lung recruitment

Annemijn H. Jonkman¹, V. Marco Ranieri² and Laurent Brochard^{3,4*}

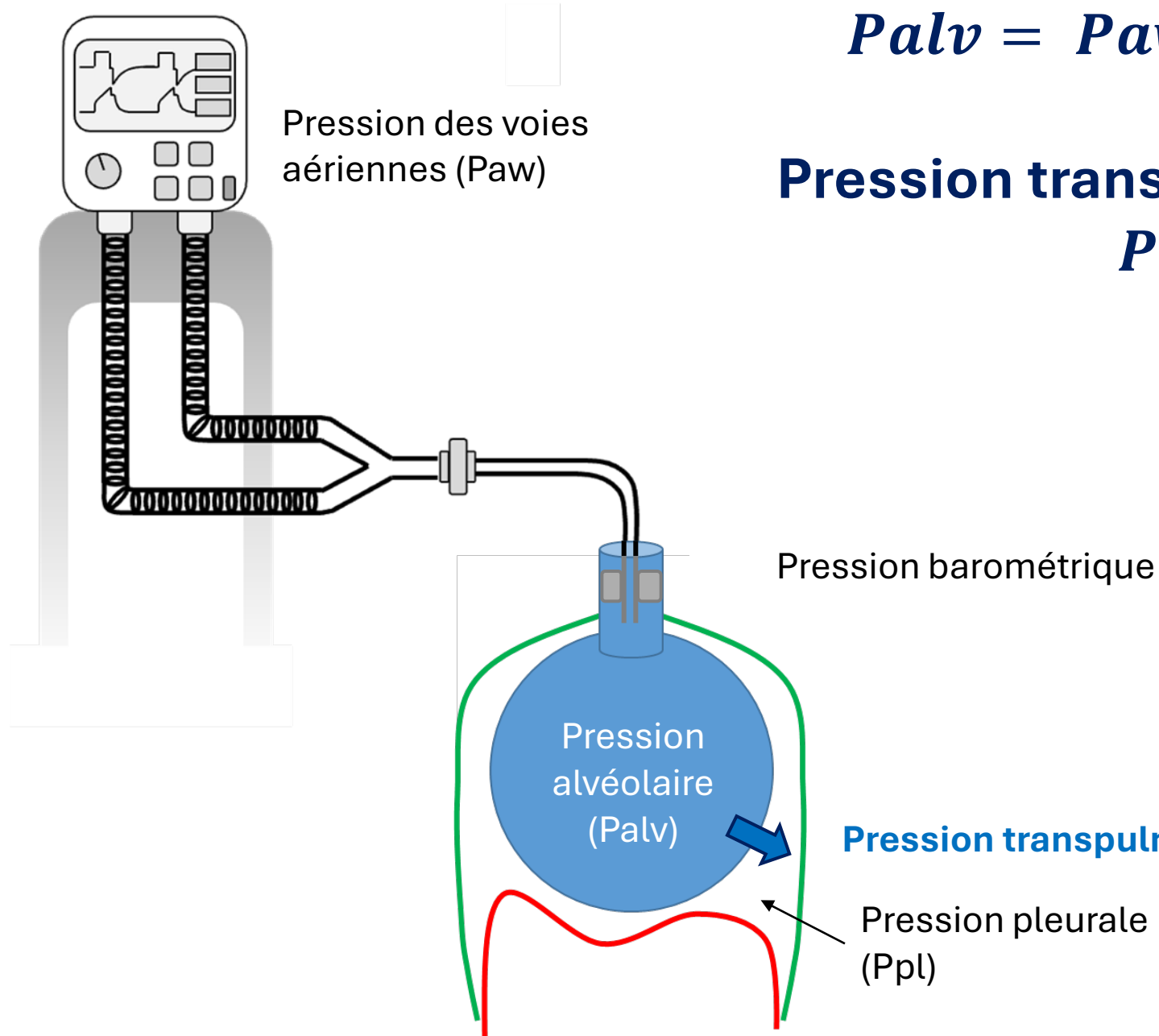
Intensive Care Med (2022) 48:936–938



$$P_{alv} = P_{aw} \text{ statique (à débit} = 0)$$

Pression transpulmonaire:

$$P_L = P_{aw} - P_{pl}$$

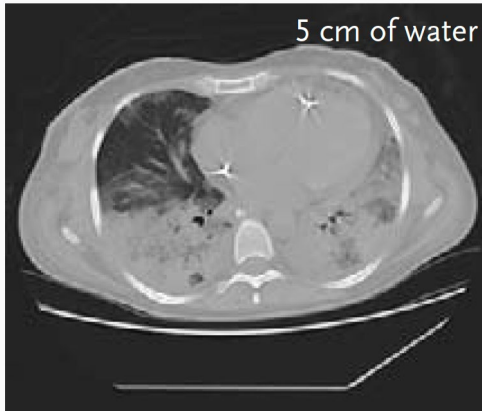


Lung Recruitment in Patients with the Acute Respiratory Distress Syndrome

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 Bagedo, M.D.

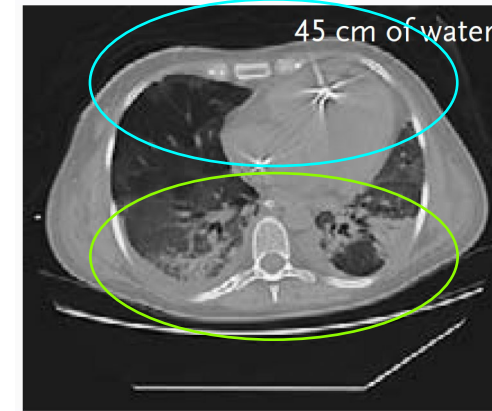
APRIL 27, 2006

5 cm H₂O



Recruitment

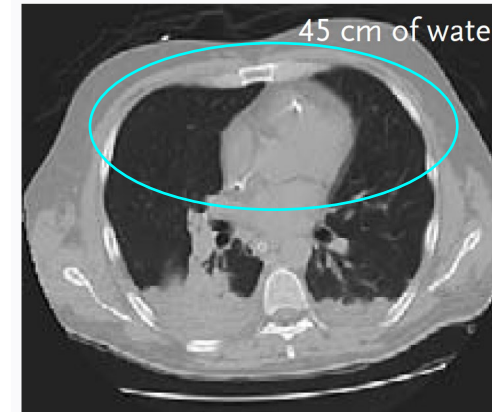
45 cm H₂O



Surdistension

Recrutement

No recruitment



Surdistension

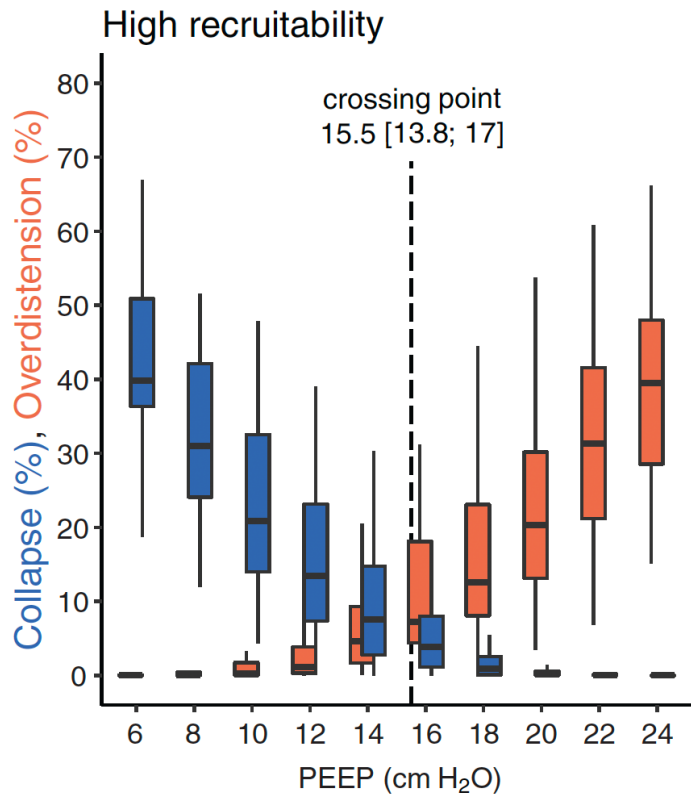
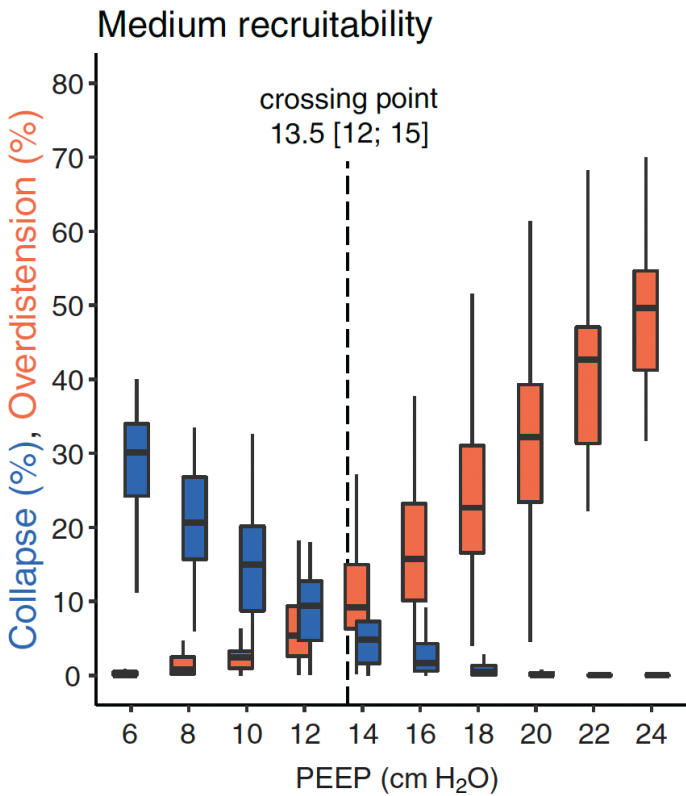
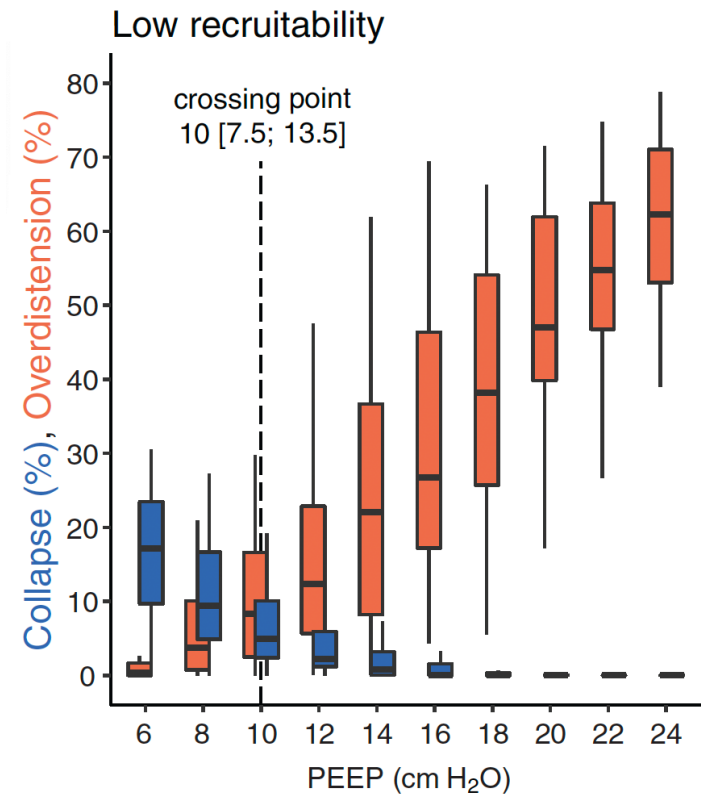
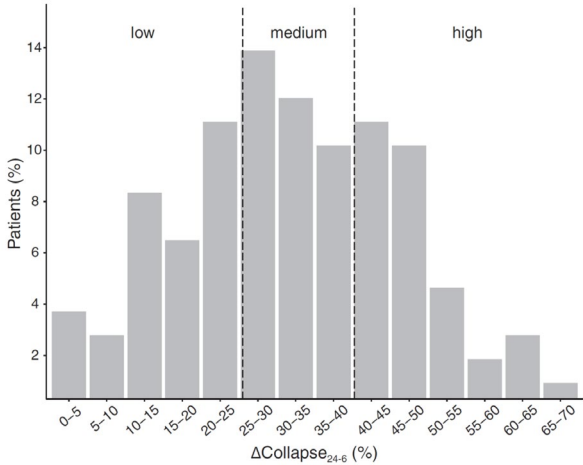
Lung Recruitment Assessed by Electrical Impedance Tomography (RECRUIT)

A Multicenter Study of COVID-19 Acute Respiratory Distress Syndrome

Annemijn H. Jonkman^{1,2,3*}, Glasiele C. Alcala^{4*}, Bertrand Pavlovsky^{5,6}, Oriol Roca^{7,8}, Savino Spadaro^{9,10}, Gaetano Scaramuzzo^{9,10}, Lu Chen^{1,2}, Jose Dianti^{2,11}, Mayson L. de A. Sousa^{1,2,4}, Michael C. Sklar^{1,2}, Thomas Piraino^{1,2}, Huiqing Ge¹², Guang-Qiang Chen¹³, Jian-Xin Zhou¹³, Jie Li¹⁴, Ewan C. Goligher^{2,11,15}, Eduardo Costa⁴, Jordi Mancebo^{16†}, Tommaso Mauri^{17‡}, Marcelo Amato^{4‡}, and Laurent J. Brochard^{1,2‡}, for the Pleural Pressure Working Group (PLUG)

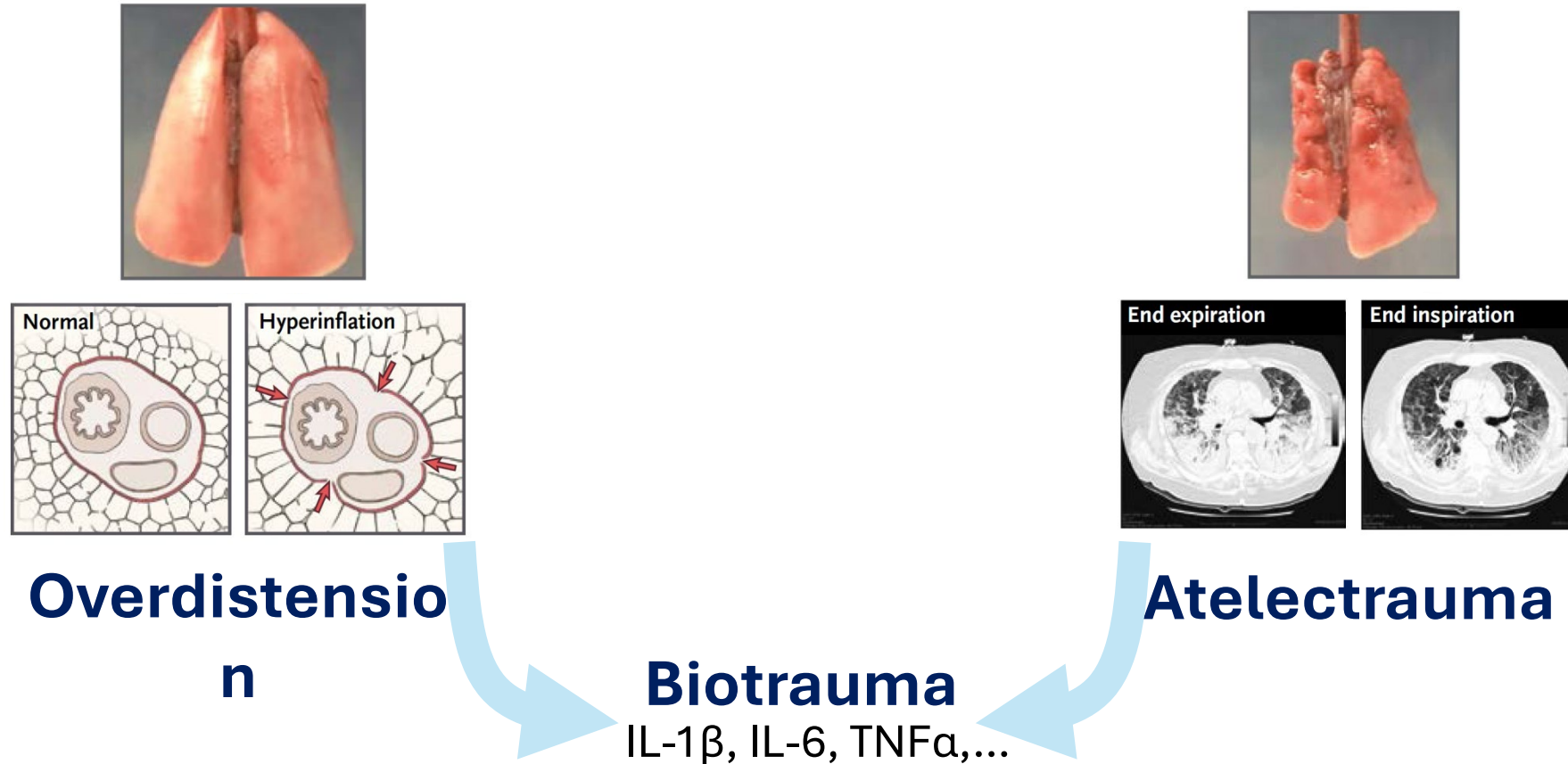
Am J Respir Crit Care Med Vol 208, Iss 1, pp 25–38, Jul 1, 2023

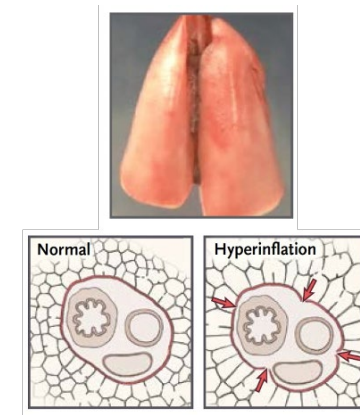
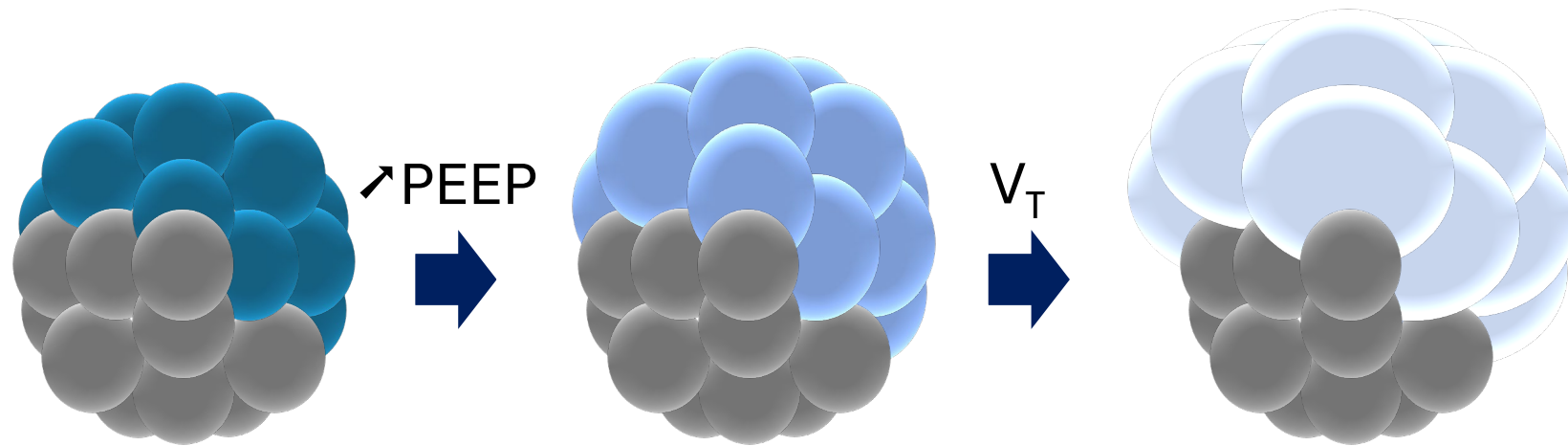
N = 108



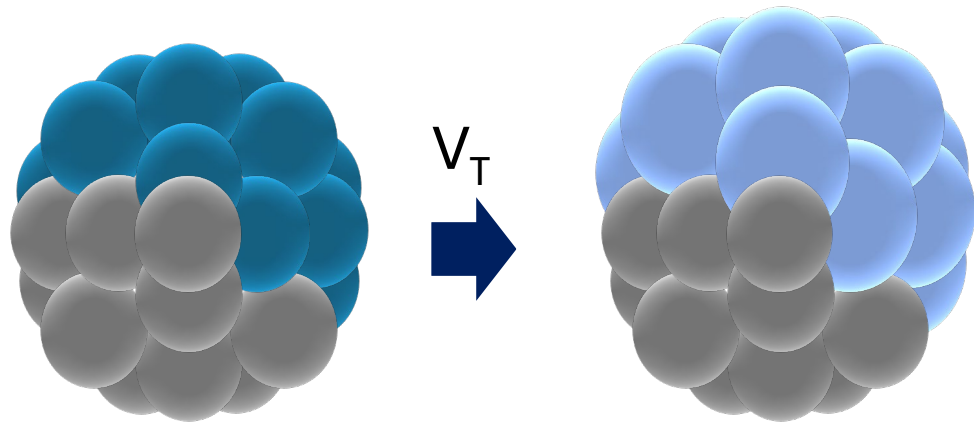
VILI

Ventilator induced lung injury

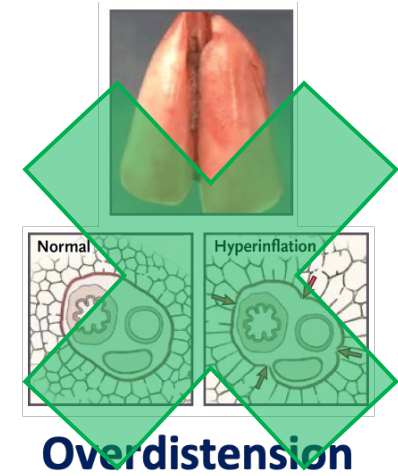
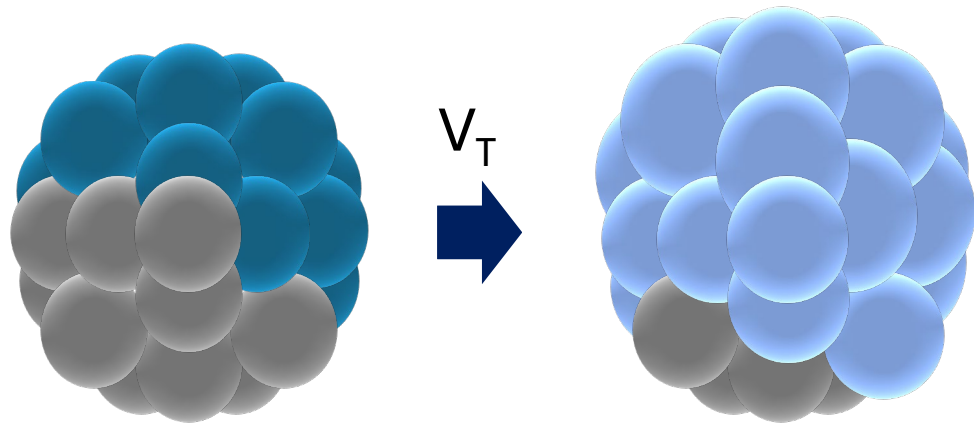




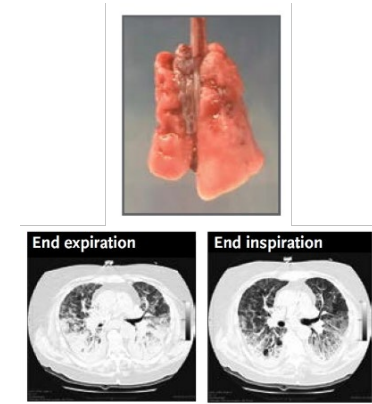
Overdistension



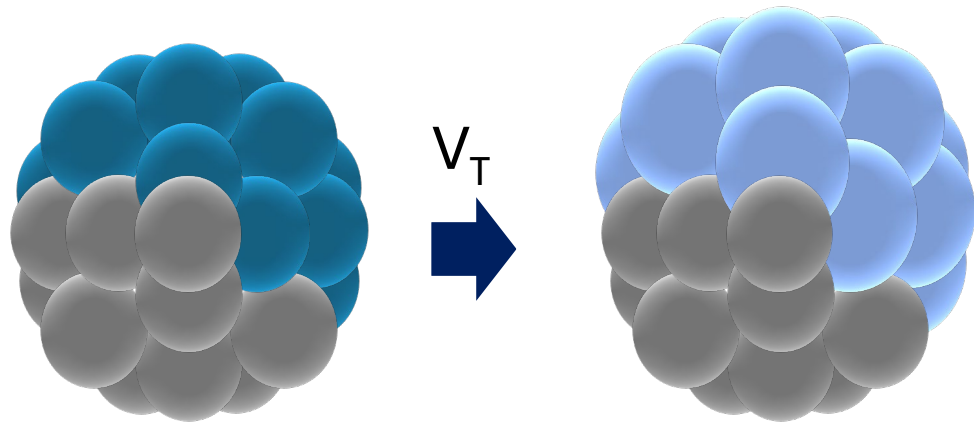
Low PEEP



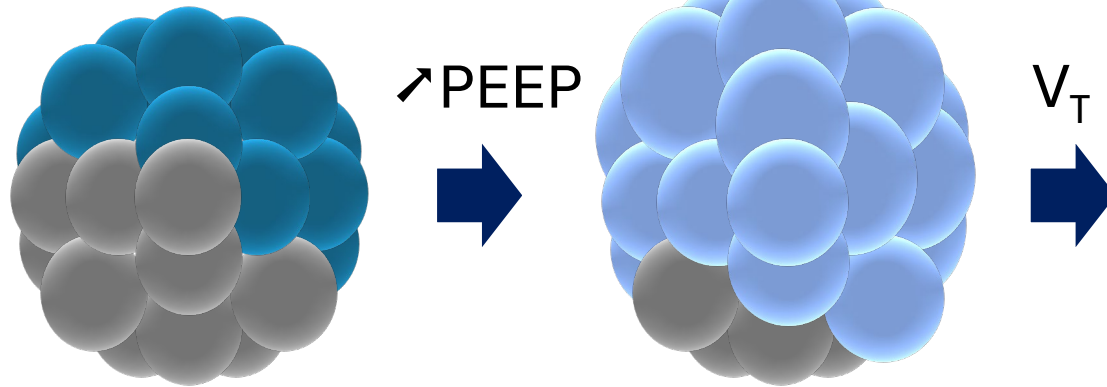
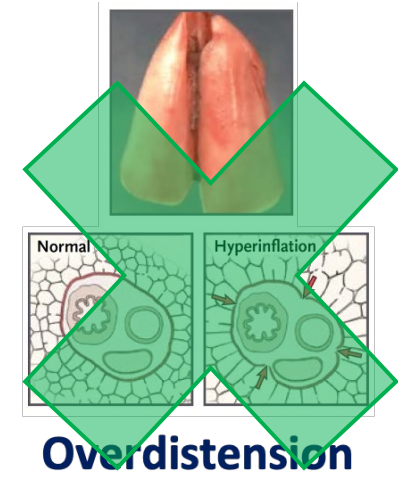
Overdistension



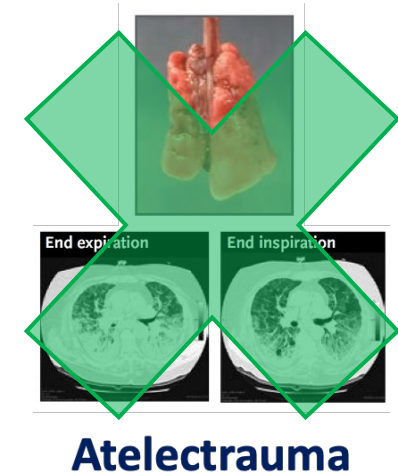
Atelectrauma



Low PEEP



high PEEP





1 ml/cm H₂O

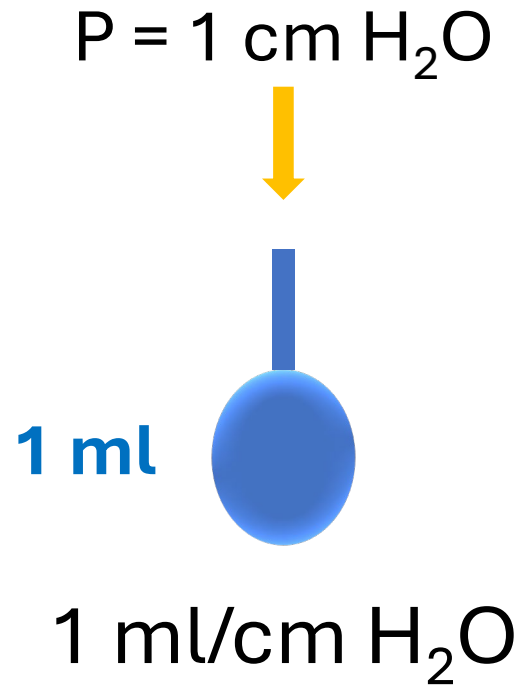
$$C = \frac{\Delta V}{\Delta P}$$

$P = 1 \text{ cm H}_2\text{O}$

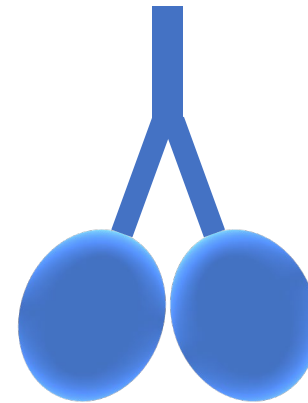
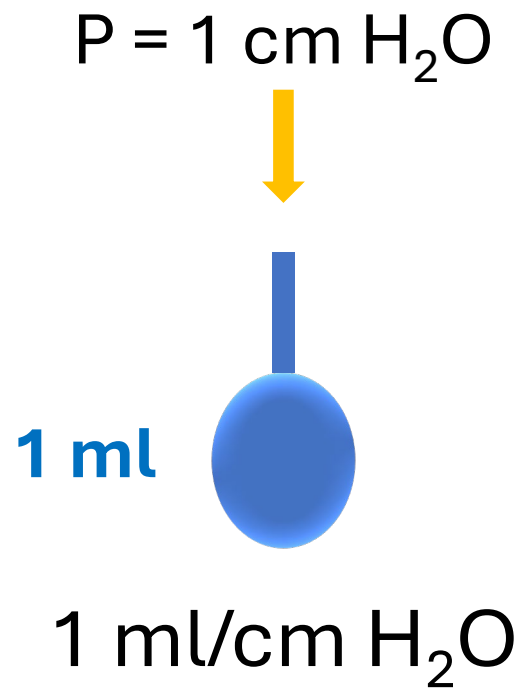


$1 \text{ ml/cm H}_2\text{O}$

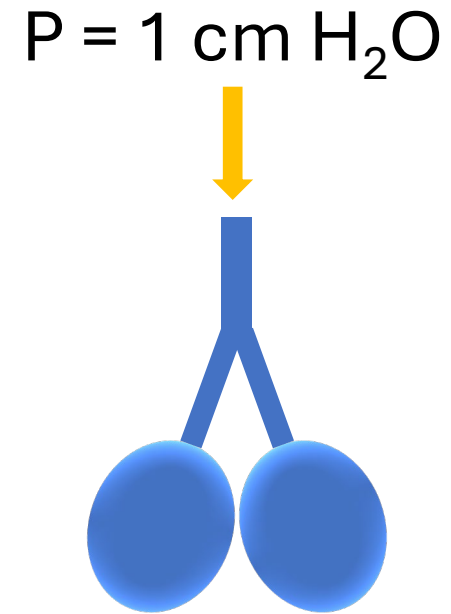
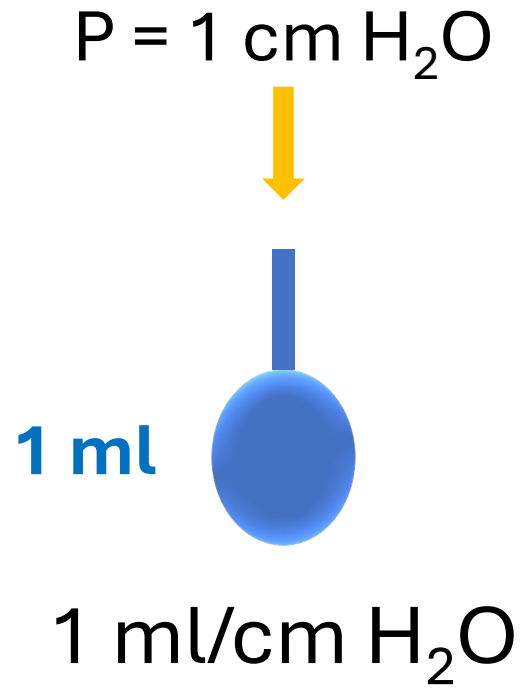
$$C = \frac{\Delta V}{\Delta P}$$



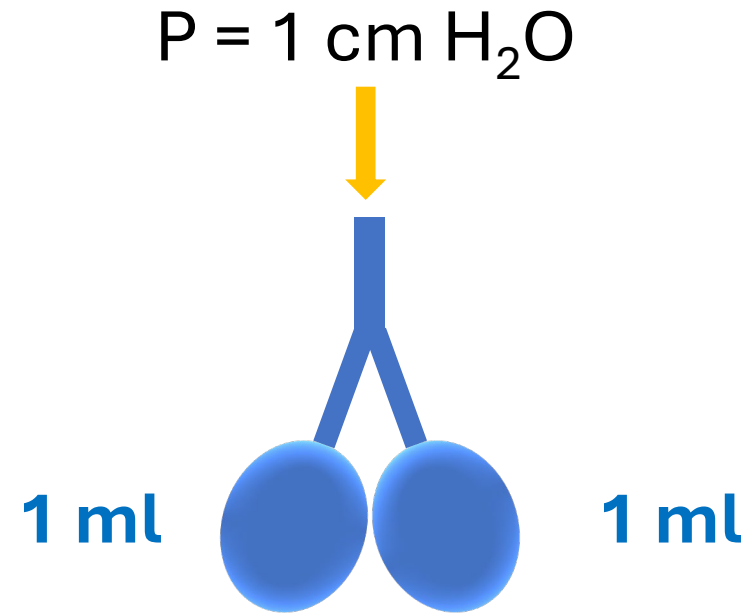
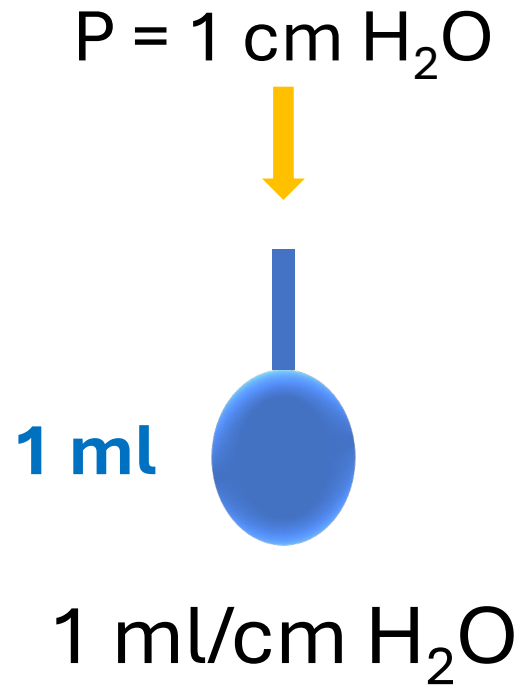
$$C = \frac{\Delta V}{\Delta P}$$



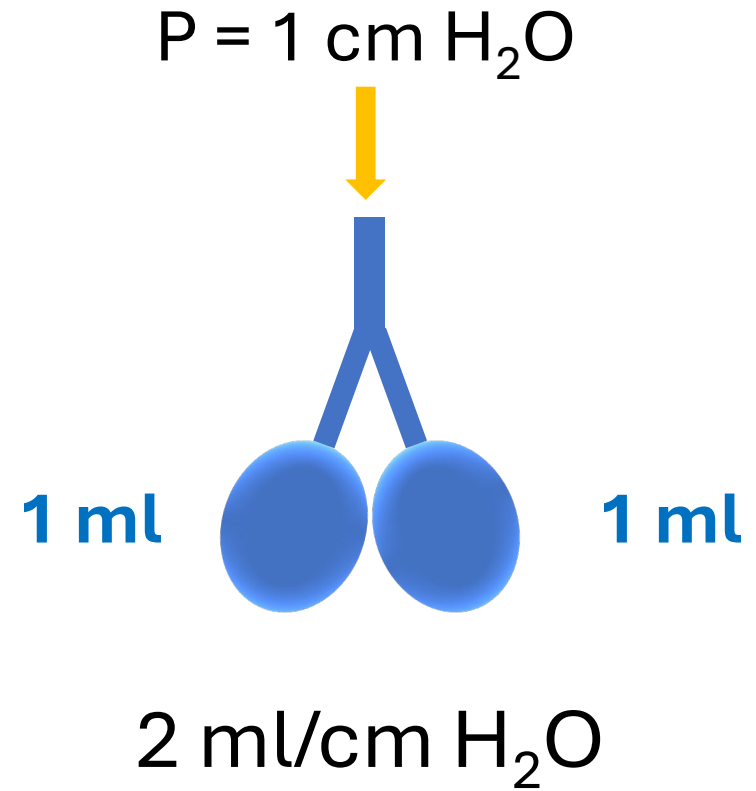
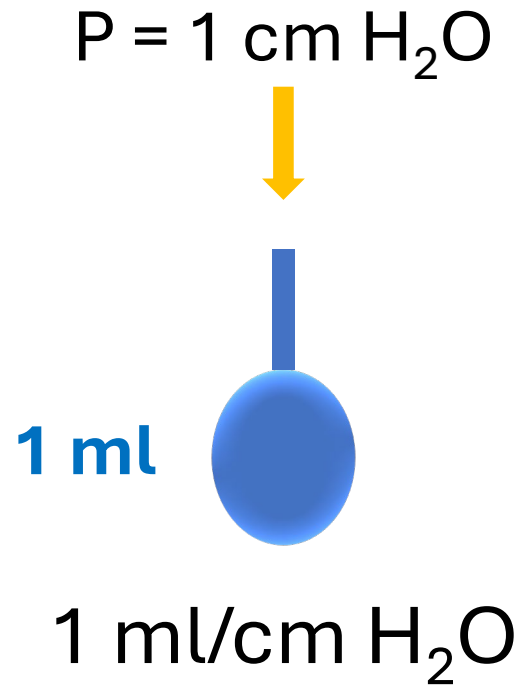
$$C = \frac{\Delta V}{\Delta P}$$



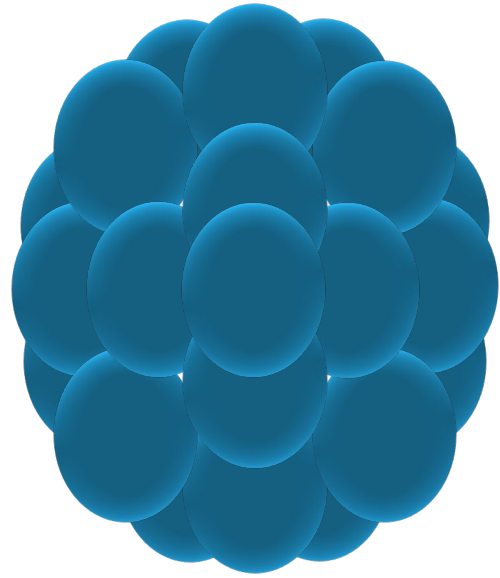
$$C = \frac{\Delta V}{\Delta P}$$



$$C = \frac{\Delta V}{\Delta P}$$



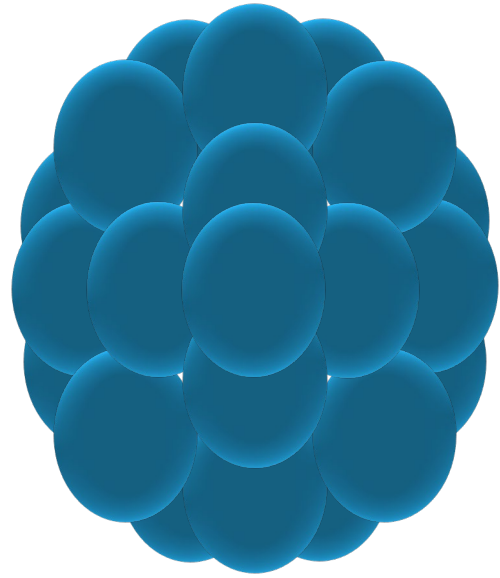
$$C = \frac{\Delta V}{\Delta P}$$



$$C = 60 \text{ ml/cm H}_2\text{O}$$

$$C = 60 \times \text{●}$$

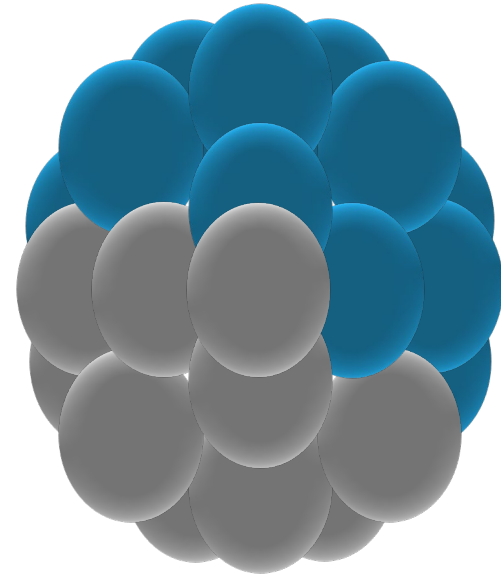
1 ml/cm H₂O



$$C = 60 \text{ ml/cm H}_2\text{O}$$

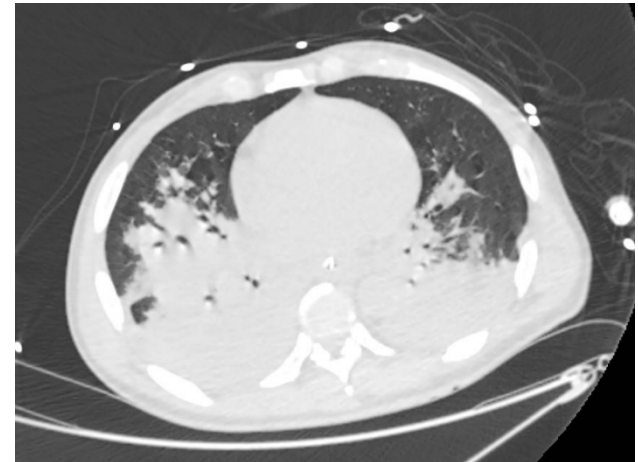
$$C = 60 \times \text{●}$$

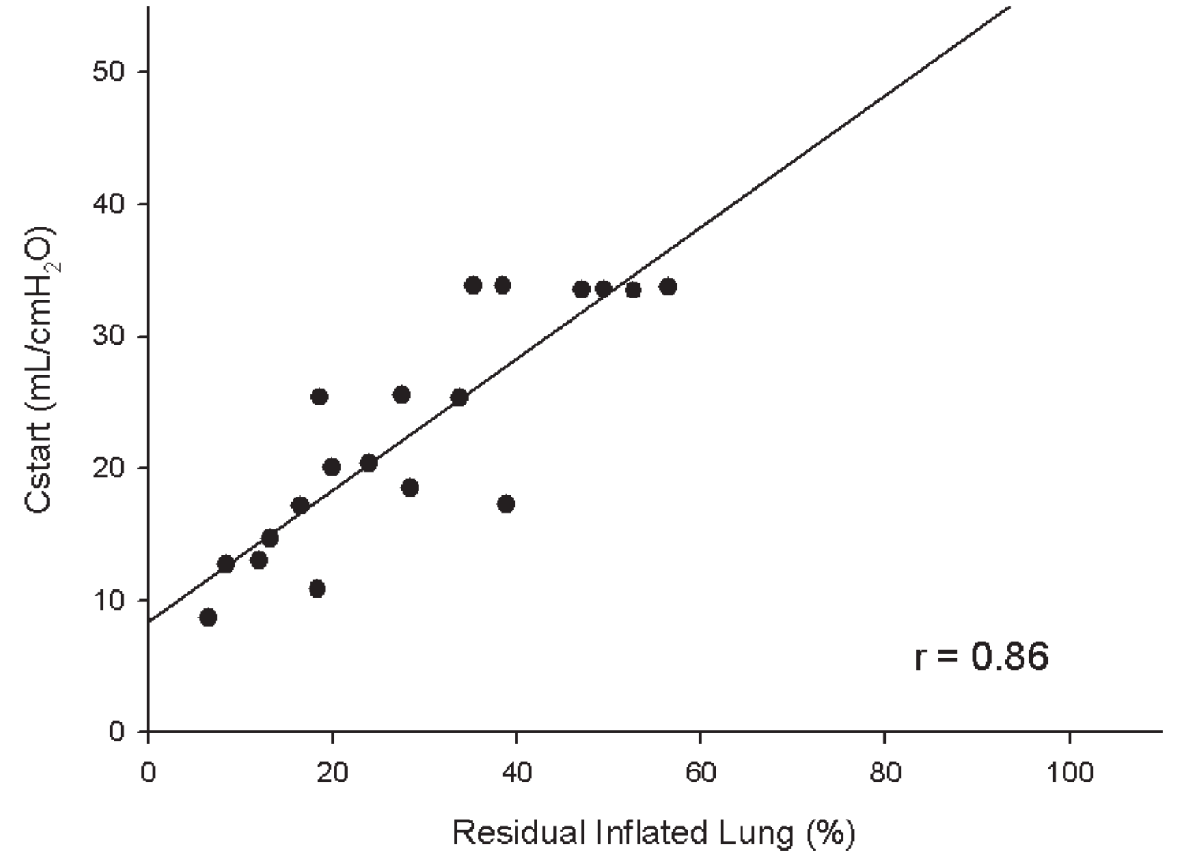
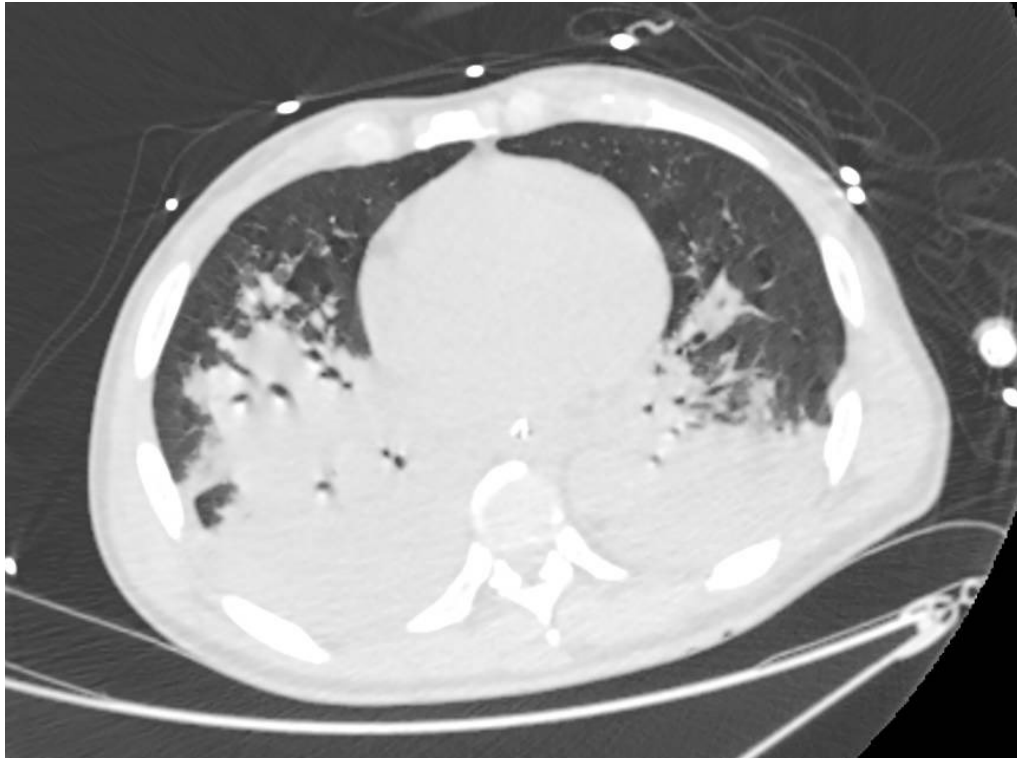
1 ml/cm H₂O



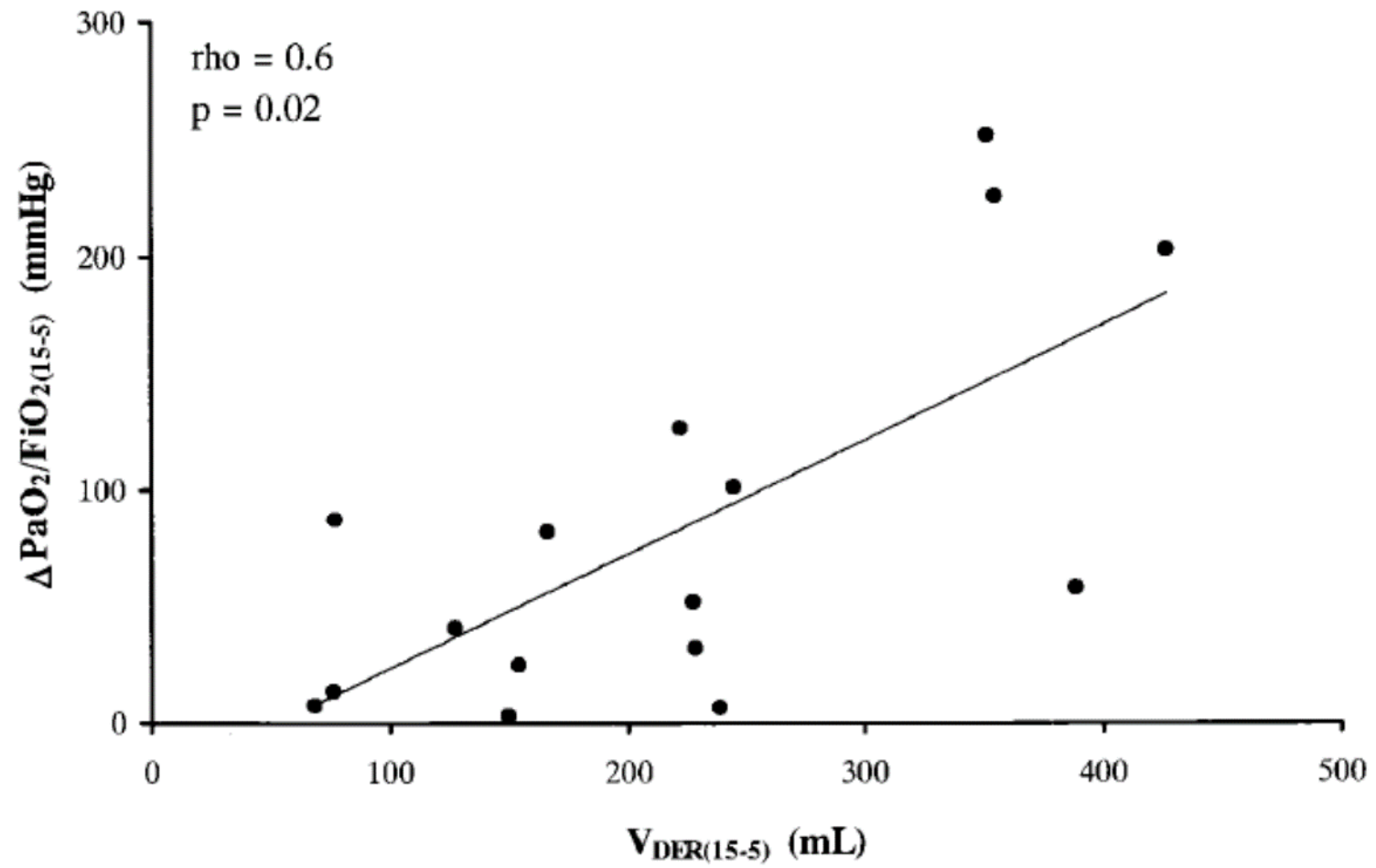
$$C = 30 \text{ ml/cm H}_2\text{O}$$

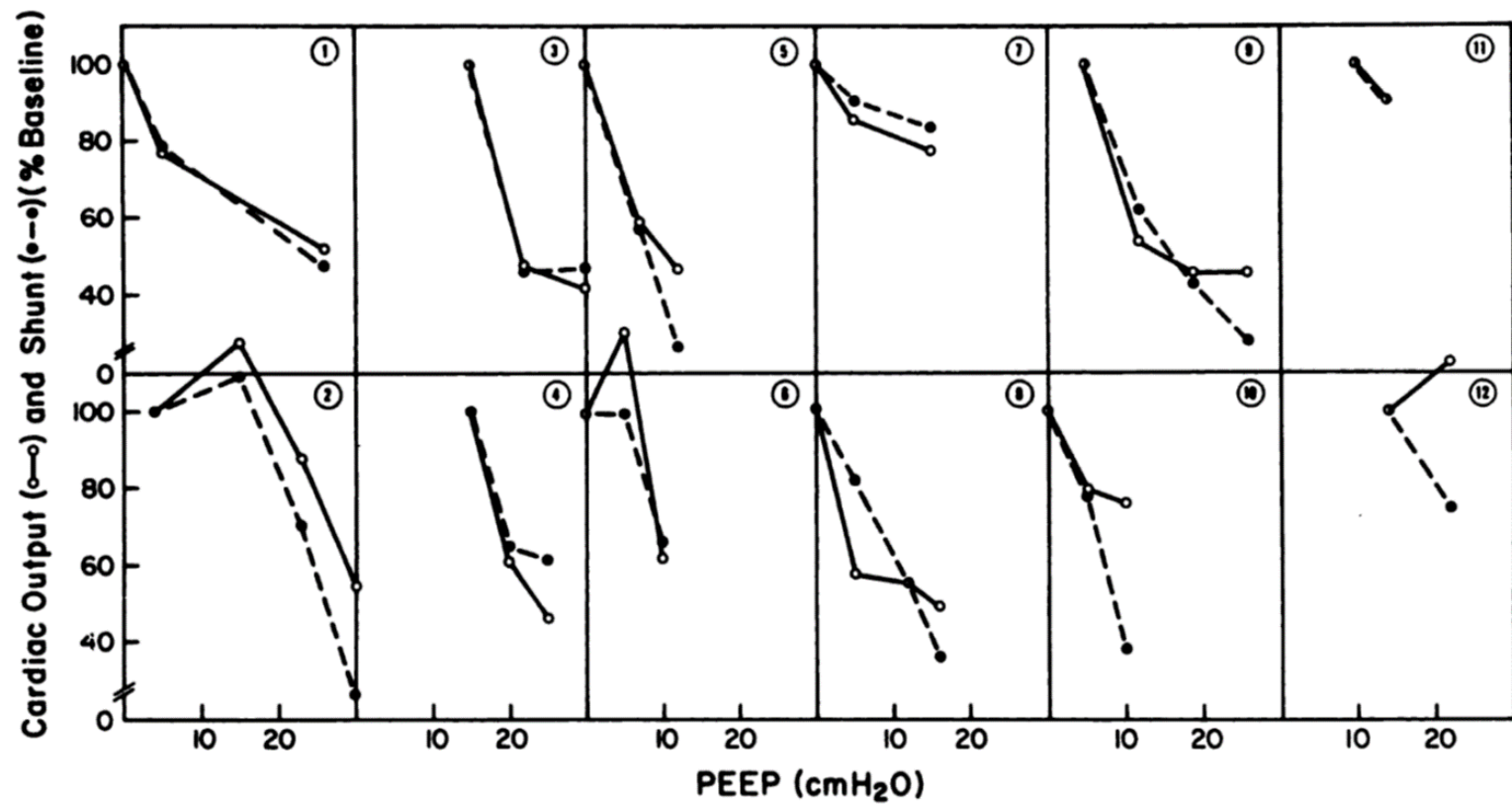
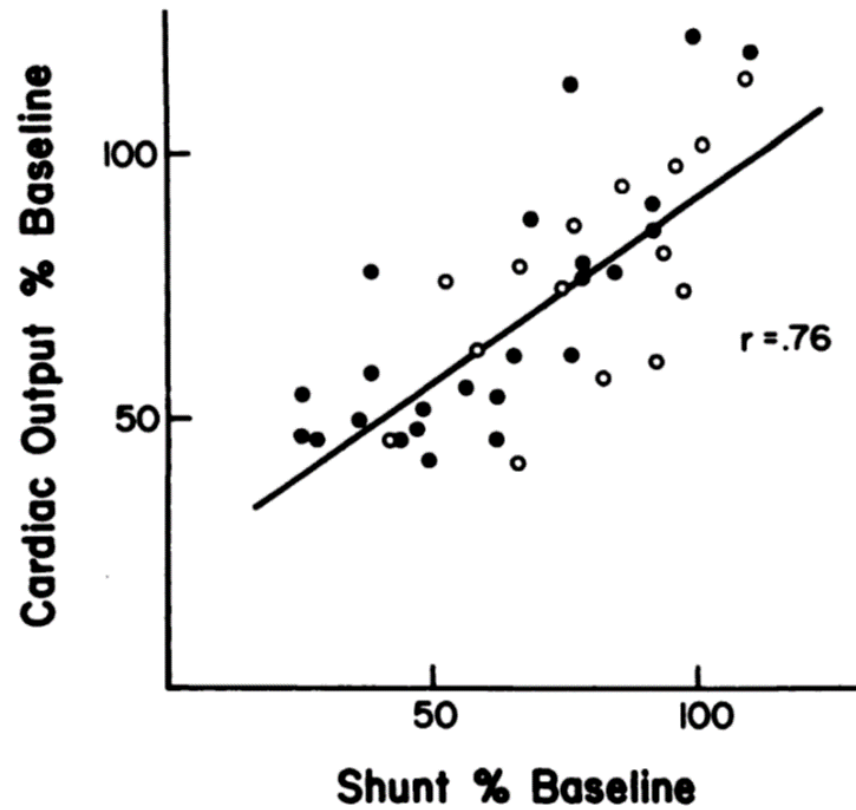
« baby lung »





Low compliance in ARDS: small lung not stiff lung





Relation shunt-débit

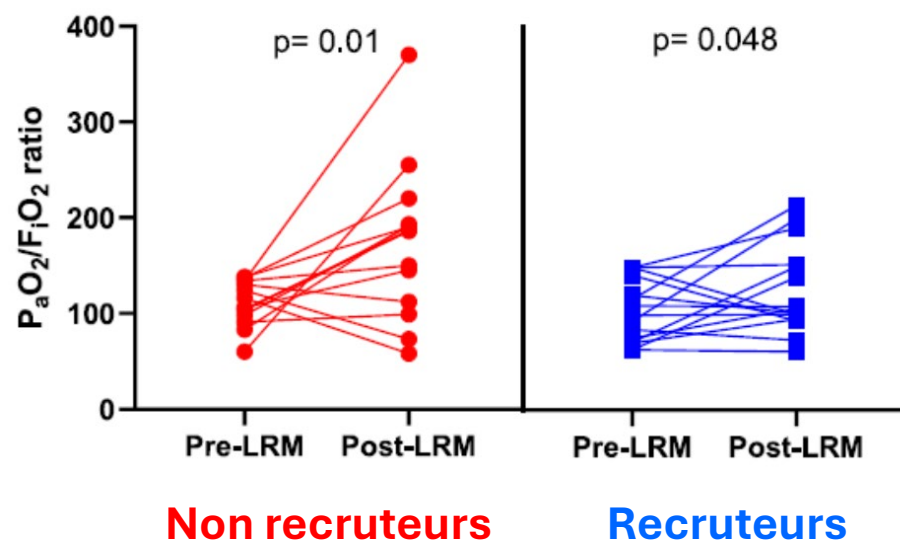
20 patients avec SDRA

Dantzker DR *et al.* *Chest* 1980



Respiratory effects of lung recruitment maneuvers depend on the recruitment-to-inflation ratio in patients with COVID-19-related acute respiratory distress syndrome

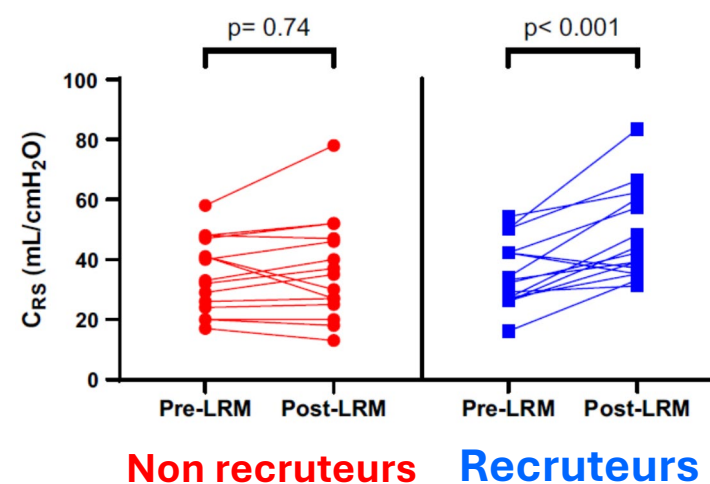
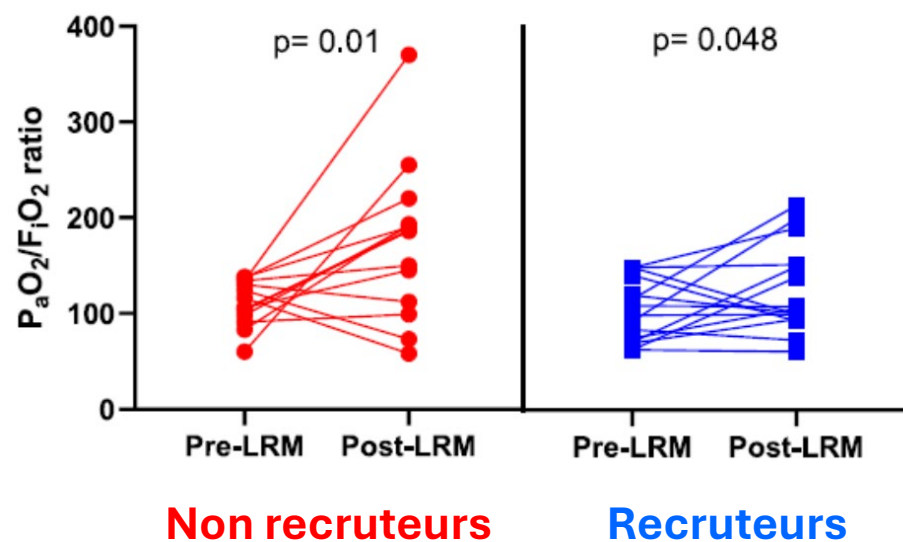
Yoann Zerbib, Alexis Lambour, Julien Maizel, Loay Kontar, Bertrand De Cagny, Thierry Soupison, Thomas Bradier, Michel Slama and Clément Brault*  *Critical Care* (2022) 26:12





Respiratory effects of lung recruitment maneuvers depend on the recruitment-to-inflation ratio in patients with COVID-19-related acute respiratory distress syndrome

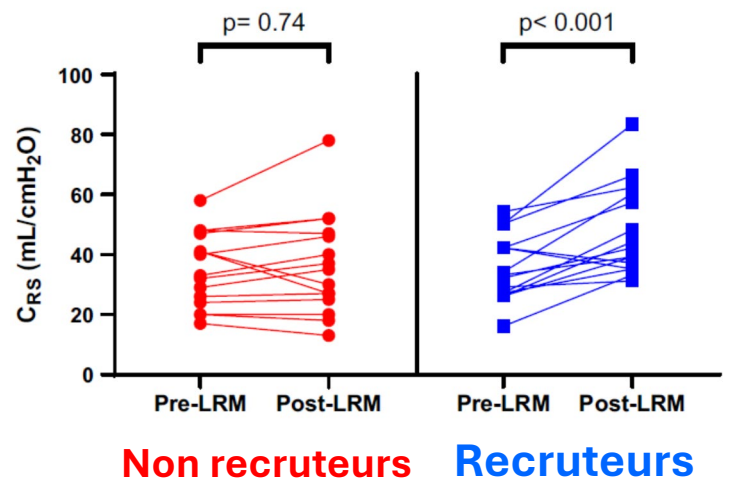
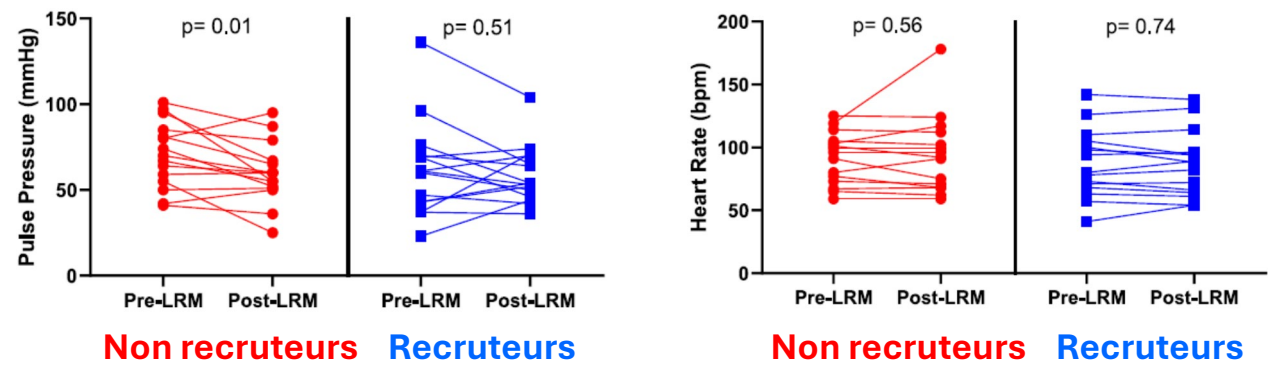
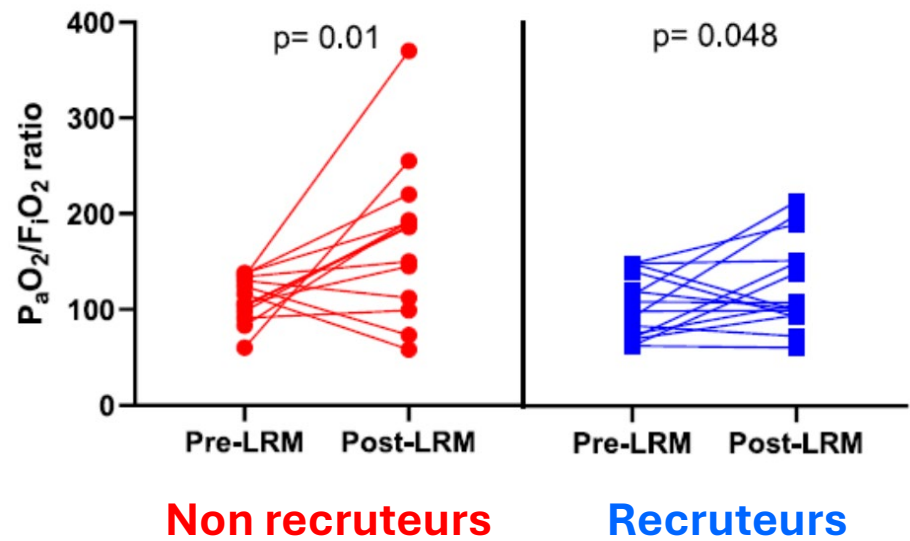
Yoann Zerbib, Alexis Lambour, Julien Maizel, Loay Kontar, Bertrand De Cagny, Thierry Soupison, Thomas Bradier, Michel Slama and Clément Brault*  *Critical Care* (2022) 26:12





Respiratory effects of lung recruitment maneuvers depend on the recruitment-to-inflation ratio in patients with COVID-19-related acute respiratory distress syndrome

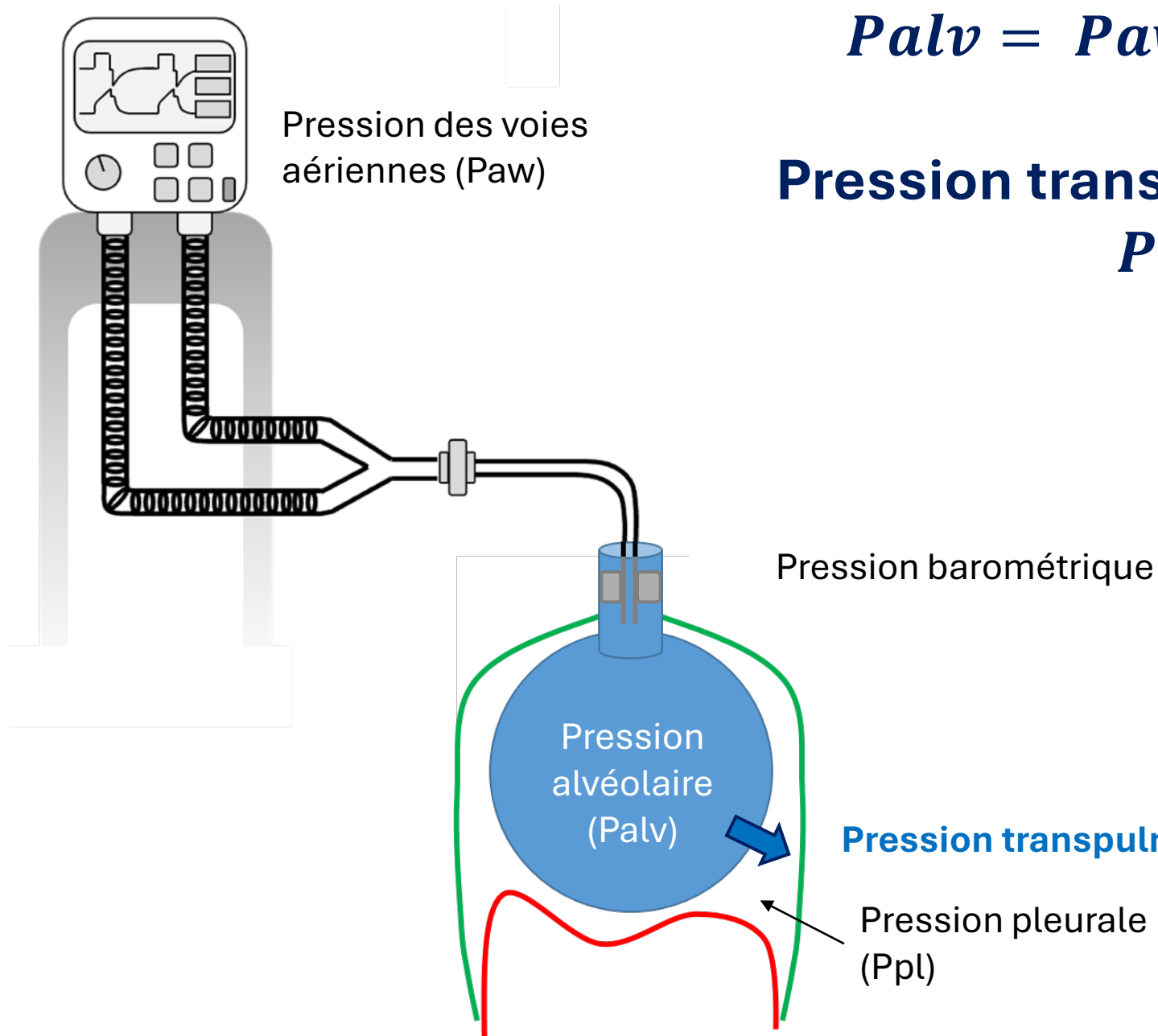
Yoann Zerbib, Alexis Lambour, Julien Maizel, Loay Kontar, Bertrand De Cagny, Thierry Soupison, Thomas Bradier, Michel Slama and Clément Brault *Critical Care* (2022) 26:12



$$P_{alv} = P_{aw} \text{ statique (à débit} = 0)$$

Pression transpulmonaire:

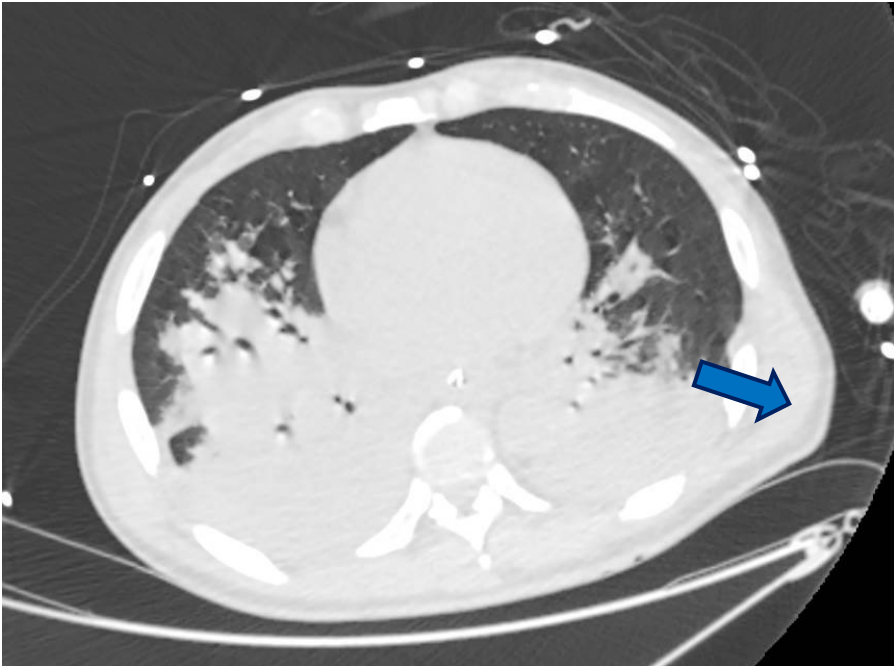
$$P_L = P_{aw} - P_{pl}$$



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.

N Engl J Med 2008;359:2095-104.



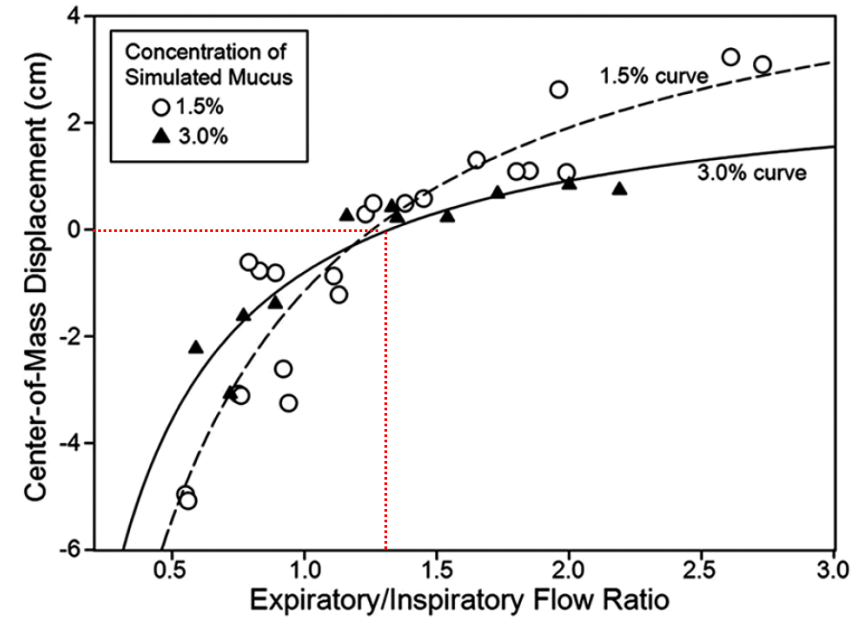
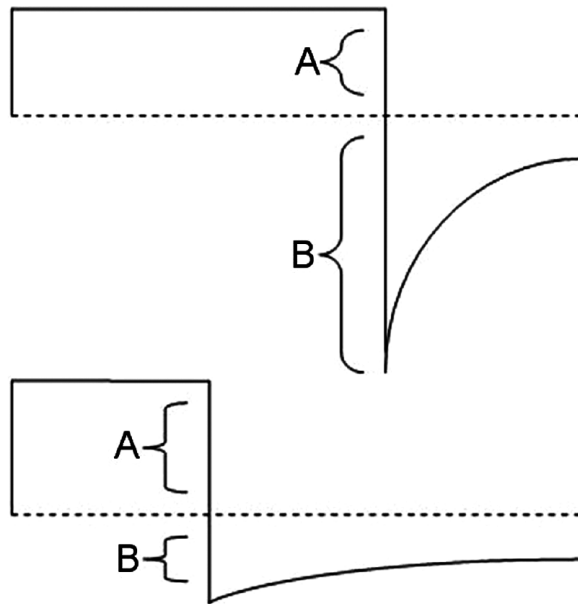
Outcome	Esophageal-Pressure-Guided (N=30)	Conventional Treatment (N=31)	P Value
28-Day mortality — no. (%)	5 (17)	12 (39)	0.055
180-Day mortality — no. (%)	8 (27)	14 (45)	0.13
Length of ICU stay — days			0.16
Median	15.5	13.0	
Interquartile range	10.8–28.5	7.0–22.0	

PEEP adjusted to maintain the $P_{L\text{ end-exp}} > 0$ vs.
PEEP according to a PEEP/FiO₂ table

Ventilation Patterns Influence Airway Secretion Movement

Marcia S Volpe, Alexander B Adams MPH RRT FAARC,
Marcelo B P Amato MD, and John J Marini MD

Respir Care 2008;53:1287-1294

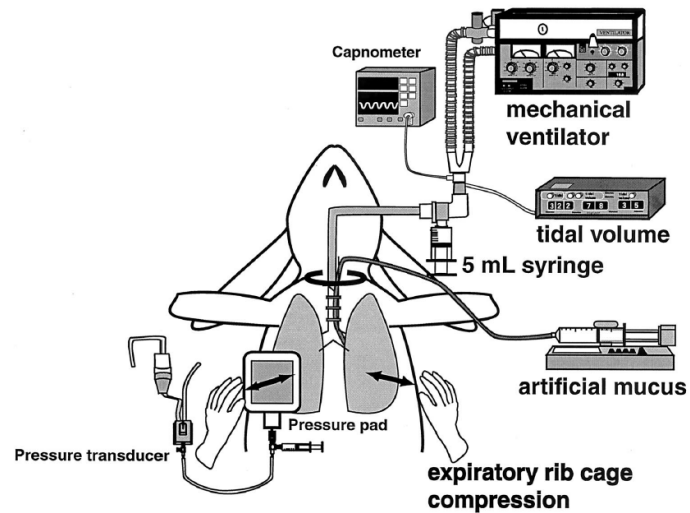


Effects of Expiratory Rib Cage Compression Combined With Endotracheal Suctioning on Gas Exchange in Mechanically Ventilated Rabbits With Induced Atelectasis

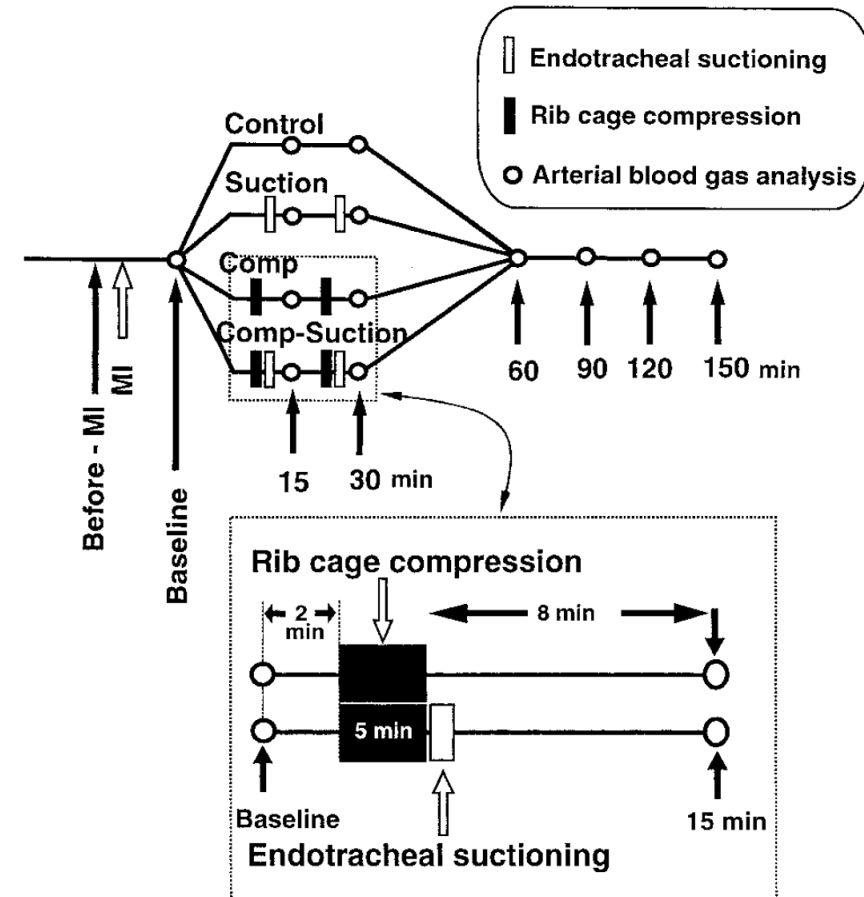
Takeshi Unoki RN MSc, Taro Mizutani MD PhD, and Hidenori Toyooka MD PhD

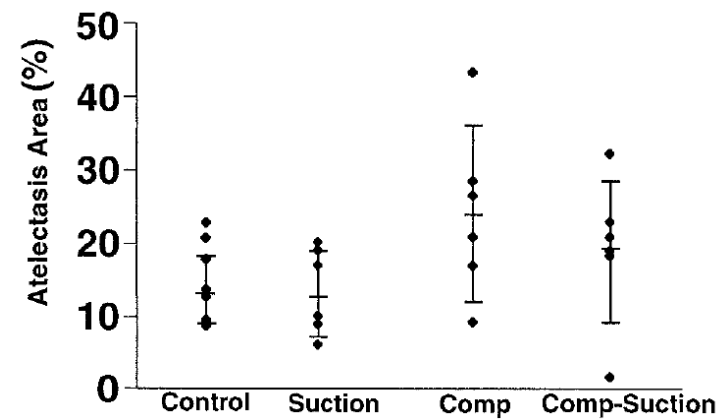
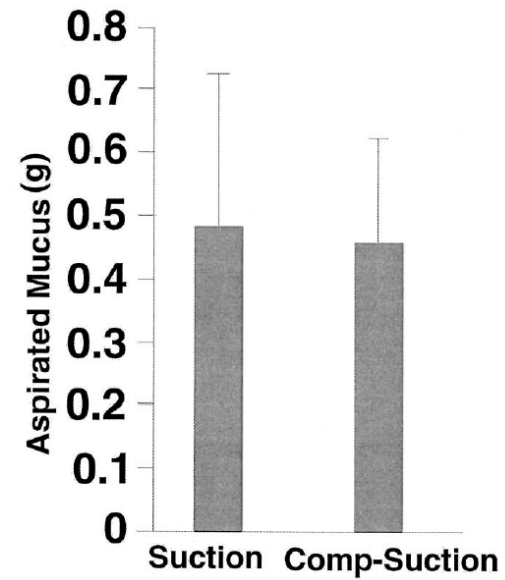
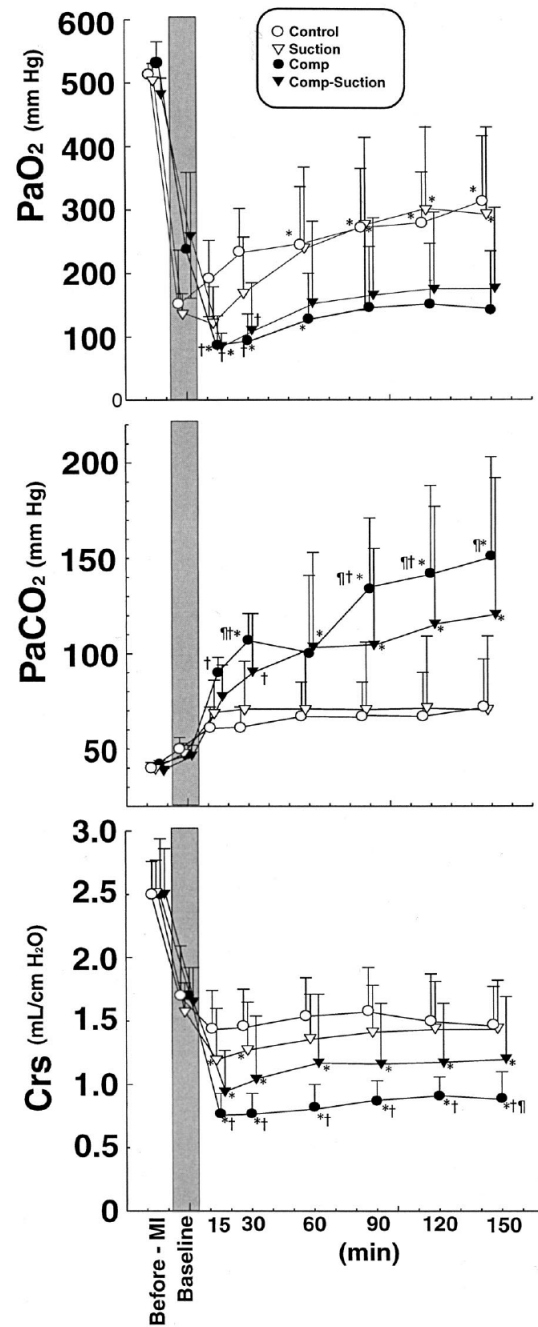
Respir Care 2004;49(8):896–901

Modèle d'atélectasie chez le lapin

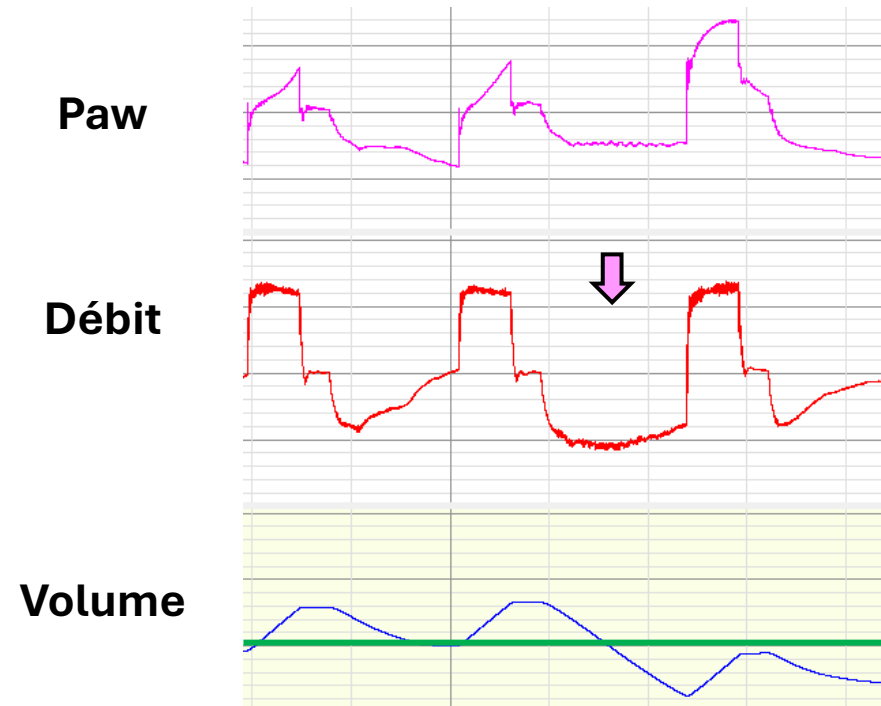


Ventilateur:
VAC
ZEEP

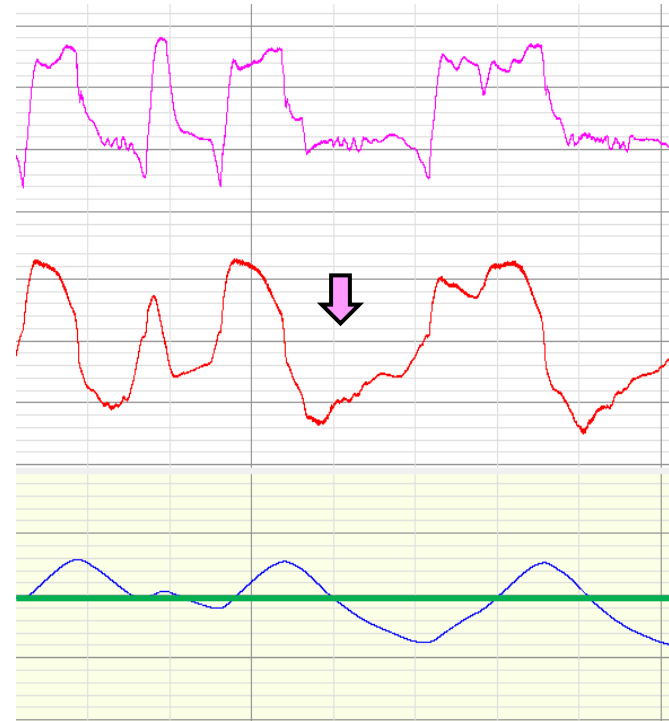




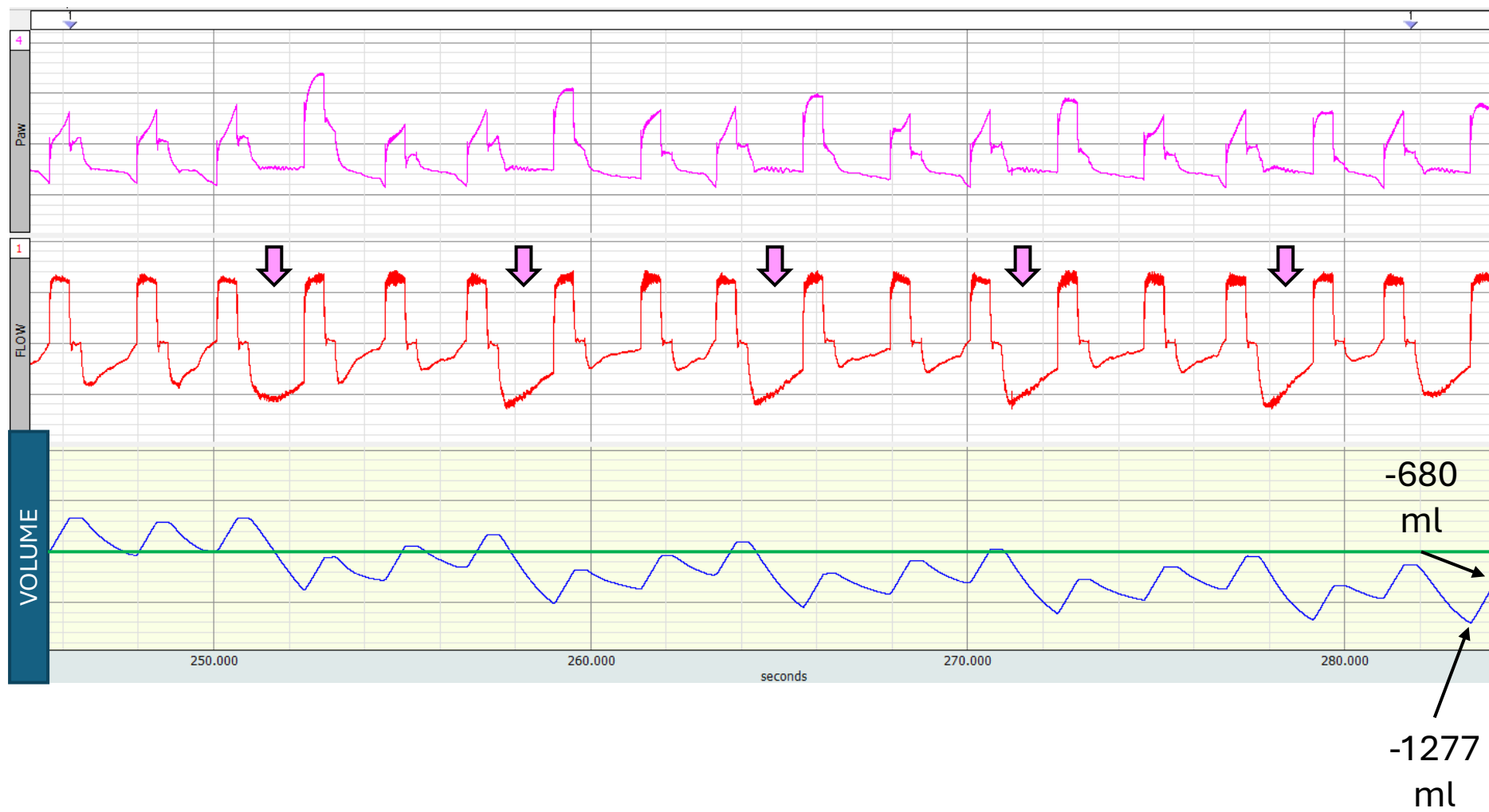
VAC



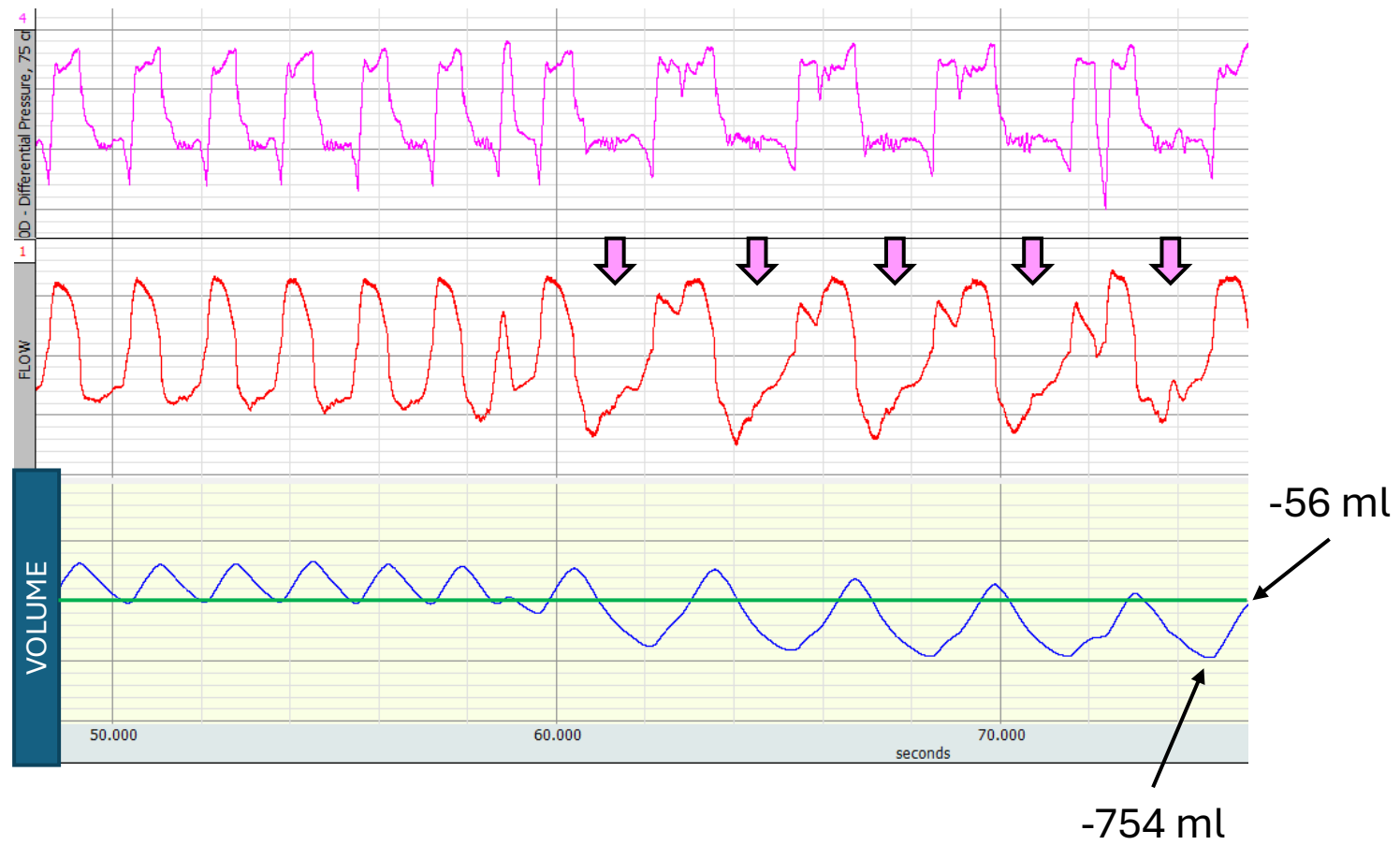
VSAI



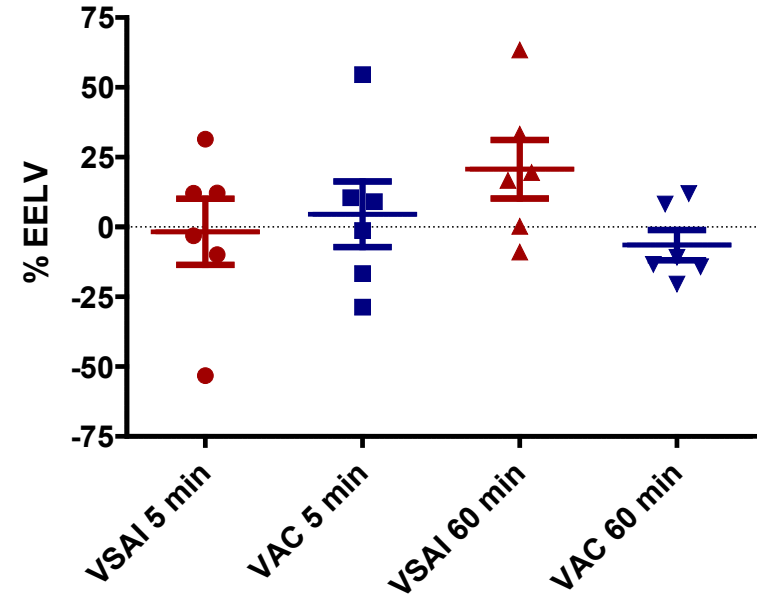
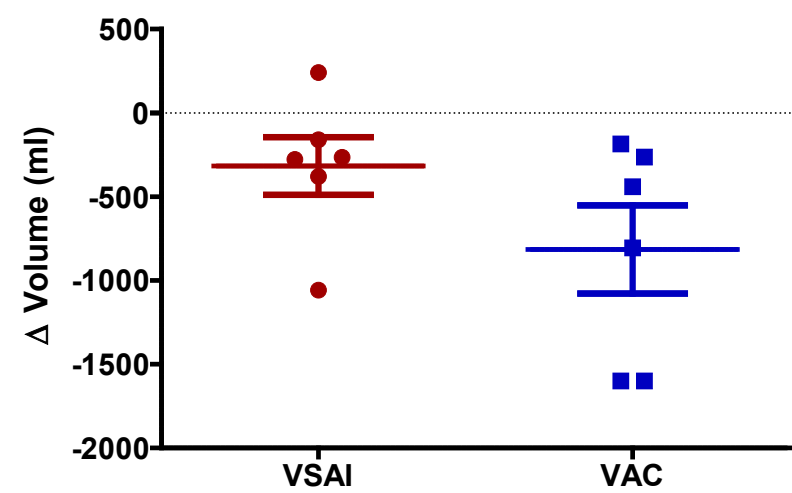
VAC



VSAI



Volumes pulmonaires et « rib cage compression »



Take home message

- Recrutement = ouverture d'unités alvéolaires préalablement fermées sous l'effet de la pression transpulmonaire positive
- Une pression transpulmonaire négative peut favoriser le dérecrutement
- La compliance du système respiratoire est corrélée au volume de poumon ouvert
- L'amélioration de l'oxygénation sous l'effet de la PEP n'est pas synonyme de recrutement
- L'effet de la kinésithérapie respiratoire sur le recrutement nécessite d'être évalué