Ventilation Spontanée dans le SDRA

Hadrien Rozé

Anesthésie Réanimation Thoracique

CHU de Bordeaux

CONSULTING

Royalties

Medtronic

SimVA Medical

GETINGE

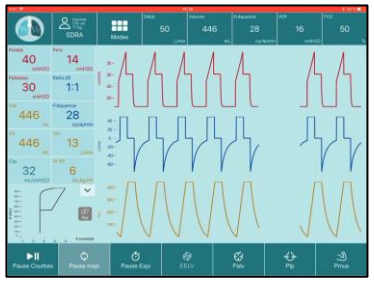
GE Healthcare

VS lors d'un SDRA a la phase aigue: Good & Bad

- Petit rappel
- Les bénéfices attendus
- Les risques

- Le monitorage

Equation du mouvement: Paw + Pmus = PEP + QxRes + V_T/Crs



Ventilation
Pression
Positive

Pcircuit
(Paw)

=

Ptracheal
(Ptr)

=

Palveolar
(Palv)

=

Ppleural
(Ppl)

Inspiratory
muscles

Rendo trach

Raw

C_L

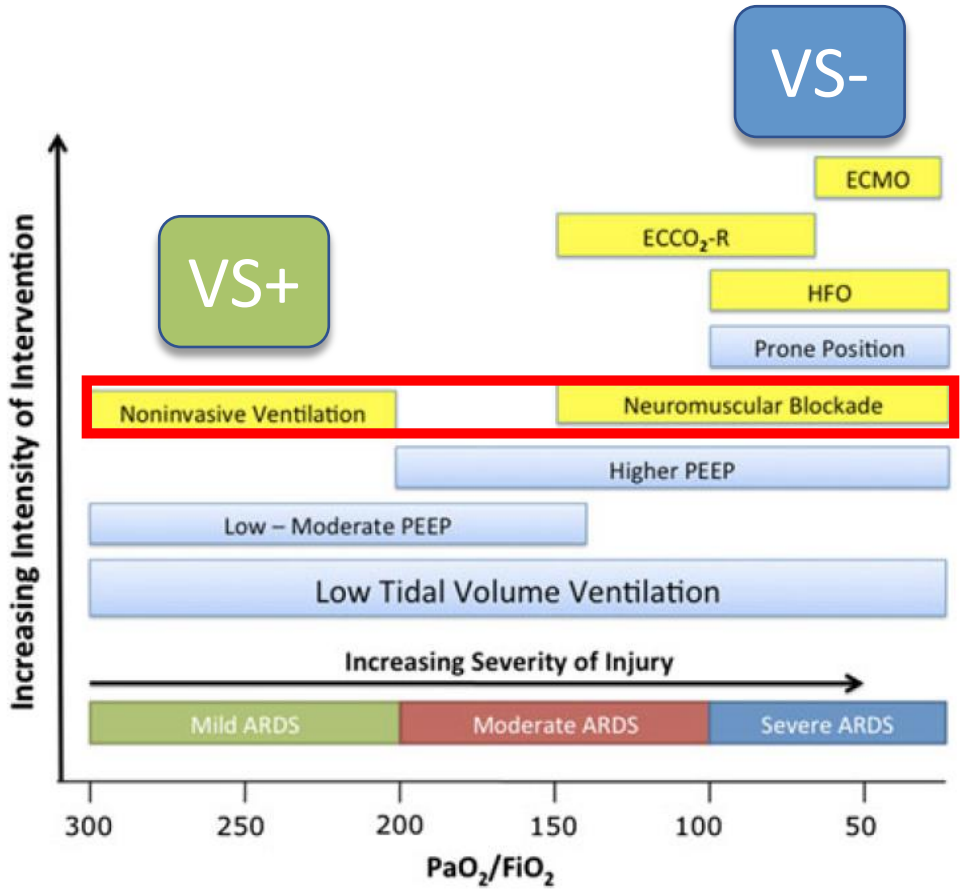
C_{cw}

Intensive Care Med (2012) 38:1573–1582
DOI 10.1007/s00134-012-2682-1

SPECIAL ARTICLE

Niall D. Ferguson
Eddy Fan
Luigi Camporota
Massimo Antonelli
Antonio Anzueto
Richard Beale
Laurent Brochard
Roy Brower
Andrés Esteban
Luciano Gattinoni
Andrew Rhodes
Arthur S. Slutsky
Jean-Louis Vincent
Gordon D. Rubenfeld
B. Taylor Thompson
V. Marco Ranieri

The Berlin definition of ARDS: an expanded rationale, justification, and supplementary material



JAMA | 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

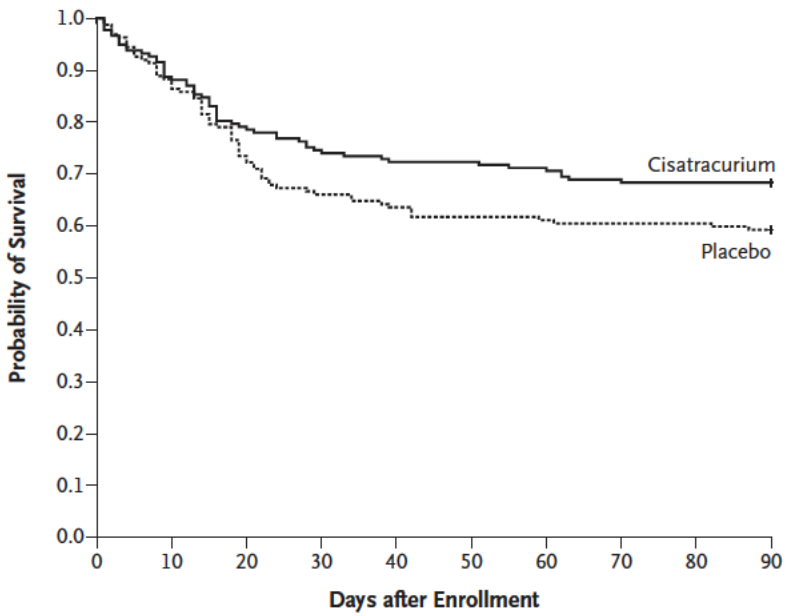
Parameter	All (N = 2377)	Mild (n = 714)	Moderate (n = 1106)	Severe (n = 557)	*P* Value[a]
Age, median (IQR), y	61 (61-62)	61 (60-63)	62 (62-63)	57 (55-58)	<.001
No longer meet ARDS criteria after 24 h, No. (%) [95% CI]	486 (17.3) [15.9-18.7]	190 (26.6) [23.4-30.0]	152 (13.7) [11.8-15.9]	71 (12.8) [10.1-15.8]	<.001
Spontaneous ventilation, No. (%) [95% CI]	723 (30.4 [8.6-32.3]	260 (36.4) [32.9-40.0]	336 (30.4) [29.7-35.3]	127 (22.8) [19.3-26.5]	<.001
Gas exchange, first day of ARDS					
Pao_2/Fio_2 ratio, mean (95% CI), mmHg	161 (158-163)	246 (244-248)	149 (147-150)	75 (74-77)	<.001
Spo_2, mean (95% CI)	95 (94-95)	97 (97-98)	95 (95-96)	90 (89-91)	<.001
Median (IQR)	96 (93-98)	98 (96-99)	96 (94-98)	92 (88-95)	
$Paco_2$, mean (95% CI), mm Hg	46.0 (45.4-46.6)	41.5 (40.7-42.2)	45.8 (44.9-46.6)	52.2 (50.7-53.7)	<.001
pH, mean (95% CI)	7.33 (7.32-7.33)	7.36 (7.36-7.37)	7.33 (7.32-7.33)	7.27 (7.26-7.29)	<.001

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 SEPTEMBER 16, 2010 VOL. 363 NO. 12

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*

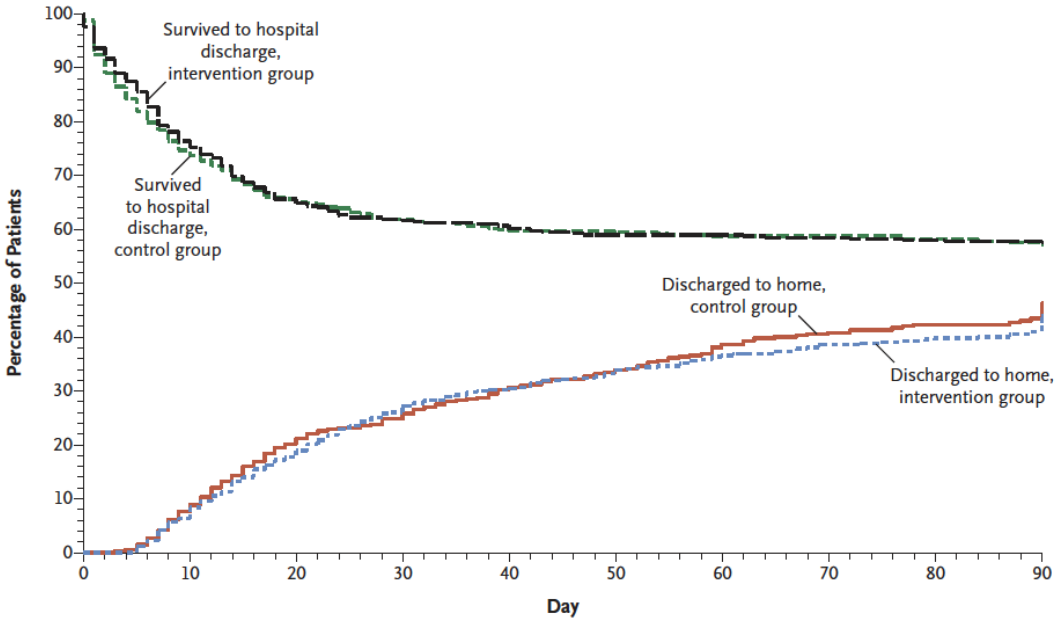


The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 MAY 23, 2019 VOL. 380 NO. 21

Early Neuromuscular Blockade in the Acute Respiratory Distress Syndrome

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



Spontaneously regulated vs. controlled ventilation of acute lung injury/acute respiratory distress syndrome

John J. Marini

Current Opinion in Critical Care 2011, 17:24–29

Sur le plan moteur respiratoire, la VS évite l'atrophie rapide des muscles respiratoire comme le diaphragme.
Les secrétions des voies aériennes peuvent être mieux évacuées par la toux qui persiste en VS.

Sur les échanges gazeux, la VS améliore les rapports ventilation/perfusion,

Sur le plan hémodynamique, la VS avec une pression intra thoracique moins positive ou négative préserve plus le retour veineux. L'utilisation de moins de sédation a aussi un effet sur la vasoplégie et donc le recours au remplissage vasculaire ou aux amines vasopressives.

Sur le plan lymphatique la pression pleurale négative de la VS aide au drainage de l'œdème.

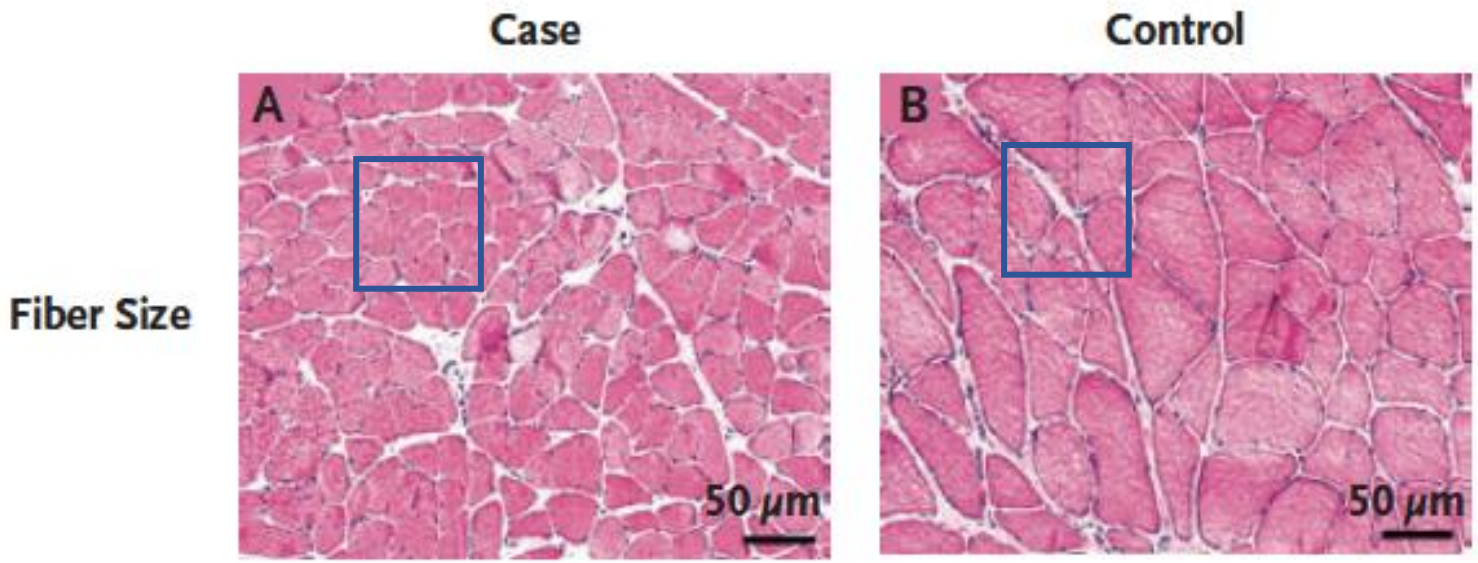
Sur le plan neurologique la VS nécessite moins de sédations, moins de délirium, moins de durée de ventilation ou de durée de séjour dans certaines études, mais pas toutes.

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 MARCH 27, 2008 VOL. 358 NO. 13

Rapid Disuse Atrophy of Diaphragm Fibers in Mechanically Ventilated Humans

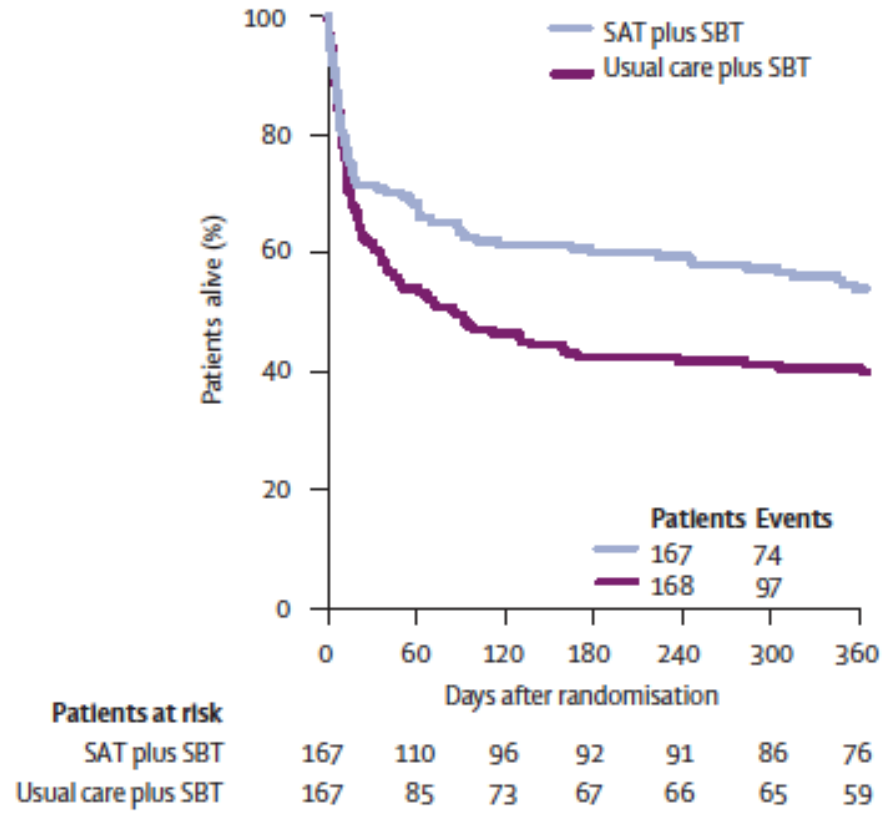
Sanford Levine, M.D., Taitan Nguyen, B.S.E., Nyali Taylor, M.D., M.P.H., Michael E. Friscia, M.D., Murat T. Budak, M.D., Ph.D., Pamela Rothenberg, B.A., Jianliang Zhu, M.D., Rajeev Sachdeva, M.D., Seema Sonnad, Ph.D., Larry R. Kaiser, M.D., Neal A. Rubinstein, M.D., Ph.D., Scott K. Powers, Ph.D., Ed.D., and Joseph B. Shrager, M.D.



N Engl J Med 2008;358:1327-35.

Efficacy and safety of a paired sedation and ventilator weaning protocol for mechanically ventilated patients in intensive care (Awakening and Breathing Controlled trial): a randomised controlled trial

Timothy D Girard, John P Kress, Barry D Fuchs, Jason W W Thomason, William D Schweickert, Brenda T Pun, Darren B Taichman, Jan G Dunn, Anne S Pohlman, Paul A Kinniry, James C Jackson, Angelo E Canonico, Richard W Light, Ayumi K Shintani, Jennifer L Thompson, Sharon M Gordon, Jesse B Hall, Robert S Dittus, Gordon R Bernard, E Wesley Ely

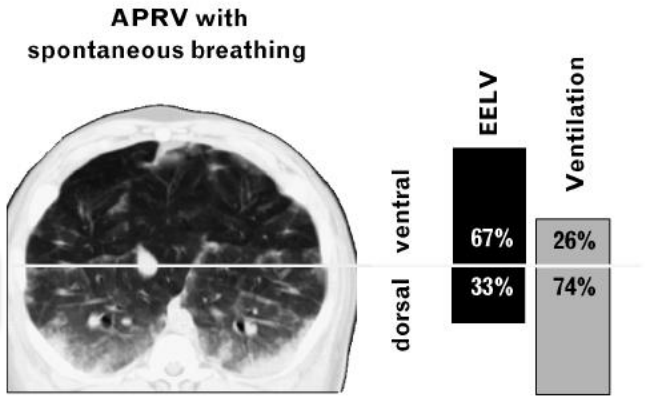


Lancet 2008; 371: 126–34

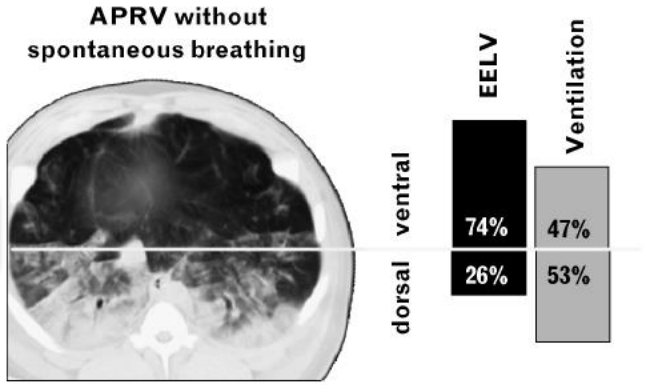
The impact of spontaneous breathing during mechanical ventilation

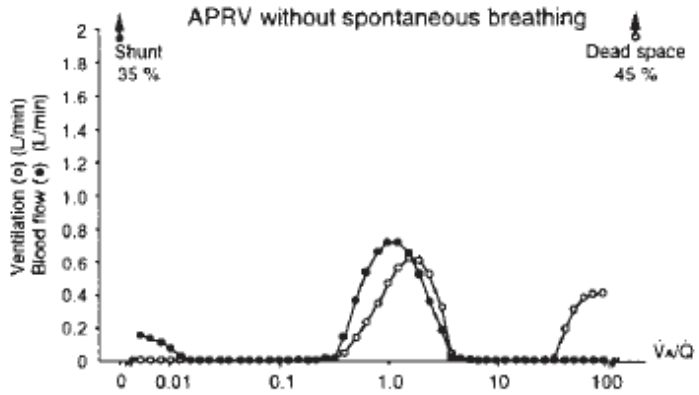
Christian Putensen, Thomas Muders, Dirk Varelmann and Hermann Wrigge

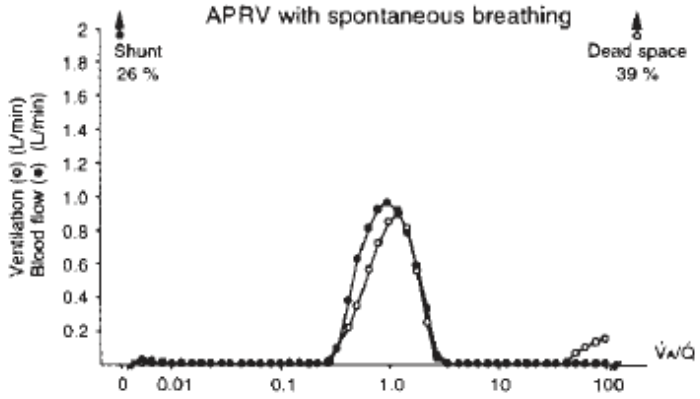
VS+



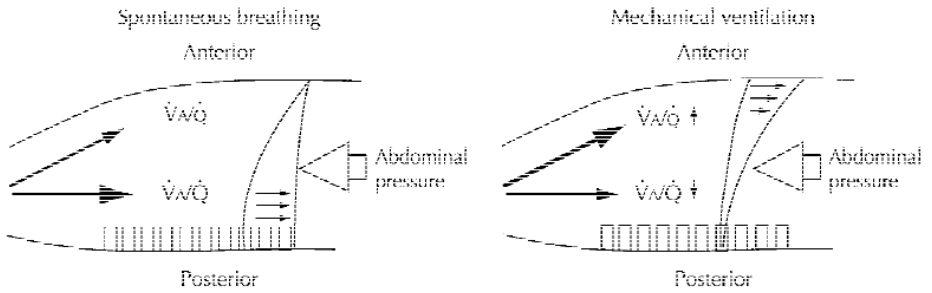
VS-





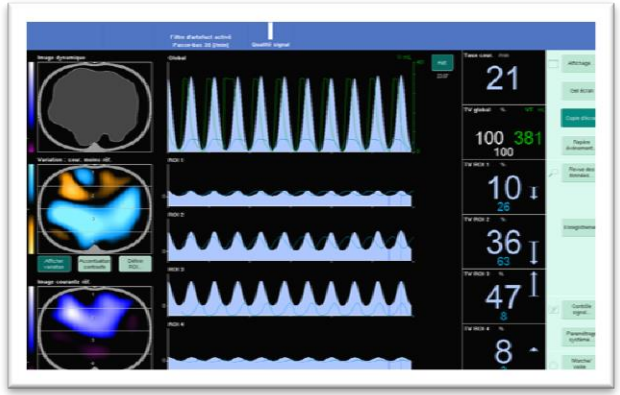


Am J Respir Crit Care Med Vol 159. pp 1241–1248, 1999



VS+ VS-

Curr Opin Crit Care 12:13–18.




Contact électrode non stable
PC
VS
VS PC
VS PC
VS PC
VT

FIFTY YEARS OF RESEARCH IN ARDS

Spontaneous Breathing during Mechanical Ventilation

Risks, Mechanisms, and Management

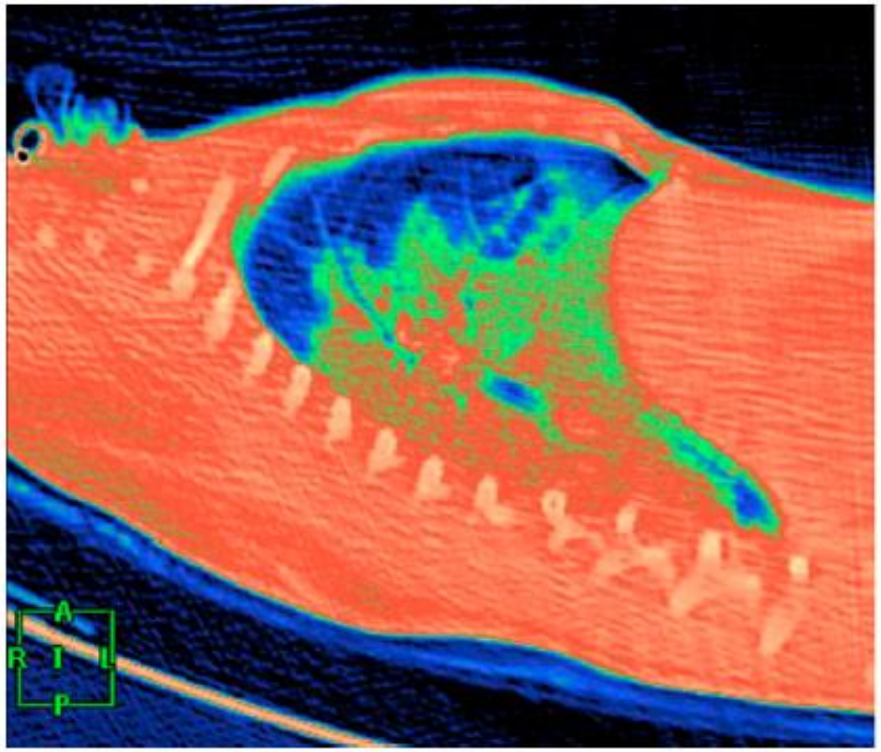
Takeshi Yoshida[1,2,3,4], Yuji Fujino[4], Marcelo B. P. Amato[5], and Brian P. Kavanagh[1,2,3]

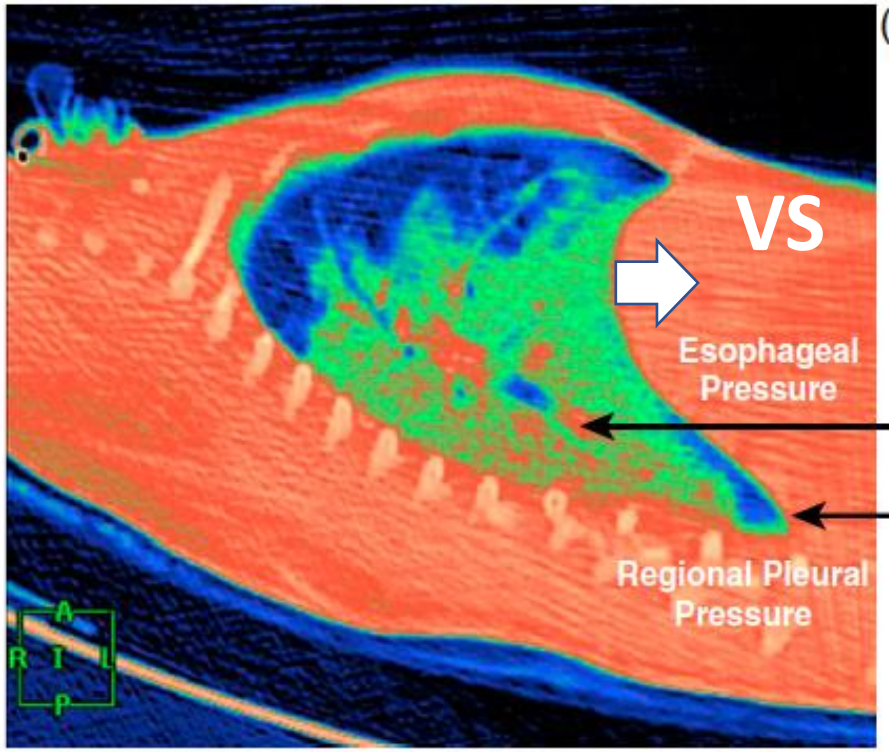
Am J Respir Crit Care Med Vol 195, Iss 8, pp 985–992, Apr 15, 2017

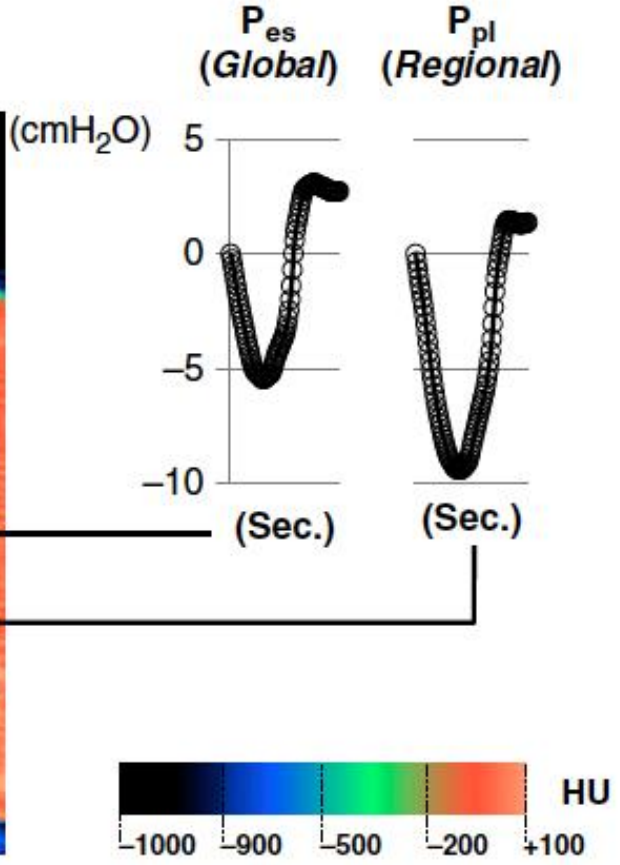
VS

Contraction du diaphragme

Dépression pleurale





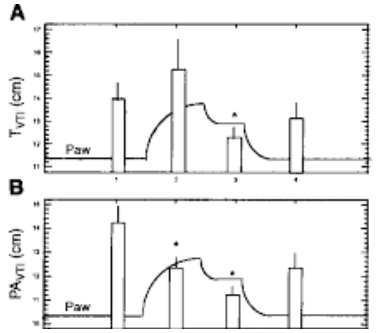


Aéré Atélectasié Partiellement aéré

Spontaneous Breathing During Ventilatory Support Improves Ventilation–Perfusion Distributions in Patients with Acute Respiratory Distress Syndrome

CHRISTIAN PUTENSEN, NORBERT J. MUTZ, GABRIELE PUTENSEN-HIMMER, and JÖRG ZINSERLING

Department of Anesthesiology and Intensive Care Medicine, University of Bonn, Bonn, Germany; and Division of Intensive Care Medicine, Department of Anesthesia and Intensive Care Medicine, University of Innsbruck, Innsbruck, Austria

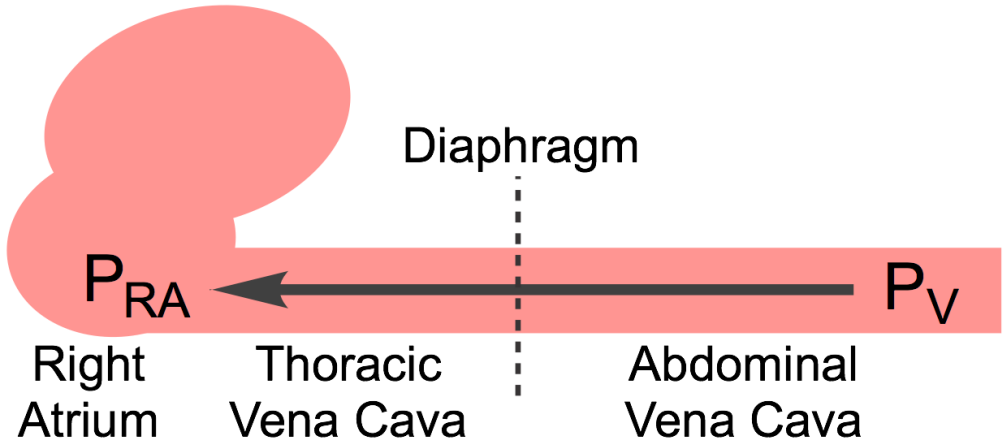


Valve Tricuspide

Valve Pulmonaire

Journal of Applied Physiology 87:1644-1650, 1999.

Pression Pleurale
moins positive en VS



$$\text{Retour Veineux} = \frac{P_V - P_{RA}}{R_V}$$

RK '15

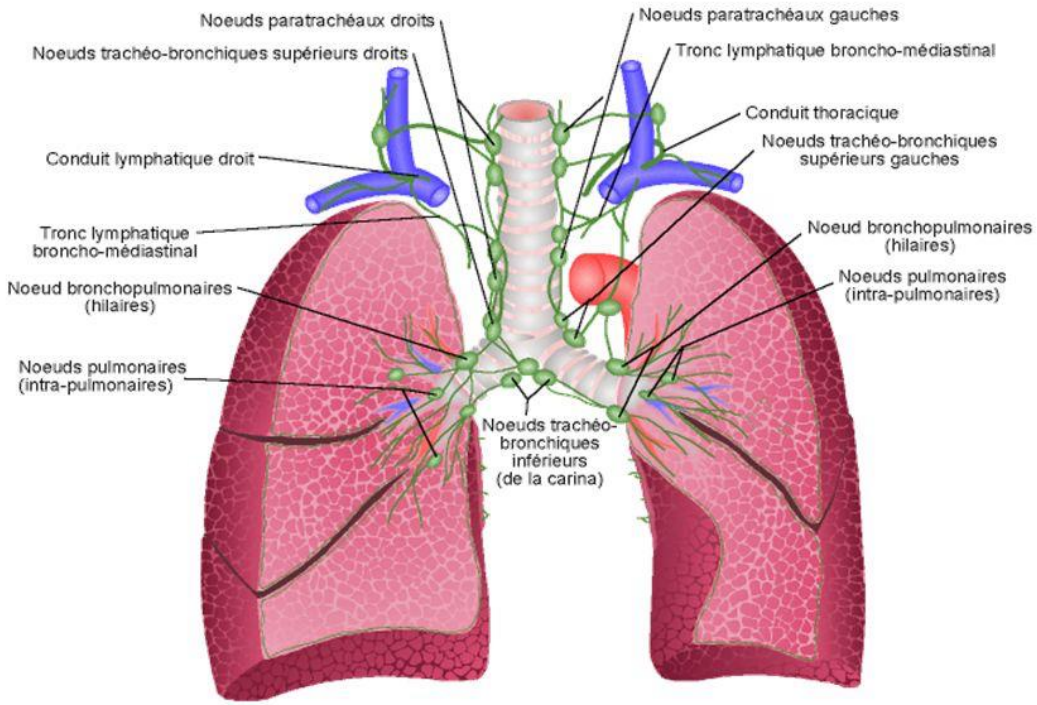
VS P_{RA} diminue

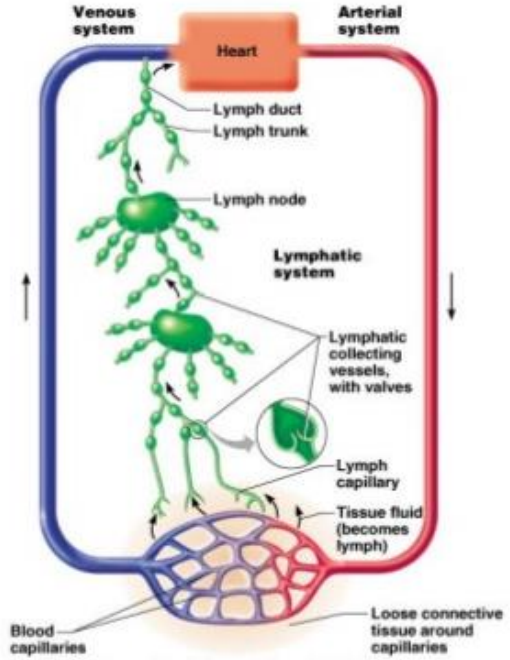
VS PVR diminue

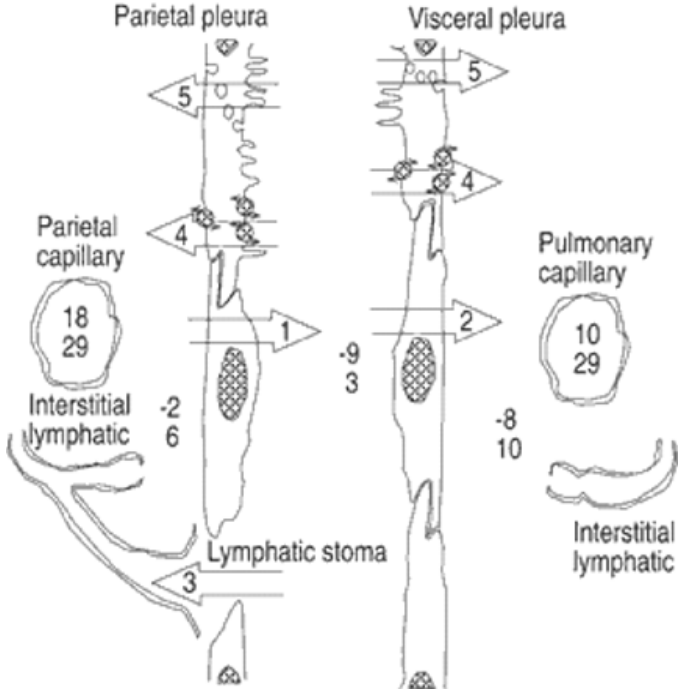
		Equal Airway Pressure Limits†		
			APRV†	APRV†
	Baseline‡	PSV†	VS-	VS+
HR, min^{-1}	112 ± 5	112 ± 4	113 ± 4	106 ± 4
Psa, mm Hg	88 ± 3	91 ± 3	90 ± 2	94 ± 3
Ppa_{tm}, mm Hg	32 ± 2	31 ± 2	33 ± 1	29 ± 2§‖
Pcv_{tm}, mm Hg	16 ± 1	16 ± 1	15 ± 1	16 ± 1
Pao_{tm}, mm Hg	16 ± 1	16 ± 1	17 ± 1	16 ± 1
CI, $L \cdot min^{-1} \cdot m^{-2}$	5.1 ± 0.2	5.3 ± 0.2	5.0 ± 0.2§	5.6 ± 0.2§‖
SVR, $dyn \cdot s \cdot cm^{-5}$	550 ± 25	550 ± 25	565 ± 31	521 ± 24
PVR, $dyn \cdot s \cdot cm^{-5}$	126 ± 12	115 ± 15	130 ± 19	95 ± 17§‖
RVEF, %	33 ± 2	36 ± 1	32 ± 2§	41 ± 2§‖
RVEDVI, $ml \cdot m^{-2}$	122 ± 3	128 ± 4	123 ± 5§	136 ± 4§‖

AM J RESPIR CRIT CARE MED 1999;159:1241–1248.

Drainage lymphatique du thorax

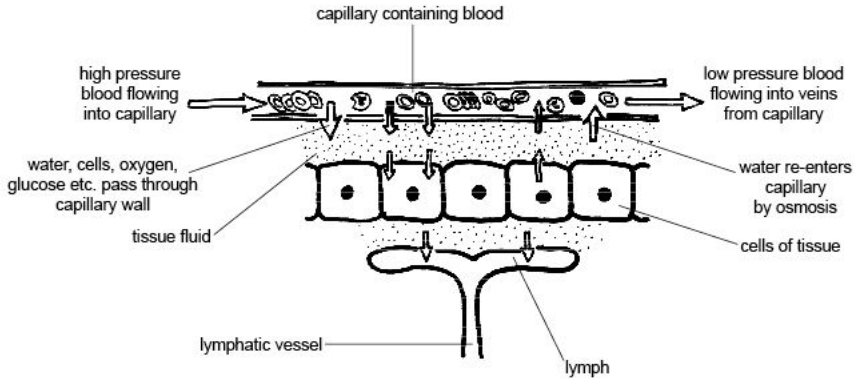






Pression Pleurale moins positive en VS

VS+



The NEW ENGLAND JOURNAL of MEDICINE

REVIEW ARTICLE

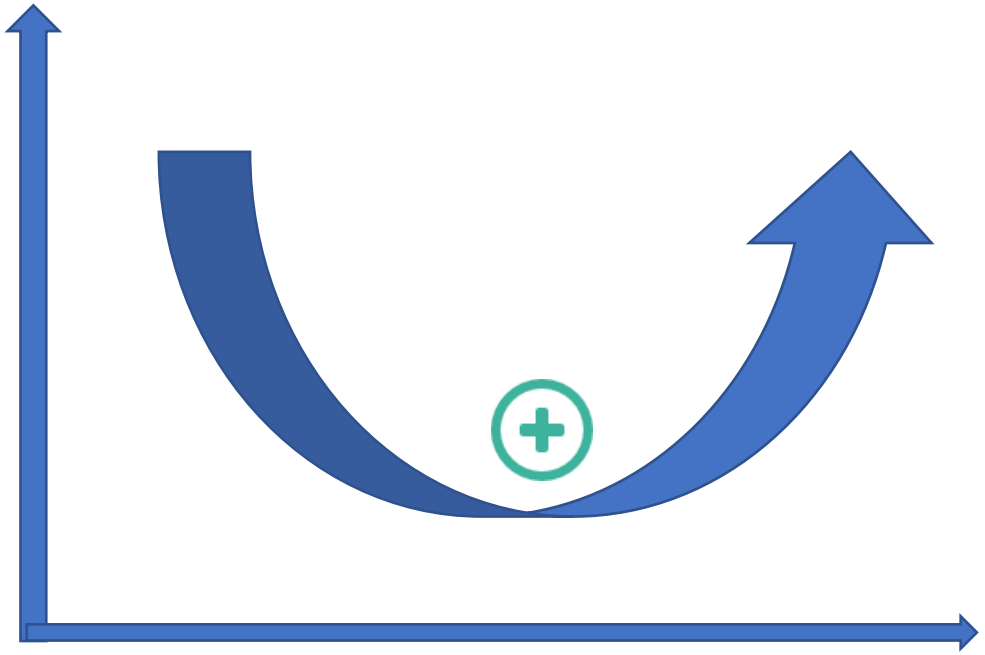
CRITICAL CARE MEDICINE

Simon R. Finfer, M.D., and Jean-Louis Vincent, M.D., Ph.D., *Editors*

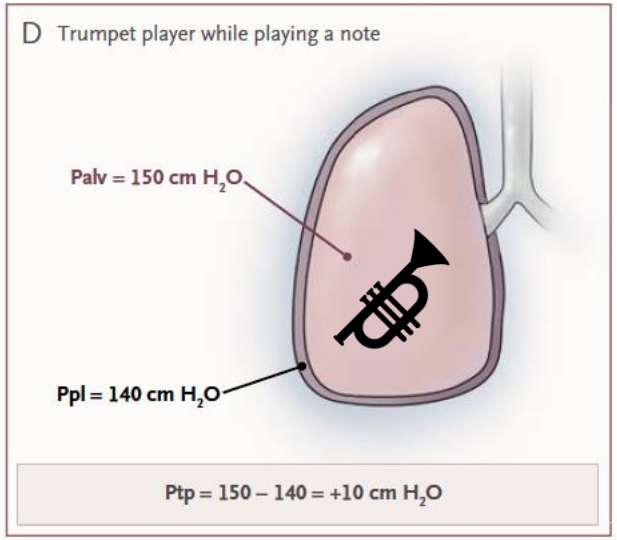
Ventilator-Induced Lung Injury

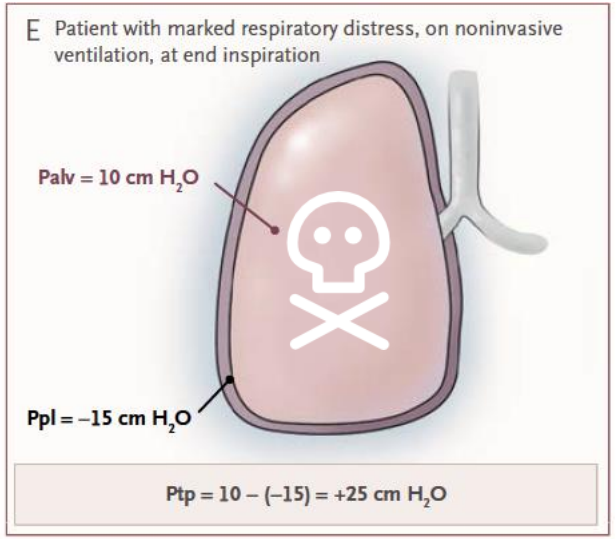
Arthur S. Slutsky, M.D., and V. Marco Ranieri, M.D.

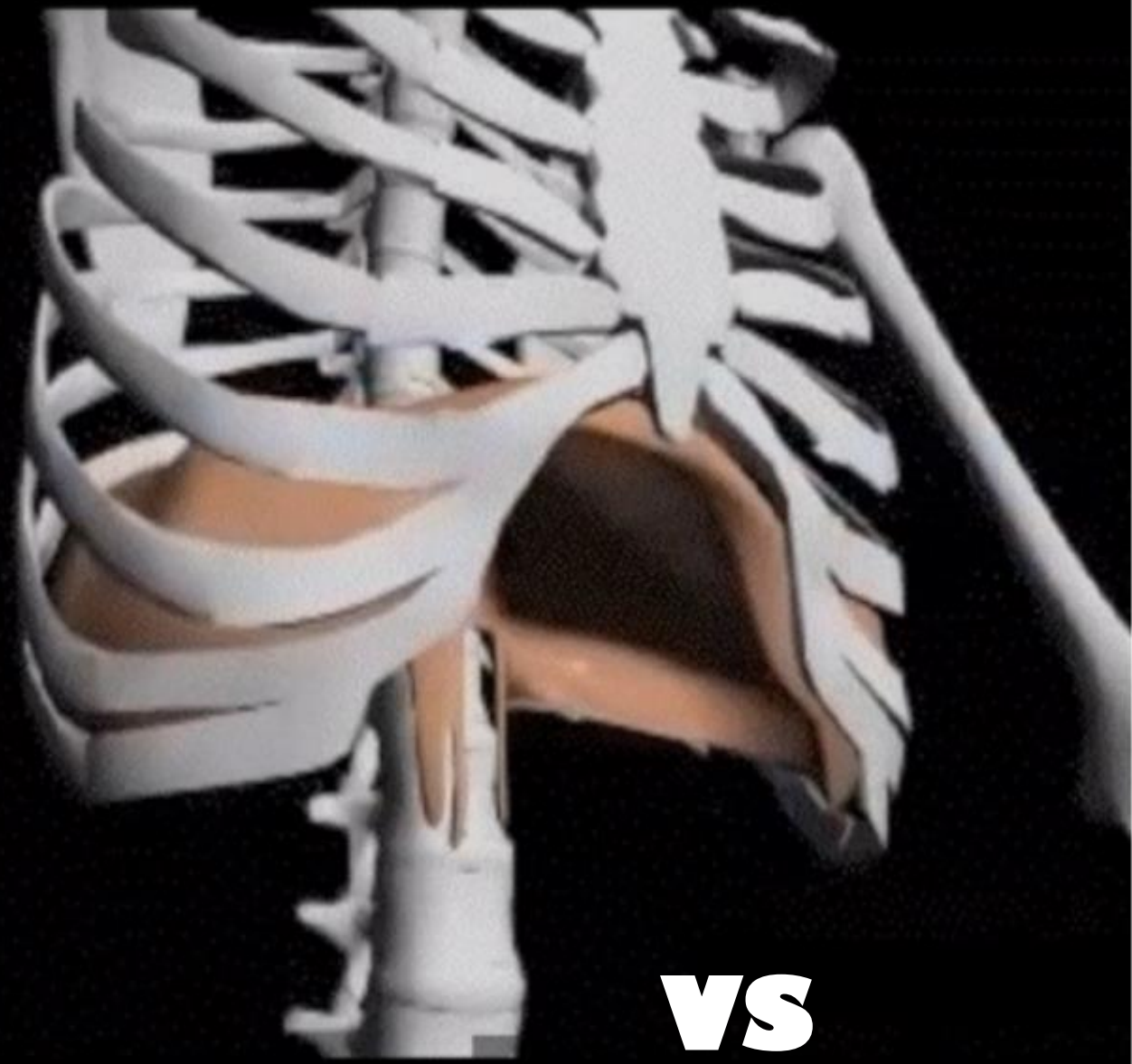
Lésions



VS







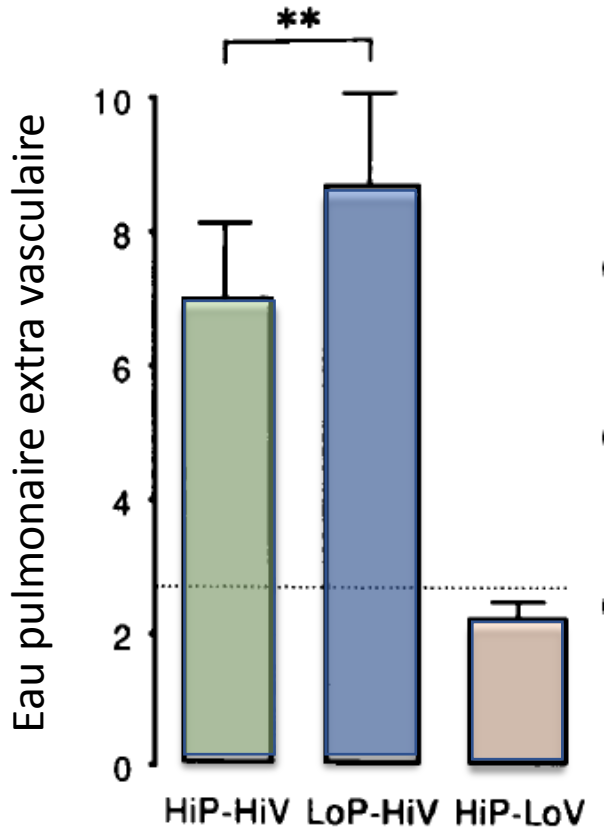
VS

Ventilator-induced Lung Injury

Lessons from Experimental Studies

DIDIER DREYFUSS and GEORGES SAUMON

Haute Pression
Haut Volume



Pression < 0
Haut Volume

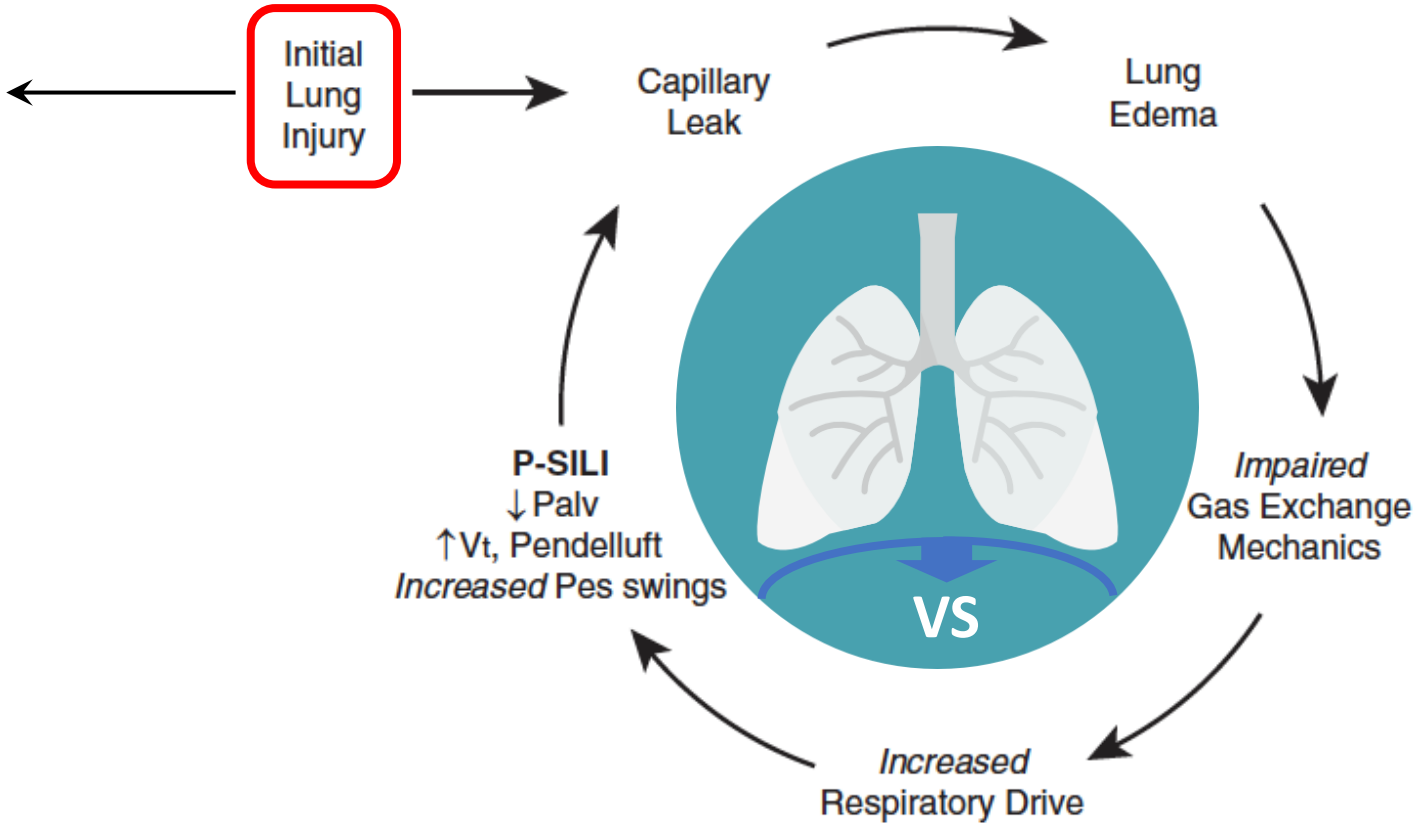
Haute Pression
Bas Volume

Am J Respir Crit Care Med Vol 157. pp 294–323, 1998

Mechanical Ventilation to Minimize Progression of Lung Injury in Acute Respiratory Failure

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

VILI vs P-SILI

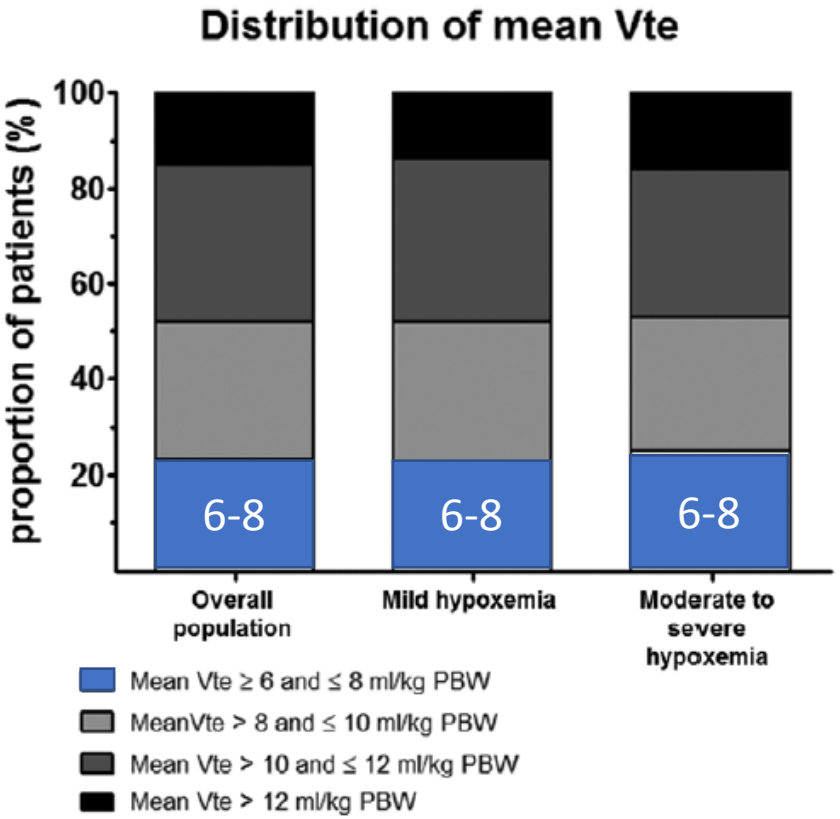


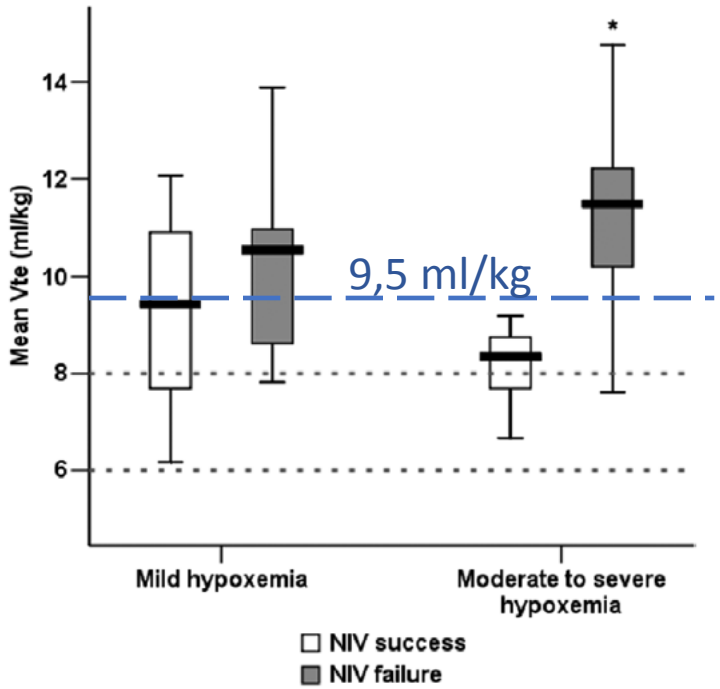
Am J Respir Crit Care Med Vol 195, Iss 4, pp 438–442, Feb 15, 2017

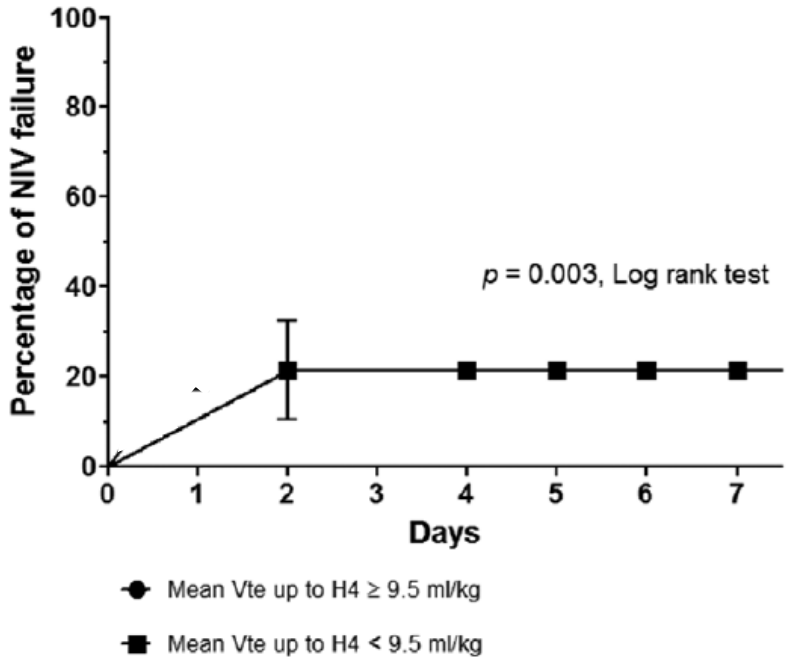
Failure of Noninvasive Ventilation for De Novo Acute Hypoxemic Respiratory Failure: Role of Tidal Volume

Le V_T en VS dans l'IRA hypoxémique

Guillaume Carteaux, MD[1,2,3]; Teresa Millán-Guilarte, MD[4]; Nicolas De Prost, MD, PhD[1,2,3]; Keyvan Razazi, MD[1,2,3]; Shariq Abid, MD, PhD[3]; Arnaud W. Thille, MD, PhD[5]; Frédérique Schortgen, MD, PhD[1,3]; Laurent Brochard, MD[3,6,7]; Christian Brun-Buisson, MD[1,2,8]; Armand Mekontso Dessap, MD, PhD[1,2,3]







Crit Care Med 2015

CHEST Original Research
CRITICAL CARE

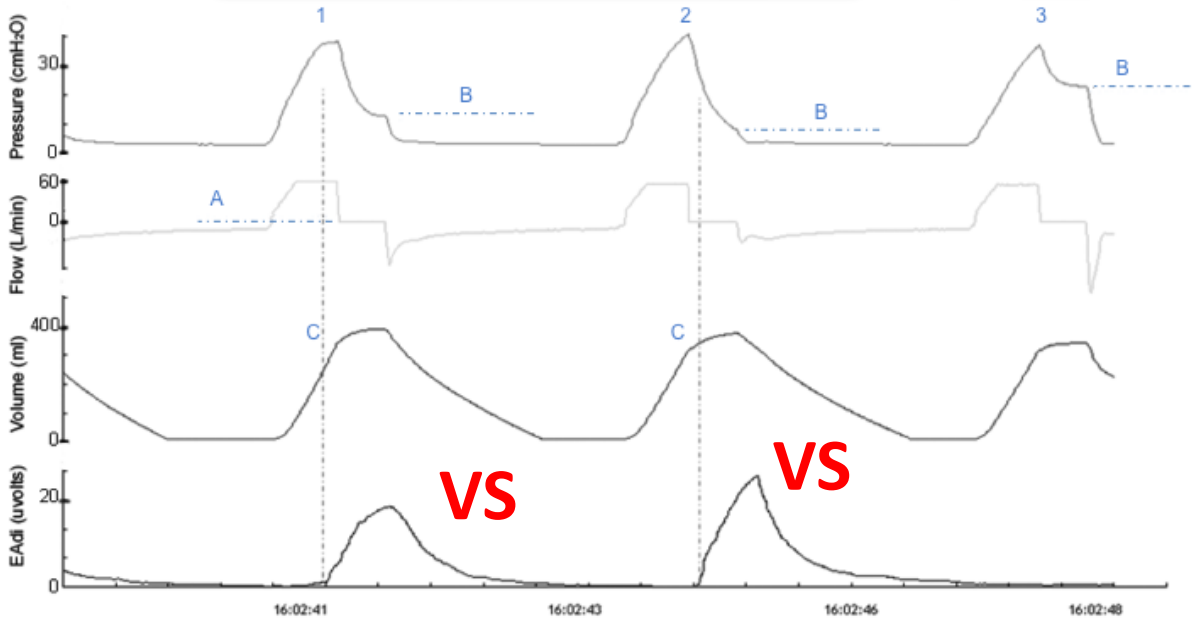
Mechanical Ventilation-Induced Reverse-Triggered Breaths

A Frequently Unrecognized Form of Neuromechanical Coupling

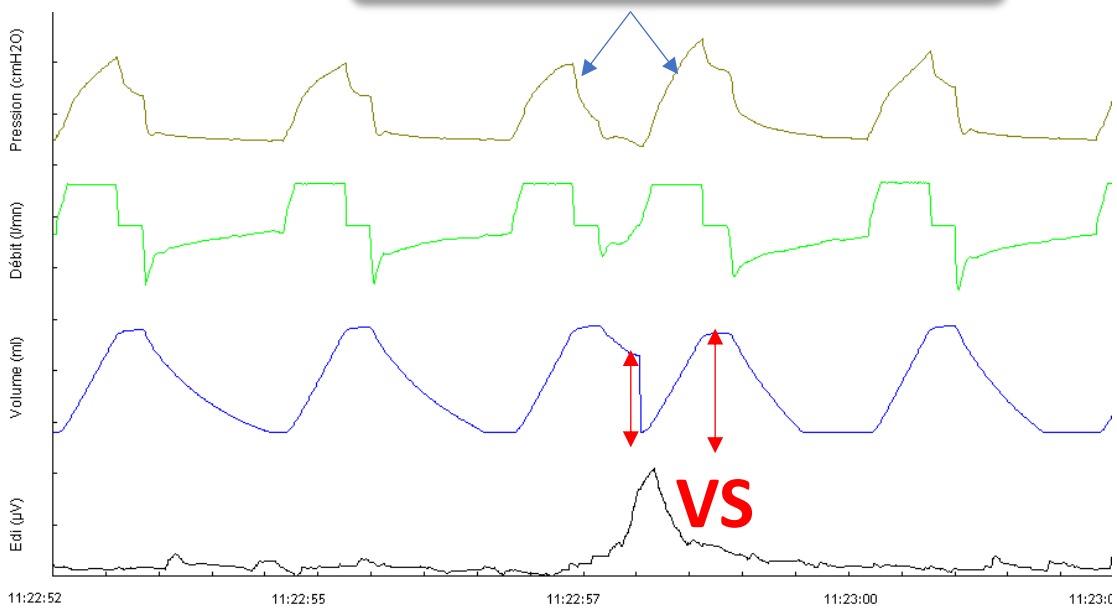
Evangelia Akoumianaki, MD; Aissam Lyazidi, PhD; Nathalie Rey, MD; Dimitrios Matamis, MD; Nelly Perez-Martinez, MD; Raphael Giraud, MD; Jordi Mancebo, MD; Laurent Brochard, MD; and Jean-Christophe Marie Richard, MD, PhD

VILI & P-SILI VS dans le SDRA avec reverse triggering

Pplat sous estimée



Double déclenchement



VAC VT 400ml FR respi = FR mesurée

VS cachée

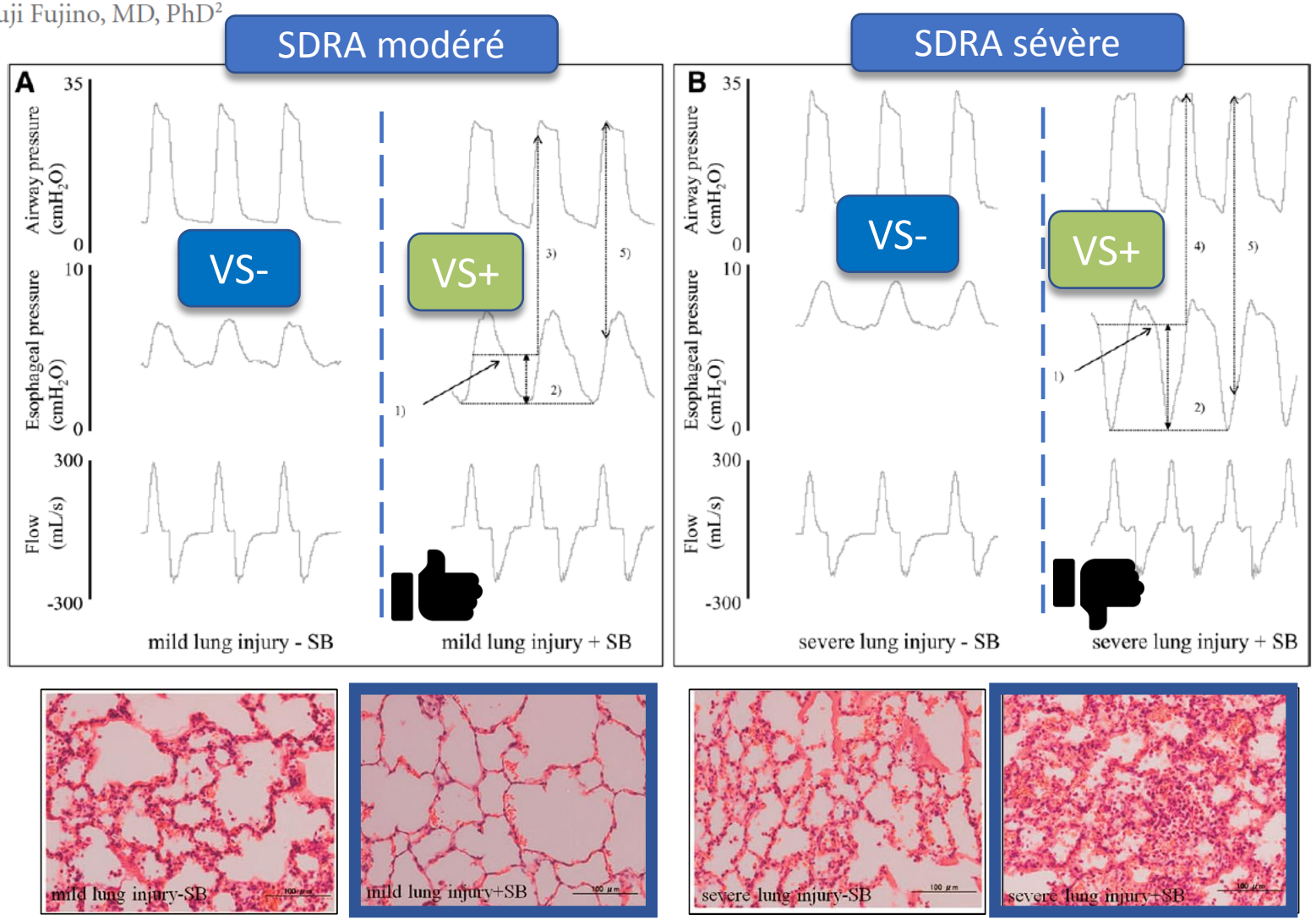
CHEST 2013; 143(4):927–938

The Comparison of Spontaneous Breathing and Muscle Paralysis in Two Different Severities of Experimental Lung Injury*

Takeshi Yoshida, MD[1,2]; Akinori Uchiyama, MD, PhD[2]; Nariaki Matsuura, MD, PhD[3]; Takashi Mashimo, MD, PhD[2]; Yuji Fujino, MD, PhD[2]

Même Paw

Poeso fct VS +/-



Crit Care Med 2013; 41:536–545

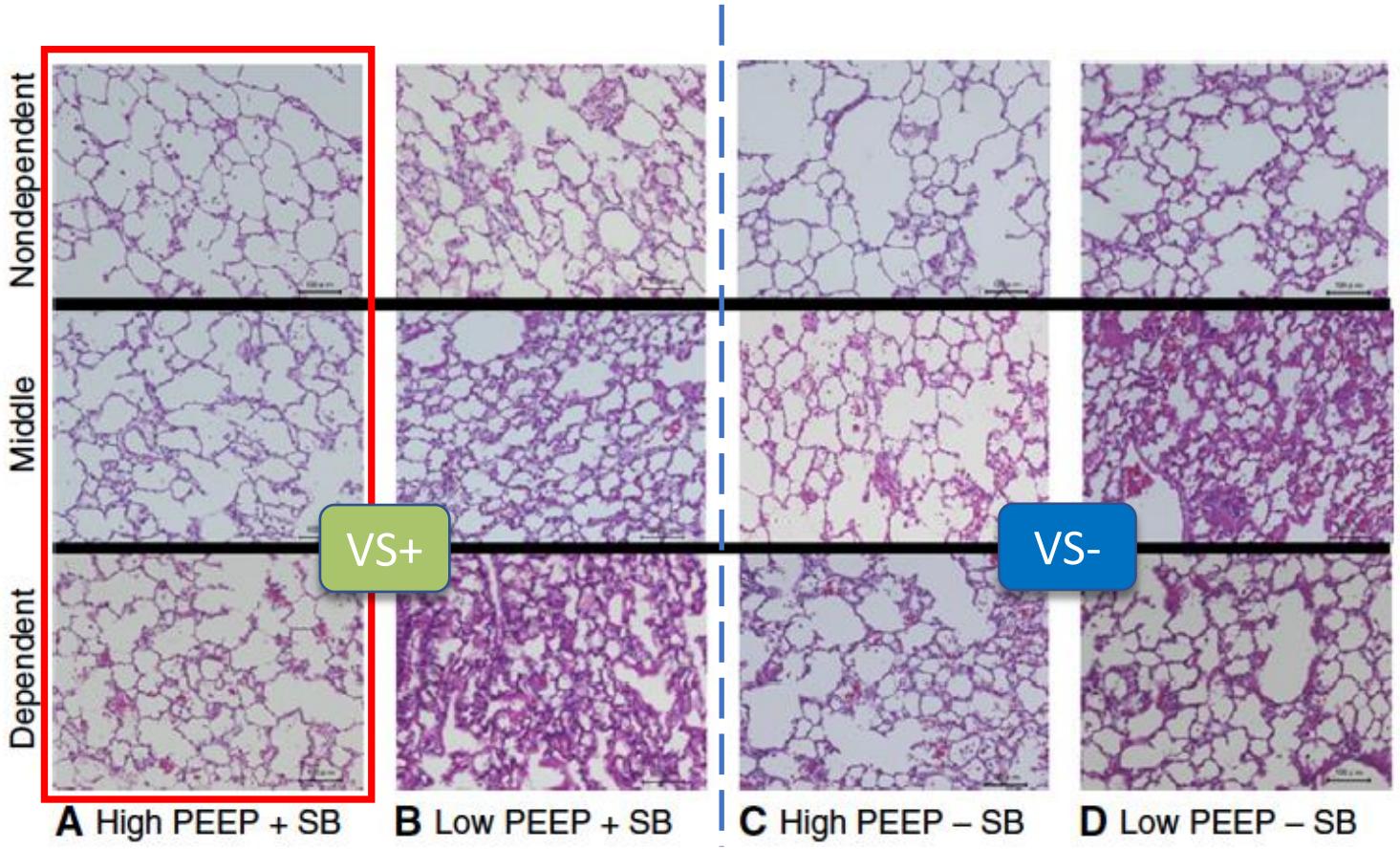
High Positive End-Expiratory Pressure Renders Spontaneous Effort Noninjurious

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], Eduardo L. V. Costa[1], and Yuji Fujino[2]

Am J Respir Crit Care Med Vol 197, Iss 10, pp 1285–1296, May 15, 2018

Palv = PEEP + VT/Crs – Pmus

Palv plus negative si moins de PEEP et/ou si Pmus augmente

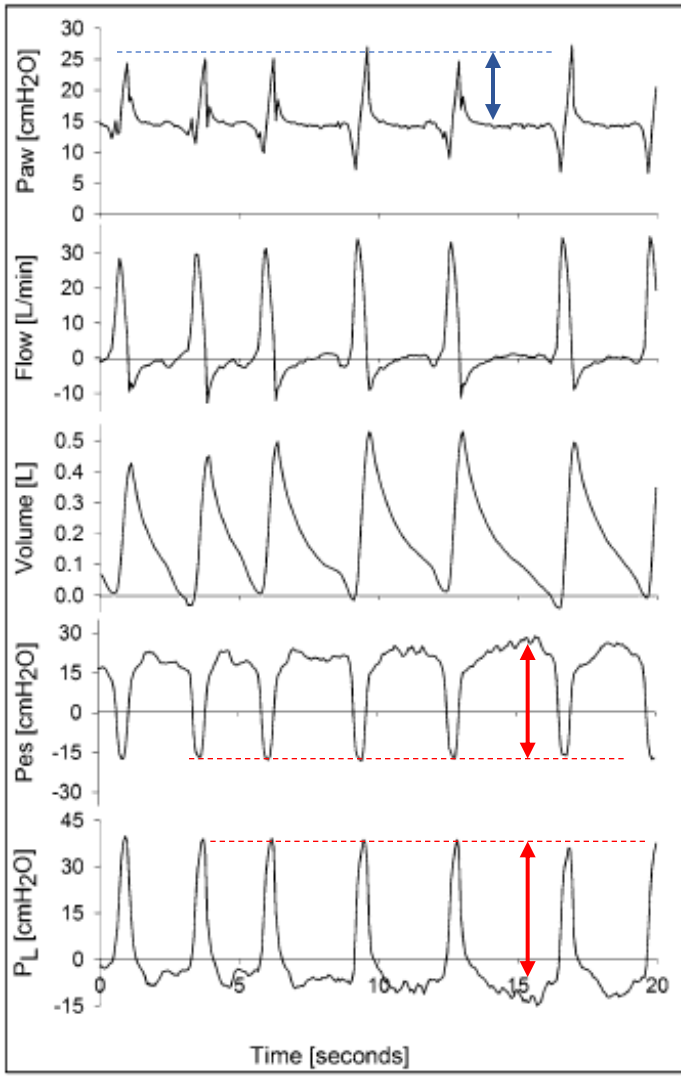


Plus homogène

Extremely high transpulmonary pressure in a spontaneously breathing patient with early severe ARDS on ECMO

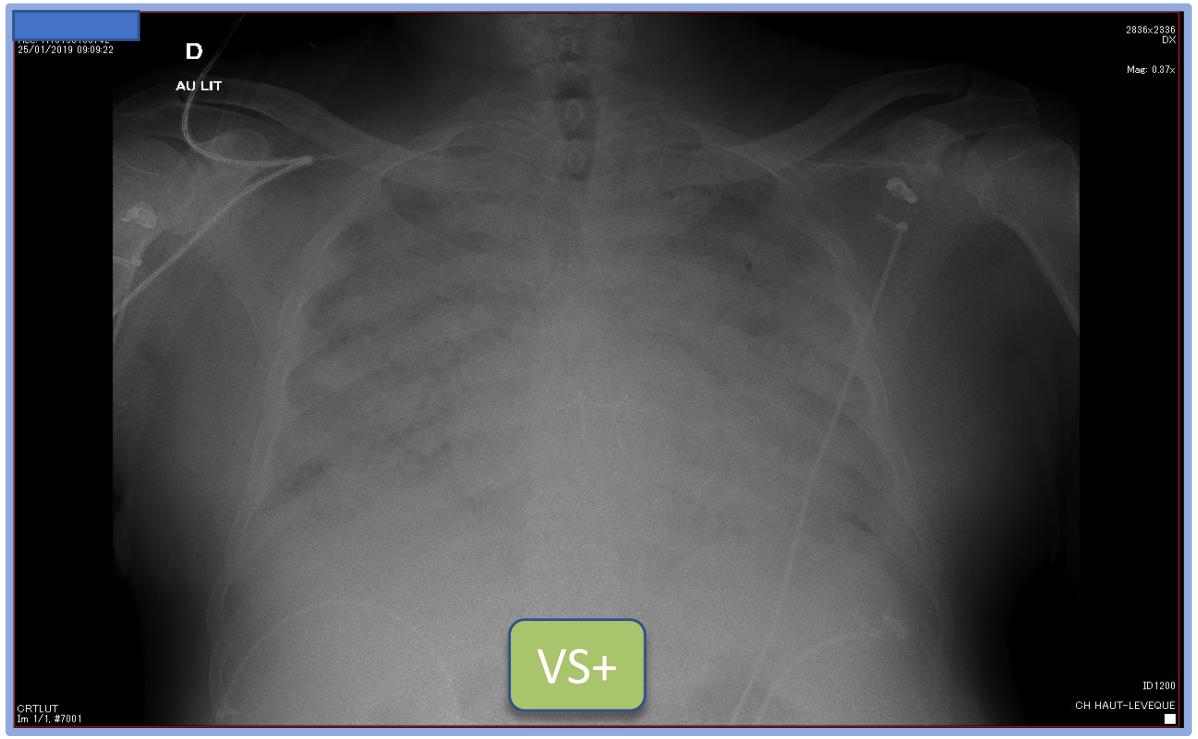
Tommaso Mauri[1], Thomas Langer[2], Alberto Zanella[1], Giacomo Grasselli[1] and Antonio Pesenti[1,2*]

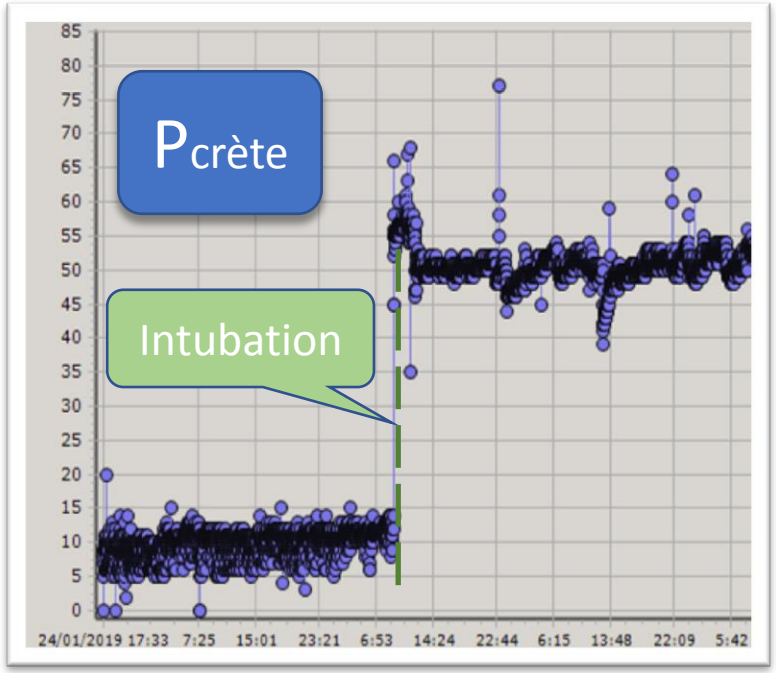
VSAI
AI 9 PEP 15



	Volume controlled	Pressure support
PEEP (cmH_2O)	15	15
Vt (ml/kg PBW)	4	6.5
RR (bpm)	10	21
Ppeak (cmH_2O)	37	24
ECMO GF (l/min)	6.5	11.0
VCO_2-NL (ml/min)	n.a.	74
VCO_2-ML (ml/min)	n.a.	253
VCO_2-ML/VCO_2-TOT (%)	n.a.	77
ΔPes (cmH_2O)	+2	-35
P_L (cmH_2O)	12	38
pH	7.42	7.47
PaO_2 (mmHg)	63	63
$PaCO_2$ (mmHg)	45	37

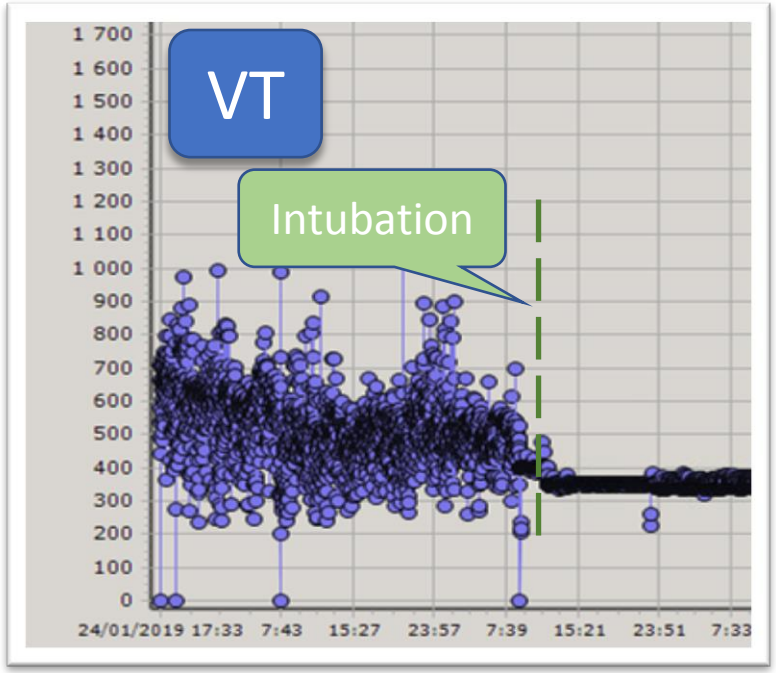
Intensive Care Med (2016) 42:2101–2103





Compliance en VAC après Intubation = 15 ml/cm$H_2$0

Pression motrice en VSAI: VT à 550 ml = 36 cmH_2O



Comment mesurer la pression motrice en VS?

A Method for Measuring Passive Elastance during Proportional Assist Ventilation

MAGDY YOUNES, KIMBERLY WEBSTER, JOHN KUN, DANIEL ROBERTS, and BRAD MASIOWSKI

PAV +

Mesure la Plat le VT et la compliance

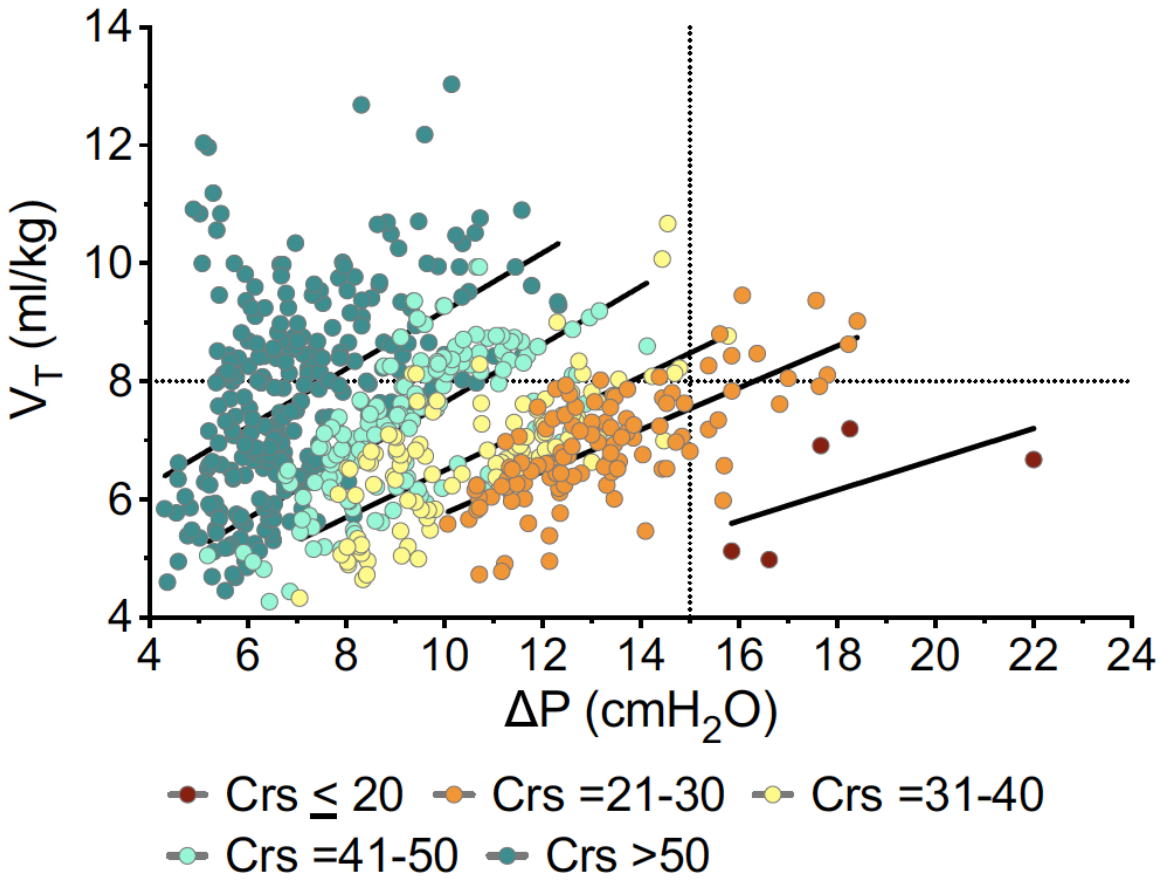
Am J Respir Crit Care Med Vol 164. pp 50–60, 2001

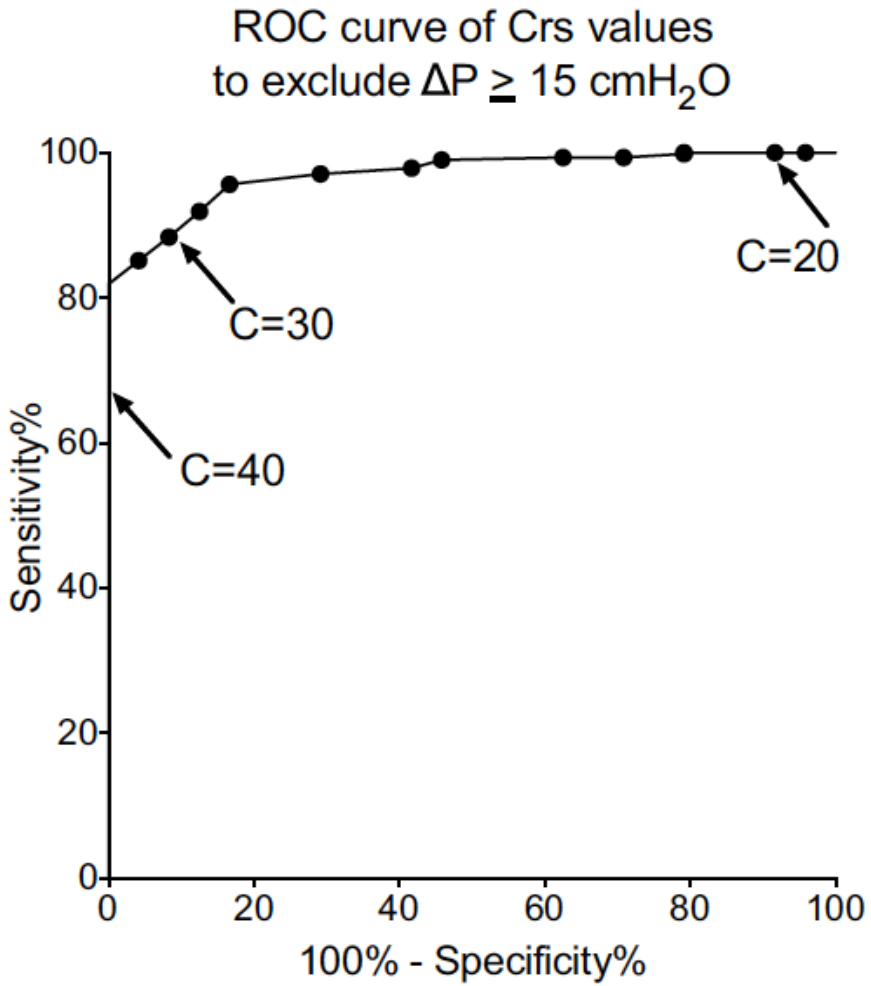
Vaporidi *et al. Ann. Intensive Care* (2019) 9:1
https://doi.org/10.1186/s13613-018-0477-4

Annals of Intensive Care

RESEARCH Open Access

Driving pressure during proportional assist ventilation: an observational study



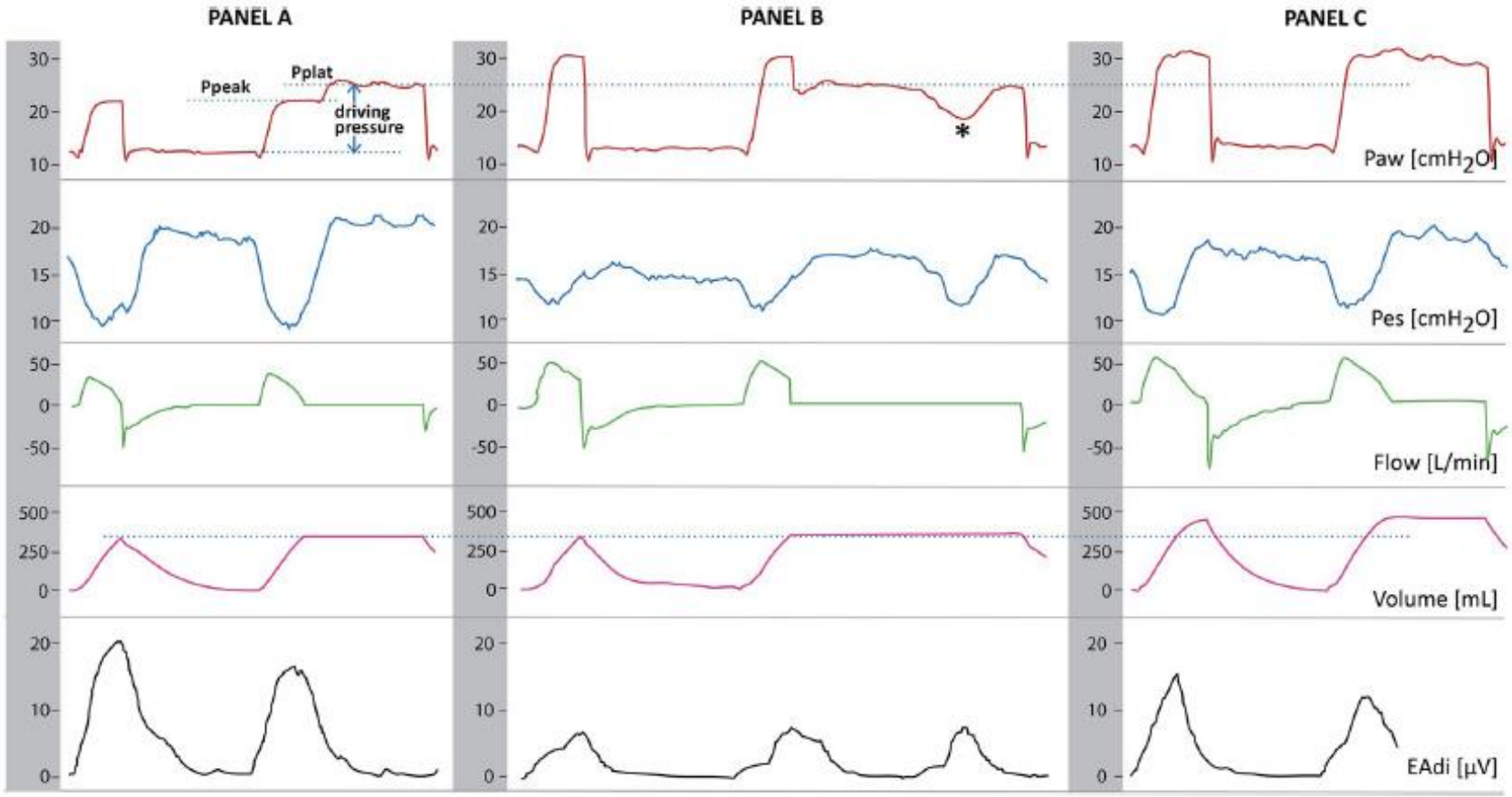


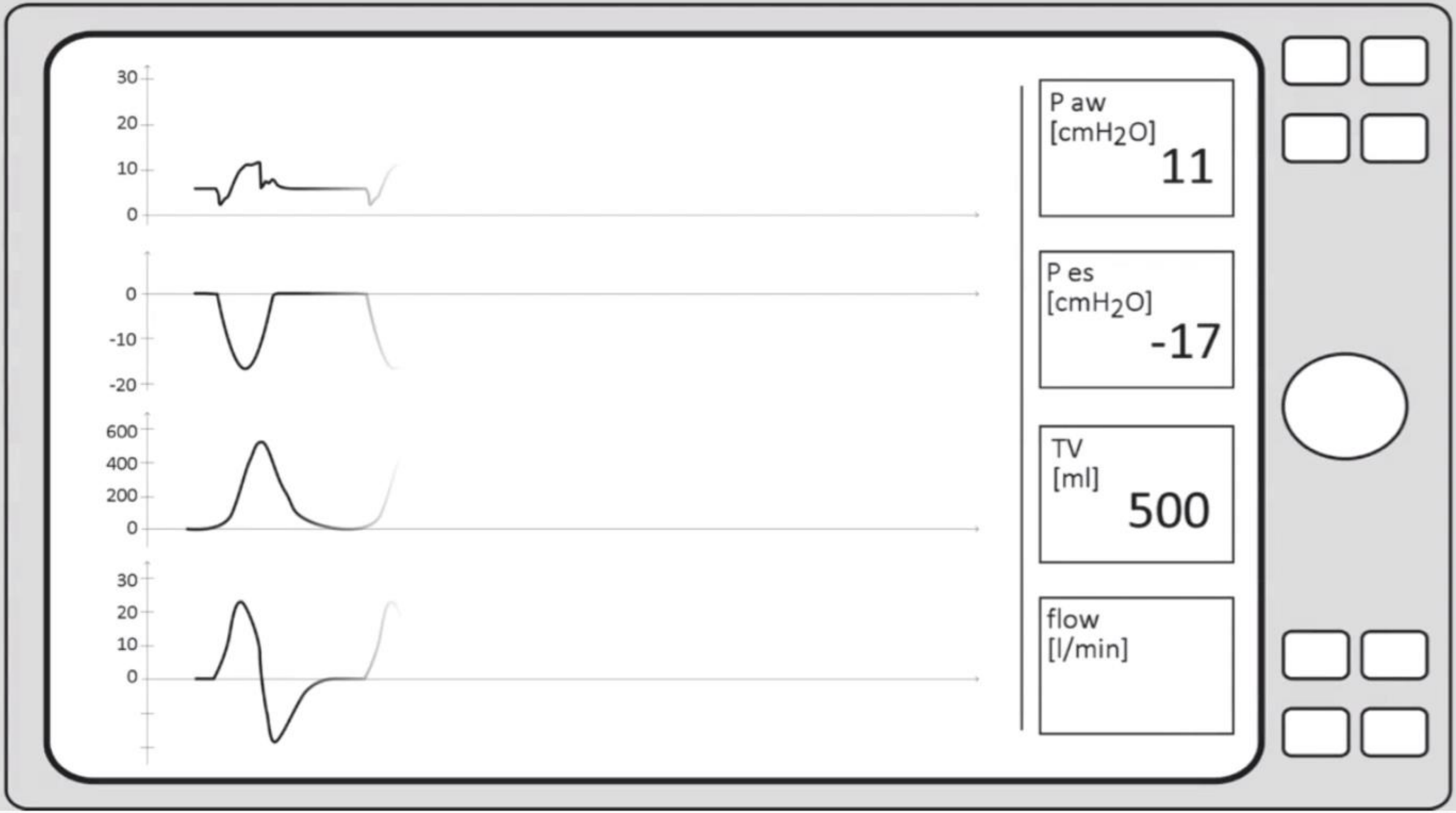
Plateau and driving pressure in the presence of spontaneous breathing

Giacomo Bellani[1,2*], Alice Grassi[1], Simone Sosio[1] and Giuseppe Foti[1,2]

VSAI

DP = Pmus + Paw – PEEP



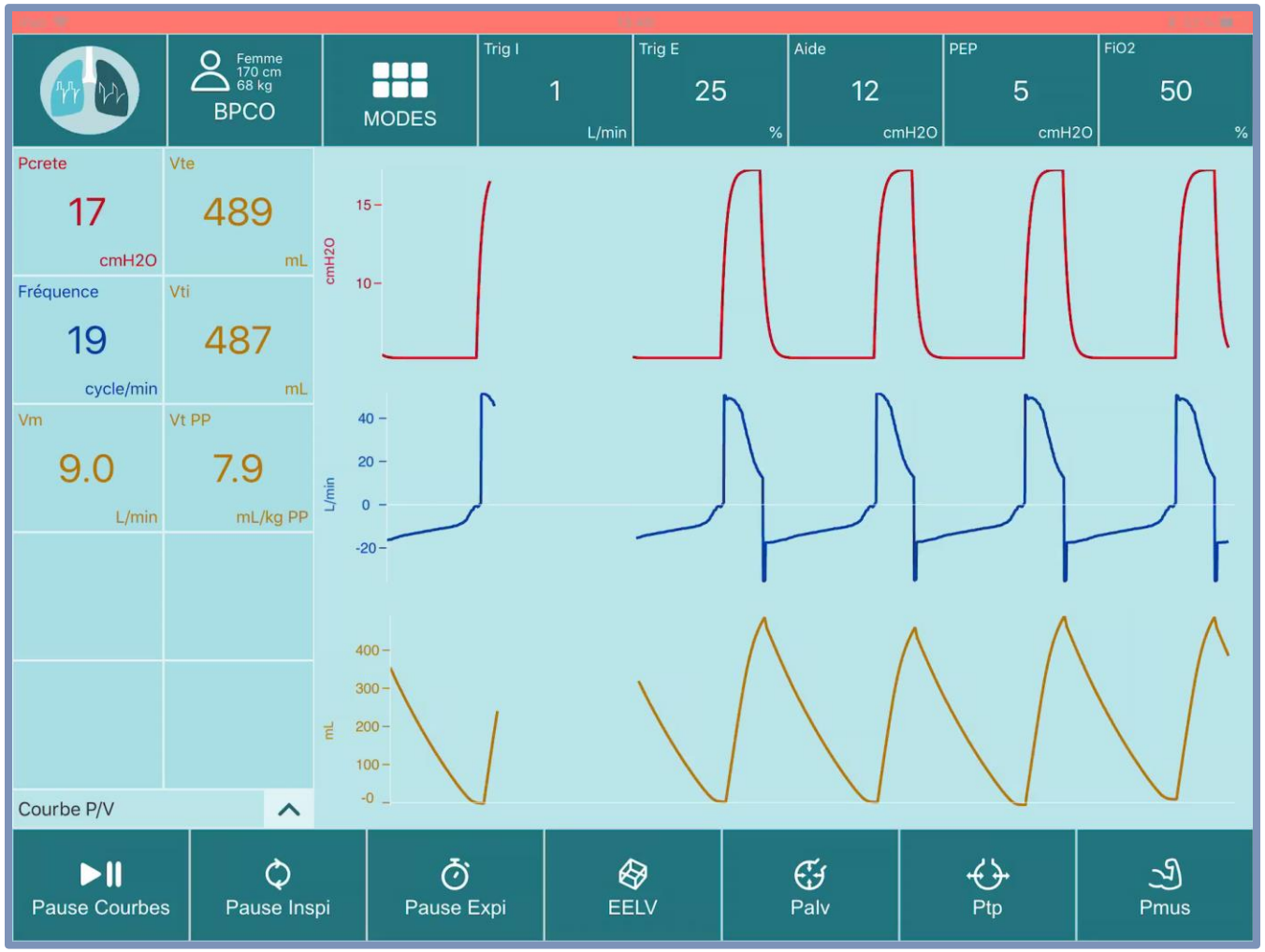

30
20
10
0
0
-10
-20
600
400
200
0
30
20
10
0
P aw
[cmH2O]
11
P es
[cmH2O]
-17
TV
[ml]
500
flow
[l/min]

Do spontaneous and mechanical breathing have similar effects on average transpulmonary and alveolar pressure? A clinical crossover study

Giacomo Bellani[1,2*], Giacomo Grasselli[2,3], Maddalena Teggia-Droghi[1,2], Tommaso Mauri[3], Andrea Coppadoro[4], Laurent Brochard[5,6] and Antonio Pesenti[1,2,3]

La Pression Alvéolaire dans le SDRA

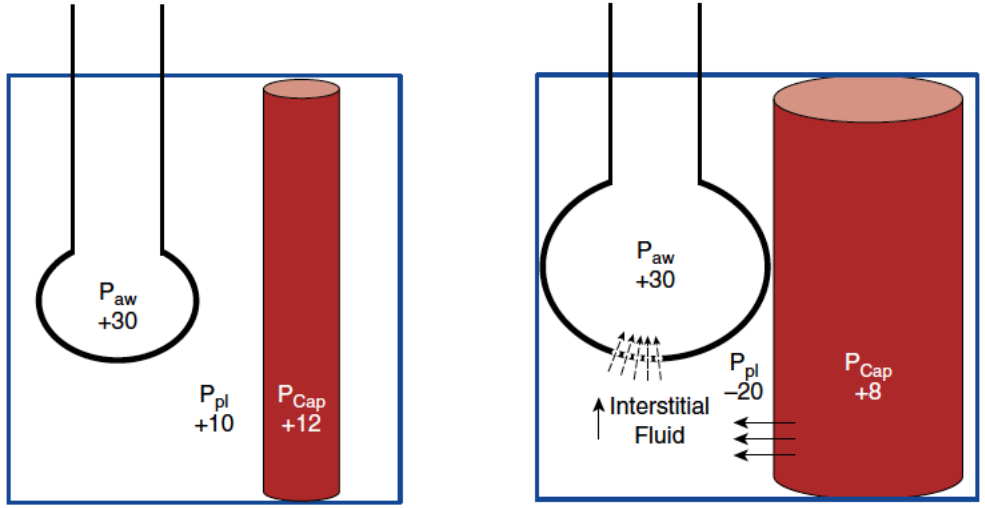
Palv = Paw - QxR = PEEP + VT/Crs – Pmus



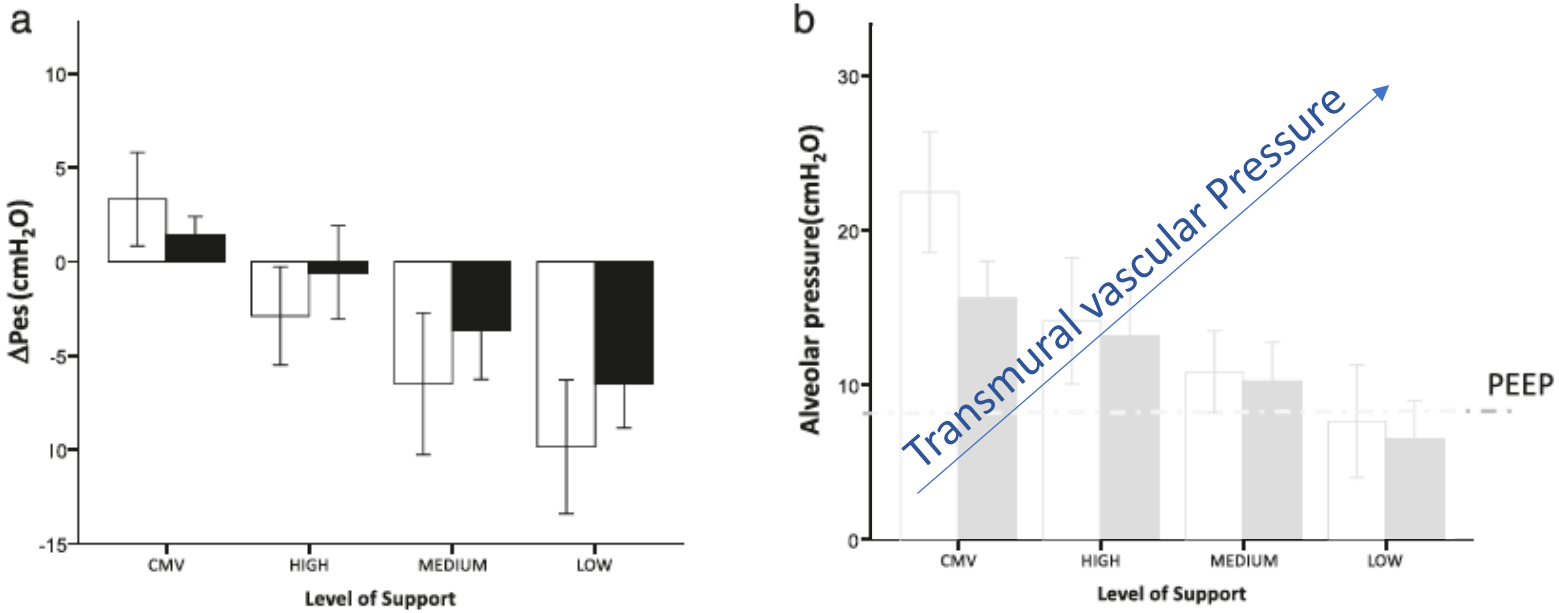
Bellani *et al. Critical Care* (2016) 20:142

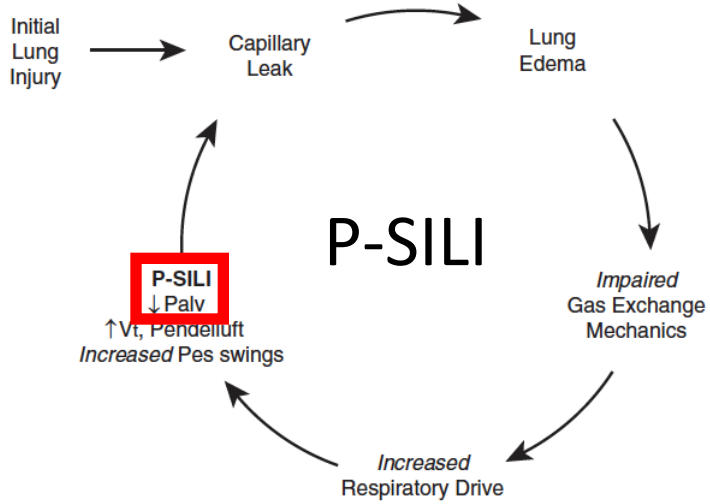
Do spontaneous and mechanical breathing have similar effects on average transpulmonary and alveolar pressure? A clinical crossover study

Giacomo Bellani[1,2*], Giacomo Grasselli[2,3], Maddalena Teggia-Droghi[1,2], Tommaso Mauri[3], Andrea Coppadoro[4], Laurent Brochard[5,6] and Antonio Pesenti[1,2,3]



Am J Respir Crit Care Med Vol 195, Iss 8, pp 985–992, Apr 15, 2017





Bellani *et al. Critical Care* (2016) 20:142

Am J Respir Crit Care Med Vol 195, Iss 4, pp 438–442, Feb 15, 2017

Birds trial

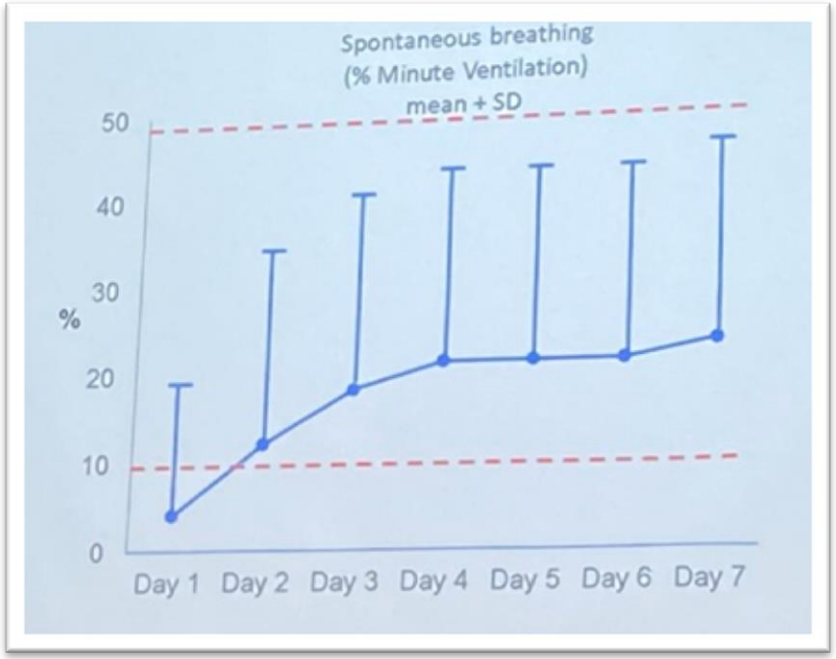
Breathing spontaneously at the early phase of ARDS

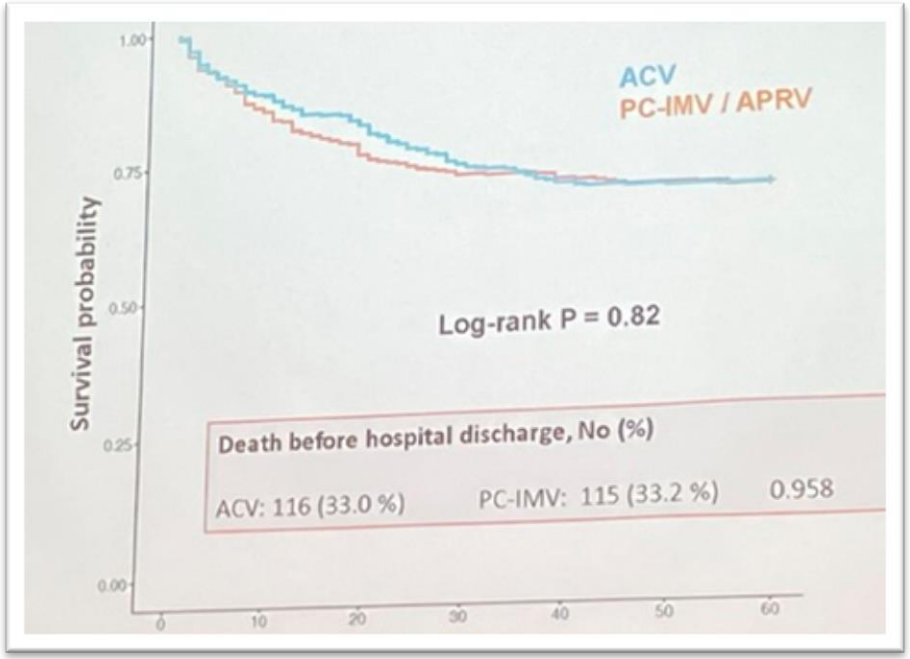
Jean-Christophe M Richard

Laurent Brochard

Alain Mercat

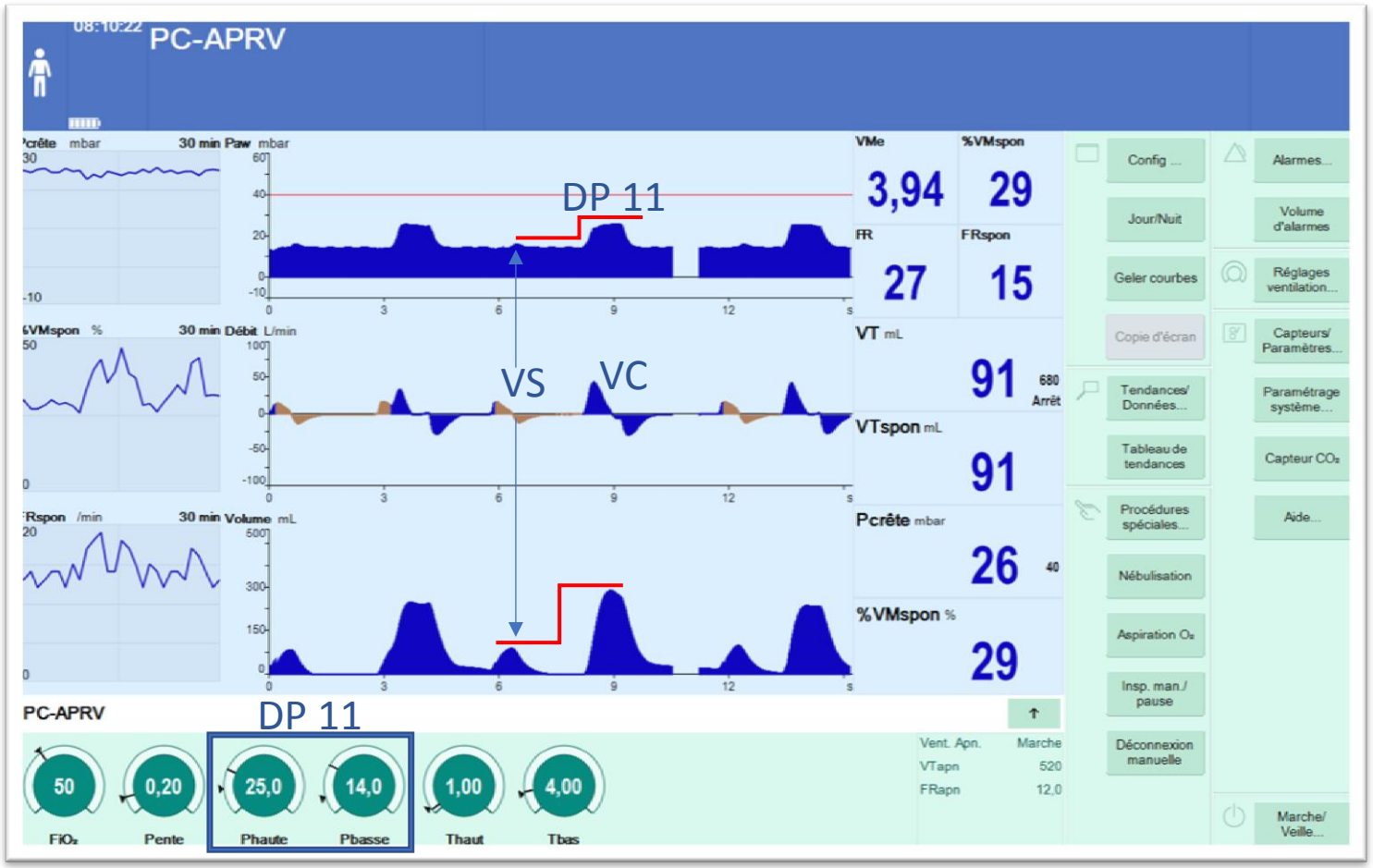
350 patients /groupe APRV vs VAC
PF 130 Crs 33 ml/cmH_20 Pmo 13 cmH_2O PEEP 13
Mortalité identique autour de 27 %
Moins de sédation en APRV
Moins de DV en APRV …





Spontaneous breathing (SB) using airway pressure-release ventilation (APRV) in patients under extracorporeal-membrane oxygenation (ECMO) for acute respiratory distress syndrome (ARDS)

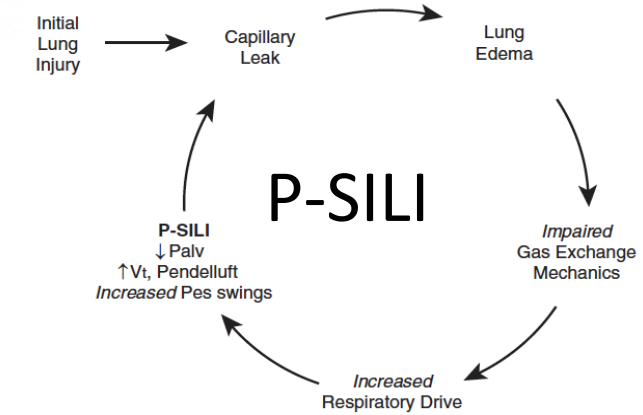
Hadrien Rozé[1*], Jean-Christophe Marie Richard[2], Mathieu Thumerel[3,4] and Alexandre Ouattara[1,5]



Crs = 290/(25-14) = 26,3 ml/cmH2O
En VS VT = 120 ml donc
DP =120/26,3 = 4,6 cmH2O

Intensive Care Med (2017) 43:1919–1920

CONCLUSION



- Balance bénéfices /risques
- VS vs Curares
- VS cachée en VAC ou PAC reverse triggering
- Concept de P-SILI
- Lésions alvéolaire sévères: attention
- Intérêt protecteur de la PEP
- Intensité de l'effort inspiratoire (monitorage) : Pmus/Pmotrice/Palv

SimVA

Ventilation Artificielle Virtuelle

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Simulation of Mechanical Ventilation

Mission statement

Healthcare simulation is an innovative method to improve safety within patient's care. Our field of interest in simulati

The reas operating rooms or at hor tilation settings are responsible for morbidity and mortality.

The goal of SimVA is to reduce it through training.

We create Interaction ssure support or proportion al point of view, driving and alveolar pressures, end expiratory lung volume, Diaphragm Electrical Activity, muscular inspiratory and trans pulmonary pressures, pressure volume curves...

This tool is a virtual simulator called SimVA, it is a tablet with a software and a learning program with video tutorials from basic to advance level.

Who is behind the conception?

SimVA comes from a vision of a passionate team with a MD,PhD in intensive care and in the operating room dealing with lung transplantations everyday and a PhD in machine intelligency and electrical heart modelisation. Both doing scientific research. Because complex things need to be explained with simplicity

Capture d'écran

WWW.SIM-VA.COM

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