La ventilation du patient en SDRA

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SDRA

- Hypoxémie sévère
- Baisse de compliance pulmonaire par œdème lésionnel
- Pas d'œdème cardiogénique
- Principales causes de SDRA:
  - Sepsis sévère/choc septique
  - Pneumopathies
  - Polytrauma, pancreatite, sepsis abdominaux

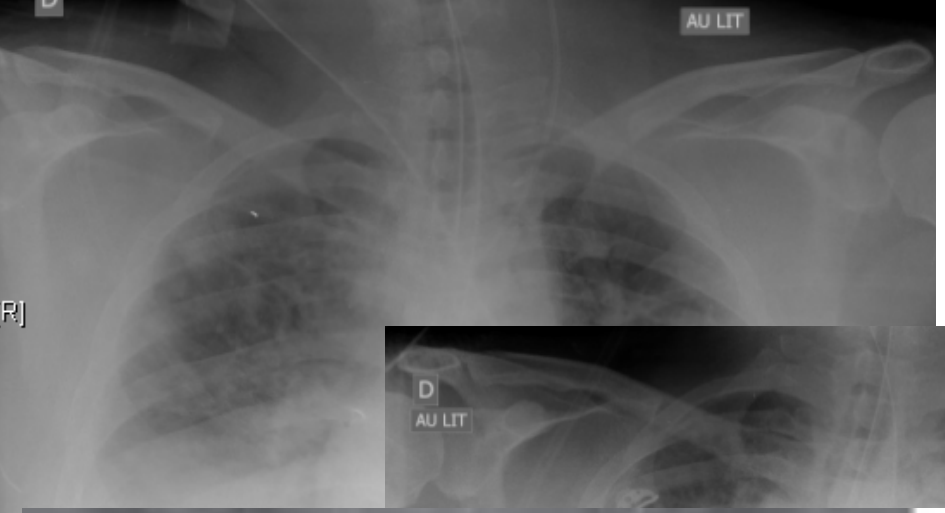
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Table 3. The Berlin Definition of Acute Respiratory Distress Syndrome

	Acute Respiratory Distress Syndrome
Timing	Within 1 week of a known clinical insult or new or worsening respiratory symptoms
Chest imaging[a]	Bilateral opacities—not fully explained by effusions, lobar/lung collapse, or nodules
Origin of edema	Respiratory failure not fully explained by cardiac failure or fluid overload Need objective assessment (eg, echocardiography) to exclude hydrostatic edema if no risk factor present
Oxygenation[b]	
Mild	200 mm Hg < PaO_2/FiO_2 ≤ 300 mm Hg with PEEP or CPAP ≥5 cm H_2O[c]
Moderate	100 mm Hg < PaO_2/FiO_2 ≤ 200 mm Hg with PEEP ≥5 cm H_2O
Severe	PaO_2/FiO_2 ≤ 100 mm Hg with PEEP ≥5 cm H_2O

Table 4. Predictive Validity of ARDS Definitions in the Clinical Database

	Modified AECC Definition[a]		Berlin Definition ARDS[a]		
	ALI Non-ARDS	ARDS	Mild	Moderate	Severe
No. (%) [95% CI] of patients	1001 (24) [23-25]	3187 (76) [75-77]	819 (22) [21-24]	1820 (50) [48-51]	1031 (28) [27-30]
Progression in 7 d from mild, No. (%) [95% CI]		336 (34) [31-37]		234 (29) [26-32]	33 (4) [3-6]
Progression in 7 d from moderate, No. (%) [95% CI]					230 (13) [11-14]
Mortality, No. (%) [95% CI][b]	263 (26) [23-29]	1173 (37) [35-38]	220 (27) [24-30]	575 (32) [29-34]	461 (45) [42-48]
Ventilator-free days, median (IQR)[b]	20 (2-25)	12 (0-22)	20 (1-25)	16 (0-23)	1 (0-20)
Duration of mechanical ventilation in survivors, median (IQR), d[b]	5 (2-10)	7 (4-14)	5 (2-11)	7 (4-14)	9 (5-17)

IOT en réanimation: geste délicat

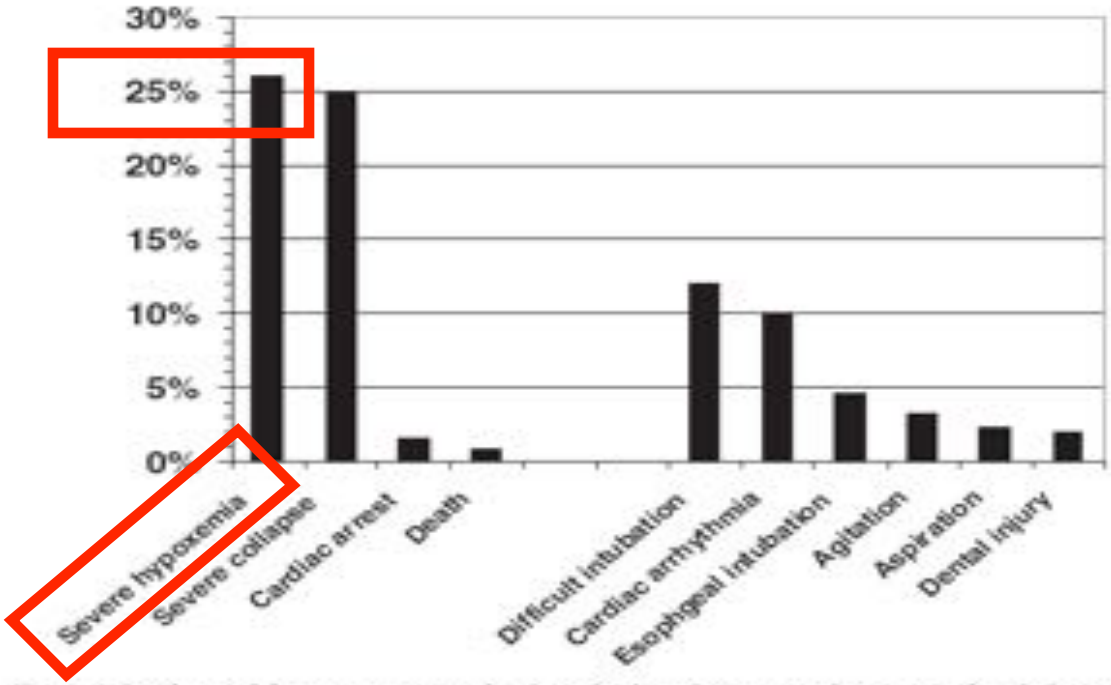


Figure 1. Incidence of the two categories of endotracheal intubation complications in the whole group: severe complications (serious hypoxemia, severe collapses, cardiac arrest and death) and mild to moderate complications (difficult intubation, cardiac arrhythmia, esophageal intubation, agitation, aspiration and dental injury). Mortality rate is calculated based on the 247 intubations carried out for patients with an obtainable blood pressure at the time of procedure.

Clinical practice and risk factors for immediate complications of endotracheal intubation in the intensive care unit: A prospective, multiple-center study*

Samir Jaber, MD, PhD; Jibba Amraoui, MD; Jean-Yves Lefrant, MD, PhD; Charles Arich, MD; Robert Cohendy, MD, PhD; Liliane Landreau, MD; Yves Calvet, MD; Xavier Capdevila, MD, PhD; Aba Mahamat, MD; Jean-Jacques Eledjam, MD, PhD

Critical Care Med 2006

Rendement de la préoxygénation en réanimation

	Stable (n = 34)	All Unstable (n = 42)	Unstable AP (n = 8)	Unstable NAP (n = 34)
T-0	79 ± 12.3[c]	67 ± 19.6	80.8 ± 7.7[b]	64.2 ± 3.5
T-4	403.6 ± 71.8[c]	103.8 ± 63.2	185.8 ± 21[b]	86.8 ± 9.5
Mean Δ	325[c]	37	105[b]	22

Stable, stable preoperative patients; All, NAP + AP patients; AP, airway protection patients; NAP, nonairway protection patients; T-0, time zero or baseline; T-4, following 4 mins of preoxygenation.

[a]$p < .02$ for all unstable compared with stable patients; [b]$p < .01$ for unstable-NAP compared with unstable-AP patients; [c]$p < .001$ for all unstable compared with stable patients. All values are mm Hg.

Mort T., Proxygénation in critically ill patients requiring emergency tracheal intubation. Crit Care Med, 2005

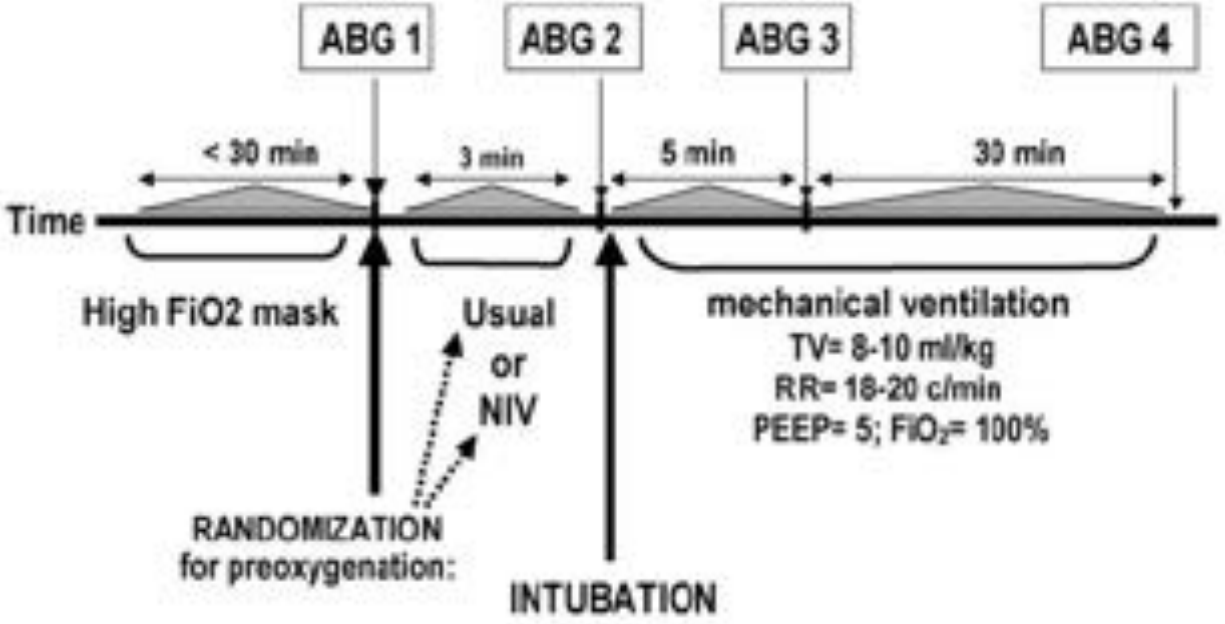
Noninvasive Ventilation Improves Preoxygenation before Intubation of Hypoxic Patients

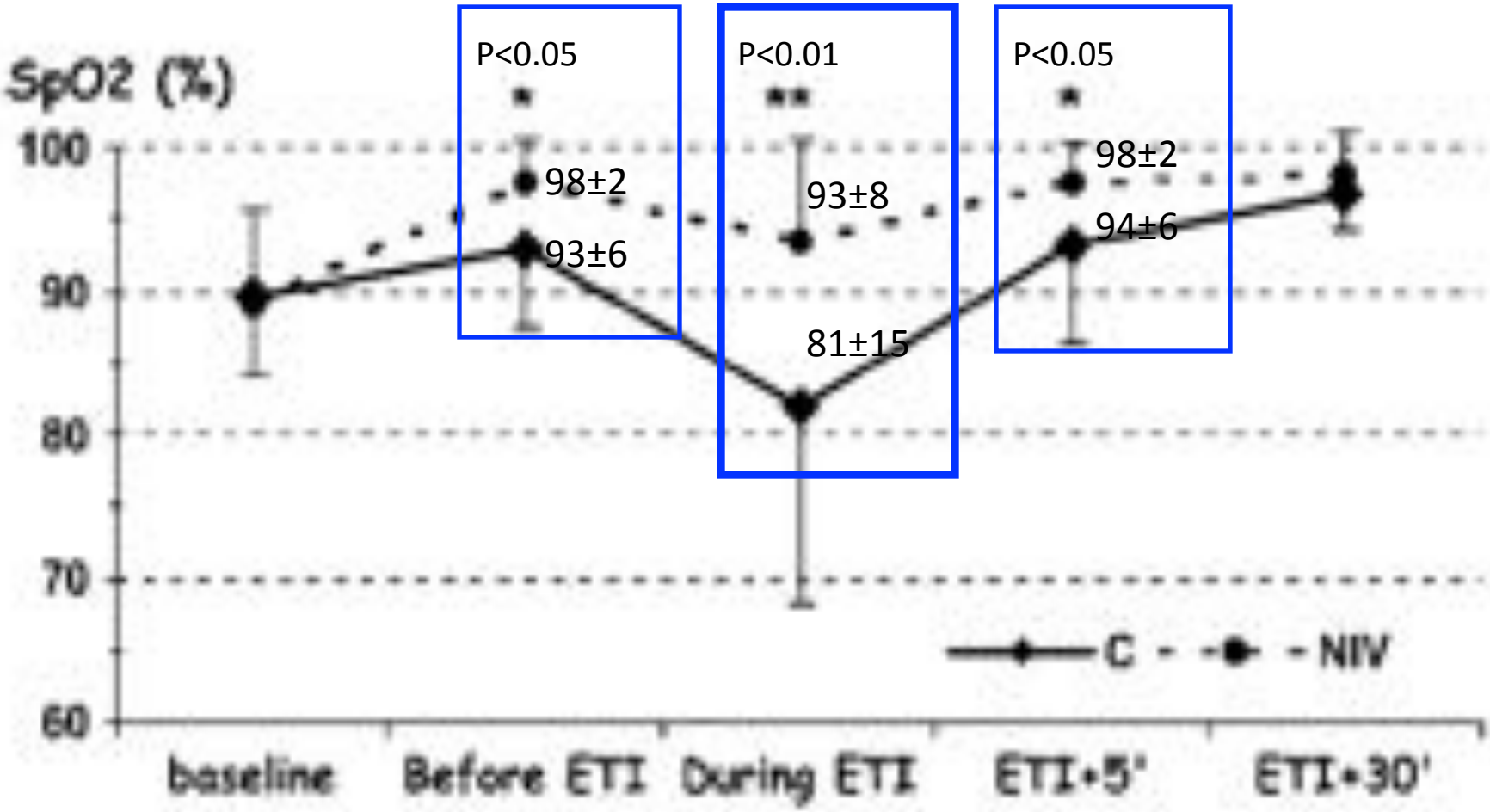
Christophe Baillard, Jean-Philippe Fosse, Mustapha Sebbane, Gérald Chanques, François Vincent, Patricia Courouble, Yves Cohen, Jean-Jacques Eledjam, Frédéric Adnet, and Samir Jaber

Department of Anesthesiology and Intensive Care, and SAMU 93, Avicenne Hospital, Paris 13 University–AP-HP, Bobigny; Intensive Care Unit, Department of Anesthesiology, DAR B University Hospital of Montpellier, and Saint Eloi Hospital, Montpellier University, Montpellier, France

Am J Respir Crit Care Med Vol 174. pp 171–177, 2006

PaO2 < 100 mmHg sous masque HC 10 l/min.

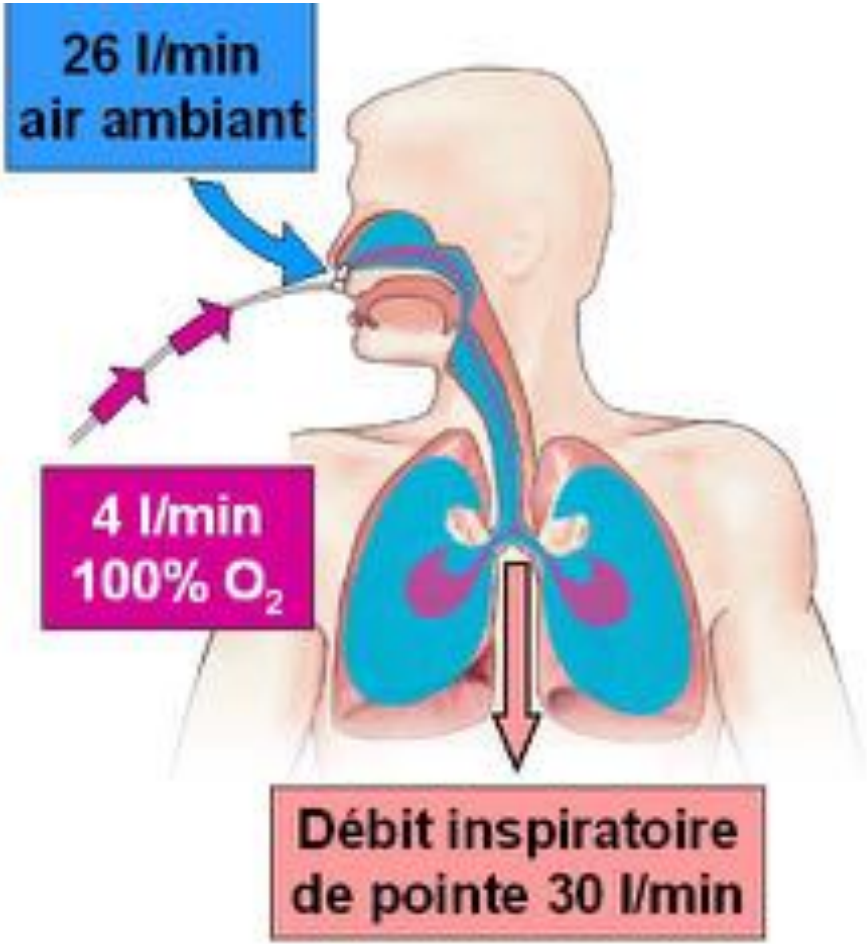


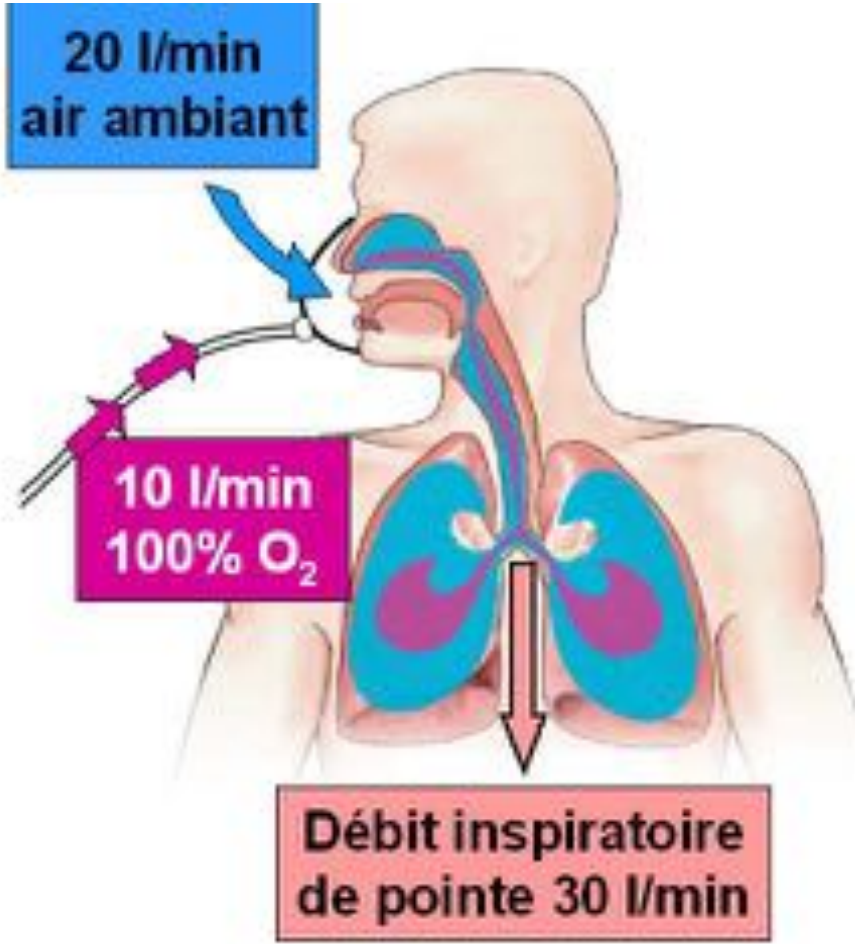

SpO2 (%)
100
90
80
70
60
P<0.05
*
98±2
93±6
P<0.01
**
93±8
81±15
P<0.05
*
98±2
94±6
C
NIV
baseline
Before ETI
During ETI
ETI+5'
ETI+30'

En pratique

- Disponibilité VNI
- Expérience VNI
- Estomac plein
- Poursuivre VNI si déjà en place !
- Pour le transport du patient très hypoxemique ?

FiO2 21-100%
Débit 10-50 l/min





- FiO2 plus élevée
- Effet PEP
- Humidification

Correction de l'hypoxémie

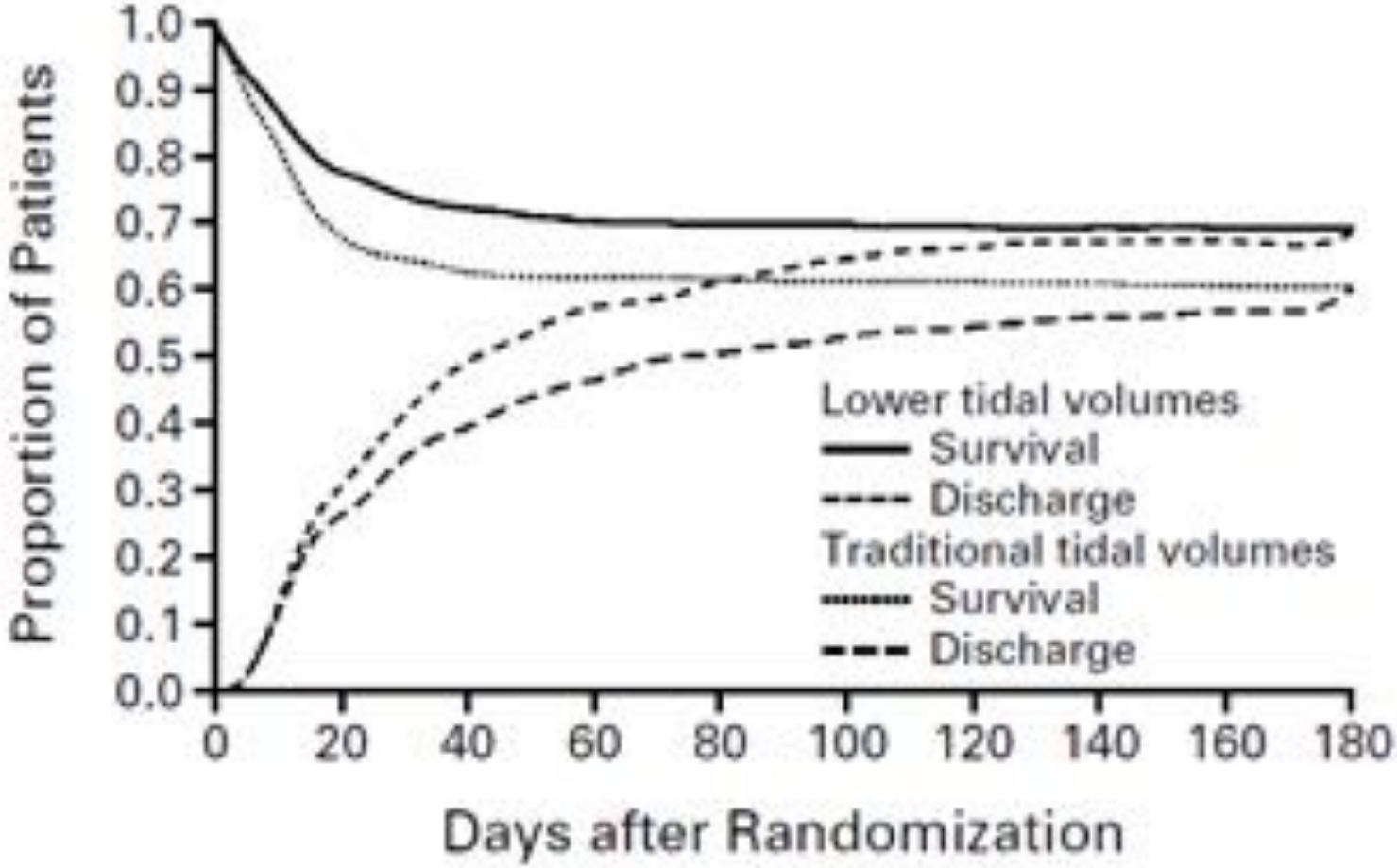
↕

Préservation du parenchyme pulmonaire

Réglages du respirateur

- Vt : 5-7 ml/kg de poids idéal
- Optimisation de la PEP, plutôt haute
- Optimisation Pplat (24-28 cmH20)
- Manœuvres de recrutement

6 vs 12 ml/kg

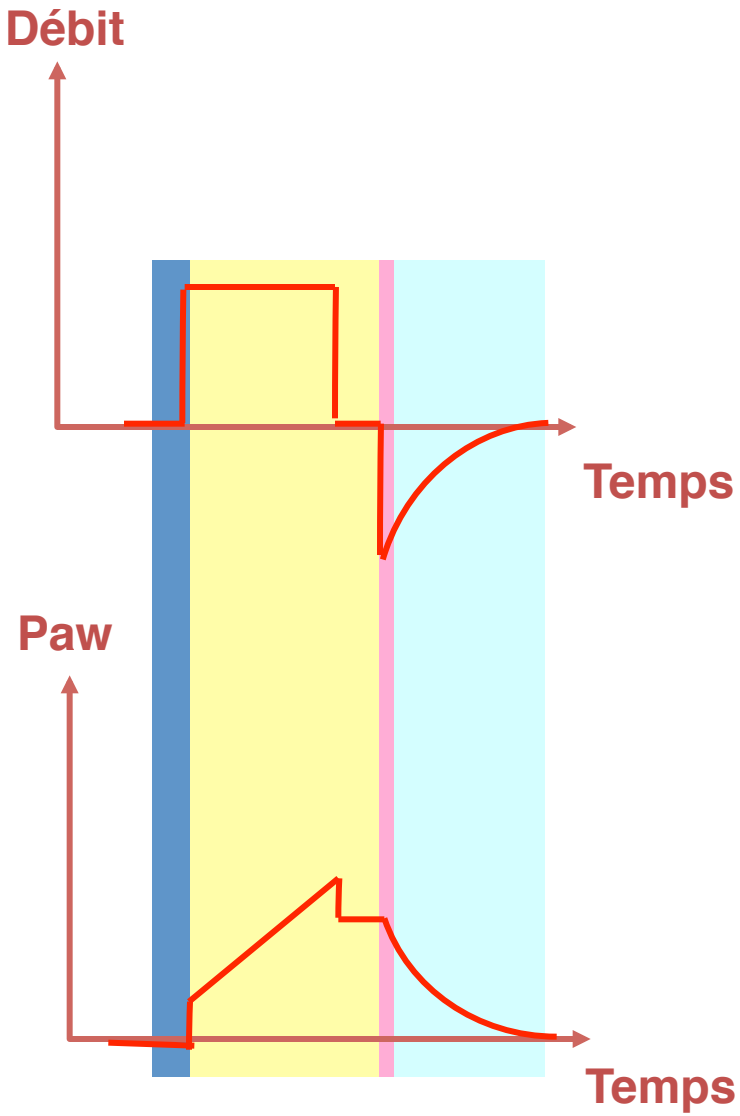


NEJM 2000

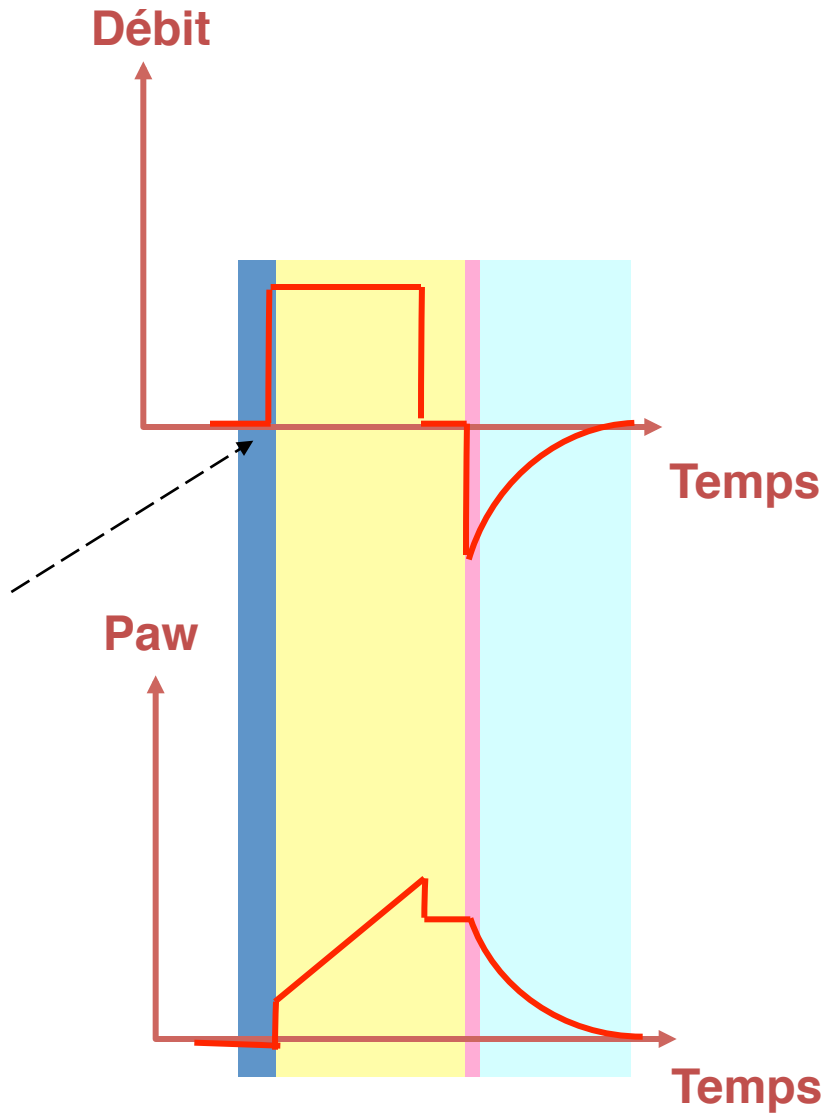
PBW = X + 0,91 (taille en cm – 152,4), avec X = 50 pour les hommes et 45,5 pour les femmes

Taille	PBW h	PBW f
155	52	48
160	57	52
165	61	57
170	66	62
175	71	66
180	75	71
185	80	75
190	84	80
195	89	84

Les 4 phases du cycle ventilatoire en VC-VAC

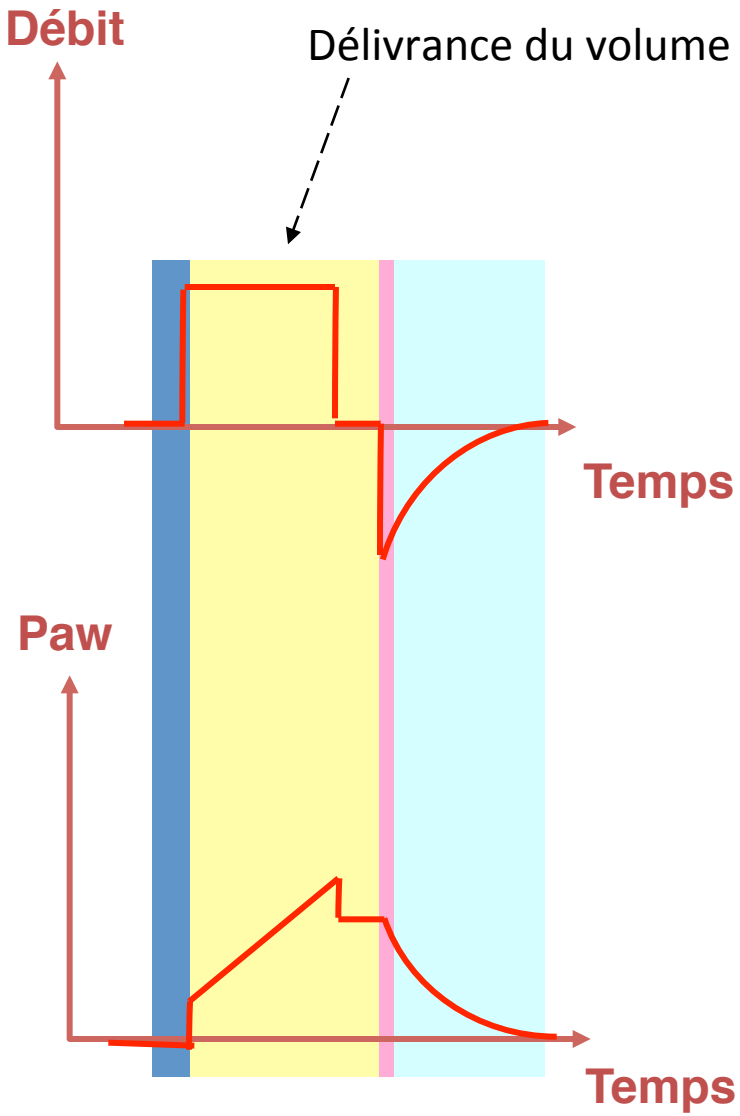


Les 4 phases du cycle ventilatoire en VC

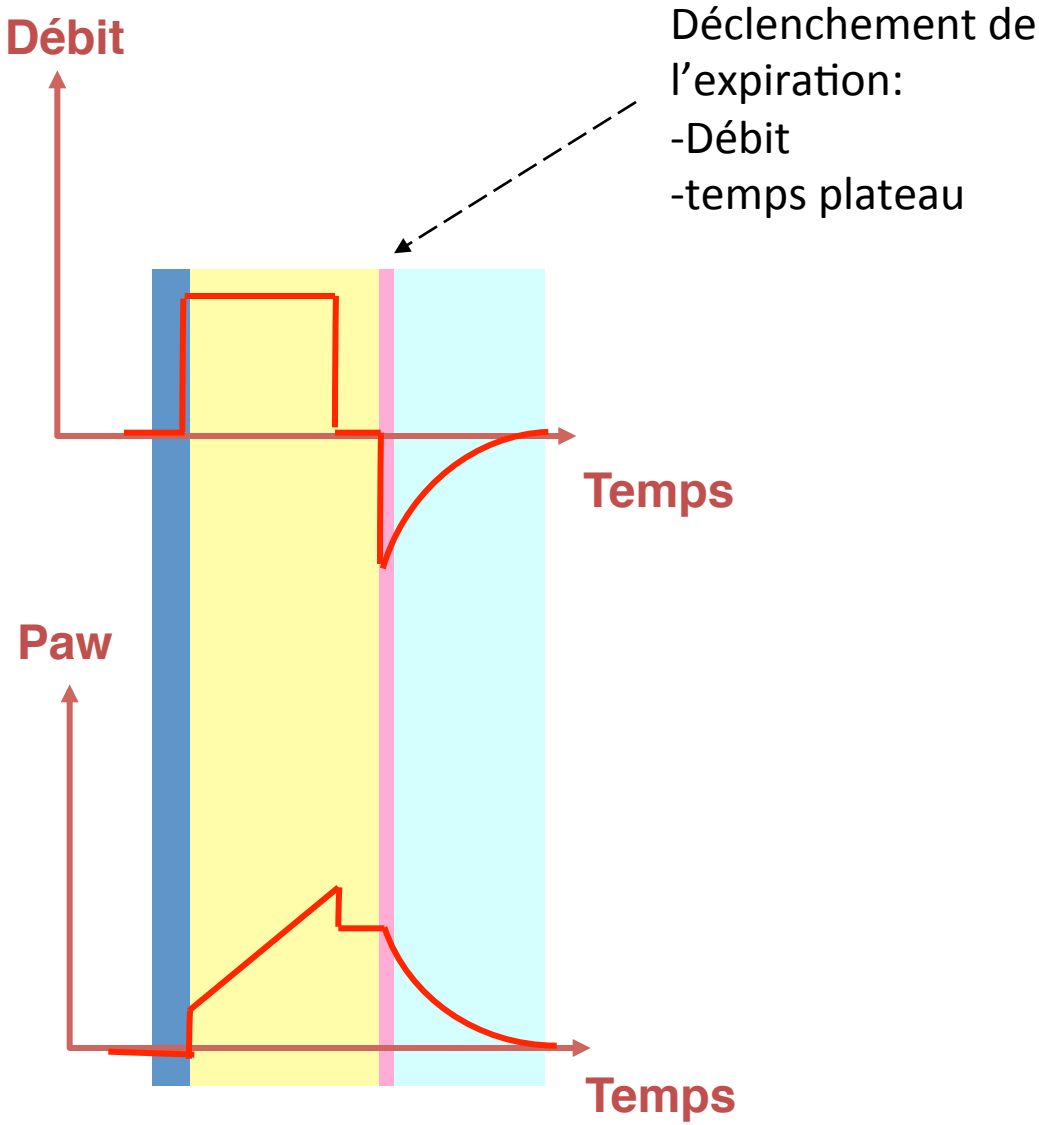


Déclenchement
de l'inspiration:
-Fréquence
-Trigger (VAC)

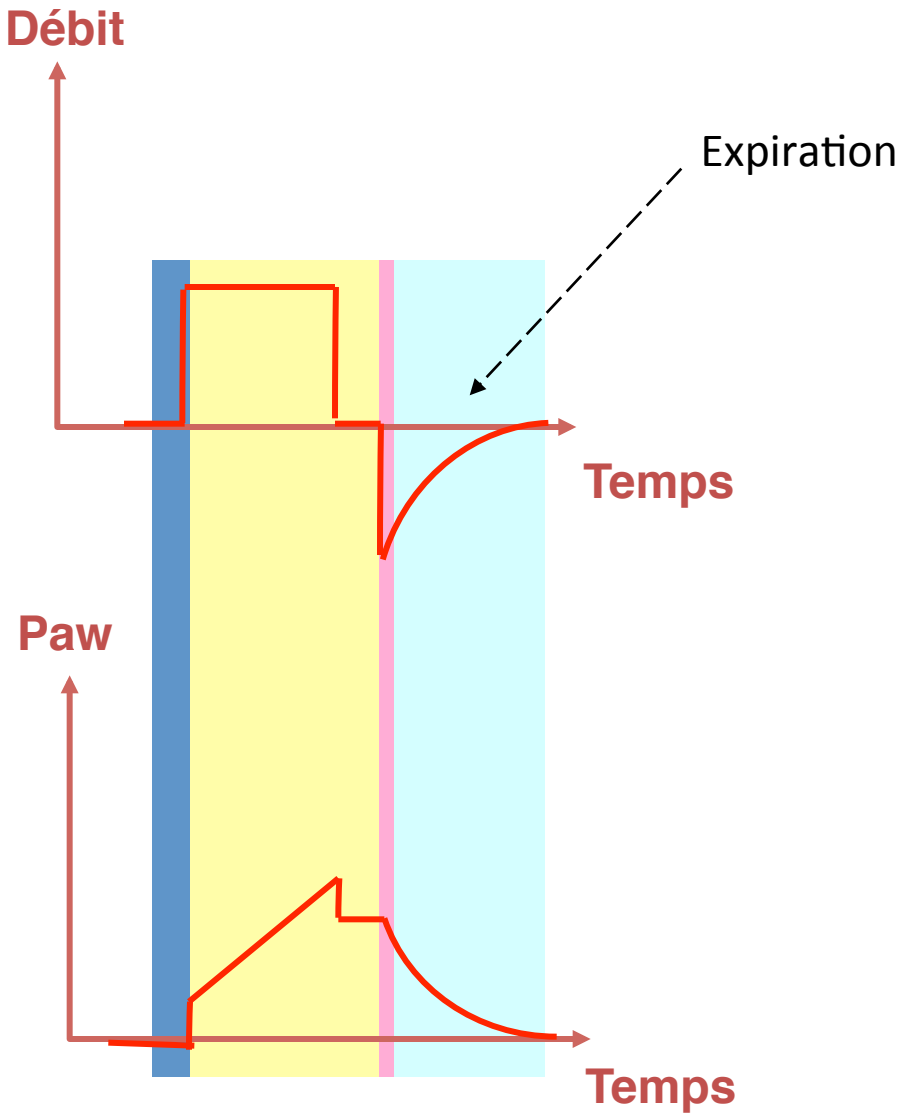
Les 4 phases du cycle ventilatoire en VC



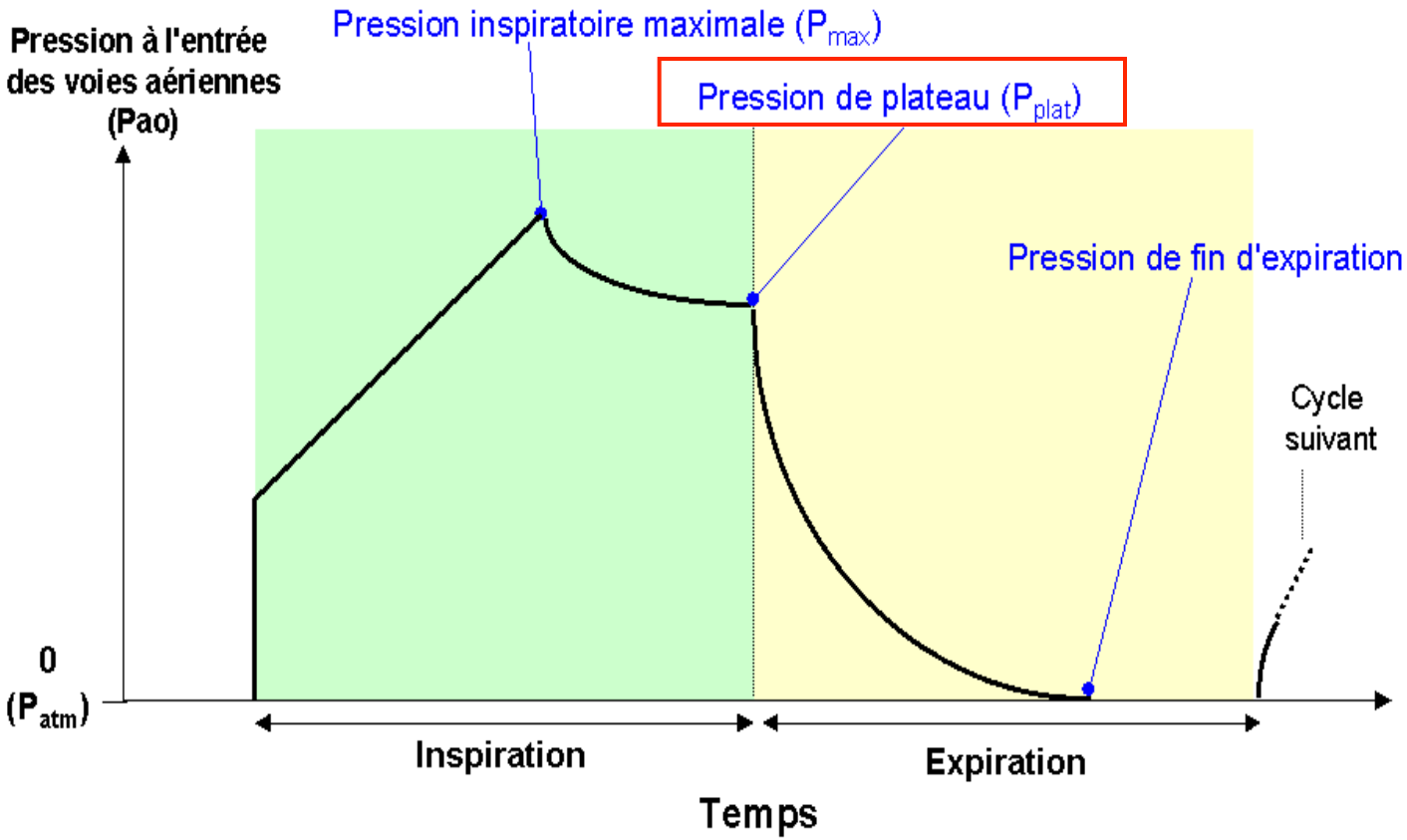
Les 4 phases du cycle ventilatoire en VC



Les 4 phases du cycle ventilatoire en VC

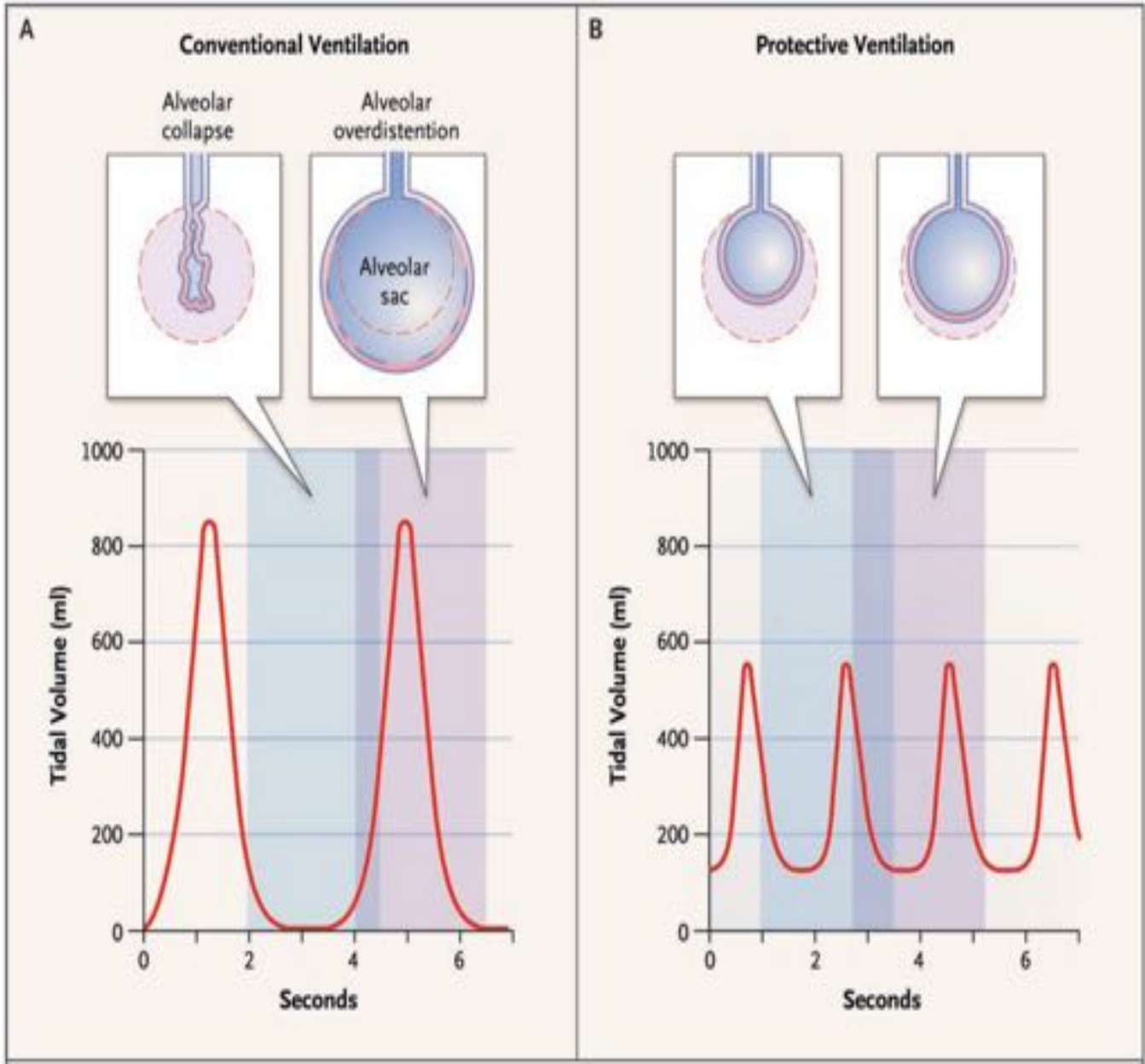


SURVEILLANCE DE LA PRESSION DE PLATEAU



SURVEILLANCE DU BAROTRAUMATISME ET DU VOLOTRAUMATISME

Ventilation protectrice: Vt bas et PEP



ExPress

VT 6 ml / kg (PBW)

RR ≤ 35 / mn ; 7.30 < pH < 7.45

55 mmHg < PaO2 < 80 mmHg

88% < SpO2 < 95%

Minimal

alveolar distension

Maximal

alveolar recruitment

PEEP set for

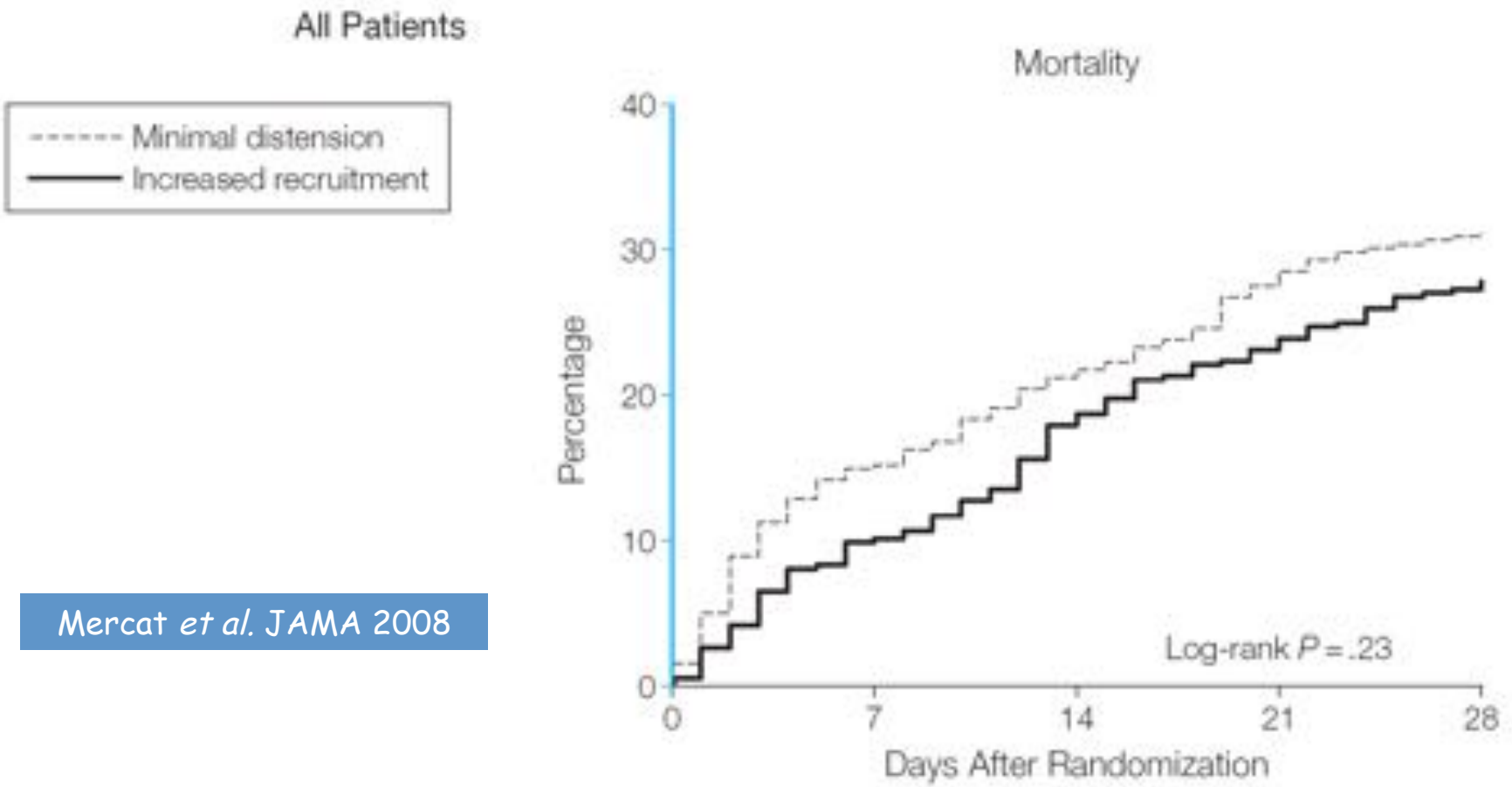
5 ≤ PEEPtot ≤ 9

PEEP set for

28 ≤ Pplat ≤ 30

PEEP

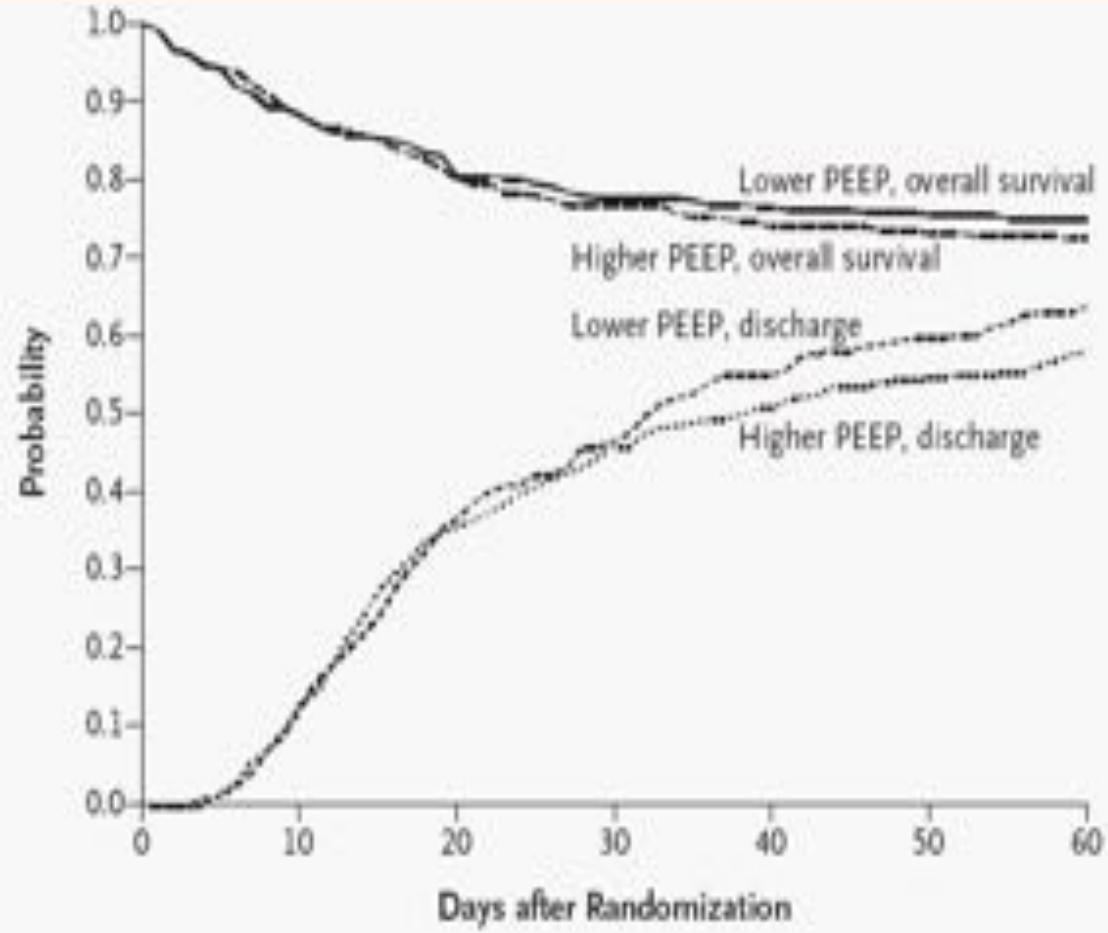
Minimal distension group	Total PEEP between 5 and 9 cm H_2O
Increased recruitment group	Plateau pressure between 28 and 30 cm H_2O



Mercat *et al.* JAMA 2008

ARDSnet NEJM 2004

Lower-PEEP group														
FiO_2	0.3	0.4	0.4	0.5	0.5	0.6	0.7	0.7	0.7	0.8	0.9	0.9	0.9	1.0
PEEP	5	5	8	8	10	10	10	12	14	14	14	16	18	18–24
Higher-PEEP group (before protocol changed to use higher levels of PEEP)														
FiO_2	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.5	0.5	0.5–0.8	0.8	0.9	1.0	
PEEP	5	8	10	12	14	14	16	16	18	20	22	22	22–24	
Higher-PEEP group (after protocol changed to use higher levels of PEEP)														
FiO_2	0.3	0.3	0.4	0.4	0.5	0.5	0.5–0.8	0.8	0.9	1.0				
PEEP	12	14	14	16	16	18	20	22	22	22–24				

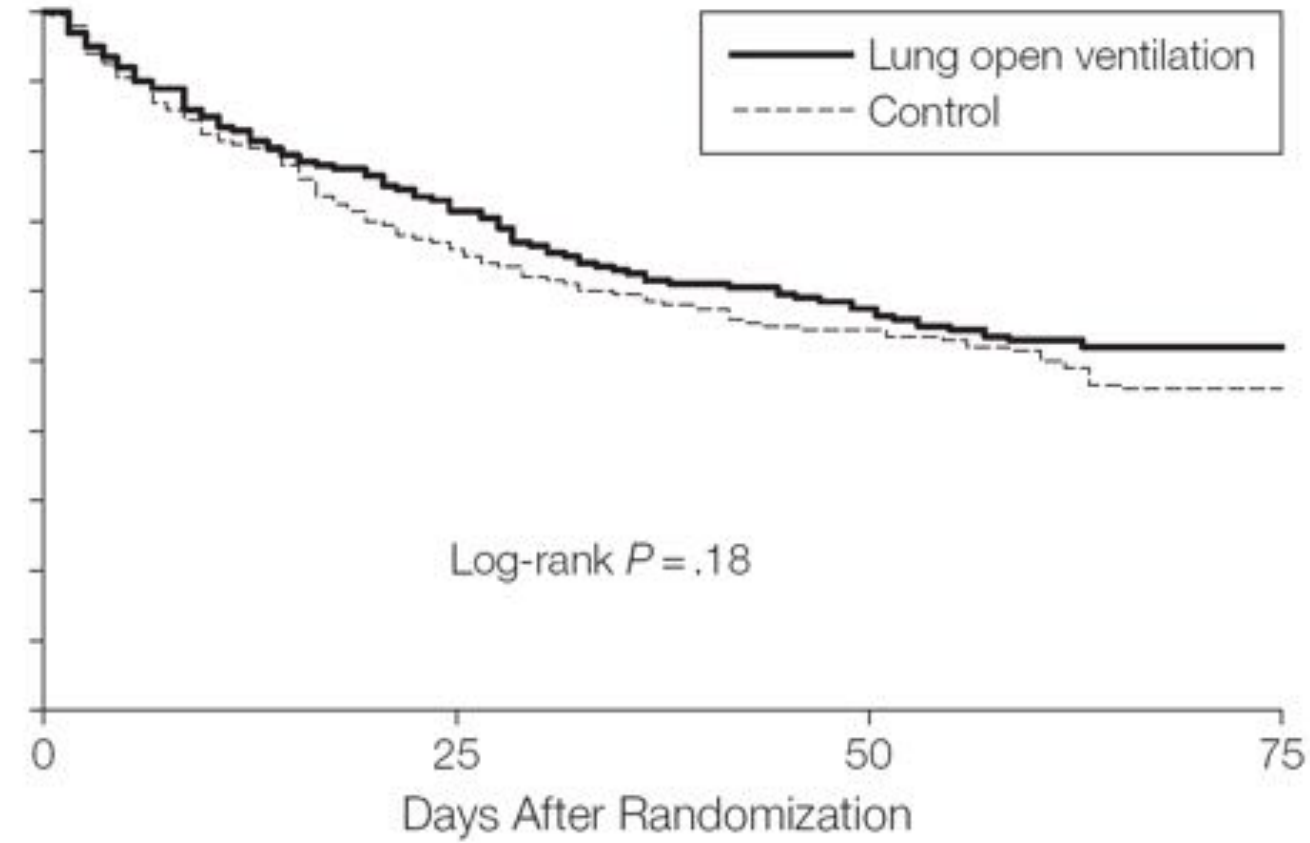


Variable	Day 1	
	Lower-PEEP Group	Higher-PEEP Group
Tidal volume (ml/kg of predicted body weight)	6.1±0.8	6.0±0.9†
No. of patients	236	258
Plateau pressure (cm of water)	24±7	27±6†
No. of patients	230	252
Mean airway pressure (cm of water)	15±5	20±5†
No. of patients	233	261
Respiratory rate (breaths/min)	29±7	29±7
No. of patients	248	263
Minute ventilation (liters/min)	12±4	12±3
No. of patients	247	264
FiO_2	0.54±0.18	0.44±0.17†
No. of patients	249	264
PEEP (cm of water)		
All patients	8.9±3.5	14.7±3.5‡
No. of patients	249	264
First 171 patients	9.1±3.3	14.2±3.2
No. of patients	76	82
Subsequent 378 patients	8.9±3.6	14.9±3.6
No. of patients	173	182
PaO_2/FiO_2	168±66	220±89‡

	Fraction of Inspired Oxygen (FIO_2)							
	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
Control PEEP ranges, cm H_2O	5	5-8	8-10	10	10-14	14	14-18	18-24
Lung open ventilation PEEP ranges, cm H_2O								
Before protocol change	5-10	10-14	14-20	20	20	20	20	20-24
After protocol change	5-10	10-18	18-20	20	20	20-22	22	22-24

All-cause mortality

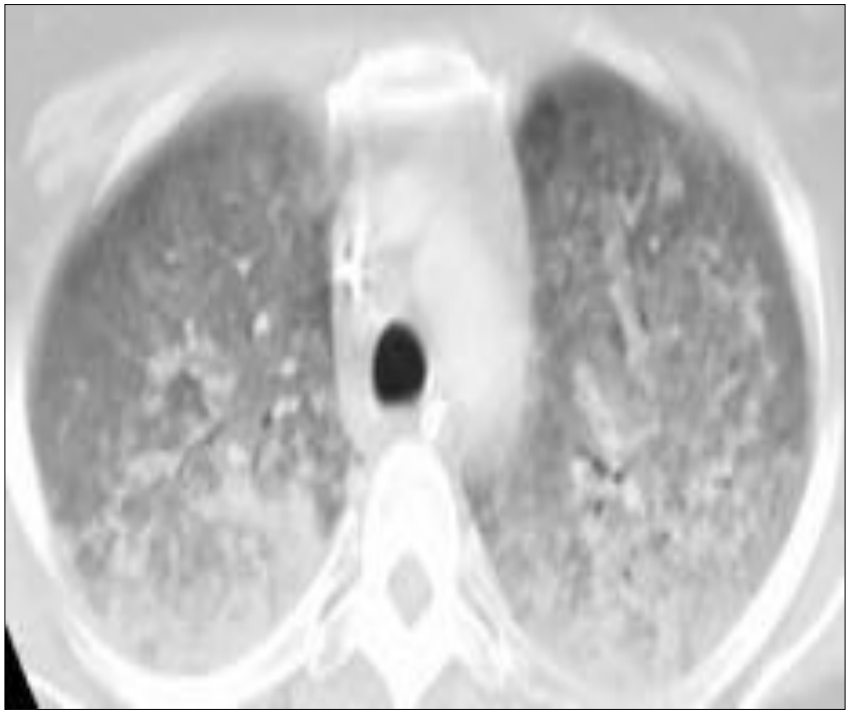
O'Meade *et al.* JAMA 2008



475	223	91	43
508	220	97	47

PATIENT AVEC DES
HYPERDENSITÉS LOBAIRES

PATIENT AVEC DES
HYPERDENSITÉS DIFFUSES



Rouby et al. ICM 2000

Ventilation Strategy Using Low Tidal Volumes, Recruitment Maneuvers, and High Positive End-Expiratory Pressure for Acute Lung Injury and Acute Respiratory Distress Syndrome

A Randomized Controlled Trial

JAMA. 2008;299(6):637-645

Day 1:
PEP 15 vs 10
Pplat 30 vs 25

Table 6. Outcomes[a]

Outcomes	No. (%) Lung Open Ventilation (n = 475)	No. (%) Control Ventilation (n = 508)	Relative Risk (95% Confidence Interval)	*P* Value
Death in hospital	173 (36.4)	205 (40.4)	0.90 (0.77-1.05)	.19
Death in intensive care unit	145 (30.5)	178 (35.0)	0.87 (0.73-1.04)	.13
Death during mechanical ventilation	136 (28.6)	168 (33.1)	0.87 (0.72-1.04)	.13
Death during first 28 d	135 (28.4)	164 (32.3)	0.88 (0.73-1.07)	.20
Barotrauma[b]	53 (11.2)	47 (9.1)	1.21 (0.83-1.75)	.33
Refractory hypoxemia	22 (4.6)	52 (10.2)	0.54 (0.34-0.86)	.01
Death with refractory hypoxemia	20 (4.2)	45 (8.9)	0.56 (0.34-0.93)	.03
Refractory acidosis	29 (6.1)	42 (8.3)	0.81 (0.51-1.31)	.39
Death with refractory acidosis	27 (5.7)	38 (7.5)	0.85 (0.51-1.40)	.52
Refractory barotrauma	14 (3.0)	12 (2.4)	1.10 (0.54-2.26)	.80
Death with refractory barotrauma	8 (1.7)	8 (1.6)	1.00 (0.41-2.40)	.99
Eligible use of rescue therapies[c]	24 (5.1)	47 (9.3)	0.61 (0.38-0.99)	.045
Total use of rescue therapies[c]	37 (7.8)	61 (12.0)	0.68 (0.46-1.00)	.05
Days of mechanical ventilation[d]	10 (6-17)	10 (6-16)		.92
Days of intensive care[d]	13 (8-23)	13 (9-23)		.98
Days of hospitalization[d]	28 (17-48)	29 (16-51)		.96

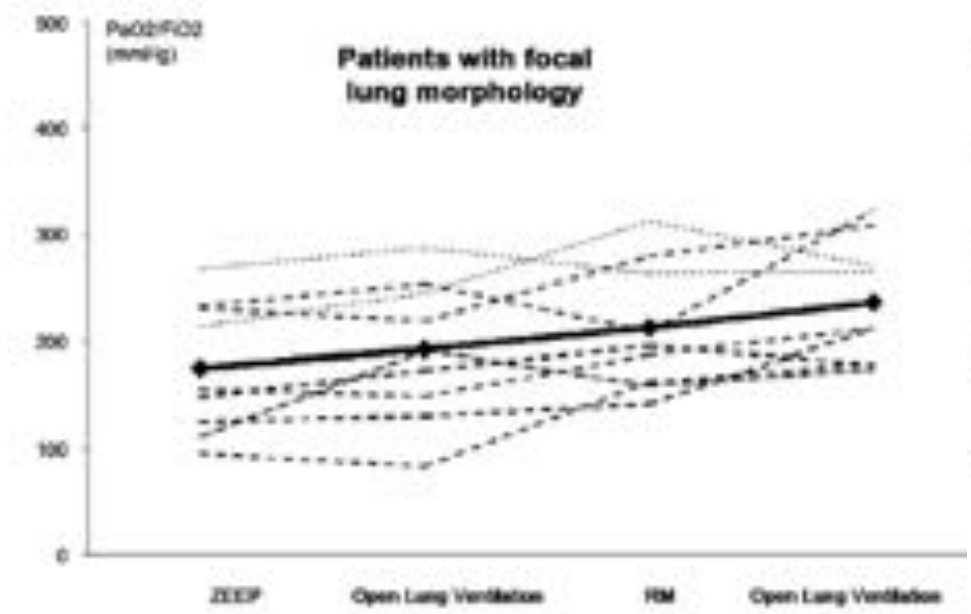
- Optimisation du réglage du respirateur
  - réduire le volume courant (6-8 ml/kg…) donc choisir plutôt VAC
  - limiter les pressions (Pplat < 32 cmH2O)
  - utiliser une PEEP suffisamment élevée (≥ 10 cmH2O, max ?)
  - Cas de l'obèse ou si Pabdo élevée
  - limiter les objectifs de PaO2 60-75 mmHg (donc utiliser le niveau le plus bas de FiO2)

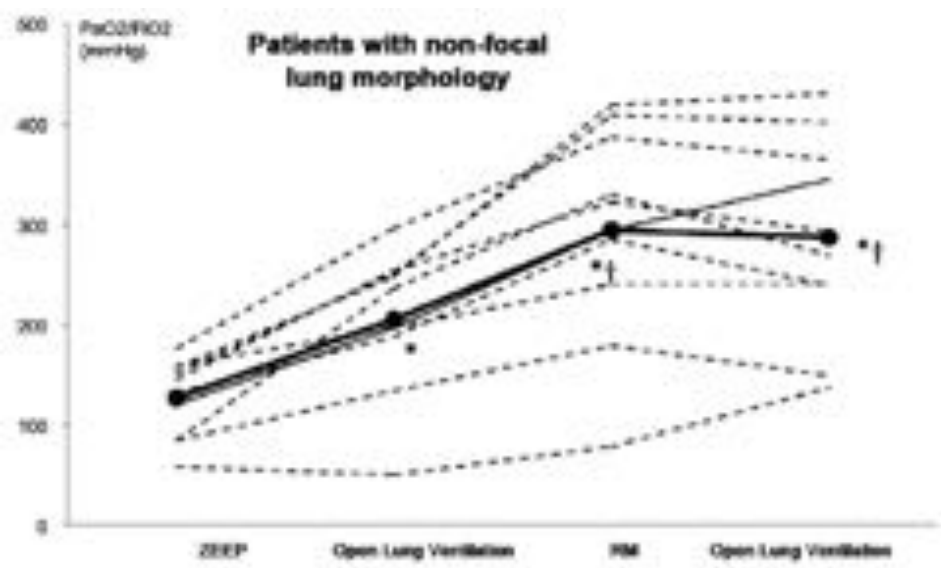
Lung morphology predicts response to recruitment maneuver in patients with acute respiratory distress syndrome

Jean-Michel Constantin, MD, PhD; Salvatore Grasso, MD, PhD; Gerald Chanques, MD; Sophie Aufort, MD; Emmanuel Futier, MD; Mustapha Sebbane, MD; Boris Jung, MD; Benoit Gallix; Jean Etienne Bazin, MD, PhD; Jean-Jacques Rouby, MD, PhD; Samir Jaber, MD, PhD

(Crit Care Med 2010; 38:1108–1117)

- CPAP 4O cmH2O pdt 40 sec,
- PEP 2 CmH2O> PI inferieur PV curve

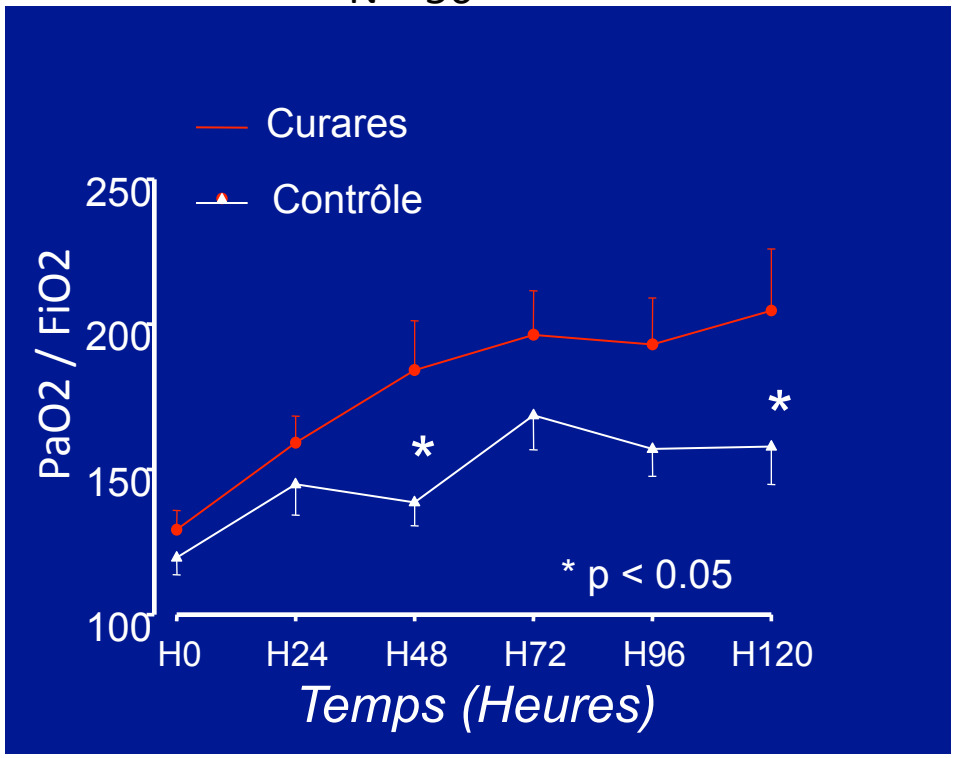




Adjuvants

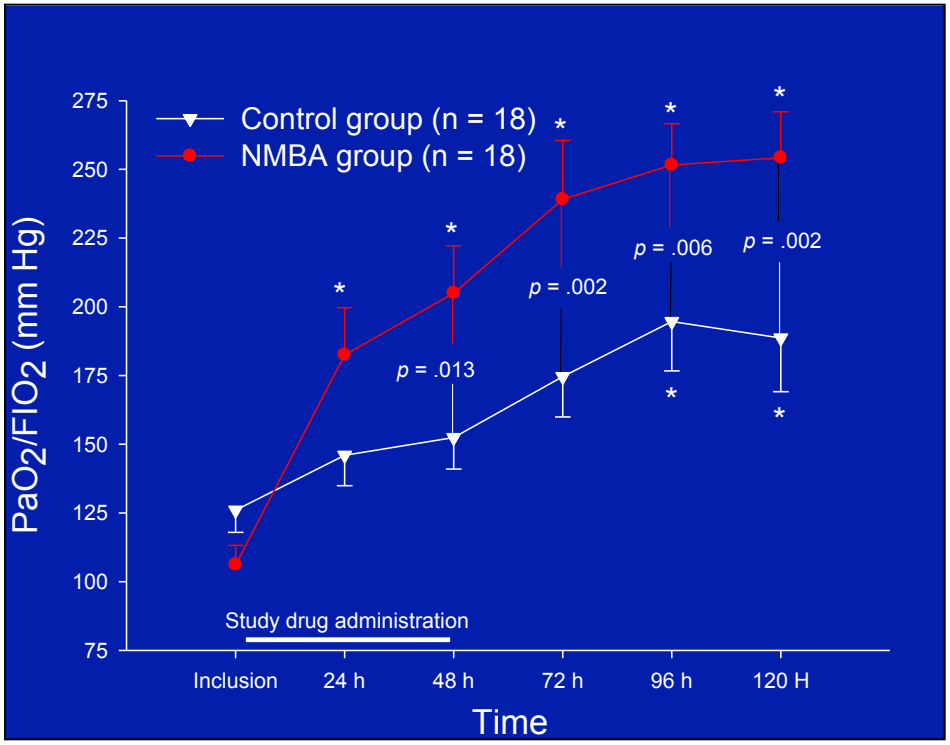
Curarisation précoce de 48 h au cours du SDRA sévère

N = 56



Gainnier, Roch, Crit Care Med 2004

N = 36

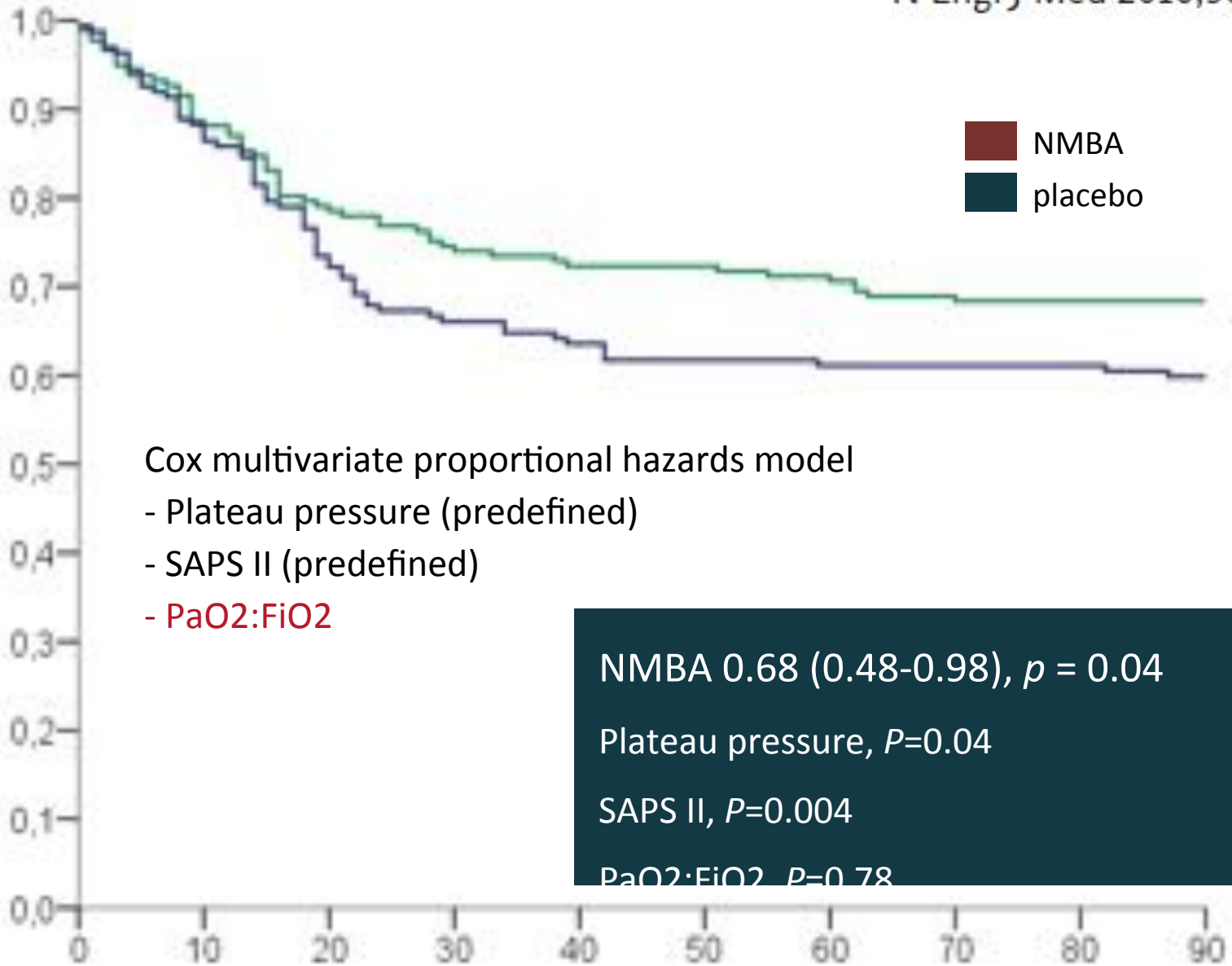


Forel, Roch, Crit Care Med 2006

PaO2/FiO2 identiques entre les groupes à H24 dans accurasys

Curarisation

N Engl J Med 2010;363:1107-16.



Cox multivariate proportional hazards model
- Plateau pressure (predefined)
- SAPS II (predefined)
- PaO2:FiO2

NMBA 0.68 (0.48-0.98), *p* = 0.04

Plateau pressure, *P*=0.04

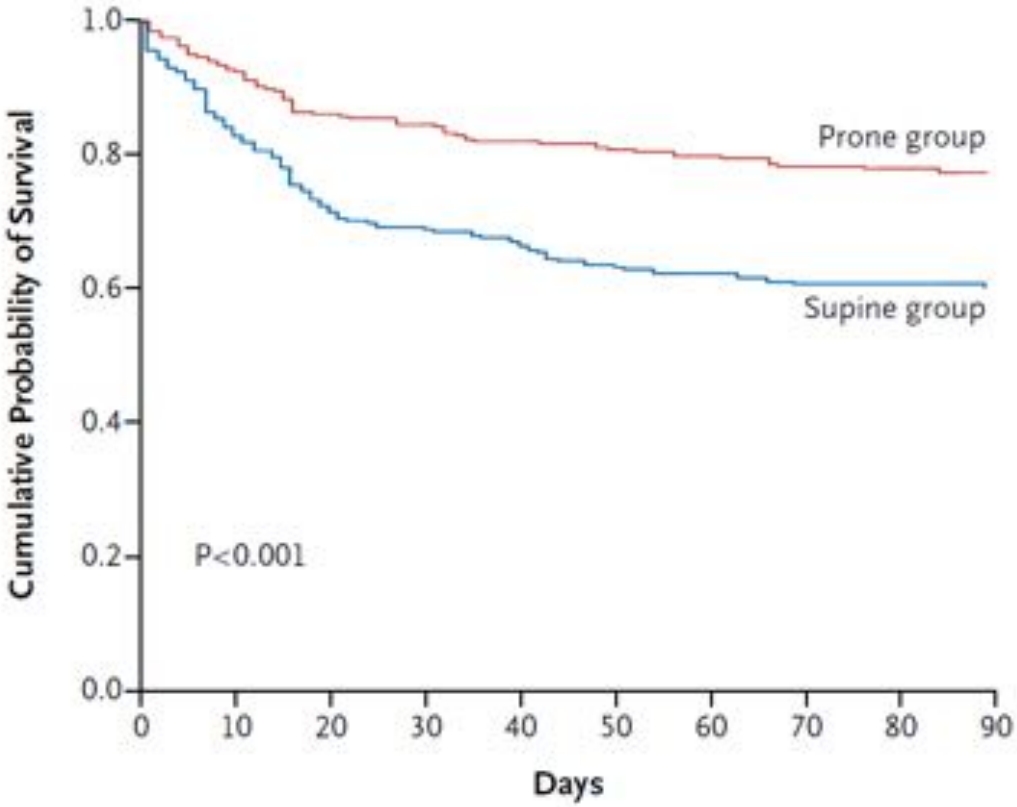
SAPS II, *P*=0.004

PaO2:FiO2, *P*=0.78

Prone Positioning in Severe Acute Respiratory Distress Syndrome

N Engl J Med 2013.

- PAFI < 150 persistant, en moyenne 100
- 4±4 séances de DV de 17±3 h



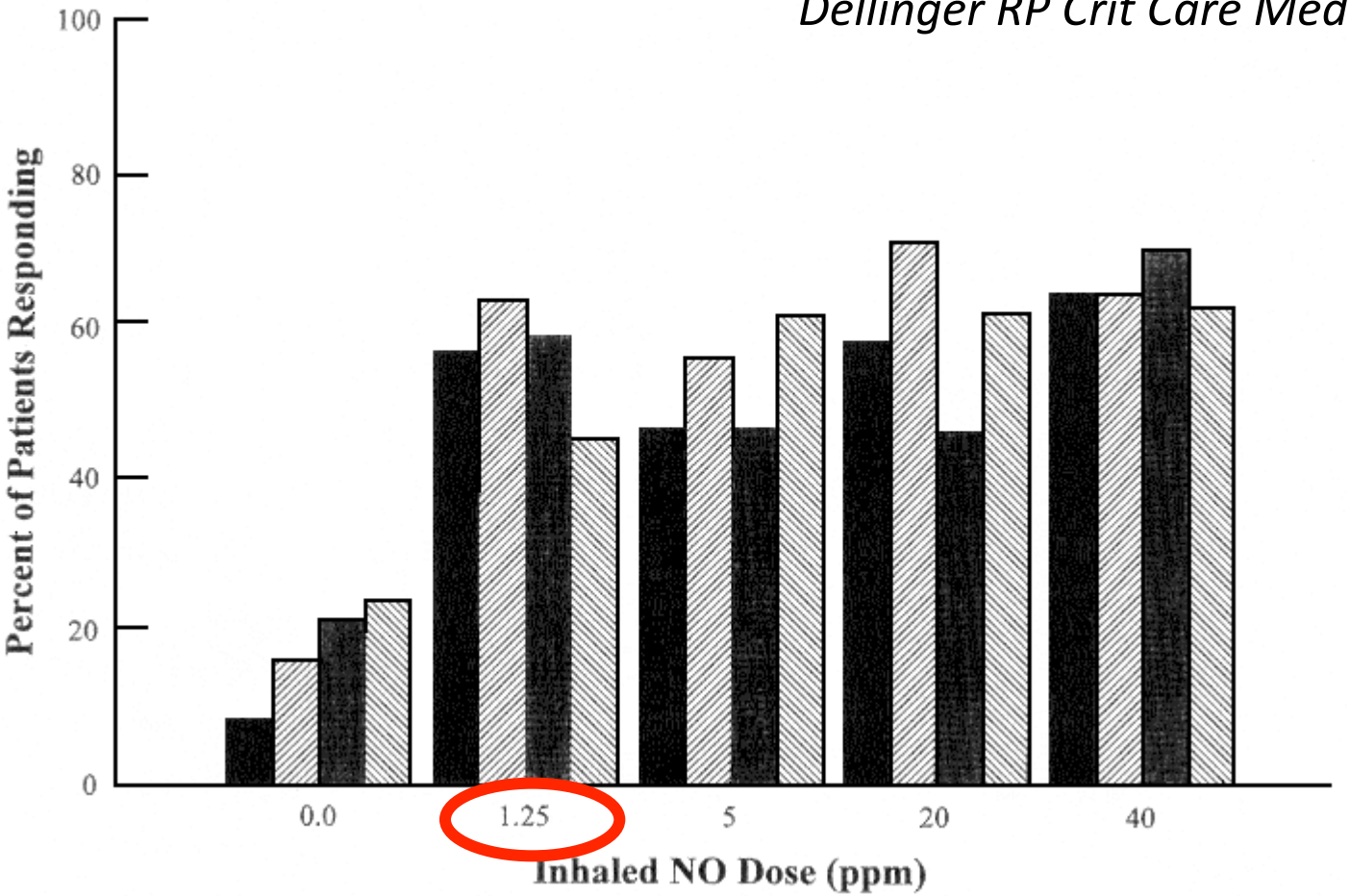
Prone Positioning in Severe Acute Respiratory Distress Syndrome

N Engl J Med 2013.

	supine	prone	p
ECMO	2.6%	0.8%	0.14
INO	15.7	9.7	0.05
almitrine	6.6	2.5	0.04

50 % de répondeurs au NO inhalé

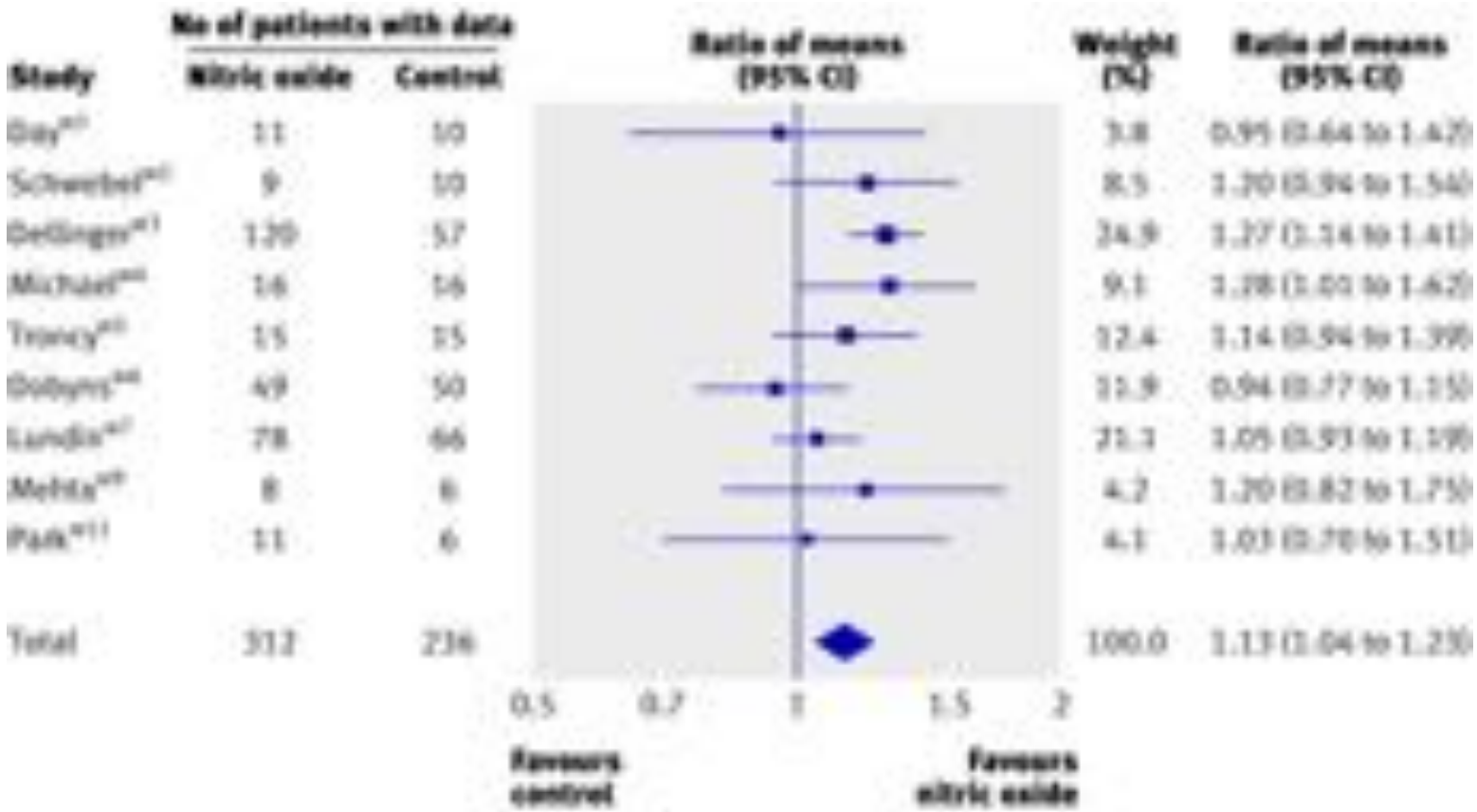
Dellinger RP Crit Care Med 1998



Effect of nitric oxide on oxygenation and mortality in acute lung injury: systematic review and meta-analysis

Neill K J Adhikari, lecturer,[1] Karen E A Burns, assistant professor,[1] Jan O Friedrich, assistant professor,[1] John T Granton, associate professor,[1] Deborah J Cook, professor,[2] Maureen O Meade, associate professor[2]

BMJ 2007

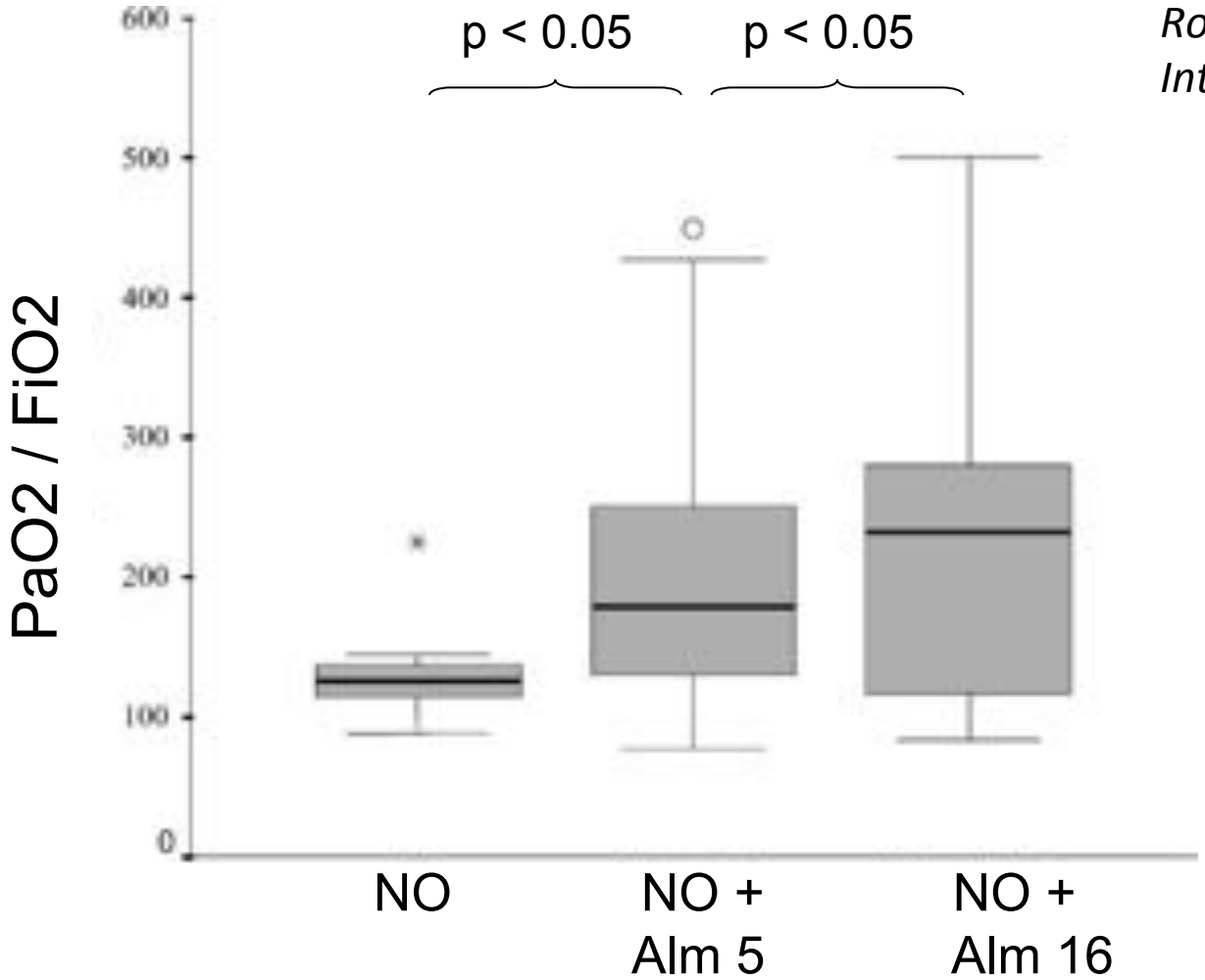


Augmentation moyenne PAFI = 13% - Pas d'effet sur la PAP

NO en pratique

- En attendant mieux
- Tester la réponse (<1h)

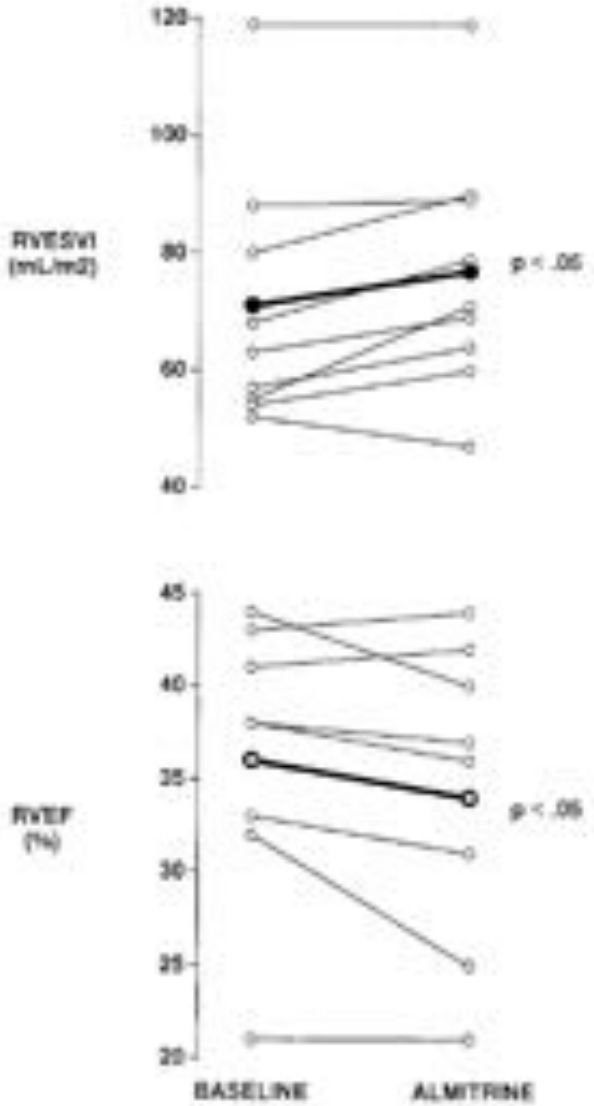
Posologies élevées d'almitrine utiles chez les patients sous noradrénaline et répondeurs au NO



Roch
Intensive Care Med 2001

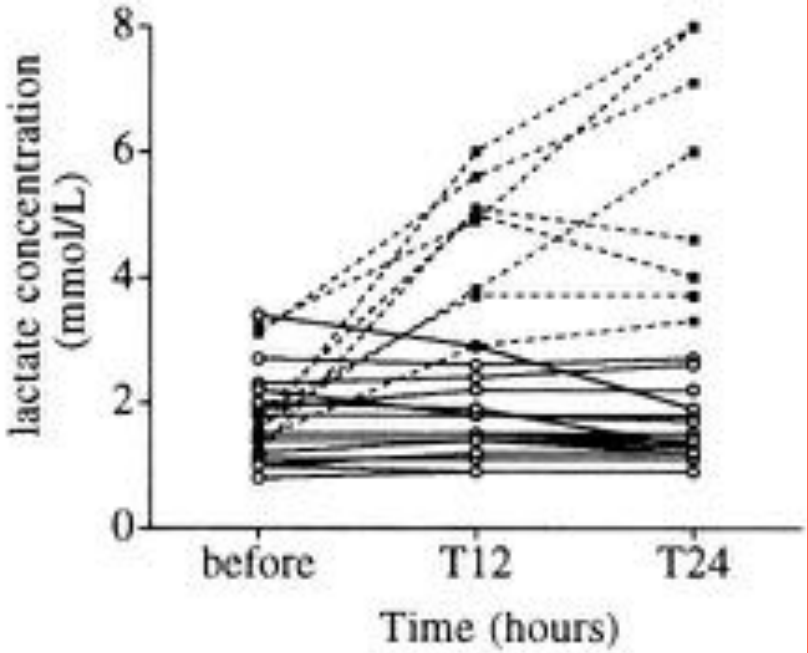
Risque pour le cœur droit

Michard Crit Care Med 2001



Risque pour le foie

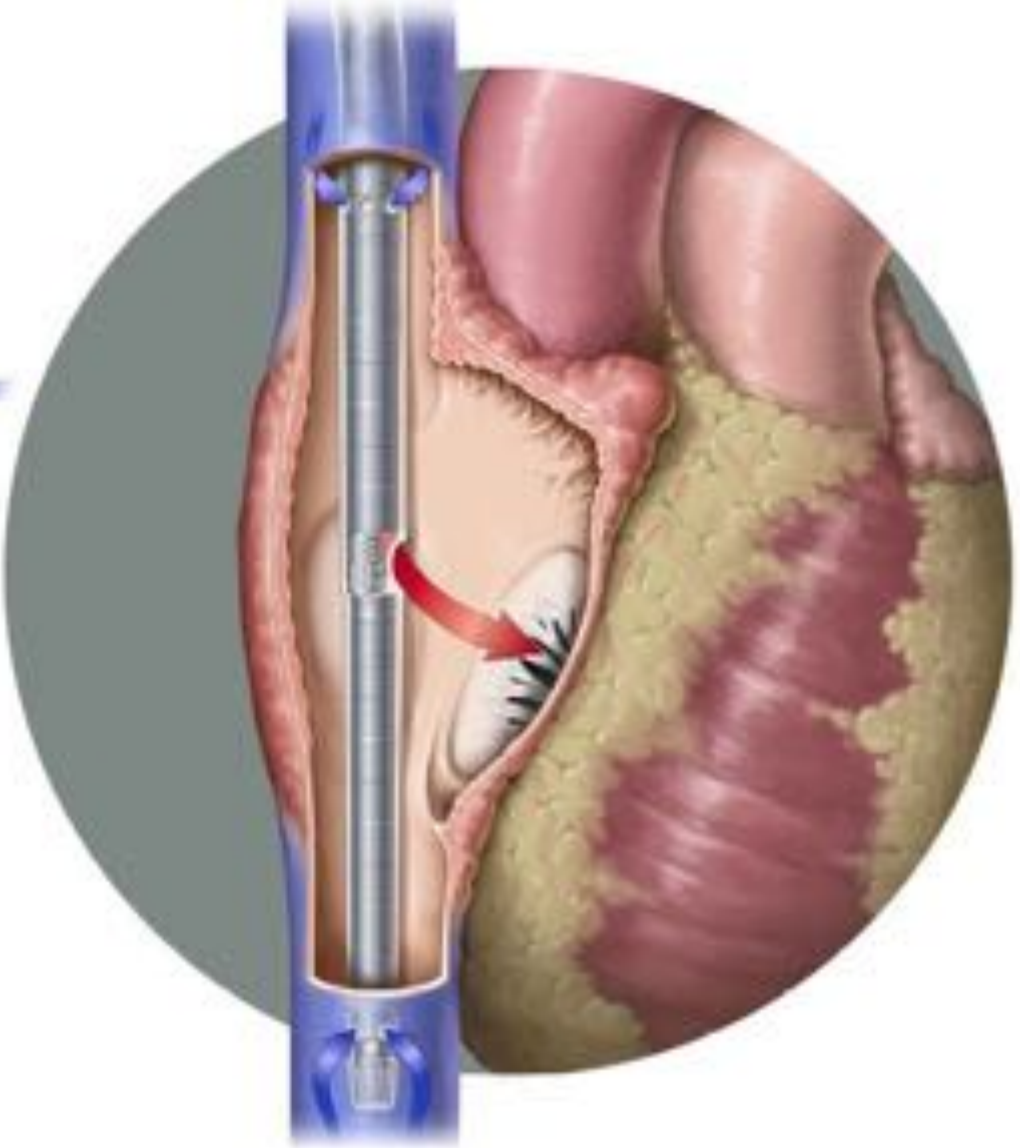
B'Chir Anesthesiology 1998



Quand en arriver à l'ECMO ?
Ou ne pas aller jusqu'à l'ECMO

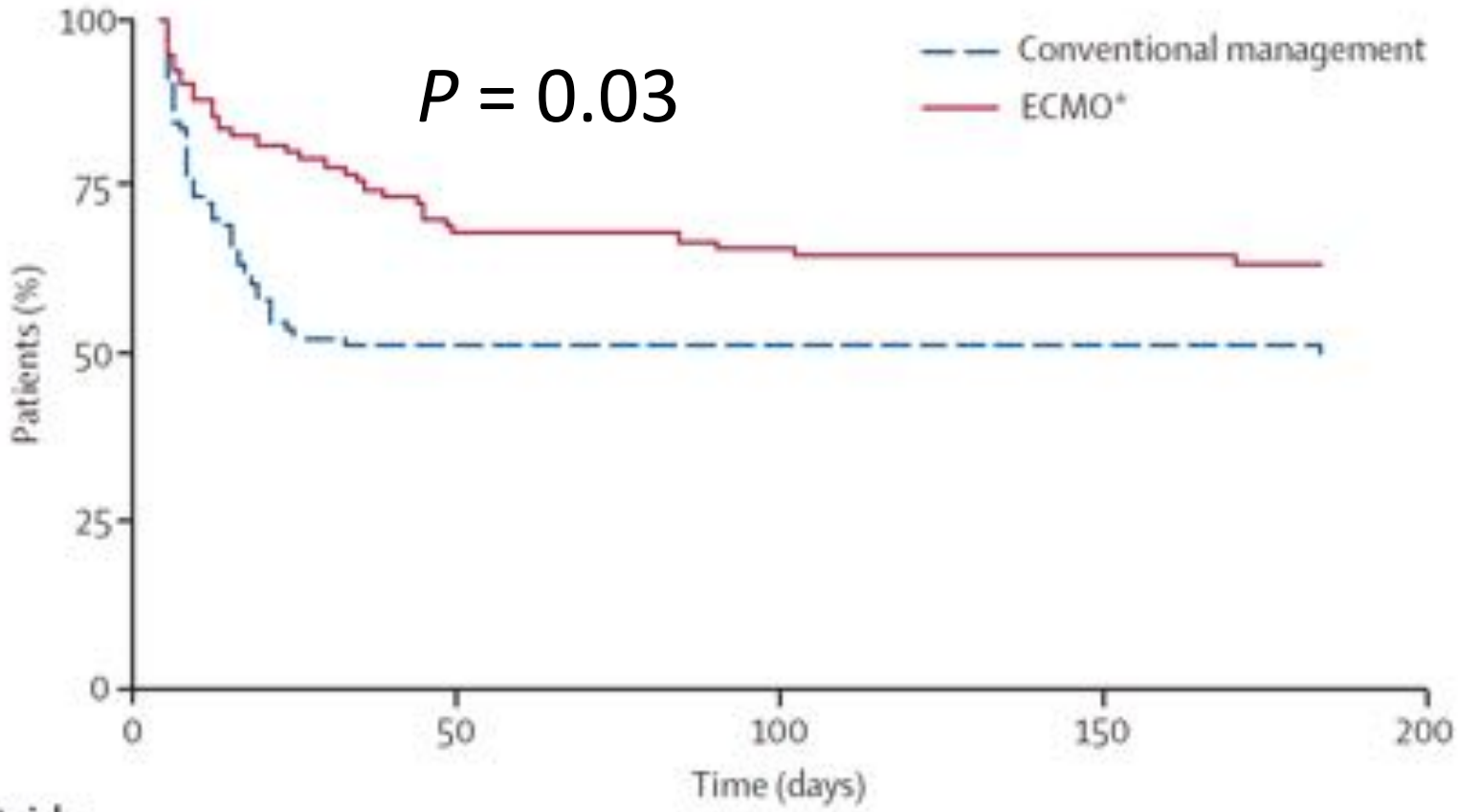
ECMO

Pompe



Décès ou handicap majeur à 6 mois

P/F < 100
VM < 7j



Patients at risk					
Conventional management	90	45	44	44	0
ECMO*	90	61	59	58	0

Peek et al. Lancet 2009

Extracorporeal Membrane Oxygenation for 2009 Influenza A(H1N1) Acute Respiratory Distress Syndrome

JAMA. 2009;302(17):1888-1895

Outcome Measure	All Infections (N = 68)
Length of stay, median (IQR), d	
ICU	27 (16-37)
Hospital	39 (23-47)
Duration, median (IQR), d	
Mechanical ventilation	25 (13-34)
ECMO support	10 (7-15)
Survival at ICU discharge	48 (71)
Still in ICU	6 (9)
Survival at hospital discharge	32 (47)
Still in hospital[b]	16 (24)
Ambulant at hospital discharge[c]	31 (97)
Sao_2 on room air at hospital discharge, median (IQR), %[c]	97 (95-98)
Discharge destination	
Died	14 (21)
Home	22 (32)
Other hospital	1 (1)
Rehabilitation facility	9 (13)
Cause of death[d]	
Hemorrhage	4 (29)
Intracranial hemorrhage	6 (43)
Infection	1 (7)
Intractable respiratory failure	4 (29)

ECMO

Collaboration multidisciplinaire

- Équipe chirurgie cardiaque disponible 24/24h

Antoine Roch
Renaud Lepaul-Ercole
Dominique Grisoli
Jacques Bessereau
Olivier Brissy
Matthias Castanier
Stephanie Dizier
Jean-Marie Forel
Christophe Guervilly
Vlad Garibolldi
Frederic Collart
Pierre Michelet
Gilles Perrin
Remi Charrel
Laurent Papazian

Extracorporeal membrane oxygenation for severe influenza A (H1N1) acute respiratory distress syndrome: a prospective observational comparative study

Intensive Care Med

	ECMO ($n = 9$)	Without ECMO ($n = 9$)	p value
Ventilation parameters, median (IQR)			
Lowest PaO_2/FiO_2 ratio (mmHg)	52 (50–60)	96 (89–143)	<0.001
Highest PEEP (cmH_2O)	12 (11–14)	10 (10–13)	NS
Highest Pplat (cmH_2O)	31 (30–35)	26 (25–29)	<0.05
Lowest pH	7.17 (7.04–7.25)	7.36 (7.3–7.37)	<0.001
Highest $PaCO_2$ (mmHg)	85 (69–91)	45 (44–53)	<0.001
Lung Injury Score, median (IQR)	3.6 (3.3–3.7)	3 (2.5–3.5)	<0.01
SOFA, median (IQR)	9 (8–10)	7 (6–8)	<0.01

Transport inter-hospitalier sous ECMO

UMAC-UMAREC

Unité Mobile d'Assistance Respiratoire Extra-Corporelle

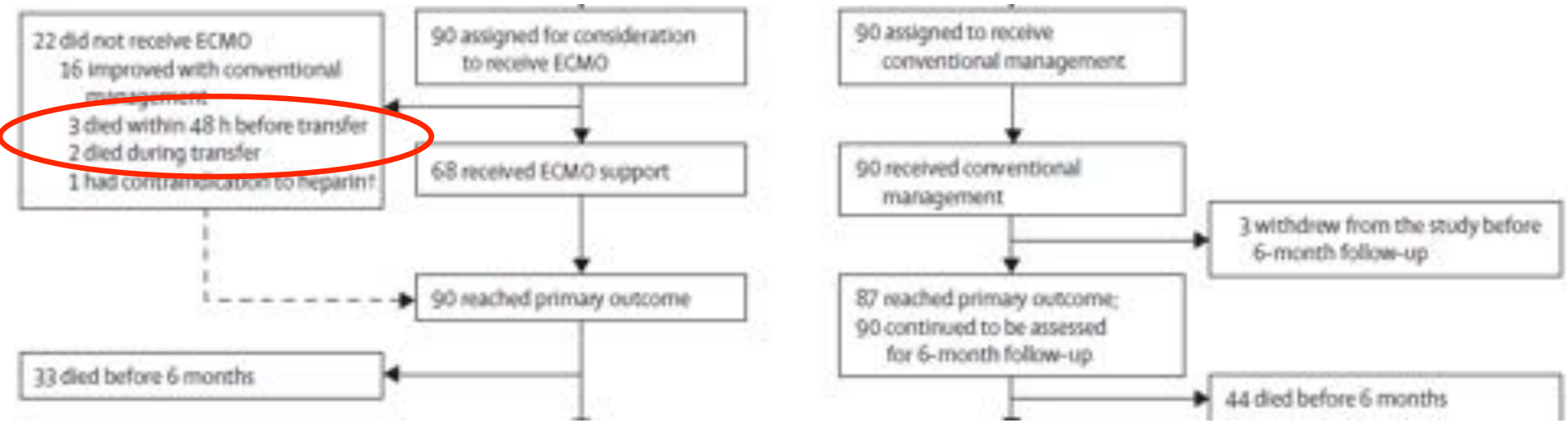
SAMU

Chirurgie cardiaque

Réanimation médicale

Efficacy and economic assessment of conventional ventilatory support versus extracorporeal membrane oxygenation for severe adult respiratory failure (CESAR): a multicentre randomised controlled trial

Lancet 2009



Three patients died before they could be transferred and two died in transit. If cannulation at the referring hospital and mobile ECMO support could be used for such patients, survival rates might be further improved.[50,51]

The PRESERVE mortality risk score and analysis of long-term outcomes after extracorporeal membrane oxygenation for severe acute respiratory distress syndrome

Intensive Care Med

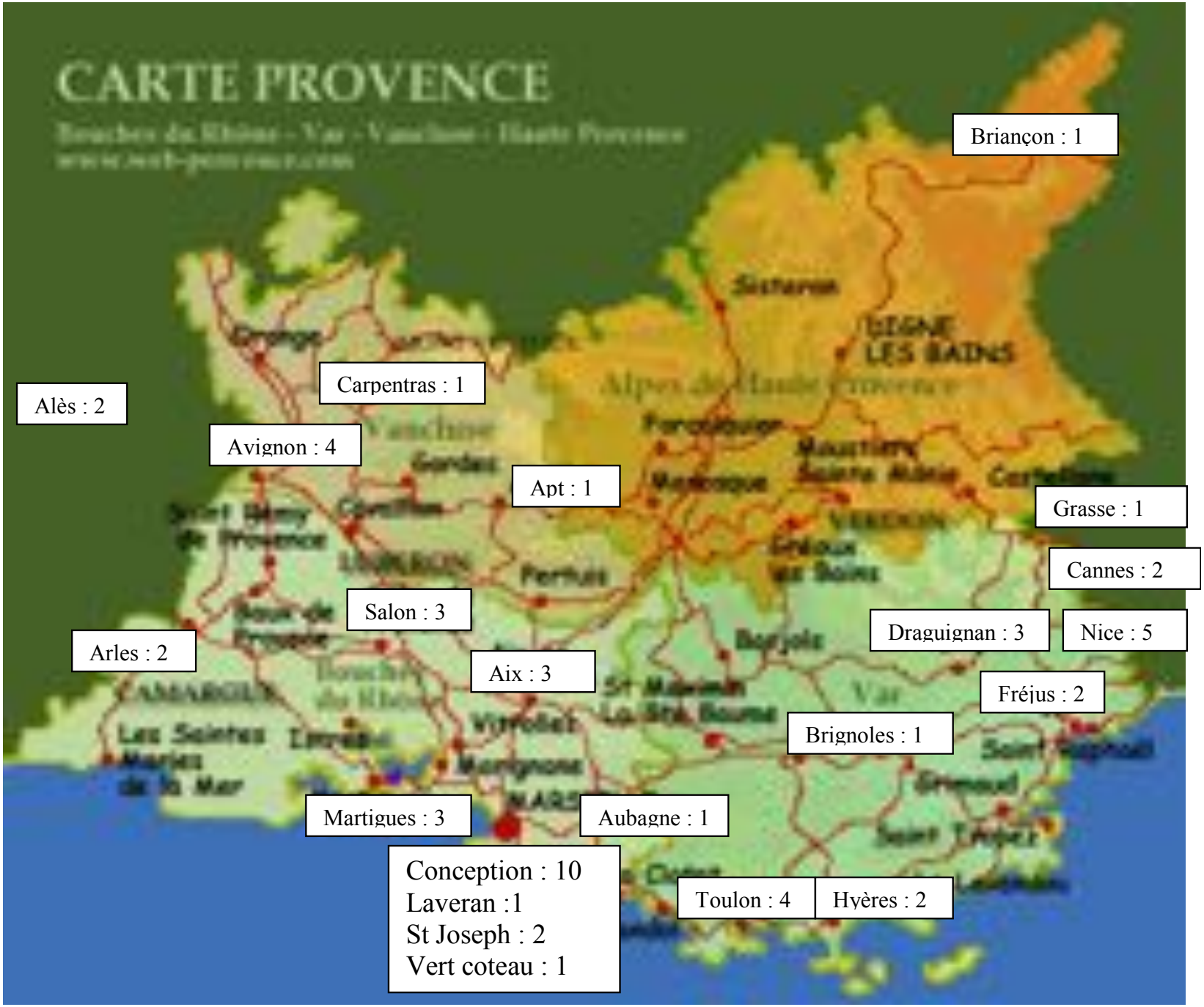
95 UMAC en 4 ans - 3 régions

Antoine Roch
Sami Hraiech
Elodie Masson
Dominique Grisoli
Jean-Marie Forel
Mohamed Boucekine
Pierre Morera
Christophe Guervilly
Mélanie Adda
Stéphanie Dizier
Richard Toesca
Fréderic Collart
Laurent Papazian

Outcome of acute respiratory distress syndrome patients treated with extracorporeal membrane oxygenation and brought to a referral center

Intensive Care Med

85 UMAC en 4 ans - PACA


CARTE PROVENCE
Briançon : 1
Carpentras : 1
Alès : 2
Avignon : 4
Apt : 1
Grasse : 1
Cannes : 2
Salon : 3
Draguignan : 3
Nice : 5
Arles : 2
Aix : 3
Fréjus : 2
Brignoles : 1
Martigues : 3
Aubagne : 1
Conception : 10
Laveran :1
St Joseph : 2
Vert coteau : 1
Toulon : 4
Hyères : 2

Critères UMAREC

- Hypoxémie profonde
  - PaO2/FiO2 < 70 sous FiO2 1 depuis 2h au moins
  - avec une PEEP d'au moins 10 cmH2O
- Une ventilation protective impossible:
  - PaO2/FiO2 entre 70 et 100 (à FiO2 = 1)
    - avec une Pplat > 35 cmH2O
    - ou la présence d'une acidose respiratoire sévère (pH < 7,15 malgré une fréquence respiratoire à 35/min).

Hotline: 06 32 36 48 22 (24/7)

Antoine Roch
Sami Hraiech
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Dominique Grisoli
Jean-Marie Forel
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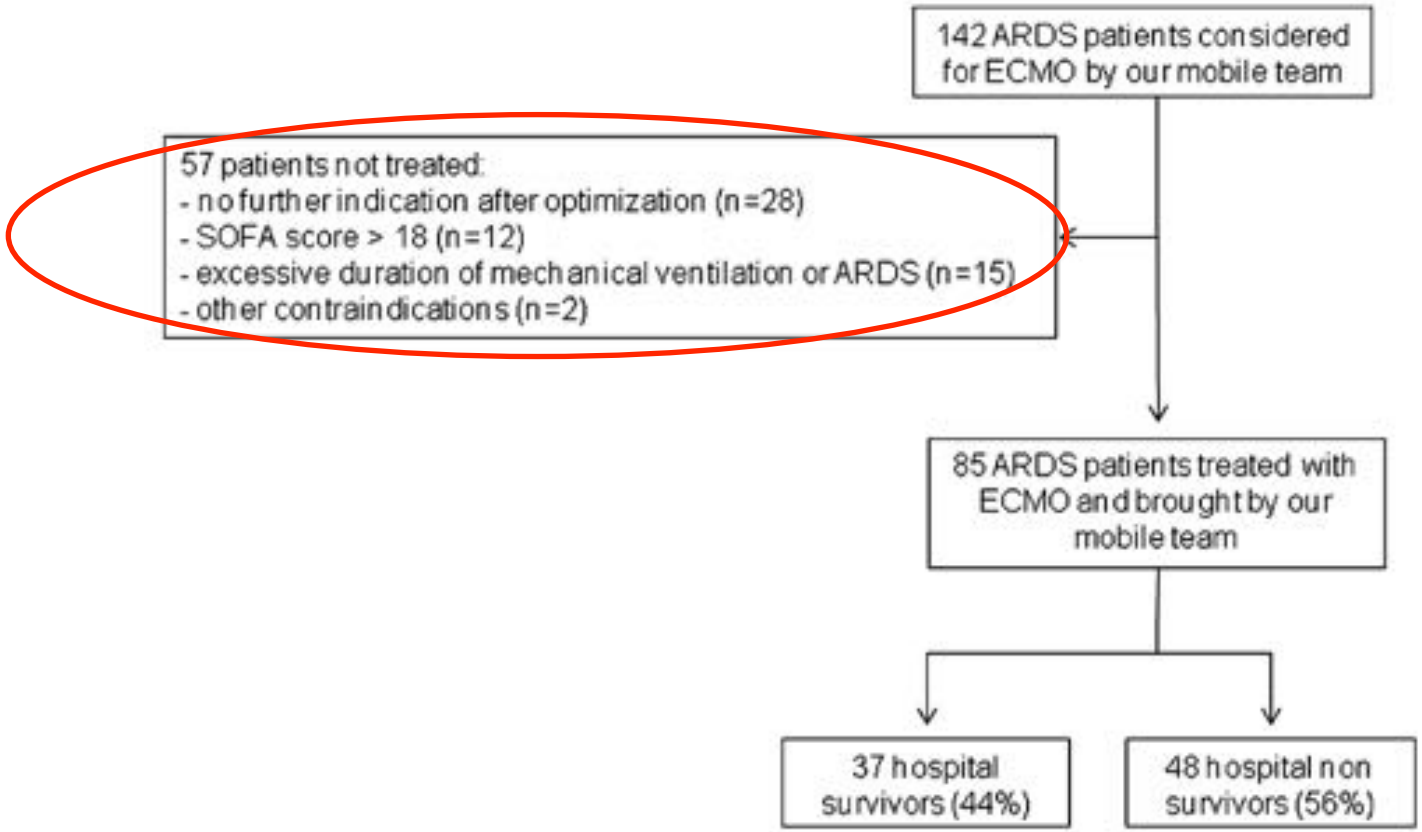
Outcome of acute respiratory distress syndrome patients treated with extracorporeal membrane oxygenation and brought to a referral center

Intensive Care Med



No serious complications (including vascular or chest tube displacement, ECMO malfunction, cardiac arrest, or death) occurred during transport by our mobile unit. For

Complications

- CESAR: 1 perforation veineuse (n=68)
- ANZICS: 6 hémorragies intracrâniennes (n=61)
- Pitié: 6 chocs hémorragiques, 4 HIC (n=140)
- Thromboses veineuses
- Thrombopénie
- Hémolyse

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Christophe Guervilly

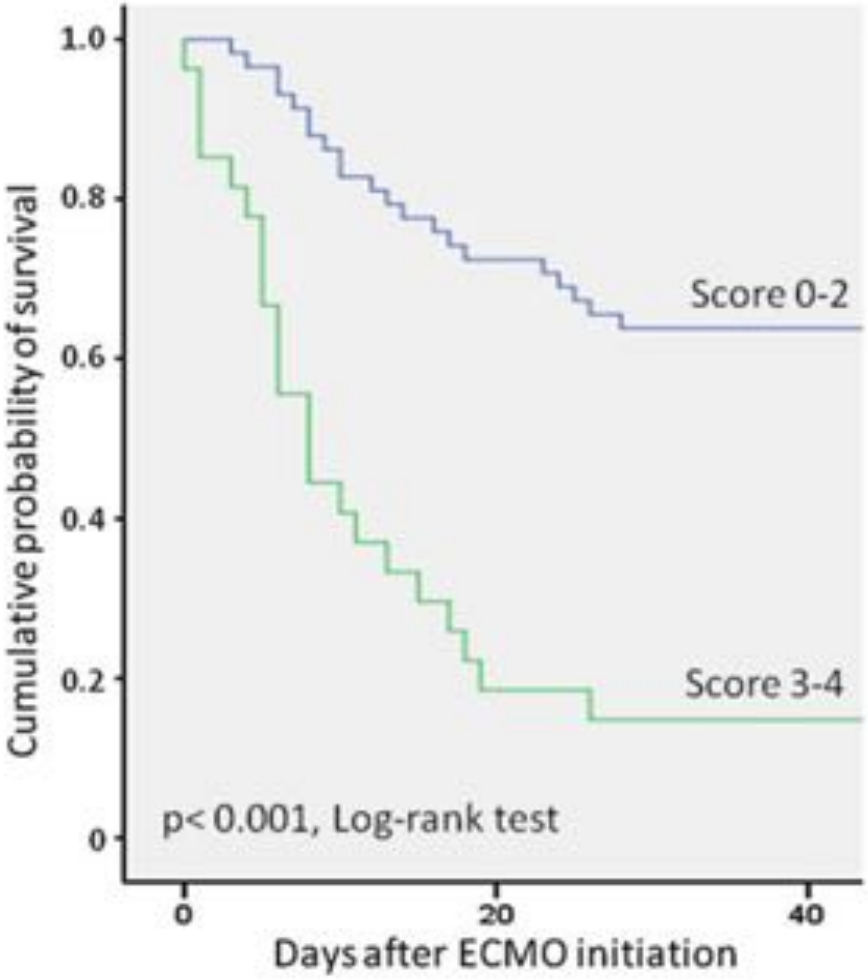
Outcome of acute respiratory distress syndrome patients treated with extracorporeal membrane oxygenation and brought to a referral center

ICM 2014

Table 3 Hospital mortality score calculated with parameters available just before ECMO initiation

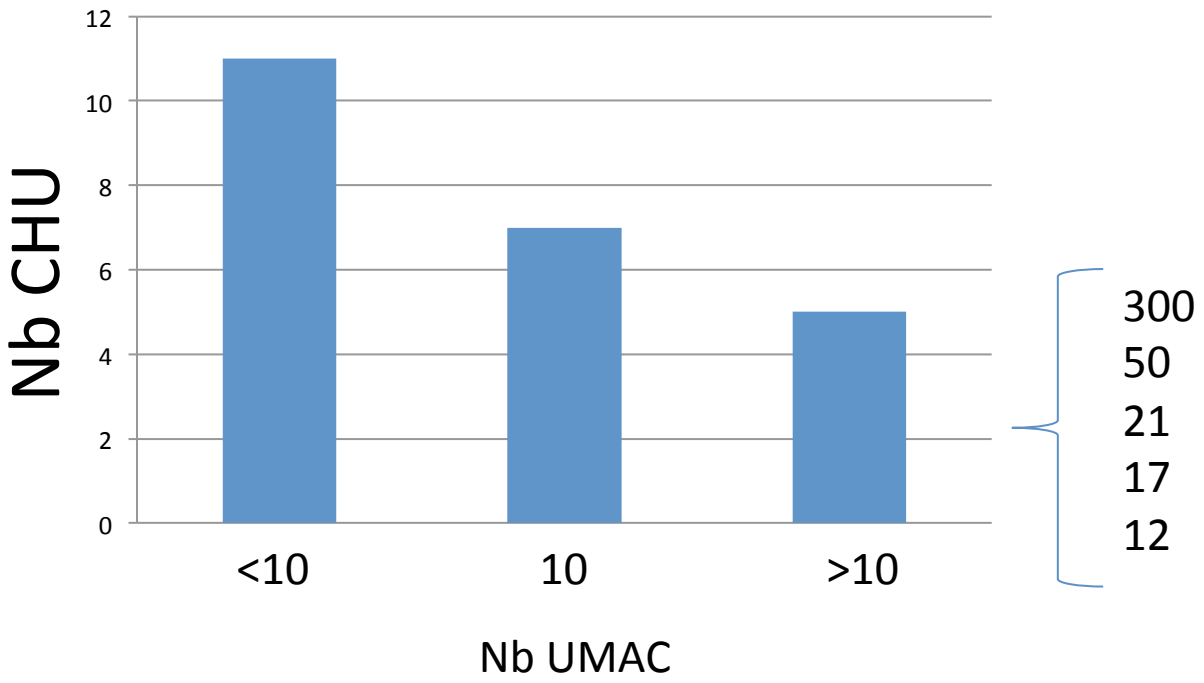
Parameter	Partial score ps_i
SOFA	
<9	0
9–11	1
≥12	2
Age	
<45 years	0
≥45 years	1
Influenza pneumonia	
Yes	0
No	1
Total score	0–4

A higher score was associated with higher hospital mortality
SOFA sequential organ failure assessment



UMAC en France

- Sur 28 CHU, 23 ont une activité d'UMAC
- Jamais identifiée en tant qu'unité fonctionnelle avec des moyens spécifiques
- Indications cardiaques **et** respiratoires pour 22 CHU
- Nombre médian = 10 par an , range [1-300]



Assistance extracorporelle au cours du syndrome de détresse respiratoire aiguë (chez l'adulte et l'enfant, à l'exclusion du nouveau-né). Conférence de consensus organisée par la Société de réanimation de langue française

Extracorporeal Life Support for Patients with Acute Respiratory Distress Syndrome (Adult and Paediatric). Consensus Conference Organized by the French Intensive Care Society

C. Richard · L. Argaud · A. Blet · T. Boulain · L. Contentin · A. Dechartres · J.-M. Dejode · L. Donetti · M. Fartoukh · D. Fletcher · K. Kuteifan · S. Lasocki · J.-M. Liet · A.-C. Lukaszewicz · H. Mal · E. Maury · D. Osman · H. Outin · J.-C. Richard · F. Schneider · F. Tamion

Réanimation
DOI 10.1007/s13546-014-0858-4

Conf consensus

- **Il est nécessaire que, dans chaque région, soit identifié au minimum un centre référent possédant tous les moyens humains et matériels indispensables à la prise en charge d'un patient atteint de SDRA et à l'implantation et la conduite des techniques d'assistance extra-corporelle : réanimation, chirurgie cardiaque et Unité Mobile d'Assistance Circulatoire**
- **Les centres référents doivent disposer d'une Unité Mobile d'Assistance Circulatoire disponible 24h/24, à même d'intervenir dans tous les établissements de santé de la région concernée**
- **Le maintien de la compétence en ECMO d'un service de réanimation risque de ne pas être assuré en deçà de dix indications annuelles d'ECMO**

43e CONGRES INTERNATIONAL

PARIS 21-23 JANVIER 2015

SRLF FICS

SOCIETE DE REANIMATION DE LANGUE FRANÇAISE

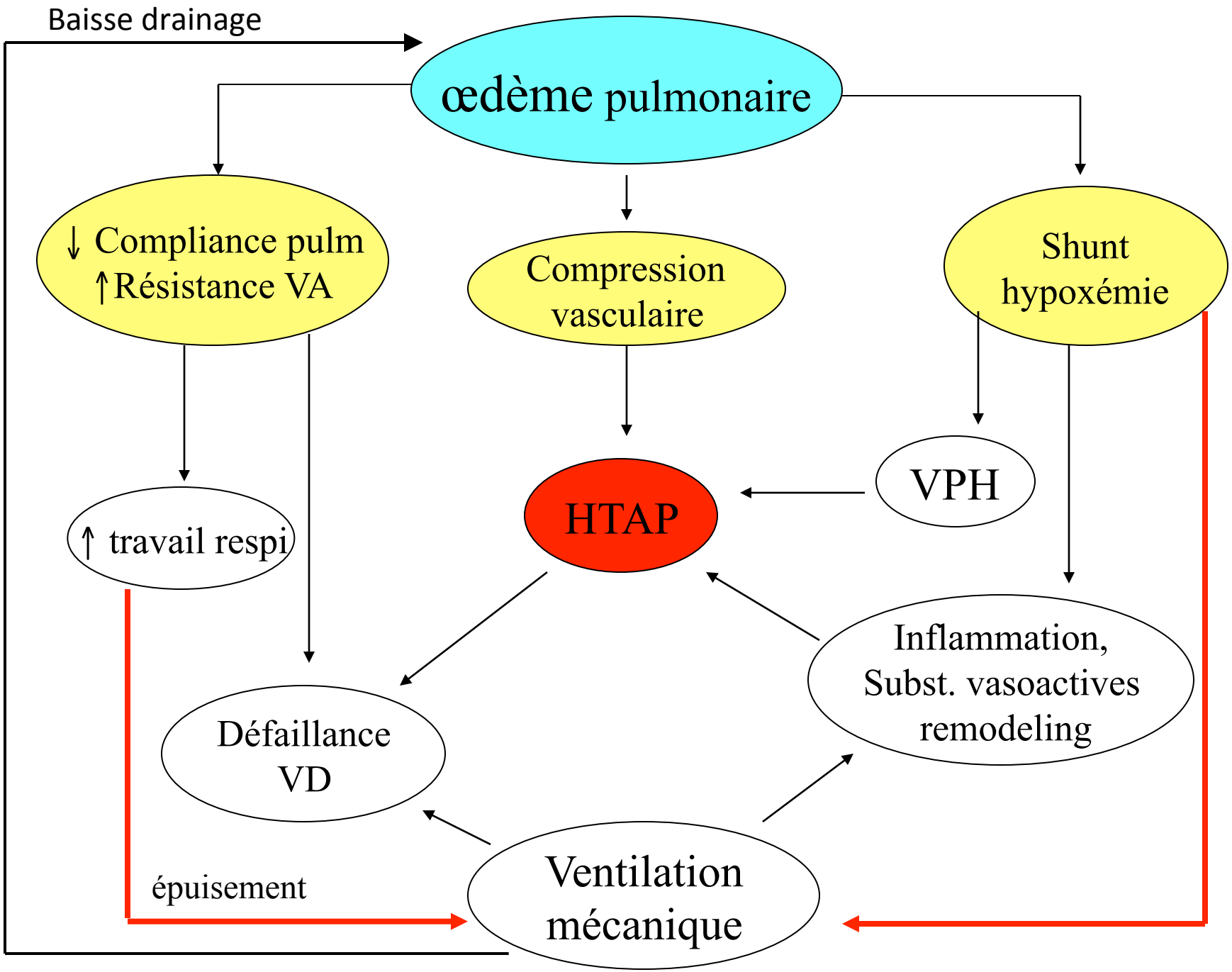
AVEC

NVIC

NEDERLANDSE VERENIGING VOOR INTENSIVE CARE

GROUPE FRANCOPHONE DE RÉANIMATION ET URGENCES PEDIATRIQUES

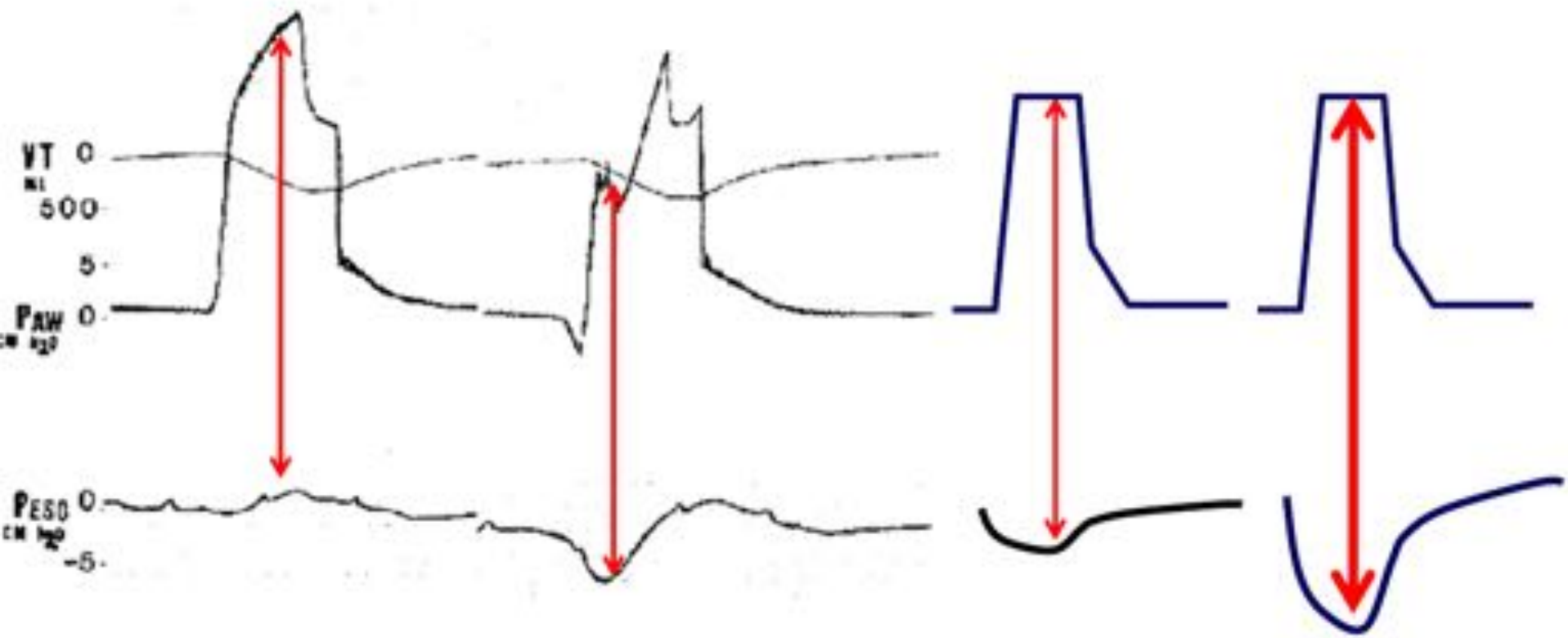
SOCIETE DE KINESITHERAPIE EN REANIMATION


Baisse drainage
œdème pulmonaire
↓ Compliance pulm
↑Résistance VA
Compression vasculaire
Shunt hypoxémie
VPH
HTAP
↑ travail respi
Inflammation, Subst. vasoactives remodeling
Défaillance VD
épuisement
Ventilation mécanique

Volume vs. Pressure-targeted modes: what's the difference?

Volume-control:
TransPulmonary Pressure is controlled

Pressure-control:
TransPulmonary Pressure is NOT controlled



Pressure-Preset Modes

No i-synchronization

- APRV

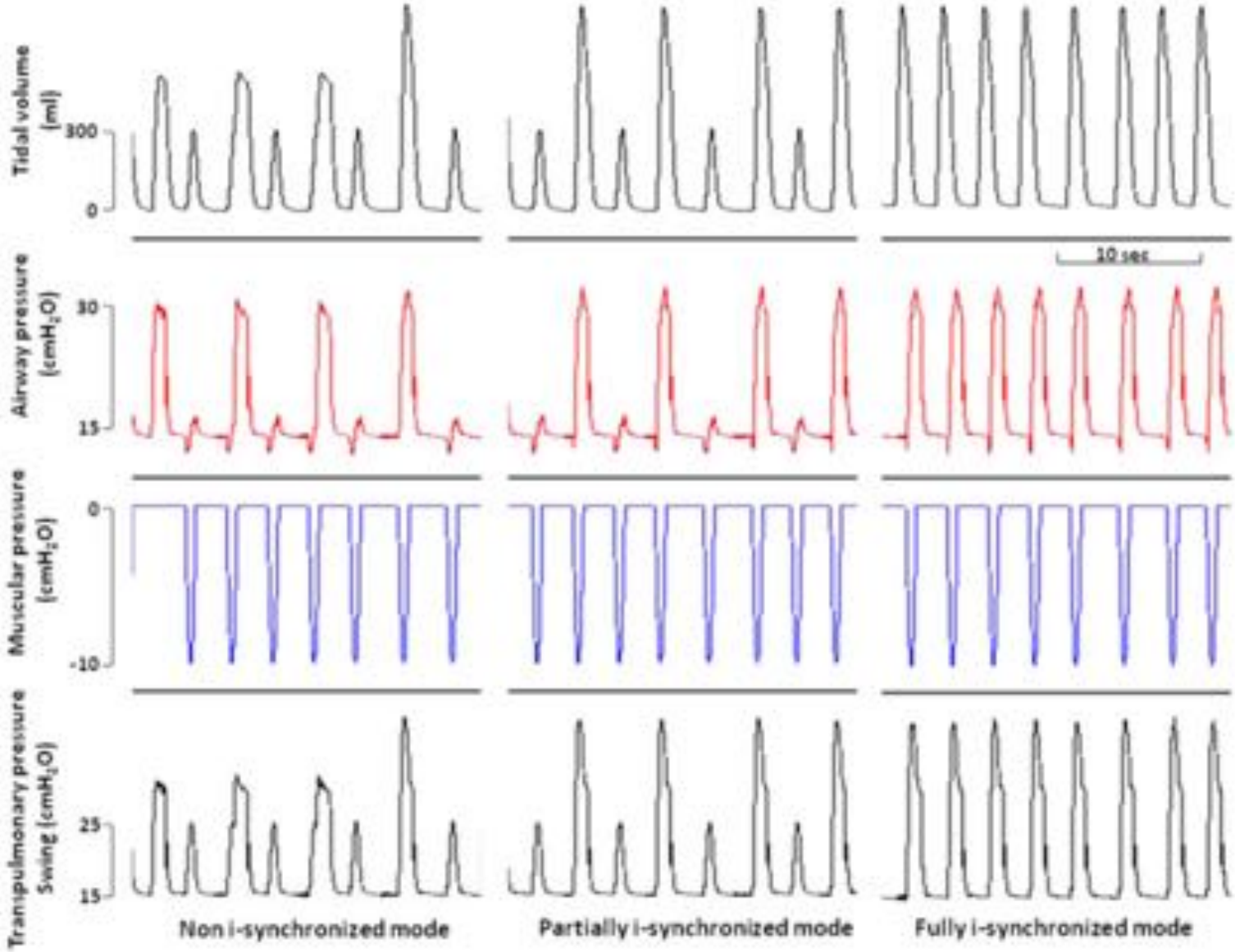
Partial i-synchronization

- BIPAP, DuoPAP, BiVent,
- Bilevel, etc.

Full i-synchronization

- BIPAPassist, , BiPAP PS Assist Pressure controlled, etc.

Richard JC ICM 2013



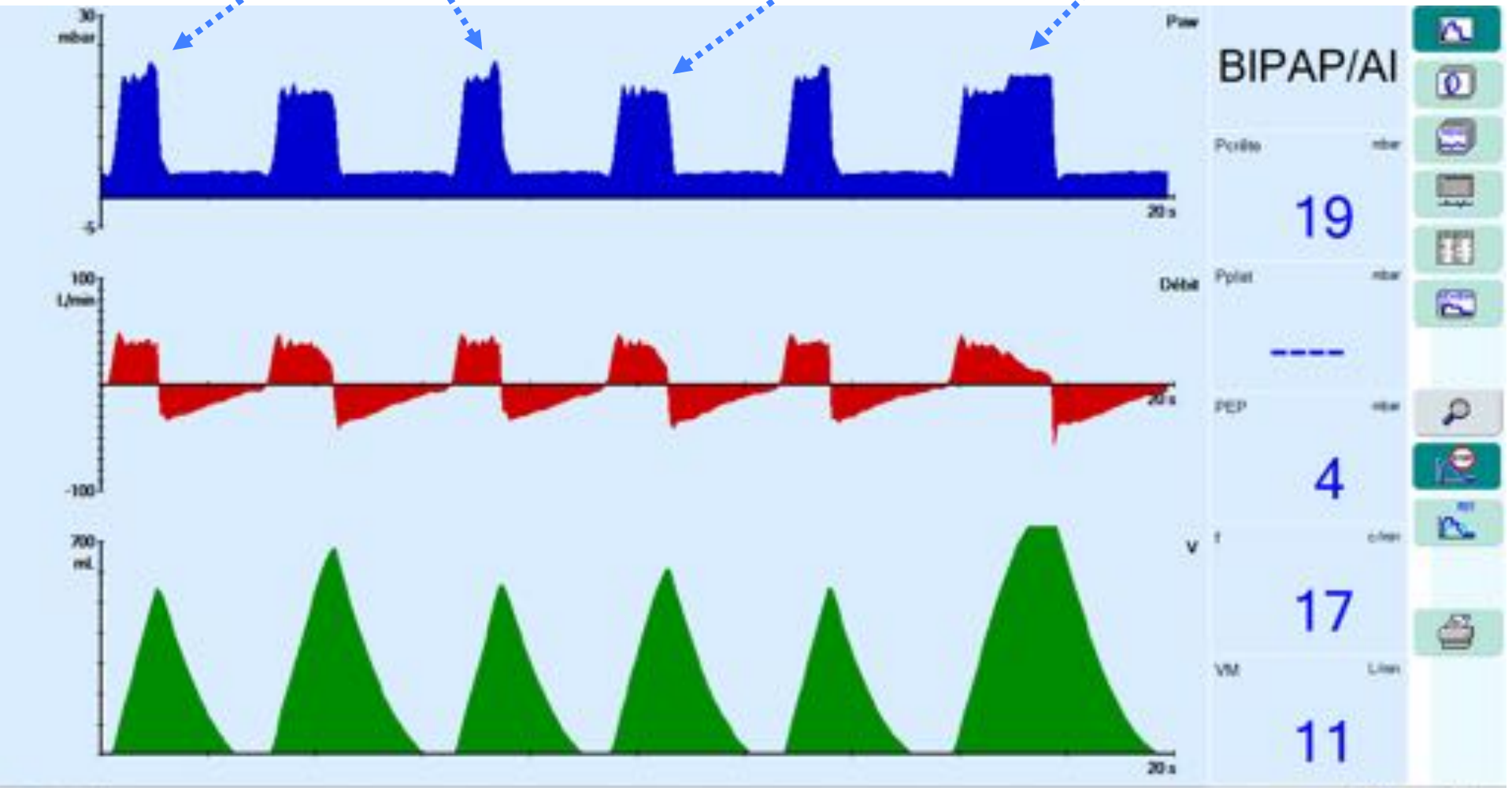
Richard JC ICM 2013

BIPAP

Cycles contrôlés en pression

Cycle en aide

VS sur cycle contrôlé

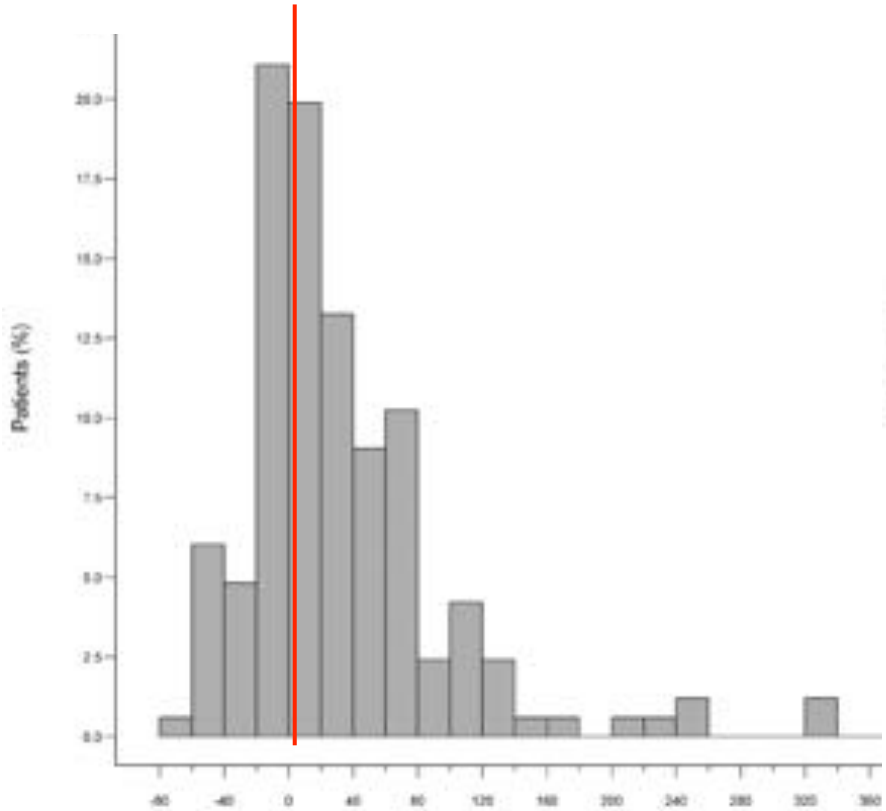


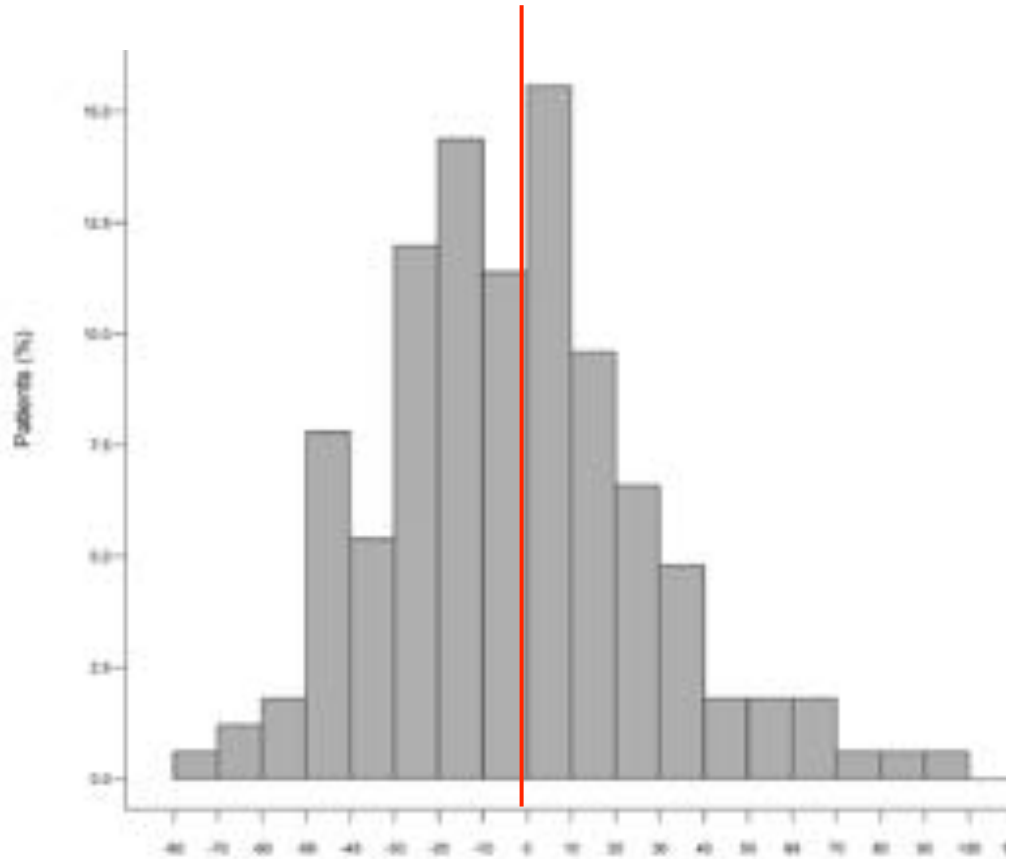
Buts de l'HFO

- More protective ventilation vs CMV:
  - Lower tidal volume
  - Safe use of higher mean airway pressures

- Treatment of oxygenation failure and/or ventilation failure

n=190





Change in PaO2 to FiO2 ratio (%)

Change in PaCO2 (%)

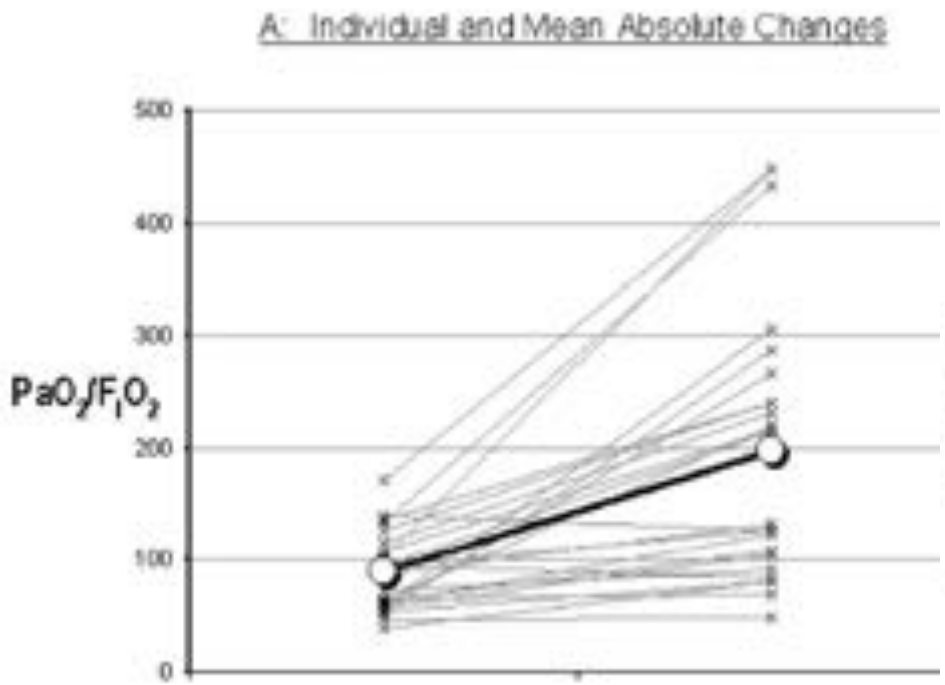
2/3 of patients exhibited an increase in PF ratio

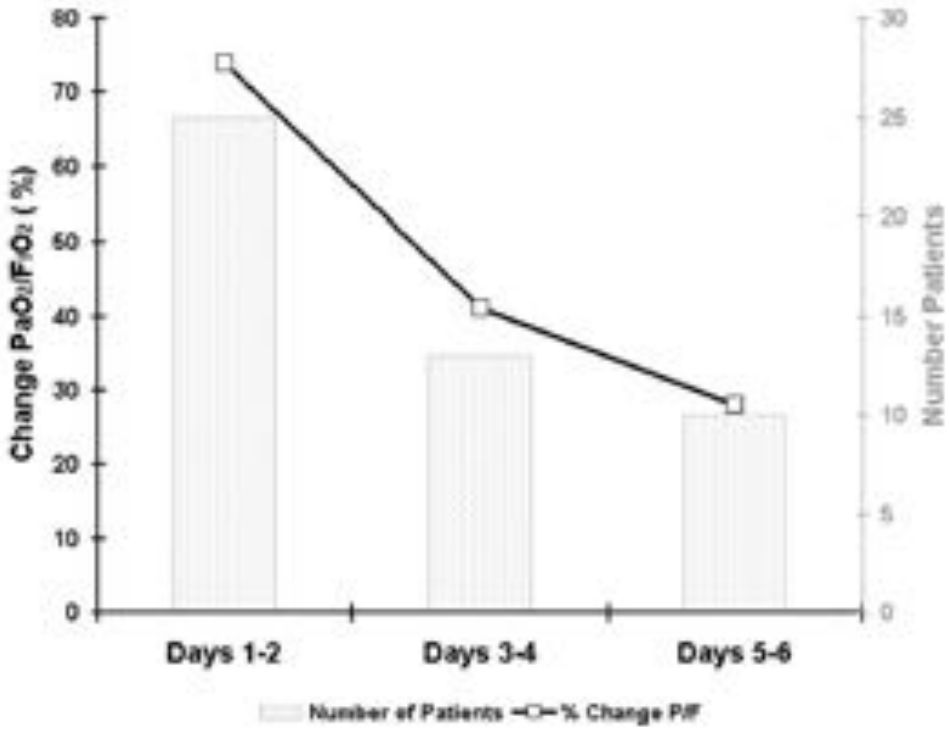
55% exhibited a decrease in PaCO2

Adhikari CCM 2011

Combining high-frequency oscillatory ventilation and recruitment maneuvers in adults with early acute respiratory distress syndrome: The Treatment with Oscillation and an Open Lung Strategy (TOOLS) Trial pilot study*

Crit Care Med 2005; 33:479–486





OSCAR

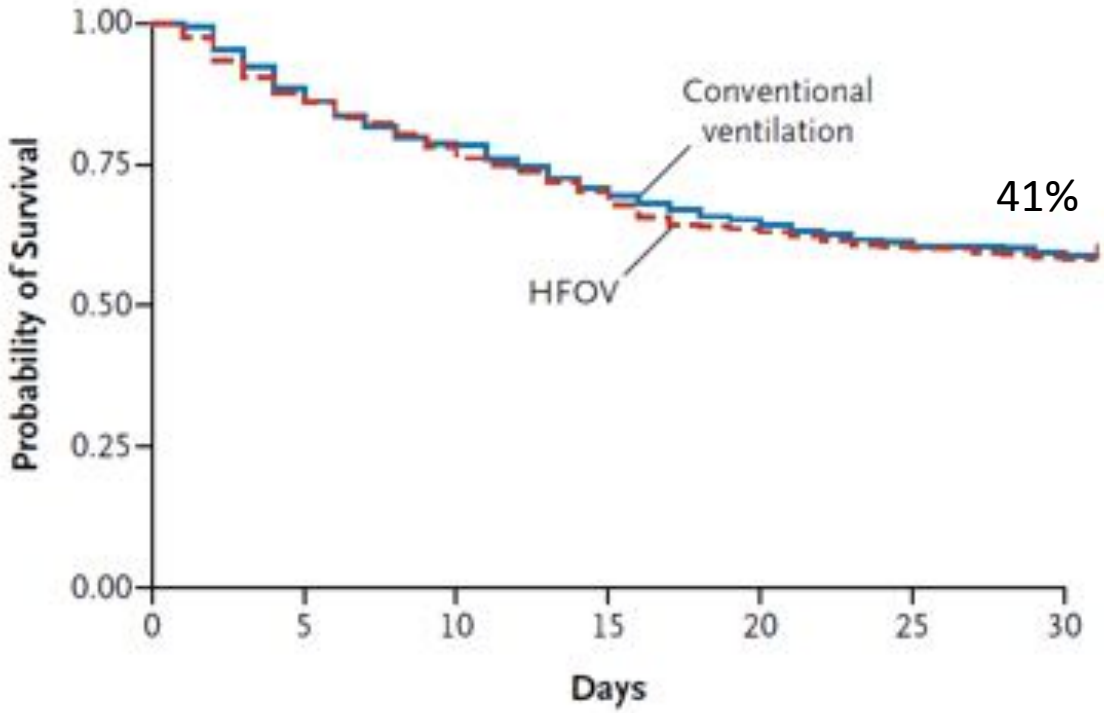
- 12 centers in UK
- PF ratio < 200 with PEEP > 5 cmH20 and MV < 7 d
- MAP up to 50 cmH2O if PF ratio < 60
- Decrease MAP when FiO2 0.4 by 2 cmH20 every 6h
- Weaning if MAP = 24 cmH2O
- Frequency 10 Hz decreased if pH < 7.25

High-Frequency Oscillation for Acute Respiratory Distress Syndrome

N Engl J Med 2013;368:806-13

Variable	Day 1		Day 2		Day 3	
	HFOV	Conventional Ventilation	HFOV	Conventional Ventilation	HFOV	Conventional Ventilation
No. of patients	370	392	326	374	240	348
Mean airway pressure (HFOV) or plateau pressure (conventional ventilation) — cm of water	26.9±6.2	30.9±11.0	25.3±5.5	29.5±10.7	25.1±5.4	28.5±11.2

5 j d'HFO en moyenne



No. at Risk							
Conventional ventilation	397	351	312	281	259	243	236
HFOV	398	349	311	280	253	241	233

High-Frequency Oscillation in Early Acute Respiratory Distress Syndrome

N Engl J Med 2013;368:795-805.

OSCILLATE

The Oscillation for ARDS Treated Early Trial

- Target recruitment: 1200 patients
- 37 centers across the world
- PF ratio < 200 with FiO2 > 0.5 and < 72h MV
- start mP_{AW} 30; keep ΔP 90; maximal frequency

High-Frequency Oscillation in Early Acute Respiratory Distress Syndrome

OSCILLATE
The Oscillation for ARDS Treated Early Trial

N Engl J Med 2013;368:795-805.

HFOV		Control Ventilation	
FIO_2	Mean Airway Pressure	FIO_2	PEEP
	cm of water		*cm of water*
0.4	20	0.3	5
0.4	22	0.3	8
0.4	24	0.3	10
0.4	26	0.4	10
0.4	28	0.4	12
0.4	30	0.4	14
0.5	30	0.4	16
0.6	30	0.4	18
0.6	32	0.5	18
0.6	34	0.5	20
0.7	34	0.6	20
0.8	34	0.7	20
0.9	34	0.8	20
1.0	34	0.8	22
1.0	36	0.9	22
1.0	38	1.0	22
		1.0	24

High-Frequency Oscillation in Early Acute Respiratory Distress Syndrome

OSCILLATE
The Oscillation for ARDS Treated Early Trial

N Engl J Med 2013;368:795-805.

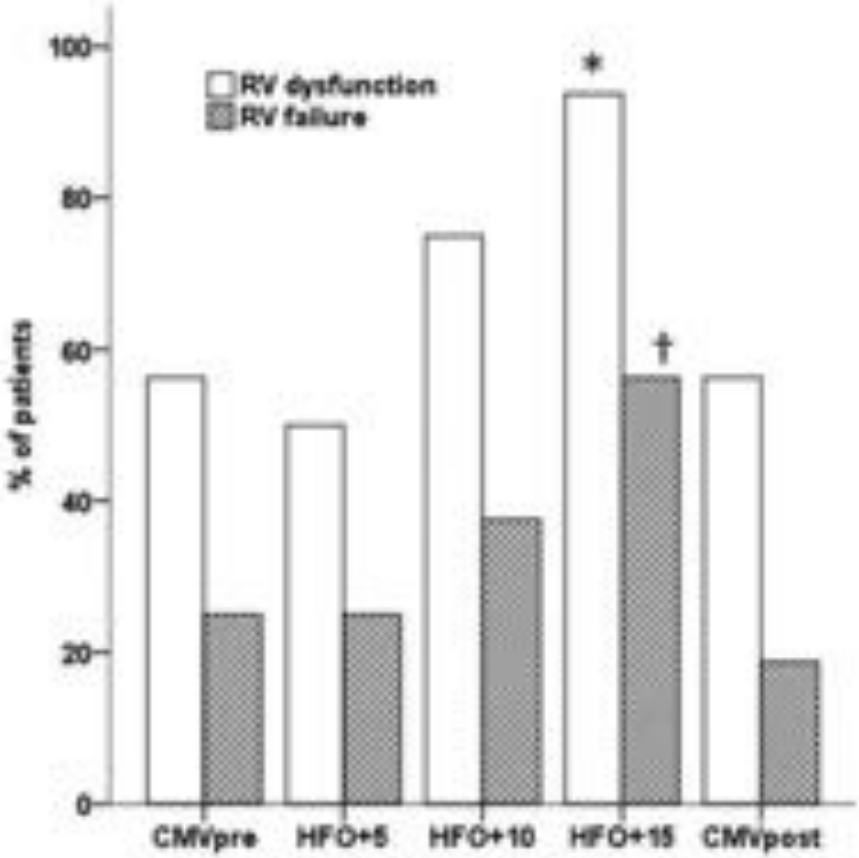
Outcome	HFOV Group (N = 275)	Control Group (N = 273)	Relative Risk (95% CI)	P Value
Death in hospital — no. (%)	129 (47)	96 (35)	1.33 (1.09–1.64)	0.005
Death in intensive care unit — no. (%)	123 (45)	84 (31)	1.45 (1.17–1.81)	0.001
Death before day 28 — no. (%)	111 (40)	78 (29)	1.41 (1.12–1.79)	0.004
New barotrauma — no./total no. (%)*	46/256 (18)	34/259 (13)	1.37 (0.91–2.06)	0.13
New tracheostomy — no./total no. (%)†	59/273 (22)	66/267 (25)	0.87 (0.64–1.19)	0.39
Refractory hypoxemia — no. (%)	19 (7)	38 (14)	0.50 (0.29–0.84)	0.007
Death after refractory hypoxemia — no./total no. (%)	15/19 (79)	25/38 (66)	1.20 (0.87–1.66)	0.31

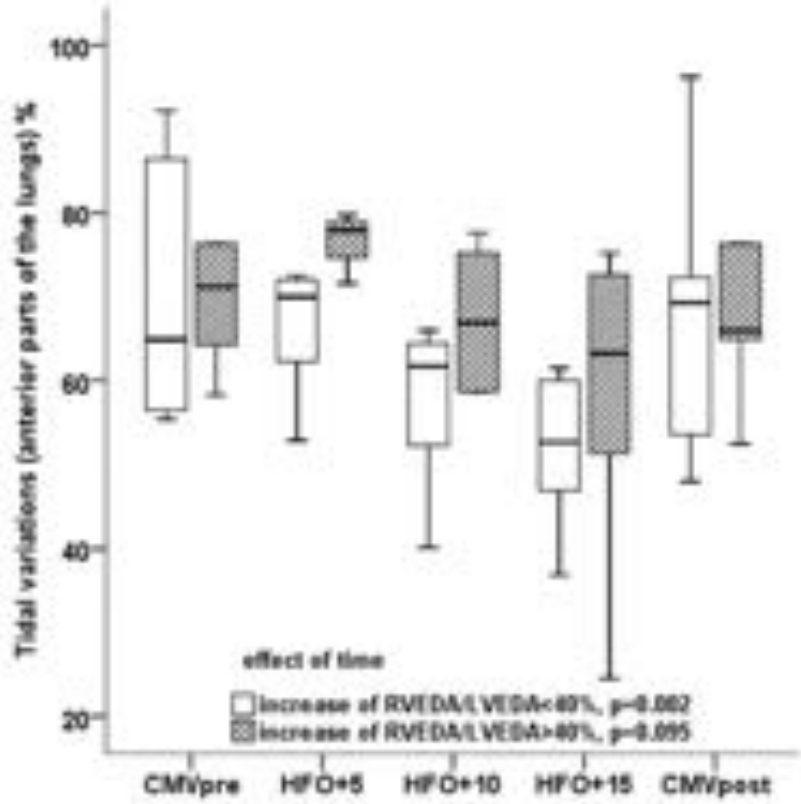
34 cross-over du groupe contrôle vers HFO

Right ventricular function during high-frequency oscillatory ventilation in adults with acute respiratory distress syndrome

Christophe Guervilly, MD; Jean-Marie Forel, MD; Sami Hraiech, MD; Didier Demory, MD; Jérome Allardet-Servent, MD; Mélanie Adda, MD; Karine Barreau-Baumstark, MD; Matthias Castanier, MD; Laurent Papazian, MD, PhD; Antoine Roch, MD, PhD

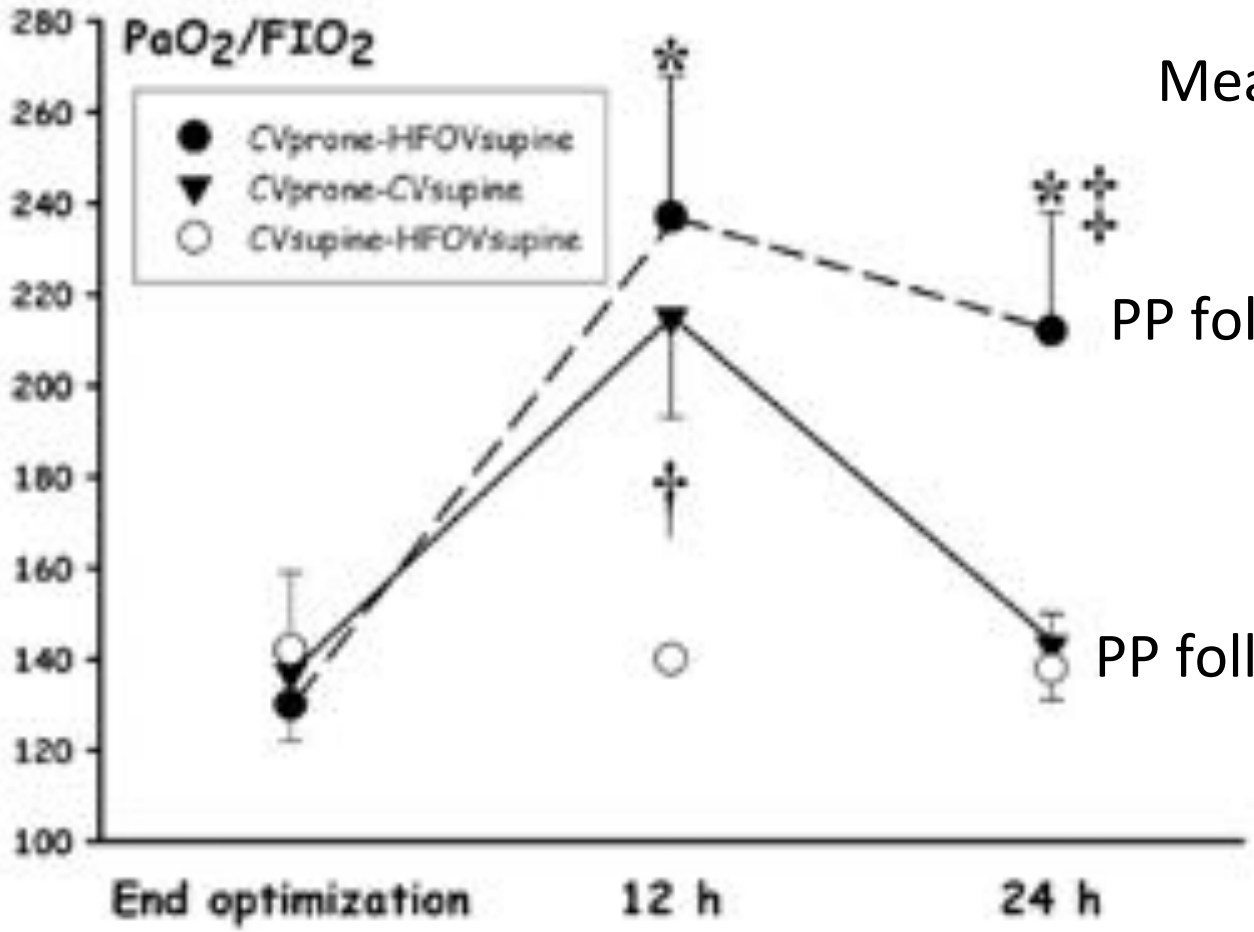
Crit Care Med 2012; 40:1539–1545





High-frequency oscillatory ventilation following prone positioning prevents a further impairment in oxygenation*

Crit Care Med 2007; 35:106–111



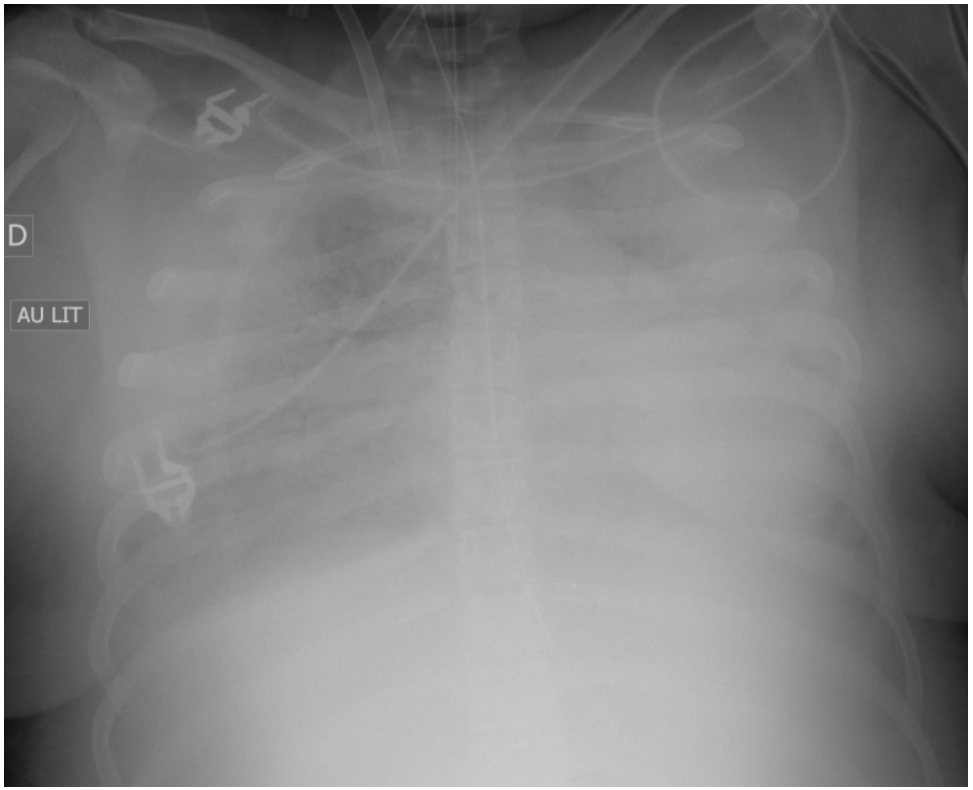
Mean Paw = 25

PP followed byHFO

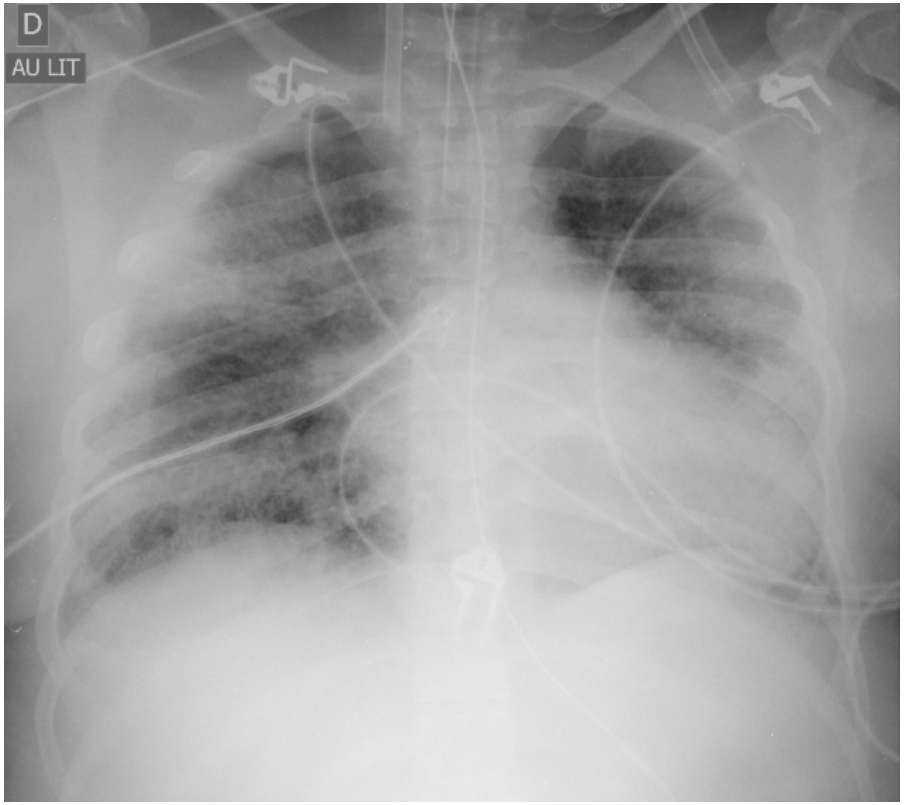
PP followed by CMV

ECMO + HFO

Fat embolism, day 2 of ECMO



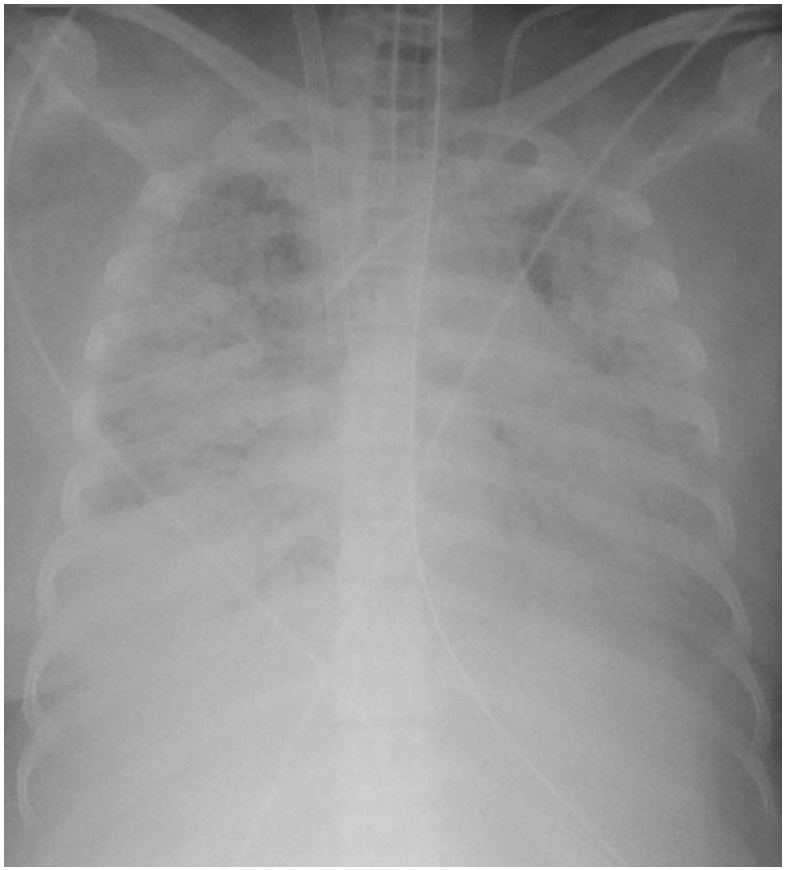
Day 3 of ECMO and HFO



ECMO weaned on day 9

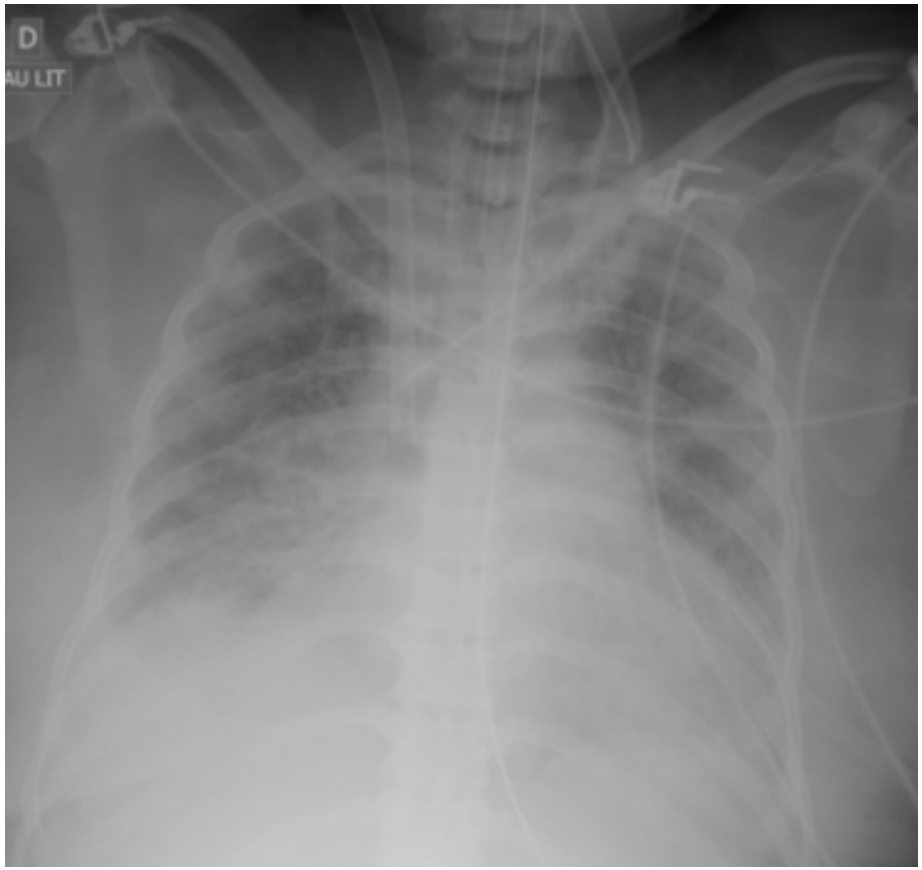
ECMO+HFO+PP

Burn + VAP – day 15 of ECMO



Fi02 0.9 – PEP 17- compliance 4 ml/cmH20

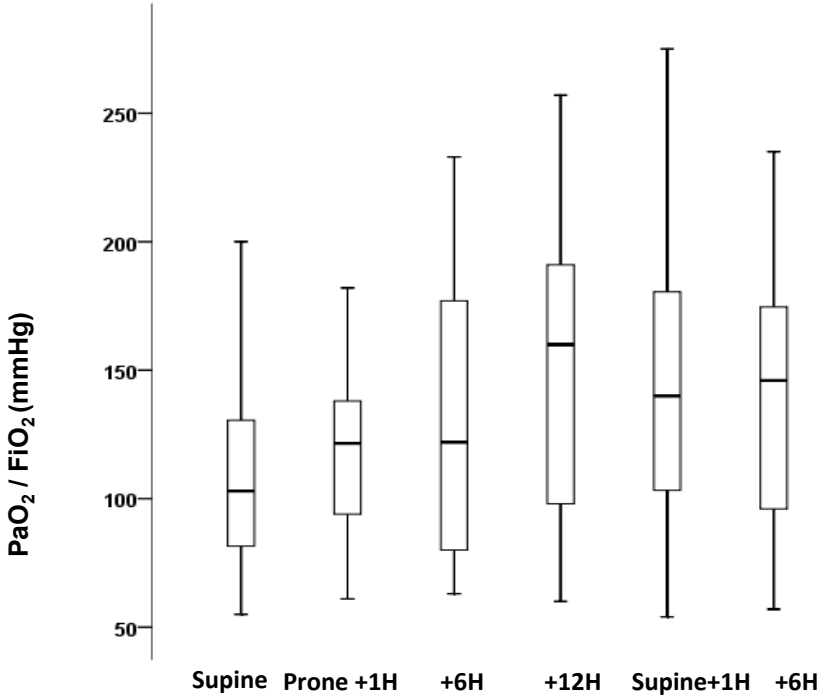
After 2 days of HFO+PP



Fi02 0.4 – FDO2 1-mean Paw 25

DV sous ECMO

- Nos indications actuelles:
  - Hypoxémie profonde sous ECMO
  - Pplat > 32
  - Sevrage ECMO impossible vers J10
- 15 patients traités, 21 séances



Under revision