Ventilation invasive en médecine d'urgence

Ne pas trop mettre la pression

Dr Nicolas Marjanovic, Praticien Hospitalier
Urgences adultes – SAMU 86 – CHU de Poitiers
CIC 1402 – ALIVe – Acute Lung Injury and VEntilatory support
n.marjanovic@chu-poitiers.fr – nicolas.marjanovic@univ-poitiers.fr

Conflits d'intérêt

- **Fisher and Paykel**.
  Symposiums nationaux et internationaux.

- **Airliquide healthcare**.
  Financement de congrès.

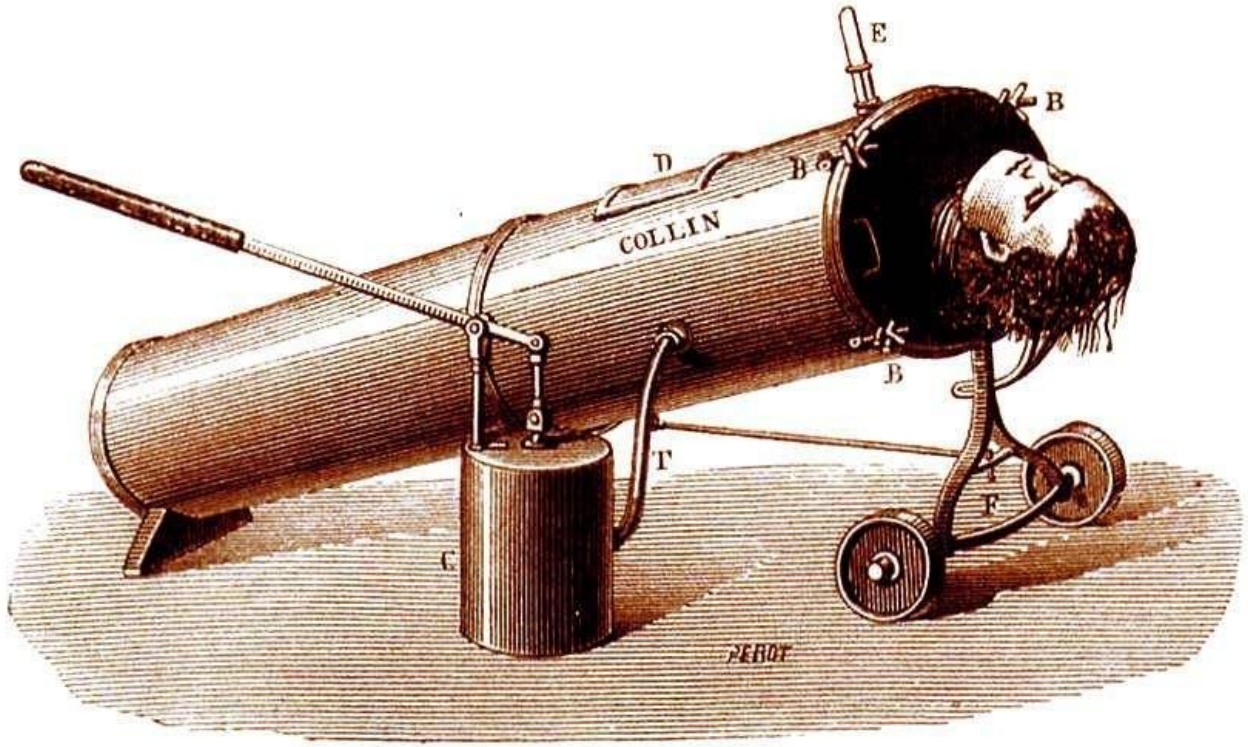
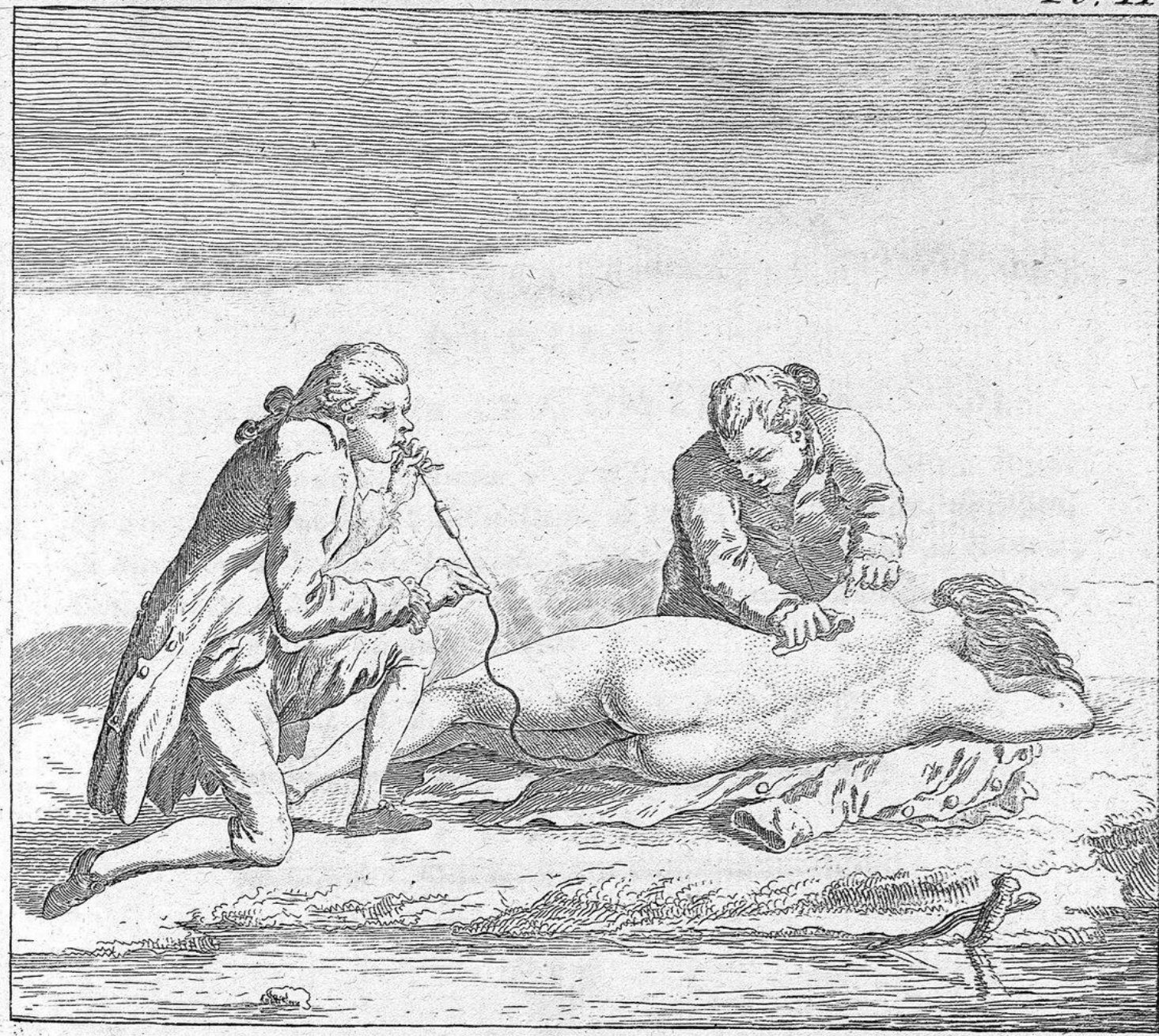

E
B
D
B
COLLIN
B
T
F
C
PERROT

FIG. 2.


monnal T60
00:22:22
FiO2
40
VTe
480
15
30
28
7.2
100% O2
トレンド
180°
メニュー
ホーム
AVCV
成人
XL touchpad


Modes
ASV
14
12.9
482
26
Controls
Alarms
Monitoring
Utilities
Events
System
HAMILTON·T1
HAMILTON MEDICAL



- Se suppléer à la ventilation spontanée en cas de détresse respiratoire aigue ou de coma quel que soit la cause.

Ventilation aux urgences

250000 patients chaque année aux US

En France ?

La ventilation aux urgences, c’est simple !

500 : 12 - PEEP 5 - FiO2 100%

Managing Initial Mechanical Ventilation in the Emergency Department

Scott D. Weingart, MD*

*Corresponding Author. E-mail: scottweingart@gmail.com, Twitter: @emcrit.

Table 2. Summary table for the 2 ventilator strategies.

	Lung Protective Strategy
Mode	Volume assist control
Tidal volume	Start at 8 mL/kg PBW; adjust for plateau pressure goal
Inspiratory flow rate	Start at 60 L/min; adjust for comfort
Respiratory rate	Start at 16 breaths/min; adjust for $PaCO_2$ goal
PEEP	Start at 5 cm H_2O; adjust according to table
FiO_2	Start at 40%; adjust according to table
Check for safety	Measure plateau pressure. If ≥30 cm H_2O, decrease tidal volume by 1 mL/kg
	If plateau pressure ≥30 cm H_2O or flow/time graph shows incomplete expiration, decrease respiratory rate

PBW, Predicted body weight; *pt*, patient.

- **Vt 8 mL/kg PIT, adapté à la Pplat**
- **PEEP 5 cmH_2O**
- **Pplat < 30 cmH_2O**
- **FiO_2 40%**

Ventilation protectrice pour tout le monde !

MAUVAISE EXCUSE N°1

Mes patients aux urgences n’ont pas de SDRA

La ventilation protectrice, c’est pour les SDRA

ONLINE FIRST

Acute Respiratory Distress Syndrome
The Berlin Definition

The ARDS Definition Task Force*

The acute respiratory distress syndrome (ARDS) was defined in 1994 by the American-European Consensus Conference (AECC); since then, issues regarding the reliability and validity of this definition have emerged. Using a consensus process, a panel of experts convened in 2011 (an initiative of the European Society of Intensive Care Medicine endorsed by the American Thoracic Society and the Society of Critical Care Medicine) developed the Berlin Definition, focusing on feasibility, reliability, validity, and objective evaluation of its performance. A draft definition proposed 3 mutually exclusive categories of ARDS based on degree of hypoxemia: mild (200 mm Hg < Pao_2/Fio_2 ≤ 300 mm Hg), moderate (100 mm Hg < Pao_2/Fio_2 ≤ 200 mm Hg), and severe (Pao_2/Fio_2 ≤ 100 mm Hg) and 4 ancillary variables for severe ARDS: radiographic severity, respiratory system compliance (≤40 mL/cm H_2O), positive end-expiratory pressure (≥10 cm H_2O), and corrected expired volume per minute (≥10 L/min). The draft Berlin Definition was empirically evaluated using patient-level meta-analysis of 4188 patients with ARDS from 4 multicenter clinical data sets and 269 patients with ARDS from 3 single-center data sets containing physiologic information. The 4 ancillary variables did not contribute to the predictive validity of severe ARDS for mortality and were removed from the definition. Using the Berlin Definition, stages of mild, moderate, and severe ARDS were associated with increased mortality (27%; 95% CI, 24%-30%; 32%; 95% CI, 29%-34%; and 45%; 95% CI, 42%-48%, respectively; *P* < .001) and increased median duration of mechanical ventilation in survivors (5 days; interquartile [IQR], 2-11; 7 days; IQR, 4-14; and 9 days; IQR, 5-17, respectively; *P* < .001). Compared with the AECC definition, the final Berlin Definition had better predictive validity for mortality, with an area under the receiver operating curve of 0.577 (95% CI, 0.561-0.593) vs 0.536 (95% CI, 0.520-0.553; *P* < .001). This updated and revised Berlin Definition for ARDS addresses a number of the limitations of the AECC definition. The approach of combining consensus discussions with empirical evaluation may serve as a model to create more accurate, evidence-based, critical illness syndrome definitions and to better inform clinical care, research, and health services planning.

JAMA. 2012;307(23):2526-2533
Published online May 21, 2012. doi:10.1001/jama.2012.5669 www.jama.com

VALID AND RELIABLE DEFINITIONS are essential to conduct epidemiological studies successfully and to facilitate enrollment of a consistent patient phenotype into clinical trials.[1] Clinicians also need such definitions to implement the results of clinical trials, discuss prognosis with families, and plan resource allocation.

Following the initial description of acute respiratory distress syndrome (ARDS) by Ashbaugh et al[2] in 1967, multiple definitions were proposed and used until the 1994 publication of the American-European Consensus Conference (AECC) definition.[3] The AECC defined ARDS as the acute onset of hypoxemia (arterial partial pressure of oxygen to fraction of inspired oxygen [Pao_2/Fio_2] ≤ 200 mm Hg) with bilateral infiltrates on frontal chest radiograph, with no evidence of left atrial hypertension. A new overarching entity—acute lung injury (ALI)—was also described, using similar criteria but with less severe hypoxemia (Pao_2/Fio_2 ≤ 300 mm Hg).[3]

The AECC definition was widely adopted by clinical researchers and clinicians and has advanced the knowledge of ARDS by allowing the acquisition of clinical and epidemiological data, which in turn have led to improvements in the ability to care for patients with ARDS. However, after 18 years of applied research, a number of issues regarding various criteria of the AECC definition have emerged, including a lack of explicit criteria for defining acute, sensitivity of Pao_2/Fio_2 to different ventilator settings, poor reliability of the chest radiograph criterion, and difficulties distinguishing hydrostatic edema (TABLE 1).[4]

For editorial comment see p 2542.

*Authors/Writing Committee and the Members of the ARDS Definition Task Force are listed at the end of this article.
Corresponding Author: Gordon D. Rubenfeld, MD, MSc, Program in Trauma, Emergency, and Critical Care, Sunnybrook Health Sciences Center, 2075 Bayview Ave, Toronto, ON M4N 3M5, Canada (gordon.rubenfeld@sunnybrook.ca).

Définition de Berlin, 2012

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

Abbreviations: CPAP, continuous positive airway pressure; Fio_2, fraction of inspired oxygen; Pao_2, partial pressure of arterial oxygen; PEEP, positive end-expiratory pressure.
[a] Chest radiograph or computed tomography scan.
[b] If altitude is higher than 1000 m, the correction factor should be calculated as follows: [Pao_2/Fio_2 × (barometric pressure/760)].
[c] This may be delivered noninvasively in the mild acute respiratory distress syndrome group.

The New England
Journal of Medicine

VOLUME 342 MAY 4, 2000 NUMBER 18

Avant 2000, le concept de traitement s'articulait autour du VT de 10-15 mL/kg

Mortalité – 9%

VENTILATION WITH LOWER TIDAL VOLUMES AS COMPARED WITH TRADITIONAL TIDAL VOLUMES FOR ACUTE LUNG INJURY AND THE ACUTE RESPIRATORY DISTRESS SYNDROME

THE ACUTE RESPIRATORY DISTRESS SYNDROME NETWORK*

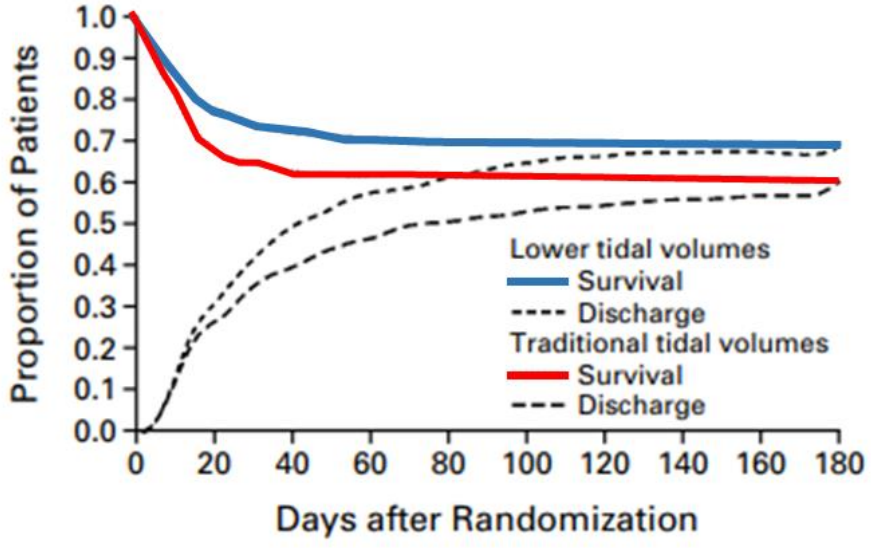


Figure 1. Probability of Survival and of Being Discharged Home and Breathing without Assistance during the First 180 Days after Randomization in Patients with Acute Lung Injury and the Acute Respiratory Distress Syndrome.

The status at 180 days or at the end of the study was known for all but nine patients. Data on these 9 patients and on 22 additional patients who were hospitalized at the time of the fourth interim analysis were censored.

TABLE 4. MAIN OUTCOME VARIABLES.*

VARIABLE	GROUP RECEIVING LOWER TIDAL VOLUMES	GROUP RECEIVING TRADITIONAL TIDAL VOLUMES	P VALUE
Death before discharge home and breathing without assistance (%)	31.0	39.8	0.007
Breathing without assistance by day 28 (%)	65.7	55.0	<0.001
No. of ventilator-free days, days 1 to 28	12±11	10±11	0.007
Barotrauma, days 1 to 28 (%)	10	11	0.43
No. of days without failure of nonpulmonary organs or systems, days 1 to 28	15±11	12±11	0.006

*Plus–minus values are means ±SD. The number of ventilator-free days is the mean number of days from day 1 to day 28 on which the patient had been breathing without assistance for at least 48 consecutive hours. Barotrauma was defined as any new pneumothorax, pneumomediastinum, or subcutaneous emphysema, or a pneumatocele that was more than 2 cm in diameter. Organ and system failures were defined as described in the Methods section.

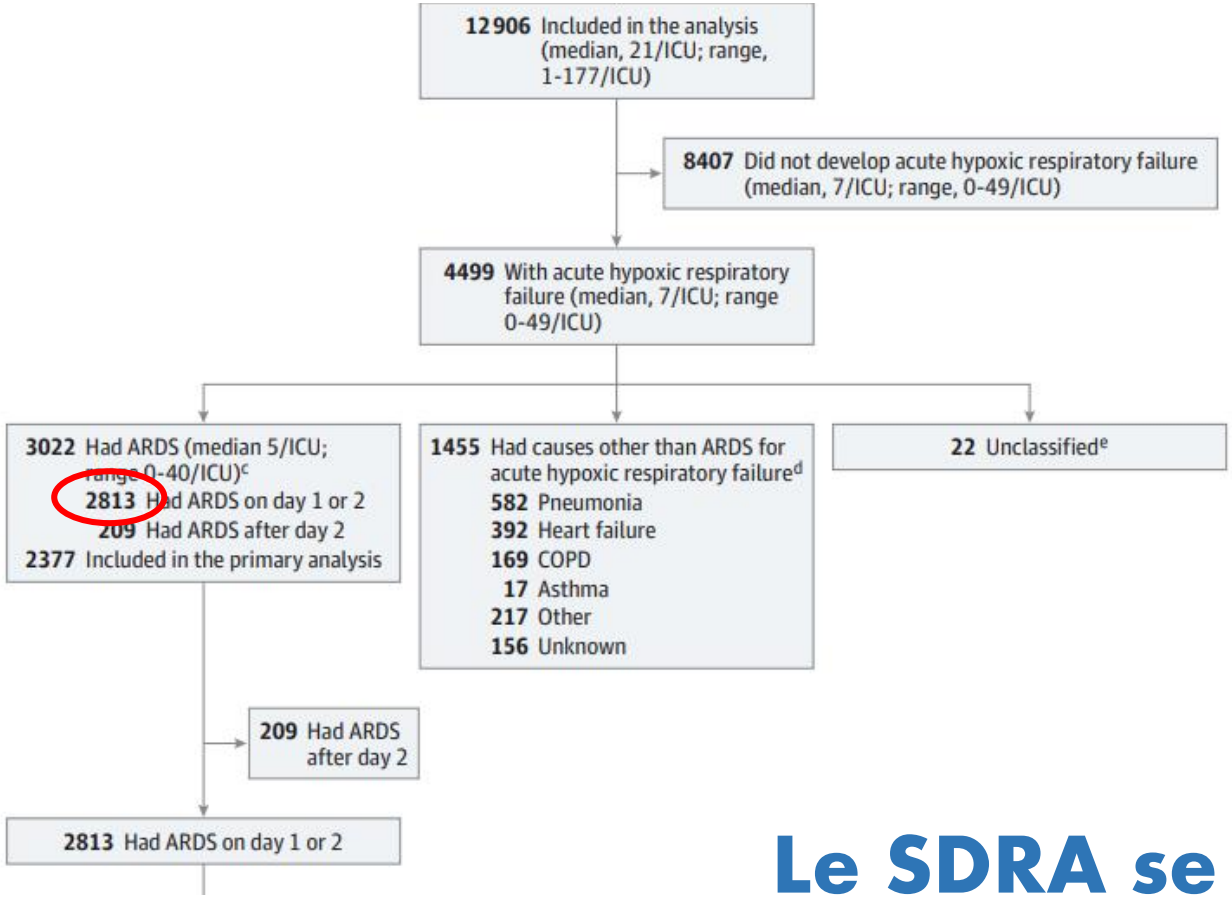
Le SDRA est un problème de réanimateur.

Le SDRA est un problème de réanimateur.
SAUF QUE…

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

Giacomo Bellani, MD, PhD; John G. Laffey, MD, MA; Tài Pham, MD; Eddy Fan, MD, PhD; Laurent Brochard, MD, HDR; Andres Esteban, MD, PhD; Luciano Gattinoni, MD, FRCP; Frank van Haren, MD, PhD; Anders Larsson, MD, PhD; Daniel F. McAuley, MD, PhD; Marco Ranieri, MD; Gordon Rubenfeld, MD, MSc; B. Taylor Thompson, MD, PhD; Hermann Wrigge, MD, PhD; Arthur S. Slutsky, MD, MASc; Antonio Pesenti, MD; for the LUNG SAFE Investigators and the ESICM Trials Group



Etude LUNGSAFE. ***Bellani et al.***
Cohorte internationale - 13000 patients
Patients sous VM en ICU

22% avec **SDRA** à 48h
62% des insuffisances respiratoires aigues

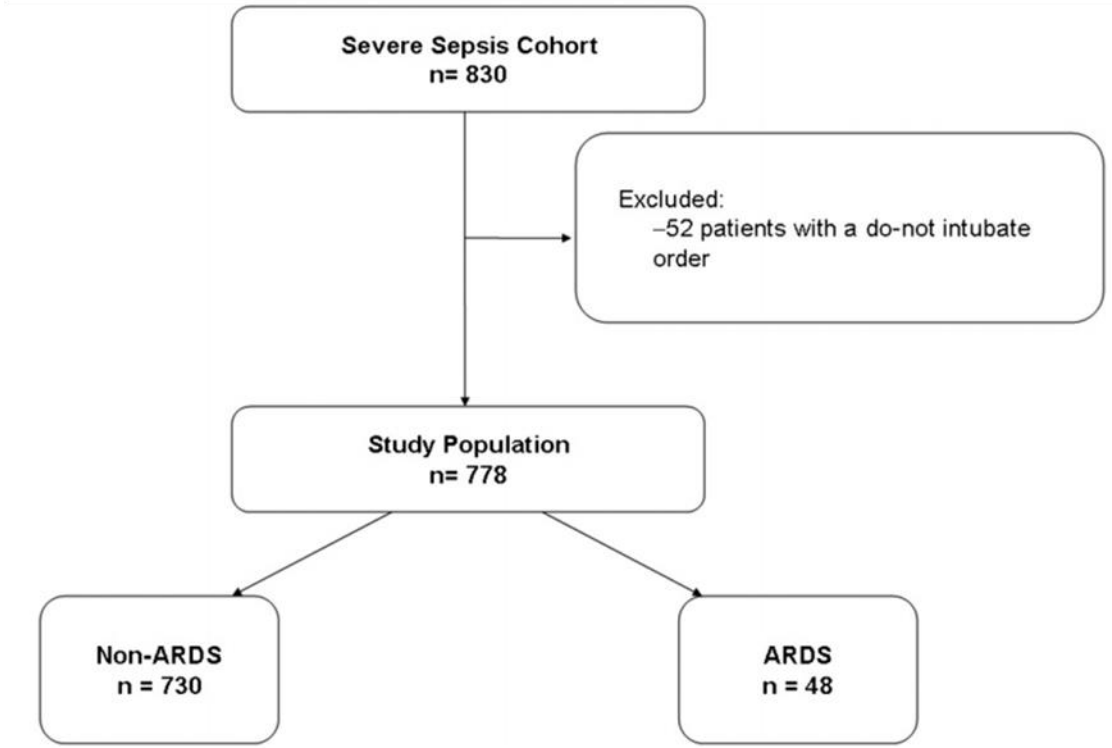
- Patients de réanimation
- Origine autre que les urgences (BO – USC – Services)

Le SDRA se développe rapidement

SHOCK, Vol. 40, No. 5, pp. 375–381, 2013

THE EPIDEMIOLOGY OF ACUTE RESPIRATORY DISTRESS SYNDROME IN PATIENTS PRESENTING TO THE EMERGENCY DEPARTMENT WITH SEVERE SEPSIS

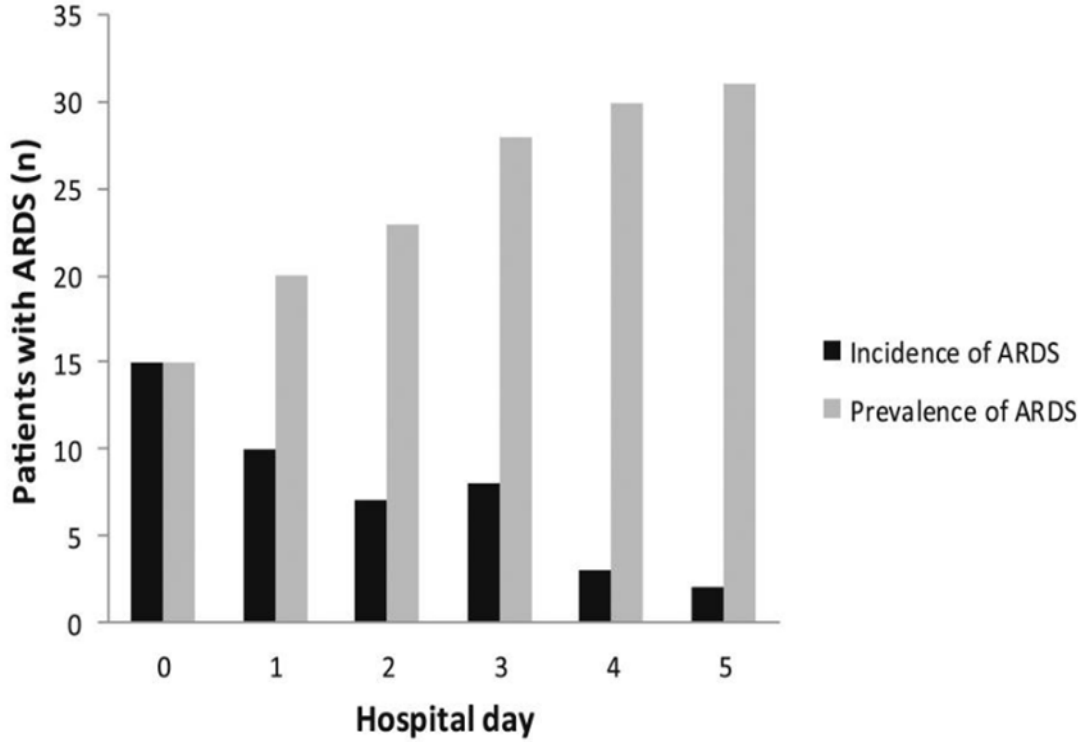
Mark E. Mikkelsen,*† Chirag V. Shah,‡§ Nuala J. Meyer,* David F. Gaieski,‖ Sarah Lyon,* Andrea N. Miltiades,¶ Munish Goyal,#** Barry D. Fuchs,* Scarlett L. Bellamy,† and Jason D. Christie*†



Mechanical Ventilation and ARDS in the ED

A Multicenter, Observational, Prospective, Cross-sectional Study

Brian M. Fuller, MD; Nicholas M. Mohr, MD; Christopher N. Miller, MD; Andrew R. Deitchman, MD; Brian J. Levine, MD; Nicole Castagno, MS; Elizabeth C. Hassebroek, MD; Adam Dhedhi, BA; Nicholas Scott-Wittenborn, BA; Edward Grace; Courtney Lehew, MD; and Marin H. Kollef, MD, FCCP



5 à 15% des patients sous VM aux urgences ont déjà des critères de SDRA aux EDs

Determann *et al. Critical Care* 2010, **14**:R1
http://ccforum.com/content/14/1/R1

CRITICAL CARE

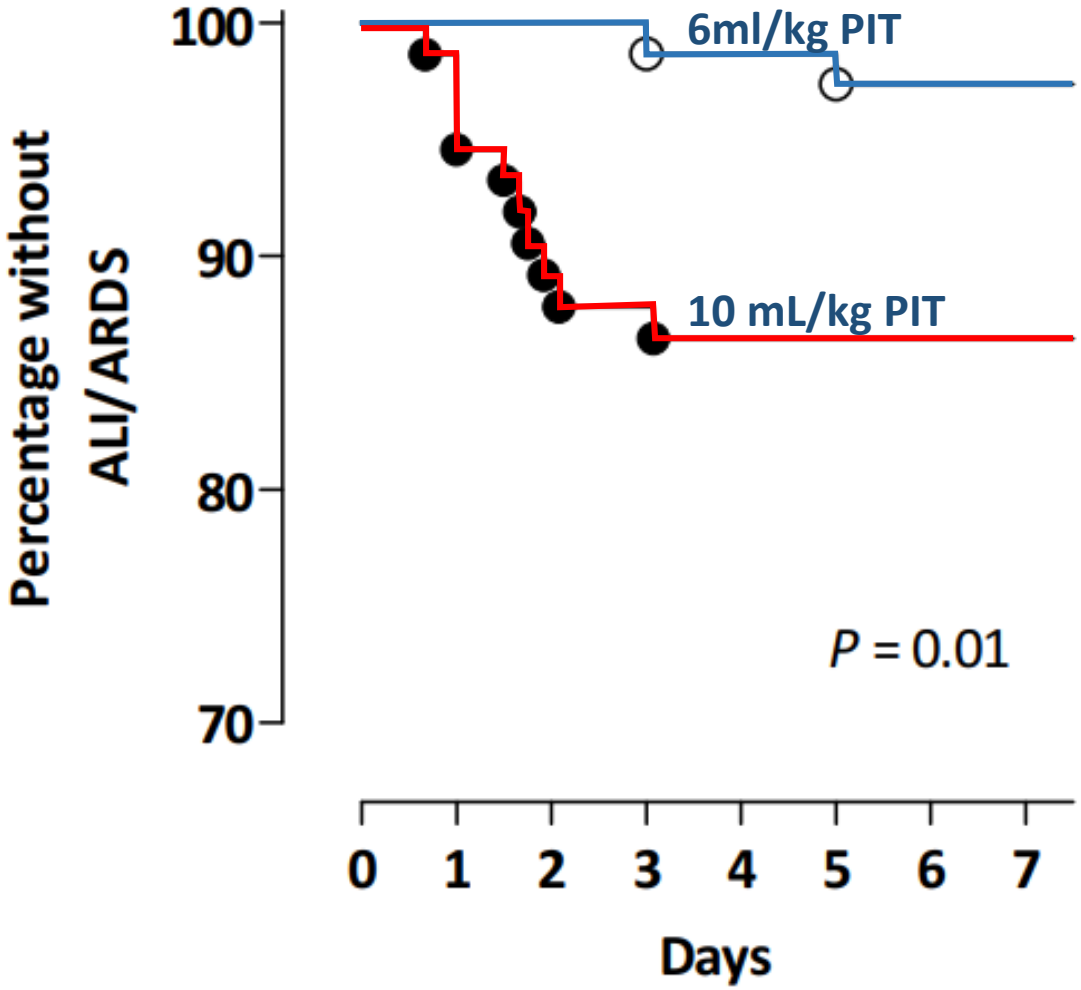
RESEARCH Open Access

Ventilation with lower tidal volumes as compared with conventional tidal volumes for patients without acute lung injury: a preventive randomized controlled trial

Rogier M Determann[1,2], Annick Royakkers[3,4], Esther K Wolthuis[1,5], Alexander P Vlaar[1], Goda Choi[1,2], Frederique Paulus[1], Jorrit-Jan Hofstra[1,4], Mart J de Graaff[1], Johanna C Korevaar[6] and Marcus J Schultz*[1,7]

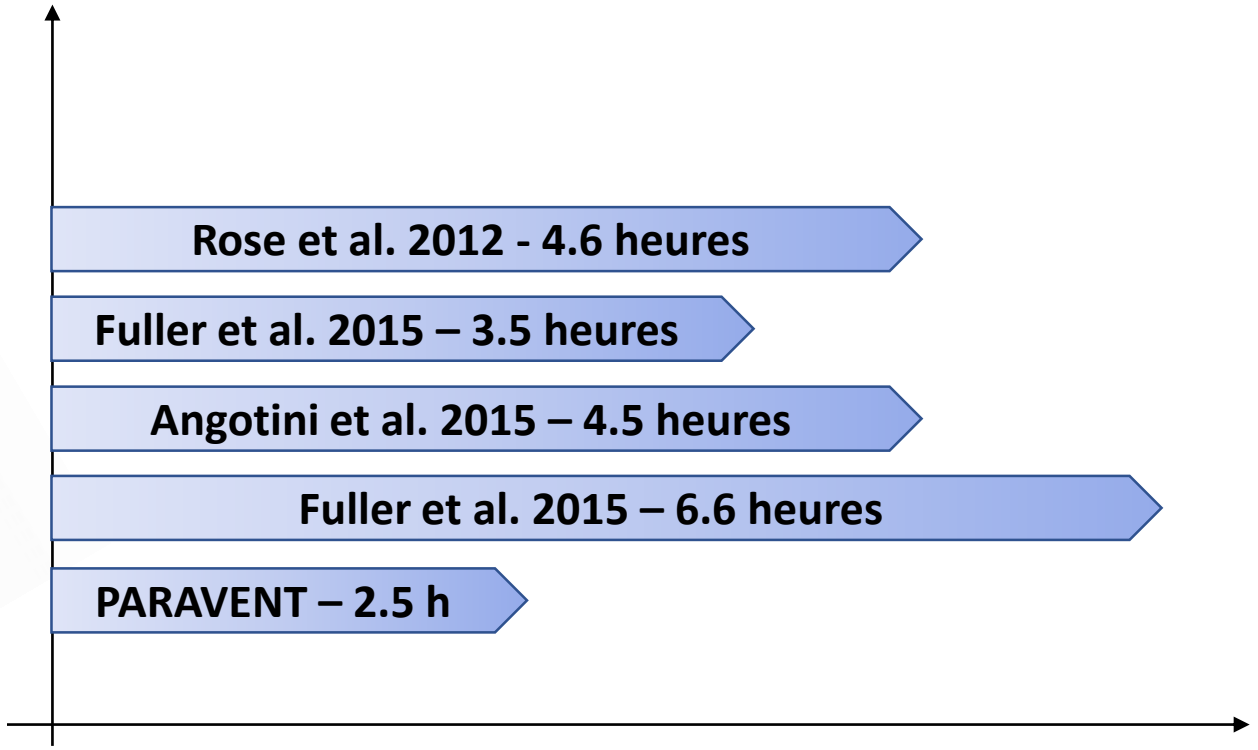
150 patients indemnes de SDRA en ICU

Incidence SDRA	
10 mL / kg	**6 mL/kg**
13,5%	**2,6%**



MAUVAISE EXCUSE N°2
Les patients sont transférés rapidement en réa

Durée de ventilation mécanique aux EDs

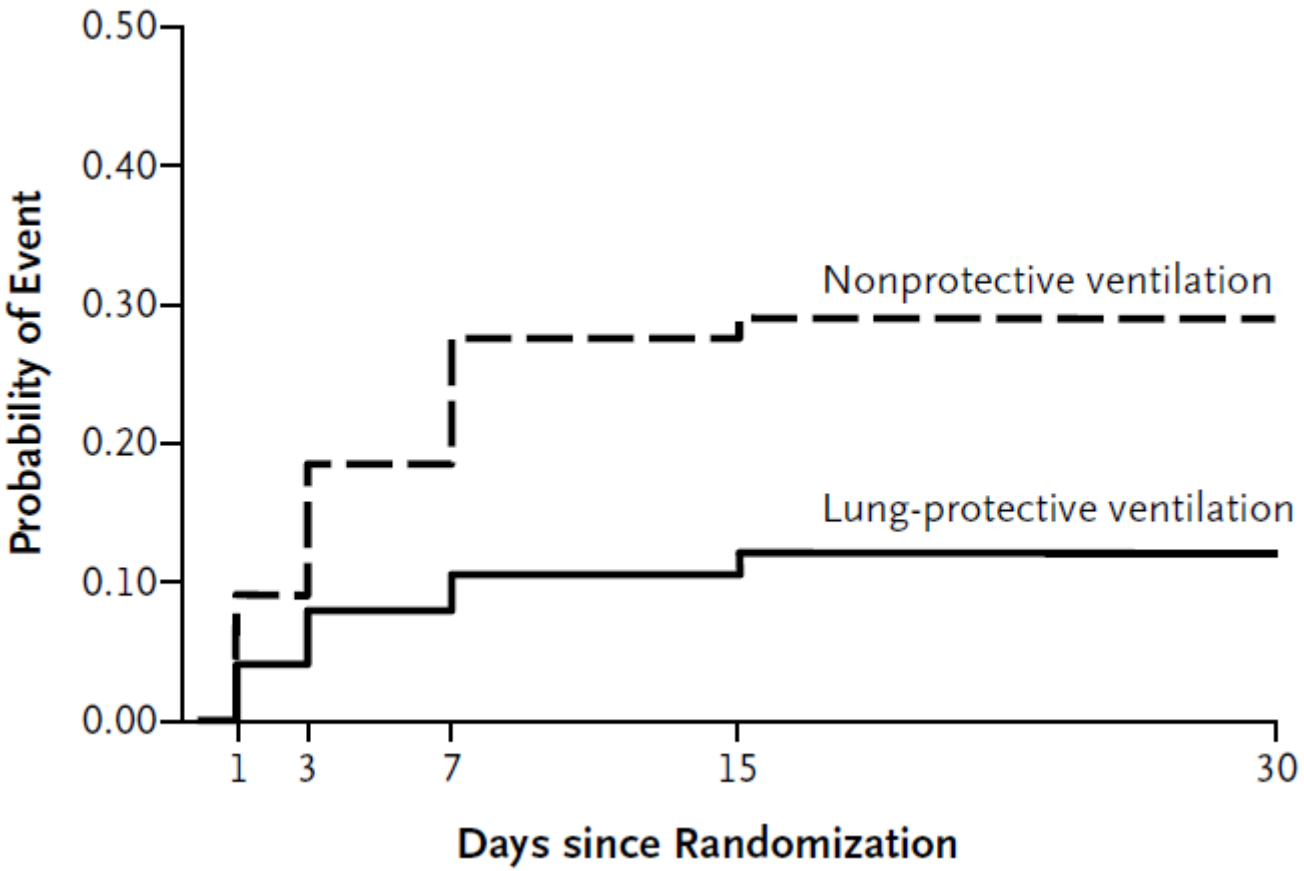


Etude IMPROVE. *Futier et al.*

Variable	Nonprotective Ventilation (N=200)	Lung-Protective Ventilation (N=200)	P Value
Tidal volume — ml	719.0±127.8	406.7±75.6	<0.001
Tidal volume — ml/kg of predicted body weight	11.1±1.1	6.4±0.8	<0.001
PEEP — cm of water			
Baseline			<0.001
Median	0	6	
Interquartile range	0–0	6–8	
End of surgery			<0.001
Median	0	6	
Interquartile range	0–0	6–8	
Duration of surgery — no./total no. (%)†			0.95
2–4 hr	76/192 (39.6)	75/195 (38.5)	
>4–6 hr	75/192 (39.1)	76/195 (39.0)	
>6 hr	41/192 (21.4)	44/195 (22.6)	
Duration of mechanical ventilation — min	344±127.9	319±139.4	0.84

- Ventilation protectrice au Bloc Opératoire
- Durée ventilation 5-6 heures

Etude IMPROVE. *Futier et al.*



- Complications respiratoires
  - atélectasie
  - pneumonie
  - pneumothorax
  - SDRA

  Incidence divisée par 2,6

- **Incidence SDRA divisée par 5,8**

MAUVAISE EXCUSE N°3
Aux urgences, on sait ventiler !

Mechanical Ventilation and Acute Lung Injury in Emergency Department Patients With Severe Sepsis and Septic Shock: An Observational Study

Brian M. Fuller, MD, Nicholas M. Mohr, MD, Matthew Dettmer, MD, Sarah Kennedy, MD, Kevin Cullison, MD, Rebecca Bavolek, MD, Nicholas Rathert, MD, and Craig McCammon, PharmD

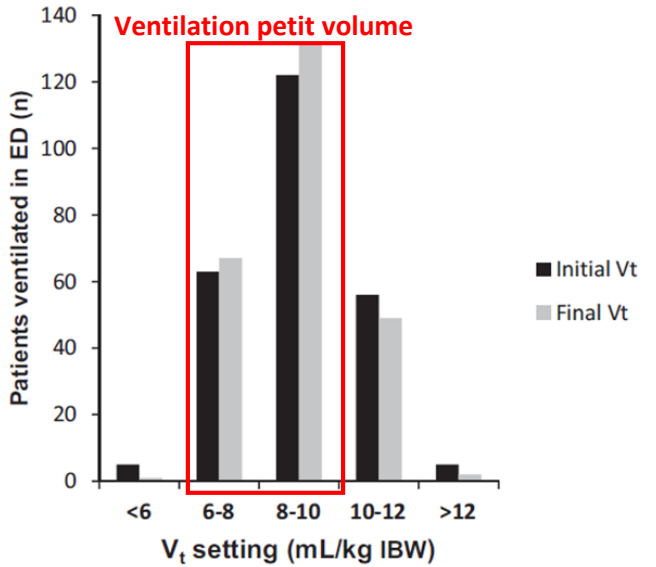


Figure 2. Delivered tidal volume in the ED. Of the 251 patients mechanically ventilated in the ED, 68 (27.1%) received lung-protective ventilation (<8 mL/kg IBW). Twenty-five patients (10.0%) had tidal volume adjusted while in the ED (*n* = 15, increase in tidal volume; *n* = 10, decrease in tidal volume). IBW = ideal body weight; V_t = tidal volume.

Fuller et al. 2013

VT 8,8mL/kg
PEEP 5 FiO2 95%
27% de ventilation protectrice

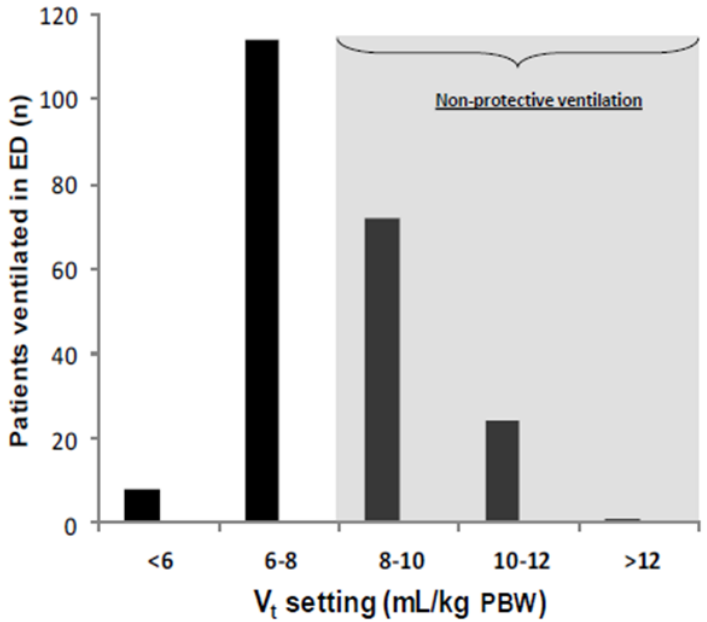
Fuller et al. 2015

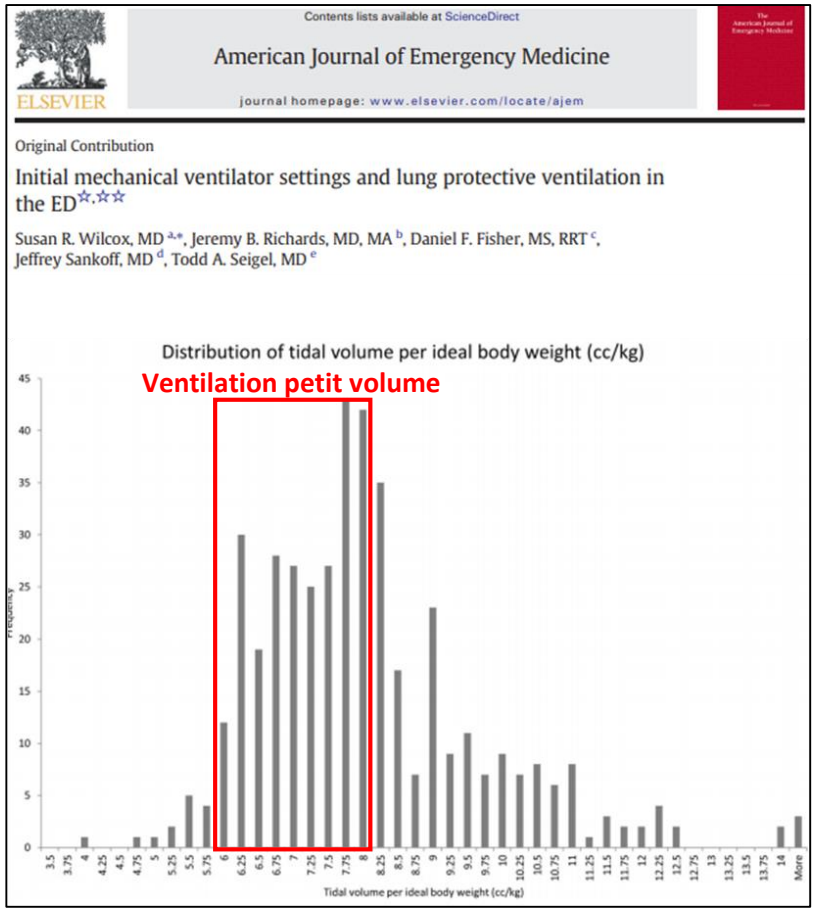
VT 7,6mL/kg
PEEP 5,3 FiO2 87%
60% de ventilation protectrice

Mechanical Ventilation and ARDS in the ED

A Multicenter, Observational, Prospective, Cross-sectional Study

Brian M. Fuller, MD; Nicholas M. Mohr, MD; Christopher N. Miller, MD; Andrew R. Deitchman, MD; Brian J. Levine, MD; Nicole Castagno, MS; Elizabeth C. Hassebroek, MD; Adam Dhedhi, BA; Nicholas Scott-Wittenborn, BA; Edward Grace; Courtney Lehew, MD; and Marin H. Kollef, MD, FCCP



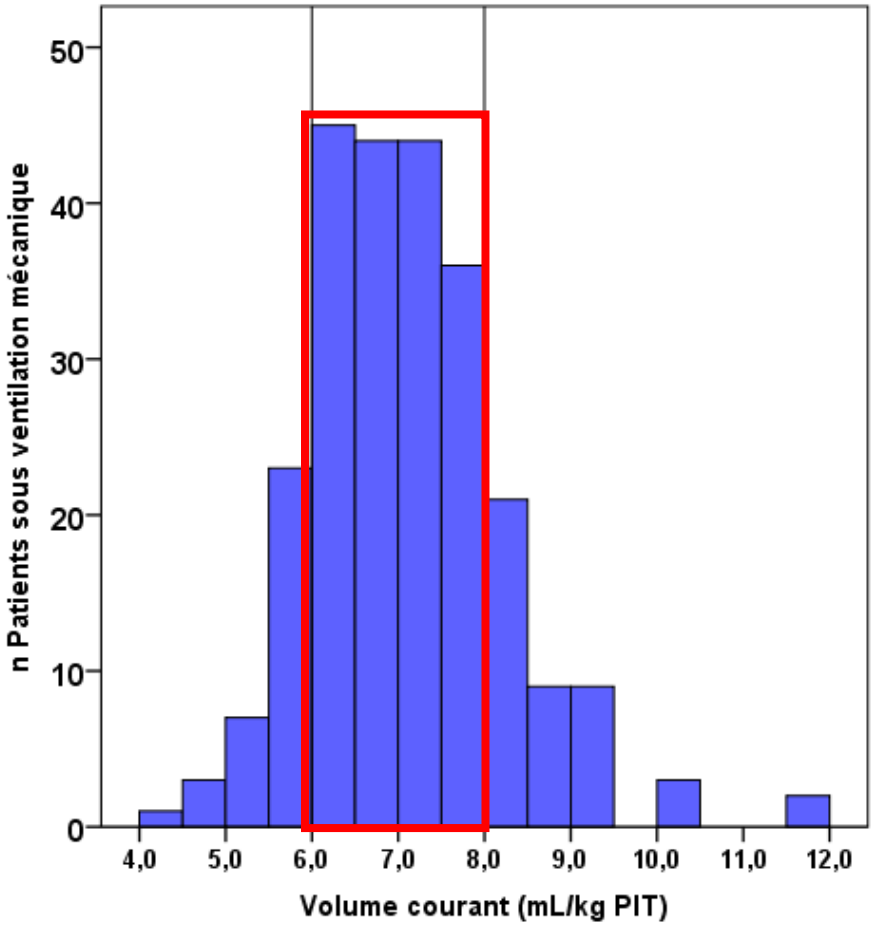


Wilcox et al. 2016

60% au-delà de 8 mL/kg
VT 8,7 mL/kg
PEEP 5 FiO2 87%

Données en France. Etude PARAVENT

Données en France. Etude PARAVENT



Ventilation protectrice 87% des patients

n	**250**
Age, années ; Moyenne±ECT	62±19
N, % homme	161 (64)
N, % femme	89 (36)
Taille, cm	168±10
Poids idéal théorique, kg	57±28
Indication de la VM, n(%)	
Défaillance respiratoire	116 (35%)
Défaillance hémodynamique	49 (15%)
Défaillance neurologique	146 (44%)
Paramètres ventilatoires	
VT, mL/kg PIT	7 [6.3-8.4]
Dont VT < 8mL/kg PIT	72%
Dont VT > 8 mL/kg PIT	13%
PEEP (cmH2O)	4 [3-5]
FiO2, %	71±25
Ratio I : E	1 : 2

MAUVAISE EXCUSE N°4
L’intérêt de la ventilation protectrice est limité aux urgences

FiO2 ?

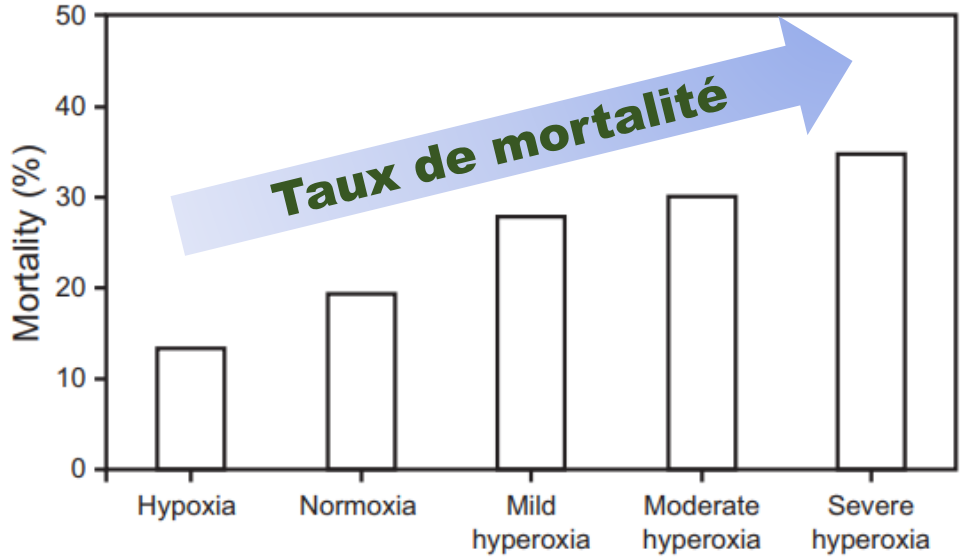
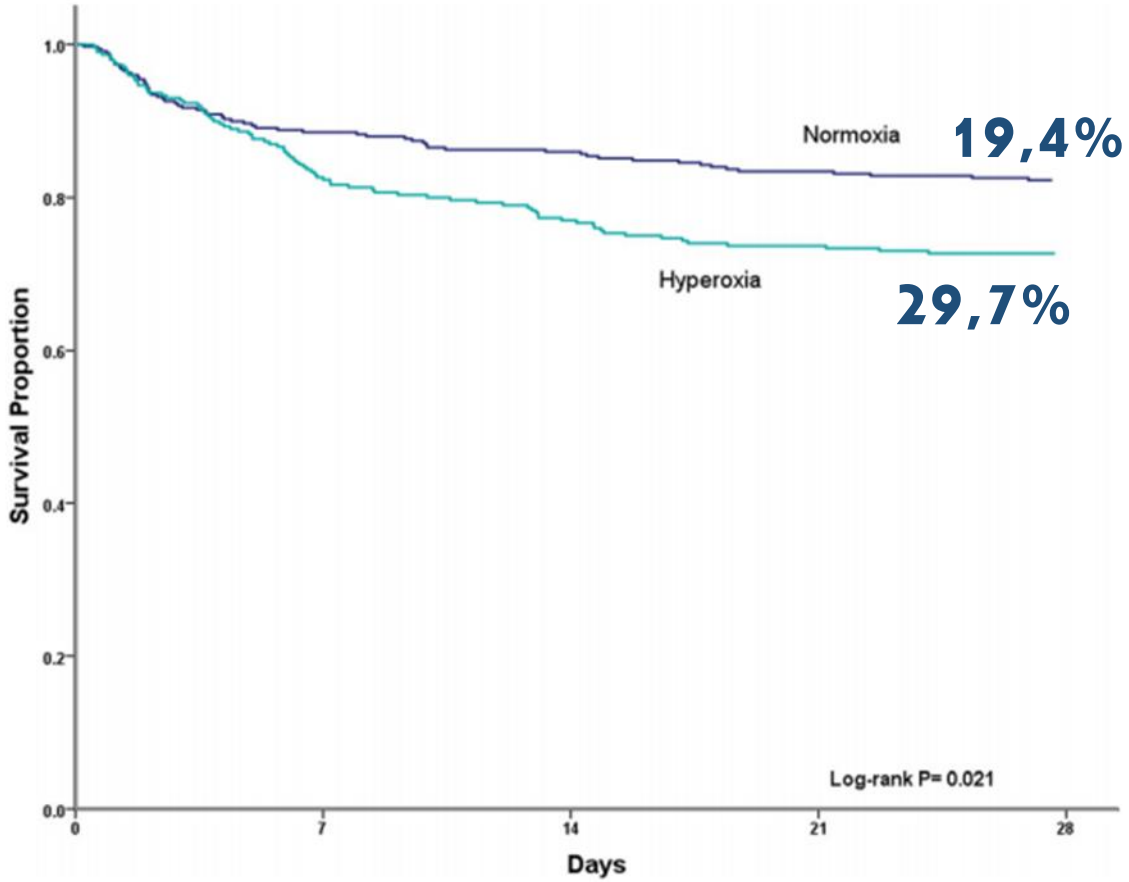


Fig. 2. Mortality across oxygenation subgroups. Hypoxia, P_{aO_2} < 60 mm Hg; normoxia, P_{aO_2} 60–120 mm Hg; mild hyperoxia, P_{aO_2} 121–200 mm Hg; moderate hyperoxia, P_{aO_2} 201–300 mm Hg; severe hyperoxia, P_{aO_2} >300 mm Hg. From Reference 7, with permission.

RESEARCH Open Access

Emergency department hyperoxia is associated with increased mortality in mechanically ventilated patients: a cohort study

David Page[3], Enyo Ablordeppey[1,2], Brian T. Wessman[1,2], Nicholas M. Mohr[4,5], Stephen Trzeciak[6,7], Marin H. Kollef[3], Brian W. Roberts[7] and Brian M. Fuller[1,2*]



PULMONARY/ORIGINAL RESEARCH

Lung-Protective Ventilation Initiated in the Emergency Department (LOV-ED): A Quasi-Experimental, Before-After Trial

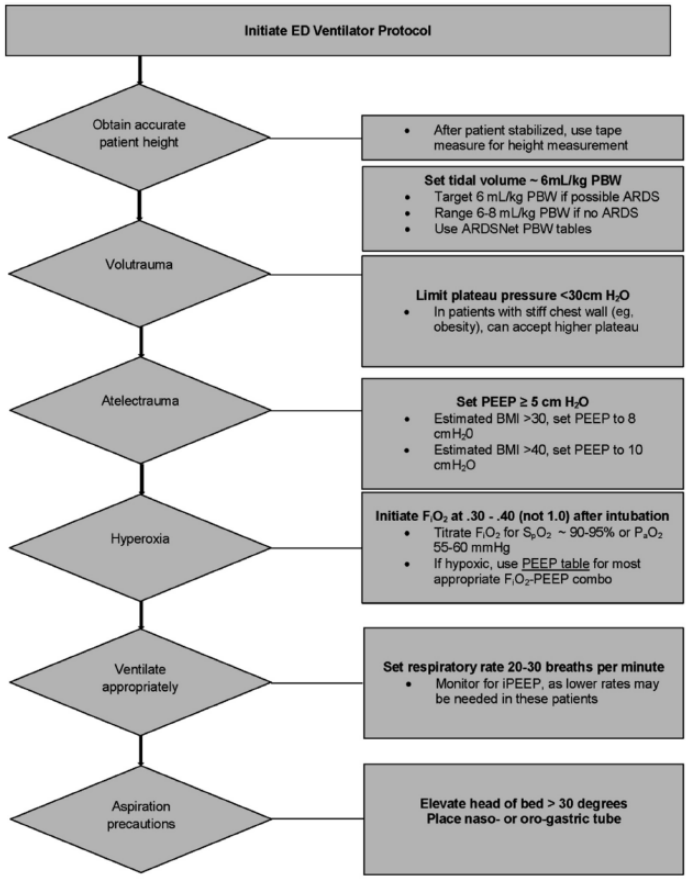
Brian M. Fuller, MD, MSCI*; Ian T. Ferguson, MPH; Nicholas M. Mohr, MD, MS; Anne M. Drewry, MD, MSCI; Christopher Palmer, MD; Brian T. Wessman, MD; Enyo Ablordeppey, MD, MPH; Jacob Keeperman, MD; Robert J. Stephens; Cristopher C. Briscoe; Angelina A. Kolomiets, BS; Richard S. Hotchkiss, MD; Marin H. Kollef, MD

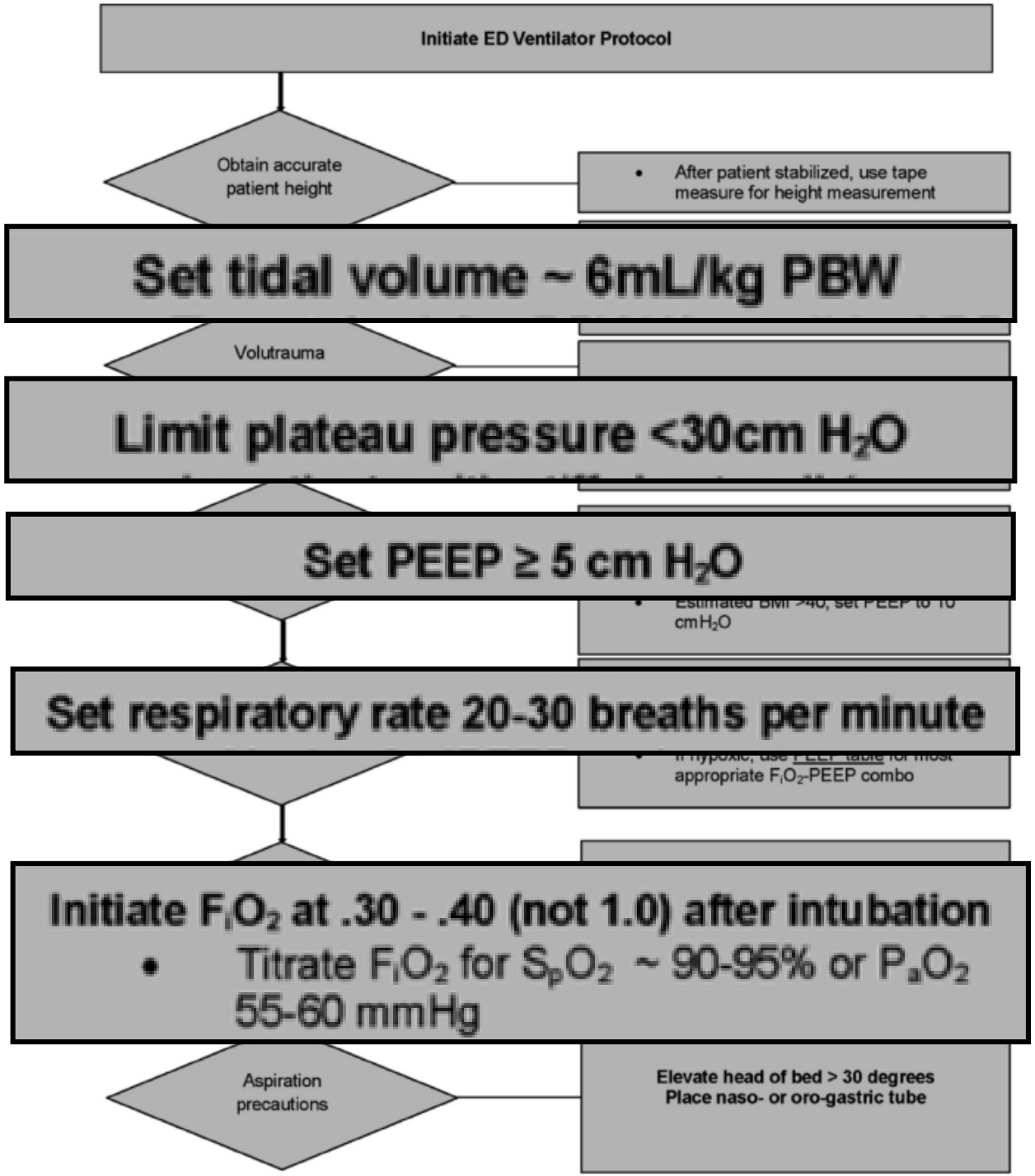
Etude LOV-ED – *Fuller et al.*

- Etude quasi-expérimentale Avant/après
- 1200 patients inclus
- 980 analysés après score de propension.

Critères de jugement

- Critère composite **ARDS et / ou VAC à J28**
- **Mortalité à J28**





Protocole de l'étude LOV-ED

- VT 6-8 mL/kg PIT
- Monitoring Pplat < 30 cmH2O
- PEEP > 5 cmH2O, adapté au BMI
- FiO2 30-40% - SpO2 cible 90-95%
- FR 20-30 cycles/minutes

Lung-Protective Ventilation Initiated in the Emergency Department (LOV-ED): A Quasi-Experimental, Before-After Trial

	Before Matching			After Matching		
	Preintervention	Intervention	OR or Between-	Preintervention	Intervention	aOR or Between-
	Preintervention Group (n=490)	**Intervention Group (n=490)**	**aOR or Between-Group Difference (95% CI)***			
Primary composite outcome						
ARDS VACs	71 (14.5)	36 (7.4)	0.47 (0.31 to 0.71)			
Mortality, No. (%)	167 (34.1)	96 (19.6)	0.47 (0.35 to 0.63)			

- **Incidence SDRA/VAC** Divisé par 2 en cas de Ventilation protectrice
- **Mortalité** -15% en cas de ventilation protectrice

Peut-être que la ventilation protectrice à un intérêt aux urgences, finalement.


CONCLUSION

1

Les patients ventilés aux urgences ont un risque important d'évoluer vers un SDRA
OU sont déjà en SDRA (5 à 15% des patients)

2

Les patients ventilés aux urgences sont ventilés plusieurs heures. Sans compter l'intervention du SMUR
Ce délai est suffisant pour entrainer des lésions pulmonaires.

3

La ventilation petit volume semble bien implantée dans les services d'urgence.

4

Une **ventilation protectrice précoce**, immédiate (VT 6-8 mL/kg; PEEP > 5; FiO2 30-40% ; FR 20-30) pour tous les patients est associé à une amélioration du pronostic.

5

Beaucoup d'études encore nécessaires.

1. VT 6-8 mL/kg de PIT
2. PEEP 5cmH2O (sauf obstructif)
3. FR 25-30 /min (adapter en fonction du débit et de l'EtCO2)
4. FiO2 30-40 %
5. Monitorer la PPlat

Des questions ?