Quand transférer un patient pour ECMO

Hadrien Winiszewski, François Belon, Gilles Capellier
Réanimation Médicale, CHRU Besançon 25000
UFR Santé, Hauts du Chazal, Besançon, BFC

Quand transférer un patient pour ECMO

JAMAIS !

- Pas de démonstration de l'intérêt
- Centres spécialisés
- Complications
- Coûts

Quand transférer un patient pour ECMO

Des critères simples

Des critères simples

- P/F < 50 -100 depuis …assez longtemps
- pH < 7,25 - $PaCO_2$ > 60 mmHg
- PEEP optimale
- Fistules broncho pleurales
- Cause réversible
- Pas de contre indication
- DV – Curares
- Balance hydrosodée


L'ARBRE QUI
CACHE
LA FORÊT

CONFERENCE REPORTS AND EXPERT PANEL

Personalized medicine for ARDS: the 2035 research agenda

Intensive Care Med (2016) 42:756–767
DOI 10.1007/s00134-016-4331-6

Jeremy R. Beitler[1*], Ewan C. Goligher[2], Matthieu Schmidt[3], Peter M. Spieth[4], Alberto Zanella[5], Ignacio Martin-Loeches[6], Carolyn S. Calfee[7], Alexandre B. Cavalcanti[8] and The ARDSne(x)t Investigators

Identify which patients require/benefit from extracorporeal support

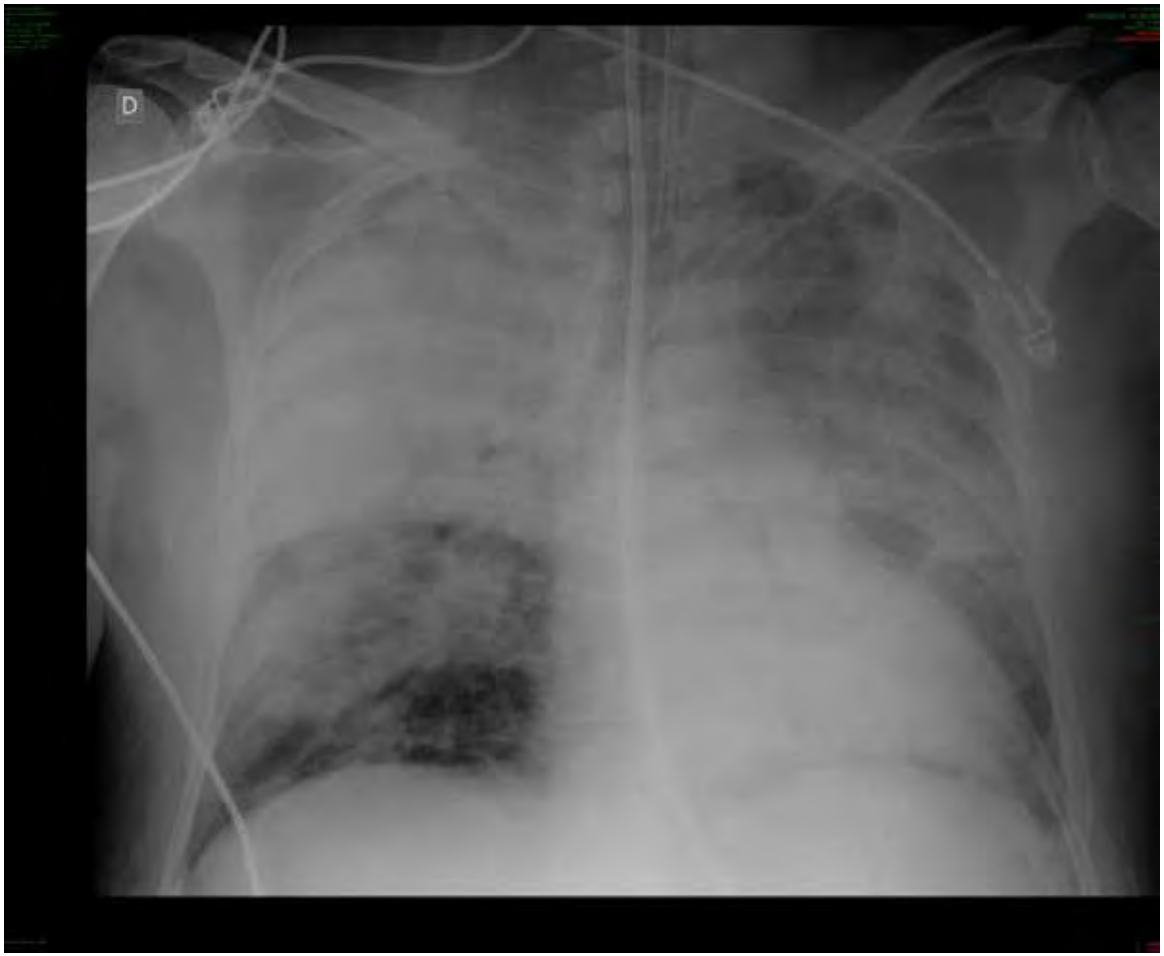
Extracorporeal support

Ventilator and anticogulation management

Criteria for initiation/weaning

En fait de multiples étapes lors de la prise en charge d'un SDRA

- Diagnostic
- Traitement
- Vivant / DCD
- Pronostic fonctionnel



En fait de multiples étapes avec l'admission d'un SDRA

- Reconnaitre le SDRA
- Prise en charge correcte
- Avoir suffisamment d'expérience
- Disposer des traitements adjuvants

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

40% des SDRA non reconnus
Diagnostic plus fréquent des formes graves (78%)
que les formes légères (51%)

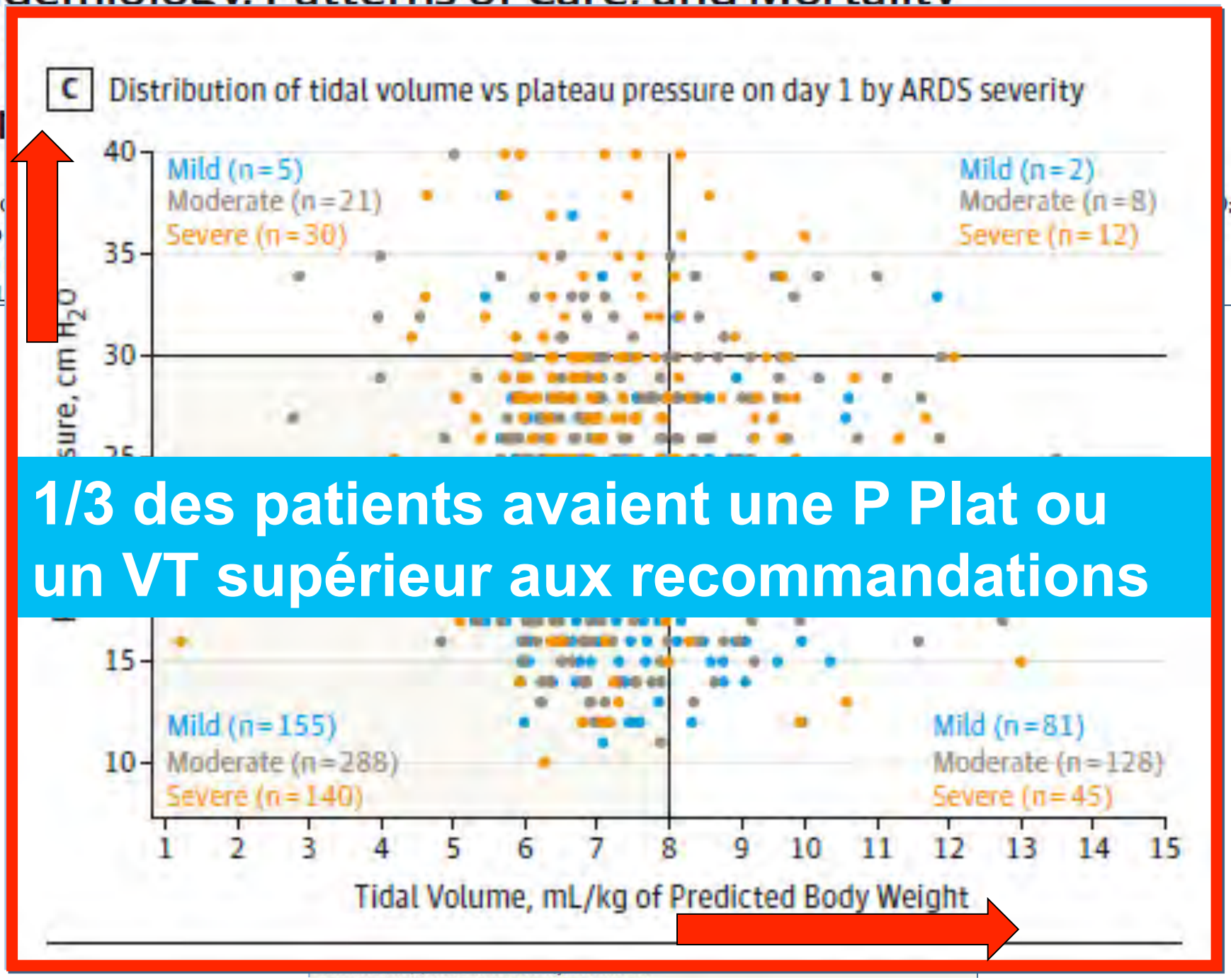
Recognition of ARDS

ARDS was underdiagnosed, with 60.2% of all patients with ARDS being clinician-recognized. Clinician recognition of ARDS ranged from 51.3% (95% CI, 47.5%-55.0%) for mild ARDS to 78.5% (95% CI, 74.8%-81.8%) for severe ARDS (eTable 4 in the Supplement). Clinician recognition of ARDS at the time of fulfillment of ARDS criteria was 34.0% (95% CI, 32.0-36.0), suggesting that diagnosis of ARDS was frequently delayed.

A multivariable analysis including variables from the bivariable analyses (eTable 5 in the Supplement), revealed several patient and organizational factors associated with clinician recognition of ARDS. Higher nurse-to-patient ratios, higher physician-to-patient ratios, younger patient age and a lower Pao_2/Fio_2 ratio, and the presence of pneumonia or pancreatitis were factors independently associated with higher probability of clinician recognition (Table 2). Absence of a risk factor and presence of concomitant

Epidemiology, Patterns of Care, and Mortality for in I

Giacomo
Luciano
Gordon
for the L



1/3 des patients avaient une P Plat ou un VT supérieur aux recommandations

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

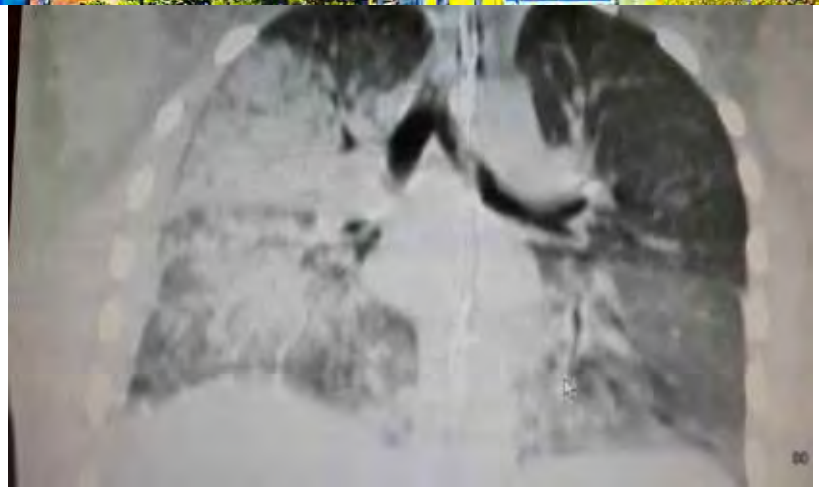
Table 4. Use of Adjunctive and Other Optimization Measures in Invasively Ventilated Patients With Acute Respiratory Distress Syndrome[a]

	Patients of No. (%) [95% CI]				
	All (n = 2377)	Mild[a] (n = 498)	Moderate[a] (n = 1150)	Severe[a] (n = 729)	*P* Value[b]
Neuromuscular	516 (21.7)	34 (6.8)	208 (18.1)	274 (37.8)	<.001
ECMO	76 (3.2) [2.5-4.0]	1 (0.2) [0.05-1.2]	27 (2.4) [1.6-3.4]	48 (6.6) [4.9-8.6]	<.001
Inhaled vasodilators	182 (7.7) [6.6-8.8]	17 (3.4) [02.0-5.4]	70 (6.1) [4.8-7.6]	95 (13.0) [10.7-15.7]	<.001
HFOV	28 (1.2) [0.8-1.7]	3 (0.6) [0.1-1.7]	14 (1.2) [0.7-2.0]	11 (1.5) [0.8-2.7]	.347
None of the above	1431 (60.2) [58.2-62.2]	397 (79.7) [75.9-83.2]	750 (65.2) [62.4-68.0]	284 (39.0) [35.4-42.6]	<.001

Curares <40 % des formes sévères
DV < 20%

Association Sufle

" un souffle pour Haiti "



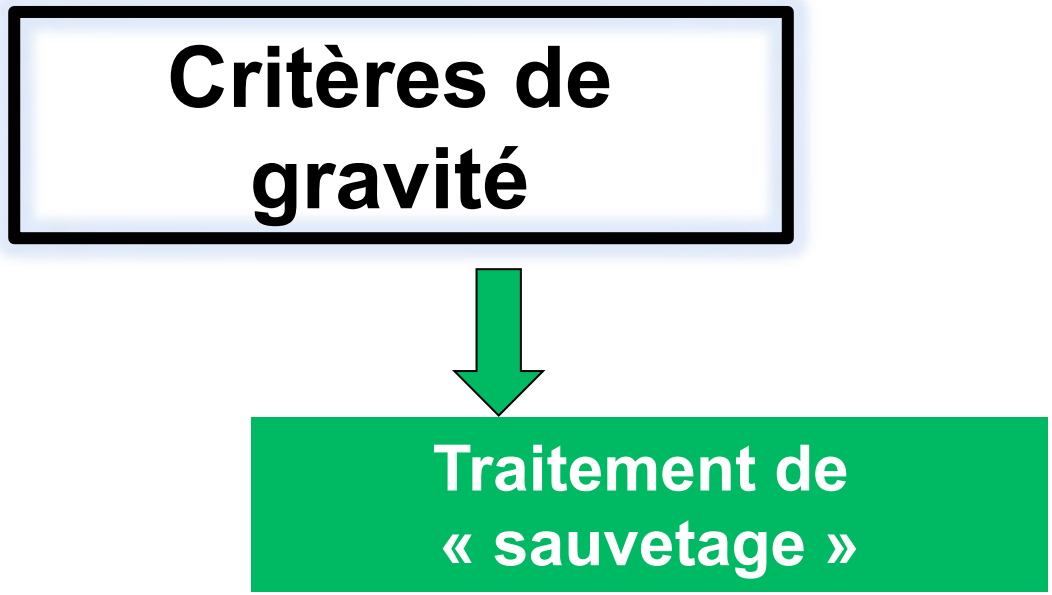
En fait de multiples étapes avec l'admission d'un SDRA

- Reconnaitre le SDRA
- Prise en charge correcte
- Avoir suffisamment d'expérience
- Disposer des traitements adjuvants

- Underrecognition
- Low use of ventilatory strategies
- Limited use of adjunct TTT
- Limited effect of physician diagnosis of ARDS on treatment decisions.
- Potential for improvement in management.

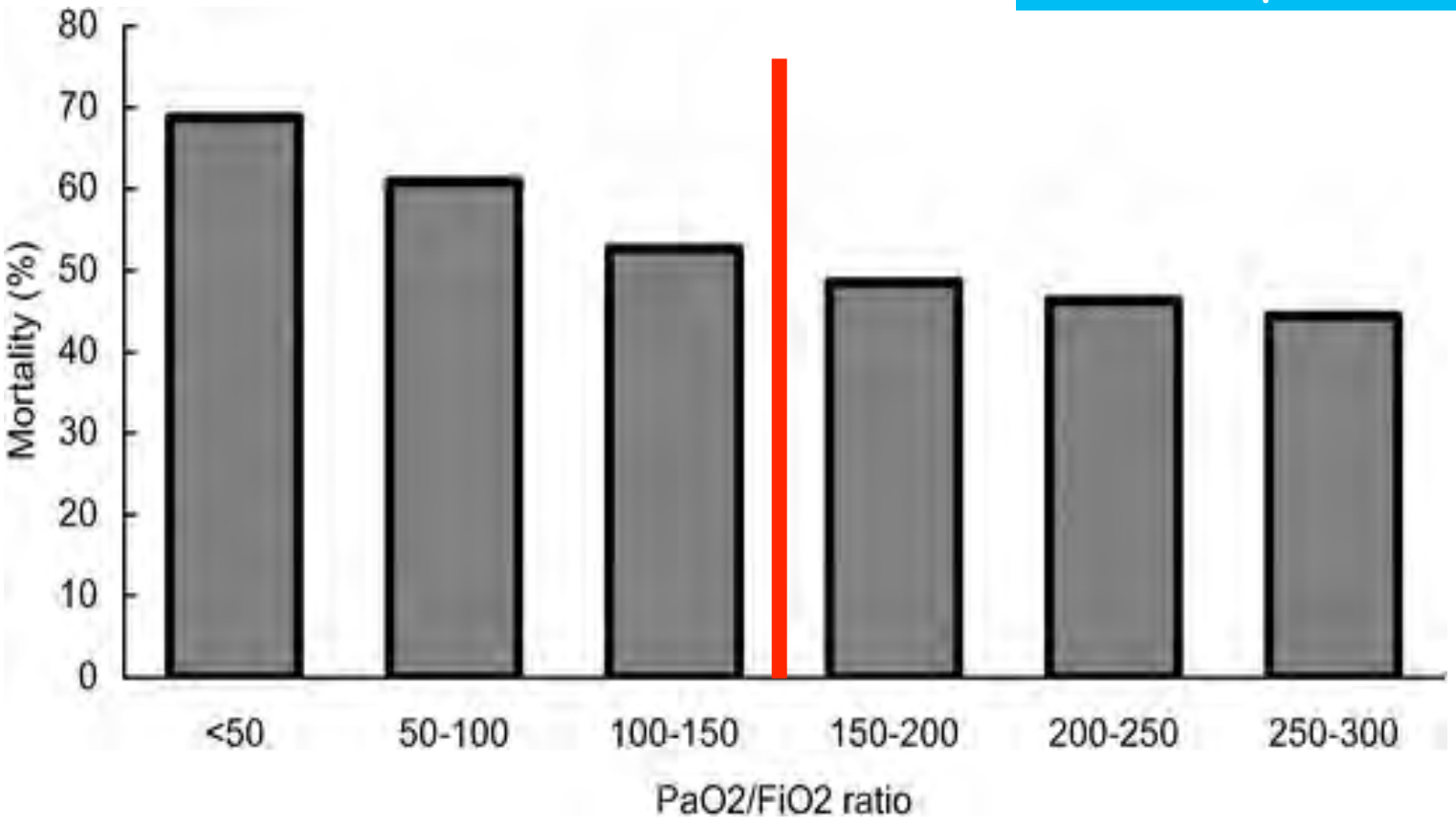
Centre de « référence»

En fait de multiples étapes avec l'admission d'un SDRA



PaO_2/FIO_2 et mortalité

Etude européenne ALIVE



Brun-Buisson et al. ICM 2004

Age, Pao_2/FIO_2, and Plateau Pressure Score: A Proposal for a Simple Outcome Score in Patients With the Acute Respiratory Distress Syndrome*

Critical Care Medicine | July 2016 • Volume 44 • Number 7

TABLE 3. A 9-Point Acute Respiratory Distress Syndrome Outcome Score (Age, Pao_2/FIO_2, and Plateau Pressure Score)

Variables	Range of Values	Score
Age, yr	< 47	1
	47–66	2
	> 66	3
Pao_2/FIO_2, mm Hg	> 158	1
	105–158	2
	< 105	3
Plateau pressure, cm H_2O	< 27	1
	27–30	2
	> 30	3
Total score		3–9

Total score is equal to the sum of the points for each category of high-risk tertiles, based on the values at 24 hr after acute respiratory distress syndrome diagnosis.

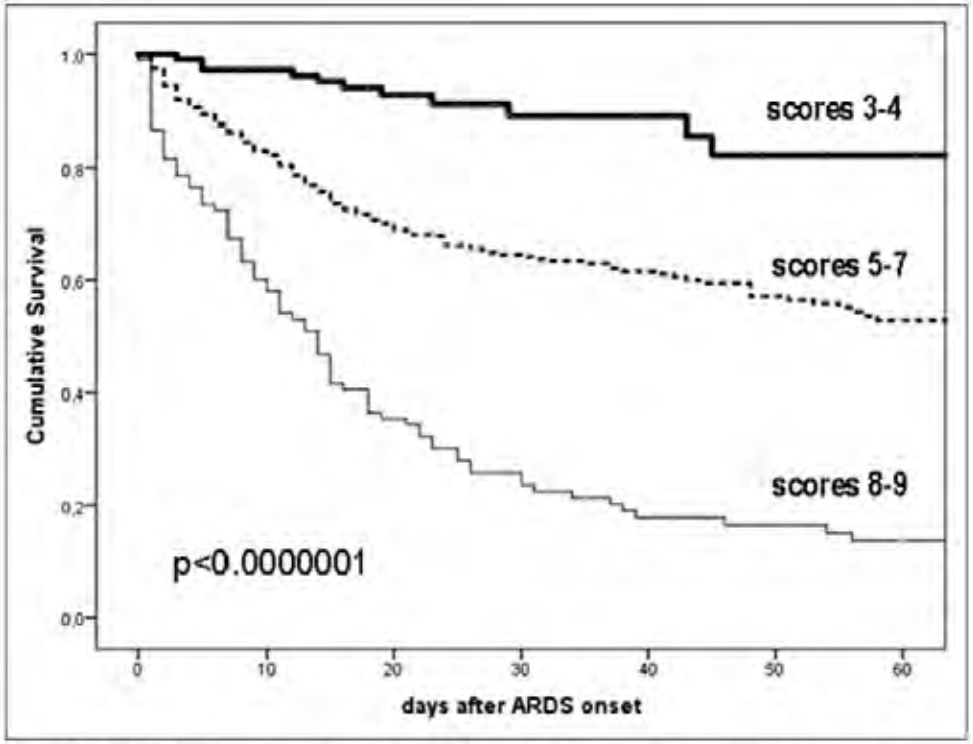


Figure 2. Kaplan-Meier 60-day probability of survival curves for the combined population of 600 acute respiratory distress syndrome (ARDS) patients. Patients were classified in three phenotypes according to their age, Pao_2/FIO_2, and plateau pressure score (< 5, 5–7, and > 7 points). Most deaths occurred within the first 15 d of inclusion into the study.

A simple classification model for hospital mortality in patients with acute lung injury managed with lung protective ventilation*

Crit Care Med 2011; 39:2645–2651

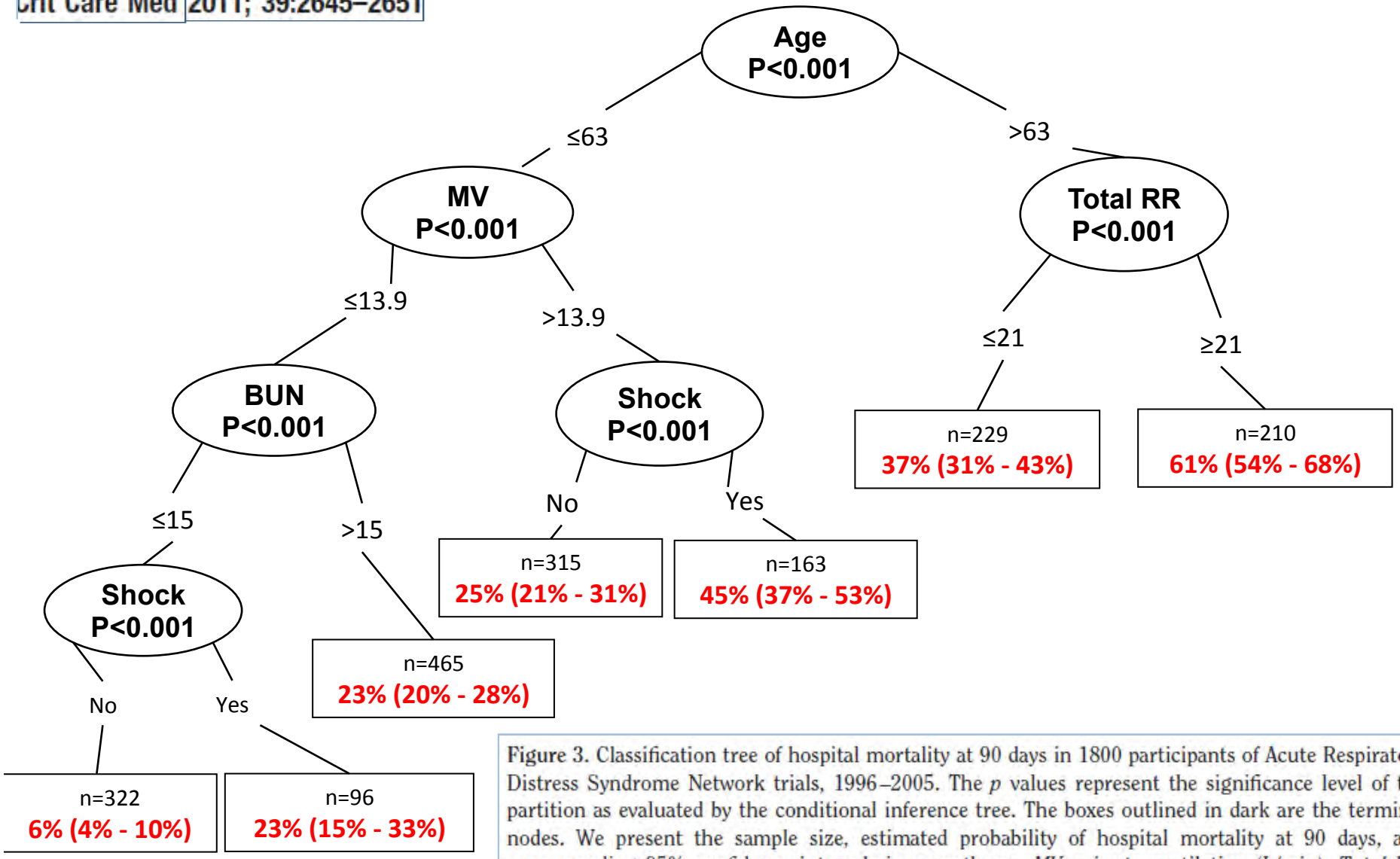


Figure 3. Classification tree of hospital mortality at 90 days in 1800 participants of Acute Respiratory Distress Syndrome Network trials, 1996–2005. The *p* values represent the significance level of the partition as evaluated by the conditional inference tree. The boxes outlined in dark are the terminal nodes. We present the sample size, estimated probability of hospital mortality at 90 days, and corresponding 95% confidence intervals in parentheses. *MV*, minute ventilation (L/min); *Total RR*, total respiratory rate (breaths/min); *BUN*, blood urea nitrogen (mg/dL).

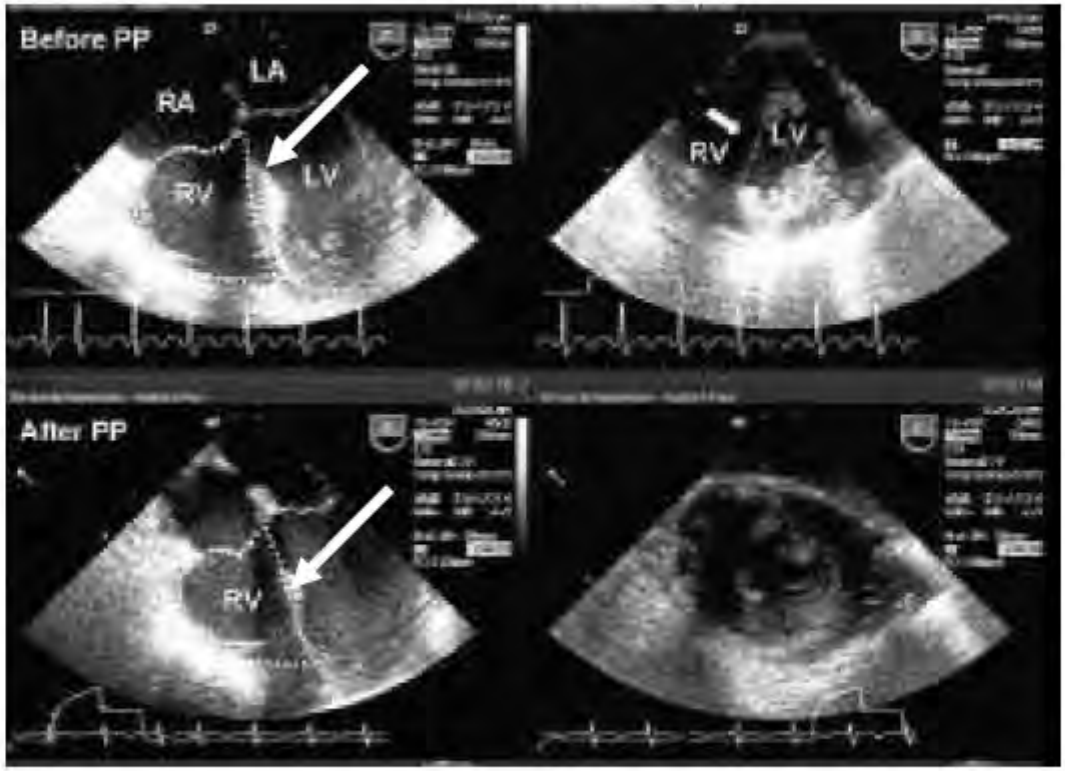
Cœur Pulmonaire Aigu et VM

Less stress on right ventricle

In SP before PP

PEEP
P Plateau
Hypercapnie
Acidose

After 18 hours in PP



Viellard-Baron
Chest 2005

DOI 10.1007/s00134-017-4854-5

ORIGINAL

External validation of a biomarker and clinical prediction model for hospital mortality in acute respiratory distress syndrome

Zhiguo Zhao[1,2], Nancy Wickersham[3], Kirsten N. Kangelaris[4], Addison K. May[5], Gordon R. Bernard[3], Michael A. Matthay[6,7], Carolyn S. Calfee[6,7], Tatsuki Koyama[1] and Lorraine B. Ware[3,8*]

Abstract

Purpose: Mortality prediction in ARDS is important for prognostication and risk stratification. However, no prediction models ha… in predicti… an observ…

Age – APACHE III – IL8 – SPD

Methods: … Trial (FACTT), 144 patients from a clinical trial of sivelestat for ARDS (STRIVE), and 545 ARDS patients from the VALID observational cohort study. To evaluate the performance of the prediction model, the area under the receiver operating characteristic curve (AUC), model discrimination, and calibration were assessed, and recalibration methods were applied.

Biomarkers

Results: The biomarker/c… Performance was better in the clinical trials with an AUC of 0.74 (… 0.67–0.77) in VALID, a more heterogeneous observational coho… nd VALID were combined.

Conclusion: We validated a mortality prediction model for ARDS that includes age, APACHE III, surfactant protein D, and interleukin-8 in a variety of clinical settings. Although the model performance as measured by AUC was lower than in the original model derivation cohort, the biomarker/clinical model still performed well and may be useful for risk assessment for clinical trial enrollment, an issue of increasing importance as ARDS mortality declines, and better methods are needed for selection of the most severely ill patients for inclusion.

Keywords: Validation, Prediction, Biomarker, Hospital mortality, ARDS

En fait de multiples étapes avec l'admission d'un SDRA

Reconnaitre le SDRA

Prise en charge correcte

Avoir suffisamment d'expérience

Disposer des traitements adjuvants

Critères de gravité

Devenir sous ECMO

Transport

ECMO centers

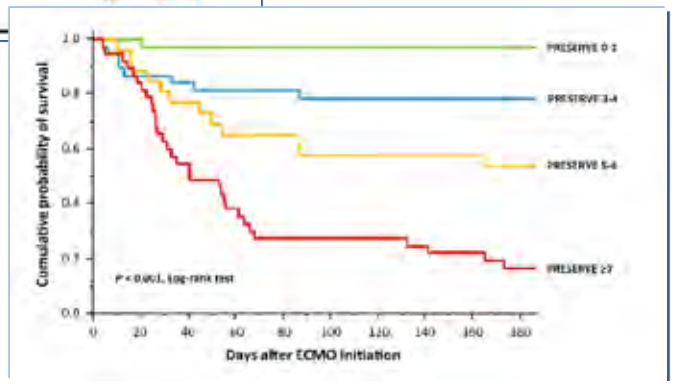
Délai

Quels malades transférer pour ECMO: pronostic

The PRESERVE mortality risk score

Intensive Care Med (2013) 39:1704–1713
DOI 10.1007/s00134-013-3037-2

Parameter	Score
Age (years)	
<45	0
45–55	2
>55	3
Body mass index >30	−2
Immunocompromised	2
SOFA >12[a]	1
MV >6 days	1
No prone positioning before ECMO	1
PEEP < 10 cm H_2O	2
Plateau pressure >30 cm H_2O	2
Total score[c]	0–14

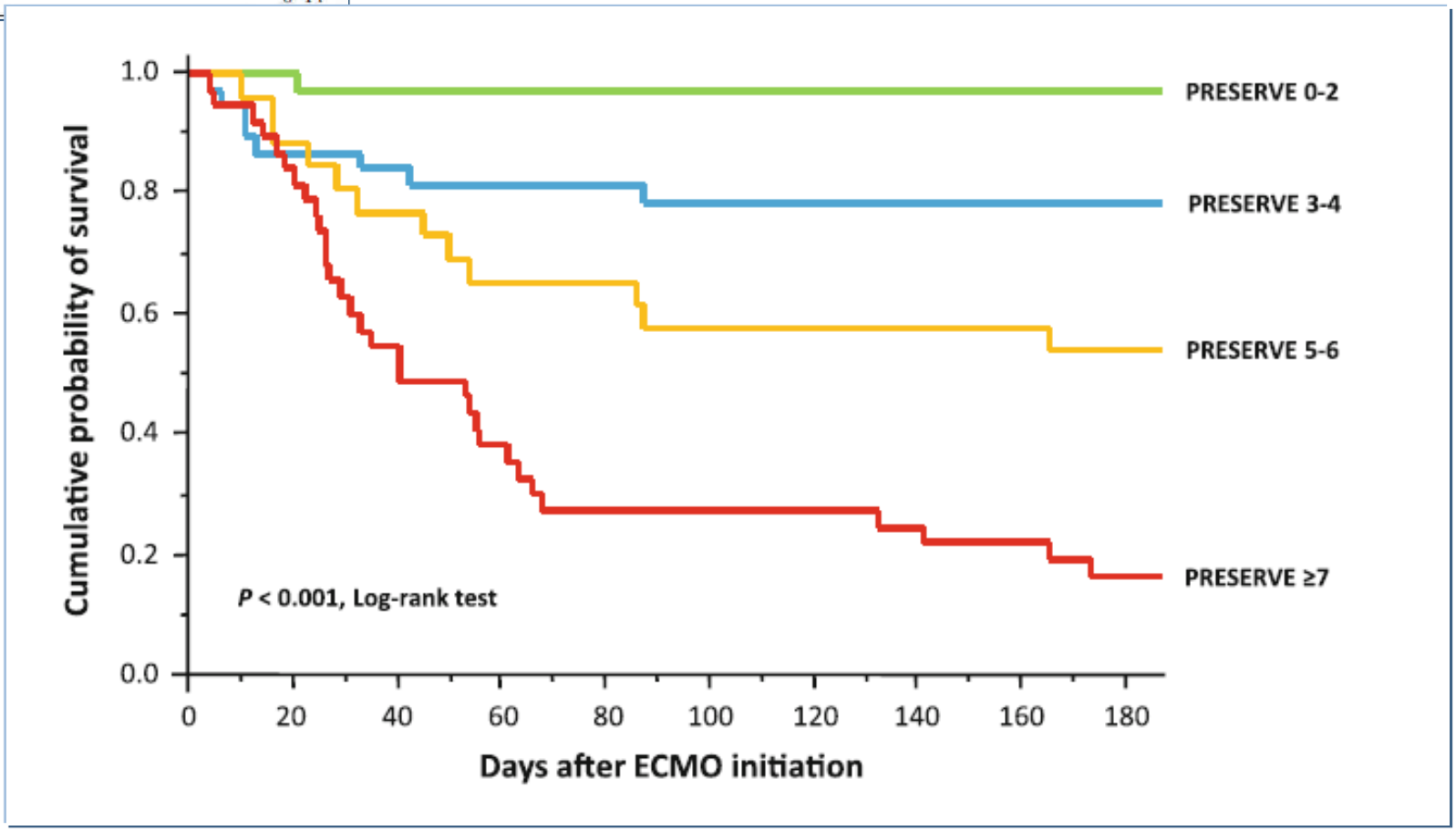


Quels malades transférer
ECMO: pronostic

The PRESERVE mortality risk score

Intensive Care Med (2013) 39:1704–1713
DOI 10.1007/s00134-013-3037-2

Parameter	Score
Age (years)	
<45	0
45–55	2
>55	3
Body mass index >30	−2
Immunocompromised	2
SOFA >12[a]	1
MV >6 days	1
No prone positioning before ECMO	1
PEEP < 10 cm H_2O	2
Plateau pressure >30 cm H_2O	2
Total score[c]	0–14



Comment transporter ?

SANS

AVEC

ECMO

Transport comment: canulé ou pas ?

The overall mortality rate was 27.5% (46/167); 18 (39.1%) of the 46 deaths were associated with transfer

The mortality rate associated with transport needs to be considered in evaluating ECMO programs. Earlier, expedited transfers may increase the survival rate. R Boedy, J Pediatr 1990;117:462-4

CESAR

- ration
- e
- n of

	ECMO group (n=90)*†	Conventional management group (n=90)	p value
Treatment by ECMO	68 (76%)	NA	NA
Transport to treatment centre	62 (69%)	NA	NA
Air (with or without ground transport)	24 (27%)	NA	NA
Ground	38 (42%)	NA	NA
Not transferred‡	6 (7%)	NA	NA
Time between randomisation and treatment (h)	6·1 (4·0–7·1)§	NA	NA
Duration of treatment (days)	9·0 (6·0–16·0)¶	NA	NA
Treatment by conventional management	22 (24%)	90 (100%)	NA
Transport to treatment centre	19 (21%)	11 (12%)||	NA
Air (with or without ground transport)	5 (6%)	2 (2%)	NA
Ground	14 (1%)	9 (10%)	NA
Not transferred	3 (3%)	79 (88%)	NA
Duration of treatment (days)	10 (4·8–22·8)	11 (4·0–20·3)	NA

81 11 92

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

Gilles J Peek, Miranda Mugford, Ravindranath Tiruvoipati, Andrew Wilson, Elizabeth Allen, Monomma M Thalanany, Clare L Hibbert, Ann Truesdale, Felicity Clemens, Nicola Cooper, Richard K Firmin, Daniel Elbourne, for the CESAR trial collaboration

Transport sans ECMO

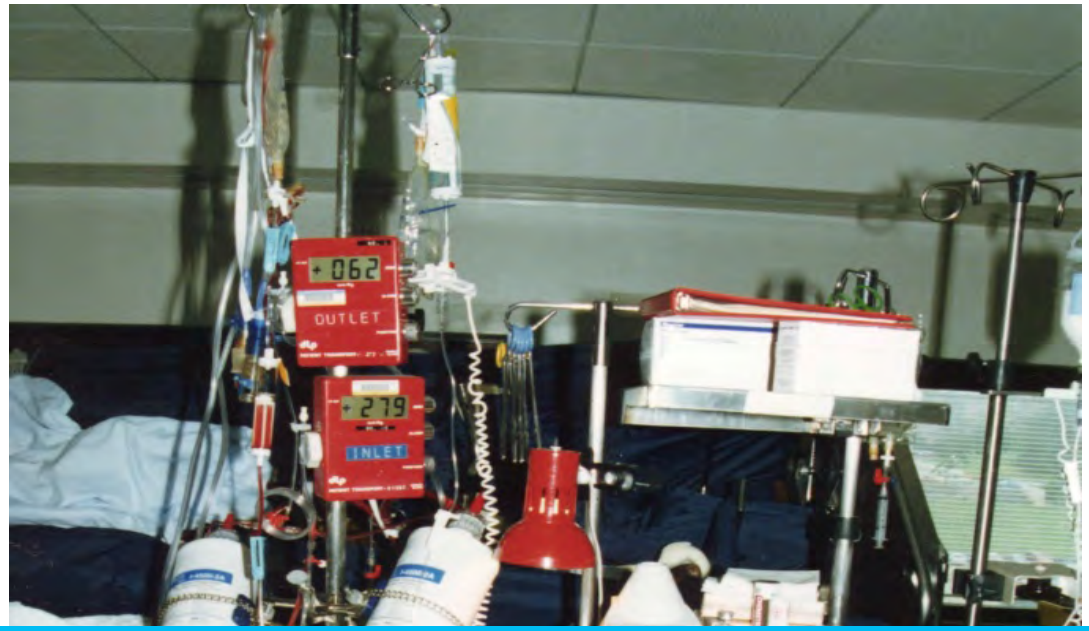
Etude	1	2	3
pH	7,32	7,1	
$PaCO_2$	52 (15)		58 (50-73)

- 1) Usaro ICM 2002
- 2) Peek Lancet 2009
- 3) Noah JAMA 2011

Transport sans ECMO

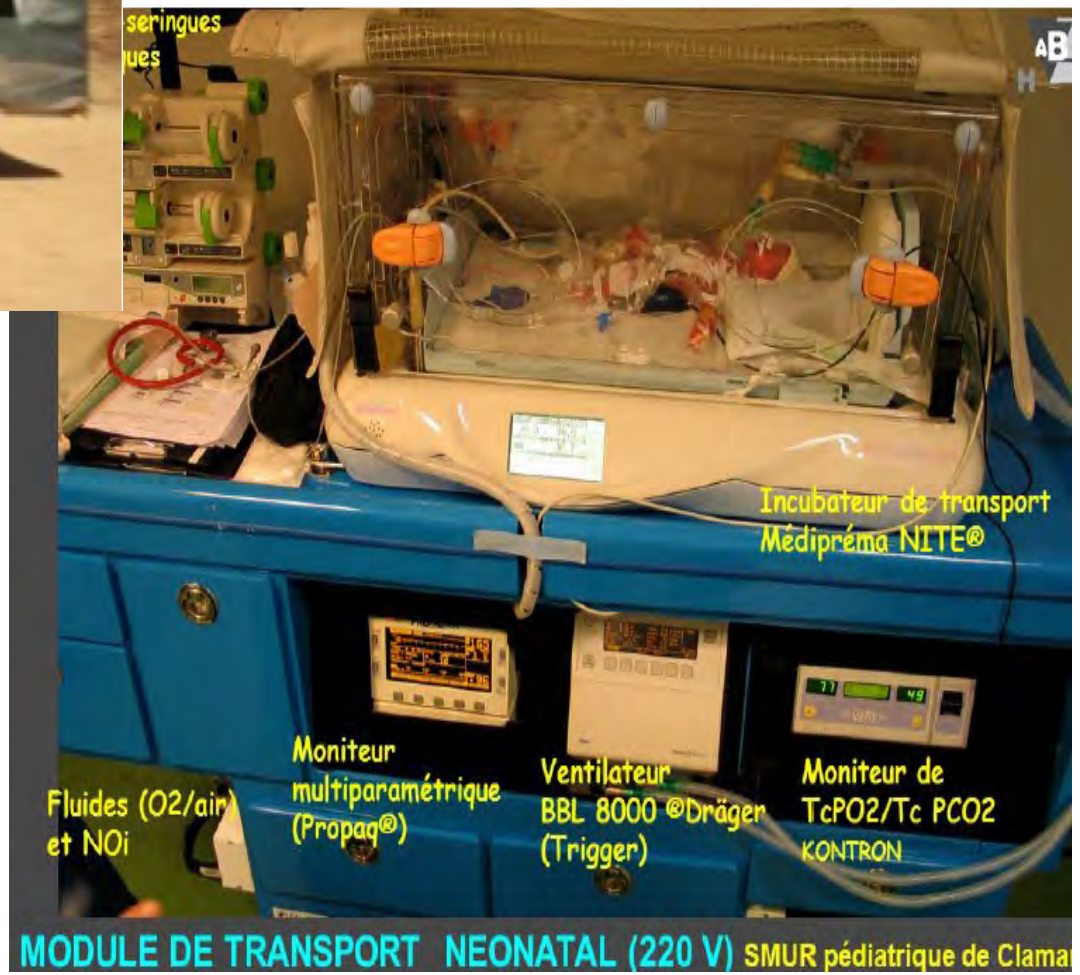
Etude	1	2	3
P/F	60 (15)	76 (25)	55 (46-63)
PEEP	12 (3)	14 (9)	15 (12-16)

- 1) Usaro ICM 2002, 28:1122-1125
- 2) Peek Lancet 2009
- 3) Noah JAMA 2001



Transportable?

ort NN



Conclusion

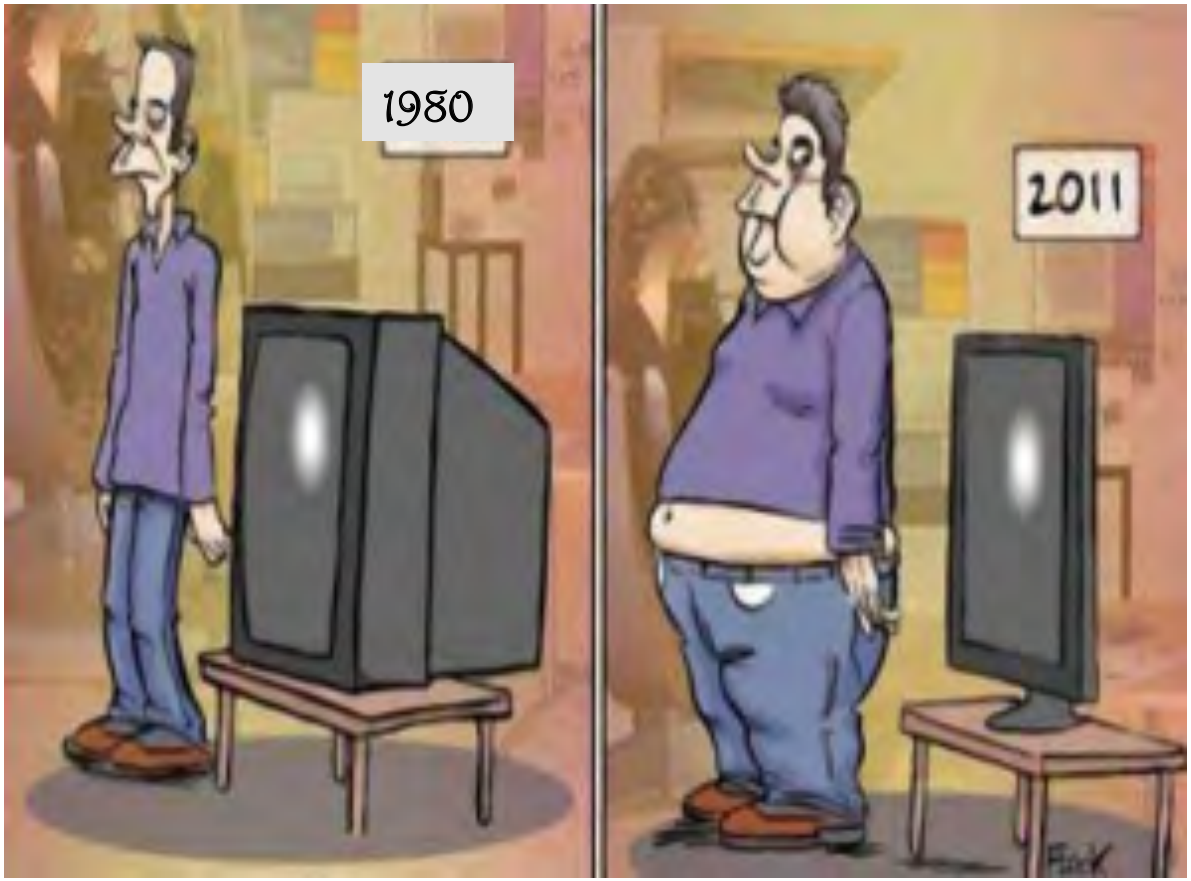
- Ne pas opposer transfert in utero et transfert post-natal pour le nouveau-né (complémentarité)

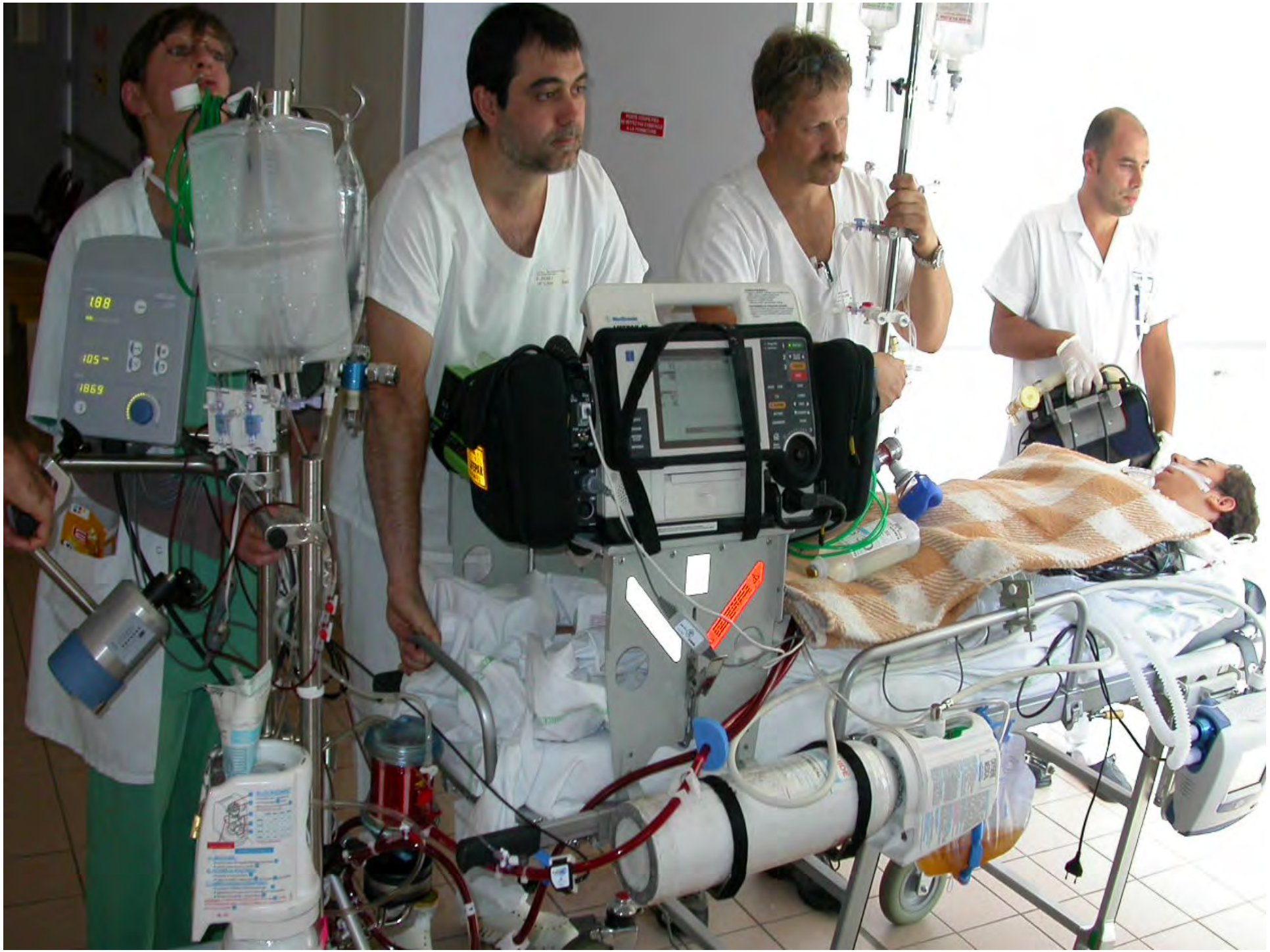
Jean-Louis Chabernaud

SMUR pédiatrique (SAMU 92)
Réanimation néonatale
Hôpital Antoine-Béclère (AP-HP)
Clamart

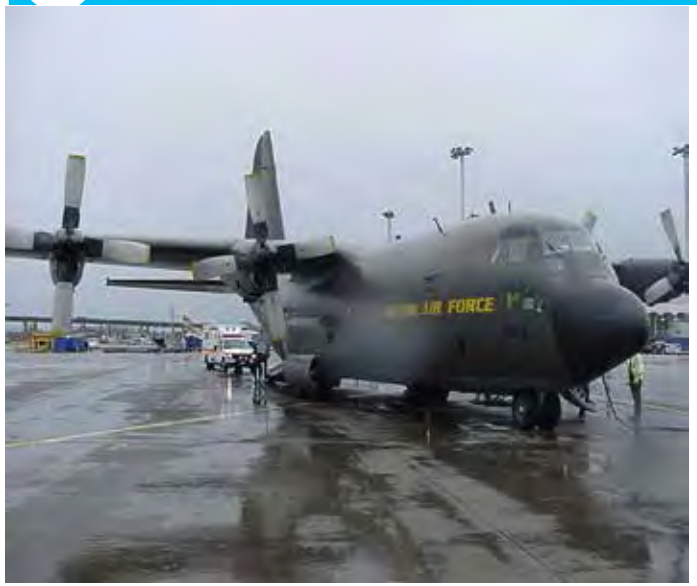
Des évolutions technologiques

Ergonomie
Simplicité
Fiabilité
Sécurité
Performance
Tolérance




188
105
1869

Inter-hospital transports on ECMO



Transport sans risque sous CEC ?

- Variable selon les séries

- Ericsson A, Regensburg, ESLO 2015
  - Etude prospective 395 transferts
  - effets indésirables dans 31% des transports
  - relation avec le malade (28%)
  - équipement dans 19 cas

- Broman LM, 2016
  - Étude rétrospective de 452 transports entre 2010-15
  - 165 EIG chez 115 malades (25,4%).
  - Plusieurs EIG dans 6% des cas.
  - 57% exposent malades ou équipe à un risque non négligeable

Survivors According To Transportation And Publications

Transportation of patients on extracorporeal membrane oxygenation: a tertiary medical center experience and systematic review of the literature

Pedro Vitale Mendes[1,2*], Cesar de Albuquerque Gallo[2], Bruno Adler Maccagnan Pinheiro Besen[2], Adriana Sayuri Hirota[2], Raquel de Oliveira Nardi[2], Edzangela Vasconcelos dos Santos[2], Ho Yeh Li[2], Daniel Joelsons[2], Eduardo Leite Vieira Costa[1,2], Flavia Krepel Foronda[2], Luciano Cesar Pontes Azevedo[1,2] and Marcelo Park[2]

Mendes *et al. Ann. Intensive Care (2017) 7:14*
DOI 10.1186/s13613-016-0232-7

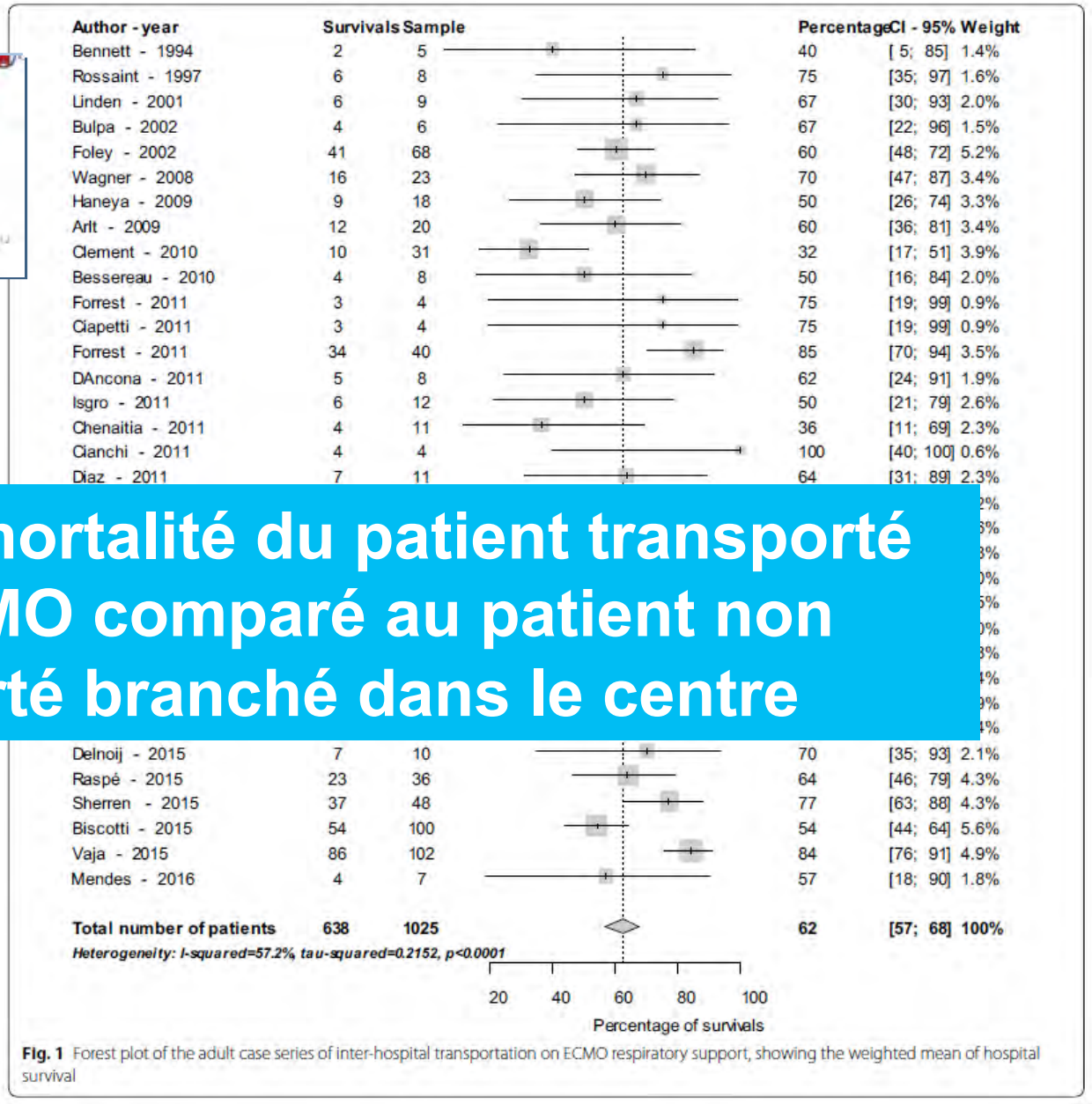
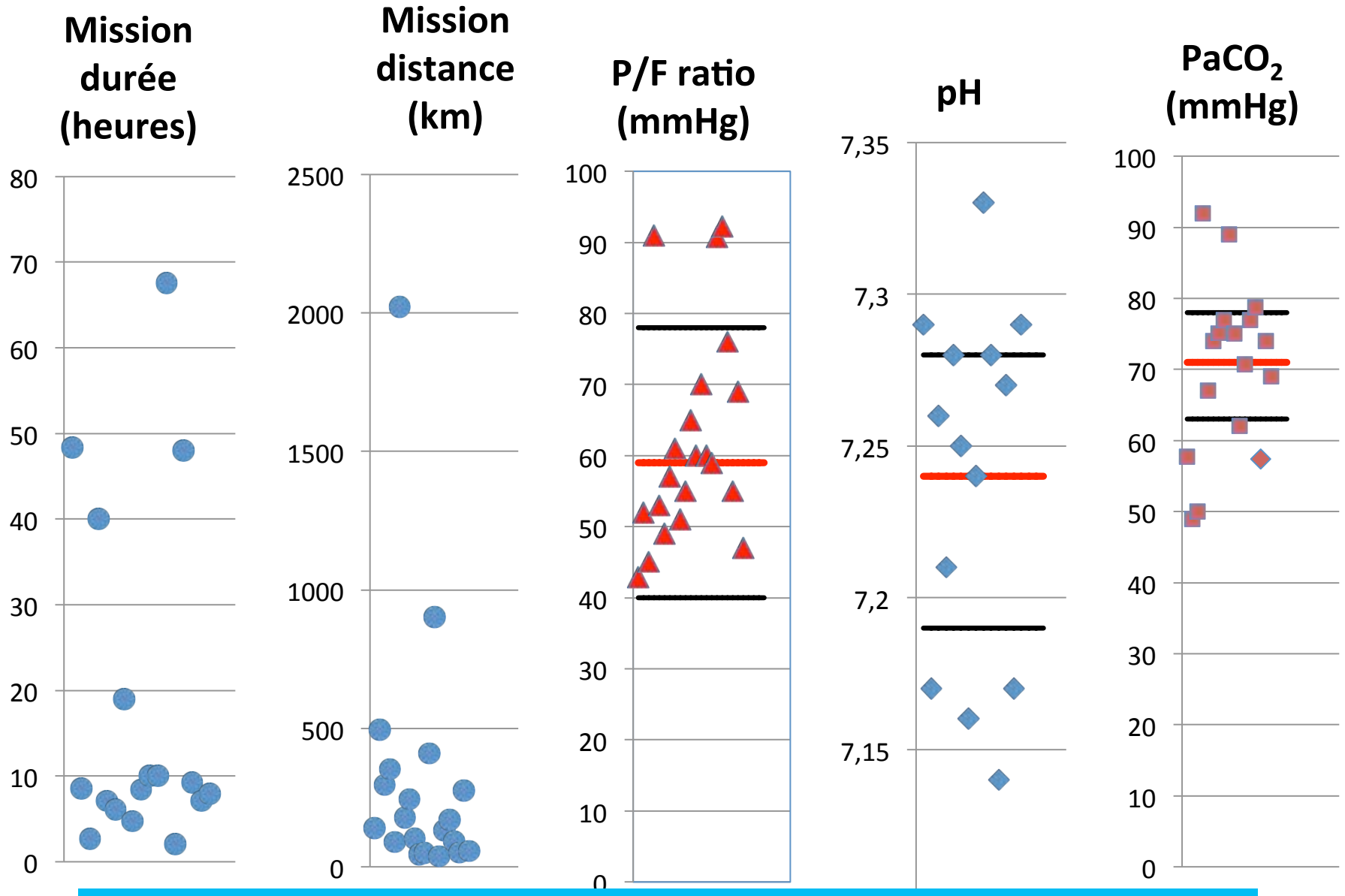


Fig. 1 Forest plot of the adult case series of inter-hospital transportation on ECMO respiratory support, showing the weighted mean of hospital survival

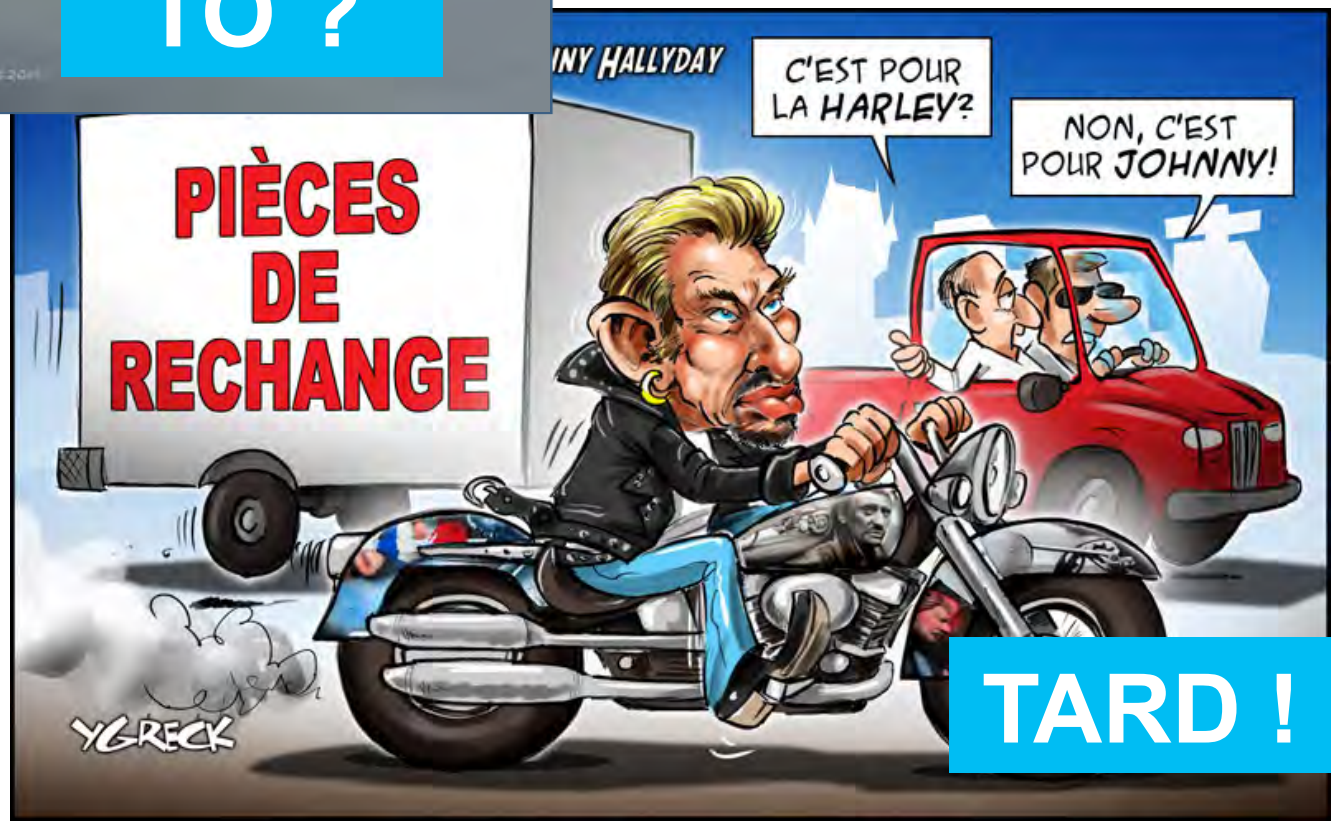
Pas de surmortalité du patient transporté sous ECMO comparé au patient non transporté branché dans le centre



Conditions de prise en charge des malades transportés sous ECMO

ECMO


TO ?


INY HALLYDAY
C'EST POUR LA HARLEY?
NON, C'EST POUR JOHNNY!
PIÈCES DE RECHANGE
YGRECK
TARD !

Facteurs de gravité sous ECMO·CI

The PRESERVE mortality risk score

Parameter	Score
Age (years)	
<45	0
45–55	2
>55	3
Body mass index >30	−2

Intensive Care Med (2013) 39:1704–1713
DOI 10.1007/s00134-013-3037-2

Table 2 Ventilation characteristics at the time of ECMO initiation according to survival status

Characteristic	All patients (n = 140)	Status at 6 months post-ICU: Alive (n = 84)	Dead (n = 56)
Mobile ECMO team	95 (68)	63 (75)	32 (57)
Interval (days)			
Hospital–ICU admission	0 (0–1)	0 (0–1)	0.5 (0–3)
Hospital admission–ECMO	7 (3–14)	5 (2–11) *	13 (7–27)
ICU admission–ECMO	6 (2–13)	4 (1–9) *	9 (4–17)
MV–ECMO	5 (1–11)	3 (1–9) *	7 (3–15)

* **P < 0,001**

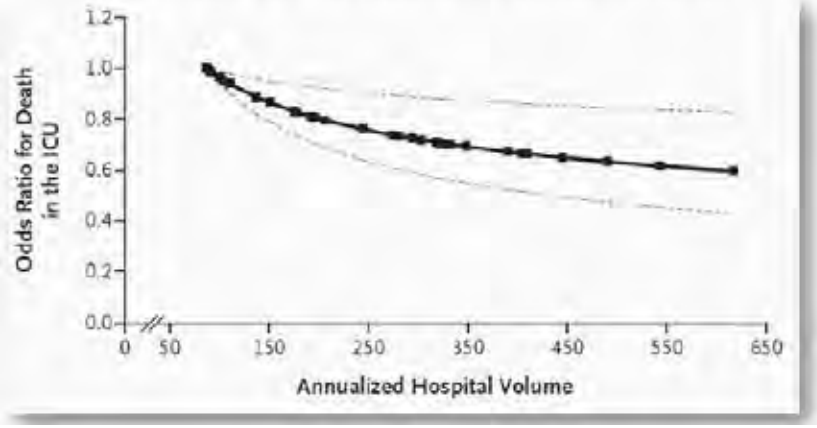
Où faire de l'ECMO?

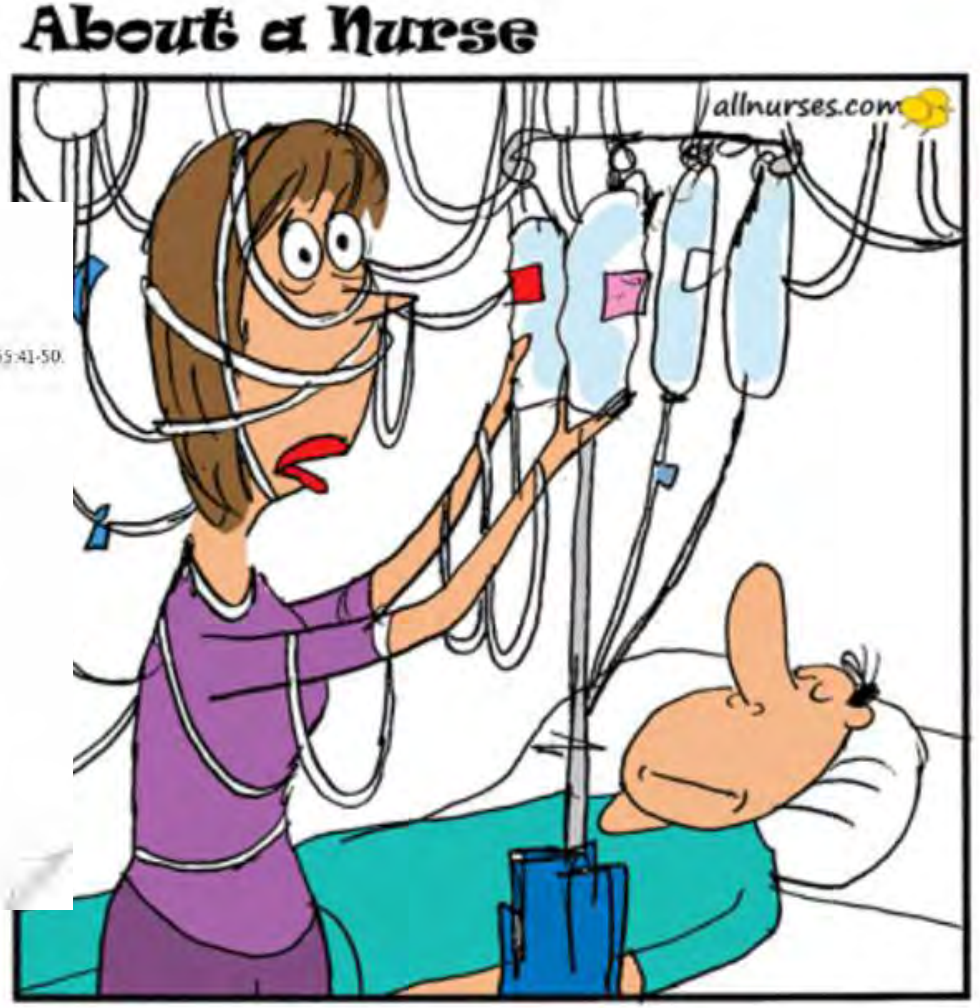
Hospital Volume and the Outcomes of Mechanical Ventilation

Jeremy M. Kahn, M.D., Christopher H. Goss, M.D., Patrick J. Heagerty, Ph.D., Andrew A. Kramer, Ph.D., Chelsea R. O'Brien, R.N., and Gordon D. Rubenfeld, M.D.

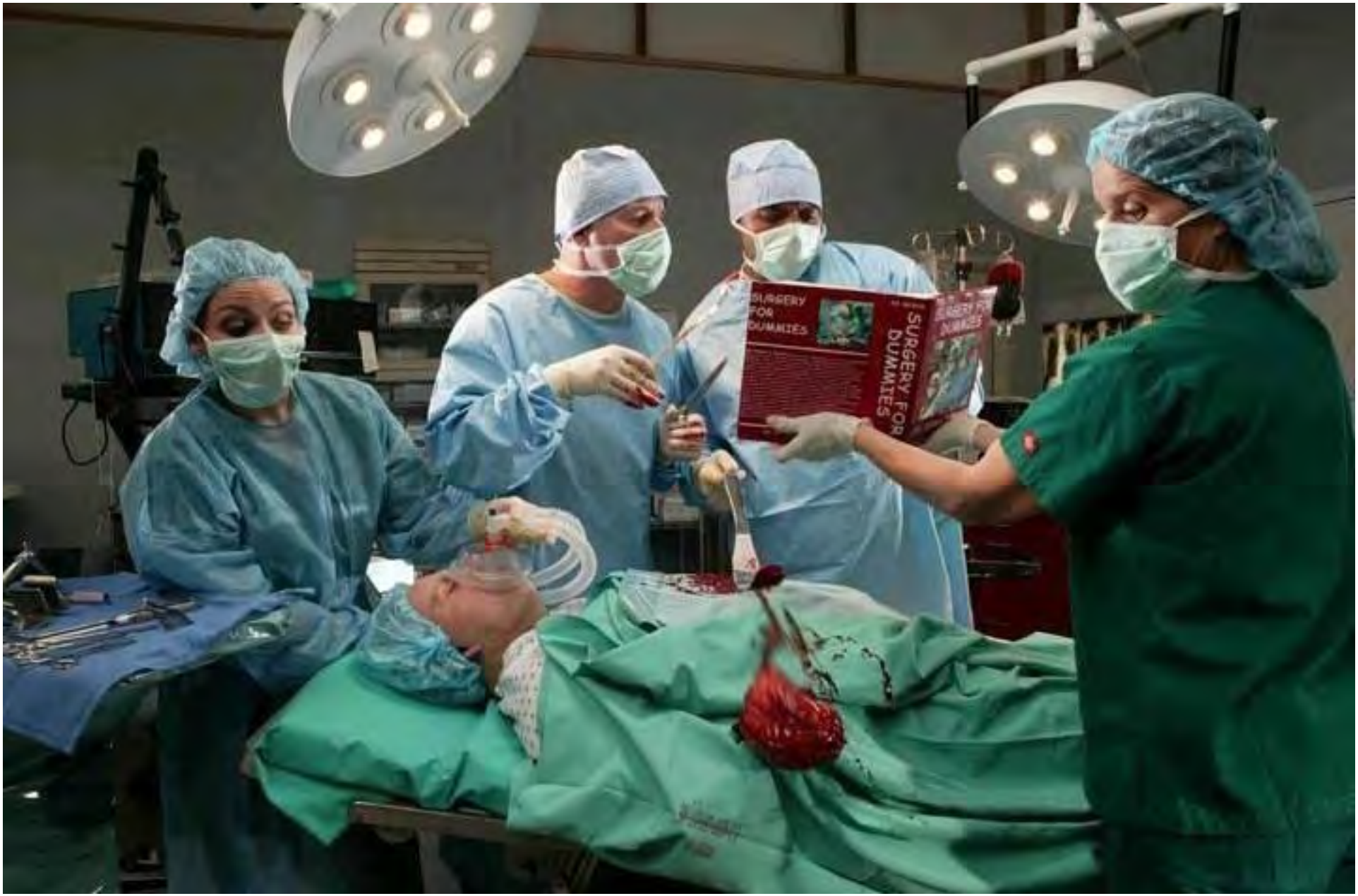
N Engl J Med 2006;355:41-50.

We analyzed data from 20,241 nonsurgical patients receiving mechanical ventilation at 37 acute care hospitals in the Acute Physiology and Chronic Health Evaluation clinical information system from 2002 through 2003. Multivariate analyses were performed to adjust for the severity of illness and other differences in the case mix.





"Help."


SURGERY FOR DUMMIES

Association of Hospital-Level Volume of Extracorporeal Membrane Oxyg… Analy…

Volume d'ECMO et survie

Mortalité Résultats:
-NN: 18-50%
-Pédiatrie: 25-66%
-Adultes: 33-92%

Ryan P. … Bartlet…
Matthe…

[1]Division … Departm…
of Surge… …novatic…;
and [9]Gerald R. Ford School of Public Policy, University of Michigan, Ann Arbor, Michigan; [4]Division of Pediatric Critical Care, Emory University, Atlanta, Georgia; and [10]Division of Pediatric Critical Care, University of Toronto, Toronto, Ontario, Canada

Table 3. Adjusted Odds of In-Hospital Mortality by Age Group and Annual ECMO Volume Category

Period	Annual Hospital ECMO Volume	Adjusted Mortality Odds Ratio (95% CI)		
		Neonate	Pediatric	Adult
1989–2013	1–5	Referent	Referent	Referent
	6–14	0.86 (0.75–0.98)	0.99 (0.86–1.13)	0.81 (0.66–0.995)
	15–30	0.74 (0.63–0.88)	0.86 (0.73–1.01)	0.75 (0.59–0.94)
	>30	0.69 (0.56–0.84)	0.89 (0.69–1.14)	0.61 (0.48–0.79)
2008–2013	1–5	Referent	Referent	Referent
	6–14	1.01 (0.79–1.28)	1.03 (0.84–1.25)	0.82 (0.64–1.05)
	15–30	0.94 (0.70–1.25)	0.92 (0.73–1.16)	0.72 (0.55–0.96)
	>30	0.65 (0.42–1.01)	0.85 (0.57–1.28)	0.61 (0.46–0.80)

Definition of abbreviations: CI = confidence interval; ECMO = extracorporeal membrane oxygenation.
The adjusted odds ratio reflects findings from models that included hospital- and patient-level demographic and pre-ECMO clinical variables (see METHODS); all analyses were performed with a hierarchical logistic regression model to account for patient-level and hospital-level variance.

Measurements and Main Results: From 1989 to 2013, a total of 290 centers provided ECMO support to 56,222 patients (30,909 neonates, 14,725 children, and 10,588 adults). Annual ECMO

Keywords: extracorporeal membrane oxygenation; high-volume hospitals; low-volume hospitals; pediatric; adult

Quand transférer un patient pour ECMO

- Optimiser la prise en charge du SDRA
- Recours aux traitements adjuvants
- Enjeux du pronostic vital et fonctionnel
- Critères gazométriques et ventilatoires
- Scores pronostiques du SDRA et de l'ECMO
- Délai entre diagnostic SDRA et ECMO
- Modalités de transport
- Centres spécialisés versus centres référents

Quand transférer un malade pour ECMO

Quand appeler un centre ECMO pour discuter de la prise en charge

Des critères simples d'appel

- P/F < 100
- pH < 7,30 - $PaCO_2$ > 50 mmHg
- Précocité (premiers jours)
- Signes de gravité (P plateau, Cœur droit)
- Instabilité hémodynamique

- Pathologie réversible, curable
- Contre indications ECMO
- Modalités de transport