

Modalités ventilatoires du SDRA

Professeur Jean-Christophe M Richard

UPRESS EA 38 30



TLC

« BABY LUNG »

Volume (L)

EELV

RV

0

Pressure (cmH₂O)

50



TLC

P_{FLEX}^{sup}

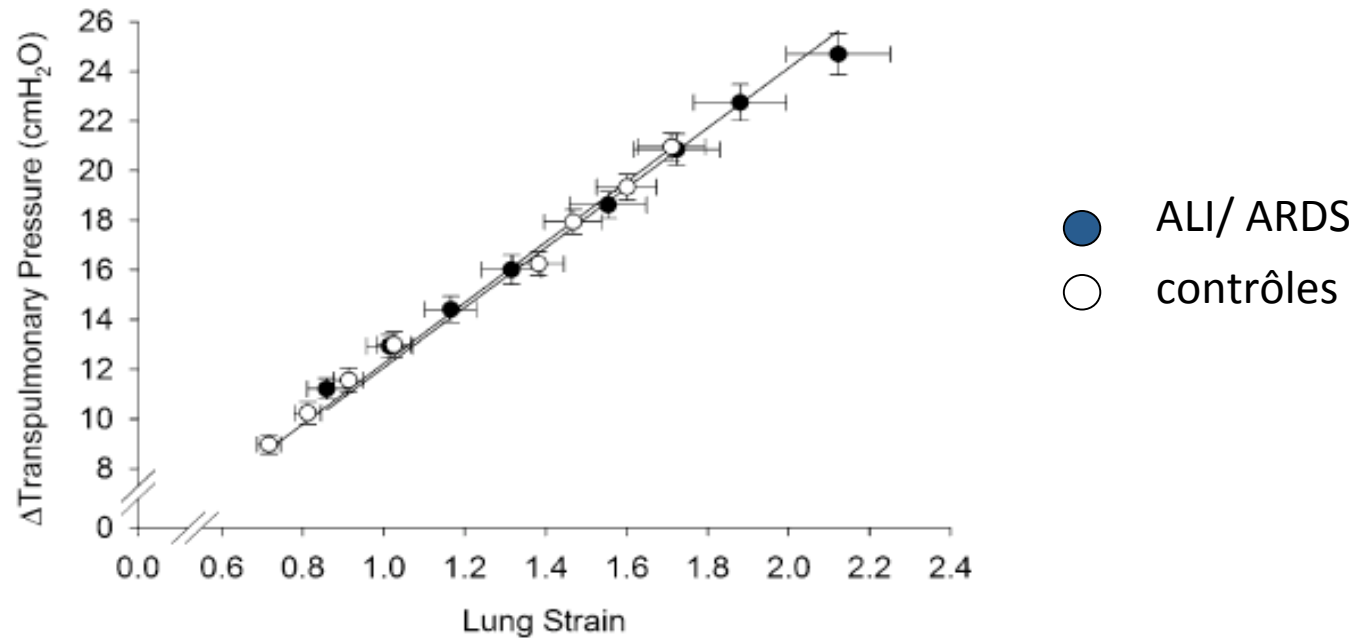
ARDS

P_{FLEX}^{inf}

EELV

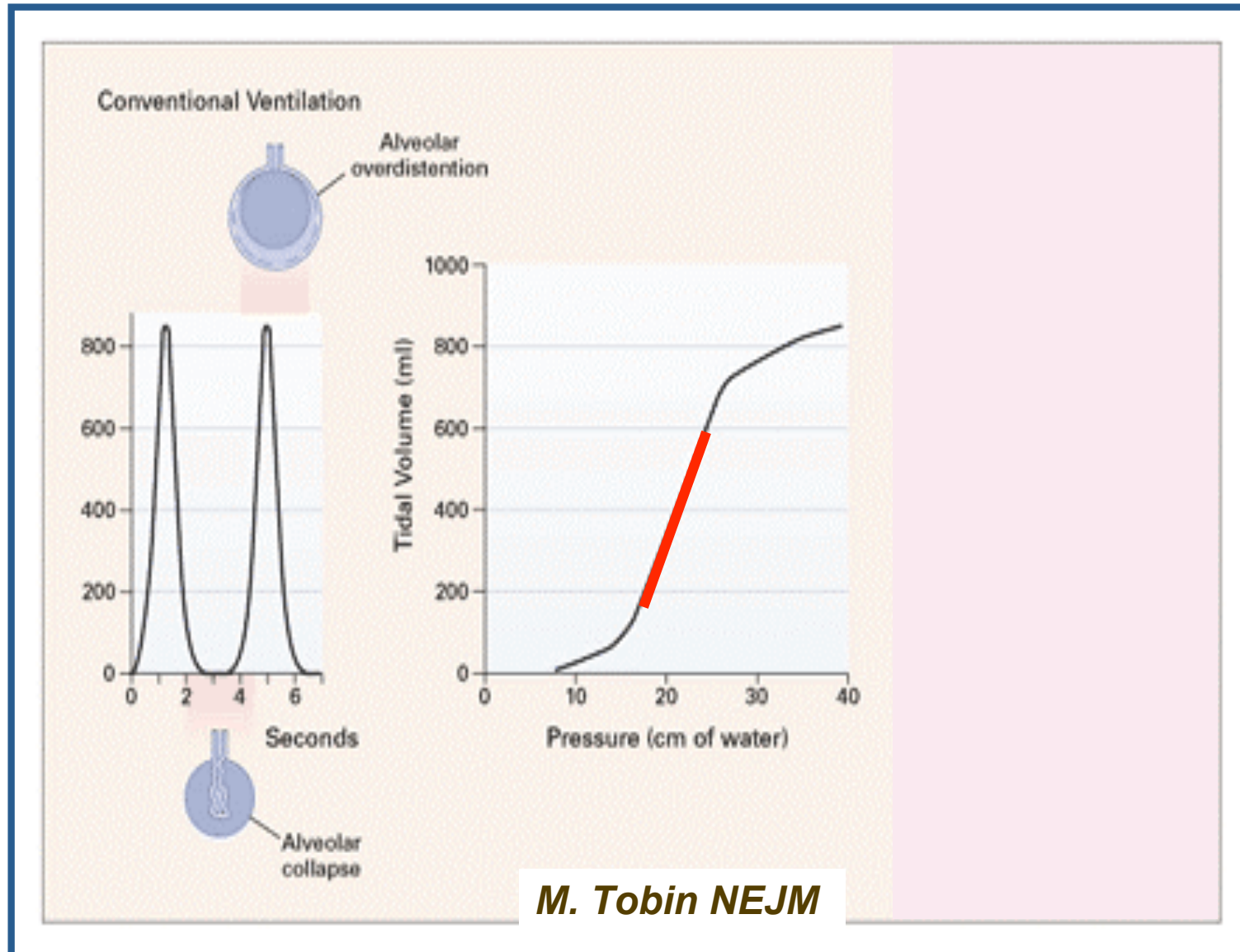
Elastance spécifique:

Elastance du poumon ventilable



BABY LUNG= small rather than stiff

SDRA : Ventilation protectrice



Should the Lung Be Rested or Recruited?

The Charybdis and Scylla of Ventilator Management

D. Dreyfuss, G. Saumon. Am J Respir Crit Care Med 1994 ; 149 : 1066 - 68



« Alveoli »



« LOVS »



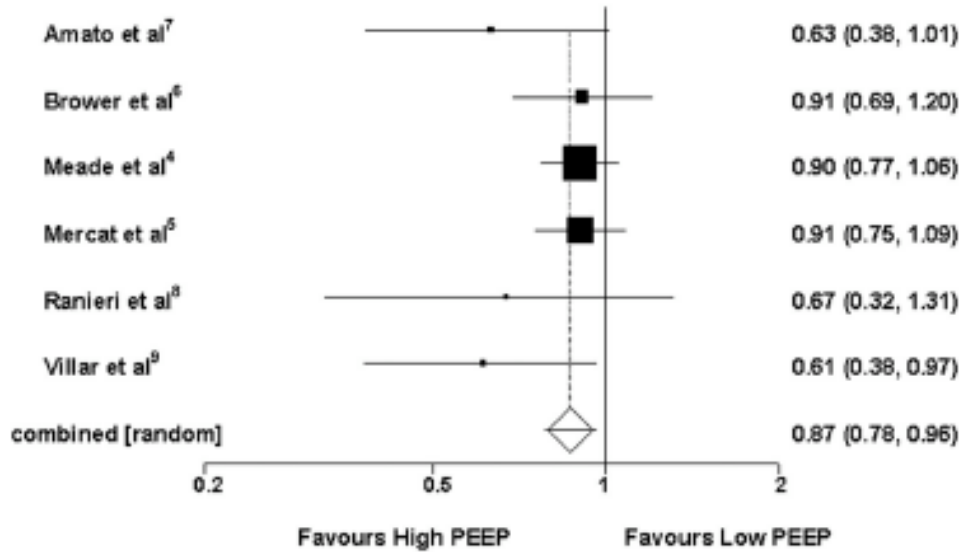
« ExPress »

Does a Higher Positive End Expiratory Pressure Decrease Mortality in Acute Respiratory Distress Syndrome?

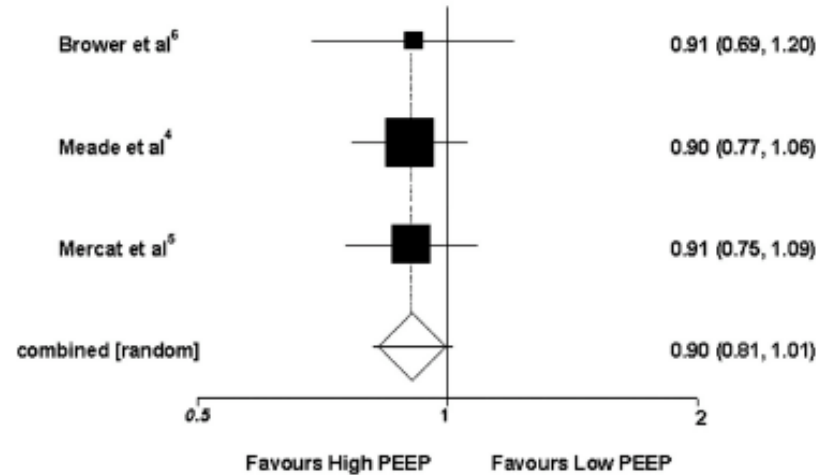
A Systematic Review and Meta-analysis

Susan I. Phoenix,* Sharath Paravastu, M.R.C.S.,† Malachy Columb, F.R.C.A.,‡ Jean-Louis Vincent, M.D., Ph.D.,§ Mahesh Nirmalan, M.D., F.R.C.A., Ph.D.||

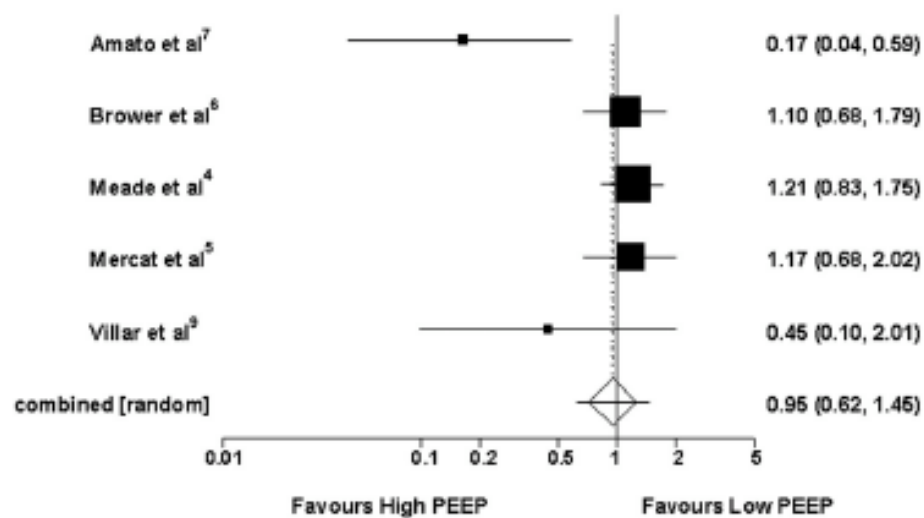
Relative risk meta-analysis plot (random effects)



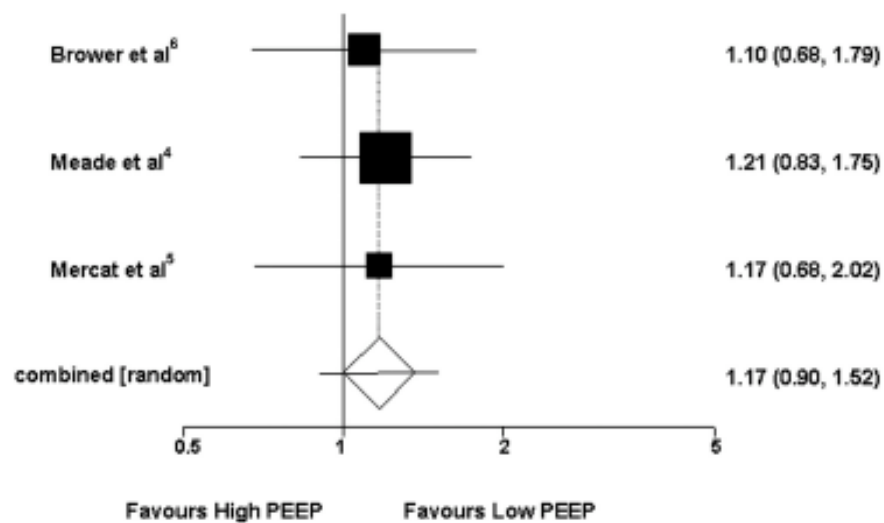
Relative risk meta-analysis plot (random effects)



Relative risk meta-analysis plot (random effects)



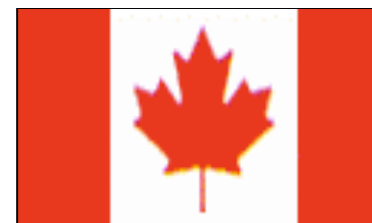
Relative risk meta-analysis plot (random effects)





ARDS network

ALVEOLI - LOVs



VT 6 ml / kg , FR \leq 35 / mn
55 mmHg < PaO₂ < 80 mmHg
88% < SpO₂ < 95%

Low PEEP / High FiO₂

FiO₂	30	40	40	50	50	60	70	70	70	80	90	90	90	100
PEEP	5	5	8	8	10	10	10	12	14	14	14	16	18	\leq 24

High PEEP / Low FiO₂

FiO₂	30	30	30	30	30	40	40	50	50	50-80	80	90	100	100
PEEP	5	8	10	12	14	14	16	16	18	20	22	22	22	24

ExPress

VT 6 ml / kg (PBW)

FR \leq 35 / mn ; 7.30 < pH < 7.45

55 mmHg < PaO₂ < 80 mmHg

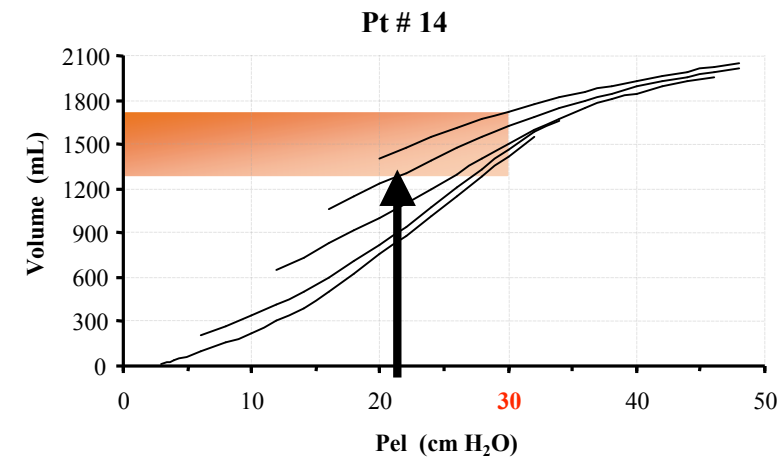
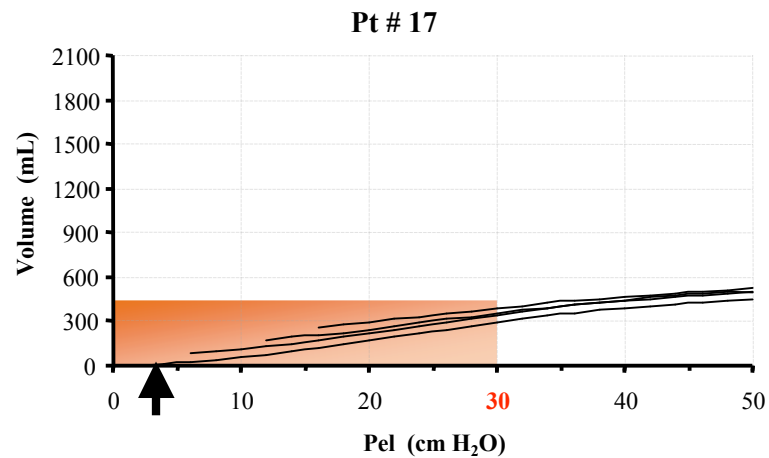
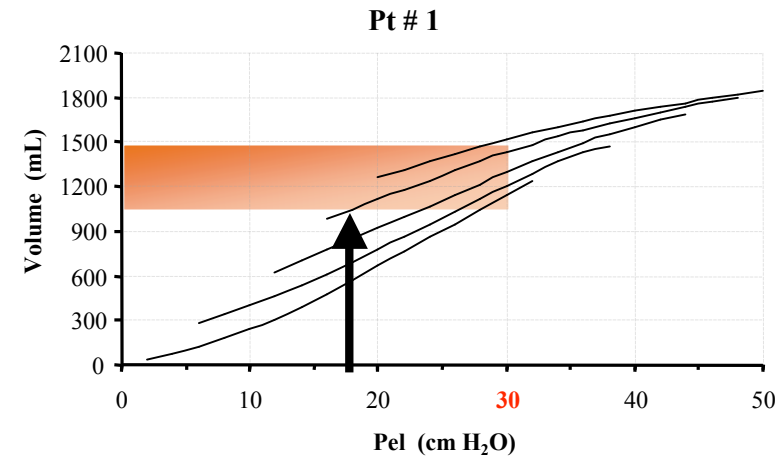
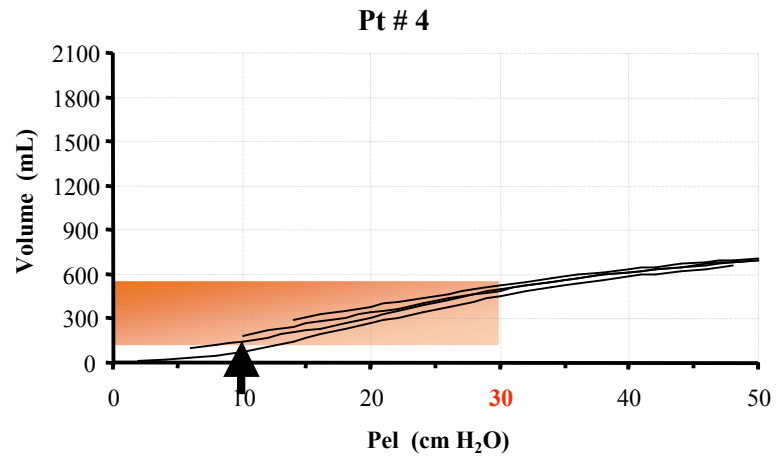
88% < SpO₂ < 95%

**Distension alvéolaire
minimale**

PEP pour
 $5 \leq \text{PEP}_{\text{tot}} \leq 9$

**Recrutement alvéolaire
maximal**

PEP pour
 $28 \leq \text{P}_{\text{plat}} \leq 30$



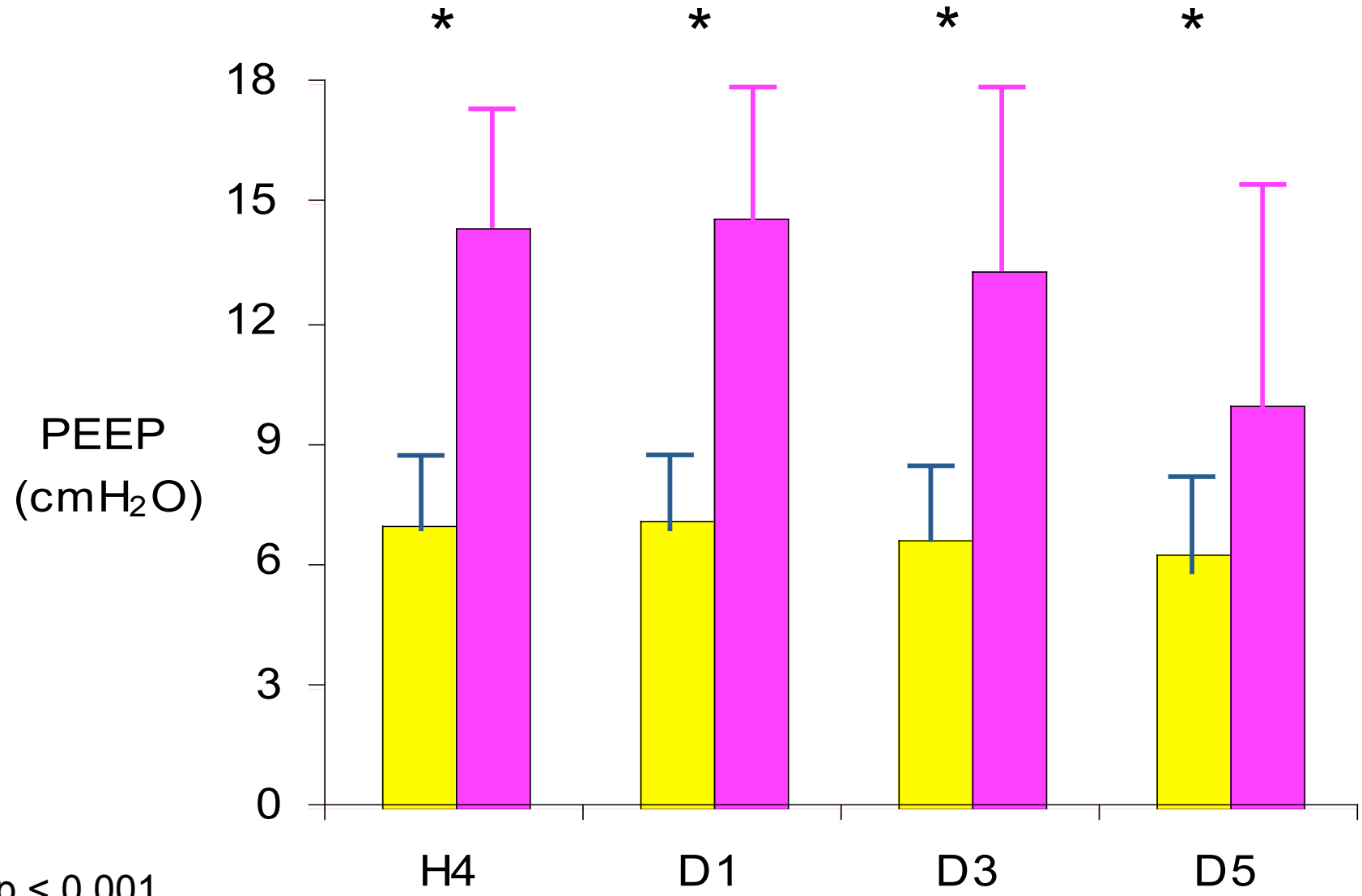
JAMA[®]

Online article and related content
current as of October 16, 2008.

**Positive End-Expiratory Pressure Setting in Adults With
Acute Lung Injury and Acute Respiratory Distress
Syndrome: A Randomized Controlled Trial**

Alain Mercat; Jean-Christophe M. Richard; Bruno Vielle; et al.

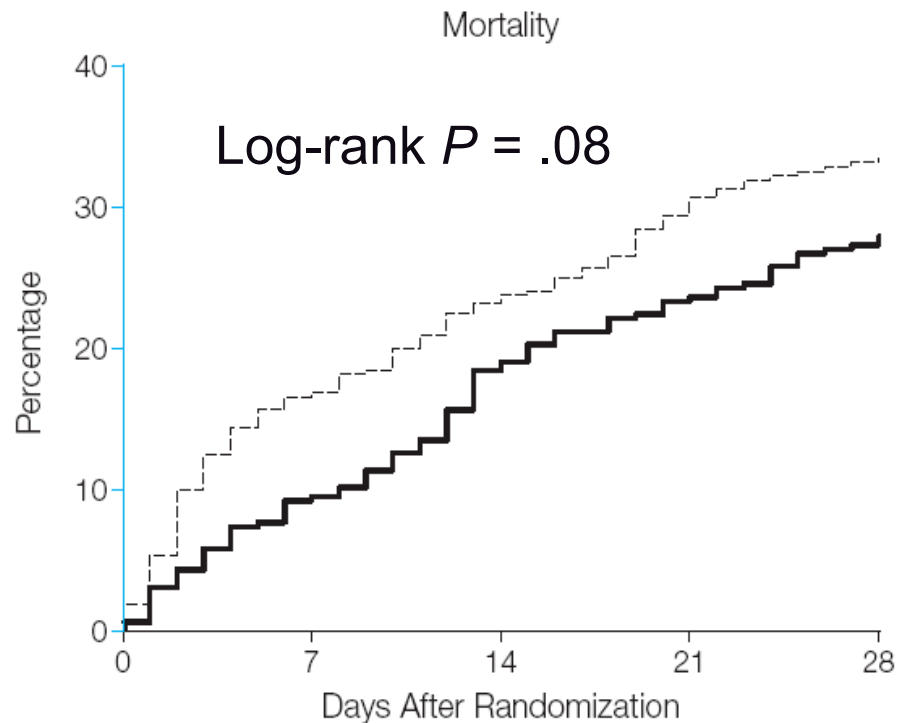
PEEP



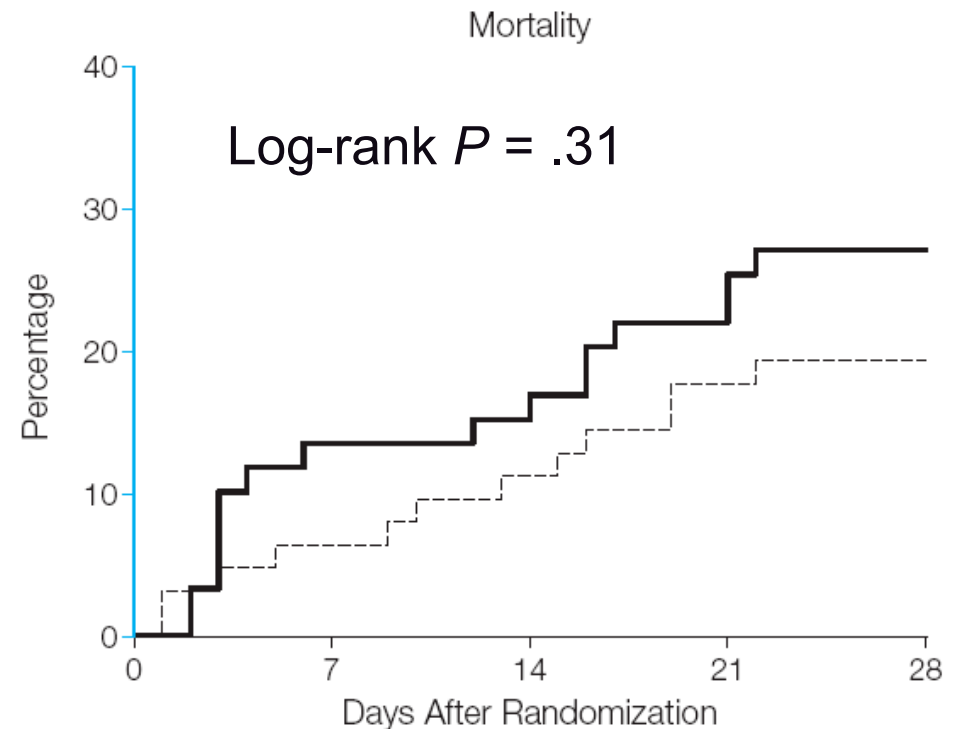
Minimal distension Maximal recruitment

ExPress : Post hoc analysis

ARDS
(n = 646)



ALI without ARDS
(n = 121)

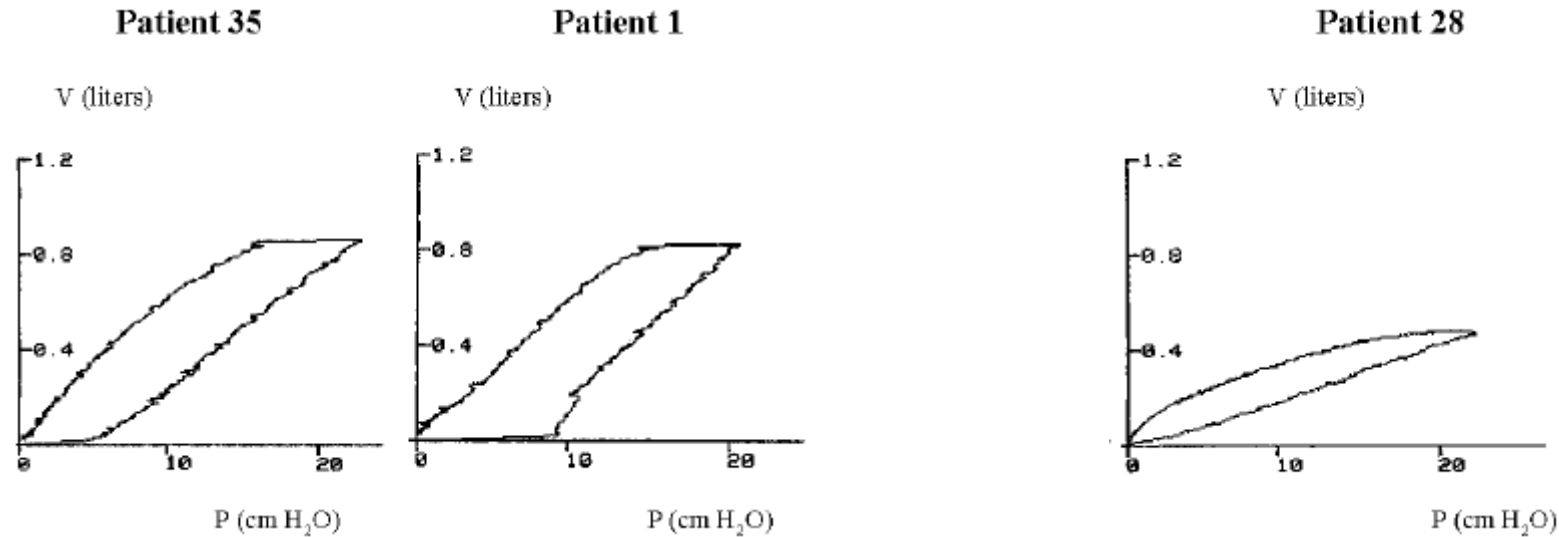


----- Minimal distension
———— Increased recruitment

Boucle P-V et recrutement

Type « 1 »
(n=38)

Type « 2 »
(n=16)



Clin = 42 ± 10 ml/cmH₂O
PFlex = 11 ± 3 cmH₂O
Vrec min = 74 ± 53 ml
Vrec max = 89 ± 54 ml

Clin = 26 ± 9 ml/cmH₂O*
PFlex = --
Vrec min = 47 ± 26 ml*
Vrec max = 48 ± 25 ml*

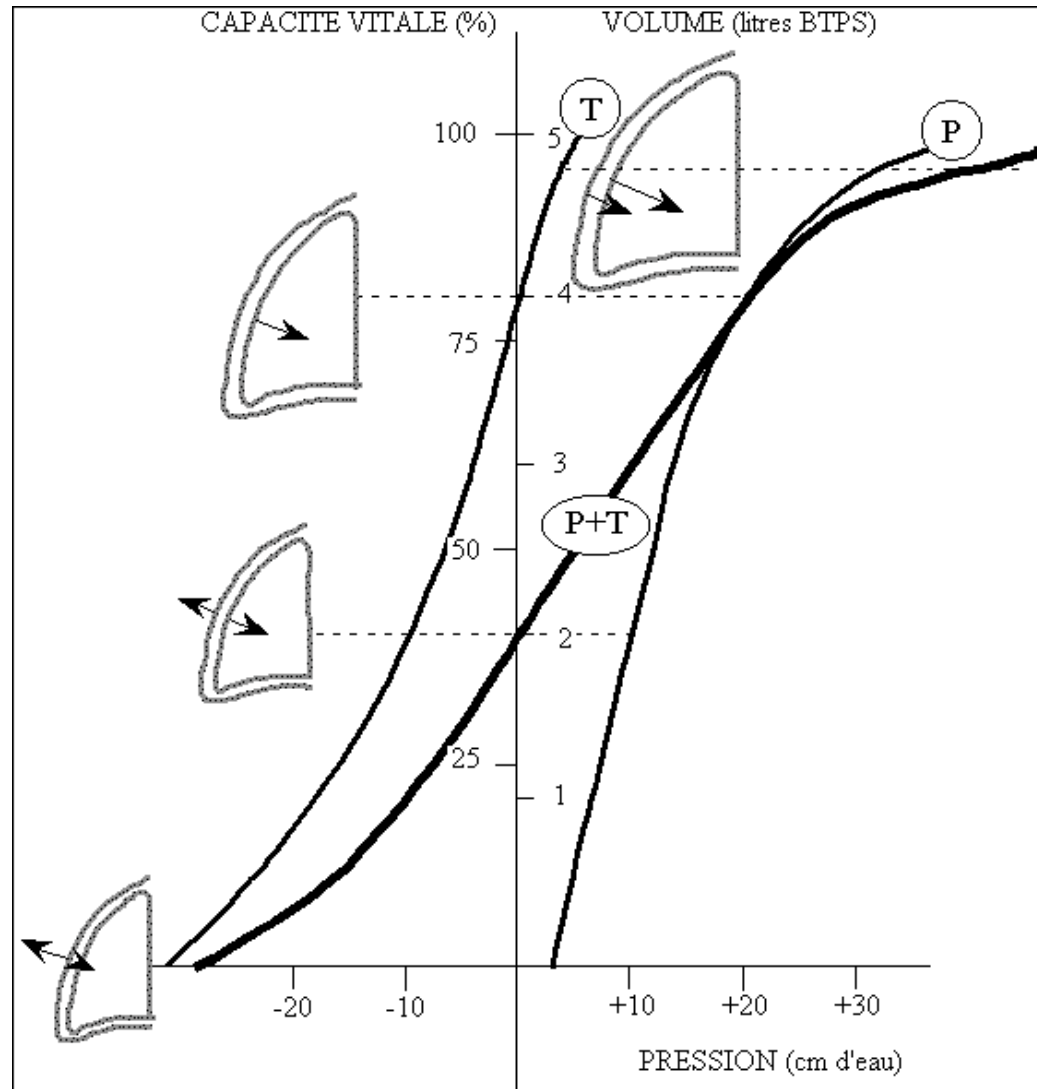
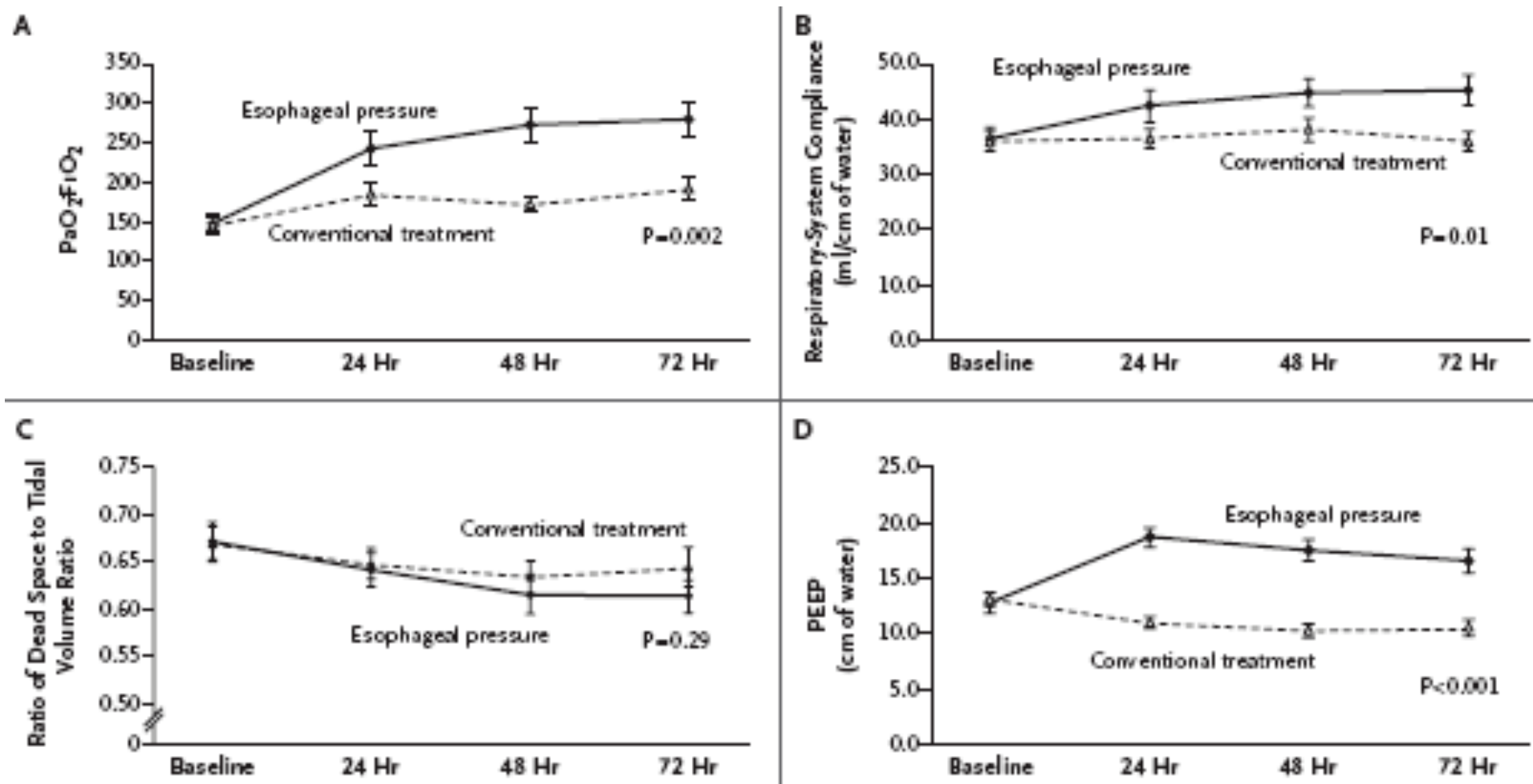


Figure 19 :

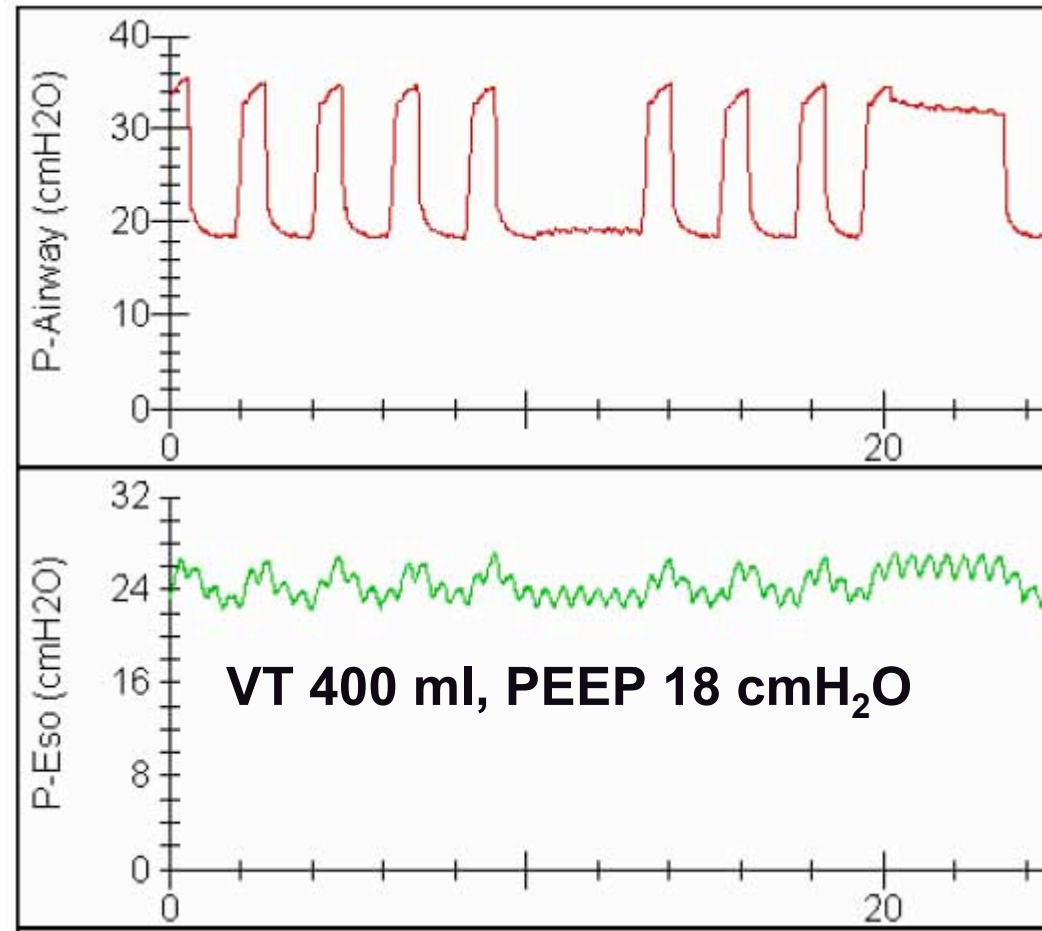
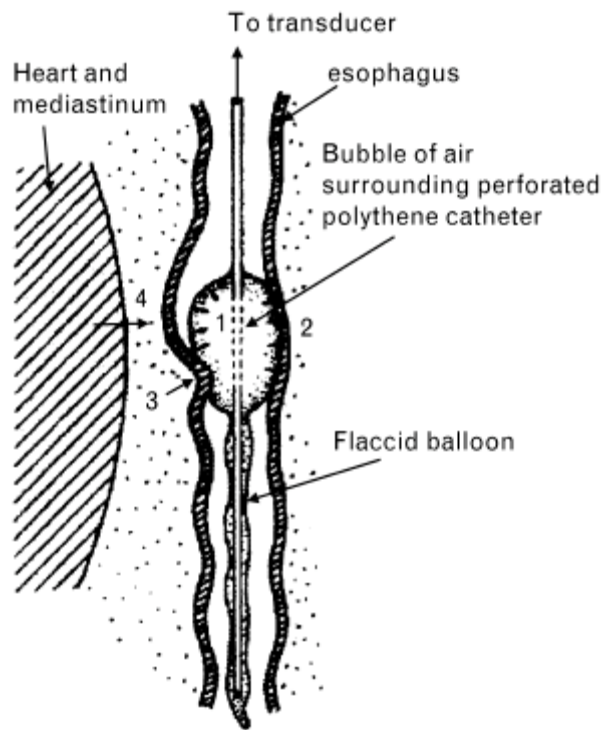
Evolution statique de la pression buccale en fonction de la position du thorax (P+T) qui décrit la courbe de relaxation pulmonaire totale. Cette courbe est en chaque point la résultante des actions élastiques pulmonaires (P) et de la cage thoracique (T) illustrées par les schémas grisés.



Outcome	Esophageal-Pressure-Guided (N = 30)	Conventional Treatment (N = 31)	P Value
28-Day mortality — no. (%)	5 (17)	12 (39)	0.055

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

SDRA : mesure pression oesophagienne ?



■ CLINICAL INVESTIGATIONS

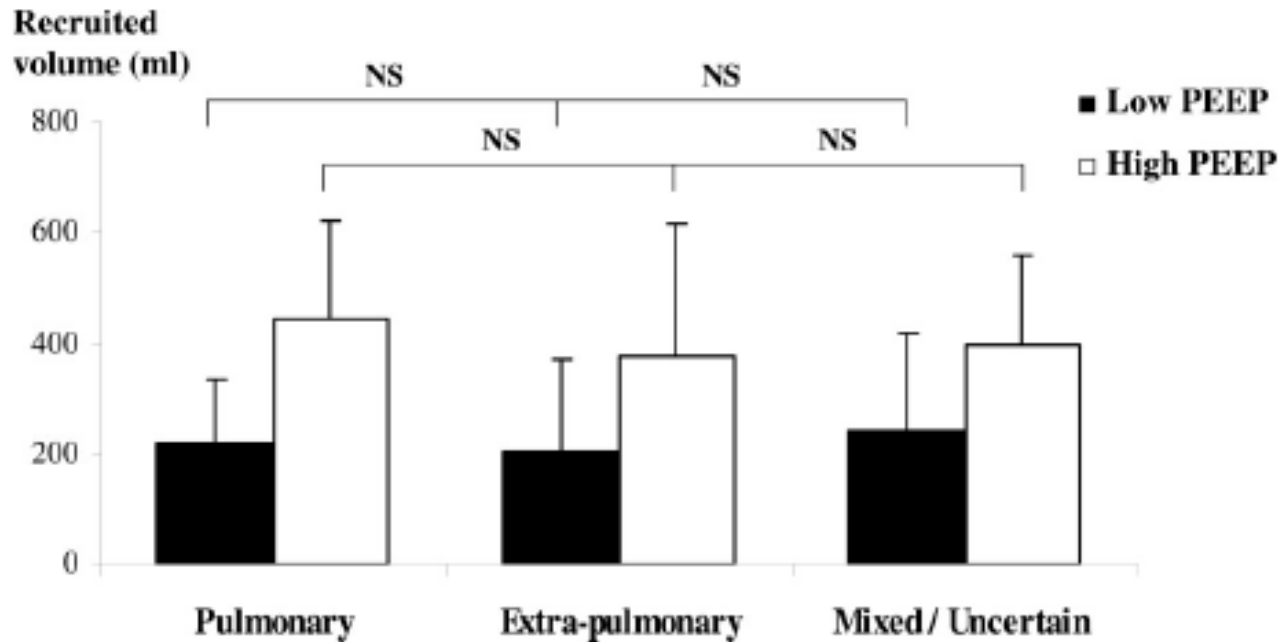
Anesthesiology 2007; 106:212-7

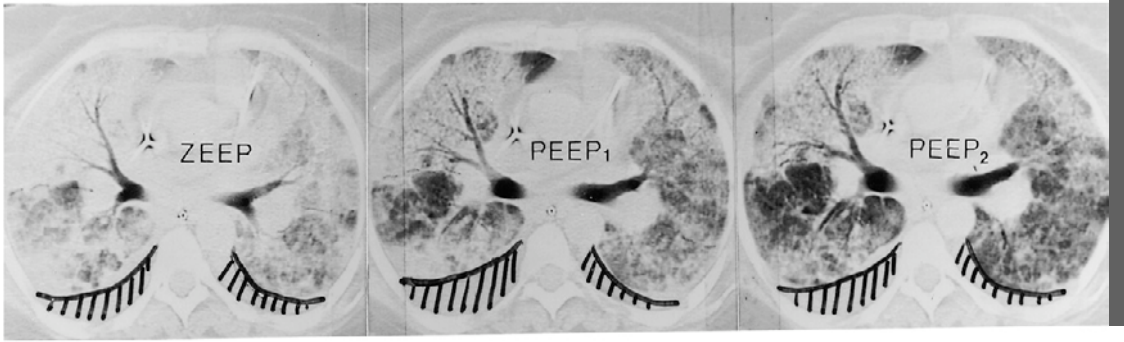
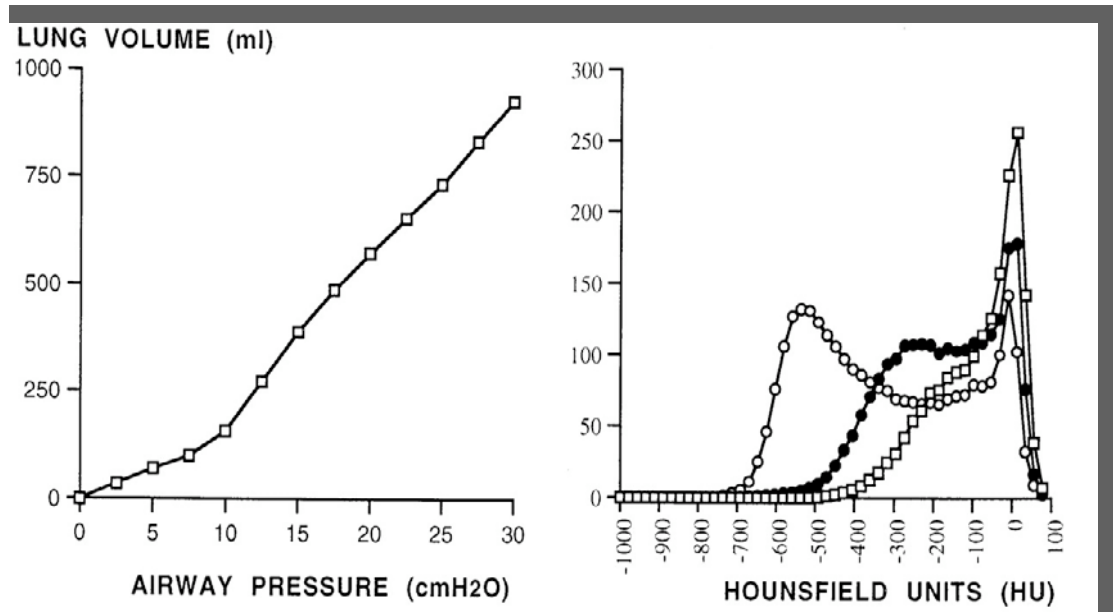
Copyright © 2007, the American Society of Anesthesiologists, Inc. Lippincott Williams & Wilkins, Inc.

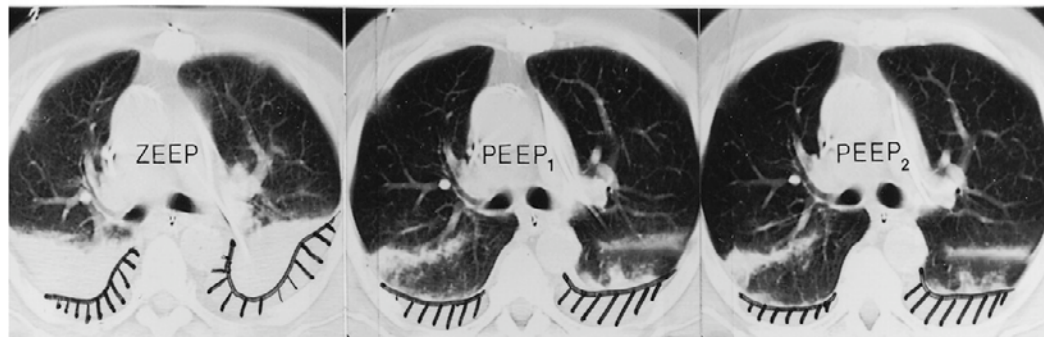
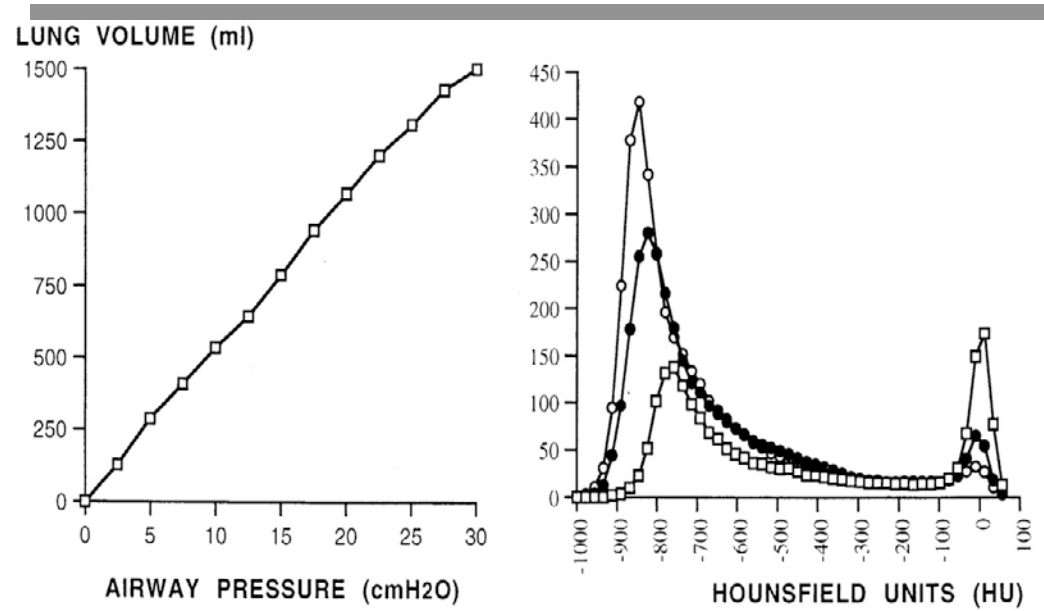
Alveolar Recruitment in Pulmonary and Extrapulmonary Acute Respiratory Distress Syndrome

Comparison Using Pressure-Volume Curve or Static Compliance

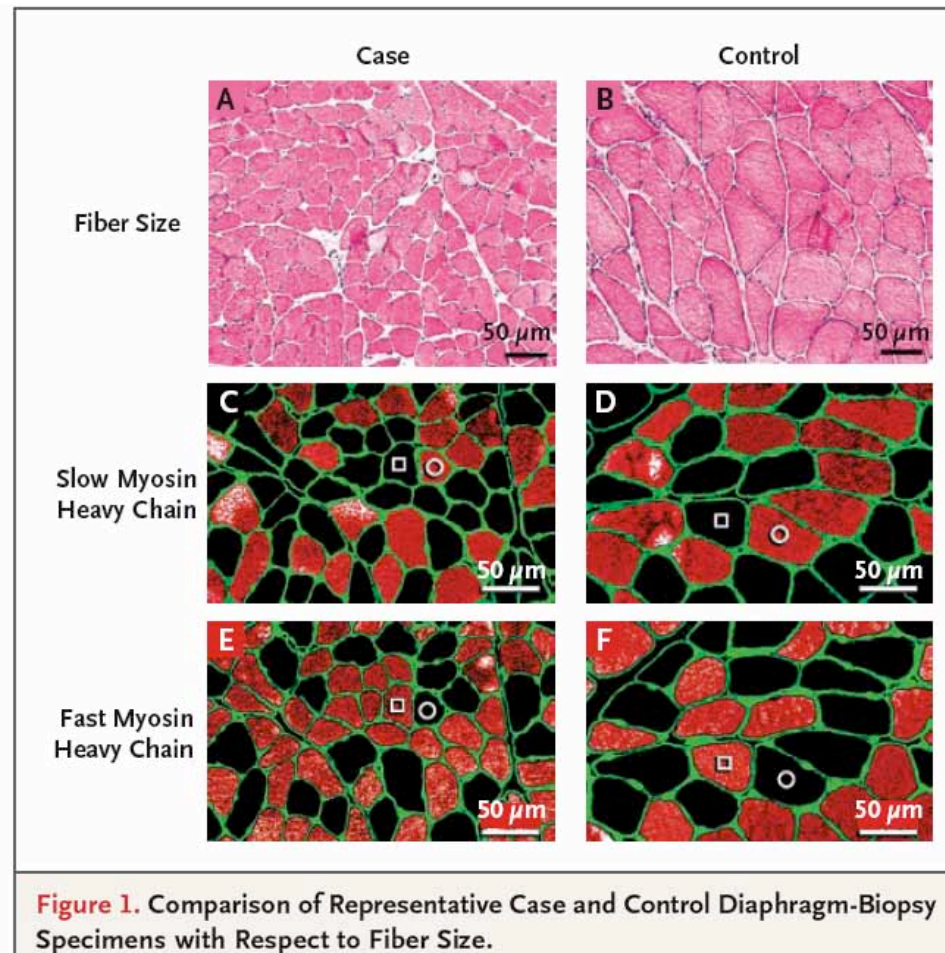
Arnaud W. Thille, M.D.,* Jean-Christophe M. Richard, M.D., Ph.D.,† Salvatore M. Maggiore, M.D., Ph.D.,‡
V. Marco Ranieri, M.D.,§ Laurent Brochard, M.D.||







Cette étude montre que la mise au repos du diaphragme pendant 18 à 69 heures est responsable d'une atrophie des fibres musculaires . Cet effet délétère de la ventilation contrôlée pourrait influencer l'issue du sevrage et la durée de ventilation



Levine et al. N Engl J Med 2008; 358:1327-352003; 99: 376-84

L'interuption quotidienne de la sédation couplée à un test de ventilation spontanée permet de diminuer significativement la durée de ventilation et d'hospitalisation. Pour 7 patients traités 1 vie était sauvée (IC 4,2 – 35,5)

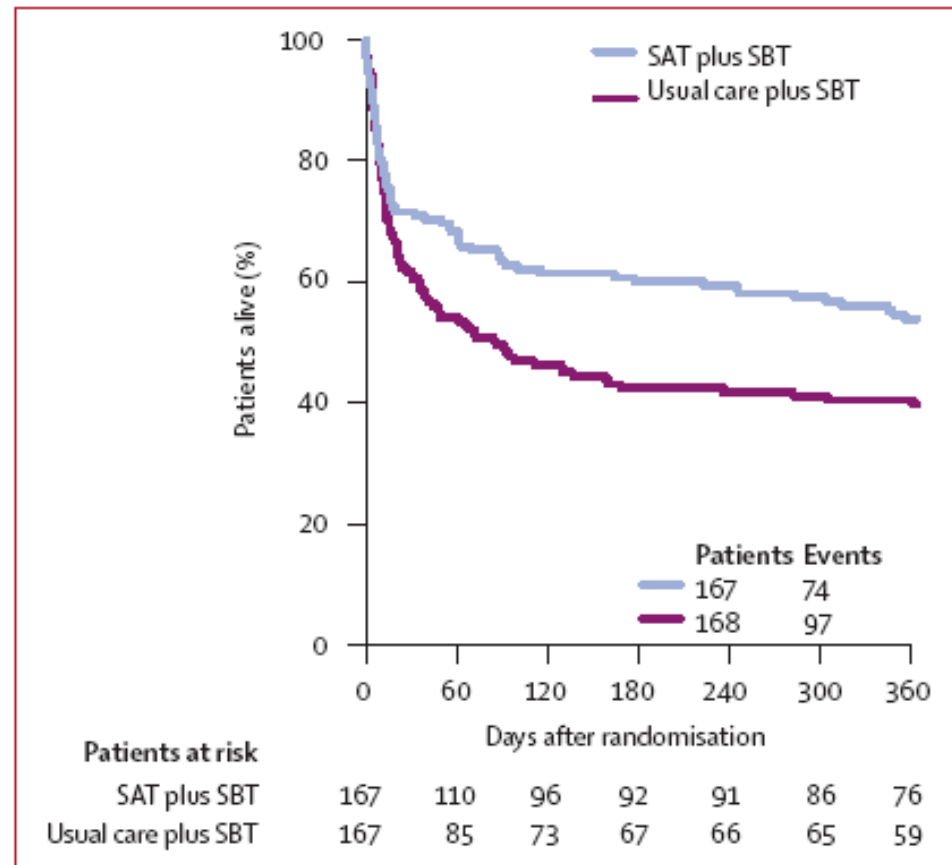


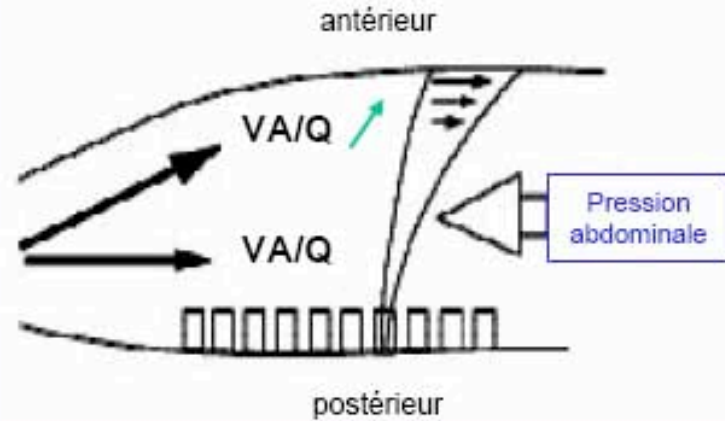
Figure 4: Survival at 1 year

Events indicate the number of deaths in each group in the year after enrolment.

Girard et al. Lancet 2008; 371: 126 - 34

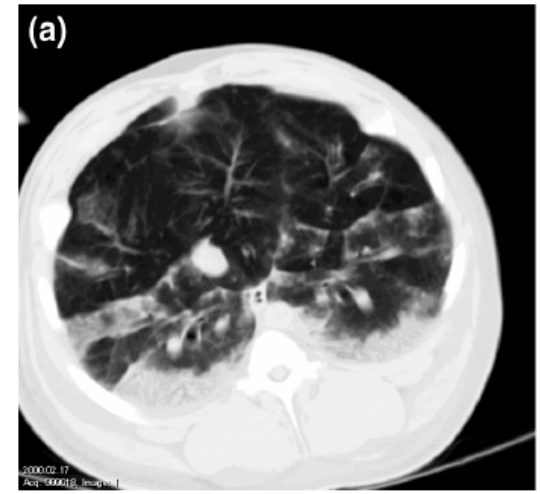
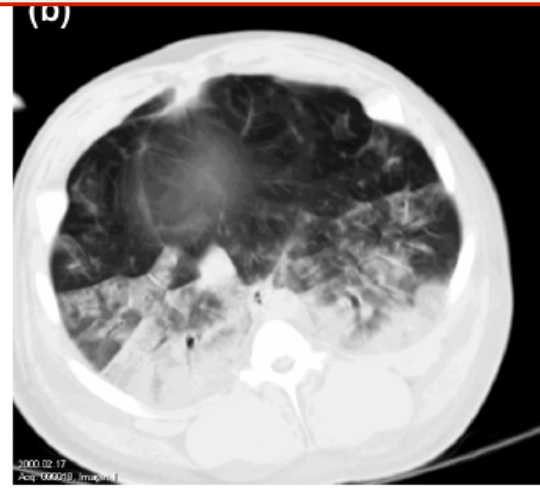
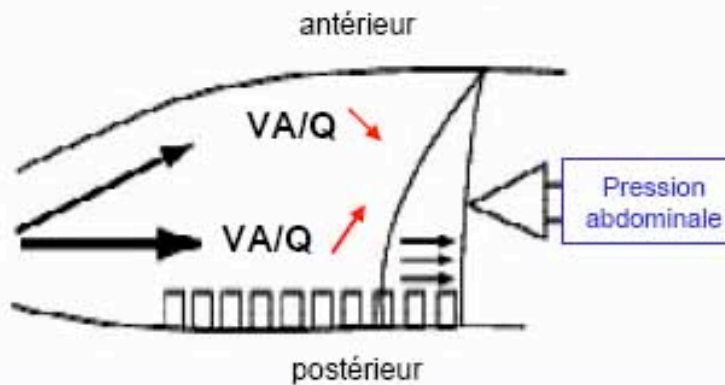
La ventilation spontanée, même superficielle, appliquée au cours de la ventilation du SDRA permet d'améliorer le recrutement alvéolaire et les échanges gazeux

Ventilation mécanique



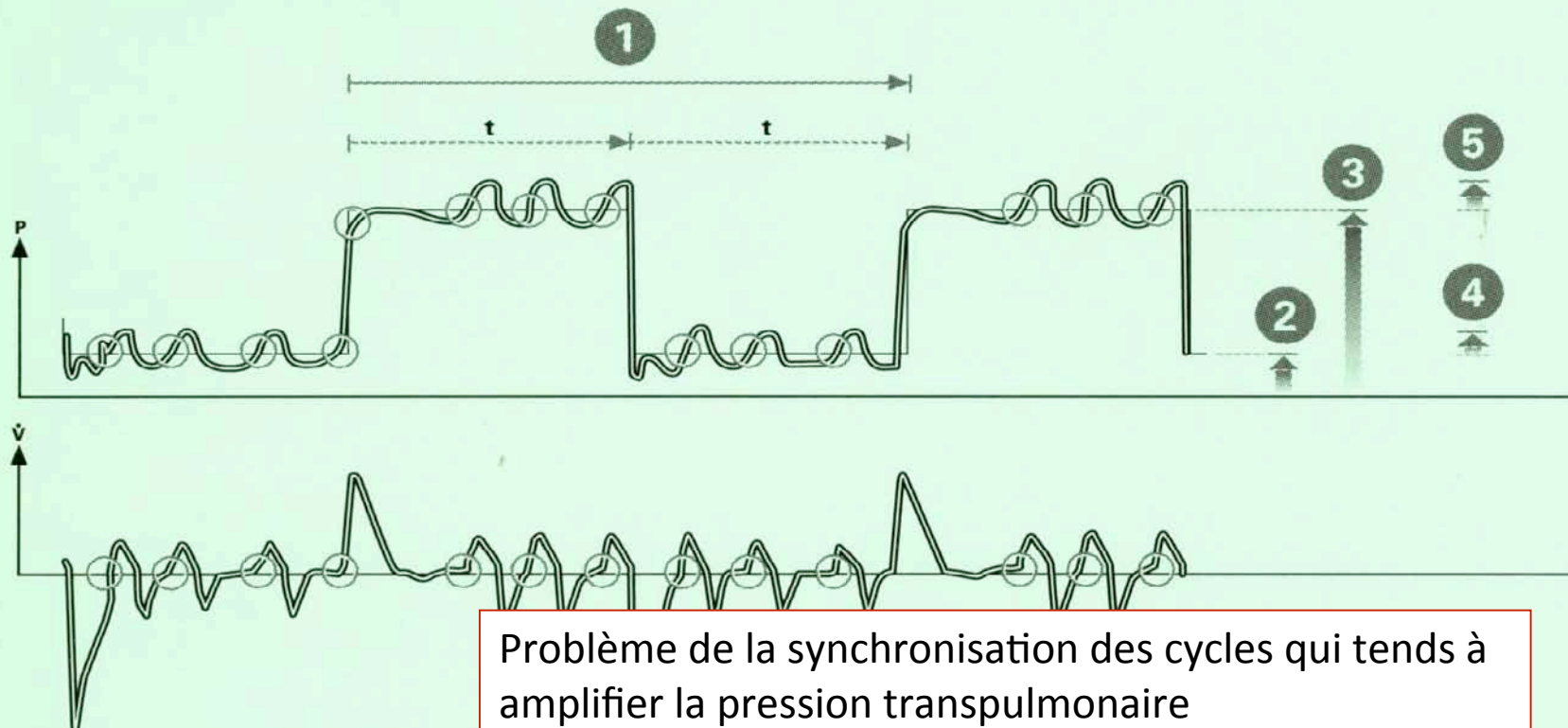
(Putensen et al, Cur Op Crit Care, 2002; 8: 52-57)

Ventilation spontanée



BIPAP, APRV, Bi-Vent, Duo PAP etc...

Bi-Vent in detail

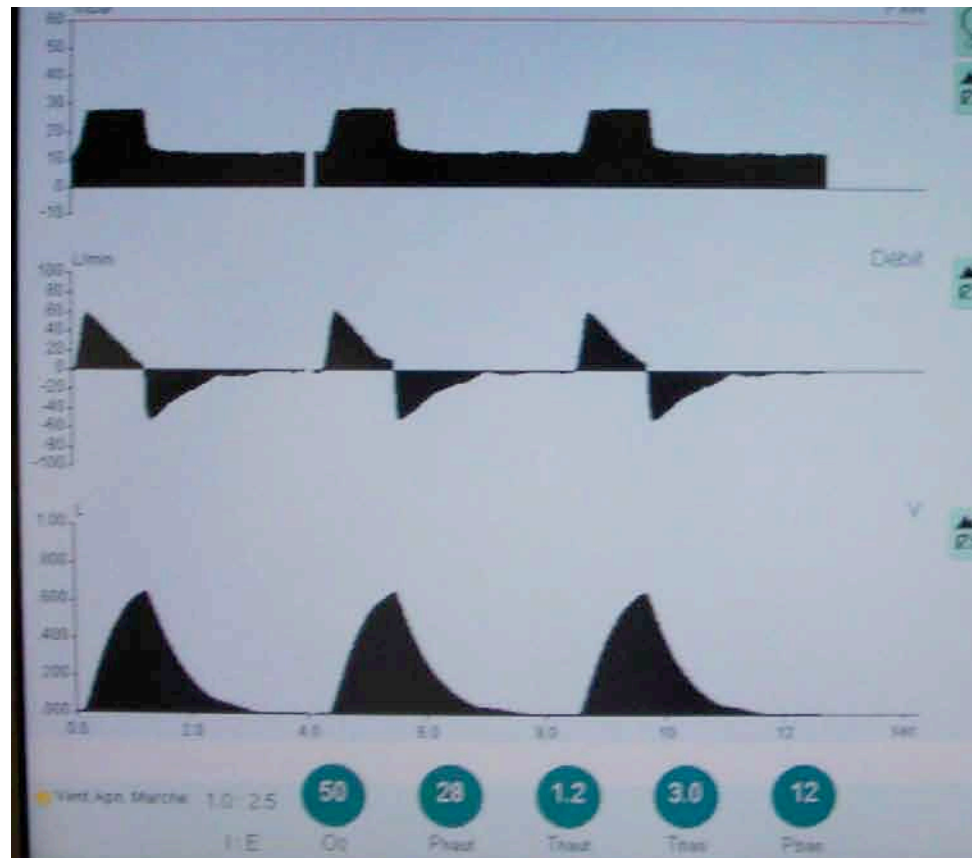


Problème de la synchronisation des cycles qui tends à amplifier la pression transpulmonaire

Propositions de réglages EXPRESS pour l'APRV à la phase initiale du SDRA:

Le malade est sédaté en VC

- $T_{\text{haut}} = 1.0$ à 1.2 sec
- $T_{\text{bas}} = 2.0$ à 0.8 sec
- $P_{\text{haute}} = 30$ cmH₂O
- PEEP = Express
- (FR = 20 à 30 cpm)
- $V_t = 6$ ml/kg

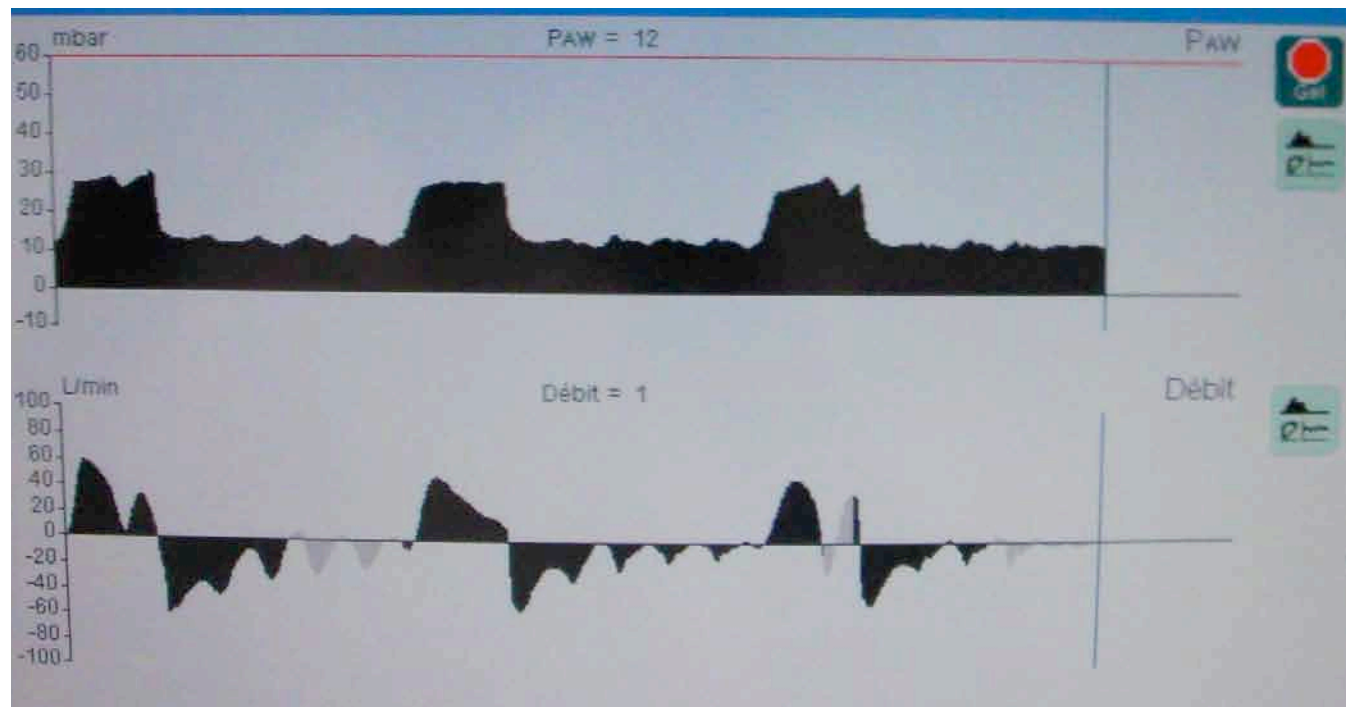


Propositions de réglages APRV (EXPRESS) dès H24:

Le malade sédaté mais démasque une ventilation spontanée

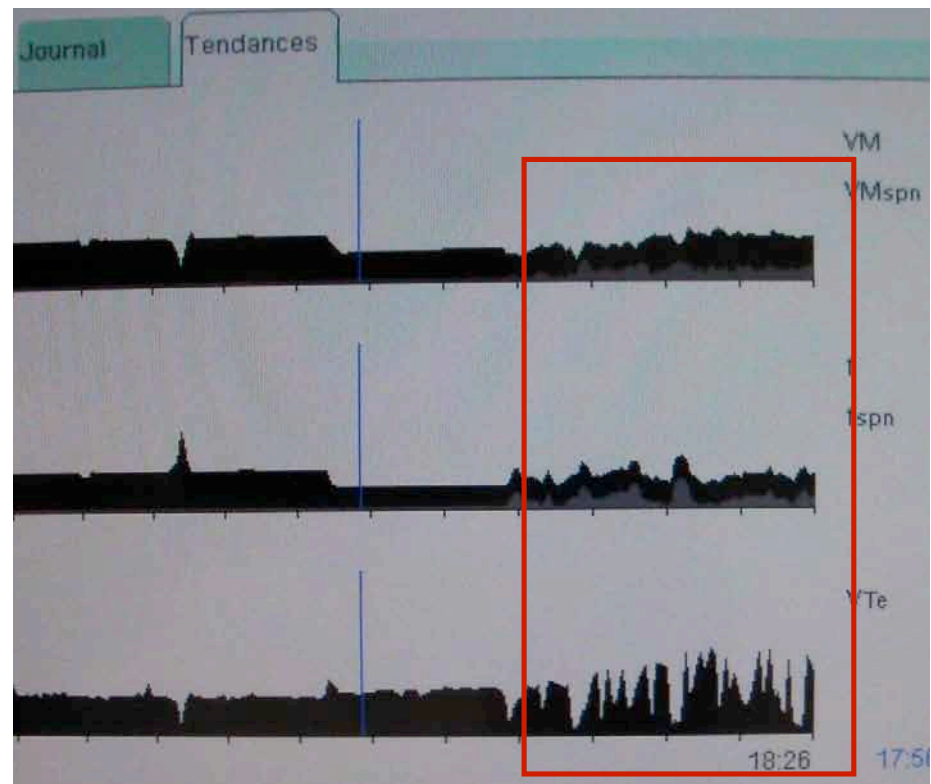
- Diminuer sédation pour que la VS = 30% Vmn totale
- Maintenir Vt spontané < 6 ml/kg
- Diminuer FR en allongeant Tbas progressivement.

L'APRV n'est pas un mode de sevrage !



Surveillance nécessaire:

- **Vt**
- **Vmn spontanée**



Bilevel positive airway pressure-airway pressure release ventilation dans le syndrome de détresse respiratoire aiguë de l'adulte : physiopathologie, domaine d'application

BIPAP-APRV in Acute Respiratory Distress Syndrome: From physiology to clinical application

M. Courvoisier^a, G. Beduneau^a, A. Mercat^b, J.C.M. Richard^{a,*}

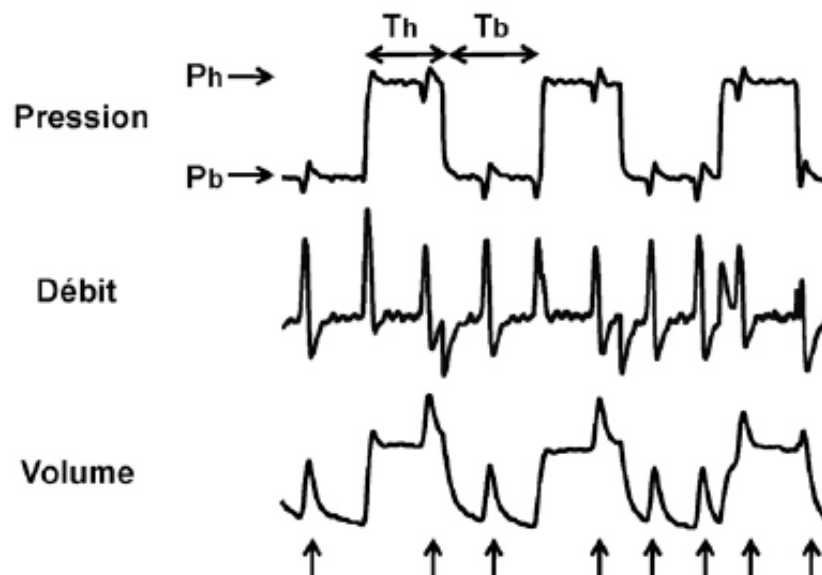


Tableau 2 Dénominations du mode « BIPAP-APRV » sur divers respirateurs de réanimation.

Fabricants	Respirateurs	Nom du mode équivalent au mode « BIPAP-APRV »
Dräger	Evita II dura, Evita IV, Evita XL	« APRV »
Covidien	Puritan Bennett 840	« Bilevel »
Maquet	Servo i	« Bi-Vent »
Hamilton	Galileo, G5	« DuoPAP/APRV »
General Electric	Engström Carestation	« BiLevel »
Taema	Horus, Extend	« VS-PPV »
Viasys	Avea	« APRV / BiPhasic »

Editorial

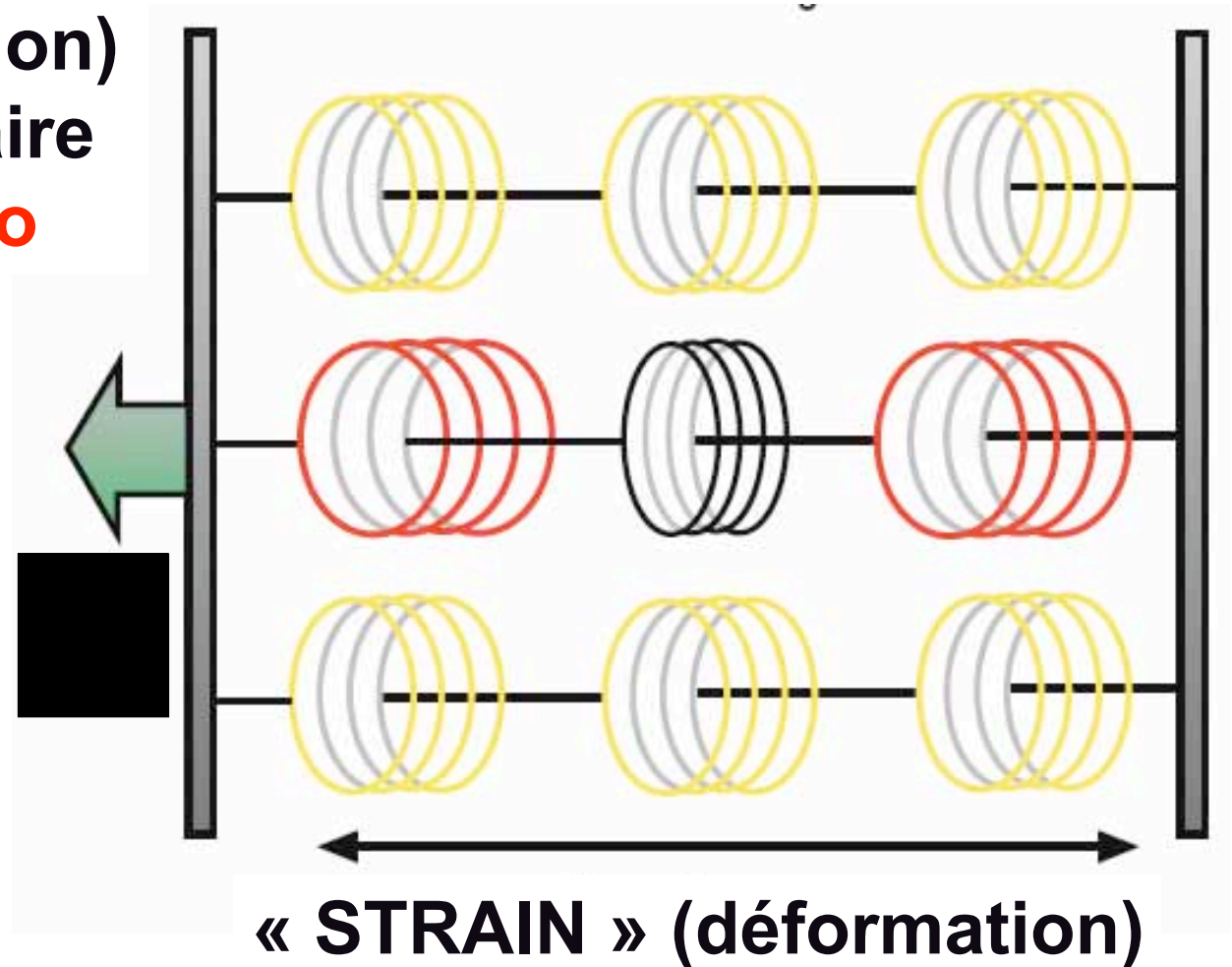
Changing Mortality in Acute Respiratory Distress Syndrome? Yes, We Can!

Caring for the critically ill is a complex and difficult task. The clinician must be aware that what matters lie in the details, God as well as the devil. For the years to come, we can remain optimistic if we are more and more patient-centered, pragmatic rather than dogmatic, less invasive, and concerned about safety.

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AP-HP, Groupe Hospitalier Albert Chenevier–Henri Mondor,
Créteil, France

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Réanimation Polyvalente
AP-HP, Hôpital Pitié-Salpêtrière
Université Pierre et Marie Curie Paris 6
Paris, France

« **STRESS** » (tension)
 $\Delta P_{\text{transpulmonaire}}$
 $\Delta P_{\text{alv}} - \Delta P_{\text{oeso}}$



$$\Delta V / V_0 = VT / CRF$$

$$\text{STRESS} = E L_{\text{spec}} \times \text{STRAIN}$$

Gattinoni, Eur Respir J 2003