21éme Journée d'Actualités en Ventilation Artificielle

22 Novembre 2014

Créteil

L'eau et les bactéries dans le poumon

Un cocktail explosif?

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Hôpital Henri Mondor – Créteil, France

PAVM: infection nosocomiale la plus fréquente

Site of infection	
Respiratory tract	4503 (63.5)
Abdominal	1392 (19.6)
Bloodstream	1071 (15.1)
Renal/urinary tract	1011 (14.3)
Skin	467 (6.6)
Catheter-related	332 (4.7)
CNS	208 (2.9)
Others	540 (7.6)

Vincent, JAMA 2009

Morbi-mortalité PAVM

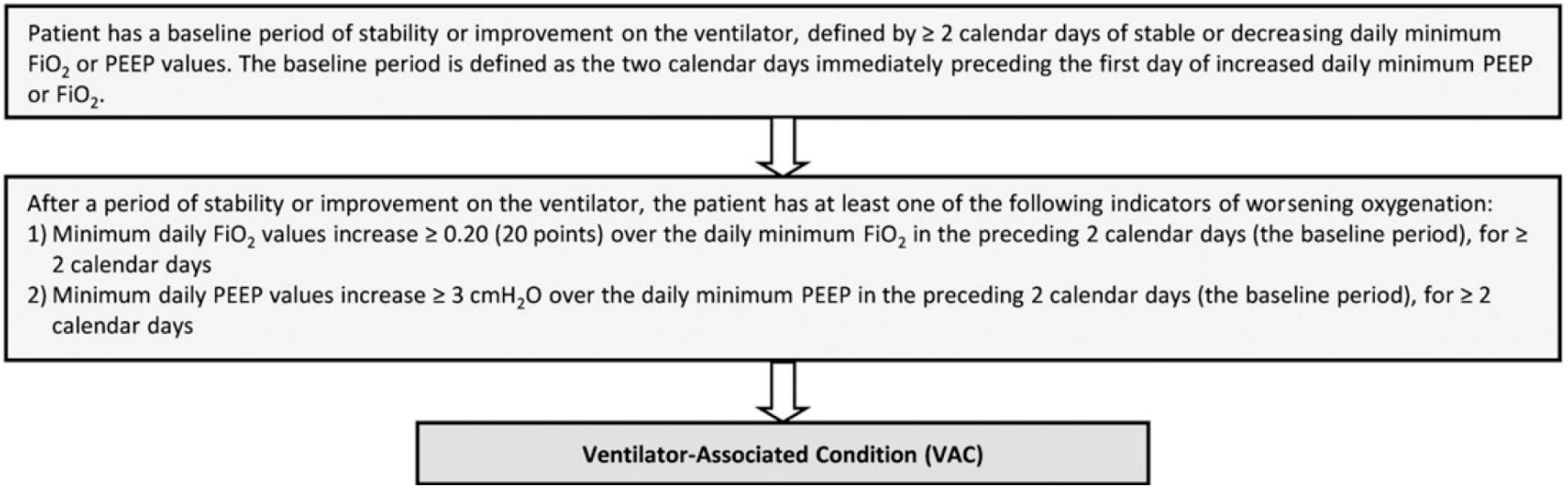
	Total number of patients	RRR VAP (95% CI)	RRR mortality (95% CI)	Attributable mortality (95% CI*)
All studies	6284	0·30 (0·21 to 0·38)	0·04 (–0·06 to 0·12)	13% (–0·14 to 0·38)
Trauma	1159	0·40 (0·25 to 0·52)	–0·08 (–0·45 to 0·19)	0% (–1·06 to 0·45)
Medical	3314	0·32 (0·17 to 0·43)	–0·01 (–0·14 to 0·11)	0% (–0·41 to 0·29)
Surgical	1560	0·26 (0·04 to 0·43)	0·18 (–0·01 to 0·33)	69% (0·08 to 3·60)
APACHE <20				
Unadjusted	1588	0·31 (0·10 to 0·47)	0·00 (–0·26 to 0·20)	0% (–0·94 to 0·72)
Adjusted†	1521	0·34 (0·14 to 0·49)	–0·03 (–0·31 to 0·18)	0% (–0·97 to 0·77)
APACHE 20–29	1176	0·28 (0·05 to 0·45)	0·10 (–0·12 to 0·27)	36% (–0·29 to 1·51)
APACHE ≥30	359	0·47 (0·08 to 0·70)	–0·03 (–0·39 to 0·23)	0% (–0·95 to 0·37)
SAPS 2 <35	364	0·45 (0·08 to 0·67)	–0·23 (–1·18 to 0·30)	0% (–4·48 to 0·82)
SAPS 2 35–58	723	0·38 (0·11 to 0·56)	0·18 (–0·07 to 0·38)	47% (–0·13 to 1·08)
SAPS 2 ≥58	377	0·35 (–0·05 to 0·60)	–0·12 (–0·50 to 0·16)	0% (–2·27 to 0·60)

RRR=relative risk reduction. VAP=ventilator–associated pneumonia. APACHE=acute physiology and chronic health evaluation. SAPS 2=simplified acute physiology score.*95% CI attributable mortality as estimated with bootstrap analyses. †Adjusted for trauma .

Table 2: **Results of primary analysis (random effects model)**

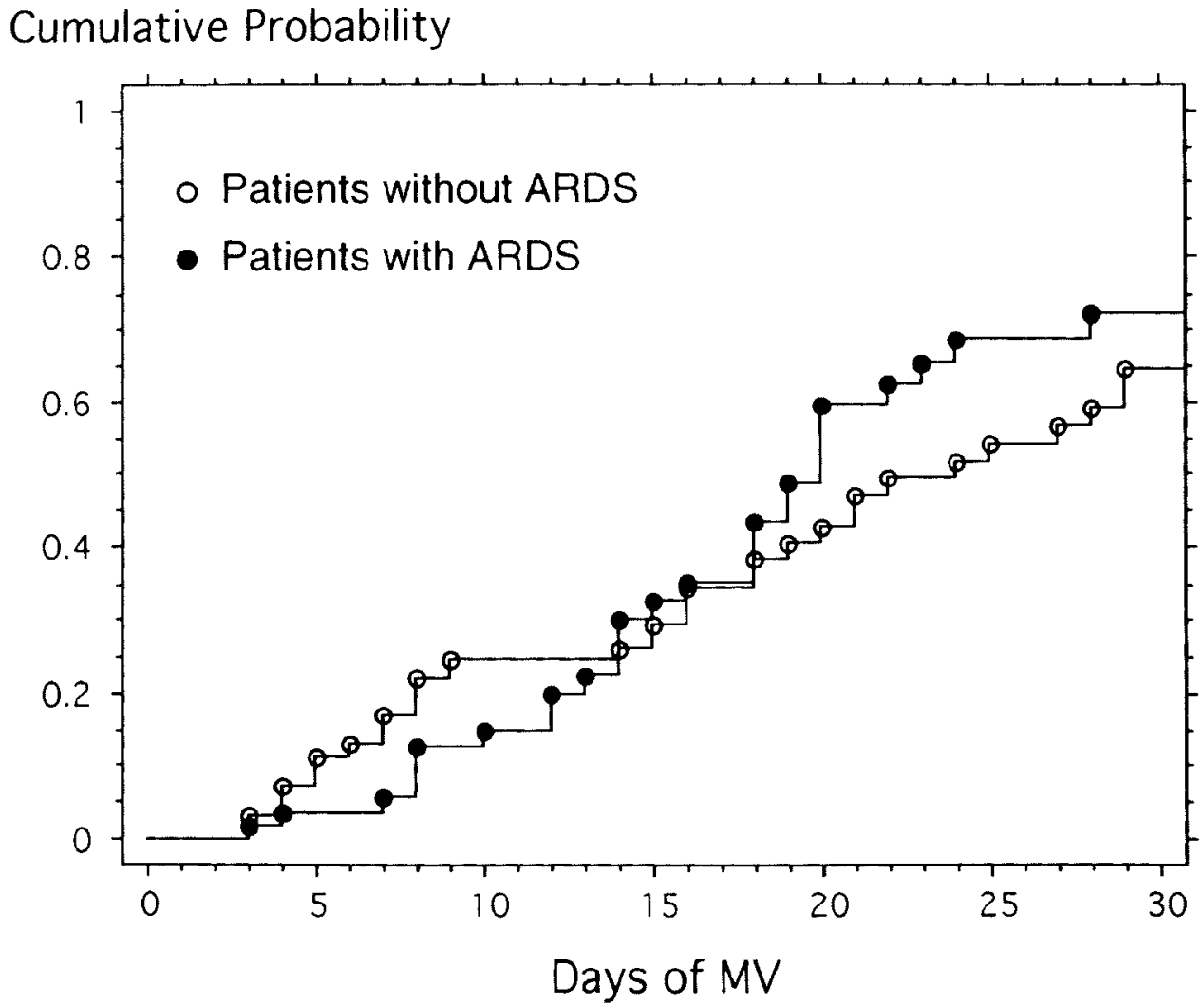
Melsen, Lancet Infect Dis 2013

VAC



Magill, Ann ATS 2013

PAVM et œdème pulmonaire lésionnel



Chastre, AJRCCM 1998

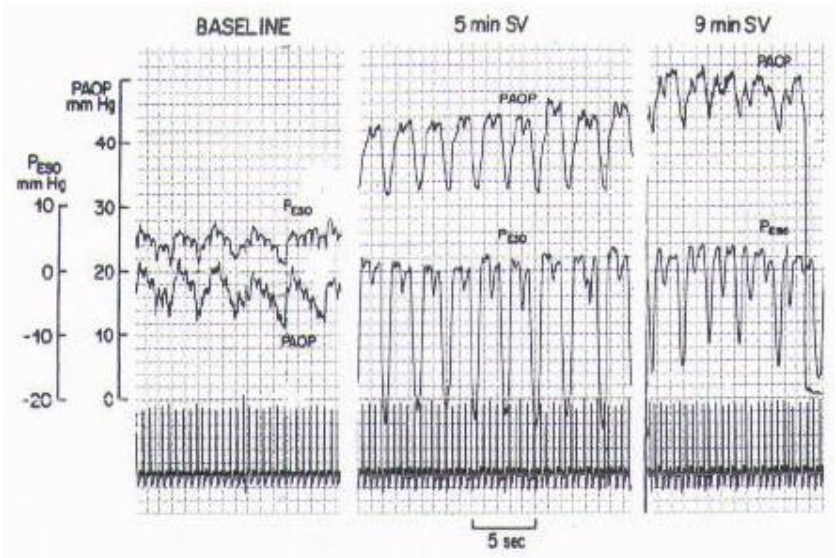
OAP cardiogénique et pneumonies

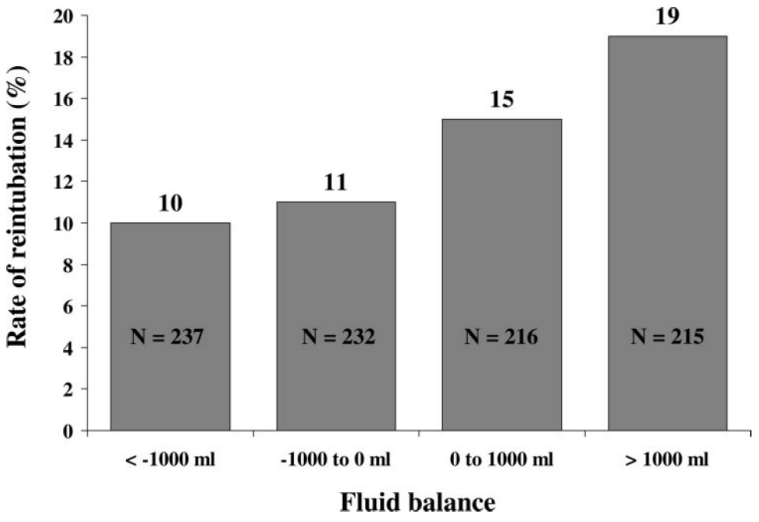
Table 3. Relation between Cardiac and Noncardiac Complications

Association with Noncardiac Complications	Odds Ratio (95% Confidence Interval)
Any cardiac complication, unadjusted	6.6 (4.3–10.2)
Any cardiac complication*	6.4 (3.9–10.6)
Ventricular fibrillation/ cardiac arrest/complete heart block†	9.3 (2.9–29.5)
Myocardial infarctions‡	4.5 (2.2–9.3)
Pulmonary edema§	10.6 (5.0–22.2)

Fleischmann, Am J Med 2003

Cœur et sevrage

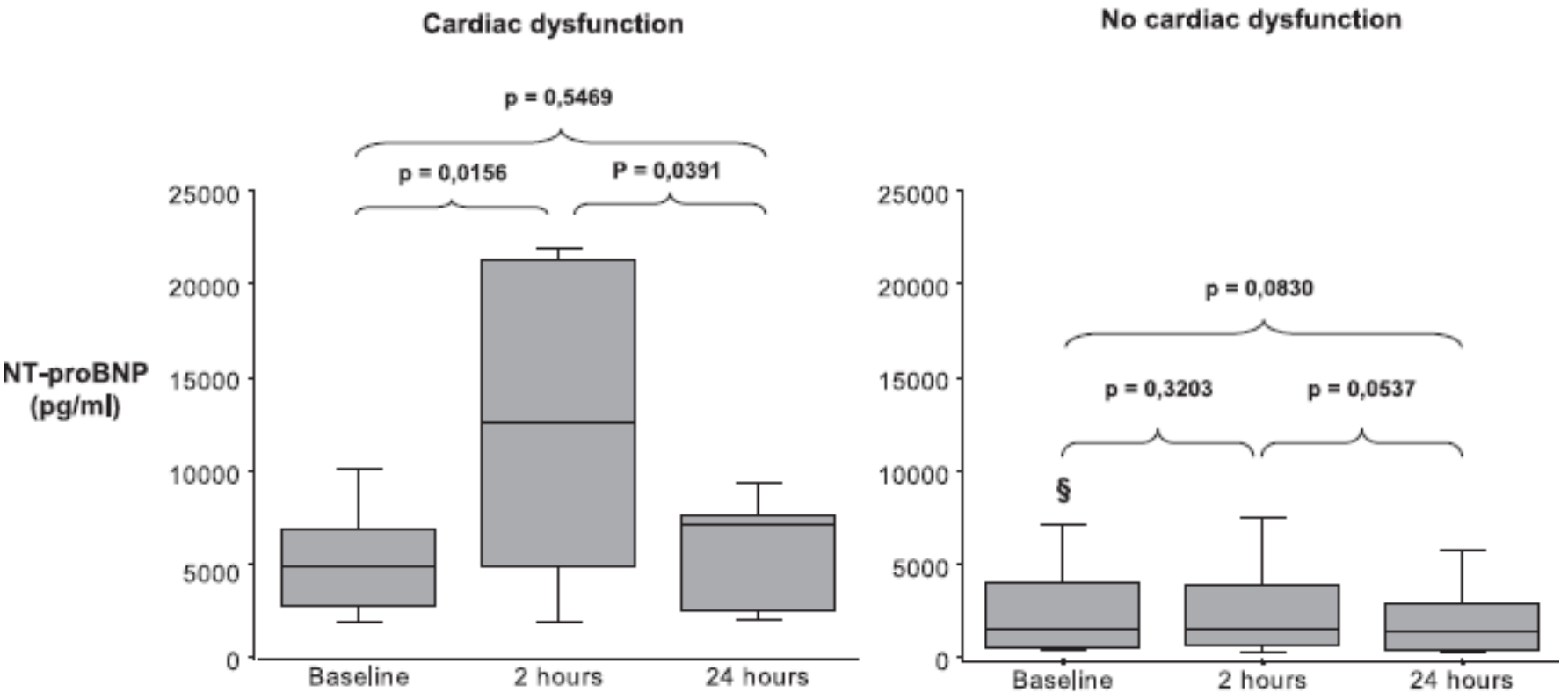




Lemaire et al, Anesthesiology 1988

Frutos Vivar et al, Chest 2006

NT-pro BNP et sevrage difficile



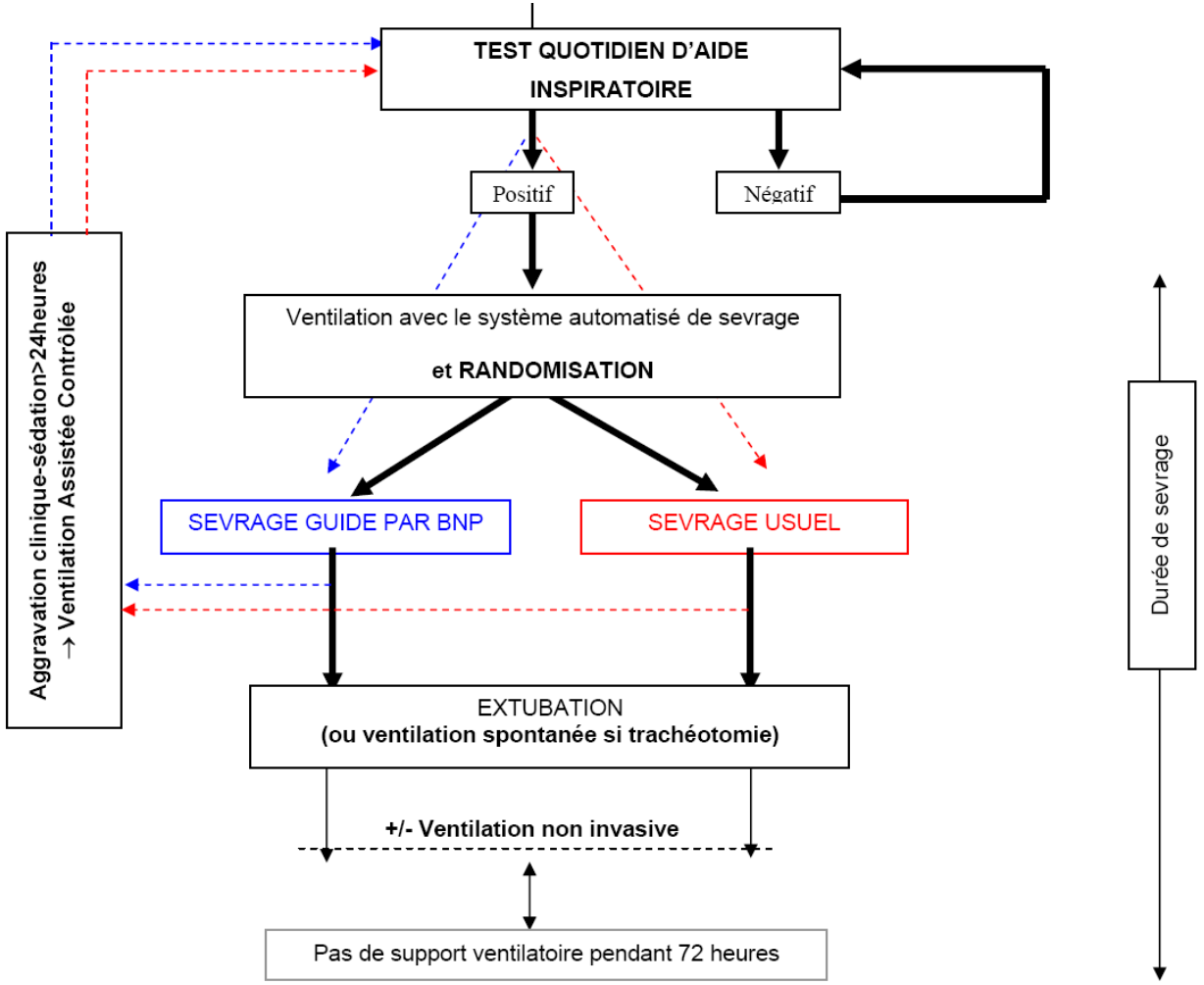
Grasso et al, CCM 2007

BMW

Natriuretic Peptide–driven Fluid Management during Ventilator Weaning

A Randomized Controlled Trial

Armand Mekontso Dessap[1,2,3], Ferran Roche-Campo[1,4], Achille Kouatchet[5], Vinko Tomicic[6], Gaetan Beduneau[7], Romain Sonneville[8], Belen Cabello[4], Samir Jaber[9], Elie Azoulay[10], Diego Castanares-Zapatero[11], Jerome Devaquet[12], François Lellouche[13], Sandrine Katsahian[14], and Laurent Brochard[1,2,3,15]

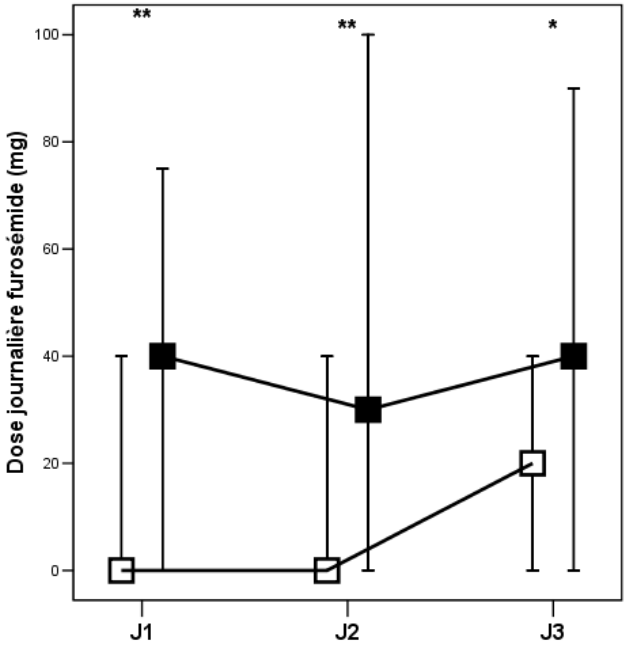


Résultats BMW

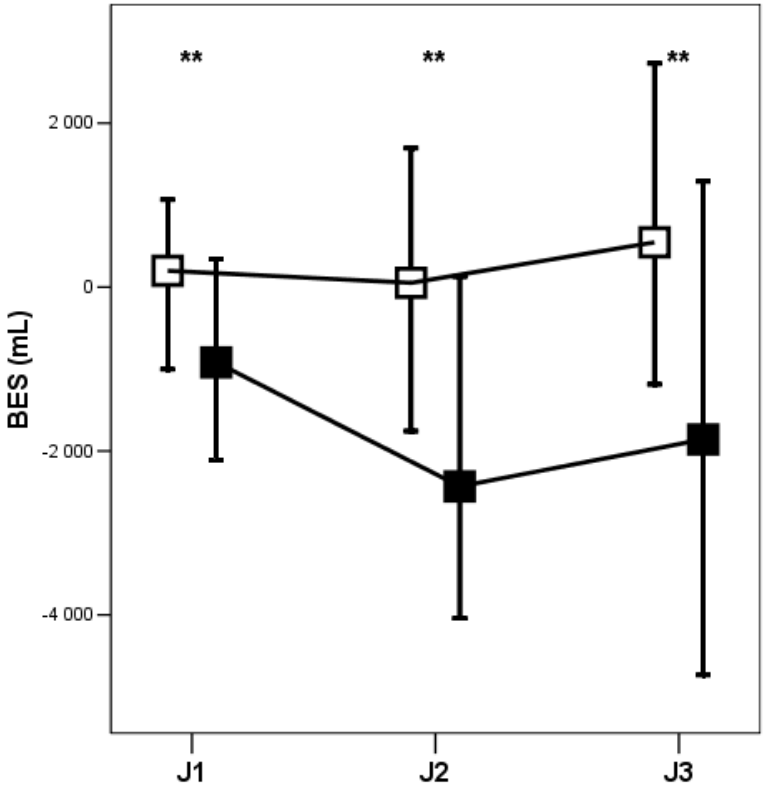
☐ Usuel

■ BNP

Diurétiques

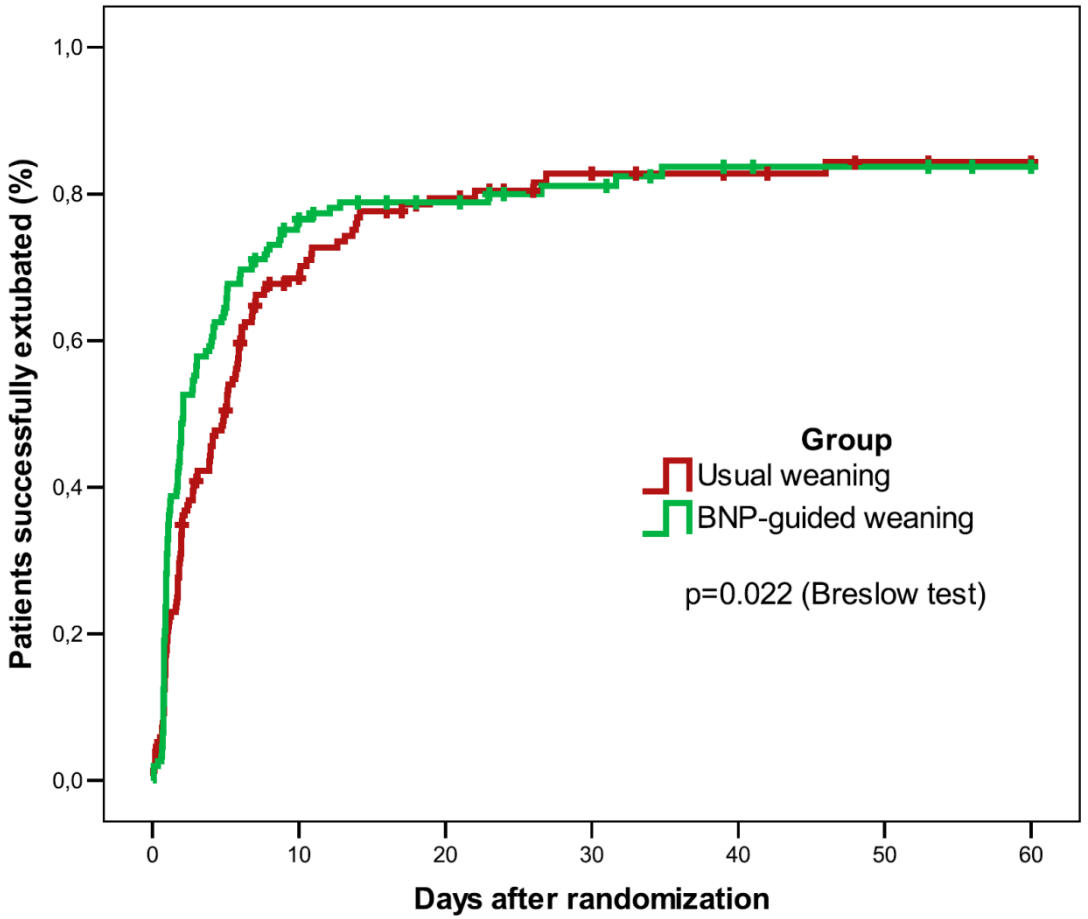


BES



Mekontso Dessap, AJRCCM 2012

Résultats BMW



Mekontso Dessap, AJRCCM 2012

Complications respiratoires

	Groupe usuel (n=152)	Groupe BNP (n=152)	p
Recours VAC (aggravation respiratoire)	66 (43%)	43 (28%)	0.004
PAVM	27 (18%)	14 (9%)	0.029
VNI post extubation	49/138 (36%)	53/142 (37%)	0.752
Trachéotomie	13 (9%)	21 (14%)	0.145
VM prolongée (>14 jours)	20 (13%)	20 (13%)	>0.999

HYPOTHÈSES

- OAP pris pour PAVM ?
  ⇨ diagnostic sur cultures quantitatives (PDP, LBA)

- Risque compétitif ?

Mekontso Dessap, AJRCCM 2012

Incidence PAVM

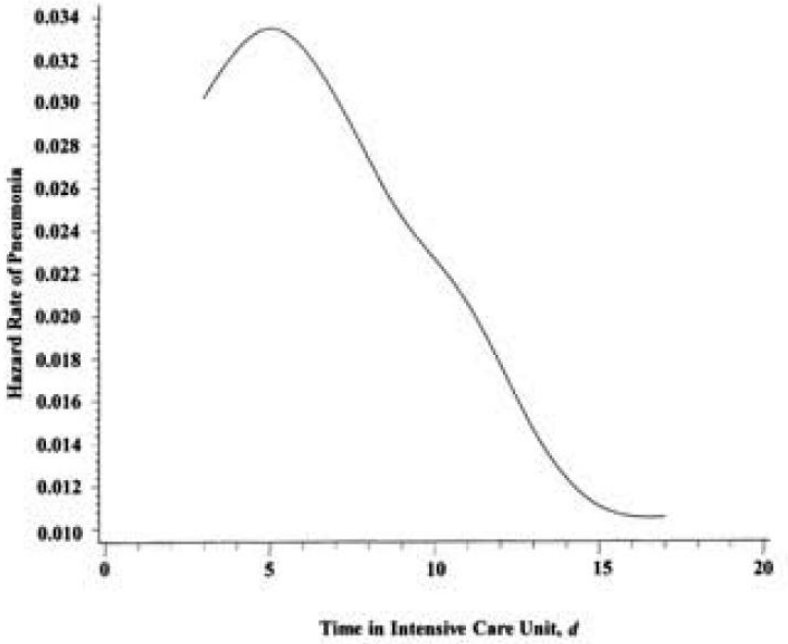
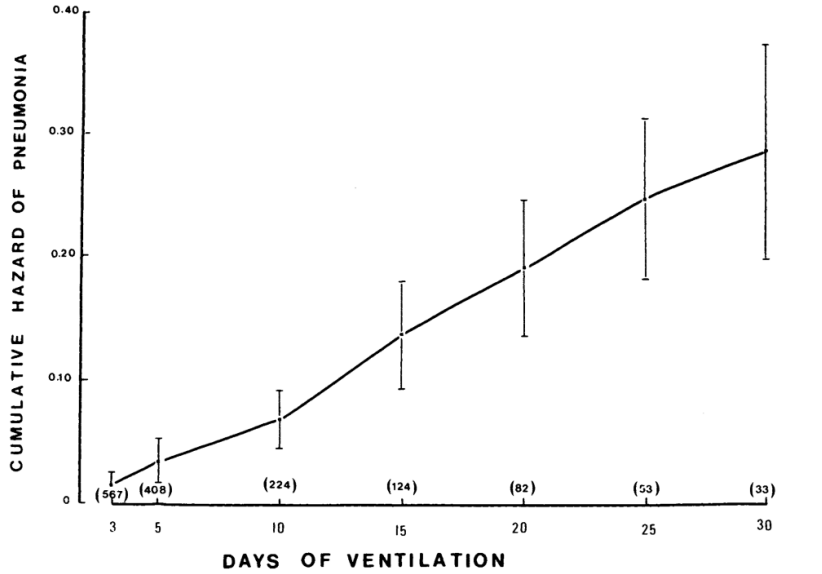


Figure 2. Hazard rate for ventilator-associated pneumonia during the stay in the intensive care unit. The hazard function presents the conditional probability of ventilator-associated pneumonia in the next day, given that a patient is event free. Estimation of the hazard function shows the event rate per day over the duration of ventilation.

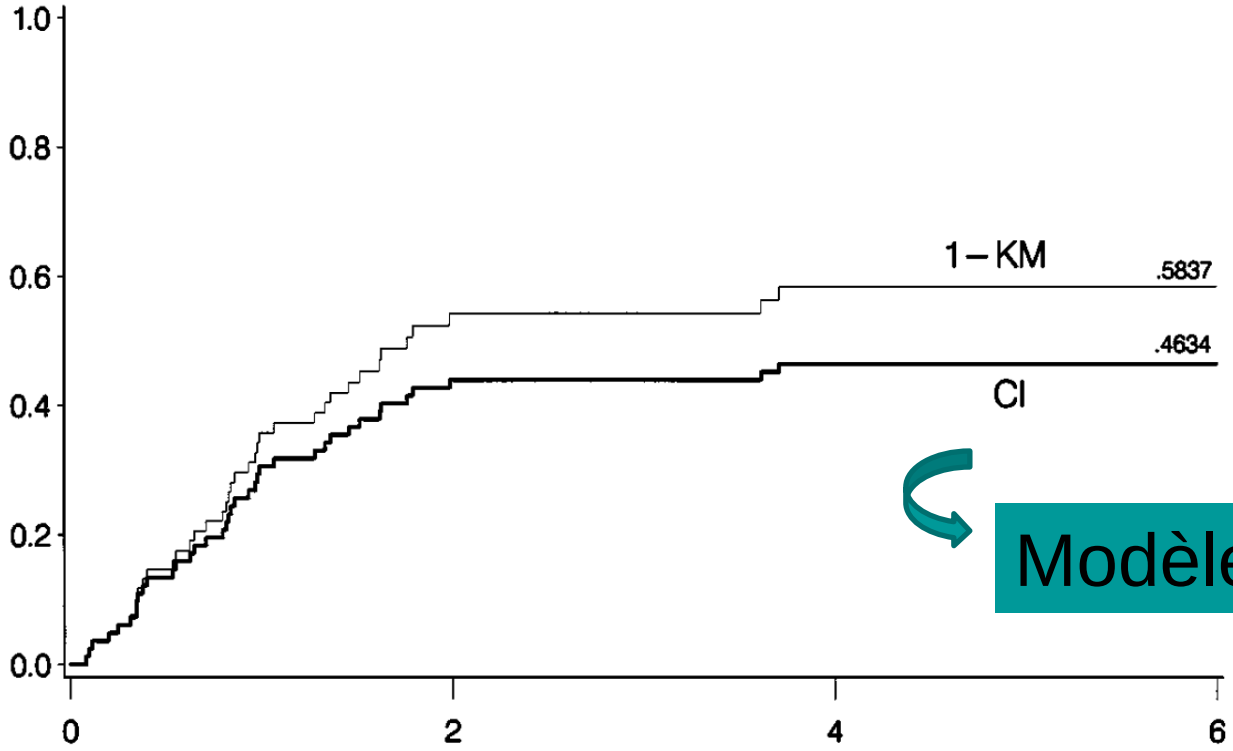


g. 1. Cumulative hazard of ventilator-associated pneumonia in 567 Patients. Data points are mean values (± 1 SD). Figures in parentheses along the abscissa refer the number of patients being followed at the start of the subsequent interval.

Cook, Annals Intern Med 1998

Fagon, ARRD1989

Risques compétitifs



Modèle de Gray

The complement of the KM estimate and the CI estimate of disease progression among 82 patients with head and neck cancer randomized to receive an experimental treatment

Gooley, Stat Med 1999

PAVM durant sevrage

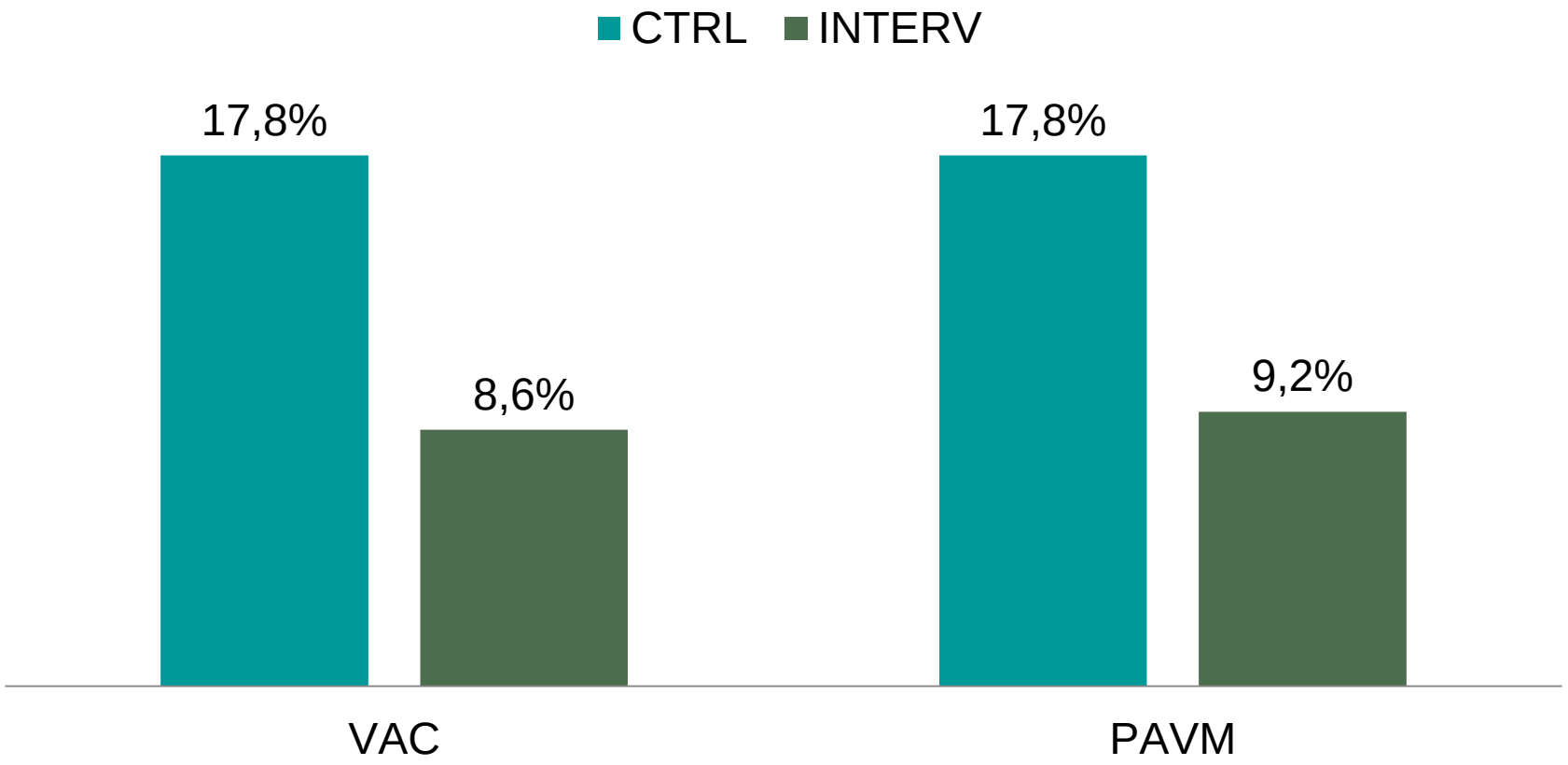
[Original Research **Critical Care**]

CHEST

Ventilator-Associated Pneumonia During Weaning From Mechanical Ventilation

Role of Fluid Management

Armand Mekontso Dessap, MD, PhD; Sandrine Katsahian, MD; Ferran Roche-Campo, MD, PhD; Hugo Varet, PhD; Achille Kouatchet, MD; Vinko Tomicic, MD; Gaetan Beduneau, MD; Romain Sonneville, MD, PhD; Samir Jaber, MD, PhD; Michael Darmon, MD, PhD; Diego Castanares-Zapatero, MD; Laurent Brochard, MD; and Christian Brun-Buisson, MD



Pathogènes impliqués

TABLE 3] Microorganisms Responsible for Ventilator-Associated Pneumonia During Weaning

Pathogen	Usual Care Group (n = 27)	Interventional Group (n = 14)
Staphylococcus species	2 (7.4)	1 (7.1)
Streptococcus species	4 (14.8)	1 (7.1)
Enterobacteriaceae	10 (37.0)	6 (42.9)
Nonfermentative gram-negative bacilli	13 (48.1)	5 (35.7)
Other gram-negative bacteria	0 (0.0)	1 (7.1)
Polymicrobial[a]	7 (25.9)	6 (42.9)

Mekontso Dessap, Chest 2014

Impact des PAVM

TABLE 4] Main Outcomes of Patients With or Without VAP During Weaning

Outcomes	VAP		*P* Value
	No (n = 263)	Yes (n = 41)	
Time to successful extubation, h	43.9 (20.7-117.3)	141.6 (49.1-330.9)	< .0001
Ventilator-free days from randomization to day 14, d	11.9 (6.9-13.1)	1.4 (0.0-11.2)	< .0001
ICU length of stay,[a] d	7.0 (4.0-14.0)	15.0 (9.0-47.0)	< .0001
ICU survivors length of stay (n = 267),[a] d	7.0 (4.0-12.5)	15.0 (9.0-51.5)	< .0001
Hospital length of stay,[a] d	22.5 (13.8-43.0)	48.0 (17.0-60.0)	.003
Hospital survivors length of stay (n = 258),[a] d	23.0 (14.0-46.0)	59.0 (21.5-60.0)	.001
ICU mortality,[b] No. (%)	30 (11.4)	7 (17.1)	.31
Hospital mortality,[b] No. (%)	39 (14.8)	7 (17.1)	.71

Mekontso Dessap, Chest 2014

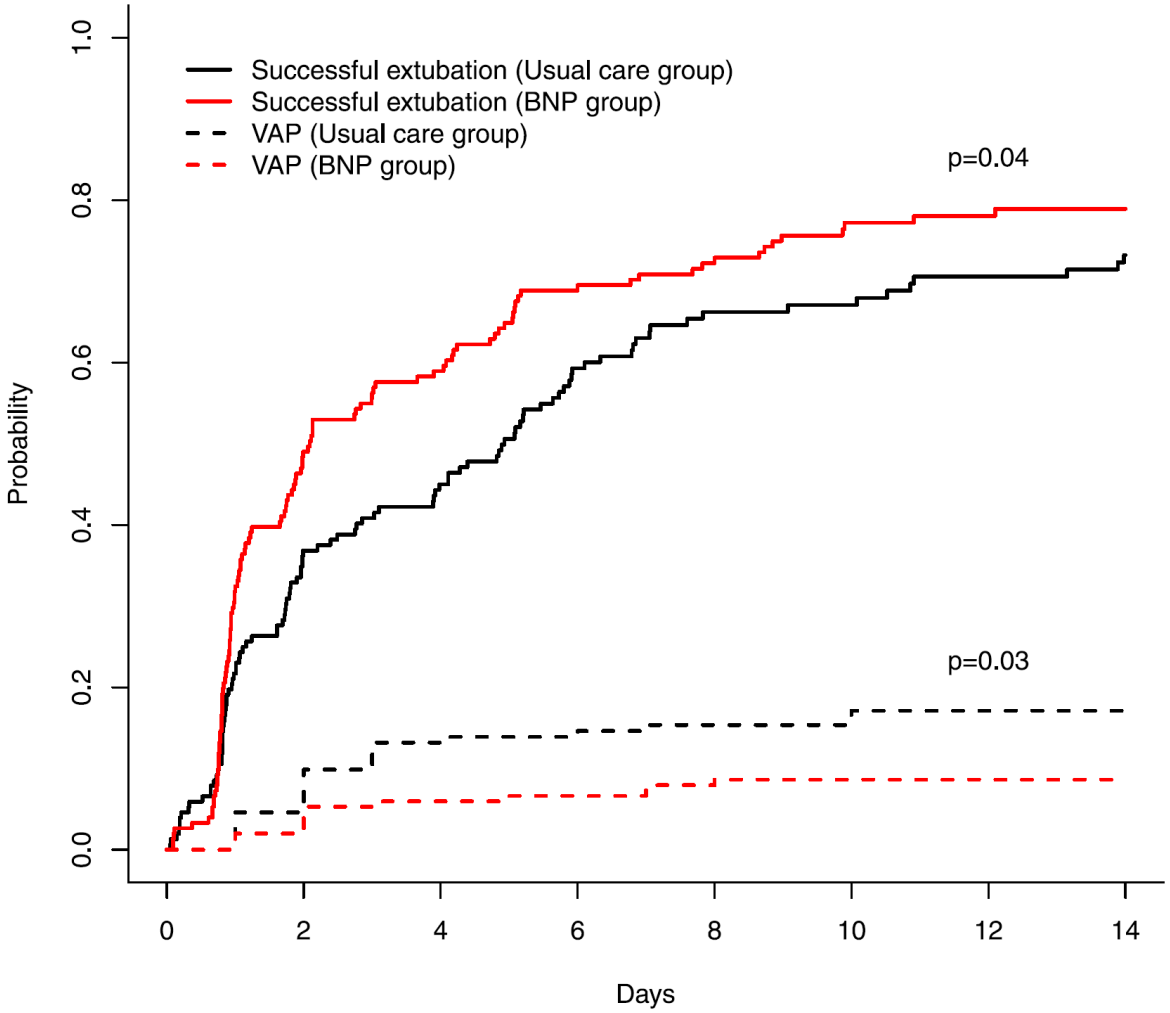


Figure 1 – *Cumulative incidence function of successful extubation (bold lines) and VAP (dotted lines) during the first 14 d following randomization in patients managed according to the interventional fluid-management strategy (red) or according to usual care (black). BNP = B-type natriuretic peptide; VAP = ventilator-associated pneumonia.*

Mekontso Dessap, Chest 2014

Importance du pathogène ?

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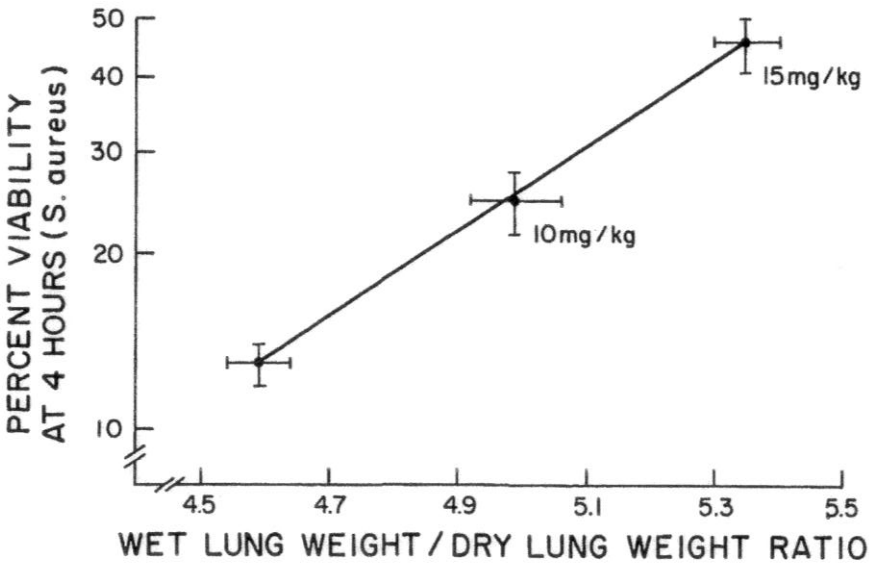
Eau, réservoir de Pyo

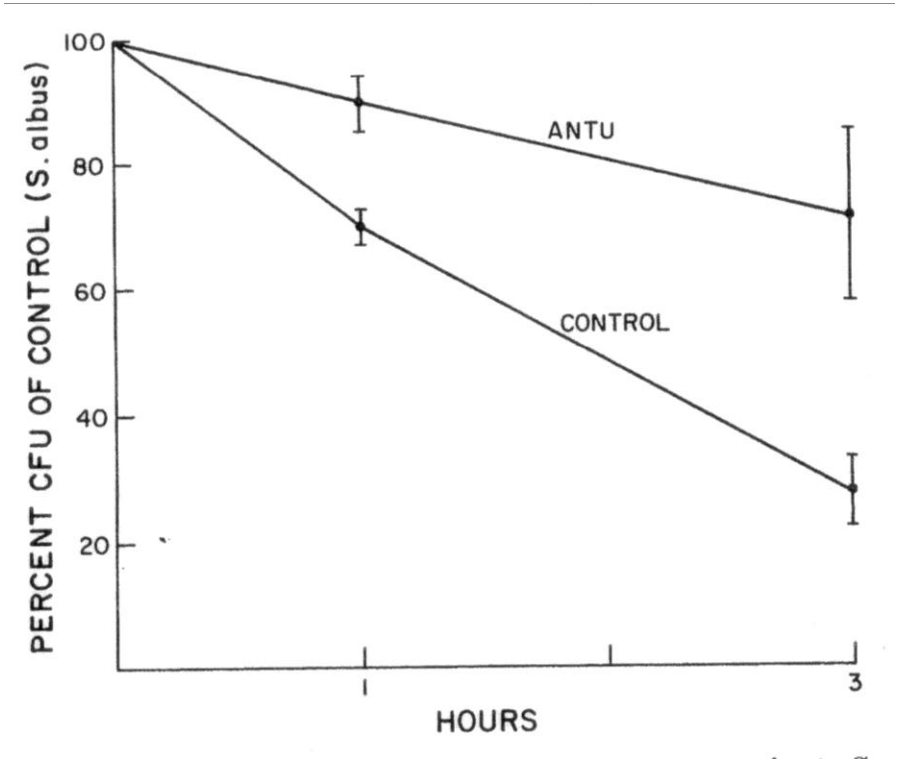
- Douches
- Sterilisateurs
- Humidificateurs
- Robinets
- Eviers
- Nutrition parentérale
- Eau minérale….

Impact de l'oedème pulmonaire sur la virulence bactérienne ?

Jefferies, Journal of Medical Microbiology 2012

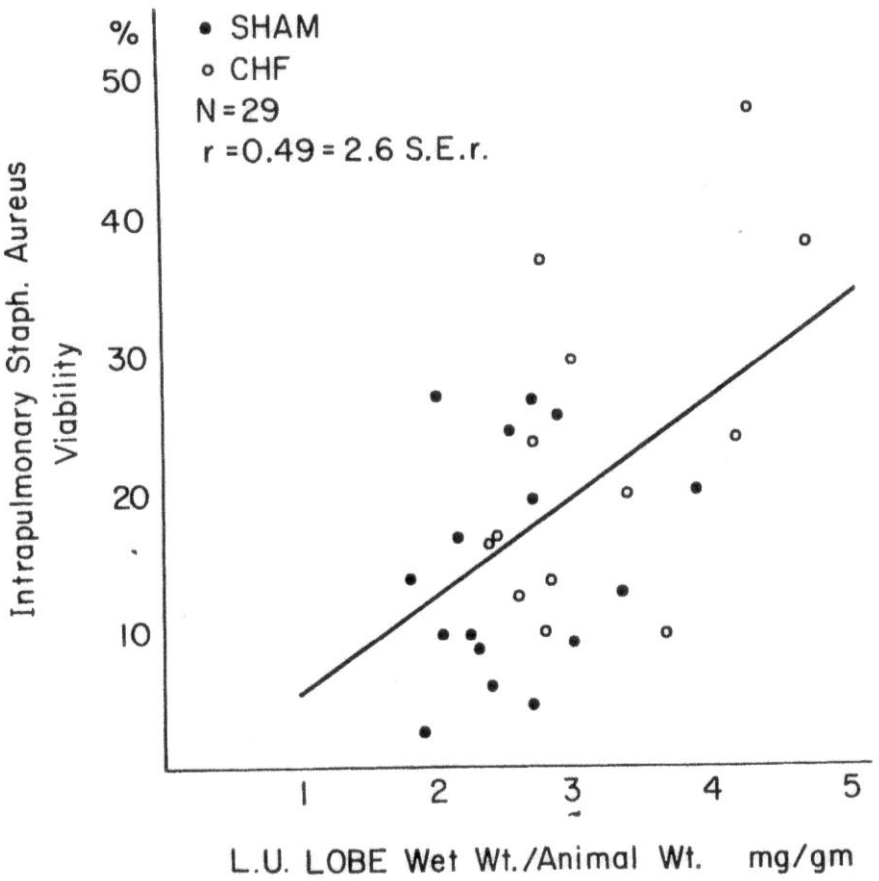
Susceptibilité du poumon œdémateux aux infections





Laforce, J Lab Clin Med 1973

Altération de la bactéricidie des macrophages alvéolaires



- Anomalies morpho
- Mécanisme peu clair
  - Déplétion macrophagique
  - Hypoxie ?
    - Non reversé par O2 pur
    - Métabolisme O2 conservé
  - Déplétion en surfactant ?
  - Facteur inhibiteur dans la liquide alvéolaire ?

Laforce, J Lab Clin Med 1973

Susceptibilité du poumon œdémateux aux infections

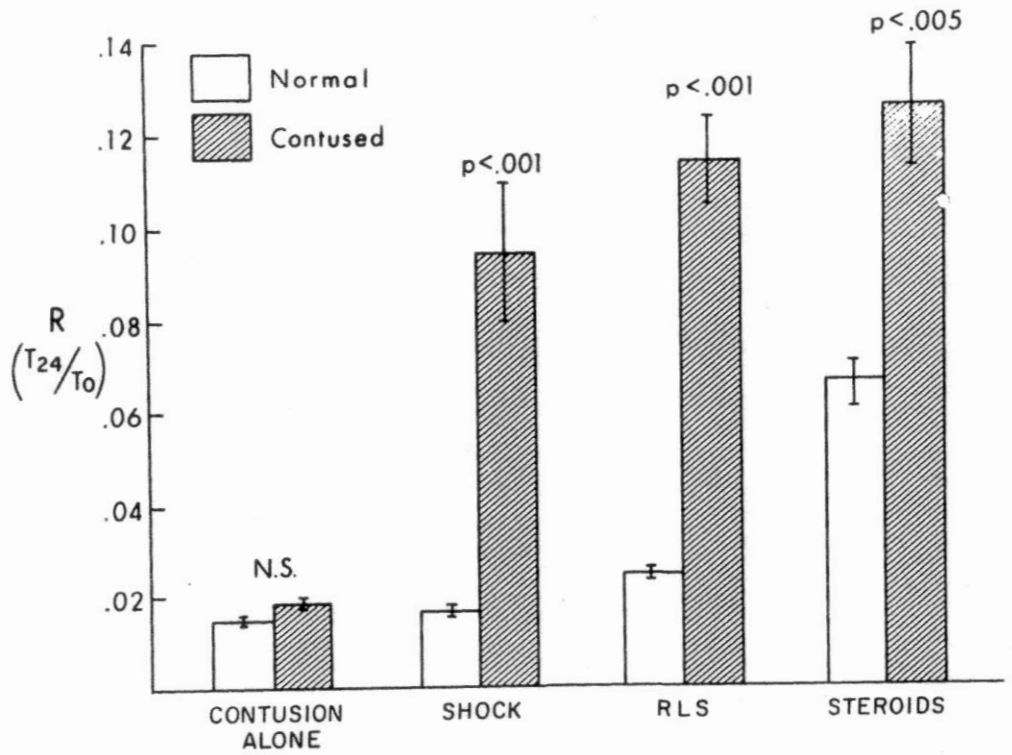


Fig. 2. The effect of various treatment models on the clearance of *S. aureus* is shown. Note that bacterial clearance is the same for contused and noncontused segments with isolated pulmonary contusion.

Richardson, Surgery 1979

Mesures de protection PAVM

Conclusions

- La PAVM a une morbidité significative au cours du sevrage de la ventilation mécanique

- Une stratégie restrictive de gestion des fluides:
  - accélère le sevrage de la ventilation artificielle
  - réduit les complications associées à la ventilation mécanique y compris les PAVM
  - à tester au sein des mesures de protection de la PAVM?

Merci !

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