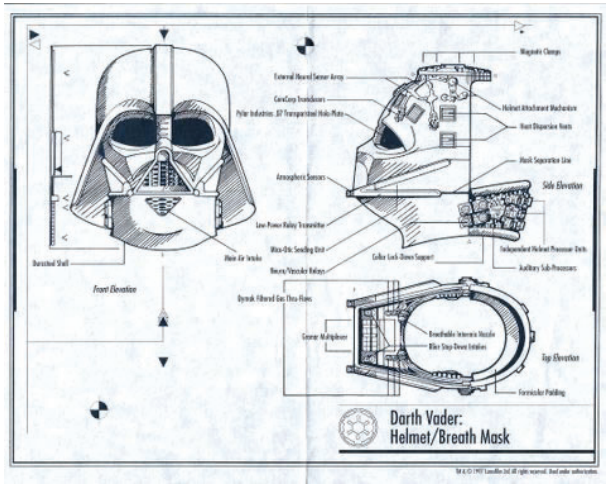
# Pneumopathie acquise sous ventilation mécanique

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SFAR

srlf
SOCIÉTÉ DE RÉANIMATION DE LANGUE FRANÇAISE

Recommandations formalisées d'experts

## PNEUMONIES ASSOCIÉES AUX SOINS DE RÉANIMATION

**RFE commune SFAR – SRLF**
**Société Française d'Anesthésie et de Réanimation**
**Société de Réanimation de Langue Française**

**En collaboration avec les Sociétés ADARPEF et GFRUP**
Association des Anesthésistes Réanimateurs Pédiatriques d'Expression Française,
Groupe Francophone de Réanimation et Urgences Pédiatriques

## HEALTHCARE ASSOCIATED PNEUMONIA IN INTENSIVE CARE UNIT

2017

CrossMark

TASK FORCE REPORT
ERS/ESICM/ESCMID/ALAT GUIDELINES

## International ERS/ESICM/ESCMID/ALAT guidelines for the management of hospital-acquired pneumonia and ventilator-associated pneumonia

Guidelines for the management of hospital-acquired pneumonia (HAP)/ventilator-associated pneumonia (VAP) of the European Respiratory Society (ERS), European Society of Intensive Care Medicine (ESICM), European Society of Clinical Microbiology and Infectious Diseases (ESCMID) and Asociación Latinoamericana del Tórax (ALAT)

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@ERSpublications
**ERS/ESICM/ESCMID/ALAT evidence-based recommendations for HAP/VAP diagnosis, treatment and prevention** http://ow.ly/dGhv30dAVoa

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*Clinical Infectious Diseases*

IDSA GUIDELINE

IDSA Infectious Diseases Society of America

hivma hiv medicine association

OXFORD

# Management of Adults With Hospital-acquired and Ventilator-associated Pneumonia: 2016 Clinical Practice Guidelines by the Infectious Diseases Society of America and the American Thoracic Society

**Andre C. Kalil,[1,a] Mark L. Metersky,[2,a] Michael Klompas,[3,4] John Muscedere,[5] Daniel A. Sweeney,[6] Lucy B. Palmer,[7] Lena M. Napolitano,[8] Naomi P. O'Grady,[9] John G. Bartlett,[10] Jordi Carratalà,[11] Ali A. El Solh,[12] Santiago Ewig,[13] Paul D. Fey,[14] Thomas M. File Jr,[15] Marcos I. Restrepo,[16] Jason A. Roberts,[17,18] Grant W. Waterer,[19] Peggy Cruse,[20] Shandra L. Knight,[20] and Jan L. Brozek[21]**

2016

# De quoi parle t-on ?

- **Pneumopathie Communautaire (CAP)**
- **Pneumopathie nosocomiale (HAP)**
  - ➔ > 48h d'hospitalisation
- **PAVM (VAP)**
  - ➔ > 48 à 72h d'intubation
  - ➔ tardive vs précoce (J5)
- Trachéobronchite acquise sous VM (VAT)
- Pneumopathie associé aux soins (HCAP)
  - ➔ Hospit récente, dialysée chronique, EHPAD…

# Pourquoi en parlons nous ?

- **2ème** cause d'infection nosocomiale
- **1ère** cause de mortalité
- Incidence de 5 à 67%...
- Risque de **1,5% / j** chez malade ventilé
  - ➔ augmentation durée hospit de 7j
  - ➔ 40 000 $

*Warren et al., CCM 2003*

# Mortalité

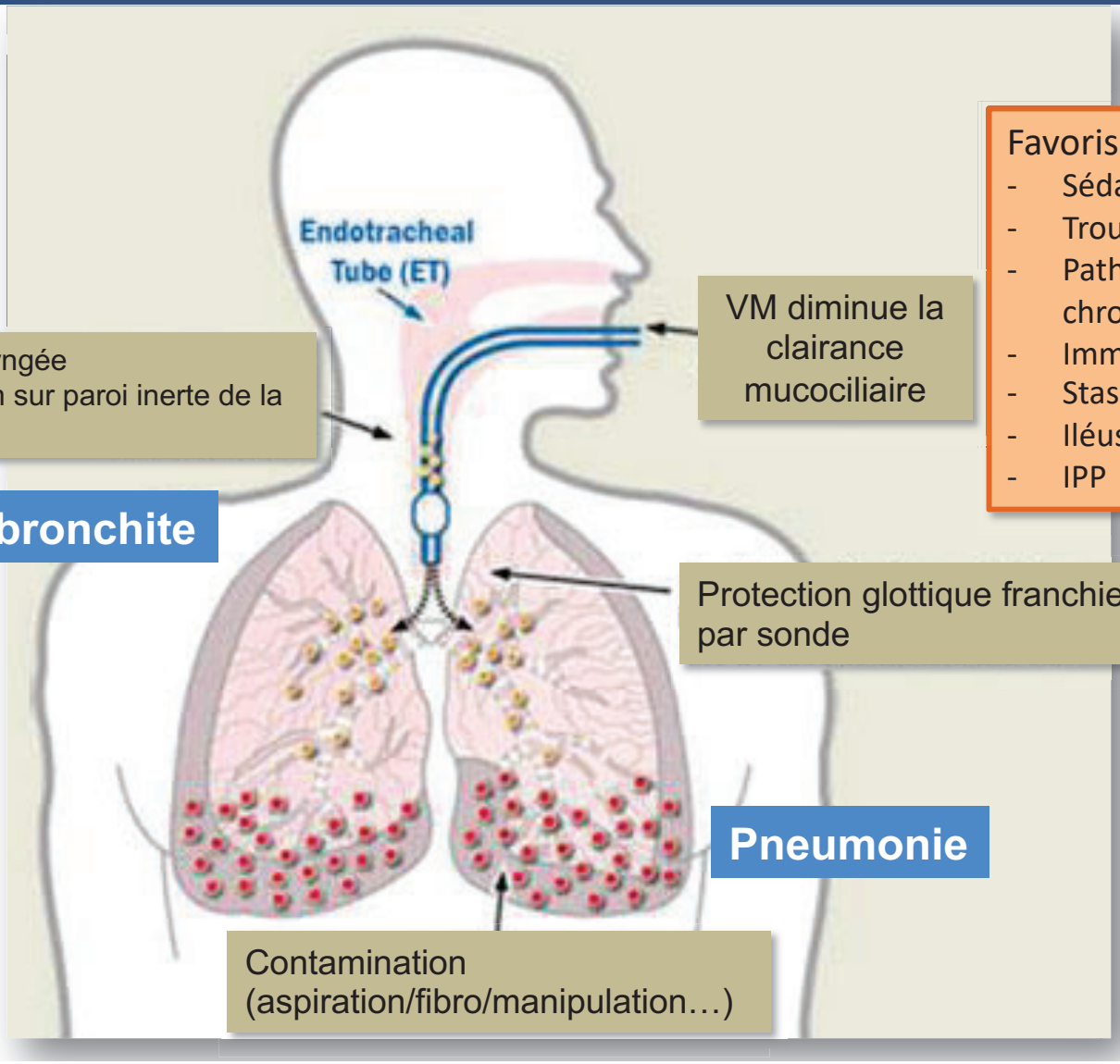
| Variable | Patients with VAP: exposed ($n$ = 434) | Patients without VAP: unexposed ($n$ = 2,439) | $P$ value[a] |
|---|---|---|---|
| Male gender, $n$ (%) | 315 (72.5) | 1,518 (62.2) | 0.005 |
| Age, median | 62.8 | 62.7 | 0.94 |
| SAPS II, median | 47.2 | 46.1 | 0.06 |
| Admission category | | | |
| Medicine, $n$ (%) | 292 (67.3) | 1,342 (55) | 0.0001 |
| Emergency surgery, $n$ (%) | 74 (17.1) | 595 (24.4) | 0.0004 |
| Scheduled surgery, $n$ (%) | 68 (15.6) | 337 (13.8) | 0.36 |
| History of immunosuppression | | | |
| Haematological malignancy, $n$ (%) | 20 (4.6) | 81 (3.3) | 0.22 |
| Metastatic cancer, $n$ (%) | 20 (4.6) | 153 (6.3) | 0.21 |
| AIDS, $n$ (%) | 11 (2.5) | 39 (1.6) | 0.26 |
| Corticosteroid therapy, $n$ (%) | 82 (18.9) | 454 (18.6) | 0.94 |
| Anticancer chemotherapy, $n$ (%) | 21 (4.8) | 125 (5.1) | 0.89 |
| Main symptom at ICU admission | | | |
| Shock, $n$ (%) | 149 (34.3) | 731 (29.9) | 0.08 |
| Coma, $n$ (%) | 100 (23.0) | 533 (21.8) | 0.62 |
| Acute respiratory failure, $n$ (%) | 115 (26.5) | 502 (20.5) | 0.01 |
| Other chronic illnesses | | | |
| Hepatic, $n$ (%) | 28 (6.4) | 150 (6.2) | 0.81 |
| Cardiovascular, $n$ (%) | 73 (16.8) | 344 (14.1) | 0.21 |
| Pulmonary, $n$ (%) | 70 (16.1) | 330 (13.5) | 0.23 |
| Renal, $n$ (%) | 14 (3.2) | 84 (3.4) | 0.81 |
| Diabetes, $n$ (%) | 49 (11.2) | 202 (8.3) | 0.04 |
| ICU mortality, $n$ (%) | 119 (27.4) | 470 (19.2) | 0.0001 |

*Nguile-Makao, ICM 2010*

# FDR mortalité

- Score APACHE élevé
- Bacteriémie
- Comorbidité importante
- Bactéries résistantes (MDR) :pyo, acinetobacter, enterobactéries…
- Délai dans l’instauration du traitement

# Physiopathologie




Colonisation oropharyngée
Formation d'un biofilm sur paroi inerte de la sonde

**Tracheo-bronchite**

VM diminue la clairance mucociliaire

Favorisé par :
- Sédatif / Coma
- Trouble déglutition
- Pathologie pulmonaire chronique
- Immunodépression
- Stase gastrique
- Iléus
- IPP

Protection glottique franchie par sonde

**Pneumonie**

Contamination (aspiration/fibro/manipulation…)

# Diagnostic

**Signes radiologiques**

Deux clichés radiologiques successifs à partir desquels l'apparition d'un foyer de pneumonie est suspecté

En l'absence d'antécédents de cardiopathie ou de maladie pulmonaire sous-jacentes, un seul examen radiologique suffit

**Et au moins un des signes suivants**

Température corporelle > 38,3°C sans autre cause

Leucocytes < 4000 /$mm^3$ ou ≥ 12000 /$mm^3$

Se 69% Sp 75%

**Et au moins deux des signes suivants**

Sécrétions purulentes

Toux ou dyspnée

Désaturation ou besoin accru en oxygène ou nécessité d'assistance ventilatoire

*SFAR/SRLF 2017*

# CPIS

Le *Clinical Pulmonary Infection Score* (CPIS) [16]

| | |
|---|---|
| *Température* | |
| ≥ 36,5 °C et ≤ 38,4 °C | 0 point |
| ≥ 38,5 °C et ≤ 38,9 °C | 1 point |
| ≤ 36 °C ou ≥ 39 °C | 2 points |
| *Leucocytose* | |
| ≥ 4 G/L et ≤ 11 G/L | 0 point |
| < 4 G/L ou > 11 G/L | 1 point |
| si formes immatures ≥ 0,5 G/L | +1 point |
| *Aspirations trachéales* | |
| < 4 + de sécrétions | 0 point |
| ≥ 4 + de sécrétions | 1 point |
| si sécrétions purulentes | +1 point |
| *$PaO_2/FIO_2$* | |
| > 240 ou SDRA | 0 point |
| ≤ 240 sans SDRA | 2 points |
| *Radiographie thoracique* | |
| absence d'infiltrat | 0 point |
| infiltrat diffus | 1 point |
| infiltrat localisé | 2 points |
| *Culture semi-quantitative des sécrétions trachéales (0, 1, 2 ou 3 +)* | |
| bactérie pathogène ≤ 1+ | 0 point |
| bactérie pathogène > 1+ | 1 point |
| si même bactérie sur Gram | +1 point |

Si > 5 pts
Se > 80%

*Pugin, ARRD 1991*

# Prélèvements

- Littérature contradictoire….
- Non invasif vs distal ?
- Quantitatif vs qualitatif ?
- **US guidelines : ECBC, qualitatif**
- **EU guidelines : LBA ou PDP, quantitatif**

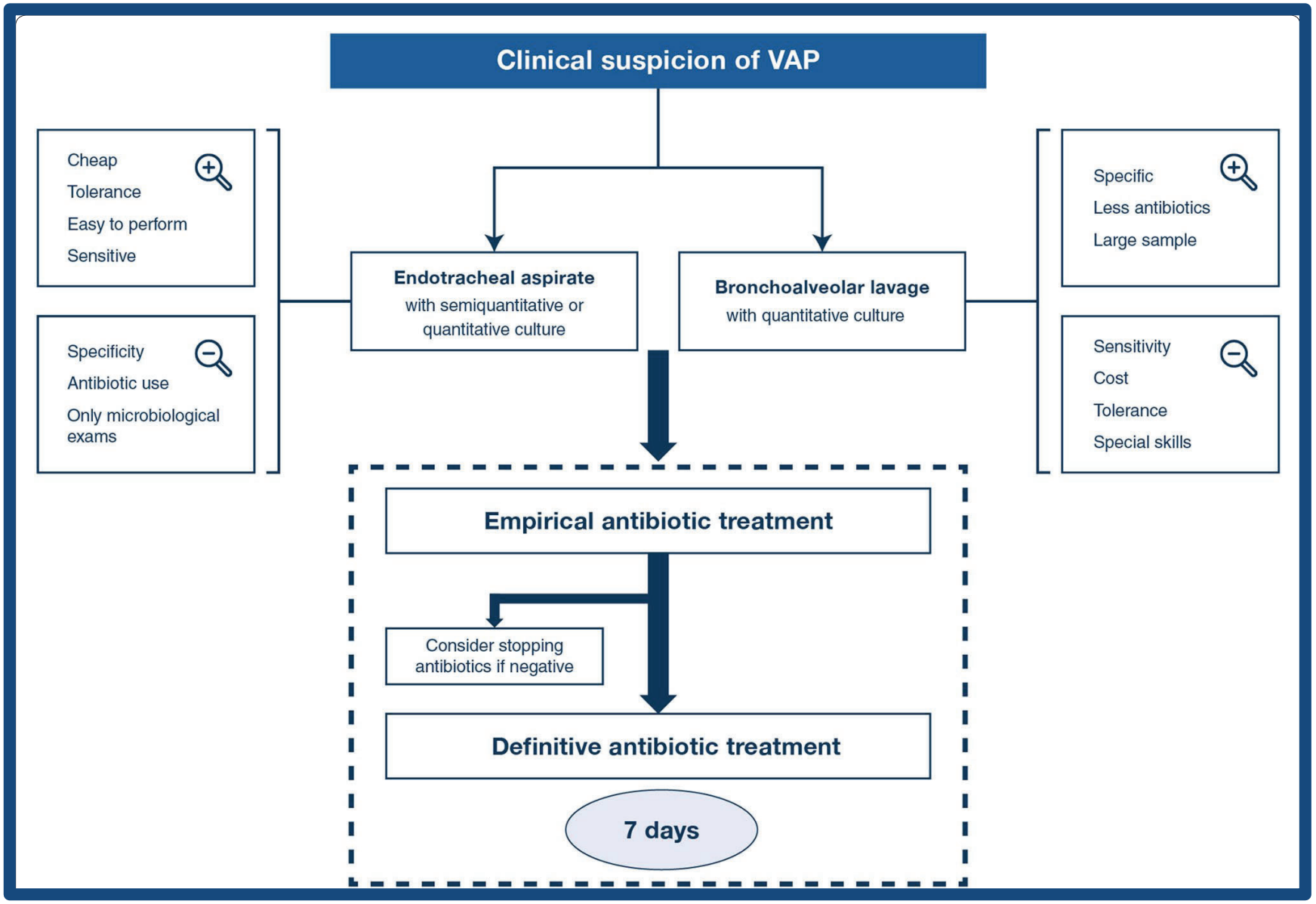
**Avant antibiothérapie ++**

**Intérêt drainage par kinésithérapeute**

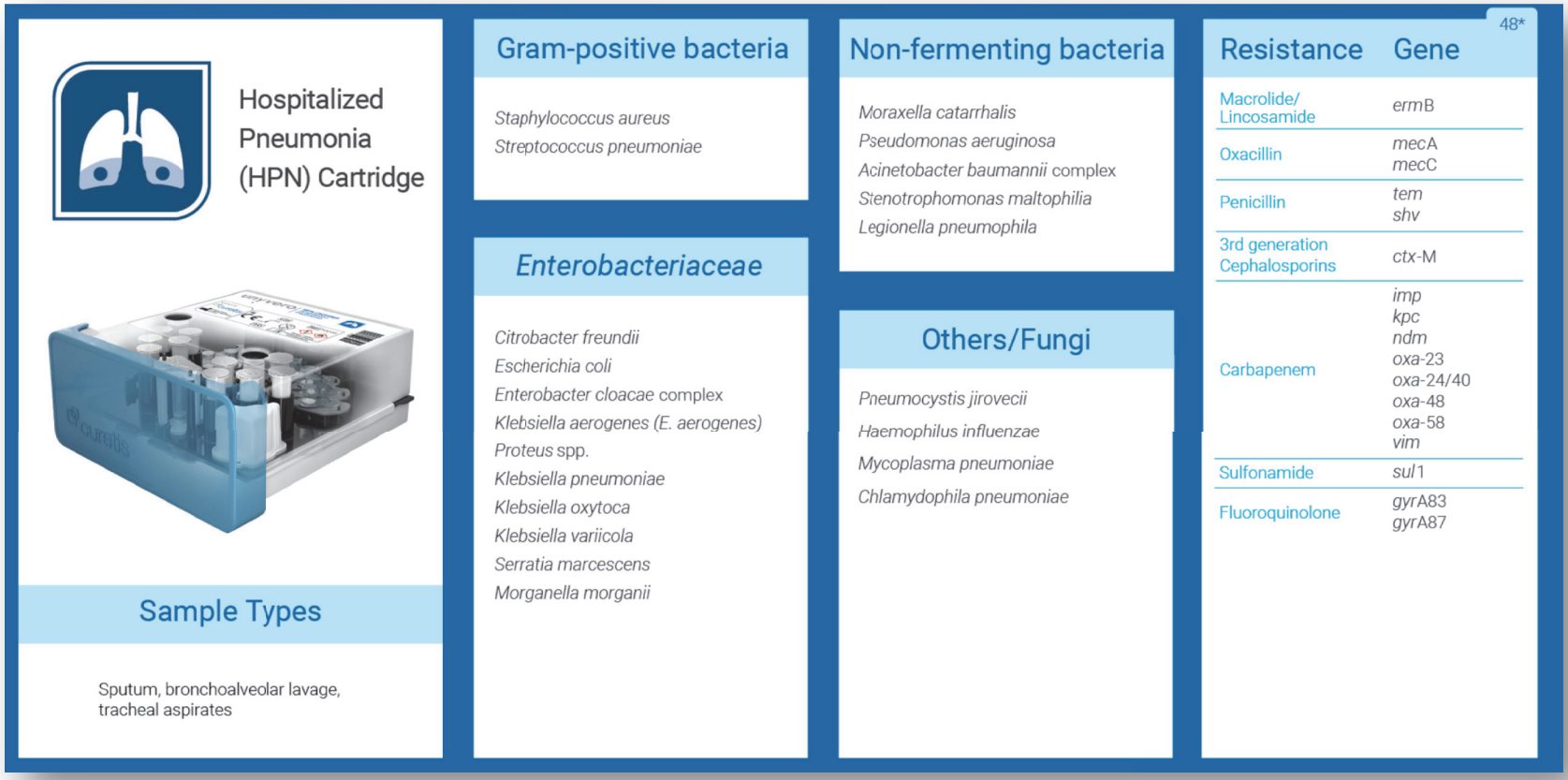
# Prélèvements

| Type de prélèvements | Sensibilité m±ds (extrêmes) | Spécificité m±ds (extrêmes) |
|---|---|---|
| Aspiration trachéale qualitative | (57%-88%) | (14%-33%) |
| Aspiration trachéale quantitative $\geq 10^6$ | 76±9% (38%-82%) | 75±28% (72%-85%) |
| Echantillonnage distal non fibroscopique PDP, mini-LBA($\geq 10^3$) | (63%-100%) | (66%-96%) |
| BTP sous fibroscopie $\geq 10^3$ | 66±19% (33%-100%) | 90±15% (50%-100%) |
| LBA sous fibroscopie$\geq 10^4$ | 73±18% (42%-93%) | 82±19% (45%-100%) |

**Avant antibiothérapie ++**


Clinical suspicion of VAP
Cheap
Tolerance
Easy to perform
Sensitive
Specificity
Antibiotic use
Only microbiological exams
Endotracheal aspirate
with semiquantitative or quantitative culture
Bronchoalveolar lavage
with quantitative culture
Specific
Less antibiotics
Large sample
Sensitivity
Cost
Tolerance
Special skills
Empirical antibiotic treatment
Consider stopping antibiotics if negative
Definitive antibiotic treatment
7 days

# PCR multiplex




Résultats en 4 à 5h...

Mais pas de différence entre colonisation et infection

# Germes

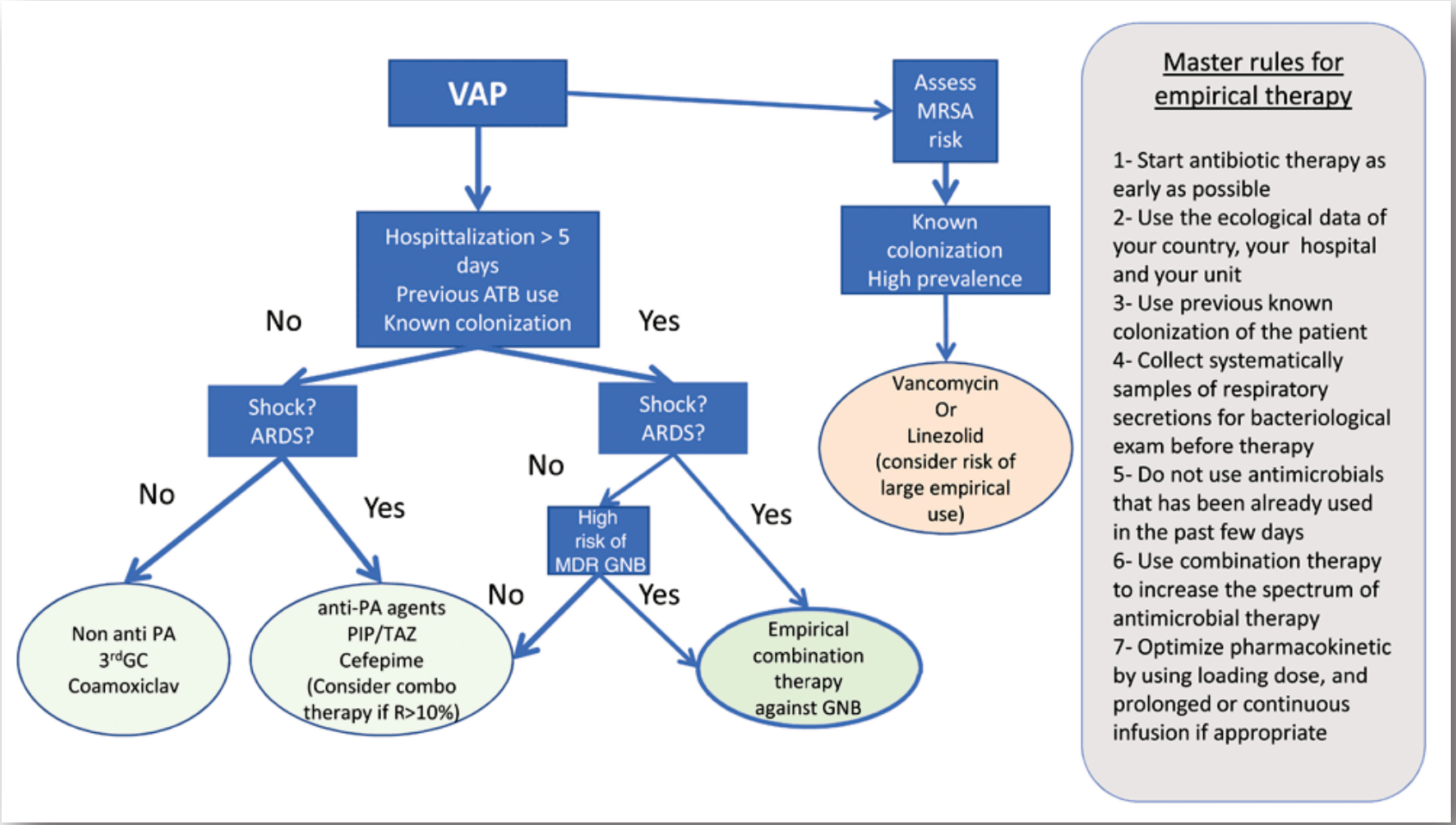
- Entérobactéries (25%)
- Pseudomonas Aeruginosa (20%)
- Staphylocoque Aureus (20%)
- Haemophilus (10%)
- Streptocoques
- Virus et champignons chez ID
- Polymicrobien dans 30% des cas

# FDR BMR

**Risk factors for multidrug-resistant ventilator-associated pneumonia**

| **Risk factors for MDR pathogens:** |
| --- |
| ▪ IV antibiotic use within the previous 90 days |
| ▪ Septic shock at the time of VAP |
| ▪ ARDS preceding VAP |
| ▪ ≥5 days of hospitalization prior to the occurrence of VAP |
| ▪ Acute renal replacement therapy prior to VAP onset |
| **Risk factors for MDR *Pseudomonas* and other gram-negative bacilli:** |
| ▪ Treatment in an ICU in which >10 percent of gram-negative isolates are resistant to an agent being considered for monotherapy |
| ▪ Treatment in an ICU in which local antimicrobial susceptibility rates are not known |
| ▪ Colonization with OR prior isolation of MDR *Pseudomonas* or other gram-negative bacilli |
| **Risk factors for MRSA:** |
| ▪ Treatment in a unit in which >10 to 20 percent of *Staphylococcus aureus* isolates are methicillin resistant |
| ▪ Treatment in a unit in which the prevalence of MRSA is not known |
| ▪ Colonization with OR prior isolation of MRSA |

# Antibiothérapie




**Master rules for empirical therapy**

1- Start antibiotic therapy as early as possible
2- Use the ecological data of your country, your hospital and your unit
3- Use previous known colonization of the patient
4- Collect systematically samples of respiratory secretions for bacteriological exam before therapy
5- Do not use antimicrobials that has been already used in the past few days
6- Use combination therapy to increase the spectrum of antimicrobial therapy
7- Optimize pharmacokinetic by using loading dose, and prolonged or continuous infusion if appropriate

# PREVENTION


the best defense
is a good offense
CHANGE MY MIND
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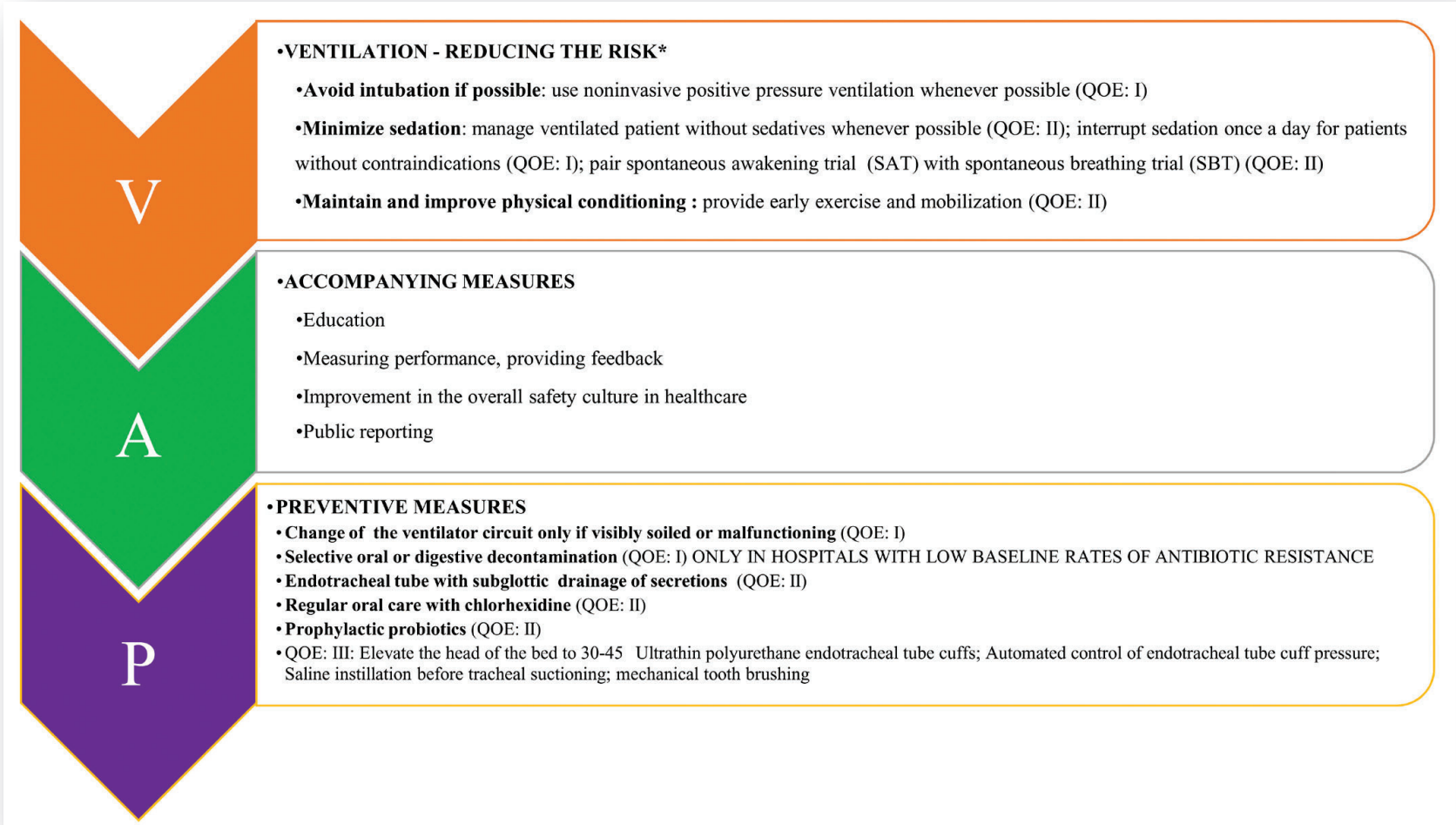
# Facteurs de risques

| Host-related risk factors | Intervention-related risk factors |
|---|---|
| Medical history and underlying illness | Peri-operative transfusion of blood products |
| Male gender | Duration of the mechanical ventilation |
| Extreme age | Reintubation |
| Prior central nervous system disorder | Supine head position in patients receiving enteral nutrition |
| Immunocompromised | Antibiotic therapy[a] |
| Acute underlying diseases | Enteral nutrition |
| Emergent surgery | Absence of subglottic secretion drainage[b] |
| Neurosurgery | Intra-hospital transports |
| Thoracic surgery | Continuous sedation, use of paralytic agents |
| Cardiac surgery | Nasogastric tubes |
| Burns | Tracheostomy |
| Re-intervention | Frequent ventilator circuit changes |
| Acute severity factors | Intracuff pressure of less than 20 cm $H_2O$ |
| Organ system failure index of at least 3 | |
| Acute renal failure | |
| Acute respiratory distress syndrome | |
| ECMO, intra-aortic support | |
| Ulcer disease | |

# Principe de prévention



# Réduire la ventilation !

•**VENTILATION - REDUCING THE RISK***

- **Avoid intubation if possible**: use noninvasive positive pressure ventilation whenever possible (QOE: I)
- **Minimize sedation**: manage ventilated patient without sedatives whenever possible (QOE: II); interrupt sedation once a day for patients without contraindications (QOE: I); pair spontaneous awakening trial (SAT) with spontaneous breathing trial (SBT) (QOE: II)
- **Maintain and improve physical conditioning :** provide early exercise and mobilization (QOE: II)

# Pneumopathie de l'Immunodéprimé

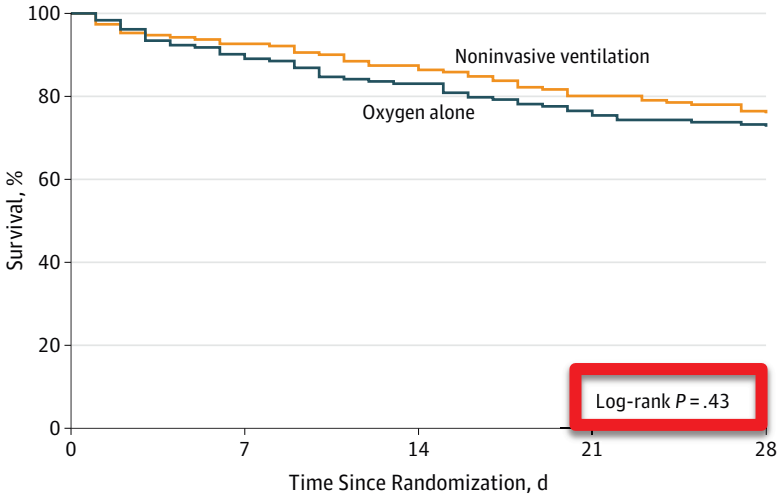
| Outcome | Noninvasive-Ventilation Group (N=26) | Standard-Treatment Group (N=26) | P Value | Relative Risk (95% CI) |
|---|---|---|---|---|
| Intubation — no./total no. (%) | 12/26 (46) | 20/26 (77) | 0.03 | 0.60 (0.38–0.96) |
| Immunosuppression from hematologic cancer and neutropenia | 8/15 (53) | 14/15 (93) | 0.02 | 0.57 (0.35–0.93) |
| Drug-induced immunosuppression | 3/9 (33) | 5/9 (56) | 0.32 | 0.60 (0.20–1.79) |
| Immunosuppression from the acquired immunodeficiency syndrome | 1/2 (50) | 1/2 (50) | 0.83 | 1.00 (0.14–7.10) |
| Initial improvement in $PaO_2$:$FiO_2$ — no. (%) | 12 (46) | 4 (15) | 0.02 | |
| Sustained improvement in $PaO_2$:$FiO_2$ without intubation — no. (%) | 13 (50) | 5 (19) | 0.02 | |
| Death in the ICU — no./total no. (%)† | 10/26 (38) | 18/26 (69) | 0.03 | 0.56 (0.32–0.96) |
| Immunosuppression from hematologic cancer and neutropenia | 7/15 (47) | 13/15 (87) | 0.02 | 0.54 (0.30–0.96) |
| Drug-induced immunosuppression | 3/9 (33) | 4/9 (44) | 0.50 | 0.75 (0.23–2.44) |
| Immunosuppression from the acquired immunodeficiency syndrome | 0/2 | 1/2 (50) | 0.50 | 0.50 (0.13–2.00) |
| Total duration of any ventilatory assistance — days | | | | |
| Among all patients | 6±3 | 6±5 | 0.59 | |
| Among survivors | 5±2 | 3±5 | 0.12 | |
| Length of ICU stay — days | | | | |
| Among all patients | 7±3 | 9±4 | 0.11 | |
| Among survivors | 7±3 | 10±4 | 0.06 | |
| Death in the hospital — no./total no. (%) | 13/26 (50) | 21/26 (81) | 0.02 | 0.62 (0.40–0.95) |
| Immunosuppression from hematologic cancer and neutropenia | 8/15 (53) | 14/15 (93) | 0.02 | 0.57 (0.35–0.93) |
| Drug-induced immunosuppression | 4/9 (44) | 6/9 (67) | 0.32 | 0.67 (0.28–1.58) |
| Immunosuppression from the acquired immunodeficiency syndrome | 1/2 (50) | 1/2 (50) | 0.83 | 1.00 (0.14–7.10) |

Original Investigation | CARING FOR THE CRITICALLY ILL PATIENT

# Effect of Noninvasive Ventilation vs Oxygen Therapy on Mortality Among Immunocompromised Patients With Acute Respiratory Failure

## A Randomized Clinical Trial

Figure 2. Probability of Survival at Day 28



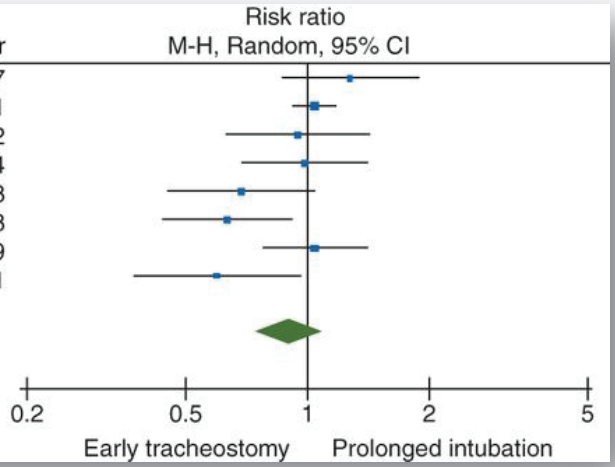

| No. at risk | | | | | |
|---|---|---|---|---|---|
| Noninvasive ventilation | 191 | 177 | 167 | 153 | 146 |
| Oxygen alone | 183 | 165 | 152 | 140 | 134 |

# Trachéotomie précoce ?

| Study or Subgroup | Early tracheostomy Events | Total | Prolonged intubation Events | Total | Weight | Risk ratio M-H, Random, 95% CI | Year |
|---|---|---|---|---|---|---|---|
| Sugerman 1997 | 25 | 53 | 34 | 92 | 11.2% | 1.28 (0.86, 1.89) | 1997 |
| Saffle et al 2002 | 21 | 21 | 22 | 23 | 20.5% | 1.04 (0.92, 1.18) | 2001 |
| Bouderka et al 2004 | 18 | 31 | 19 | 31 | 10.7% | 0.95 (0.63, 1.43) | 2002 |
| Blot et al 2008 | 30 | 61 | 31 | 62 | 12.2% | 0.98 (0.69, 1.40) | 2004 |
| Terragni et al 2010 | 30 | 209 | 44 | 210 | 10.3% | 0.69 (0.45, 1.05) | 2008 |
| Saboori, 2009 | 12 | 20 | 19 | 20 | 11.8% | 0.63 (0.44, 0.92) | 2008 |
| Trouillet 2011 | 50 | 109 | 47 | 107 | 14.3% | 1.04 (0.78, 1.40) | 2009 |
| Zheng et al 2012 | 17 | 58 | 30 | 61 | 9.0% | 0.60 (0.37, 0.96) | 2011 |
| Total (95% CI) | | 562 | | 606 | 100.0% | 0.90 (0.75, 1.08) | |
| Total events | 203 | | 246 | | | | |

Heterogeneity. $Tau^2 = 0.04$; $Chi^2 = 18.20$, $df = 7$ ($P = 0.01$); $I^2 = 62\%$

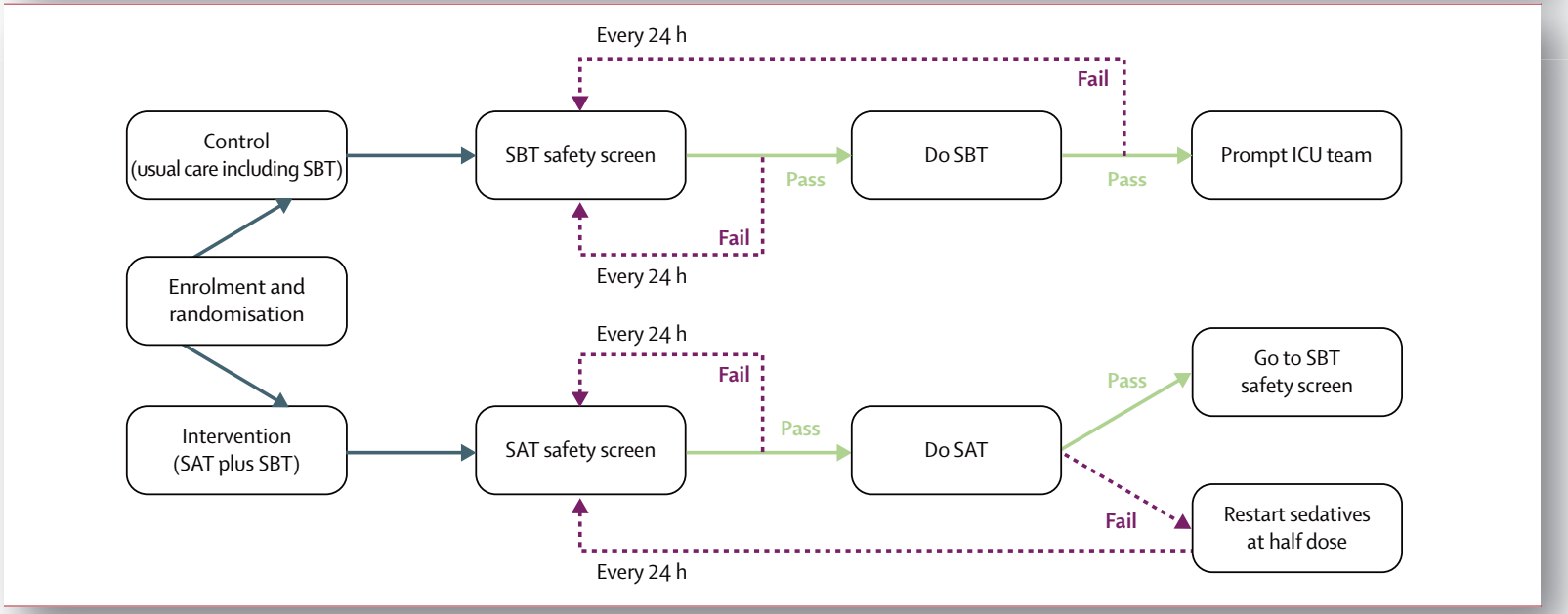
Test for overall effect: $Z = 1.12$ ($P = 0.26$)




*Szakmany, BJA 2015*

# Protocole de sevrage

**Efficacy and safety of a paired sedation and ventilator weaning protocol for mechanically ventilated patients in intensive care (Awakening and Breathing Controlled trial): a randomised controlled trial**

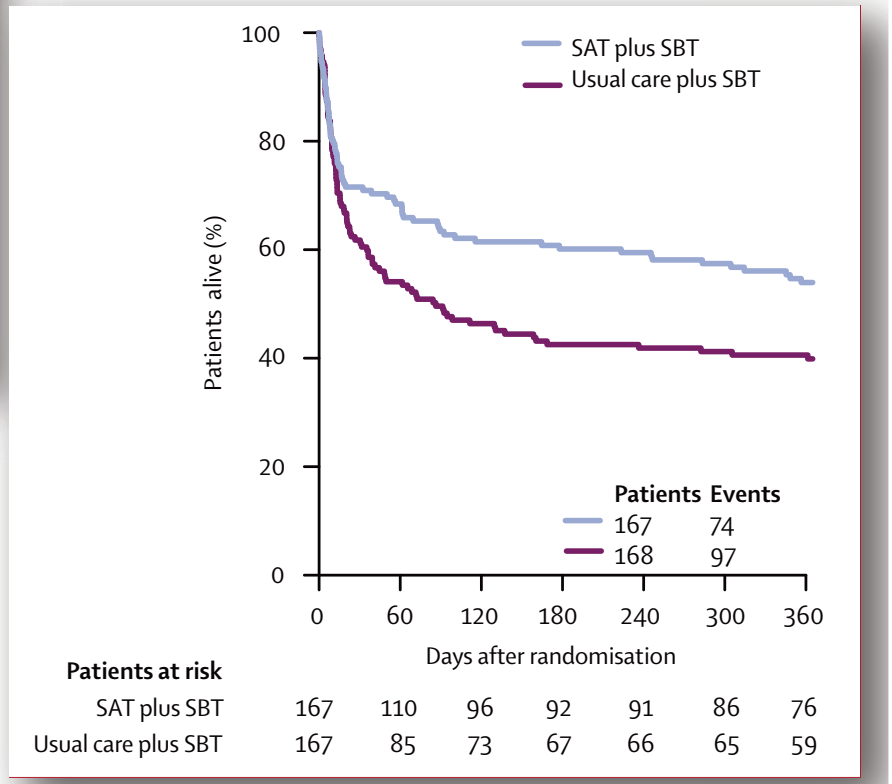



*Girard et al, Lancet 2008*

| | Intervention group (n=167) | Control group (n=168) | p value |
|---|---|---|---|
| Ventilator-free days* | | | |
| Mean | 14·7 (0·9) | 11·6 (0·9) | 0·02 |
| Median | 20·0 (0 to 26·0) | 8·1 (0 to 24·3) | |
| Time to discharge (days) | | | |
| From intensive care | 9·1 (5·1 to 17·8) | 12·9 (6·0 to 24·2) | 0·01 |
| From hospital | 14·9 (8·9 to 26·8) | 19·2 (10·3 to NA)† | 0·04 |
| 28-day mortality | 47 (28%) | 58 (35%) | 0·21 |
| 1-year mortality | 74 (44%) | 97 (58%) | 0·01 |
| Duration of brain dysfunction (days) | | | |
| Coma | 2 (0 to 4) | 3 (1 to 7) | 0·002 |
| Delirium | 2 (0 to 5) | 2 (0 to 6) | 0·50 |
| RASS at first successful SBT | −1 (−3 to 0) | −2·5 (−4 to 0) | 0·0001 |
| Complications | | | |
| Any self-extubation | 16 (10%) | 6 (4%) | 0·03 |
| Self-extubation requiring reintubation‡ | 5 (3%) | 3 (2%) | 0·47 |
| Reintubation‡ | 23 (14%) | 21 (13%) | 0·73 |
| Tracheostomy | 21 (13%) | 34 (20%) | 0·06 |

Data are mean (SD), n (%), or median (IQR). RASS=Richmond agitation-sedation scale. SAT=spontaneous awakening trial. SBT=spontaneous breathing trial. *Ventilator-free days from study day 1 to 28. †Greater than 25% of patients in the SBT group remained in the hospital at study day 28. ‡Reintubation within 48 hours of extubation.

***Table 3:*** **Main outcomes**

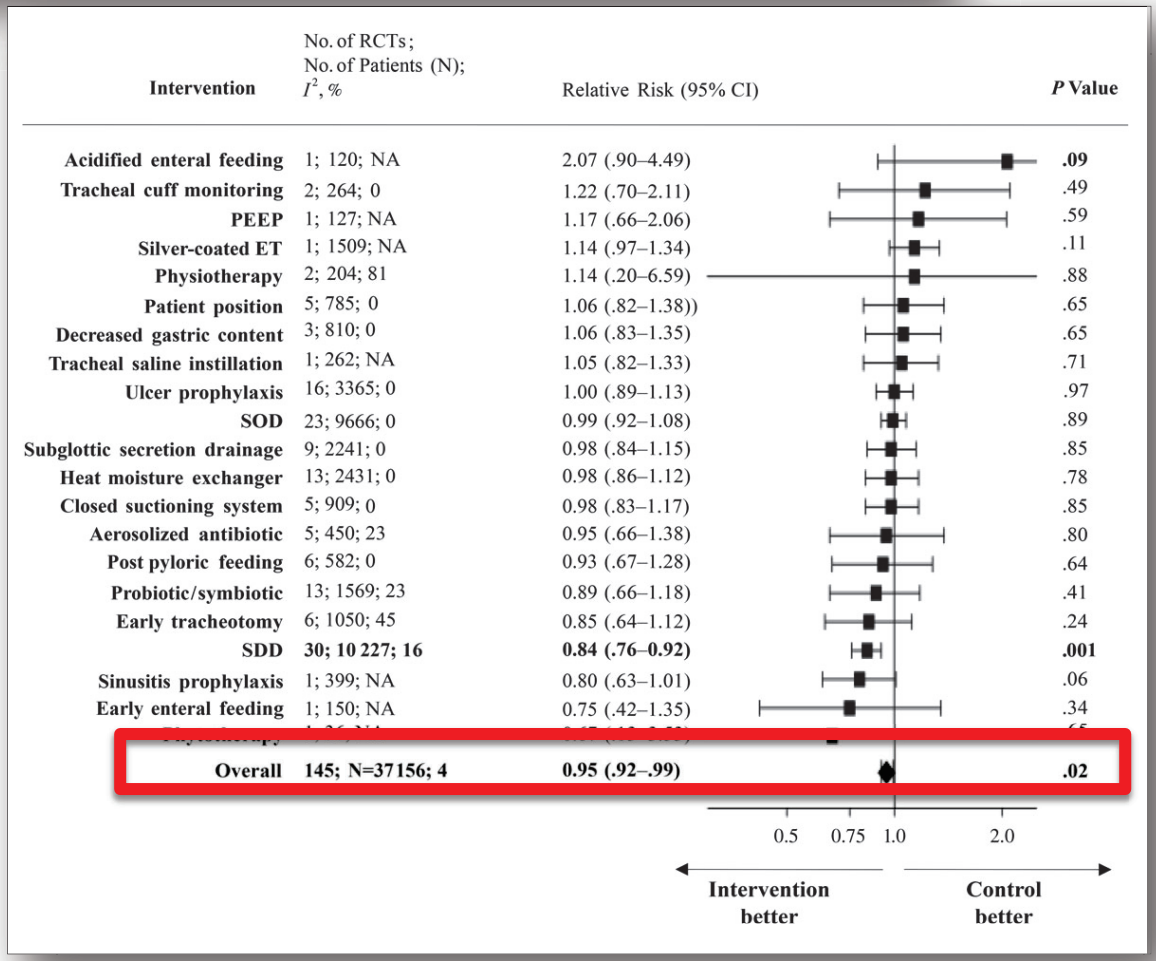


# Surveiller / Eduquer

- **ACCOMPANYING MEASURES**
  - Education
  - Measuring performance, providing feedback
  - Improvement in the overall safety culture in healthcare
  - Public reporting

# Pneumonia Prevention to Decrease Mortality in Intensive Care Unit: A Systematic Review and Meta-analysis

**Antoine Roquilly,[1] Emmanuel Marret,[3] Edward Abraham,[4] and Karim Asehnoune[1,2]**



| Intervention | No. of RCTs; No. of Patients (N); $I^2$, % | Relative Risk (95% CI) | *P* Value |
|---|---|---|---|
| Acidified enteral feeding | 1; 120; NA | 2.07 (.90–4.49) | **.09** |
| Tracheal cuff monitoring | 2; 264; 0 | 1.22 (.70–2.11) | .49 |
| PEEP | 1; 127; NA | 1.17 (.66–2.06) | .59 |
| Silver-coated ET | 1; 1509; NA | 1.14 (.97–1.34) | .11 |
| Physiotherapy | 2; 204; 81 | 1.14 (.20–6.59) | .88 |
| Patient position | 5; 785; 0 | 1.06 (.82–1.38)) | .65 |
| Decreased gastric content | 3; 810; 0 | 1.06 (.83–1.35) | .65 |
| Tracheal saline instillation | 1; 262; NA | 1.05 (.82–1.33) | .71 |
| Ulcer prophylaxis | 16; 3365; 0 | 1.00 (.89–1.13) | .97 |
| SOD | 23; 9666; 0 | 0.99 (.92–1.08) | .89 |
| Subglottic secretion drainage | 9; 2241; 0 | 0.98 (.84–1.15) | .85 |
| Heat moisture exchanger | 13; 2431; 0 | 0.98 (.86–1.12) | .78 |
| Closed suctioning system | 5; 909; 0 | 0.98 (.83–1.17) | .85 |
| Aerosolized antibiotic | 5; 450; 23 | 0.95 (.66–1.38) | .80 |
| Post pyloric feeding | 6; 582; 0 | 0.93 (.67–1.28) | .64 |
| Probiotic/symbiotic | 13; 1569; 23 | 0.89 (.66–1.18) | .41 |
| Early tracheotomy | 6; 1050; 45 | 0.85 (.64–1.12) | .24 |
| SDD | **30; 10 227; 16** | **0.84 (.76–0.92)** | **.001** |
| Sinusitis prophylaxis | 1; 399; NA | 0.80 (.63–1.01) | .06 |
| Early enteral feeding | 1; 150; NA | 0.75 (.42–1.35) | .34 |
| **Overall** | **145; N=37156; 4** | **0.95 (.92–.99)** | **.02** |



*Roquilly et al, CID 2015*

# Long-Term Impact of a Multifaceted Prevention Program on Ventilator-Associated Pneumonia in a Medical Intensive Care Unit

**Lila Bouadma,[1] Emmanuelle Deslandes,[2] Isabelle Lolom,[3] Bertrand Le Corre,[1] Bruno Mourvillier,[1] Bernard Regnier,[1] Raphael Porcher,[2] Michel Wolff,[1,4] and Jean-Christophe Lucet[3]**

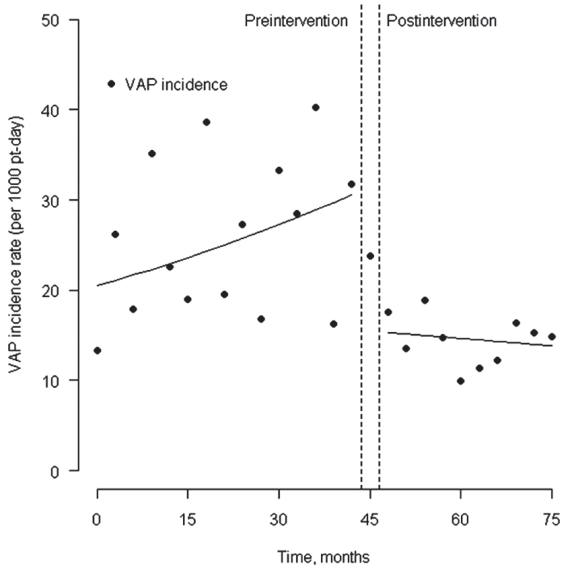
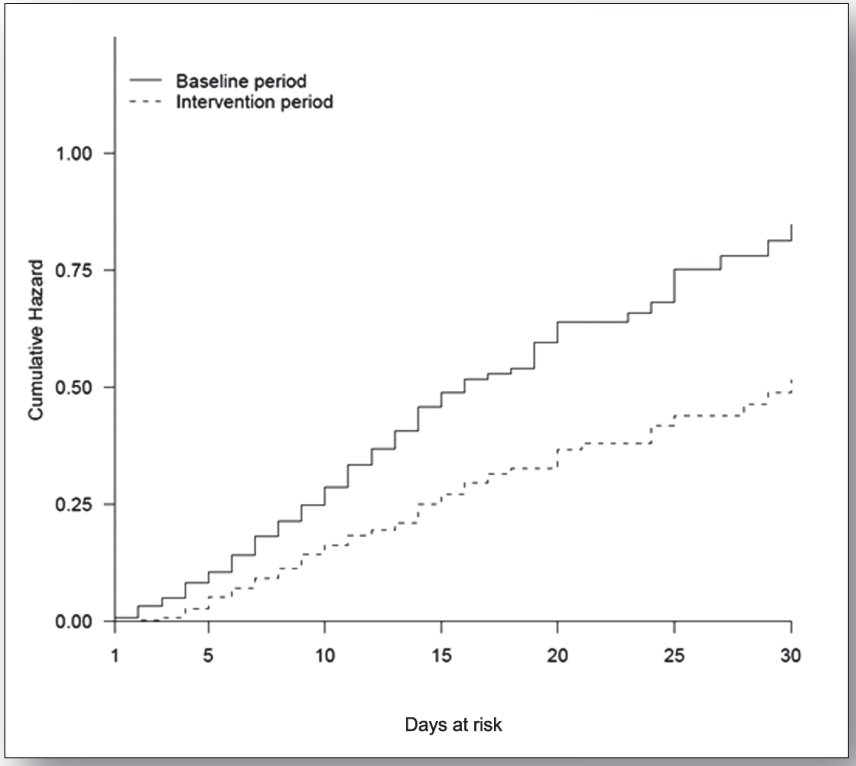



**Figure 1.** Segmented Poisson regression analysis, comparing incidence rates of ventilator-associated pneumonia (VAP) in the intensive care unit before and after a preventive intervention.

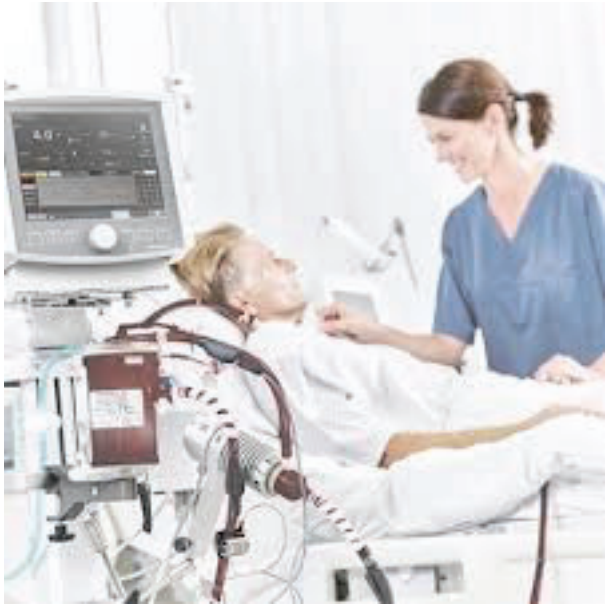


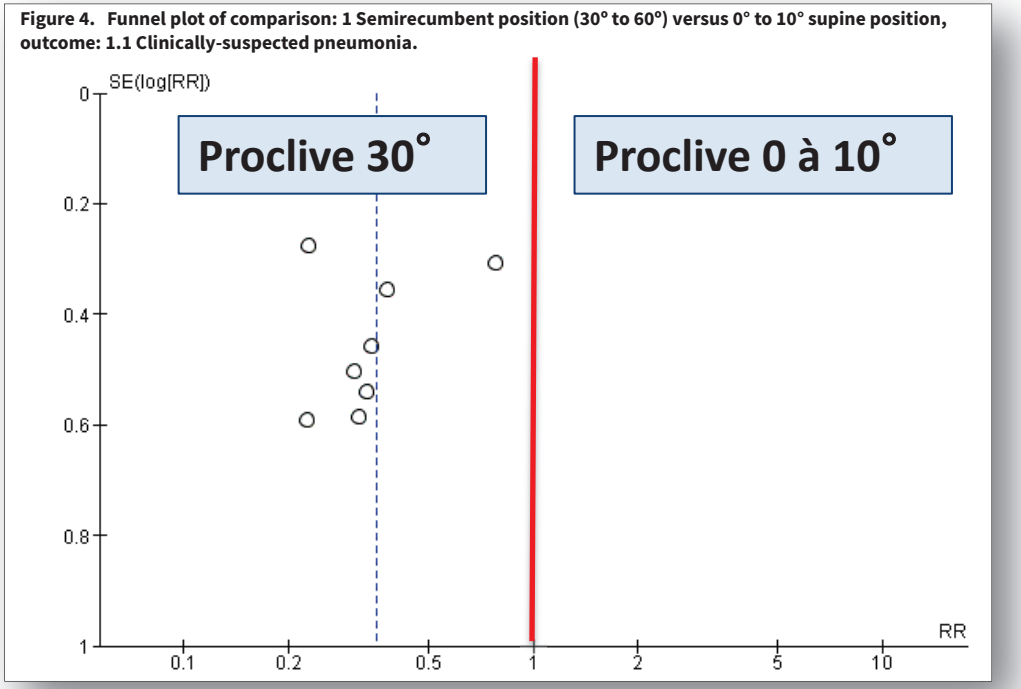

*Bouadma et al, CID 2010*

# Prévenir = BUNDLE

- **PREVENTIVE MEASURES**
  - **Change of the ventilator circuit only if visibly soiled or malfunctioning** (QOE: I)
  - **Selective oral or digestive decontamination** (QOE: I) ONLY IN HOSPITALS WITH LOW BASELINE RATES OF ANTIBIOTIC RESISTANCE
  - **Endotracheal tube with subglottic drainage of secretions** (QOE: II)
  - **Regular oral care with chlorhexidine** (QOE: II)
  - **Prophylactic probiotics** (QOE: II)
  - QOE: III: Elevate the head of the bed to 30-45 Ultrathin polyurethane endotracheal tube cuffs; Automated control of endotracheal tube cuff pressure; Saline instillation before tracheal suctioning; mechanical tooth brushing

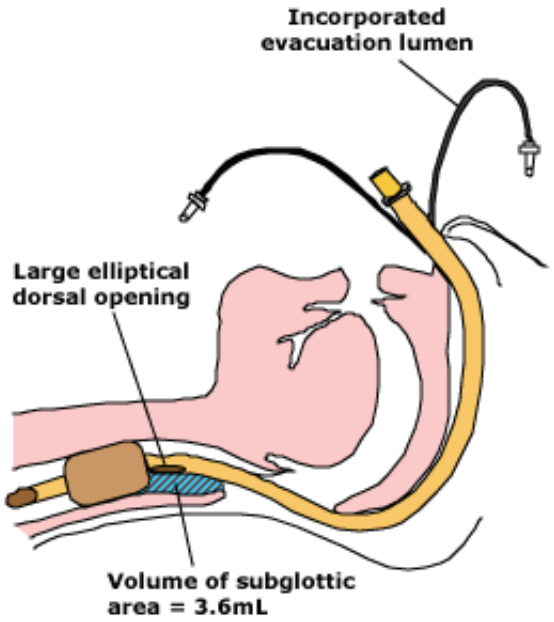
# Prévenir l’inhalation





# Prévenir l'inhalation

**Device for continuous aspiration of subglottic secretions**




Representation of a specially designed endotracheal tube that permits the drainage of subglottic secretions. Hi-Lo EVAC tube (Mallinckrodt).

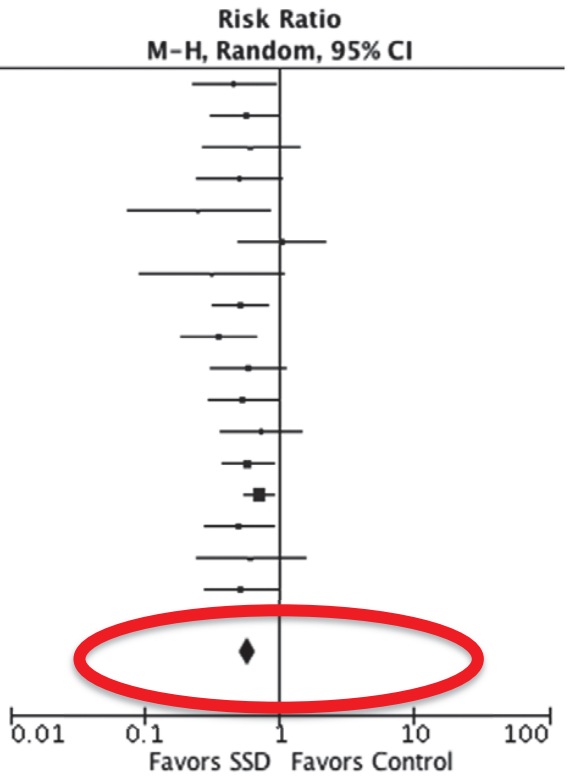
# Subglottic Secretion Drainage and Objective Outcomes: A Systematic Review and Meta-Analysis

Daniel A. Caroff, MD[1,2]; Lingling Li, PhD[1]; John Muscedere, MD[3]; Michael Klompas, MD, MPH[1,2]

| Study or Subgroup | SSD Events | SSD Total | Control Events | Control Total | Weight | Risk Ratio M-H, Random, 95% CI | Year |
|---|---|---|---|---|---|---|---|
| Mahul 1992 | 9 | 70 | 21 | 75 | 3.8% | 0.46 [0.23, 0.93] | 1992 |
| Valles 1995 | 14 | 95 | 25 | 95 | 5.5% | 0.56 [0.31, 1.01] | 1995 |
| Kollef 1999 | 8 | 160 | 15 | 183 | 2.8% | 0.61 [0.27, 1.40] | 1999 |
| Bo 2000 | 8 | 35 | 15 | 33 | 3.7% | 0.50 [0.25, 1.03] | 2000 |
| Smulders 2002 | 3 | 75 | 12 | 75 | 1.3% | 0.25 [0.07, 0.85] | 2002 |
| Girou 2004 | 5 | 8 | 6 | 10 | 3.5% | 1.04 [0.50, 2.18] | 2004 |
| Liu S 2006 | 3 | 48 | 10 | 50 | 1.3% | 0.31 [0.09, 1.07] | 2006 |
| Liu Q 2006 | 14 | 41 | 30 | 45 | 8.5% | 0.51 [0.32, 0.82] | 2006 |
| Lorente 2007 | 11 | 140 | 31 | 140 | 4.6% | 0.35 [0.19, 0.68] | 2007 |
| Zheng 2008 | 9 | 30 | 16 | 31 | 4.6% | 0.58 [0.31, 1.11] | 2008 |
| Yang 2008 | 12 | 48 | 20 | 43 | 5.6% | 0.54 [0.30, 0.97] | 2008 |
| Bouza 2008 | 13 | 345 | 19 | 369 | 4.0% | 0.73 [0.37, 1.46] | 2008 |
| Lacherade 2010 | 25 | 169 | 42 | 164 | 9.6% | 0.58 [0.37, 0.90] | 2010 |
| Tao 2014 | 52 | 102 | 34 | 47 | 28.3% | 0.70 [0.54, 0.91] | 2014 |
| Damas 2014 | 15 | 170 | 32 | 182 | 5.7% | 0.50 [0.28, 0.89] | 2014 |
| Koker 2014 | 5 | 23 | 10 | 28 | 2.3% | 0.61 [0.24, 1.53] | 2014 |
| Gopal 2015 | 13 | 120 | 25 | 120 | 5.0% | 0.52 [0.28, 0.97] | 2015 |
| **Total (95% CI)** | | **1679** | | **1690** | **100.0%** | **0.58 [0.51, 0.67]** | |
| Total events | 219 | | 363 | | | | |

Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 12.12$, df = 16 (P = 0.74); $I^2 = 0\%$

Test for overall effect: Z = 7.71 (P < 0.00001)




*Caroff et al, CCM 2016*

Lorente *et al. Critical Care* 2014, **18**:R77
http://ccforum.com/content/18/2/R77

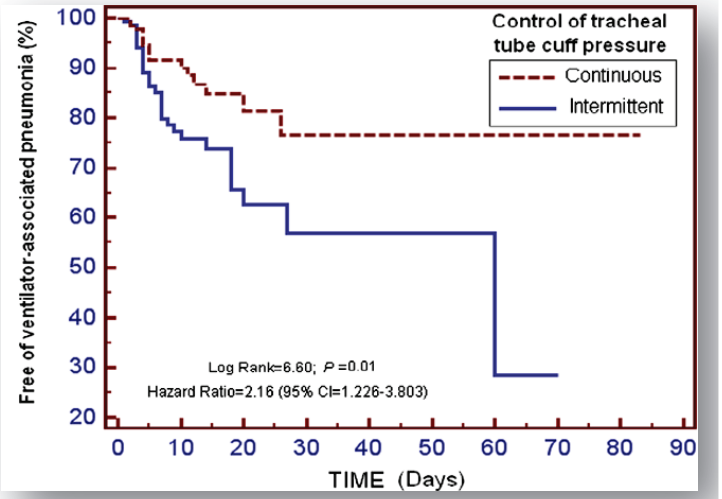
CRITICAL CARE

RESEARCH Open Access

# Continuous endotracheal tube cuff pressure control system protects against ventilator-associated pneumonia

Leonardo Lorente[1*], María Lecuona[2], Alejandro Jiménez[3], Lisset Lorenzo[1], Isabel Roca[1], Judith Cabrera[1], Celina Llanos[1] and María L Mora[1]

- Etude prospective espagnole monocentrique
- 25 cmH2O
- Continu vs toutes les 8h
- 284 patients
- NS sur durée d'hospit et mortalité



# Prévenir : la Décontamination

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

# Decontamination of the Digestive Tract and Oropharynx in ICU Patients

- Etude multicentrique randomisée
- 13 réas, Pays Bas
- 5939 patients ventilés plus de 72h
- 3 groupes:

→ SDD : Cefotaxime IV 4j + application orale de Tobramycine + Colistine + Ampho B

→ SOD : Pate orale seule

→ Groupe contrôle

*De Smet et al, NEJM 2009*

**Table 2. Primary and Secondary End Points.***

| End Point | Study Group | | | Unadjusted Odds Ratio or Hazard Ratio (95% CI)† | | Adjusted Odds Ratio or Hazard Ratio (95% CI)† | | |
|---|---|---|---|---|---|---|---|---|
| | Standard Care (N=1990) | SDD (N=2045) | SOD (N=1904) | Standard Care | SDD | SOD | Standard Care | SDD | SOD |
| Death — no. (%) | | | | | | | | | |
| During the first 28 days | 544 (27.5) | 546 (26.9) | 502 (26.6) | 1.00 | 0.94 (0.82–1.08) | 0.95 (0.82–1.10) | 1.00 | 0.83 (0.72–0.97) | 0.86 (0.74–0.99) |
| In the ICU | 443 (22.3) | 440 (21.5) | 416 (21.8) | 1.00 | 0.91 (0.79–1.06) | 0.97 (0.83–1.13) | 1.00 | 0.81 (0.69–0.94) | 0.87 (0.74–1.02) |
| In the hospital | 632 (31.8) | 665 (32.6) | 584 (30.7) | 1.00 | 0.99 (0.86–1.13) | 0.94 (0.82–1.08) | 1.00 | 0.88 (0.76–1.01) | 0.85 (0.74–0.98) |
| Time to outcome for survivors at day 28 — days | | | | | | | | | |
| Cessation of mechanical ventilation | | | | 1.00 | 1.06 (0.96–1.18) | 1.01 (0.89–1.15) | 1.00 | 1.10 (0.99–1.22) | 1.03 (0.90–1.17) |
| Median | 8 | 7 | 8 | | | | | | |
| Interquartile range | 3–17 | 4–15 | 4–15 | | | | | | |
| Discharge from ICU | | | | 1.00 | 1.02 (0.92–1.12) | 1.00 (0.89–1.11) | 1.00 | 1.09 (0.99–1.21) | 1.06 (0.94–1.19) |
| Median | 9 | 9 | 9 | | | | | | |
| Interquartile range | 6–19 | 6–18 | 6–17 | | | | | | |
| Discharge from hospital | | | | 1.00 | 1.04 (0.91–1.19) | 1.05 (0.91–1.22) | 1.00 | 1.13 (1.01–1.25) | 1.13 (0.96–1.32) |
| Median | 29 | 28 | 28 | | | | | | |
| Interquartile range | 16–48 | 16–45 | 16–47 | | | | | | |

*De Smet et al, NEJM 2009*

**Table 3. Cumulative Incidence of ICU-Acquired Bacteremia and Candidemia.***

| Type of Infection | Study Group | | | Crude Odds Ratio (95% CI) | | |
|---|---|---|---|---|---|---|
| | Standard Care (N=1990) | SOD (N=1904) | SDD (N=2045) | SDD vs. Standard Care | SOD vs. Standard Care | SDD vs. SOD |
| | | *no. (%)* | | | | |
| *Staphylococcus aureus* | 22 (1.1) | 9 (0.5) | 9 (0.4) | 0.40 (0.18–0.86) | 0.43 (0.20–0.93) | 0.93 (0.37–2.40) |
| *Streptococcus pneumoniae* | 3 (0.2) | 1 (0.1) | 1 (0.0) | 0.32 (0.03–3.12) | 0.35 (0.04–3.35) | 0.93 (0.06–14.90) |
| GNF-GNR species† | 36 (1.8) | 17 (0.9) | 16 (0.8) | 0.43 (0.24–0.77) | 0.49 (0.27–0.87) | 0.88 (0.44–1.74) |
| Enterobacteriaceae | 87 (4.4) | 59 (3.1) | 18 (0.9) | 0.19 (0.12–0.32) | 0.70 (0.50–0.98) | 0.28 (0.16–0.47) |
| Enterococcus species | 55 (2.8) | 49 (2.6) | 48 (2.3) | 0.85 (0.57–1.25) | 0.93 (0.63–1.37) | 0.91 (0.61–1.36) |
| Candida species | 16 (0.8) | 14 (0.7) | 8 (0.4) | 0.49 (0.21–1.11) | 0.91 (0.45–1.85) | 0.53 (0.23–1.24) |
| Patients with at least one episode of bacteremia or candidemia — no. (%) | 186 (9.3) | 124 (6.5) | 88 (4.3) | 0.44 (0.34–0.57) | 0.68 (0.53–0.86) | 0.65 (0.49–0.85) |

➔ **Mais augmentation de résistance des germes...**

*De Smet et al, NEJM 2009*

ORIGINAL

# Ecological effects of selective oral decontamination on multidrug-resistance bacteria acquired in the intensive care unit: a case–control study over 5 years

Check for updates

**Table 3 ICU-acquired MDRB over a 5-year period in all patients under study**

| 1 > all included patients | 86,281 days with SOD ($n = 3340$) | | 32,177 days without SOD ($n = 1694$) | | Comparison of two rates |
|---|---|---|---|---|---|
| | No | Incidence densities/1000 days | No | Incidence densities /1000 days | *p* value |
| Methicillin-resistant *S. aureus* | 16 | 0.19 | 12 | 0.37 | 0.06 |
| Vancomycin-resistant *E. faecium* | 62 | 0.72 | 10 | 0.31 | |
| ESBL-producing *E. coli* | 58 | 0.67 | 15 | 0.47 | |
| Fluoroquinolone-resistant *E. coli* | 57 | 0.66 | 25 | 0.78 | |
| ESBL-producing *K. pneumoniae* | 19 | 0.22 | 18 | 0.56 | |
| Carbapenem-resistant *K. pneumoniae* | 3 | 0.03 | 4 | 0.12 | |
| *Enterobacter cloacae* | 36 | 0.42 | 13 | 0.40 | |
| *Serratia marcescens* | 10 | 0.12 | 4 | 0.12 | |
| *Stenotrophomonas maltophilia* | 80 | 0.93 | 33 | 1.03 | |
| *Pseudomonas aeruginosa* | 58 | 0.67 | 25 | 0.78 | |
| *Acinetobacter baumannii* | 16 | 0.19 | 3 | 0.09 | |

*ICU*, intensive care unit; *SOD*, selective oropharynx decontamination; *MDRB*, multidrug-resistant bacteria; *ESBL*, extended-spectrum beta-lactamas

Pas de différence sur incidence BMR
(hors ERV)

**Table 6 Health-care-associated infections in both groups after propensity score matching**

| ICU-acquired infections during prevention* | with SOD ($n = 1694$) | | | Without SOD ($n = 1694$) | | | *p* value |
|---|---|---|---|---|---|---|---|
| | Number of cases | % | Incidence density/1000 days | Number of cases | % | Incidence density/1000 days | |
| Ventilator-associated pneumonia | 243 | 14 | 10.2 | 302 | 18 | 14.1 | < 0.01 |
| Bacteremia | 218 | 13 | 8.92 | 182 | 11 | 8.48 | 0.61 |
| Urinary tract infections | 162 | 10 | 6.79 | 138 | 8 | 6.43 | 0.64 |

*Days at risk with mechanical ventilation: 23,876 days with SOD, 21,467 days without SOD

*ICU*, intensive care unit; *SOD*, selective oropharynx decontamination

**Table 7 Incidence rate of death in the ICU in both groups**

| Death in the ICU* | With SOD | | | Without SOD | | | *p* value |
|---|---|---|---|---|---|---|---|
| | No | % | Incidence density/1000 days | No | % | Incidence density/1000 days | |
| Before propensity score matching | 759/3340 | 23 | 8.8 | 509/1694 | 30 | 15.8 | < 0.01 |
| After propensity score matching | 478/1694 | 28 | 13.2 | 509/1694 | 30 | 15.8 | < 0.01 |

*Days at risk in the ICU: 86,281 and 36,167 days with SOD, respectively; 32,177 days without SOD

*ICU*, intensive care unit; *SOD*, selective oropharynx decontamination

Diminution VAP et mortalité en réa

*Wang et al, ICM 2022*

# Rôle du pH gastrique ?

## Acid Suppressive Medication Use and the Risk for Hospital Acquired Pneumonia

Shoshana J. Herzig MD
Michael D. Howell MD MPH
Long H. Ngo PhD
Edward R. Marcantonio MD SM

**Context** The use of acid-suppressive medication has been steadily increasing, particularly in the inpatient setting, despite lack of an accepted indication in the majority of these patients.

**Objective** To examine the association between acid-suppressive medication and hospital-acquired pneumonia.

**Table 4.** Rates of Hospital-Acquired Pneumonia According to Type of Acid-Suppressive Medication

| | Acid-Suppressive Medication | No Acid-Suppressive Medication | Unadjusted OR (95 CI) | Adjusted OR (95 CI) |
|---|---|---|---|---|
| **Proton-Pump Inhibitors**[a] | | | | |
| Total admissions, No. | 25 374 | 30 956 | 56 330 | 56 330 |
| Hospital-acquired pneumonia, No. ( ) | 1340 (5.3) | 610 (2.0) | 2.8 (2.5-3.1) | 1.3 (1.1-1.4)[b] |
| **Histamine$_2$ Receptor Antagonists**[c] | | | | |
| Total admissions, No. | 5686 | 30 956 | 36 642 | 36 642 |
| Hospital-acquired pneumonia, No. ( ) | 176 (3.1) | 610 (2.0) | 1.6 (1.3-1.9) | 1.2 (0.98-1.4)[b] |

*Herzig et al., JAMA 2009*

# Rôle du pH gastrique ?

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 DECEMBER 6, 2018 VOL. 379 NO. 23

Pantoprazole in Patients at Risk for Gastrointestinal Bleeding in the ICU

- Étude prospective, randomisée, multicentrique, internationale
- 3298 patients avec FDR d'hémorragie digestive haute (anticoagulants, choc, ventilation, EER…)
- Pantoprazole 40mg vs Placebo

# Rôle du pH gastrique ?

**Table 2.** Primary and Secondary Outcome Measures.

| Outcomes | Pantoprazole | Placebo | Relative Risk (95% CI)* | P Value† |
|---|---|---|---|---|
| Primary outcome: death by day 90 — no./total no. (%) | 510/1642 (31.1) | 499/1640 (30.4) | 1.02 (0.91–1.13) | 0.76 |
| Secondary outcomes | | | | |
| One or more clinically important events — no./total no. (%)‡ | 360/1644 (21.9) | 372/1647 (22.6) | 0.96 (0.83–1.11) | — |
| One or more episodes of clinically important gastrointestinal bleeding — no./total no. (%) | 41/1644 (2.5) | 69/1647 (4.2) | 0.58 (0.40–0.86) | — |
| One or more infectious adverse events — no./total no. (%)§ | 276/1644 (16.8) | 279/1647 (16.9) | 0.99 (0.84–1.16) | — |
| Severe adverse reaction — no./total no. (%)¶ | 0/1644 (0) | 0/1647 (0) | — | — |
| Median percentage of days alive without the use of life support (IQR)‖ | 92 (60–97) | 92 (65–97) | — | — |

# Prévention : autres mesures

- Pas d'intérêts à l'utilisation de :

**- Probiotiques**

**- Sonde IOT recouvertes d'argent ou forme ballonnet « optimisée »**

**- Corticoïdes**

**- Système d'aspiration clos**

**- Antibioprophylaxie par aérosols**

**- Changement quotidien du circuit ou filtre**

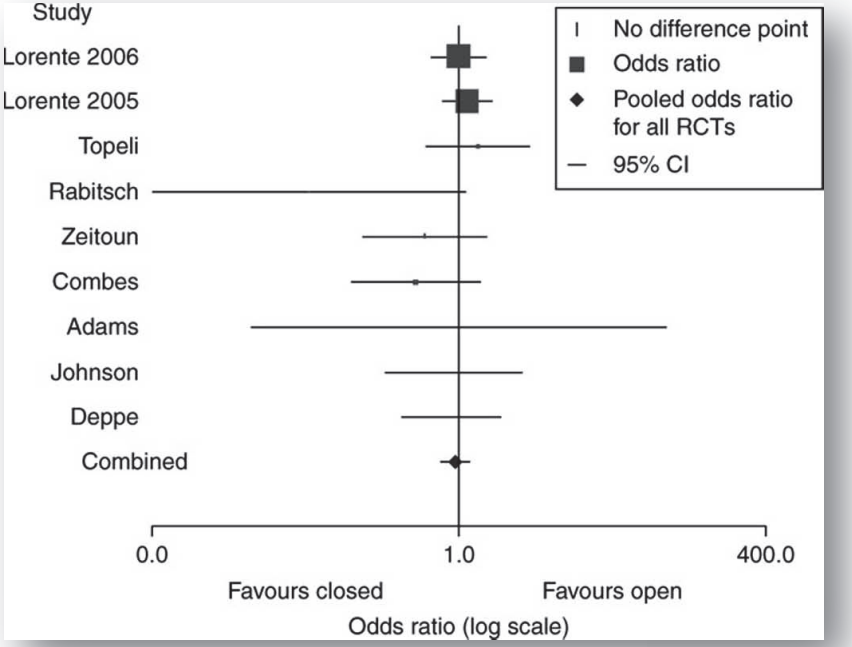
*British Journal of Anaesthesia* **100 (3):** 299–306 (2008)
doi:10.1093/bja/aem403 Advance Access publication February 4, 2008

BJA

# Closed tracheal suction systems for prevention of ventilator-associated pneumonia

**I. I. Siempos[1], K. Z. Vardakas[1] and M. E. Falagas[1 2 3]***

*[1]Alfa Institute of Biomedical Sciences (AIBS), 9 Neapoleos Street, 151 23 Marousi, Athens, Greece. [2]Department of Medicine, Henry Dunant Hospital, Athens, Greece. [3]Department of Medicine, Tufts University School of Medicine, Boston, MA, USA*




- NS sur incidence PAVM
- Augmentation durée de ventilation et colonisation bactérienne

# Impact kinésithérapie ?

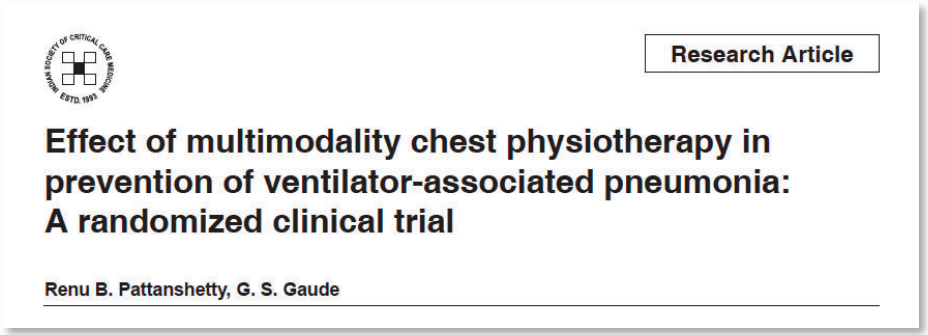
Intensive Care Med (2002) 28:850–856
DOI 10.1007/s00134-002-1342-2

ORIGINAL

G. Ntoumenopoulos
J. J. Presneill
M. McElholum
J. F. Cade

**Chest physiotherapy for the prevention of ventilator-associated pneumonia**

2002, n=60
Diminution VAP

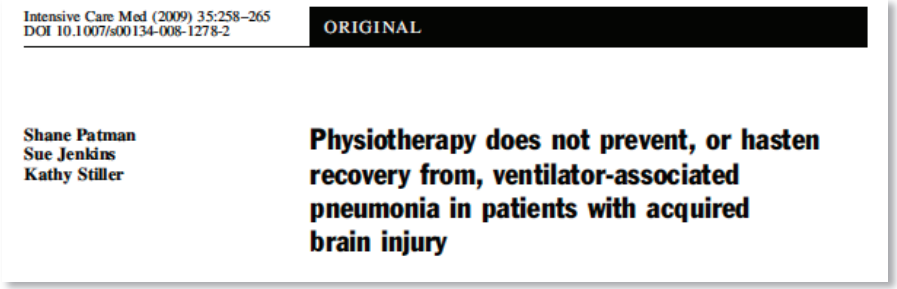


Research Article

**Effect of multimodality chest physiotherapy in prevention of ventilator-associated pneumonia: A randomized clinical trial**

Renu B. Pattanshetty, G. S. Gaude

2010, n=101
Diminution du score CPIS



Intensive Care Med (2009) 35:258–265
DOI 10.1007/s00134-008-1278-2

ORIGINAL

Shane Patman
Sue Jenkins
Kathy Stiller

**Physiotherapy does not prevent, or hasten recovery from, ventilator-associated pneumonia in patients with acquired brain injury**

2008, n=101, neurolésé
Pas de diminution survenue VAP
ni d'amélioration pronostic si VAP

Donnée contradictoire …

# Impact kinésithérapie ?

Chest physiotherapy for the prevention of ventilator-associated pneumonia: A meta-analys

Meng-Yang Wang BS [a,*], Lei Pan M

[a] Joint Programme of Nanchang University of London, Nanc
[b] Department of Respiratory and Critical Care Medicine, Bi


| First author/y/reference | RR (95%CI) | Weight % |
|---|---|---|
| Ntoumenopoulos G, 1998[19] | 0.55 (0.19, 1.56) | 3.85 |
| Templeton M, 2007[20] | 1.37 (0.90, 2.08) | 16.61 |
| Patman S, 2009[21] | 0.74 (0.40, 1.35) | 9.80 |
| Pattanshetty RB, 2010[22] | 1.04 (0.94, 1.15) | 39.94 |
| Pattanshetty RB, 2011[23] | 1.13 (0.88, 1.45) | 27.75 |
| Zeng H, 2017[24] | 0.21 (0.05, 0.91) | 2.05 |
| Overall ($I^2$ = 49.0%, $P$ = .081) | 1.02 (0.82, 1.26) | 100.00 |

NOTE: Weights are from random effects analysis

20.9

Peu d'études, petits effectifs, hétérogénicité…

*Wang et al, AJIC 2019*

# Prévention

## Prévention

### Quels moyens de prévention des pneumonies associées aux soins faut-il utiliser pour diminuer la morbimortalité des patients de réanimation ?

R1.1 – Il faut utiliser une approche standardisée multimodale de prévention des pneumonies associées aux soins pour diminuer la morbidité des patients hospitalisés en réanimation.
GRADE 1+, ACCORD Fort

SFAR

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SOCIÉTÉ
DE RÉANIMATION
DE LANGUE FRANÇAISE

# Protocole multimodal de prévention des pneumonies associées aux soins

**1 - Favoriser la ventilation non-invasive (notamment en post-opératoire de chirurgie digestive et chez le BPCO)**

**En cas de nécessité de ventilation invasive**

**2 - Appliquer un protocole de décontamination digestive sélective avec une antibiothérapie systémique < 5 jours si prévalence de BMR faible (< 20%)**

**3 - Associer certaines des méthodes suivantes (1ère intention) :**

- Favoriser le recours à la VNI pour éviter l'intubation
- Limiter les doses et la durée d'administration de sédatifs et analgésiques liés à la ventilation mécanique
- Initier précocement une nutrition entérale
- Contrôler régulièrement la pression du ballonnet de la sonde endotrachéale
- Réaliser une aspiration sous-glottique (/6-8 heures) à l'aide de sonde endotrachéale adaptée
- Préférer la voie orotrachéale pour l'intubation

*NB: l'association d'un proclive > 30° et/ou d'une décontamination oro-pharyngée à la chlorhexidine 0,12 ou 0,2% pourraient être proposée en association à ces mesures malgré une faible efficacité car elles sont peu coûteuses et bien tolérées*

**4- Eviter d'utiliser les méthodes suivantes :**

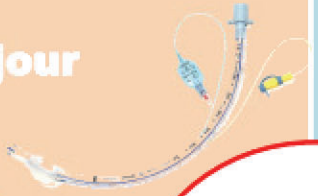
- Trachéotomie précoce systématique (hors indication spécifique)
- Prophylaxie anti-ulcéreuse (hors indication spécifique)
- Nutrition entérale post-pylorique (hors indication spécifique)
- Administration de probiotiques
- Changement précoce (hors recommandation du constructeur) des filtres humidificateurs en systématique
- Utilisation des systèmes clos d'aspiration endo-trachéale
- Utilisation de sonde d'intubation imprégnée avec un antiseptique, ou à forme « optimisée » du ballonnet
- Décontamination oro-pharyngée à la polyvidone iodée
- Utilisation d'une antibioprophylaxie par aérosols
- Décontamination cutanée quotidienne par antiseptique

# PREVENTION DES PAVM

**5 POINTS CLÉS**

**Aspiration sous glottique**

3x/jour



**Pression du ballonnet**

25-30 cm H2O

**Elévation tête du lit**

30-45°

**Evaluation sédation/extubation**

1x/jour

**Soins de bouche**

6x/jour

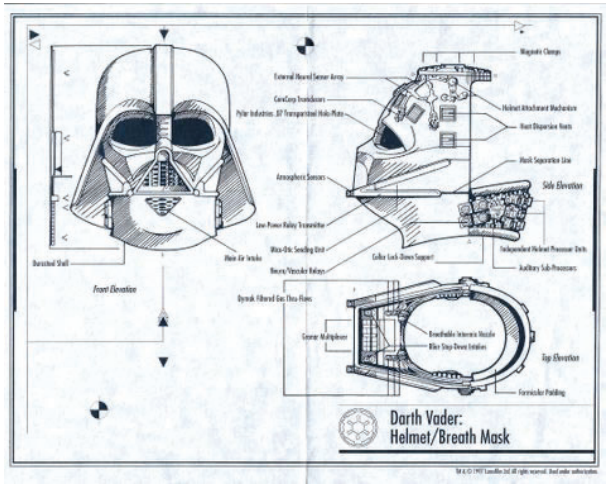
Janvier 2020-CHU0257

CHU Hôpitaux de Bordeaux

# Conclusions

- Moins de ventilation… moins de PAVM !
- Diagnostic précoce pour traitement adapté
- **Protocole de service pour prévention = BUNDLE**

# Pneumopathie acquise sous ventilation mécanique

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