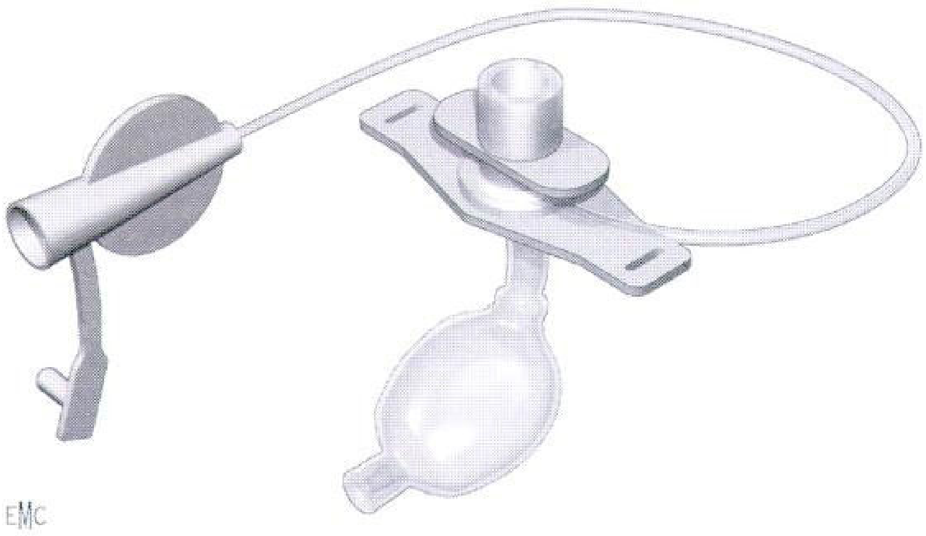
CENTRE HOSPITALIER
de la Côte Basque

université de BORDEAUX

Trachéotomie en Réanimation



DU Kiné
Mars 2026

Pr Hadrien Rozé
Réanimation Polyvalente
Centre Hospitalier Côte Basque

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iVentilate

JAMA Otolaryngology–Head & Neck Surgery | Original Investigation

Timing, Complications, and Safety of Tracheotomy in Critically Ill Patients With COVID-19

Francesc Xavier Avilés-Jurado, MD, PhD; Daniel Prieto-Alhambra, MD, PhD; Nesly González-Sánchez, MD; José de Ossó, MD; Claudio Arancibia, MD; María Jesús Rojas-Lechuga, MD; Laura Ruiz-Sevilla, MD; Joan Remacha, MD; Irene Sánchez, MD; Eduardo Lehrer-Coriat, MD; Mauricio López-Chacón, MD; Cristóbal Langdon, MD; Josep María Guilemany, MD, PhD; Francisco Larrosa, MD, PhD; Isam Alobid, MD, PhD; Manuel Bernal-Sprekelsen, MD, PhD; Pedro Castro, MD, PhD; Isabel Vilaseca, MD, PhD

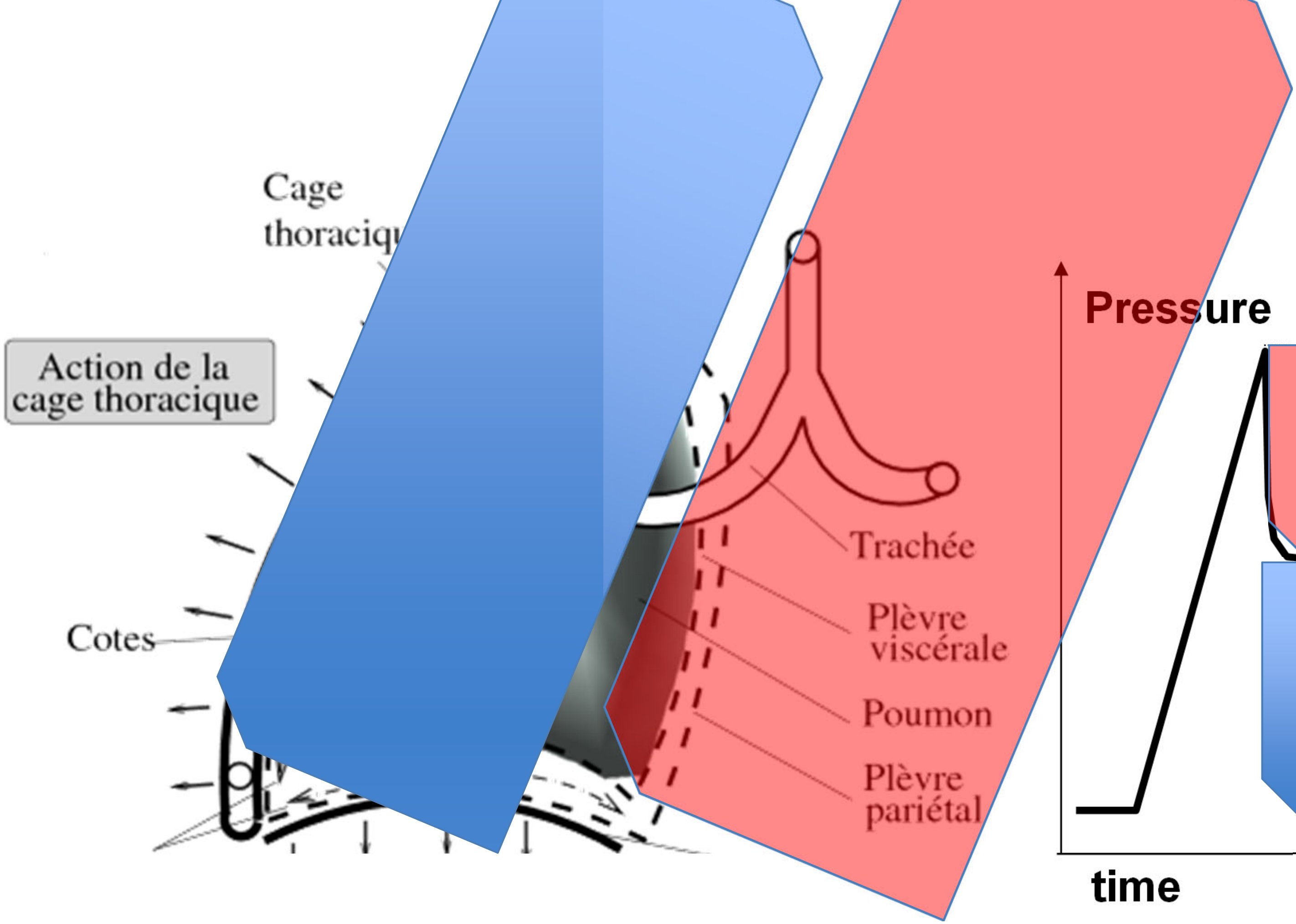
JAMA Otolaryngol Head Neck Surg. 2021;147(1):41-48.

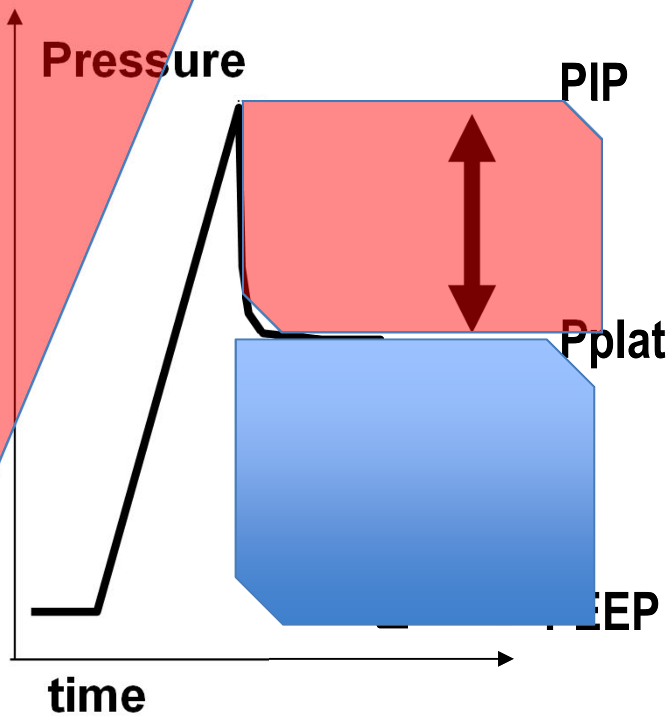
Characteristic	Total (N = 50)	Early tracheotomy (n = 32)	Late tracheotomy (n = 18)
Postoperative complications			
Minor diffuse bleeding	6 (12)	5 (15.6)	1 (5.5)
Major bleeding	0	0	0
Air leak	3 (6)	1 (3)	2 (11)
Cannula dislocation	1 (2)	0	1 (5.5)
Tolerance to cuff deflation in survivors (n = 42)	42 (100)	42 (100)	42 (100)
Ability to phonate in survivors (n = 42)	42 (100)	42 (100)	42 (100)
Neurologic impairment			
No	41 (82)	28 (56)	13 (26)
Yes	3 (6)	2 (4)	1 (2)
Dead before examination	6 (12)	2 (4)	4 (8)
Intubation time before tracheotomy, d			
Median (IQR)	9 (4.2)	8 (2)	12.5 (2.25)
Mean (SD)	9.6 (3.6)	7.5 (1.9)	13.2 (3)
Total time receiving IMV, d			
Median (IQR)	18 (6)	17 (5)	20 (5)
Mean (SD)	17.9 (4.5)	16.6 (4.5)	20.5 (3.4)
Time from tracheotomy to IMV withdrawn, d			
Median (IQR)	8 (6)	8 (9)	8 (9)
Mean (SD)	8.5 (4.5)	9.2 (5.1)	7.22 (2.6)
Decannulation rate in survivors	42 (100)	42 (100)	42 (100)
Time to decannulation, d			
Median (IQR)	22 (15)	20 (15)	25 (14)
Mean (SD)	23.7 (12)	22.2 (13)	26.4 (9)

- Equation du mouvement du poumon :

Palv = PEP + (Vt / Ctp) + (Débit x Res)

RS vs VC
VNI vs IOT
VAS nez vs bouche
Trachéo vs nez

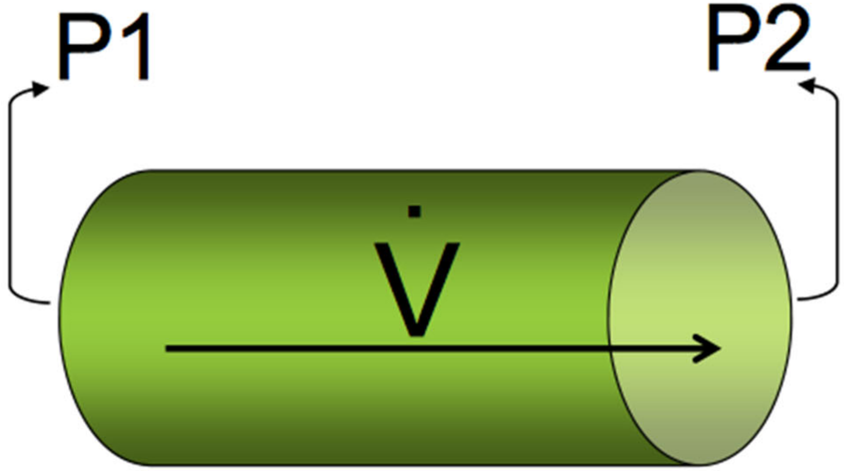




Propriétés résistives

- Ventilation = condition dynamique
  • L’activité des muscles respiratoires doit
- – vaincre l’élasticité pulmonaire (2/3 au repos)
  – vaincre la résistance du système respiratoire au
- passage de l’air (1/3 au repos)
  • résistances tissulaires (≈ 20%): frottements du
  tissu pulmonaire
- • résistances des voies aériennes (≈ 80%):
  résistance à l’écoulement des molécules

- Fluide
  - viscosité η
  - densité ρ
  - conduit de longueur l
  - rayon r

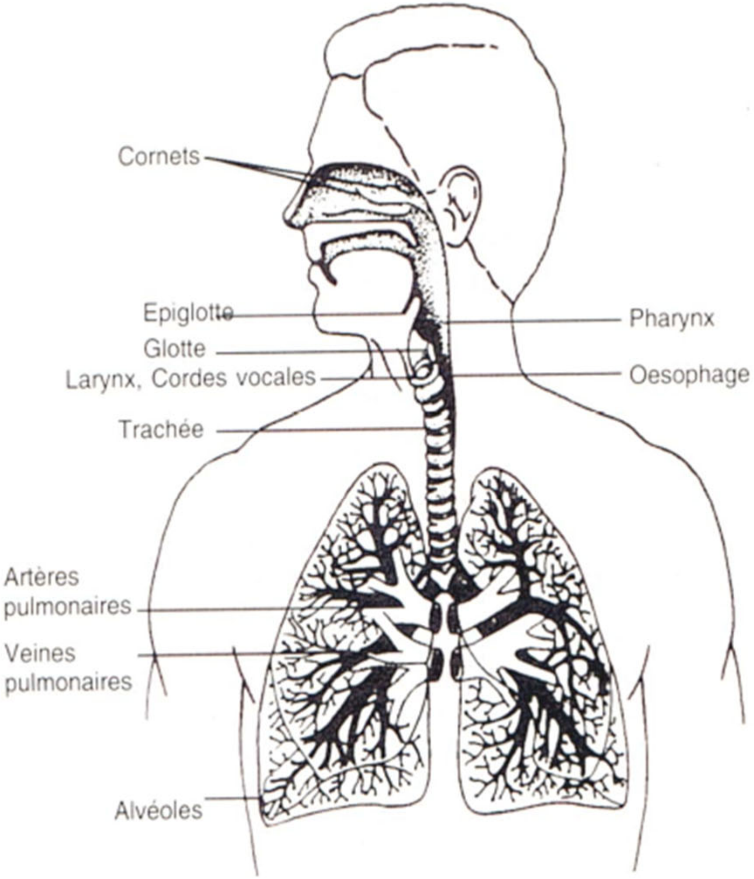


- En écoulement laminaire

$$\dot{V} = \frac{\Delta P^*}{R} \qquad R = \frac{8\eta l}{\pi r^4}$$

Résistances pulmonaires

En respiration nasale



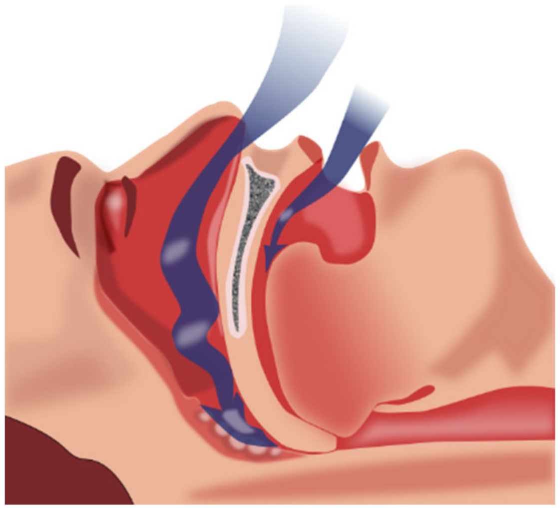
VA extra-thoraciques (nez +++)
50%

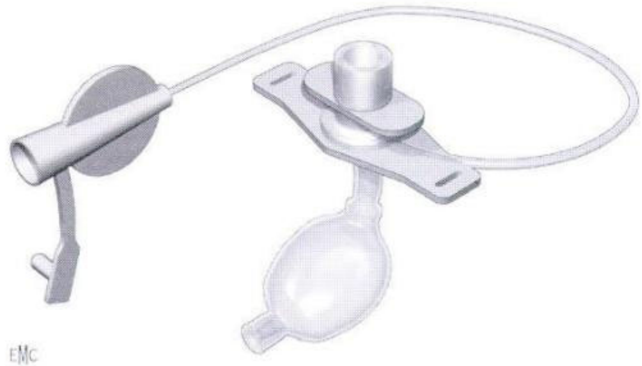
Trachée et grosses bronches
40%

G_7 à G_{23}
10%

Resistances Trachéo = VS par le nez

- R trac = R VS par le nez
- Si IOT la longueur modifie les résistances inspi et expiratoires et R Trac < R IOT à même diamètre (7 ou 8)

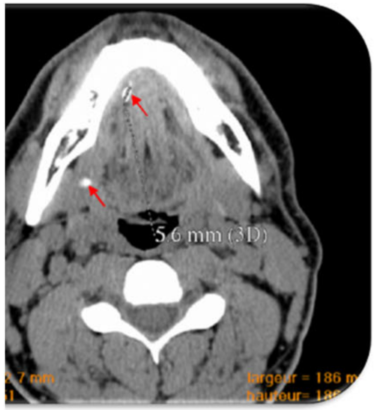


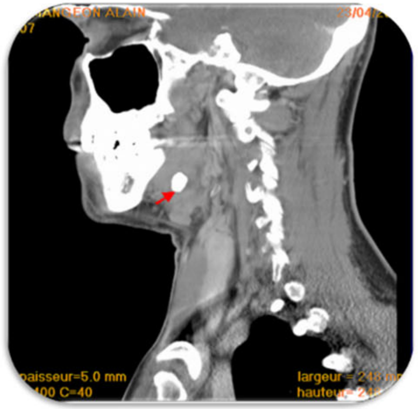


Espace mort

- L'augmentation de l'effet espace mort (de l'ordre de 25 % chez le sujet normal et pouvant atteindre 60 à 80 % chez le patient BPCO en poussée) est responsable de l'hypercapnie.
- La $PaCO_2$ est proportionnelle à la production de CO_2 et inversement proportionnelle à la ventilation alvéolaire (VA) :
- **$PaCO_2$ = K x VCO2/VA**
- La ventilation alvéolaire est la différence entre la ventilation totale et la ventilation de l'espace mort :
- **VA = Ve x VD/VT= VE x (1-VD)/VT**
- VD est l'espace mort physiologique, c'est-à-dire la fraction du volume courant qui ne participe pas aux échanges gazeux. VT est le volume courant. Ainsi, en remplaçant VA dans la première équation, on obtient :
- **$PaCO_2$ = K x VCO2/ (VE x 51-VD/VT))**

Espace mort





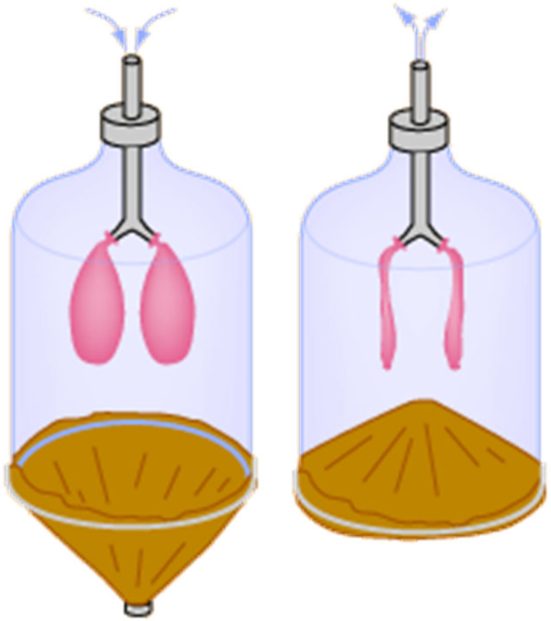

- La trachéo diminue l'espace mort de 156 ml à 230 ml.

Intensive Care Med (2002) 28:1761–1767

- Le VT est poche de 6 ml.kg afin de limiter les asynchronies et l'auto PEP chez les BPCO

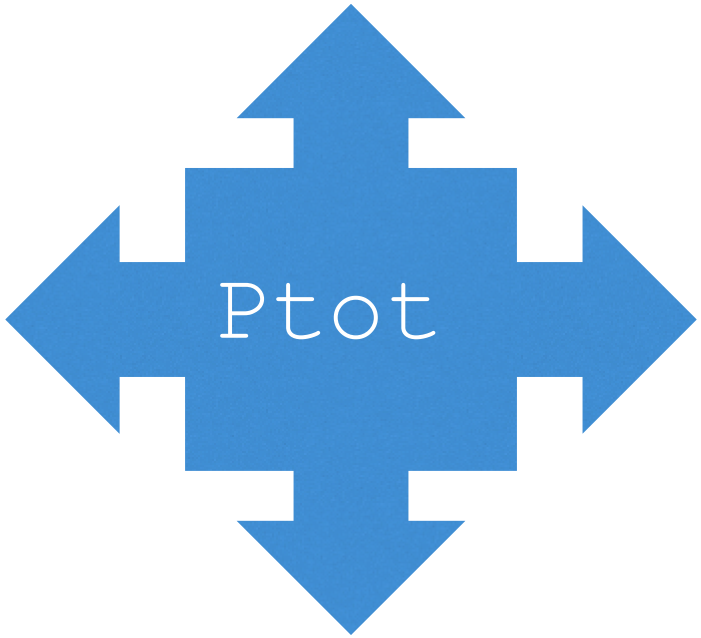
Intensive Care Med (2008) 34:1477–1486

b



Forces de
rétraction
Élastique du
poumon

Forces opposées
à la ventilation

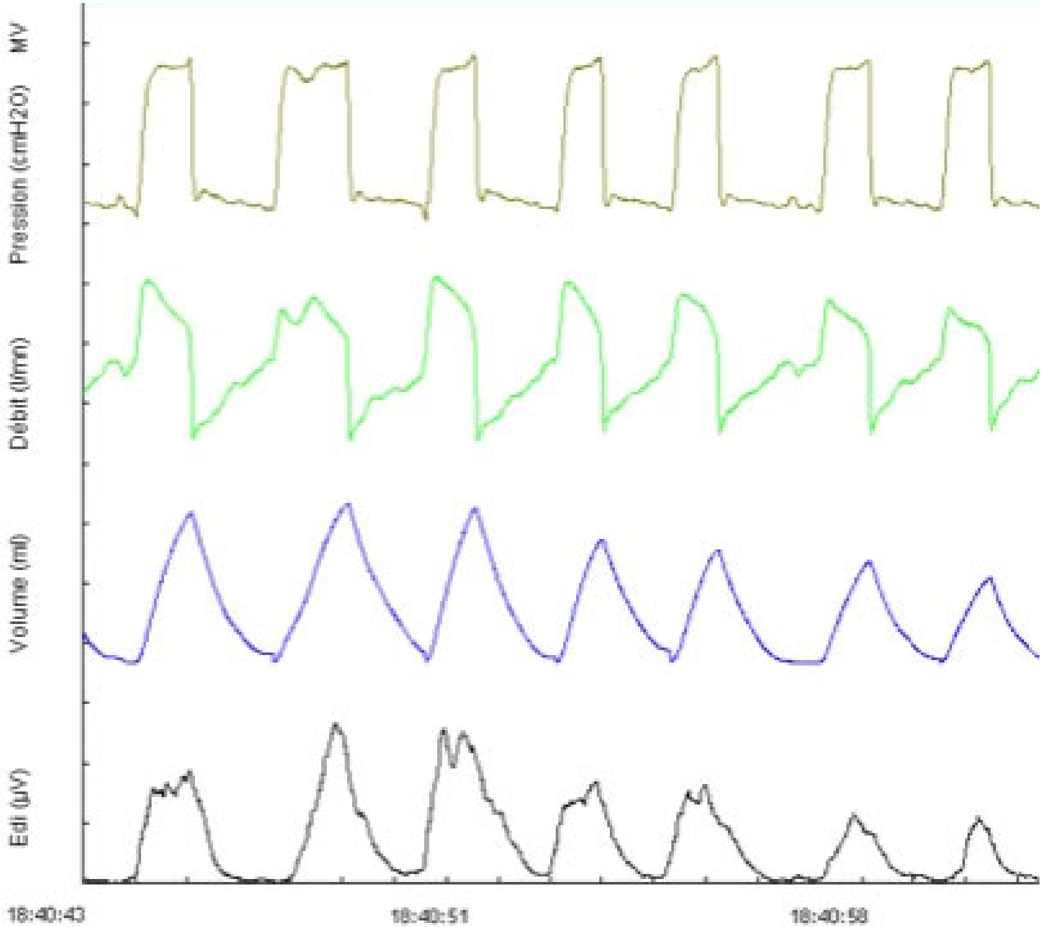


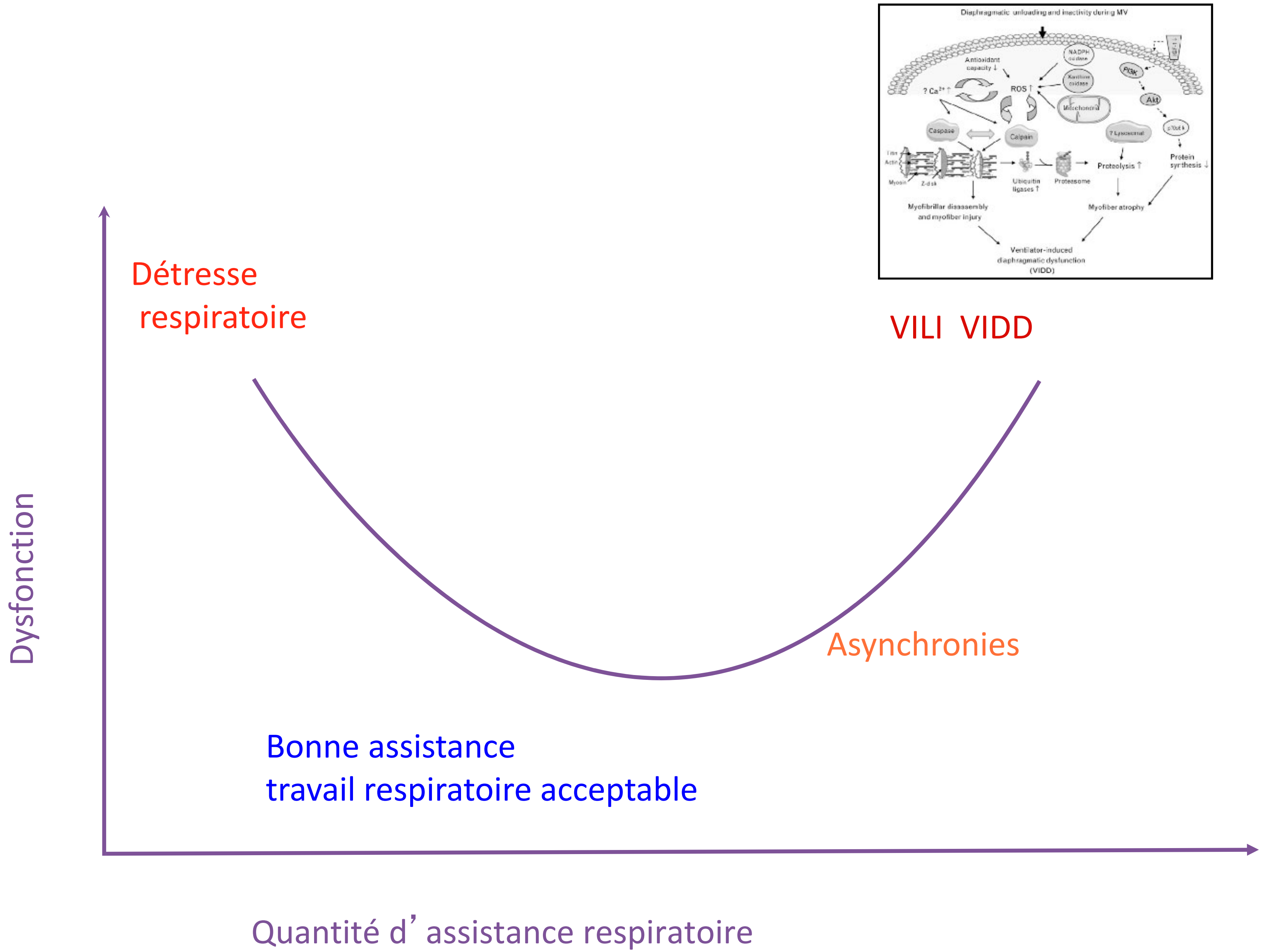
Résistances
à l’écouleme
du gaz

Travail respiratoire
Litres/cmH_2O
Joules

$$P\ tot_{(t)} = R\ .\ Débit_{(t)} + 1/C\ .$$

Ptot = Pmus + Paw



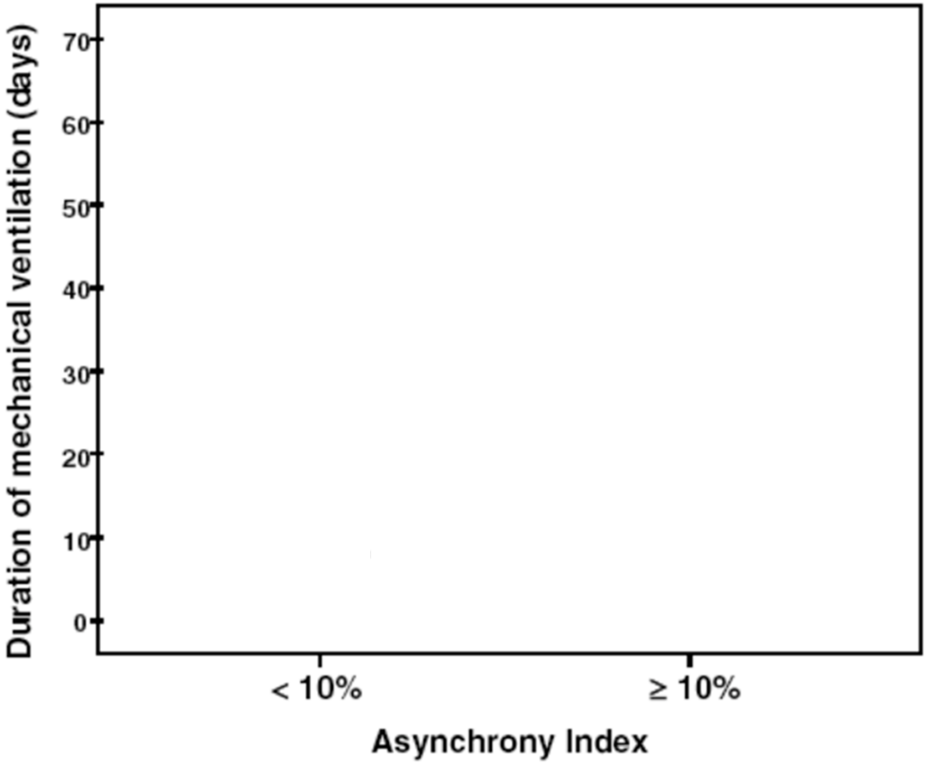

Diaphragmatic unloading and inactivity during MV
Antioxidant capacity ↓
NADPH oxidase
Xanthine oxidase
? Ca2+ ↑
ROS ↑
PI3K
Akt
Caspase
Calpain
? Lysosomal
Titin
Actin
Myosin
Z-disk
Ubiquitin ligases ↑
Proteasome
Proteolysis ↑
Protein synthesis ↓
Myofibrillar disassembly and myofiber injury
Myofiber atrophy
Ventilator-induced diaphragmatic dysfunction (VIDD)
Détresse respiratoire
VILI VIDD
Dysfonction
Asynchronies
Bonne assistance
travail respiratoire acceptable
Quantité d'assistance respiratoire

Intensive Care Med (2006) 32:1515–1522
DOI 10.1007/s00134-006-0301-8

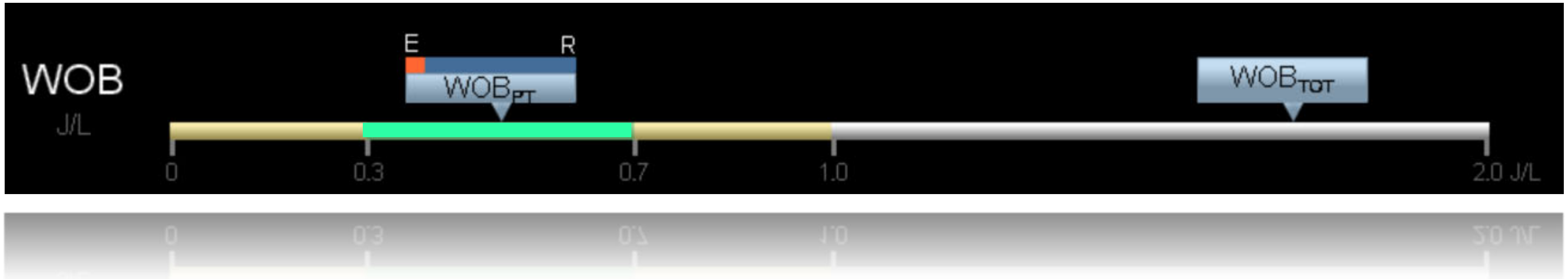
ORIGINAL

Arnaud W. Thille
Pablo Rodriguez
Belen Cabello
François Lellouche
Laurent Brochard

Patient-ventilator asynchrony during assisted mechanical ventilation



- Assistance en fonction du travail respiratoire



Intensive Care Med (2006) 32:1311–1314
DOI 10.1007/s00134-006-0278-3

PHYSIOLOGICAL NOTE

1 joule = mobilisation de 1 l de gaz avec un ΔP de 10 cmH2O

ɛn (joule) ≠ P

Belen Cabello
Jordi Mancebo

Work of breathing

Review

J Appl Physiol 107: 962–970, 2009.
First published April 30, 2009; doi:10.1152/japplphysiol.00165.2009.

HIGHLIGHTED TOPIC | *The Respiratory Muscles in Chronic Obstructive Pulmonary Disease*

Role of the respiratory muscles in acute respiratory failure of COPD: lessons from weaning failure

Martin J. Tobin,[1] Franco Laghi,[1] and Laurent Brochard[2]

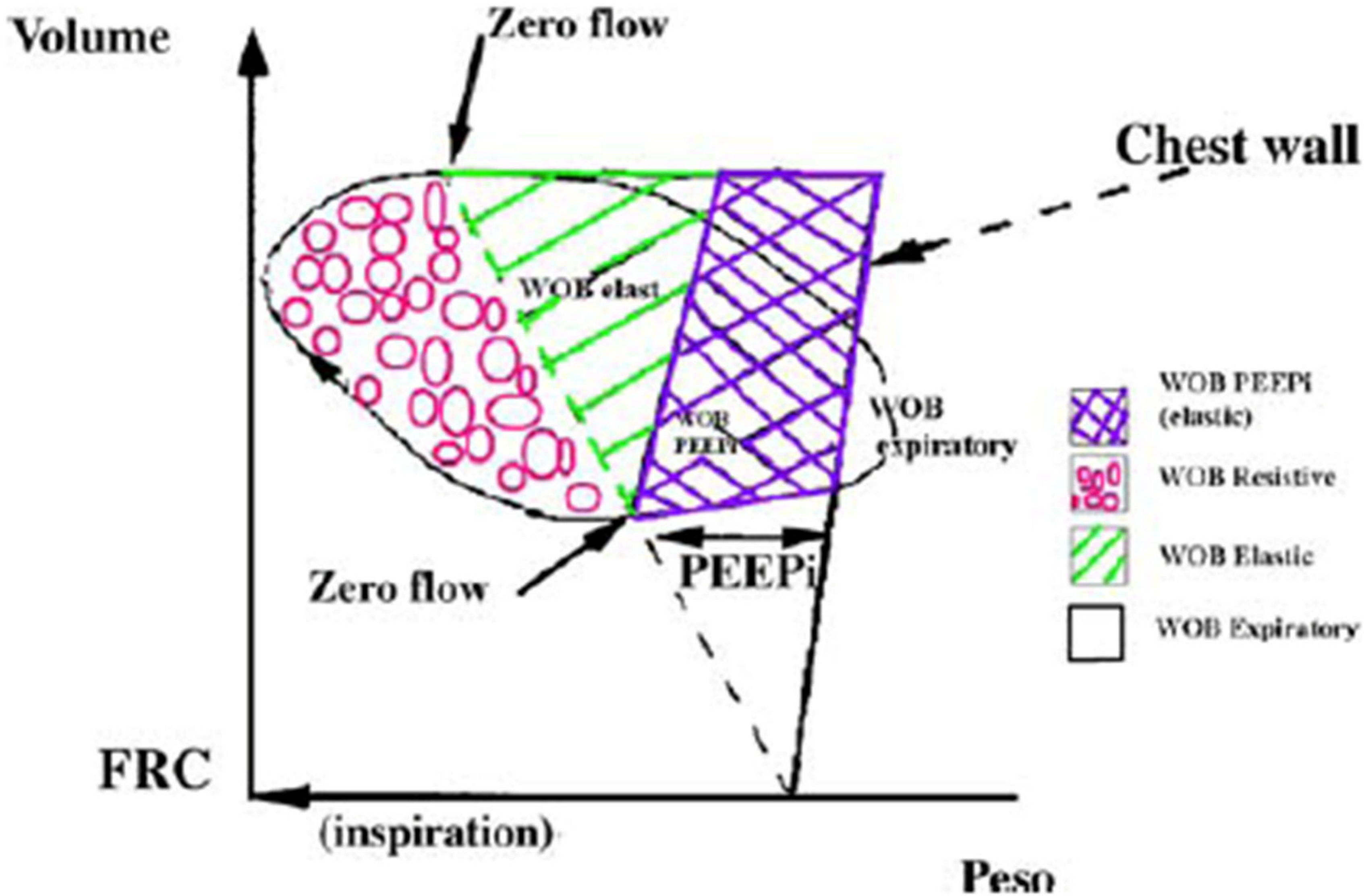


Diagramme de Campbel

WOB: Travail respiratoire

- 31 BPCO échec de sevrage
- Début SBT: PTP échec 255 (59) $cmH_2O.s/min$

  succès 158 (23)
- Fin SBT : PTP échec 388 (68)*

  succès 205 (25)

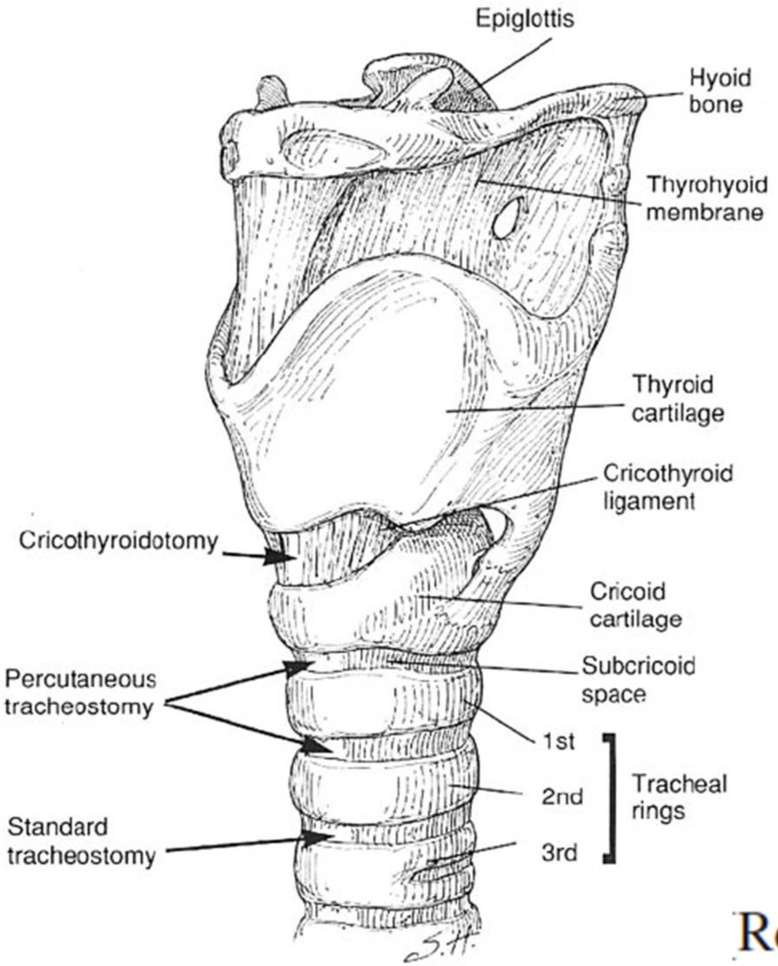
>> Echec si trop de travail

Jubran, Tobin. *Am J Respir Crit Care Med* 1997;155: 906-915

New Horizons Symposium Papers

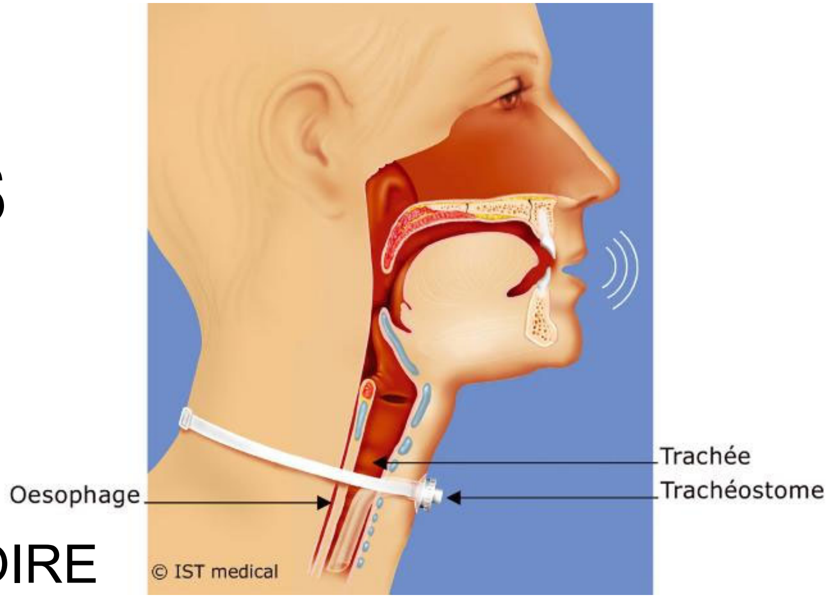
Anatomy and Physiology of Tracheostomy

Scott K Epstein MD



Respir Care 2005;50(3):476–482.

AVANTAGES ATTENDUS



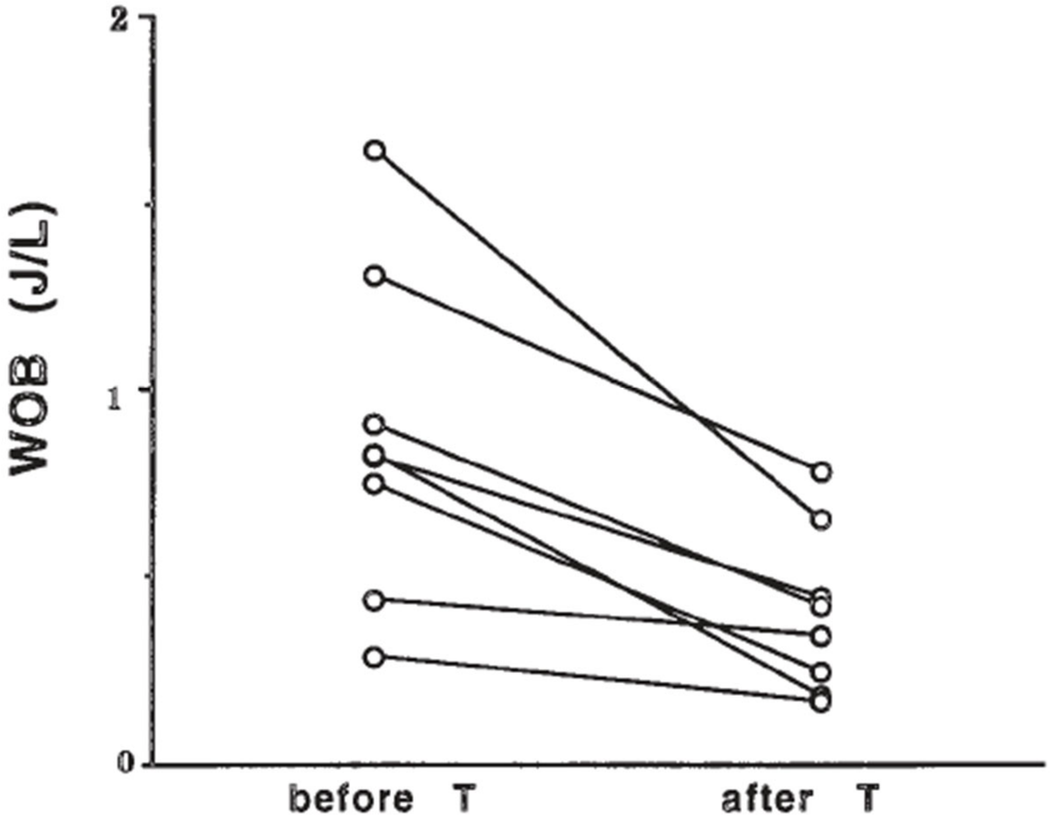
- REDUCTION DU TRAVAIL RESPIRATOIRE
- DIMINUTION DES PNEUMOPATHIES
- SEVRAGE VENTILATOIRE PROGRESSIF
- CONFORT
- SECURITE

Changes in the Work of Breathing Induced by Tracheotomy in Ventilator-dependent Patients

JEAN-LUC DIEHL, SOUHEIL EL ATROUS, DOMINIQUE TOUCHARD, FRANÇOIS LEMAIRE, and LAURENT BROCHARD

Service de Réanimation Médicale, Hôpital Henri Mondor, AP-HP, Institut Nationale de la Santé et de la Recherche Médicale 492, Université Paris 12, Créteil, France

Am J Respir Crit Care Med Vol 159. pp 383–388, 1999



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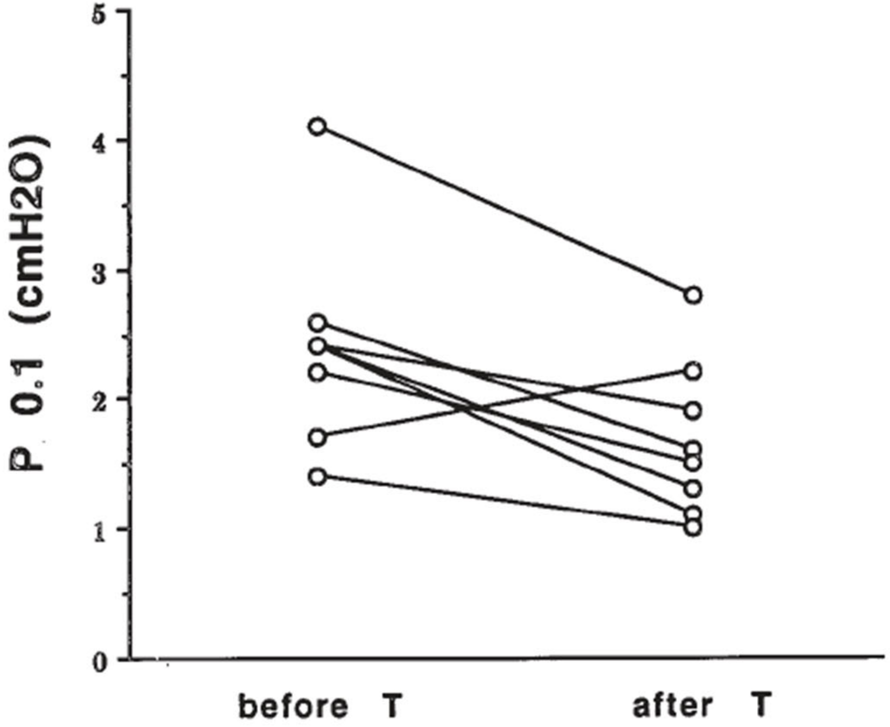
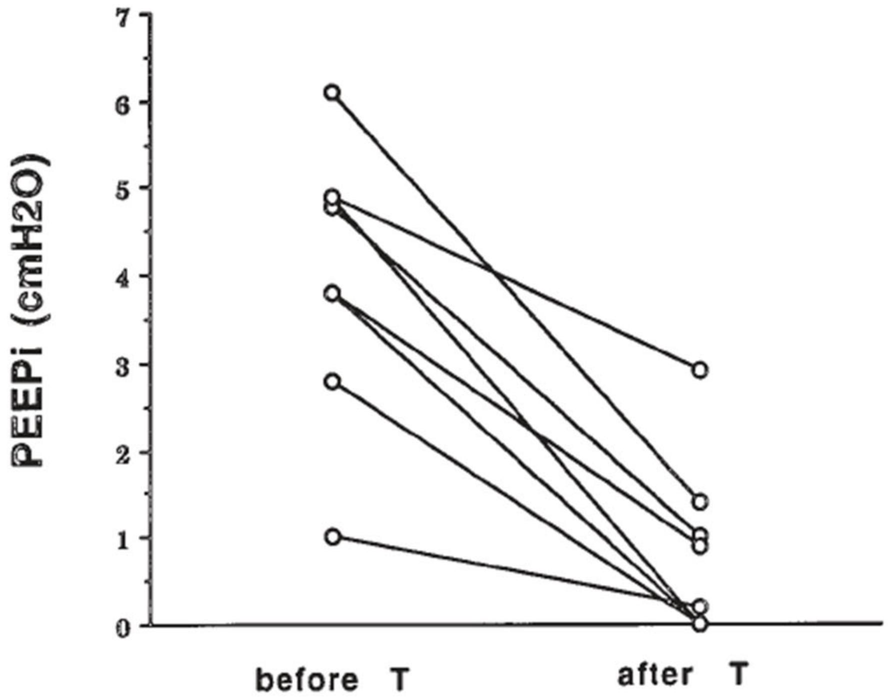
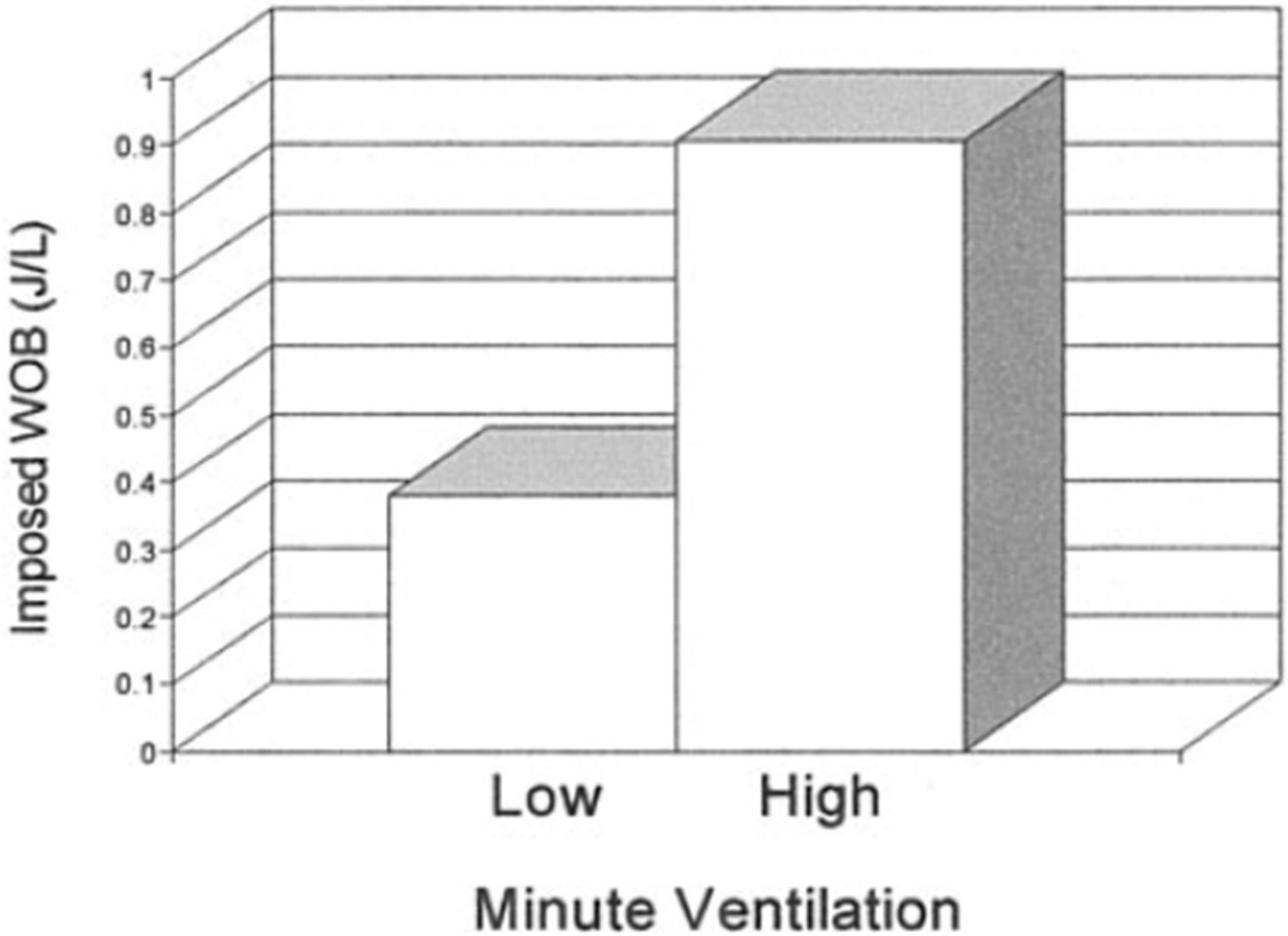




WOB et ventilation minute

10 patients trachéotomisés



ICM 1999;25:514-9

Impact of tracheotomy on sedative administration, sedation level, and comfort of mechanically ventilated intensive care unit patients*

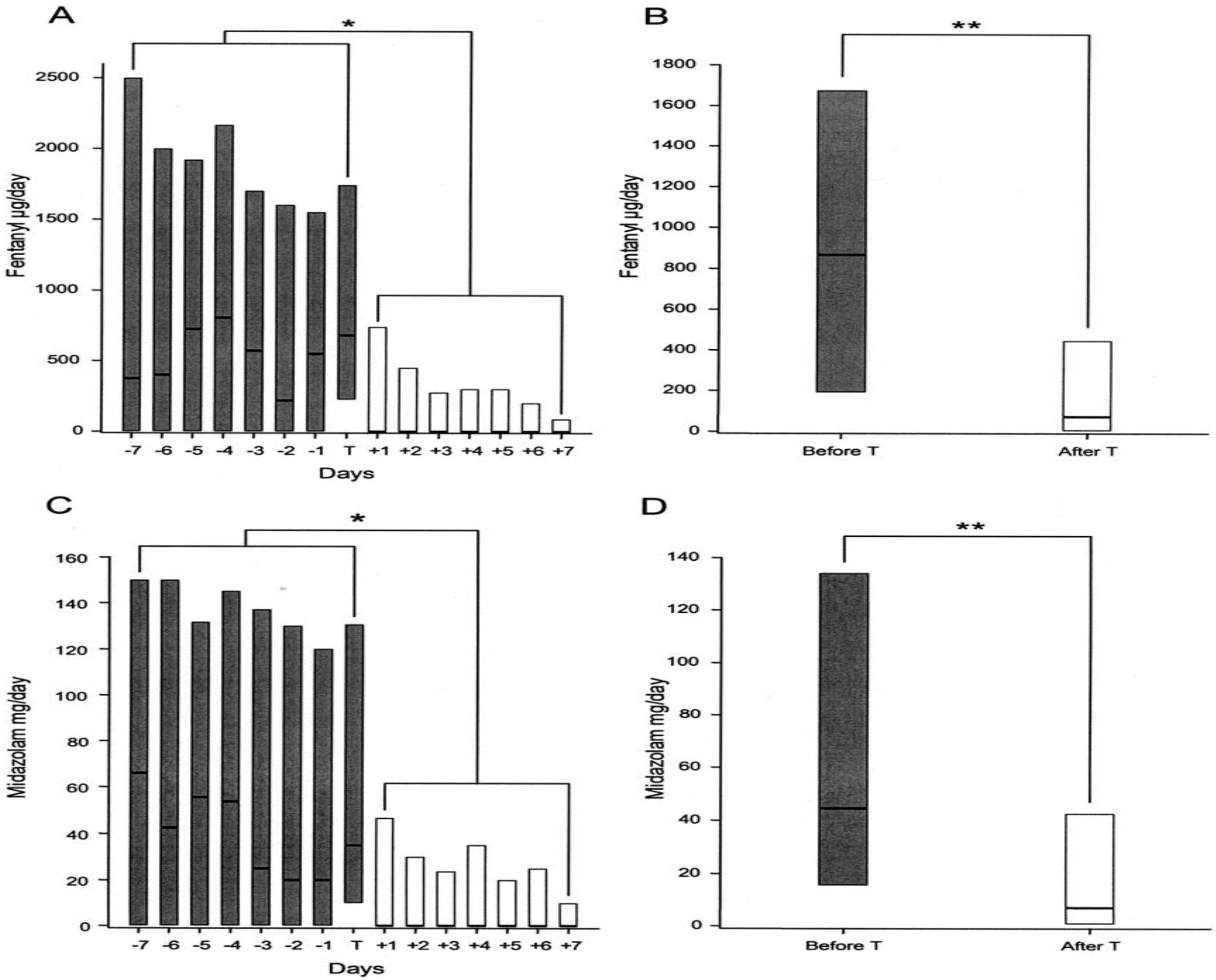
Ania Nieszkowska, MD; Alain Combes, MD, PhD; Charles-Edouard Luyt, MD, PhD; Hichem Ksibi, MD; Jean-Louis Trouillet, MD; Claude Gibert, MD; Jean Chastre, MD

72 patients avant vs après trachéo

Characteristic	Value
At ICU admission	
Age	58 (52,72)
Sex, male, n (%)	43 (59.7)
Type of admission, n (%)	
Surgery	40 (55.6)
Cardiac	38 (52.7)
Other	2 (2.8)
Medical	32 (44.4)
SAPS II	46 (36,66)
McCabe	2 (1,2)
Reason for MV, n (%)	
Acute exacerbation of COPD	7 (9.7)
Acute respiratory failure	29 (40.3)
Postoperative respiratory failure	27 (37.5)
Neurologic	9 (12.5)
On the day of tracheotomy	
SOFA score	7 (5.8,10.0)
Radiologic score	5 (3,7)
Temperature, °C, mean ± SD	37.8 ± 1.0
Pa_{O_2}/F_{IO_2}, mm Hg	197 (150,280)
Shock, n (%)	29 (40.3)

Nieszkowska Crit Care Med 2005

Amélioration du confort

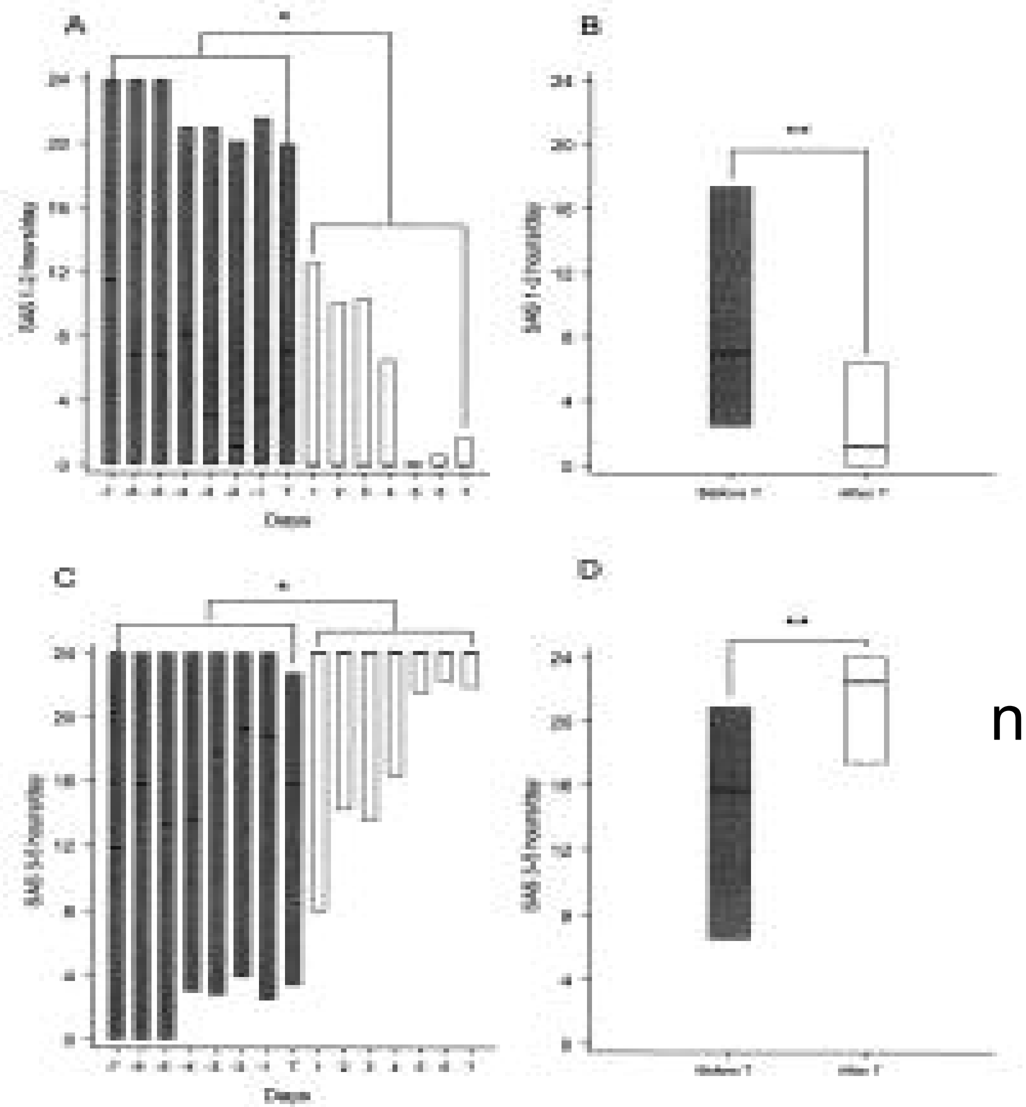


morphinique

benzodiazépine

Nieszkowska Crit Care Med 2005

Amélioration du confort



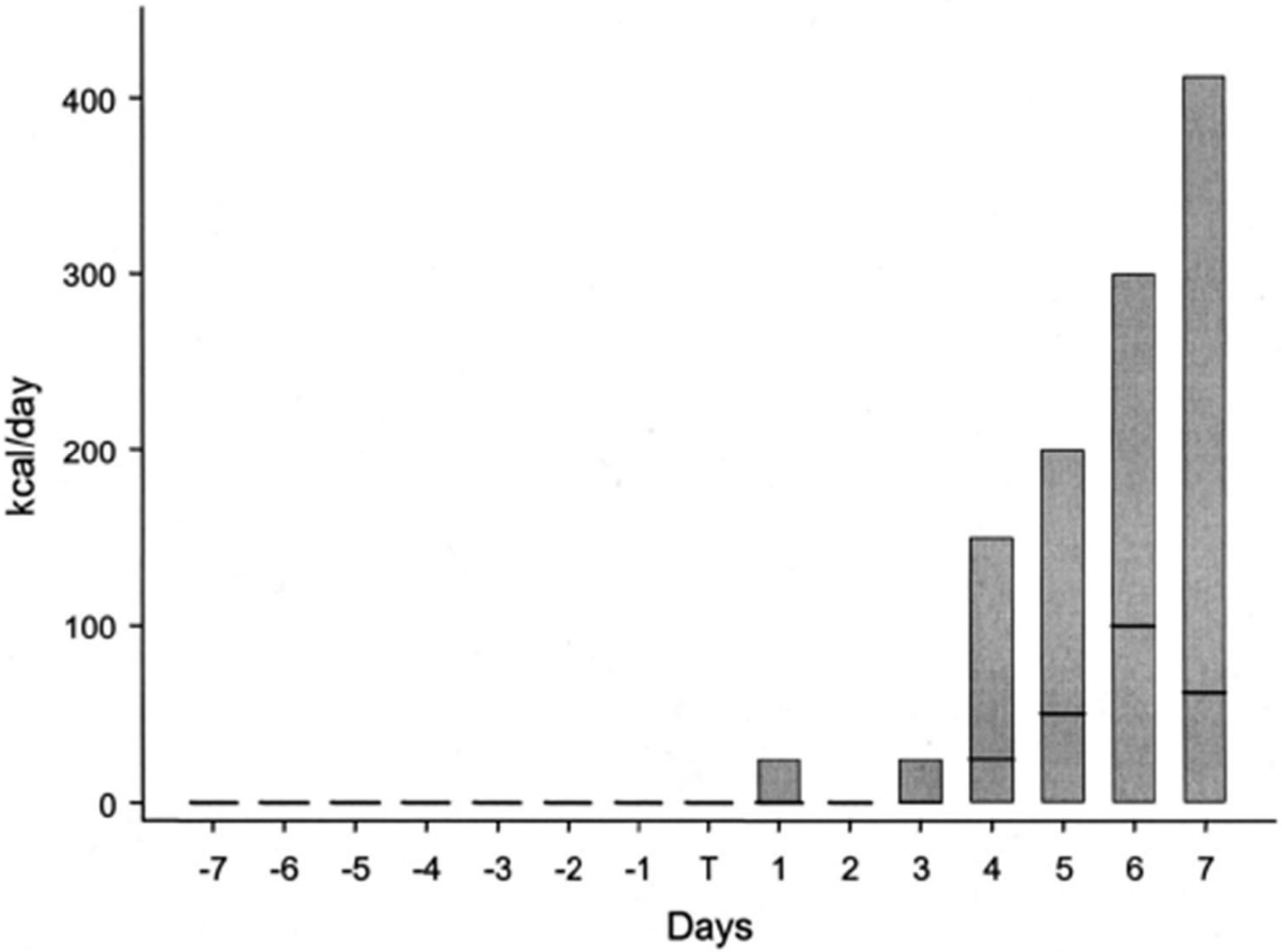
profondément sédaté

non ou légèrement sédaté

pas de différence pour les périodes d ’agitation marquée

Nieszkowska Crit Care Med 2005

Nutrition voie orale



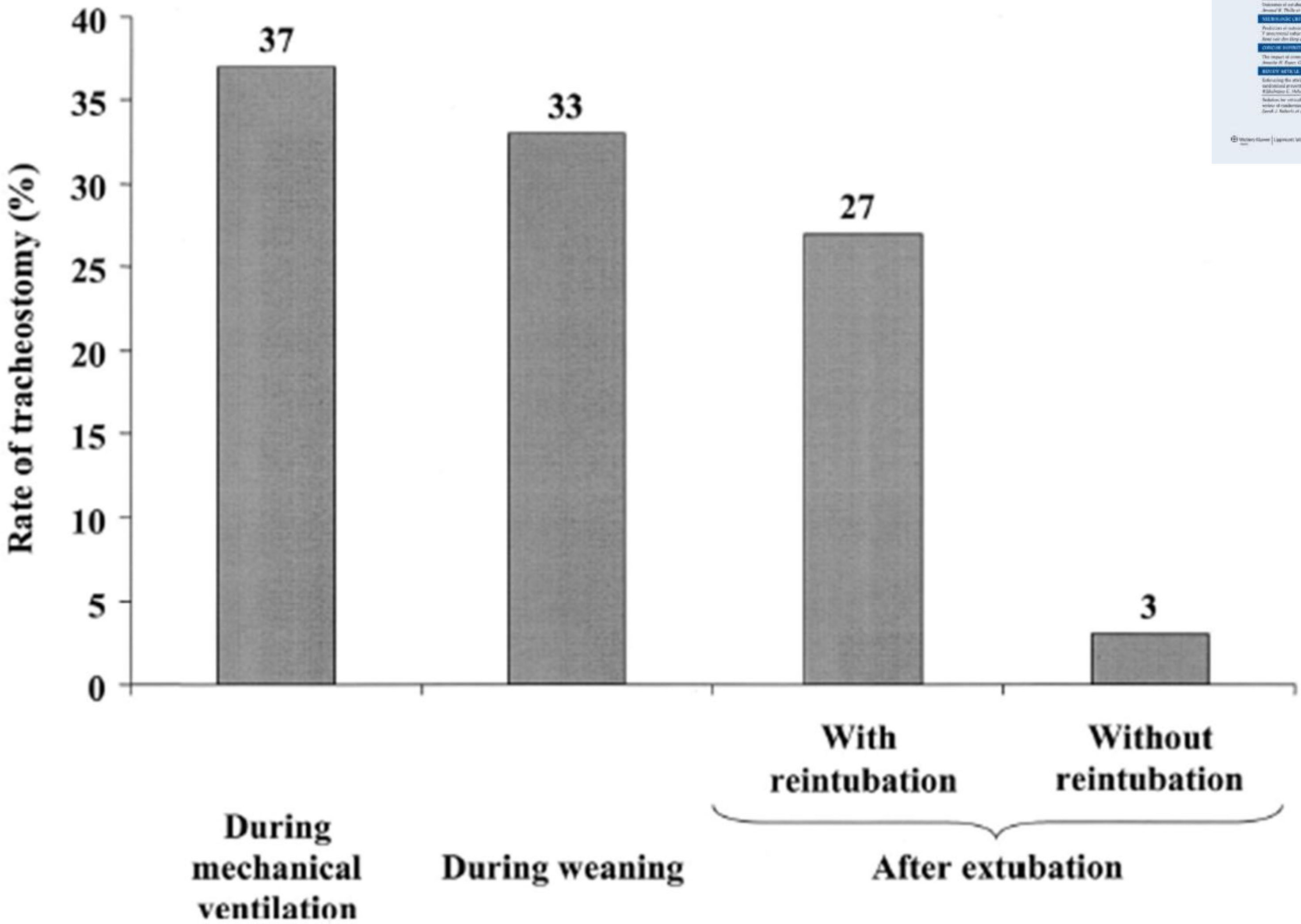
Nieszkowska Crit Care Med 2005

Outcome of mechanically ventilated patients who require a tracheostomy*

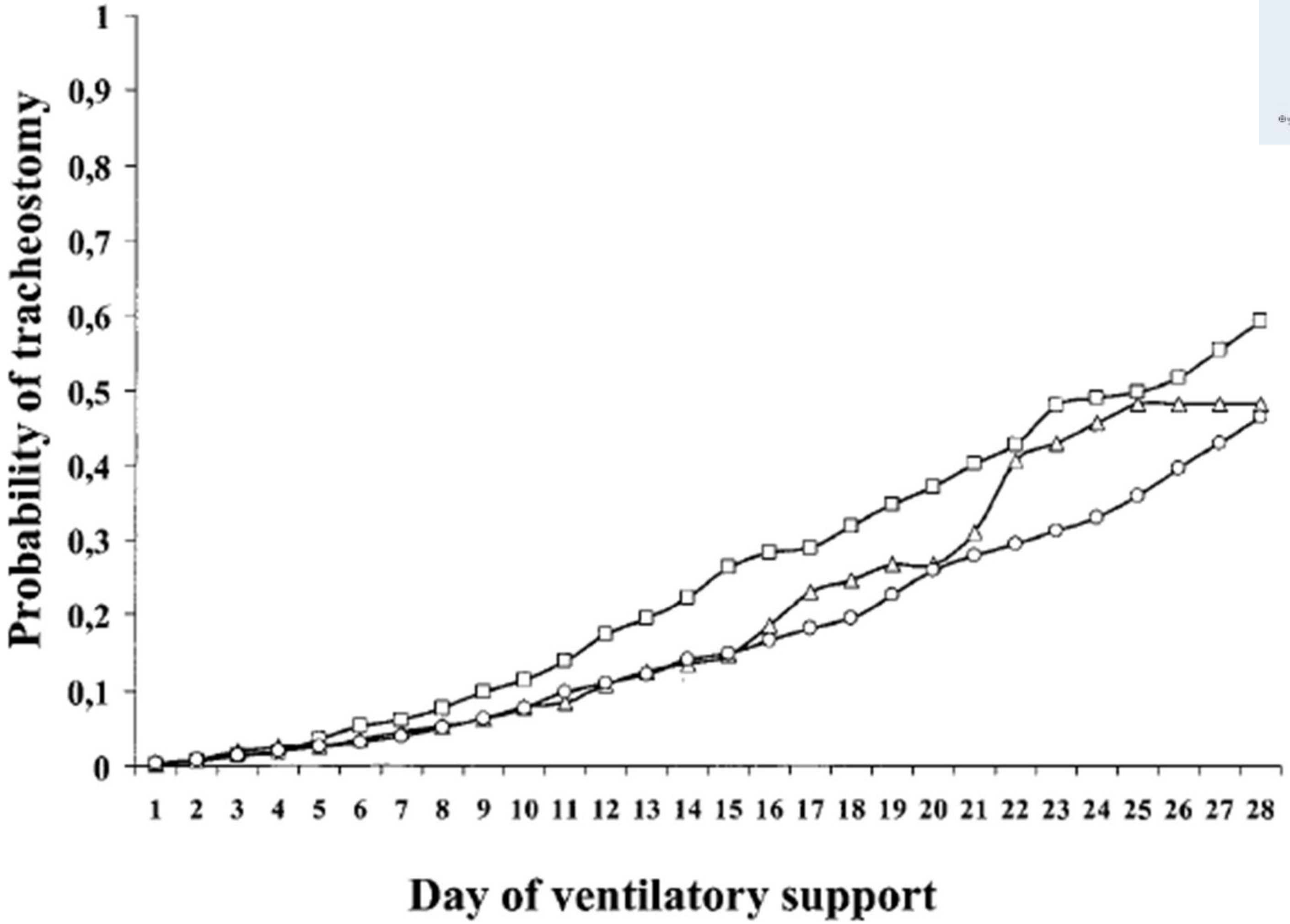
Fernando Frutos-Vivar, MD; Andrés Esteban, MD, PhD; Carlos Apezteguía, MD; Antonio Anzueto, MD; Peter Nightingale, MD; Marco González, MD; Luis Soto, MD; Carlos Rodrigo, MD; Jean Raad, MD; Cide M. David, MD; Dimitros Matamis, MD; Gabriel D' Empaire, MD; for the International Mechanical Ventilation Study Group

- Mars 1998, 361 services, 20 pays
- 5 183 patients ventilés > 12 h (- 102 déjà trachéotomisés)
- 546 (10,7 %) trachéotomisés après 12 [7-17] j de VM

CCM 2005;33:290-298



CCM 2005;33:290-298



Neuro
IRC
IRA

CCM 2005;33:290-298

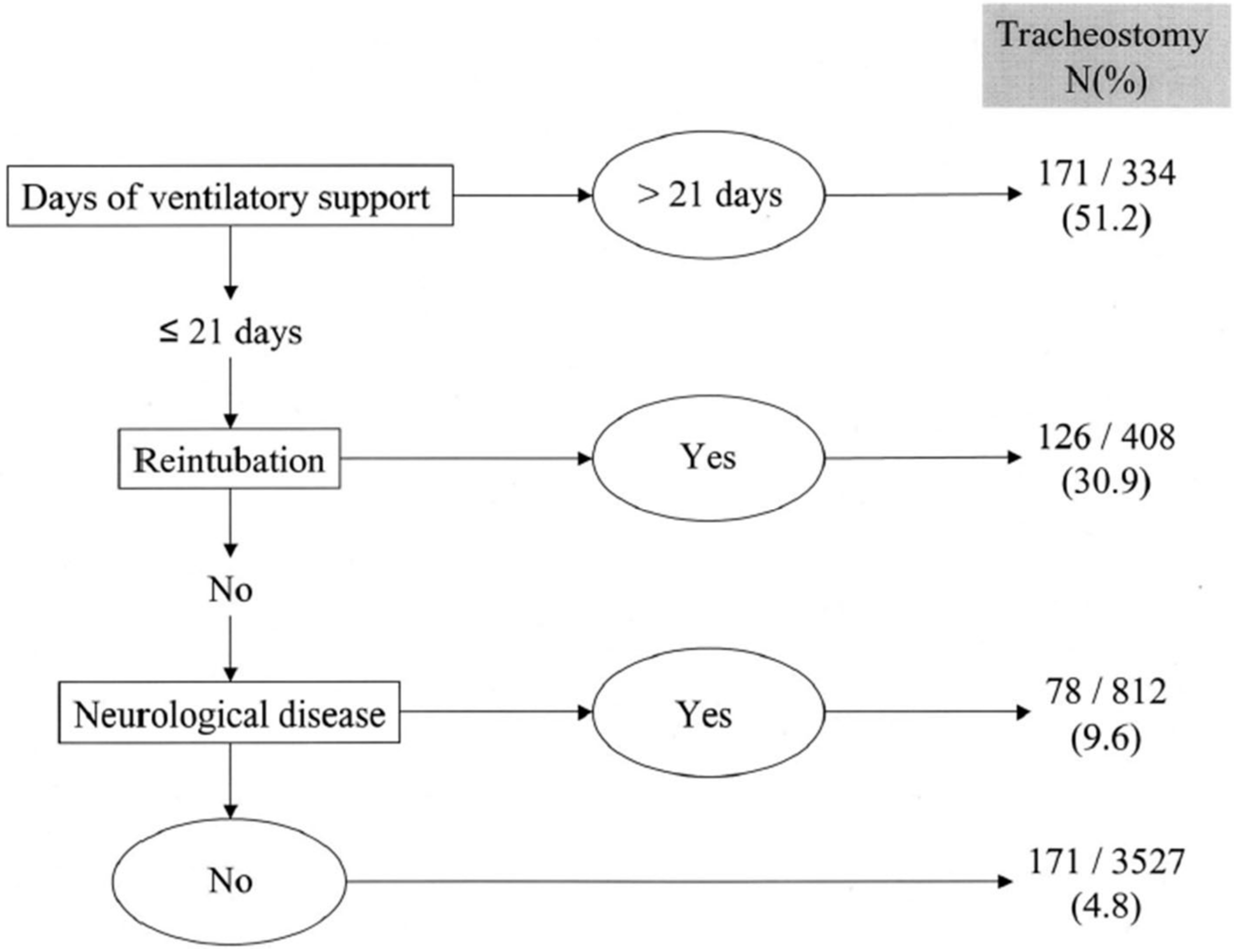


Figure 3. Tree-building of risk factors for tracheostomy obtained by the recursive partitioning method.

CCM 2005;33:290-298

Trachéotomisés : Quel devenir ?

	Mortalité en réa	Mortalité hospitalière
Trachéotomie +	20 %	39 %
Trachéotomie -	32 %	40 %

CCM 2005;33:290-298

Tracheostomy does not improve the outcome of patients requiring prolonged mechanical ventilation: A propensity analysis*

Christophe Clec'h, MD; Corinne Alberti, MD, PhD; François Vincent, MD; Maïté Garrouste-Orgeas, MD; Arnaud de Lassence, MD; Dany Toledano, MD; Elie Azoulay, MD, PhD; Christophe Adrie, MD; Samir Jamali, MD; Isabelle Zaccaria; Yves Cohen, MD; Jean-François Timsit, MD, PhD; on behalf of the OUTCOMEREA study group

Patients comparables

Variable	Tracheostomy (n = 160)	No Tracheostomy (n = 422)	*p* Value
Duration of MV ≥15 days, no. (%)	95 (59.4)	229 (54.3)	.77
Need for reintubation, no. (%)	4 (2.5)	6 (1.3)	.25
MV for neurologic disease, no. (%)	46 (28.8)	126 (27.8)	.67
Chronic respiratory disease, no. (%)	46 (28.8)	101 (22.3)	.11
Do-not-resuscitate order, no. (%)	18 (11.3)	61 (13.4)	.48
Cause of acute respiratory failure, no. (%)			
Postoperative	24 (15)	82 (18.1)	.16
Congestive heart failure	10 (6.3)	32 (7.1)	.99
Cardiac arrest	4 (2.5)	8 (1.8)	.46

CCM 2007;35:132-138

Mortalité en réanimation

	OR	95% CI	p Value
Model 1			
All patients	0.94	0.63–1.39	.74
Patients with early tracheostomy[a]	0.41	0.10–1.80	.24
Patients with late tracheostomy[b]	0.97	0.65–1.50	.90
Model 2			
All patients	1.12	0.75–1.67	.59
Patients with early tracheostomy[a]	0.78	0.21–2.91	.71
Patients with late tracheostomy[b]	1.16	0.77–1.75	.49

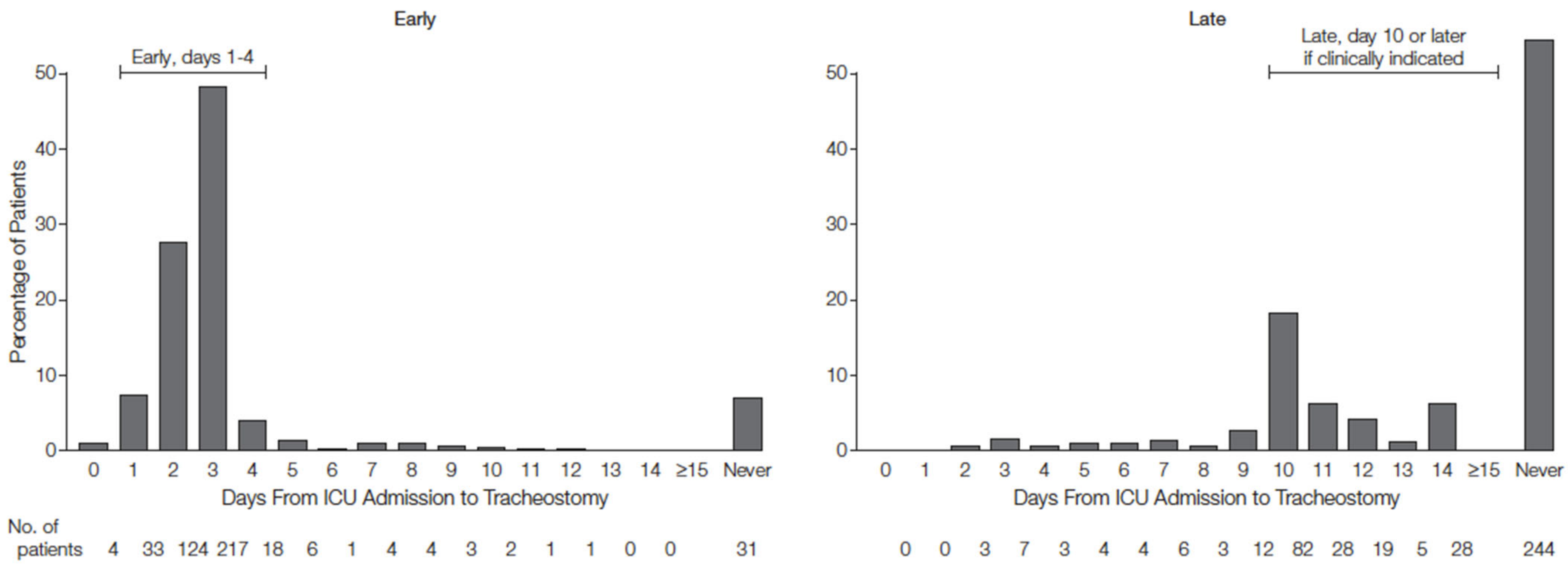
CCM 2007;35:132-138

Effect of Early vs Late Tracheostomy Placement on Survival in Patients Receiving Mechanical Ventilation

The TracMan Randomized Trial

JAMA®
he Journal of the American Medical Association

JAMA. 2013;309(20):2121-2129



Effect of Early vs Late Tracheostomy Placement on Survival in Patients Receiving Mechanical Ventilation

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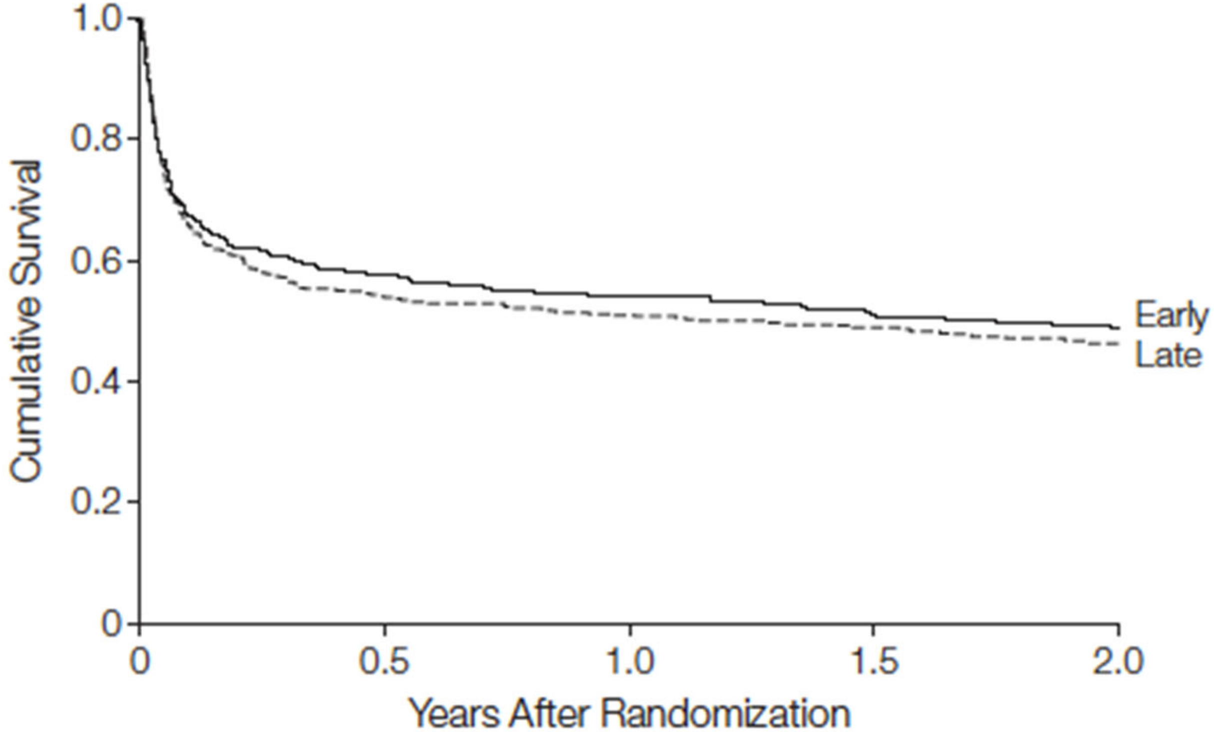
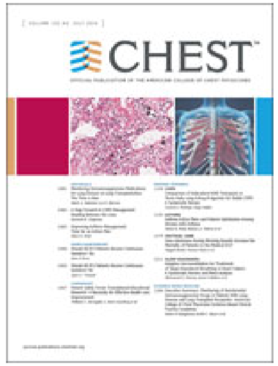
JAMA. 2013;309(20):2121-2129



No. at risk					
Early	451	261	244	230	221
Late	448	242	226	217	205

:



TRACHÉOTOMIE PRÉCOCE
VERSUS
TRACHÉOTOMIE TARDIVE / INTUBATION PROLONGÉE

Trachéotomie précoce: < 8 jours d’intubation
Trachéotomie tardive: > 15 jours d’intubation

Méta-analyse de Griffiths BMJ 2005
Méta-analyse de Wang Chest 2010

Systematic review and meta-analysis of studies of the timing of tracheostomy in adult patients undergoing artificial ventilation

John Griffiths, Vicki S Barber, Lesley Morgan, J Duncan Young

Study	No of patients (n=406)	Timing of tracheostomy: Early	Timing of tracheostomy: Late	Intensive care setting	Randomisation	Mortality expressed on intention to treat basis	Duration of ventilation and critical care stay expressed on intention to treat basis
Bouderka et al 2004[24]	62	5-6 days after admission	Prolonged endotracheal intubation	Unit for patients with head injuries	Randomised; method not stated	Implied	Implied both
Dunham et al 1984[25]	74	3-4 days after initiation of translaryngeal intubation	14 days after initiation of translaryngeal intubation	Trauma unit	Quasi-randomised	Mortality not recorded Pneumonia analysed by intention to treat	Yes
Rodriguez et al 1990[26]	106	1-7 days after admission to intensive care unit	8 or more days after admission to intensive care unit	Surgical unit	Quasi-randomised	Implied	Implied both
Rumbak et al 2004[17]	120	0-2 days after initiation of mechanical ventilation	14-16 days after initiation of mechanical ventilation	Three medical units	True randomisation	Implied	Yes
Saffle et al 2002[16]	44	Next available operative day	14 days after burn injury	Burns unit	True randomisation	Implied	Yes

2005 BMJ Griffiths

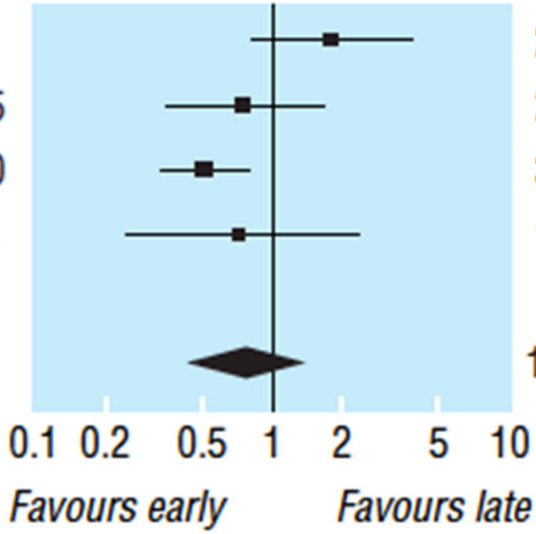
Systematic review and meta-analysis of studies of the timing of tracheostomy in adult patients undergoing artificial ventilation

John Griffiths, Vicki S Barber, Lesley Morgan, J Duncan Young

Mortalité en réanimation

Study	Early tracheostomy n/N	Late tracheostomy n/N	Relative risk (random) 95% CI	Weight (%)	Relative risk (random) 95% CI
Bouderka et al 2004[24]	12/31	7/31		23.71	1.71 (0.78 to 3.77)
Rodriguez et al 1990[26]	9/51	13/35		24.53	0.75 (0.35 to 1.60)
Rumbak et al 2004[17]	19/60	37/60		35.71	0.51 (0.34 to 0.78)
Saffle et al 2002[16]	4/21	6/23		16.05	0.73 (0.24 to 2.23)
Total (95% CI)	163	169		100.00	0.79 (0.45 to 1.39)

χ^2=7.11, df=3



2005 BMJ Griffiths

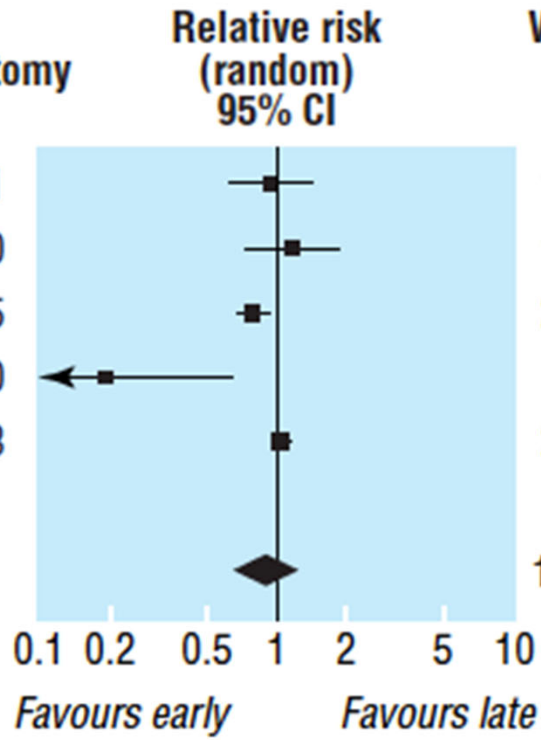
Systematic review and meta-analysis of studies of the timing of tracheostomy in adult patients undergoing artificial ventilation

John Griffiths, Vicki S Barber, Lesley Morgan, J Duncan Young

Pneumonies infectieuses

Study	Early tracheostomy n/N	Late tracheostomy n/N	Weight (%)	Relative risk (random) 95% CI
Bouderka et al 2004[24]	18/31	19/31	19.18	0.95 (0.63 to 1.43)
Dunham et al 1984[25]	20/34	20/40	18.89	1.18 (0.77 to 1.79)
Rodriguez et al 1990[26]	40/51	53/55	27.62	0.81 (0.70 to 0.95)
Rumbak et al 2004[17]	3/60	15/60	5.29	0.20 (0.06 to 0.66)
Saffle et al 2002[16]	21/21	22/23	29.02	1.05 (0.96 to 1.14)
Total (95% CI)	197	209	100.00	0.90 (0.66 to 1.21)

χ^2=29.58, df=3

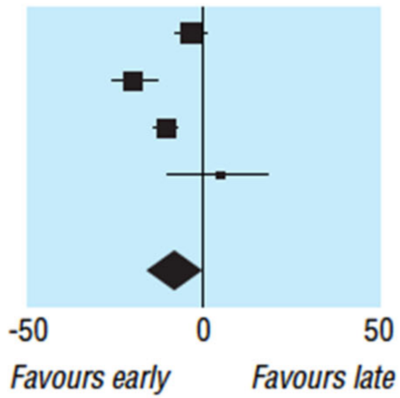


2005 BMJ Griffiths

Durées de ventilation

Study	Early tracheostomy N	Early tracheostomy Mean (SD)	Late tracheostomy N	Late tracheostomy Mean (SD)	Weight (%)	Weighted mean difference (random) 95% CI
Bouderka et al 2004[24]	31	14.50 (7.30)	31	17.50 (10.60)	28.34	-3.00 (-7.53 to 1.53)
Rodriguez et al 1990[26]	51	12.00 (7.14)	55	32.00 (22.25)	25.57	-20.00 (-26.20 to -13.80)
Rumbak et al 2004[17]	60	7.60 (4.00)	60	17.40 (5.30)	31.76	-9.80 (-11.48 to -8.12)
Saffle et al 2002[16]	21	35.50 (20.62)	23	31.40 (24.94)	14.32	4.10 (-9.38 to 17.58)
Total (95% CI)	163		169		100.00	-8.49 (-15.32 to -1.66)

χ^2=22.96, df=3



CHEST

Original Research

CRITICAL CARE

The Timing of Tracheotomy in Critically Ill Patients Undergoing Mechanical Ventilation

A Systematic Review and Meta-analysis of Randomized Controlled Trials

Fei Wang, MD, PhD; Youping Wu, MD, PhD; Lulong Bo, MD, PhD; Jingsheng Lou, MD, PhD; Jiali Zhu, MD; Feng Chen, MD, PhD; Jinbao Li, MD, PhD; and Xiaoming Deng, MD, PhD

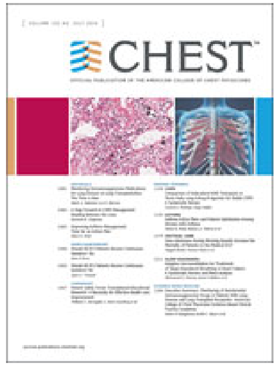
Table 1—*Characteristics of Included Trials*

Study/Year	Intensive Care Setting	Timing of Tracheotomy		Mean Age, y		Disease Severity	Weaning Control	Tracheotomy Information	VAP Definition	Intention-to-Treat Analysis
		Early	Late	Early	Late					
Saffle et al[illegible]/2002	Burn ICU	Next available operative day	14 d after burn injury	44.5 ± 19.7	51.3 ± 19.2	Not reported	Yes	Performed in the operating room, mostly using surgical technique	CDC criteria	Yes
Bouderka et al[illegible]/2004	Units for head injury patients	5-6 d after admission	Prolonged endotracheal intubation	41.1 ± 17.5	40 ± 19	SAPS score: Early: 5.4 ± 1.5 Late: 6 ± 3.8	No	Not reported	CDC criteria	Implied
Rumbak et al[illegible]/2004	3 Medical ICUs	0-2 d after initiation of MV	14-16 d after initiation of MV	63 ± 10.4	63 ± 9.3	APACHE II score: Early: 27.4 ± 4.2 Prolonged: 26.3 ± 2.6	Yes	Percutaneous dilational tracheotomy procedure	Clinical features with positive protected specimen brushes or BAL cultures	Yes
Barquist et al[illegible]/2006	Trauma center	Before 8 d of admission	After 28 d after admission	53.7 ± 21.5	49.9 ± 18.3	APACHE II score: Early: 12.1 ± 3.2 Late: 13.1 ± 5.1	Yes	Performed both at the bedside and in the operating room	CDC criteria	Yes
Blot et al[illegible]/2008	25 Medical-surgical ICUs	Before 4 d of initiation of MV	After 14 d of initiation of MV	55 (19-88)[a]	58 (20-88)[a]	SAPS II score: Early: 50 (17-103)[a] Late: 50 (15-96)[a]	Yes	Most often performed at the bedside using a surgical technique	Clinical features with positive cultures of pulmonary secretion samples	Yes
Terragni et al[illegible]/2010	12 ICUs	6-8 d after endotracheal intubation	13-15 d after endotracheal intubation	61.8 ± 17.4	61.3 ± 16.8	SAPS II score: Early: 51.1 ± 8.7 Late: 49.7 ± 8.6	Yes	Performed at the bedside using percutaneous techniques	Using the simplified CPIS. CPIS > 6 was considered to indicate the presence of VAP	Yes
Trouillet et al[illegible]/2011	Postcardiac surgery ICU	Before 5 d after surgery	15 d after initiation of MV	64.1 ± 13.3	66.0 ± 12.4	SAPS II score: Early: 47.2 ± 12.4 Late: 45.8 ± 11.4	Yes	Performed at the bedside using percutaneous techniques	Clinical features with positive BAL cultures	Yes

Data are presented as mean ± SD unless indicated otherwise. APACHE = Acute Physiology and Chronic Health Evaluation; CDC = Centers for Disease Control and Prevention; CPIS = Clinical Pulmonary Infection Score; MV = mechanical ventilation; SAPS = Simplified Acute Physiologic Score; VAP = ventilator-associated pneumonia.
[a]Median (range).

CHEST 2011; 140(6):1456–1465

DURÉE DE VENTILATION

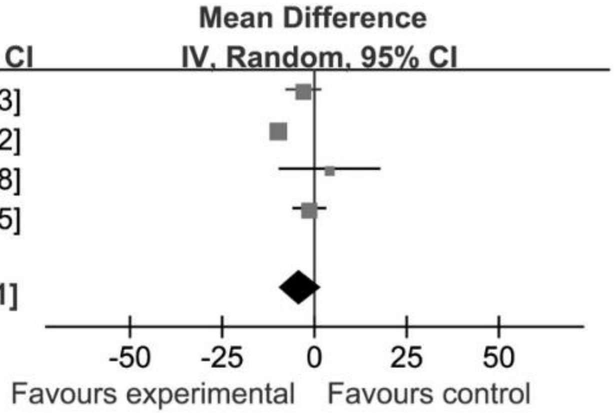


(trachéotomie précoce versus tardive)

Study or Subgroup	ET Mean	ET SD	ET Total	LT Mean	LT SD	LT Total	Weight	Mean Difference IV, Random, 95% CI
Bounderka 2004	14.5	7.3	31	17.5	10.6	31	27.6%	-3.00 [-7.53, 1.53]
Rumbak 2004	7.6	4	60	17.4	5.3	60	32.3%	-9.80 [-11.48, -8.12]
Saffle 2002	35.5	20.62	21	31.4	24.94	23	11.9%	4.10 [-9.38, 17.58]
Trouillet 2011	17.9	14.9	109	19.3	16.9	107	28.2%	-1.40 [-5.65, 2.85]
Total (95% CI)			**221**			**221**	**100.0%**	**-3.90 [-9.71, 1.91]**

Heterogeneity: $Tau^2 = 26.44$; $Chi^2 = 21.43$, df = 3 ($P < 0.0001$); $I^2 = 86\%$

Test for overall effect: Z = 1.32 (P = 0.19)

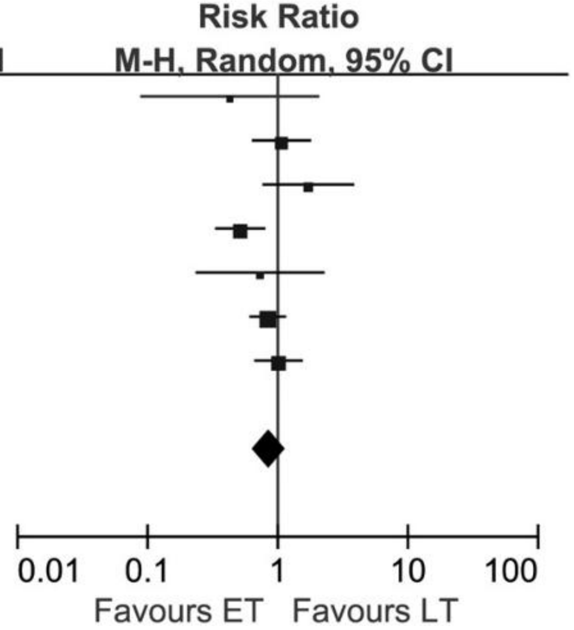


Wang Chest 2011

influence sur la mortalité précoce

Study or Subgroup	ET Events	ET Total	LT Events	LT Total	Weight	Risk Ratio M-H, Random, 95% CI
Barquist 2006	2	29	5	31	3.0%	0.43 [0.09, 2.03]
Blot 2008	21	61	20	62	16.7%	1.07 [0.65, 1.76]
Bounderka 2004	12	31	7	31	9.3%	1.71 [0.78, 3.77]
Rumbak 2004	19	60	37	60	19.8%	0.51 [0.34, 0.78]
Saffle 2002	4	21	6	23	5.3%	0.73 [0.24, 2.23]
Terragni 2010	55	209	66	210	25.4%	0.84 [0.62, 1.13]
Trouillet 2011	33	109	32	107	20.5%	1.01 [0.67, 1.52]
Total (95% CI)		**520**		**524**	**100.0%**	**0.86 [0.65, 1.13]**
Total events	146		173			

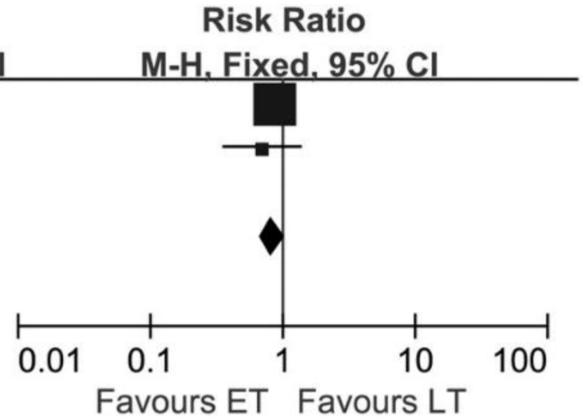
Heterogeneity: Tau² = 0.06; Chi² = 10.85, df = 6 (P = 0.09); I² = 45%
Test for overall effect: Z = 1.09 (P = 0.28)



influence sur la mortalité tardive

Study or Subgroup	ET Events	ET Total	LT Events	LT Total	Weight	Risk Ratio M-H, Fixed, 95% CI
Terragni 2010	72	144	85	148	83.0%	0.87 [0.70, 1.08]
Trouillet 2011	12	76	17	75	17.0%	0.70 [0.36, 1.36]
Total (95% CI)		**220**		**223**	**100.0%**	**0.84 [0.68, 1.04]**
Total events	84		102			

Heterogeneity: Chi² = 0.41, df = 1 (P = 0.52); I² = 0%
Test for overall effect: Z = 1.63 (P = 0.10)



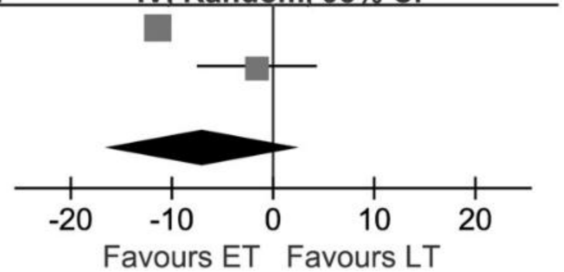
Wang Chest 2011

influence sur la durée de séjour en réanimation

Study or Subgroup	ET Mean	ET SD	ET Total	LT Mean	LT SD	LT Total	Weight	Mean Difference IV, Random, 95% CI
Rumbak 2004	4.8	1.4	60	16.2	3.8	60	54.4%	-11.40 [-12.42, -10.38]
Trouillet 2011	23.9	21.3	109	25.5	22.2	107	45.6%	-1.60 [-7.40, 4.20]
Total (95% CI)			**169**			**167**	**100.0%**	**-6.93 [-16.50, 2.63]**

Heterogeneity: Tau² = 43.50; Chi² = 10.62, df = 1 (P = 0.001); I² = 91%
Test for overall effect: Z = 1.42 (P = 0.16)

Mean Difference IV, Random, 95% CI

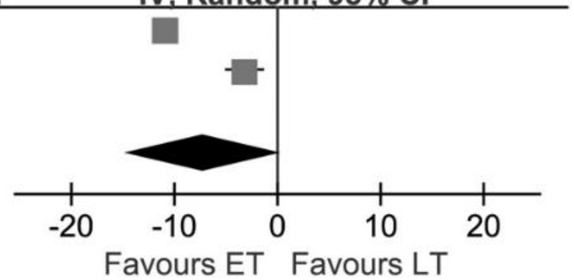


influence sur la durée de sédation

Study or Subgroup	ET Mean	ET SD	ET Total	LT Mean	LT SD	LT Total	Weight	Mean Difference IV, Random, 95% CI
Rumbak 2004	3.2	0.4	60	14.1	2.9	60	50.6%	-10.90 [-11.64, -10.16]
Trouillet 2011	6.4	5.9	109	9.6	7.3	107	49.4%	-3.20 [-4.97, -1.43]
Total (95% CI)			**169**			**167**	**100.0%**	**-7.09 [-14.64, 0.45]**

Heterogeneity: Tau² = 29.16; Chi² = 61.75, df = 1 (P < 0.00001); I² = 98%
Test for overall effect: Z = 1.84 (P = 0.07)

Mean Difference IV, Random, 95% CI



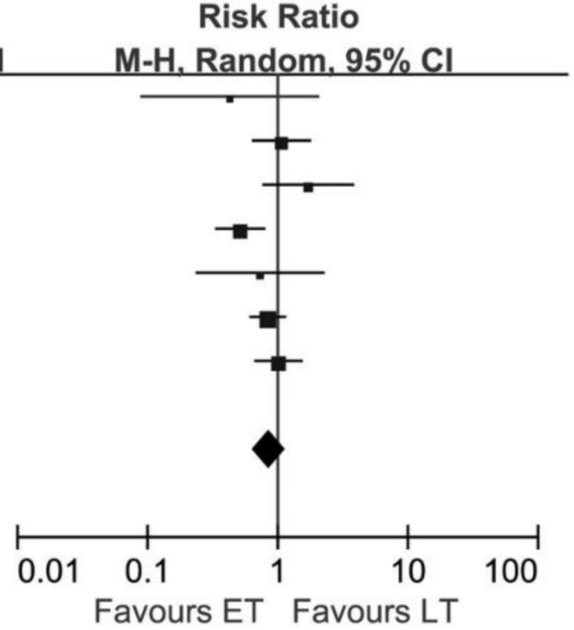
Wang Chest 2011

MORTALITÉ PRÉCOCE

Study or Subgroup	ET Events	ET Total	LT Events	LT Total	Weight	Risk Ratio M-H, Random, 95% CI
Barquist 2006	2	29	5	31	3.0%	0.43 [0.09, 2.03]
Blot 2008	21	61	20	62	16.7%	1.07 [0.65, 1.76]
Bounderka 2004	12	31	7	31	9.3%	1.71 [0.78, 3.77]
Rumbak 2004	19	60	37	60	19.8%	0.51 [0.34, 0.78]
Saffle 2002	4	21	6	23	5.3%	0.73 [0.24, 2.23]
Terragni 2010	55	209	66	210	25.4%	0.84 [0.62, 1.13]
Trouillet 2011	33	109	32	107	20.5%	1.01 [0.67, 1.52]
Total (95% CI)		**520**		**524**	**100.0%**	**0.86 [0.65, 1.13]**
Total events	146		173			

Heterogeneity: $Tau^2 = 0.06$; $Chi^2 = 10.85$, df = 6 (P = 0.09); $I^2 = 45\%$

Test for overall effect: Z = 1.09 (P = 0.28)



Wang Chest 2011

Annals of Internal Medicine | Original Research

Early Percutaneous Tracheotomy Versus Prolonged Intubation of Mechanically Ventilated Patients After Cardiac Surgery

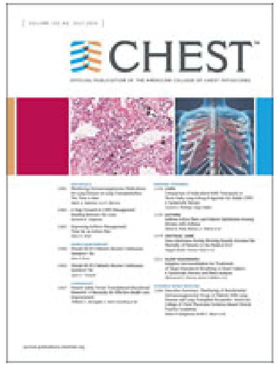
A Randomized Trial*

Jean-Louis Trouillet, MD; Charles-Edouard Luyt, MD, PhD; Marguerite Guiguet, PhD; Alexandre Ouattara, MD, PhD; Elisabeth Vaissier, MD; Ralouka Makri, MD; Ania Nieszkowska, MD; Pascal Leprince, MD, PhD; Alain Pavie, MD; Jean Chastre, MD; and Alain Combes, MD, PhD

Sedation				
Mean duration of intravenous sedation (SD), *d*‡	6.4 (5.9)	9.6 (7.3)	−3.2 (−5.0 to −1.3)	0.007
Mean sedation-free days during 1–28 d (SD)	19.0 (9.1)	15.5 (9.3)	4.5 (1.2 to 6.9)	0.005
Mean cumulative sufentanil dose during 1–15 d (SD), *μg/kg*	4.0 (6.5)	10.2 (18.2)	−6.2 (−9.9 to −2.5)	0.001
Mean cumulative propofol dose during 1–15 d (SD), *mg/kg*	32.9 (60.2)	67.8 (116.7)	−34.9 (−60.1 to −9.8)	0.004
Mean cumulative midazolam dose during 1–15 d (SD), *mg/kg*	2.7 (4.7)	6.4 (14.3)	−3.7 (−6.6 to −0.8)	0.01
Mean days (during 1−15 d) of haloperidol therapy (SD)	1.9 (3.0)	3.2 (4.2)	−1.3 (−2.3 to −0.3)	0.01
Mean cumulative haloperidol dose during 1–15 d (SD), *mg/kg*	0.26 (0.51)	0.57 (0.92)	−0.3 (−0.5 to −0.1)	0.002
VAP after randomization, *n (%)*	50 (46)	47 (44)	2.0 (−11.3 to 15.2)	0.77
Sternal wound infection, *n (%)*	14 (13)	14 (13)	−0.2 (−9.2 to 8.7)	0.96
Bloodstream infection, *n (%)*	18 (17)	16 (15)	1.5 (−8.1 to 11.3)	0.85
Mean days (during 1−15 d) nurse-assessed as comfortable (SD)	11.8 (3.8)	10.4 (4.4)	1.4 (0.3 to 2.5)	0.01
Mean days (during 1−15 d) with nurse-assessed easy management (SD)	12.0 (3.8)	10.8 (4.4)	1.2 (0.05 to 2.3)	0.04
Received oral nutrition at 15 d, *n (%)*	91 (83)	57 (53)	30.2 (18.5 to 42.2)	<0.001
Bed-to-chair transfer at 15 d, *n (%)*	72 (66)	47 (44)	22.1 (9.2 to 35.1)	0.002
Muscle strength assessment (SD)§				
14 d (*n* = 76, 68)	156.9 (87.0)	134.9 (92.8)	22.0 (−7.7 to 51.6)	0.15
28 d (*n* = 36, 36)	164.0 (86.1)	176.9 (85.6)	−12.9 (−53.3 to 27.5)	0.52
42 d (*n* = 21, 21)	170.1 (86.4)	195.4 (67.5)	−25.3 (−73.6 to 23.1)	0.30
56 d (*n* = 8, 11)	149.7 (70.4)	185.4 (76.0)	−35.7 (−108.0 to 36.6)	0.31

Ann Intern Med. 2011;154:373-383.

Is the Duration of Mechanical Ventilation Predictable?*



Gilles Troché, MD; and Pierre Moine, MD

CHEST 1997; 112:745-51

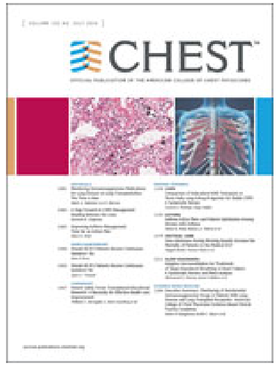
- Réanimation chirurgicale
- 195 patients + cohorte de validation (n = 128)
- Prédiction d'une VM ≥ 15 j
- Multiples variables analysées : Age, BMI, type chirurgie, IGS, LIS, OSF, …
- Régression logistique, ROC curve

Difficile à prévoir !

Parameters	Group 1 (MV≤14 d) (n=177)	Group 2 (MV≥15 d) (n=26)	p Value
Age, yr	59.7±19.6	57.0±20.6	NS (0.52)
BMI	24.5±5.0	24.6±4.2	NS (0.92)
Emergent admission	127 (71.8%)	23 (88.5%)	NS (0.07)
Elective admission	50 (28.2%)	3 (11.5%)	
Altemeier classification			NS (0.39)
0 (medical patients)	38 (21.5%)	7 (26.9%)	
I and II	53 (30.0%)	4 (15.4%)	
III and IV	86 (48.6%)	15 (57.7%)	
Pathology/admission			NS (0.31)
Abdominal surgery	106 (59.9%)	12 (46.2%)	
Orthopedic surgery	3 (1.7%)	6 (23.1%)	
Gynecologic or obstetric disease	6 (3.4%)	0	
Medical disease	42 (23.7%)	8 (30.8%)	
SAPS	15.1±5.6	15.5±4.2	NS (0.77)
GCS	13.0±3.7	12.3±3.6	NS (0.34)
APACHE II	20.7±8.3	22.9±7.7	NS (0.20)
SS	9.2±5.7	12.5±7.5	0.01
OSFI 0	95 (53.7%)	6 (23.1%)	
OSFI I	51 (28.8%)	14 (53.8%)	<0.05
OSFI II, III, or IV	31 (17.5%)	6 (23.1%)	
Albuminemia, g/L	28.1±7.7	24.1±7.5	<0.05

*NS=not significant.

Shock on Admission Day Is the Best Predictor of Prolonged Mechanical Ventilation in the ICU*

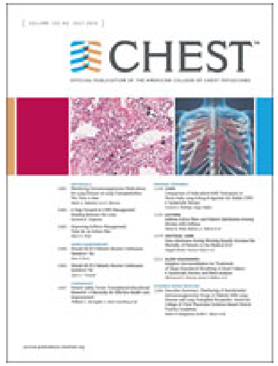


Elisa Estenssoro, MD; Francisco González, MD; Enrique Laffaire, MD; Héctor Canales, MD; Gabriela Sáenz, MD; Rosa Reina, MD; and Arnaldo Dubin, MD

- Réanimation polyvalente (Buenos Aires)
- 551 patients (mortalité 31 %), 348 ventilés
- Multiples variables recueillies à J 1
- Ventilation prolongée : > 21 j (**n = 79**, 23 % des ventilés)

CHEST 2005; 127:598–603

Shock on Admission Day Is the Best Predictor of Prolonged Mechanical Ventilation in the ICU*



Elisa Estenssoro, MD; Francisco González, MD; Enrique Laffaire, MD; Héctor Canales, MD; Gabriela Sáenz, MD; Rosa Reina, MD; and Arnaldo Dubin, MD

Variables	OR	95% CI	p Value
Shock day 1	2.17	1.25–3.77	0.006
SAPS II	1.04†	1.02–1.06	0.0001
PaO_2/FIO_2 day 1	0.99‡	0.99–1.00	0.125

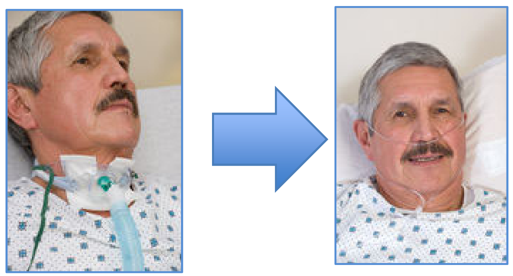
CHEST 2005; 127:598–603

Quels patients trachéotomiser ?

Concept de « chronically ill patients »

- Survivants de situations dramatiques
- Dépendants Ventilation Mécanique
- Dépendants richesse environnement humain et technique
- Sans autre défaillance vitale
- Nombreuses autres affections : séquelle(s) des défaillances viscérales, motrice, déficit nutritionnel, germes nosocomiaux, processus invasifs, …

Typologie particulière



JAMA®
The Journal of the American Medical Association

Mobilizing Patients in the Intensive Care Unit
Improving Neuromuscular Weakness and Physical Function

Dale M. Needham, MD, PhD

Sevrage et Réhabilitation : Décanulation

Intensive Care Med (2003) 29:845–848
DOI 10.1007/s00134-003-1689-z

BRIEF REPORT

Piero Ceriana
Annalisa Carlucci
Paolo Navalesi
Ciro Rampulla
Monica Delmastro
GianCarlo Piaggi
Elisa De Mattia
Stefano Nava

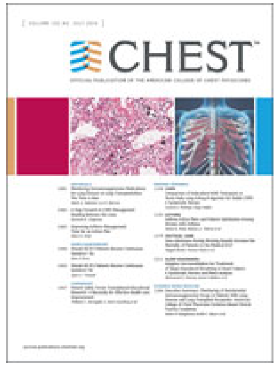
Weaning from tracheotomy in long-term mechanically ventilated patients: feasibility of a decisional flowchart and clinical outcome

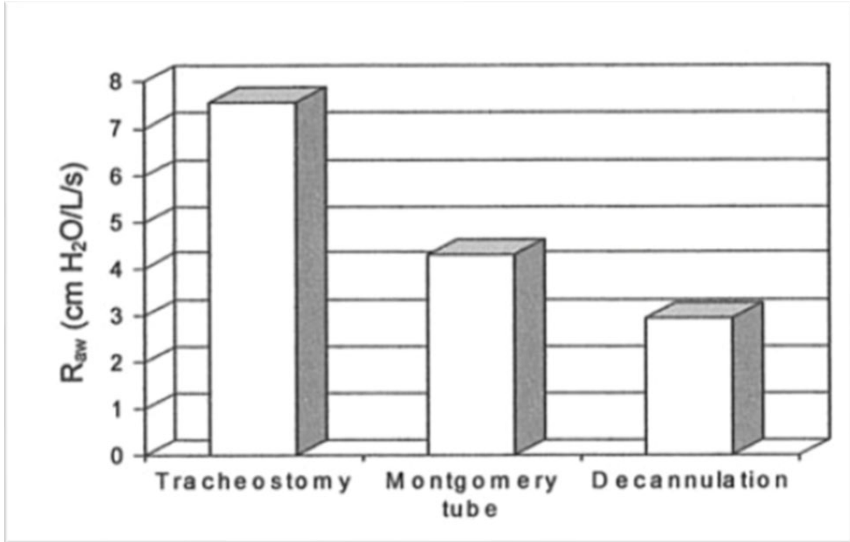
« Pré requis »

- **Stabilité clinique**
- **$PaCO_2 < 60$ mmHg**
- **Absence de délire ou d'autres désordres psychiatriques**
- **Absence de sténose trachéale ou glottique**
- **Toux efficace**, **pression expiratoire maximale (PEM) ≥ 40 cmH2**
- **Déglutition correcte**
- **Patient consentant**

Respiratory Muscle Dysfunction Secondary to Chronic Tracheostomy Tube Placement*

Gerard Criner, M.D.;† Barry Make, M.D., F.C.C.P.; and Bartolome Celli, M.D., F.C.C.P.





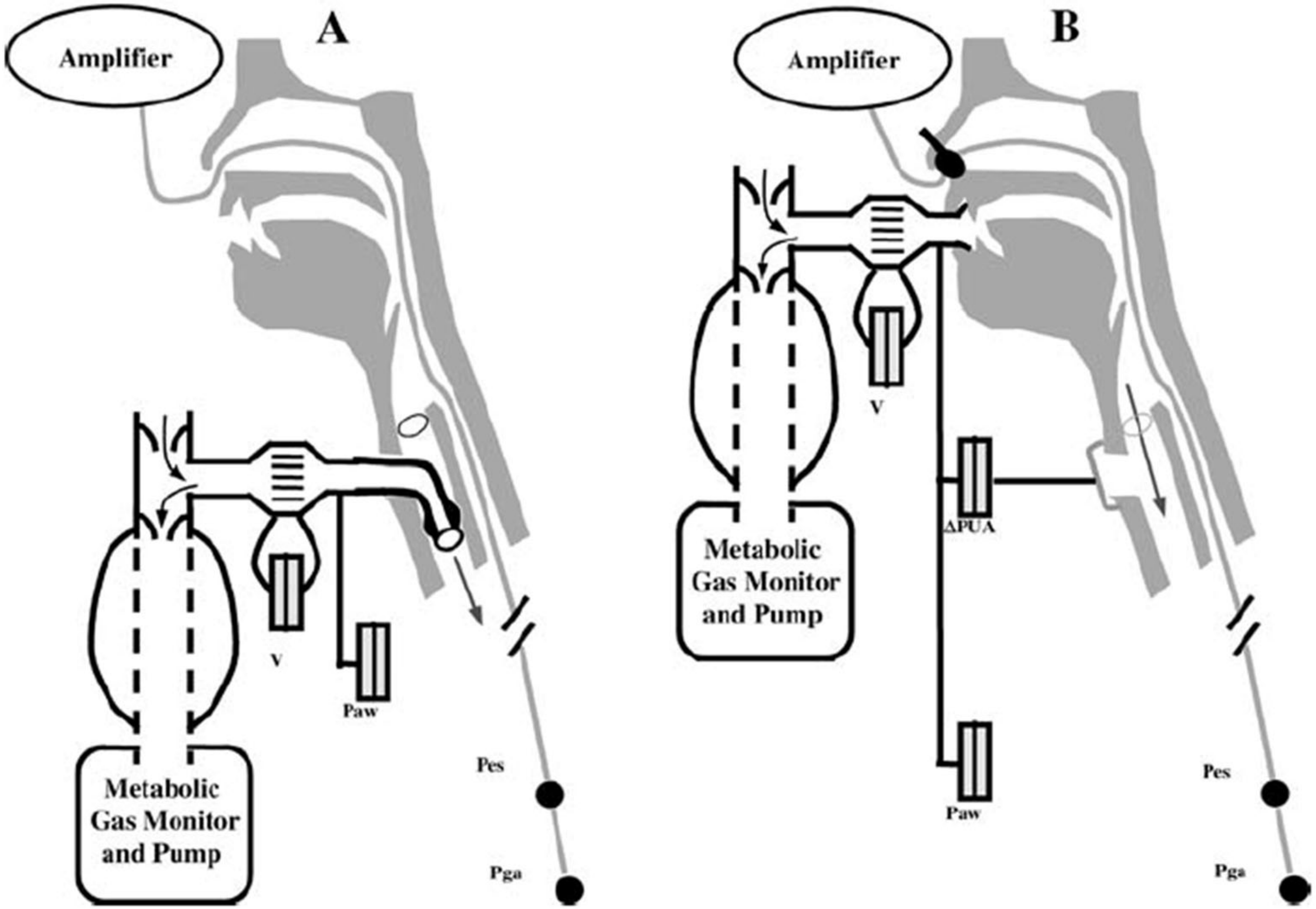
	Tracheostomy†	Montgomery Button	Decannulation	Predicted
FVC (L)	1.17	0.88	1.02	2.94
FEV_1 (L)	0.52	0.44	0.48	2.32
FEV_1/FVC	0.44	0.50	0.47	0.80
FRC (L)	4.50		3.89	2.62
Raw (CmH_2O/L/s)	7.55	4.28	2.94	2.29
Po_2(mm Hg)	80	80	N‡	N‡
Pco_2(mm Hg)	51	54	N‡	N‡

Intensive Care Med (2002) 28:1761–1767
DOI 10.1007/s00134-002-1545-6

ORIGINAL

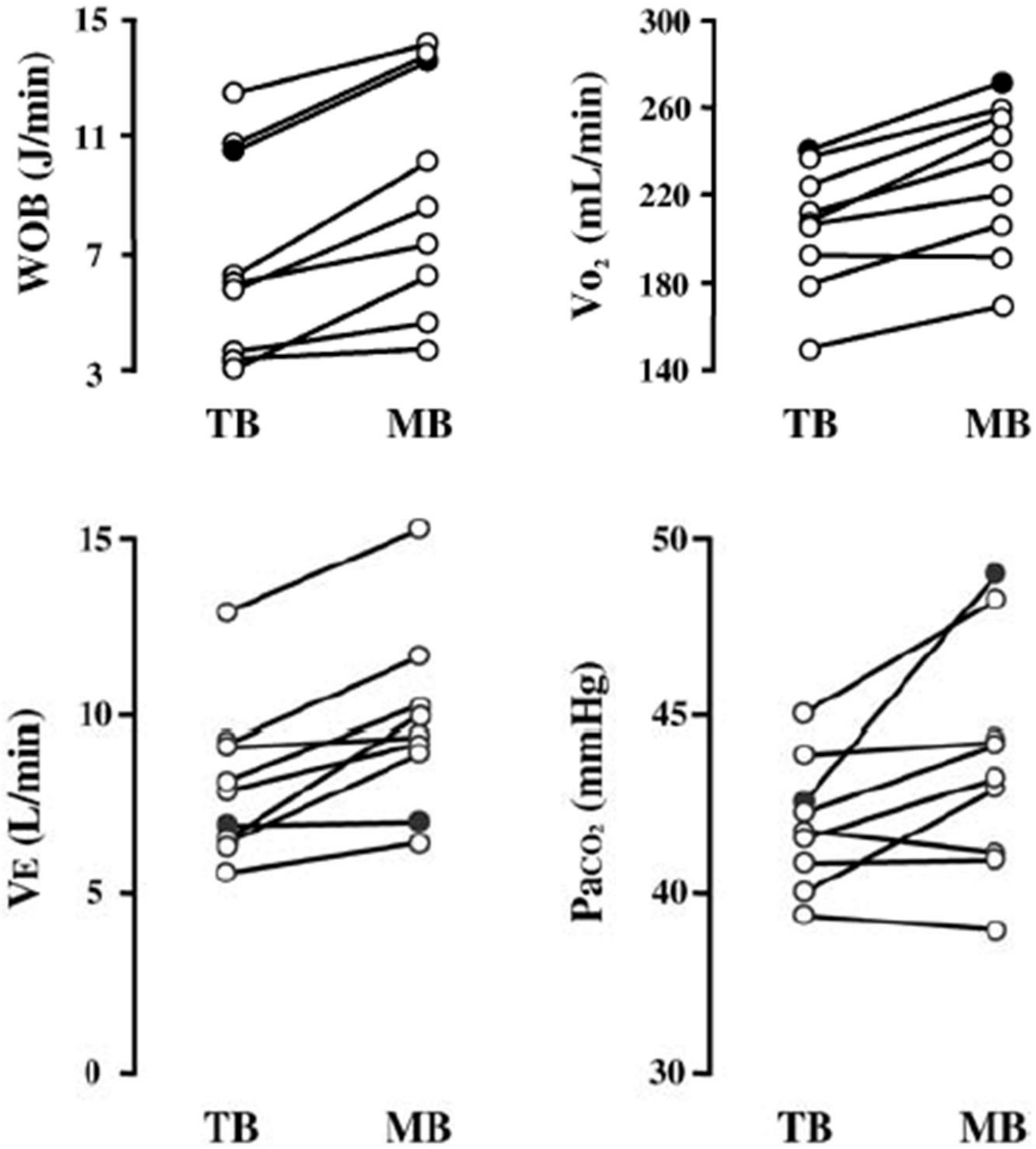
Karim Chadda
Bruno Louis
Lamine Benaïssa
Djillali Annane
Philippe Gajdos
Jean Claude Raphaël
Frédéric Lofaso

Physiological effects of decannulation in tracheostomized patients



$$V_D^{phys}+V_D^{circ}=V_T\times(Pa_{CO2}-PE_{CO2}/Pa_{CO2})$$

Espace mort augmente après décanulation



TB: Trachéo
MB: Bouche

Décanulation

Nez artificiel

↓

Valve phonatoire

↓

Canule bouchée

↓

Décanulation

Diminution du diamètre de la canule

CONCLUSIONS

La trachéotomie n'est pas une technique de sevrage

La trachéotomie est bénéfique uniquement par rapport à la ventilation prolongée

La trachéotomie garde toute sa place pour les malades au sevrage très prolongé

Une stratégie visant a aller vers la décanulation est nécessaire

Des structures spécialisées peuvent êtres intéressantes