Sevrage respiratoire
DU Kiné

Mai 2024

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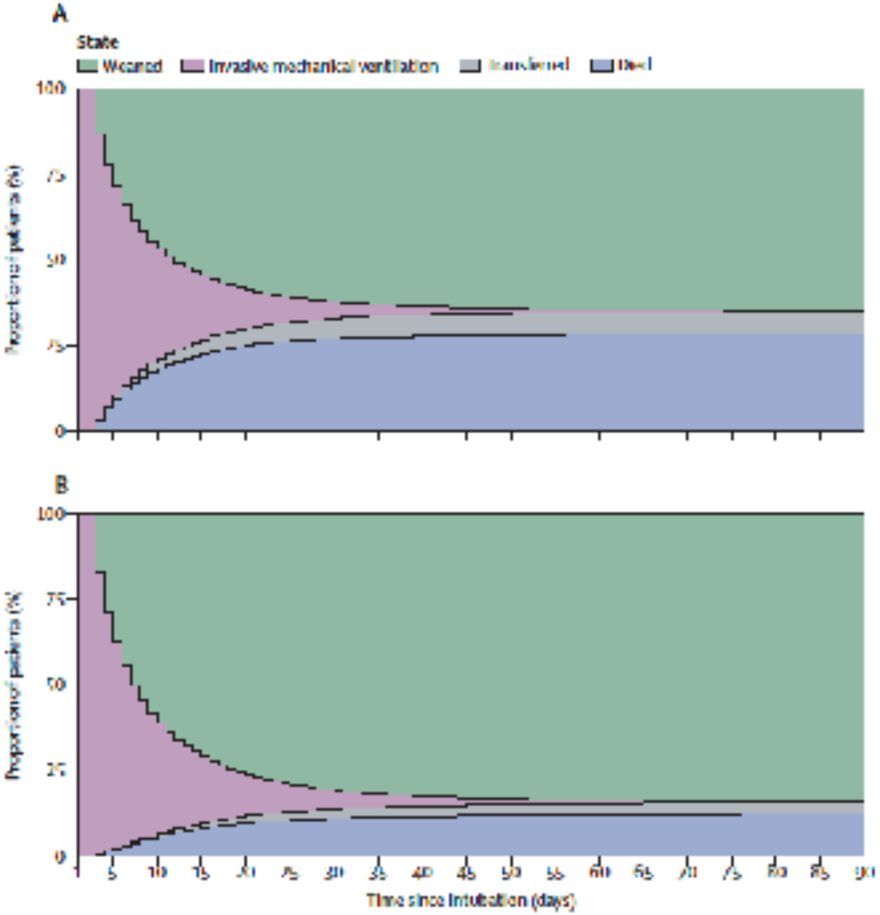
Réanimation Polyvalente,
Centre Hospitalier Côte Basque
Université de Bordeaux

LES GRANDS PRINCIPES DU SEVRAGE

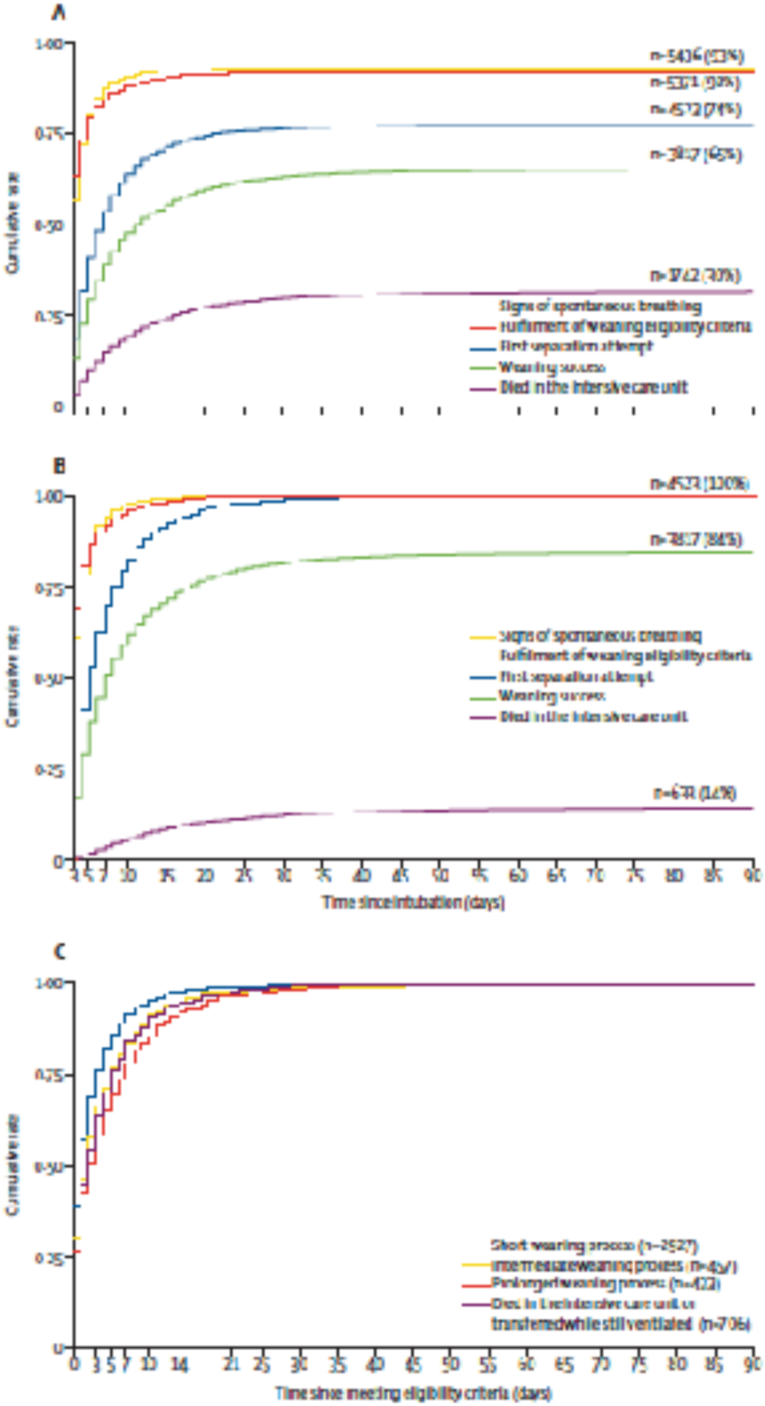
- Simple à Difficile
- Sédation
- Fonction Cardiaque
- Force musculaire

Weaning from mechanical ventilation in intensive care units across 50 countries (WEAN SAFE): a multicentre, prospective, observational cohort study

Tài Pham, Leo Heunks, Giacomo Bellani, Fabiana Madotto, Irene Aragao, Gaetan Beduneau, Ewan C Goligher, Giacomo Grasselli, Jon Henrik Laake, Jordi Mancebo, Oscar Peñuelas, Lise Piquilloud, Antonio Pesenti, Hannah Wunsch, Frank van Haren, Laurent Brochard, John G Laffey*, for the WEAN SAFE Investigators†*



Lancet Respir Med 2023;
11: 465–76


A
1·00
0·75
0·50
0·25
0
Cumulative rate
n=5436 (93%)
n=5371 (92%)
n=4523 (77%)
n=3817 (65%)
n=1742 (30%)
Signs of spontaneous breathing
Fulfilment of weaning eligibility criteria
First separation attempt
Weaning success
Died in the intensive care unit
B
1·00
0·75
0·50
0·25
0
Cumulative rate
n=4523 (100%)
n=3817 (84%)
n=648 (14%)
Signs of spontaneous breathing
Fulfilment of weaning eligibility criteria
First separation attempt
Weaning success
Died in the intensive care unit
3 5 7 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90
Time since intubation (days)
C
1·00
0·75
0·50
0·25
0
Cumulative rate
Short weaning process (n=2927)
Intermediate weaning process (n=468)
Prolonged weaning process (n=422)
Died in the intensive care unit or transferred while still ventilated (n=706)
0 3 5 7 10 14 21 25 30 35 40 45 50 55 60 65 70 75 80 85 90
Time since meeting eligibility criteria (days)

Sevrage 3 situations

1) **Sevrage simple** (premier essai)

65%

2) **Sevrage prolongé** (plus d'un essai)

25%

3) **Sevrage (très) difficile**

10%

Sevrage 3 situations

	Funk	Penuelas	Sellares	Tonnelier
Simple	59 %	55 %	44 %	30 %
Prolongé	26 %	39 %	37 %	40 %
Difficile	14 %	6 %	18 %	30 %

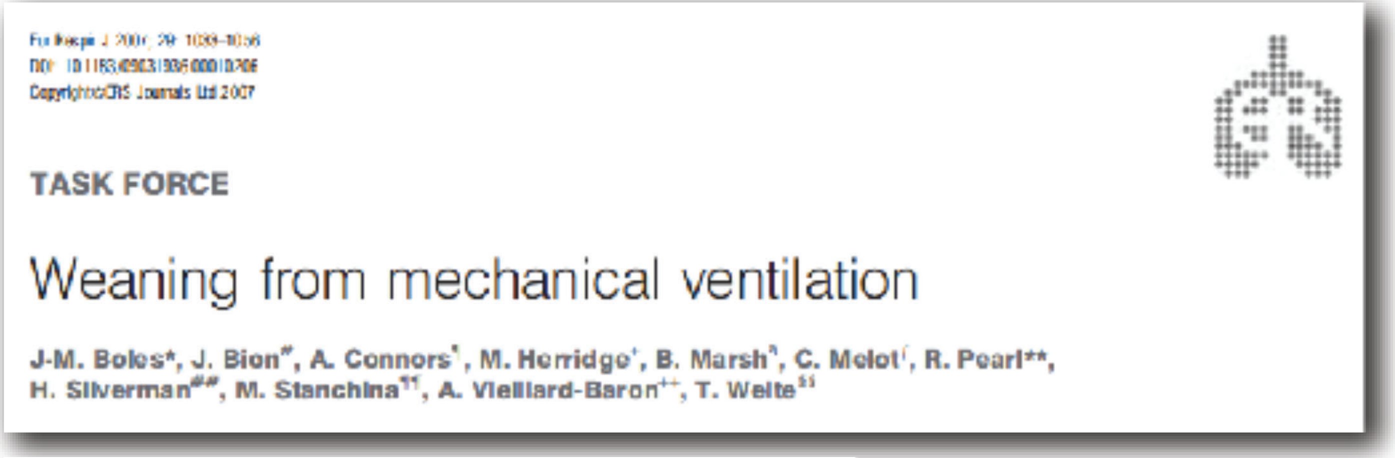
Etude WIND G.Beduneau terminée

Mécanismes du Sevrage non difficile

- Sevrage possible d'emblée:
  - ✳ screening quotidien
- Sevrage possible mais non identifié
  - ✳ Sur assistance
  - ✳ Trop de sédation
  - ✳ Pas de screening

Mécanismes du Sevrage difficile

- Pathologie pulmonaire/cardiaque sous jacente sévère
- Surcharge volémique
- Faiblesse musculaire respiratoire
- Métabolique/Nutrition/Anémie



Eur Respir J 2007; 29: 1033–1056
DOI: 10.1183/09031936.00010206
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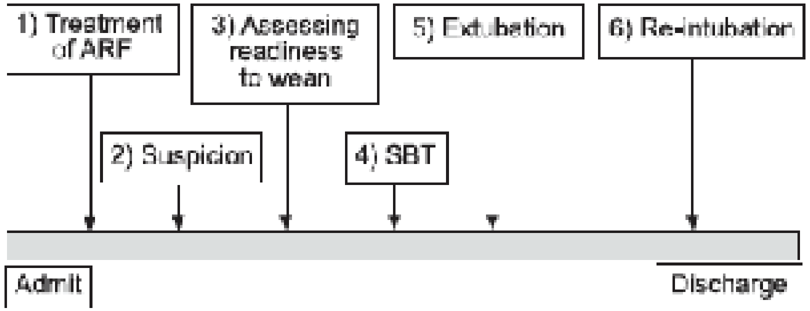
TASK FORCE

Weaning from mechanical ventilation

J-M. Boles*, J. Bion[#], A. Connors[¶], M. Herridge[+], B. Marsh[§], C. Melot[ƒ], R. Pearl**,
H. Silverman[##], M. Stanchina[¶¶], A. Vieillard-Baron[++], T. Welte[§§]


1) Treatment of ARF
3) Assessing readiness to wean
5) Extubation
6) Re-intubation
2) Suspicion
4) SBT
Admit
Discharge

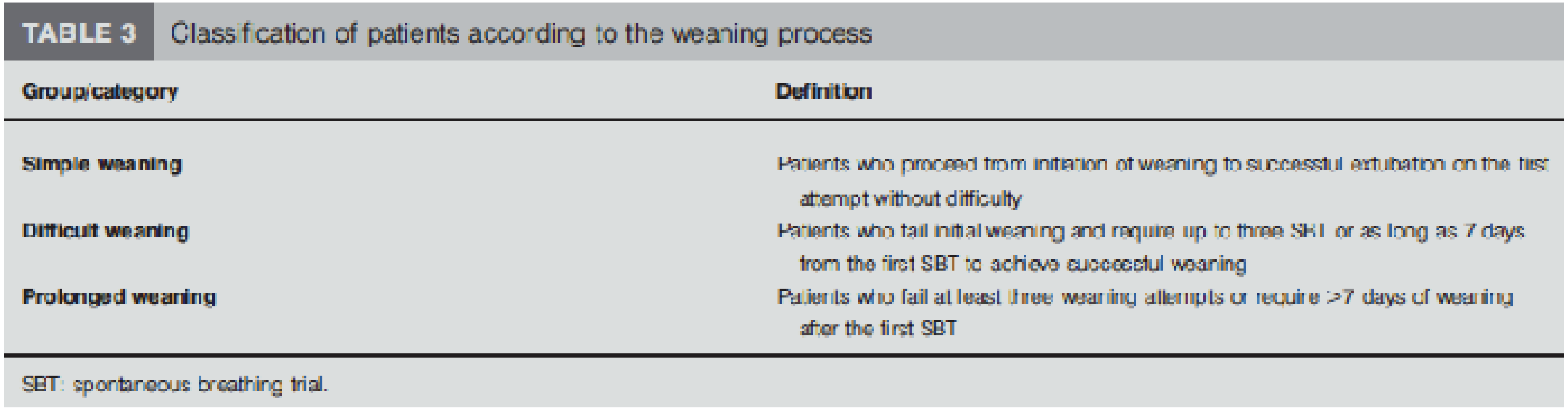


TABLE 3 Classification of patients according to the weaning process

Group/category	Definition
Simple weaning	Patients who proceed from initiation of weaning to successful extubation on the first attempt without difficulty
Difficult weaning	Patients who fail initial weaning and require up to three SBT or as long as 7 days from the first SBT to achieve successful weaning
Prolonged weaning	Patients who fail at least three weaning attempts or require >7 days of weaning after the first SBT

SBT: spontaneous breathing trial.

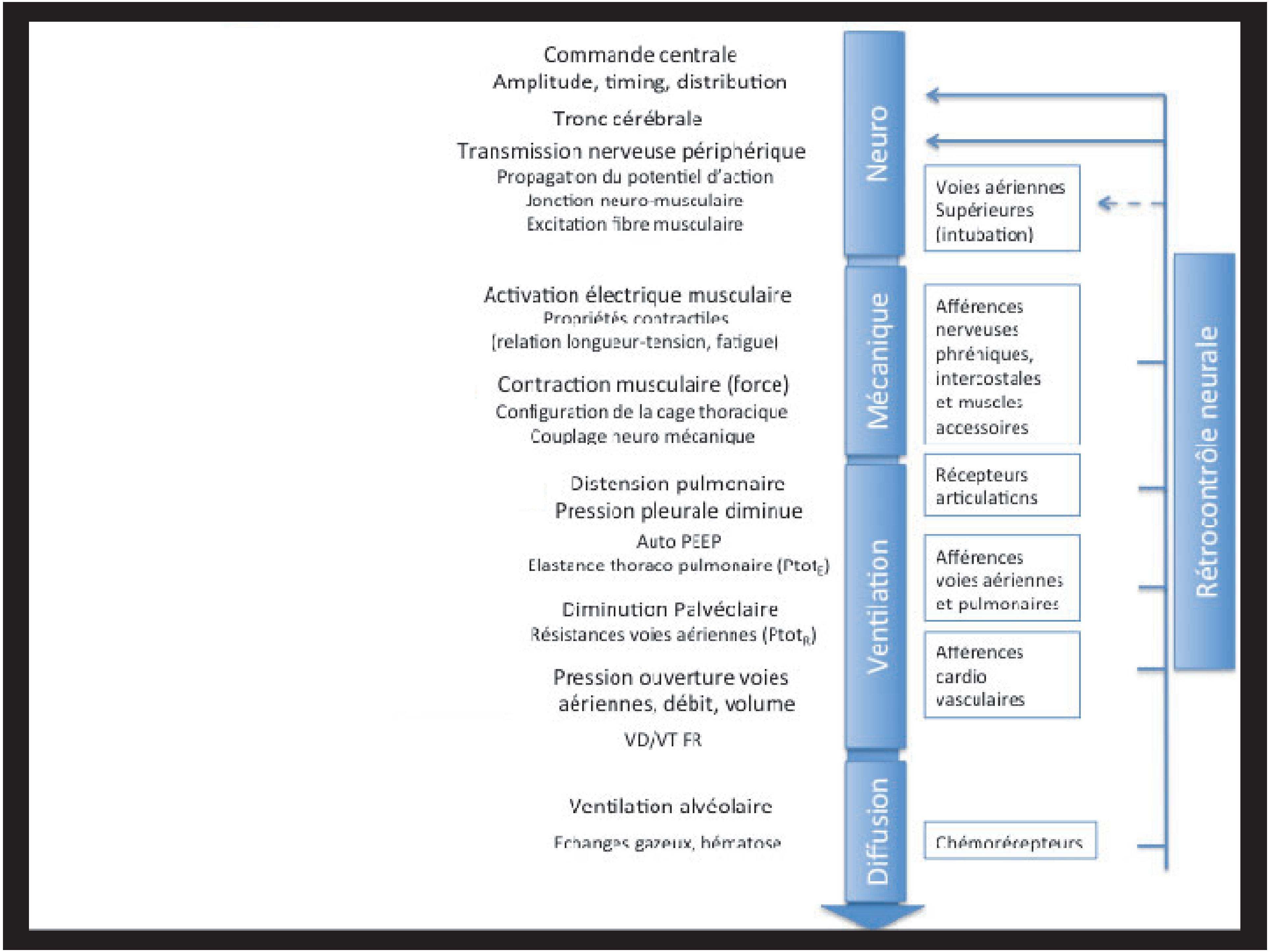
Correspondence

WEAN SAFE and the definition of the first separation attempt

Authors' reply

Sevrage du ventilateur

Sevrage de la sonde



Commande centrale
Amplitude, timing, distribution

Tronc cérébrale

Transmission nerveuse périphérique
Propagation du potentiel d'action
Jonction neuro-musculaire
Excitation fibre musculaire

Activation électrique musculaire
Propriétés contractiles
(relation longueur-tension, fatigue)

Contraction musculaire (force)
Configuration de la cage thoracique
Couplage neuro mécanique

Distension pulmonaire
Pression pleurale diminue
Auto PEEP
Elastance thoraco pulmonaire ($Ptot_E$)

Diminution Palvéolaire
Résistances voies aériennes ($Ptot_R$)

Pression ouverture voies aériennes, débit, volume
VD/VT FR

Ventilation alvéolaire
Echanges gazeux, hématose

Neuro

Mécanique

Ventilation

Diffusion

Voies aériennes Supérieures (intubation)

Afférences nerveuses phréniques, intercostales et muscles accessoires

Récepteurs articulations

Afférences voies aériennes et pulmonaires

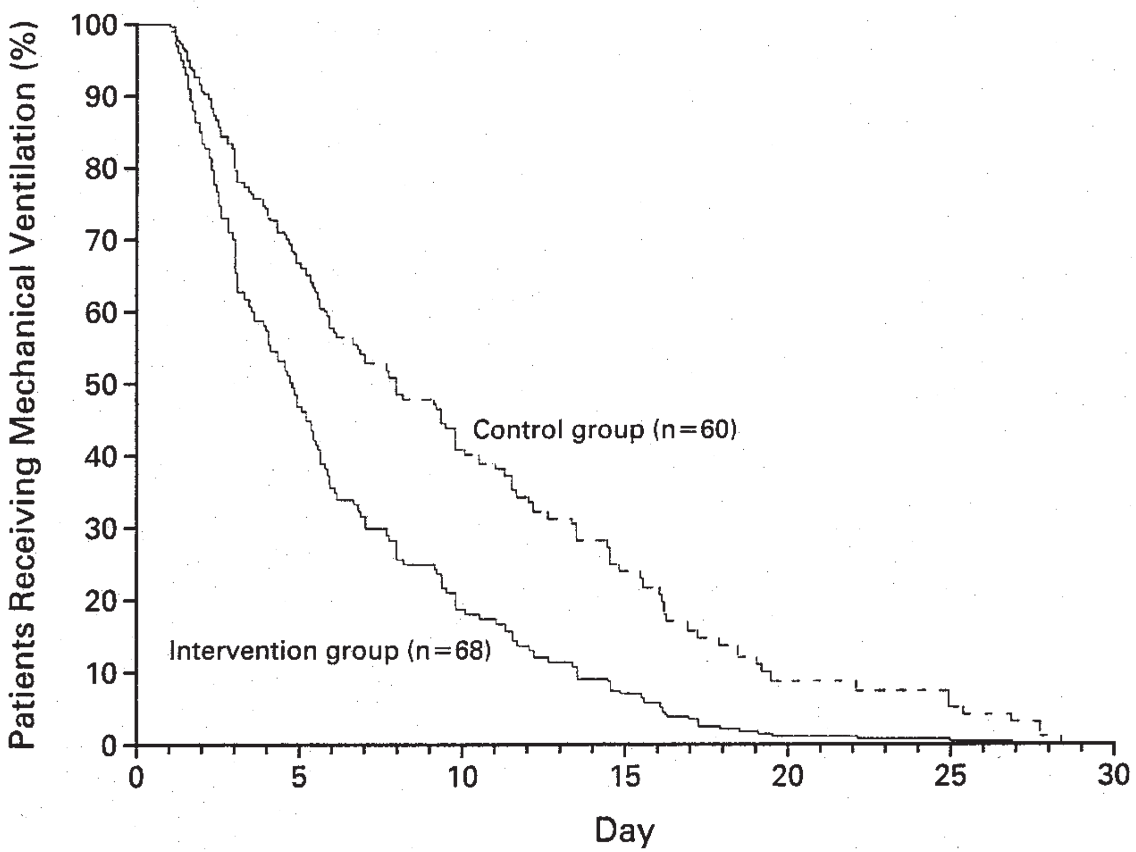
Afférences cardio vasculaires

Chémorécepteurs

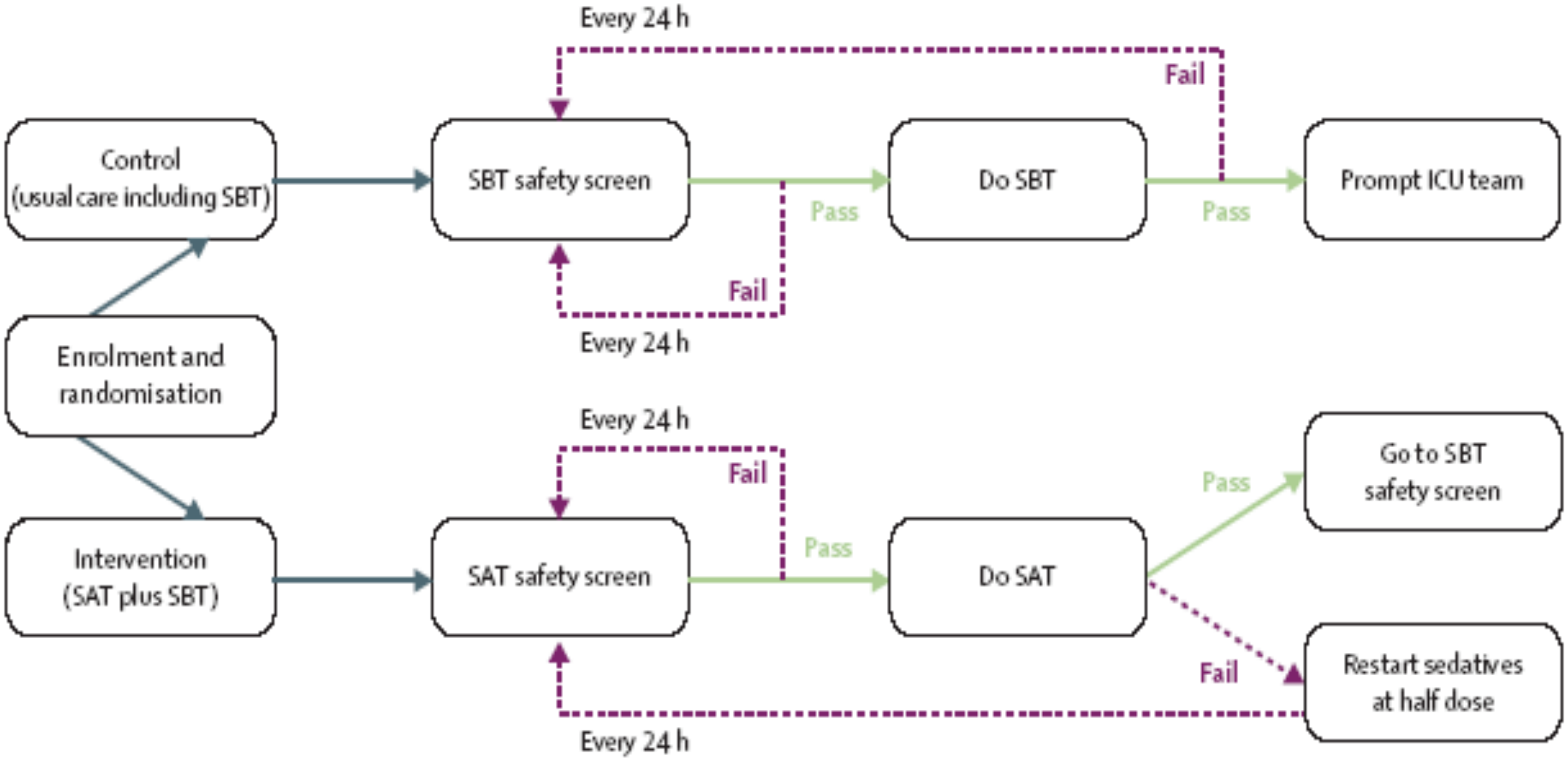
Rétrocontrôle neurale

Protocole de sedation

Kress, JP. et al. N Engl J Med 2000; 342:1471-1477



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



Every 24 h

Fail

Control
(usual care including SBT)

SBT safety screen

Pass

Do SBT

Pass

Prompt ICU team

Fail

Every 24 h

Enrolment and randomisation

Every 24 h

Fail

Go to SBT safety screen

Pass

Intervention
(SAT plus SBT)

SAT safety screen

Pass

Do SAT

Fail

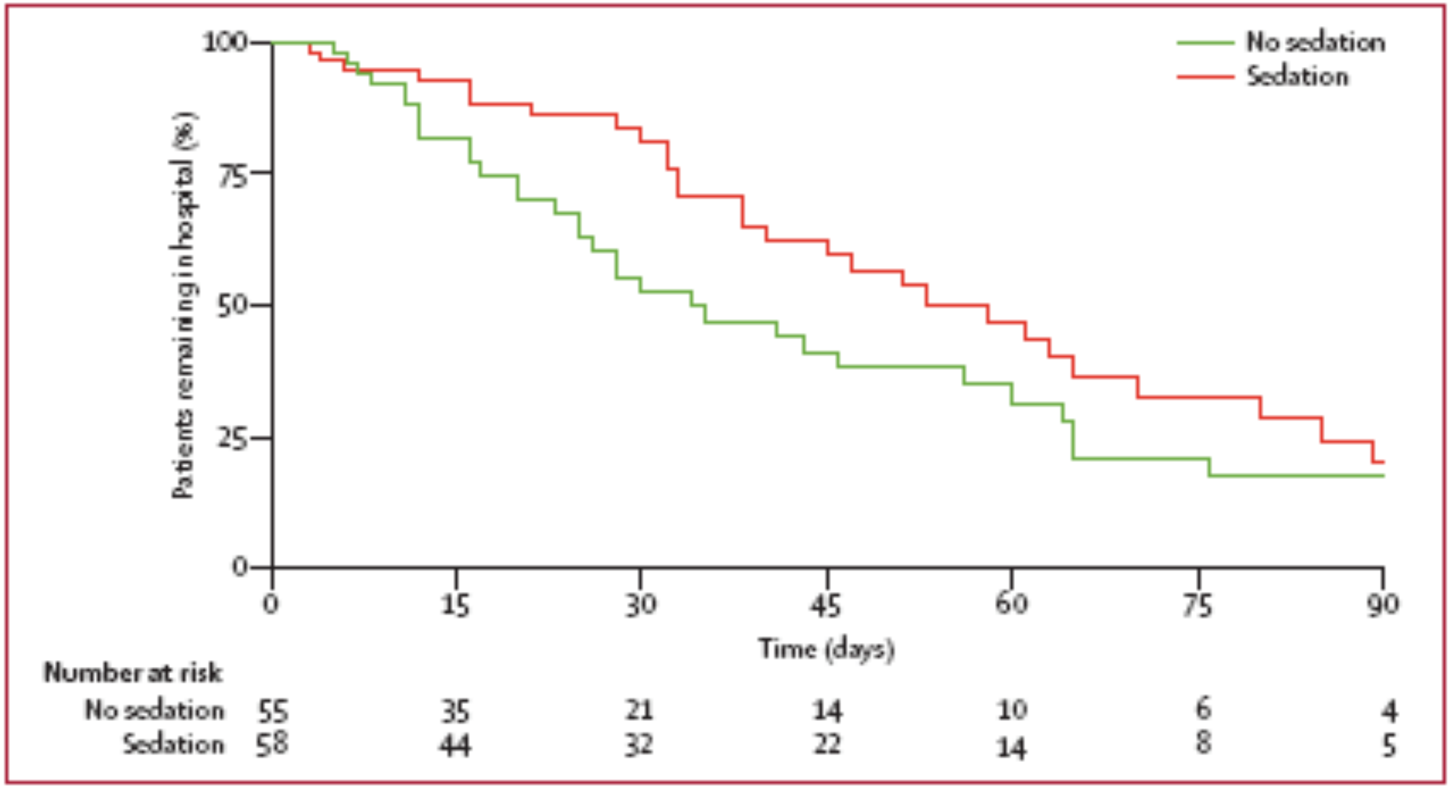
Restart sedatives at half dose

Every 24 h

Lancet 2008; 371: 126–34

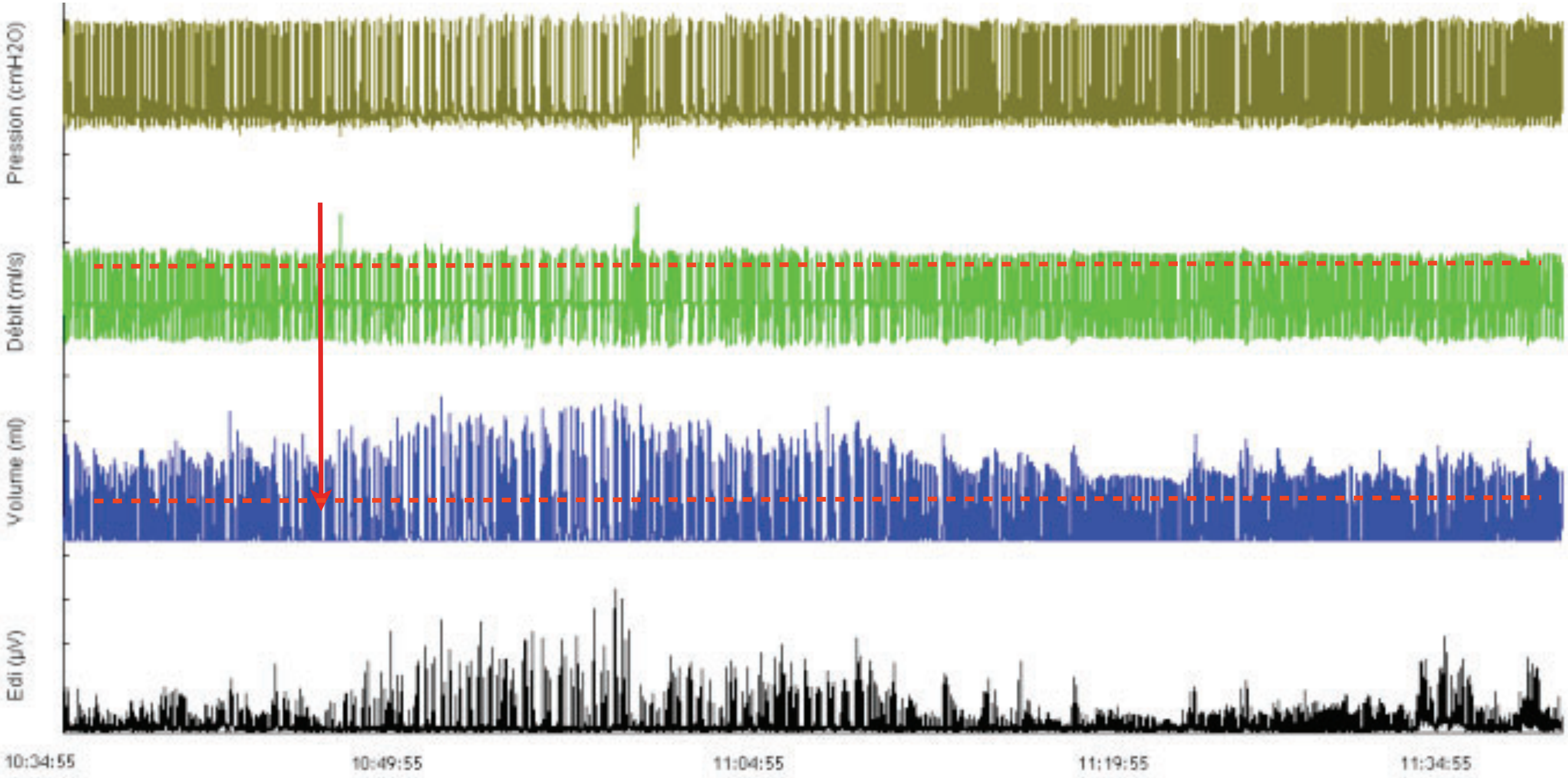
A protocol of no sedation for critically ill patients receiving mechanical ventilation: a randomised trial

Thomas Strøm, Torben Martinussen, Palle Toft



Lancet 2010

Test à l'anexate démontre l'inhibition de la sedation



Teboul et al. Critical Care 2010, 14:211
http://ccforum.com/14/2/211

CRITICAL CARE

REVIEW

Weaning failure of cardiac origin: recent advances

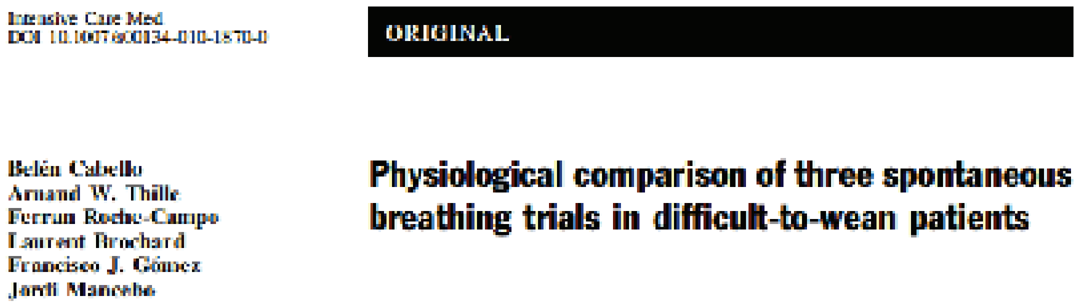
Jean-Louis Teboul, Xavier Monnet, and Christian Richard

Intensive Care Med (2005) 31:1605–1607
DOI 10.1007/s00134-005-2698-x

EDITORIAL

Christian Richard
Jean Louis Teboul

Weaning failure from cardiovascular origin

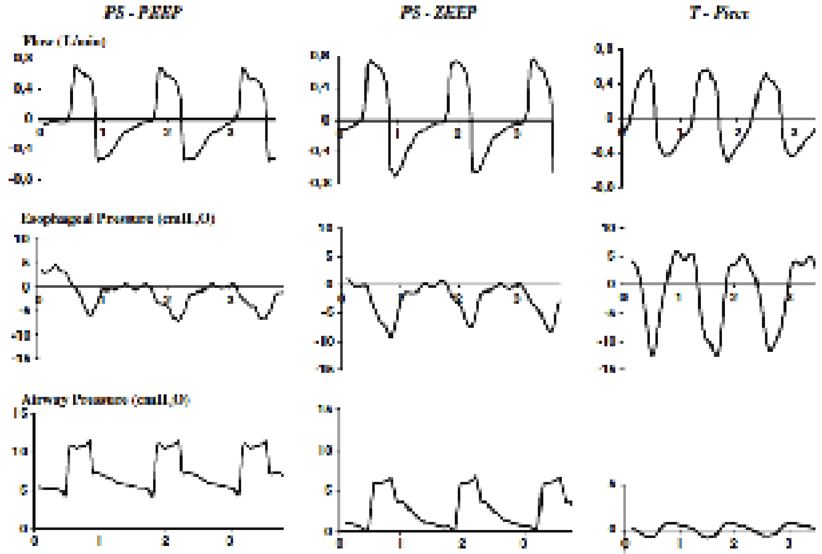


Intensive Care Med
DOI 10.1007/s00134-010-1870-0

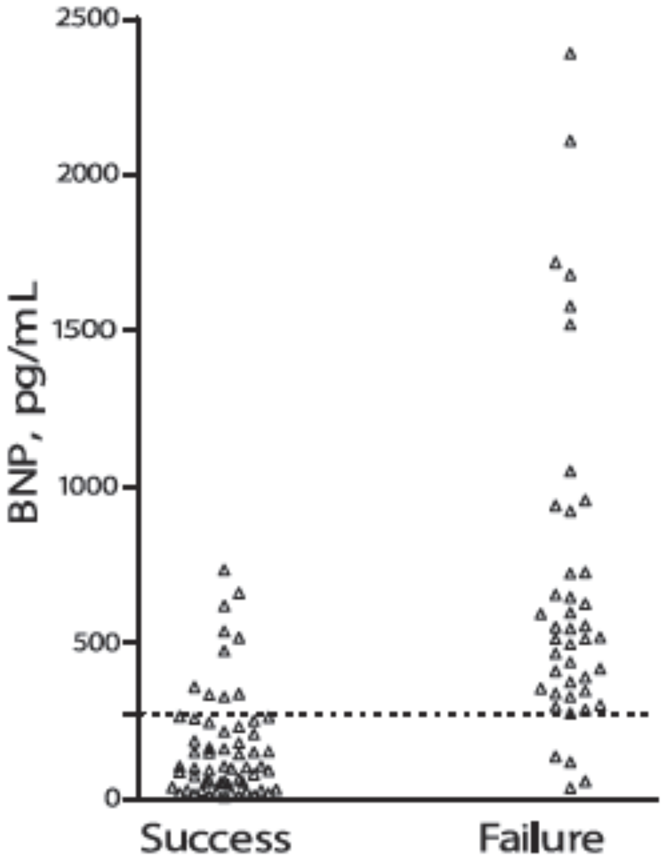
ORIGINAL

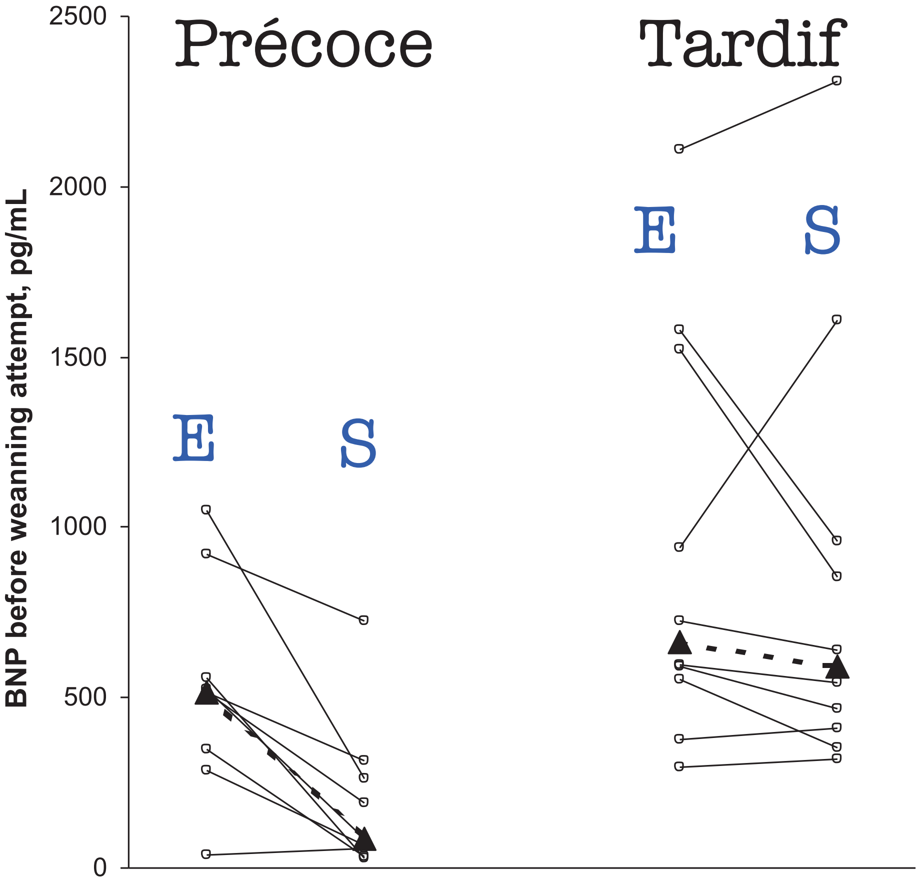
Belén Cabello
Arnaud W. Thille
Ferran Roche-Campo
Laurent Brochard
Francisco J. Gómez
Jordi Mancebo

Physiological comparison of three spontaneous breathing trials in difficult-to-wean patients



Fonction cardiaque

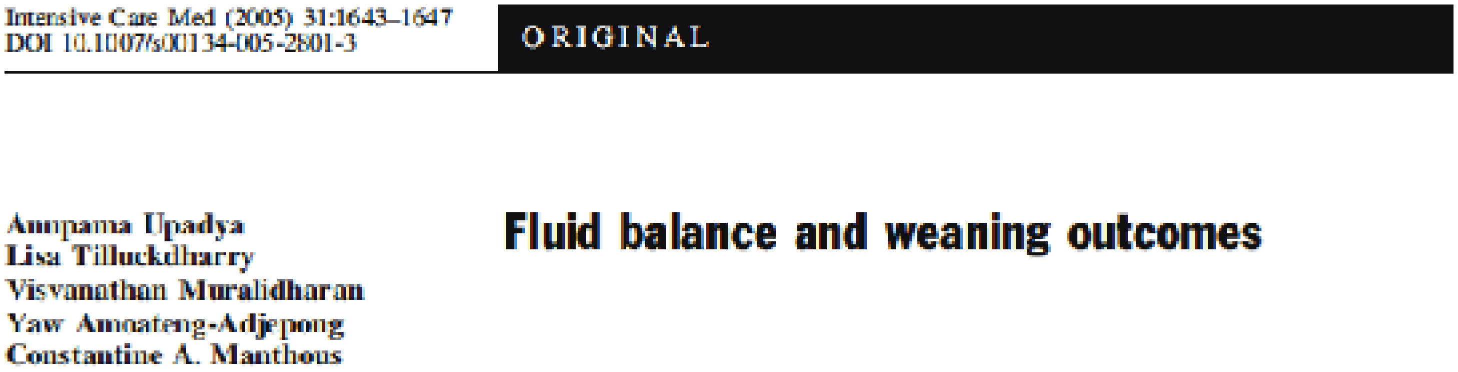




Succès vs échec

Mekontso-Dessap ICM 2006

Balance hydrique

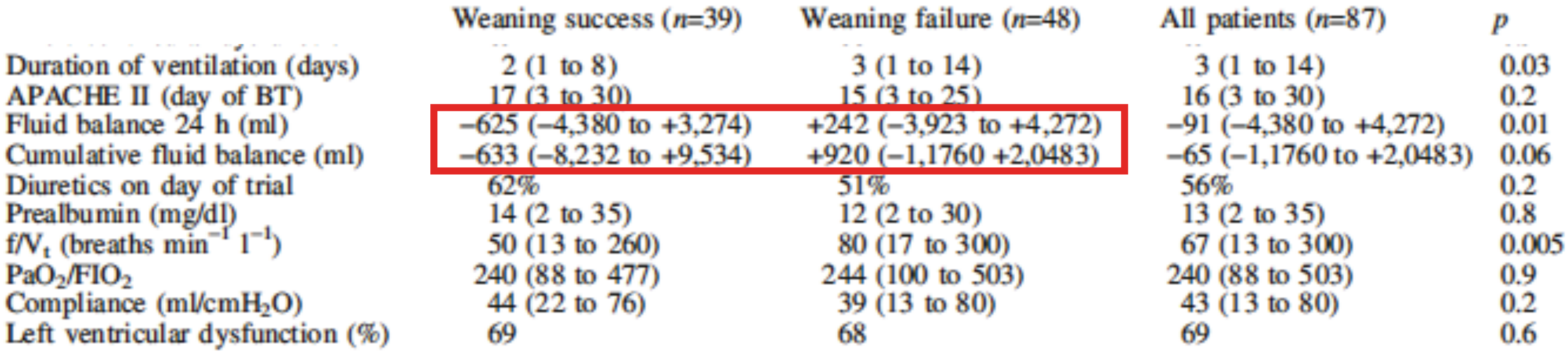


Intensive Care Med (2005) 31:1643–1647
DOI 10.1007/s00134-005-2801-3

ORIGINAL

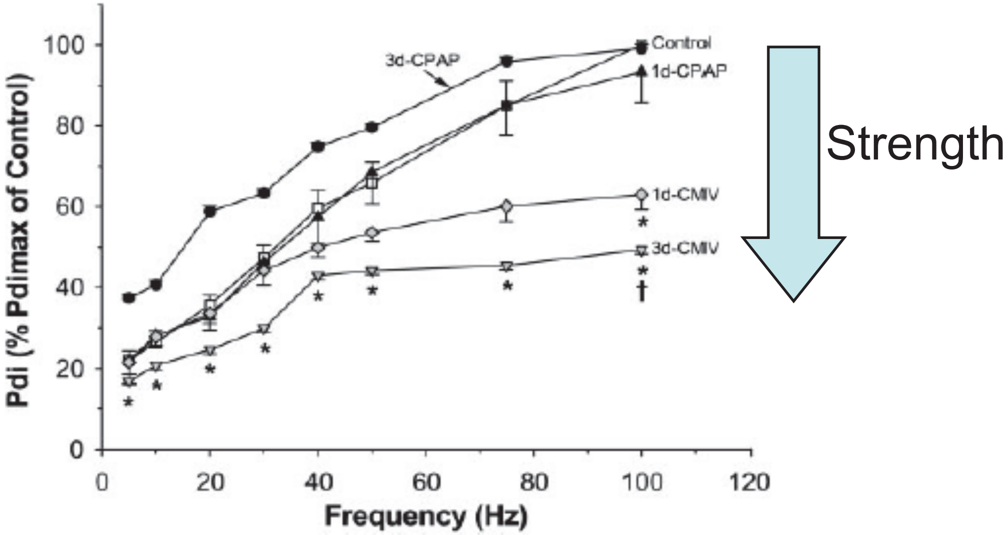
Anupama Upadya
Lisa Tilluckdharry
Visvanathan Muralidharan
Yaw Amoateng-Adjepong
Constantine A. Manthous

Fluid balance and weaning outcomes

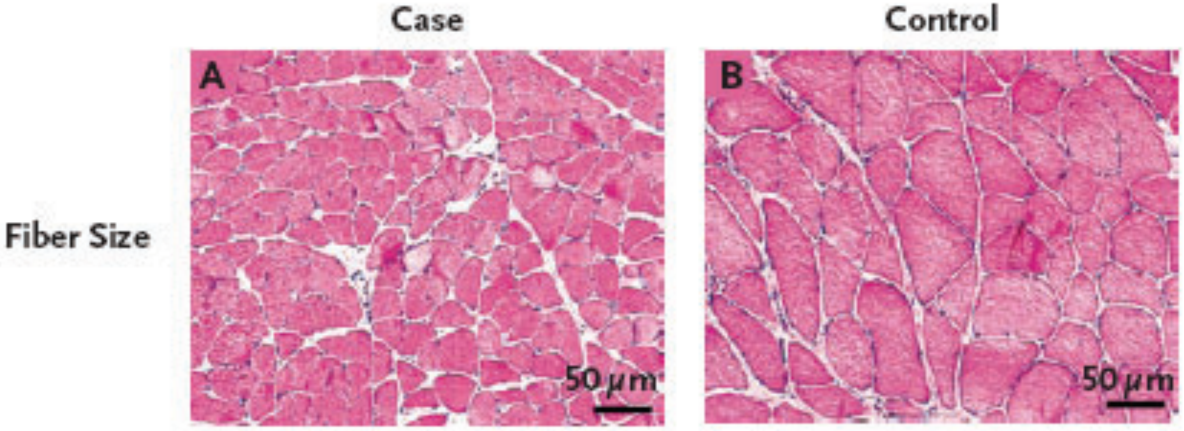


	Weaning success (*n*=39)	Weaning failure (*n*=48)	All patients (*n*=87)	*p*
Duration of ventilation (days)	2 (1 to 8)	3 (1 to 14)	3 (1 to 14)	0.03
APACHE II (day of BT)	17 (3 to 30)	15 (3 to 25)	16 (3 to 30)	0.2
Fluid balance 24 h (ml)	−625 (−4,380 to +3,274)	+242 (−3,923 to +4,272)	−91 (−4,380 to +4,272)	0.01
Cumulative fluid balance (ml)	−633 (−8,232 to +9,534)	+920 (−1,1760 +2,0483)	−65 (−1,1760 to +2,0483)	0.06
Diuretics on day of trial	62%	51%	56%	0.2
Prealbumin (mg/dl)	14 (2 to 35)	12 (2 to 30)	13 (2 to 35)	0.8
f/V_t (breaths min^{-1} l^{-1})	50 (13 to 260)	80 (17 to 300)	67 (13 to 300)	0.005
PaO_2/FIO_2	240 (88 to 477)	244 (100 to 503)	240 (88 to 503)	0.9
Compliance (ml/cmH_2O)	44 (22 to 76)	39 (13 to 80)	43 (13 to 80)	0.2
Left ventricular dysfunction (%)	69	68	69	0.6

Faiblesse musculaire: Dysfonction diaphragmatique



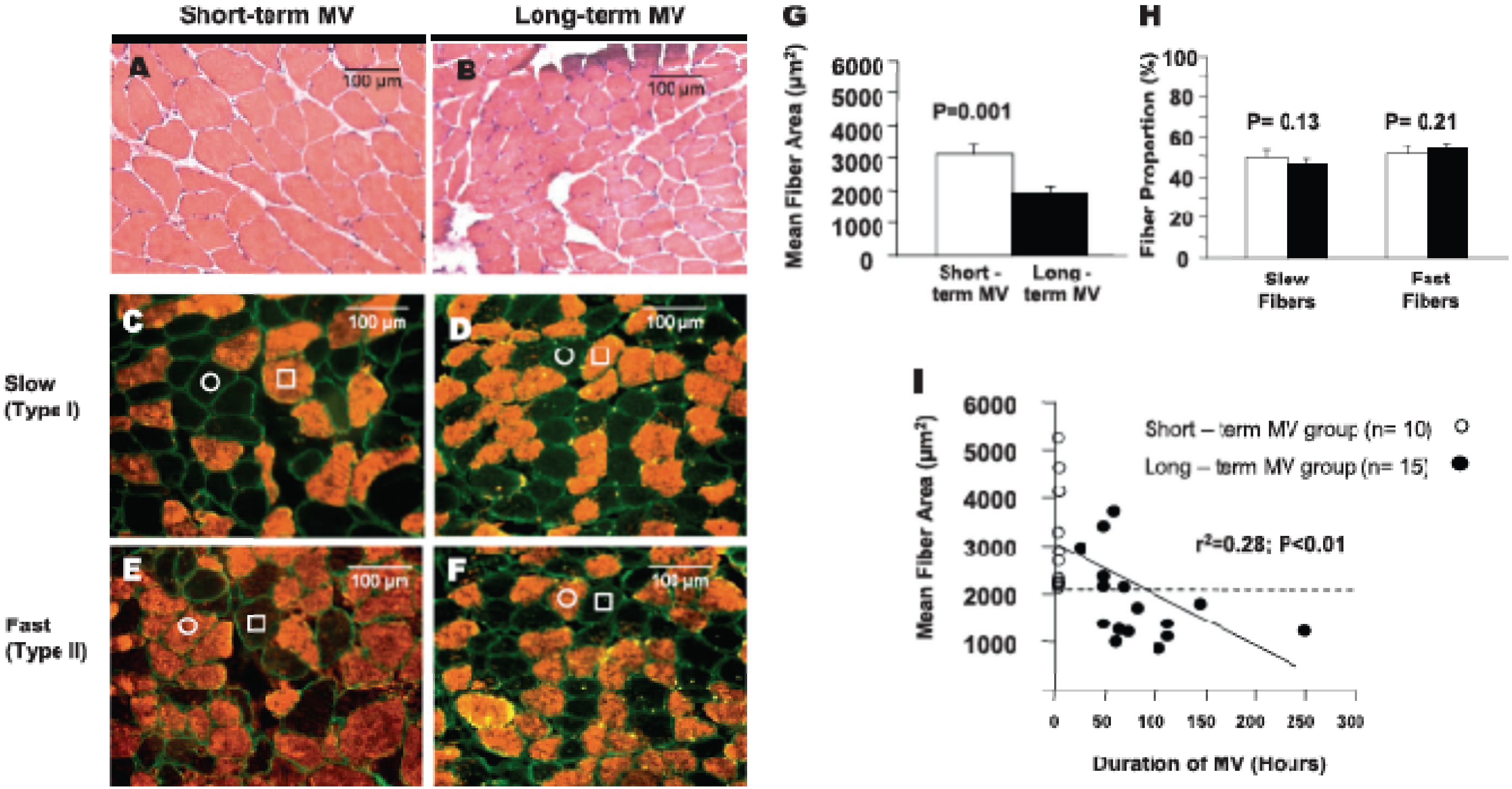
J Appl Physiol 92: 2585–2595, 2002.


Case
Control
Fiber Size
A
B
50 µm
50 µm

N Engl J Med 2008;358:1327-35.

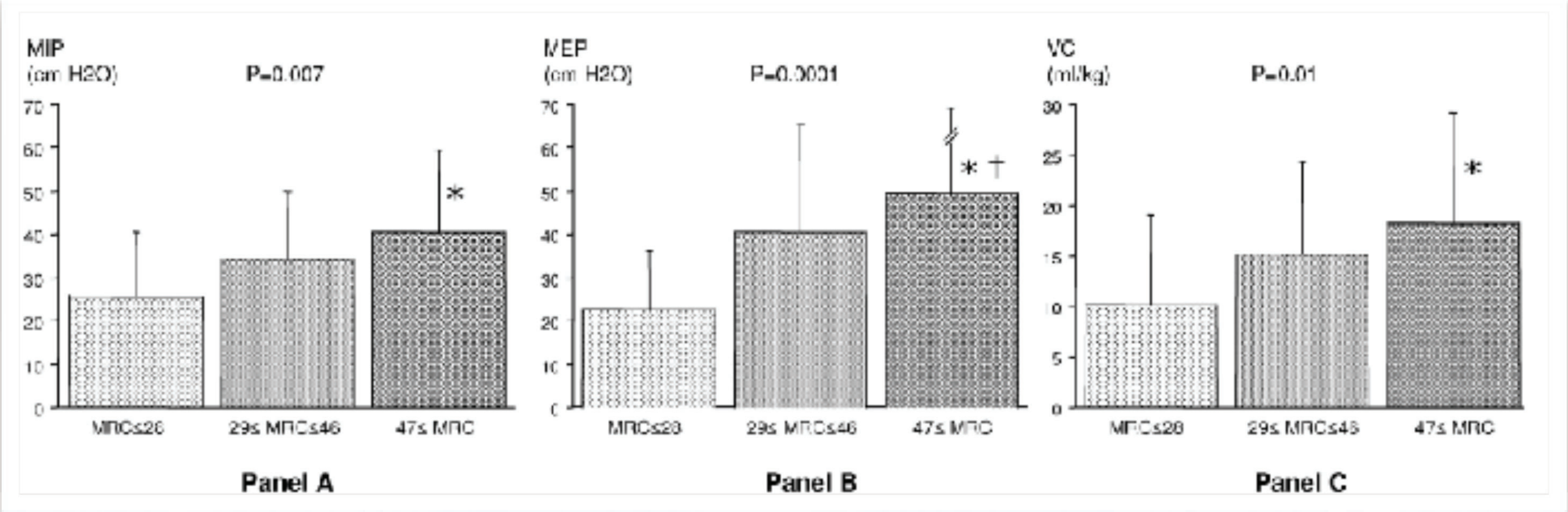
Rapidly Progressive Diaphragmatic Weakness and Injury during Mechanical Ventilation in Humans

Samir Jaber[1,2,6], Basil J. Petrof[3], Boris Jung[1,2], Gérald Chanques[1,2], Jean-Philippe Berthet[4], Christophe Rabuel[5], Hassan Bouyabrine[6], Patricia Courouble[1,7], Christelle Koechlin-Ramonatxo[7], Mustapha Sebbane[1,7], Thomas Similowski[8], Valérie Scheuermann[9], Alexandre Mebazaa[5], Xavier Capdevila[1,2], Dominique Mornet[2], Jacques Mercier[2,10], Alain Lacampagne[9], Alexandre Philips[7], and Stefan Matecki[7,10]



Respiratory weakness is associated with limb weakness and delayed weaning in critical illness*

Bernard De Jonghe, MD; Sylvie Bastuji-Garin, MD, PhD; Marie-Christine Durand, MD;
Isabelle Malissin, MD; Pablo Rodrigues, MD; Charles Cerf, MD; Hervé Outin, MD; Tarek Sharshar, MD, PhD;
for Groupe de Réflexion et d'Etude des Neuromyopathies En Réanimation



Crit Care Med 2007; 35:2007–2015

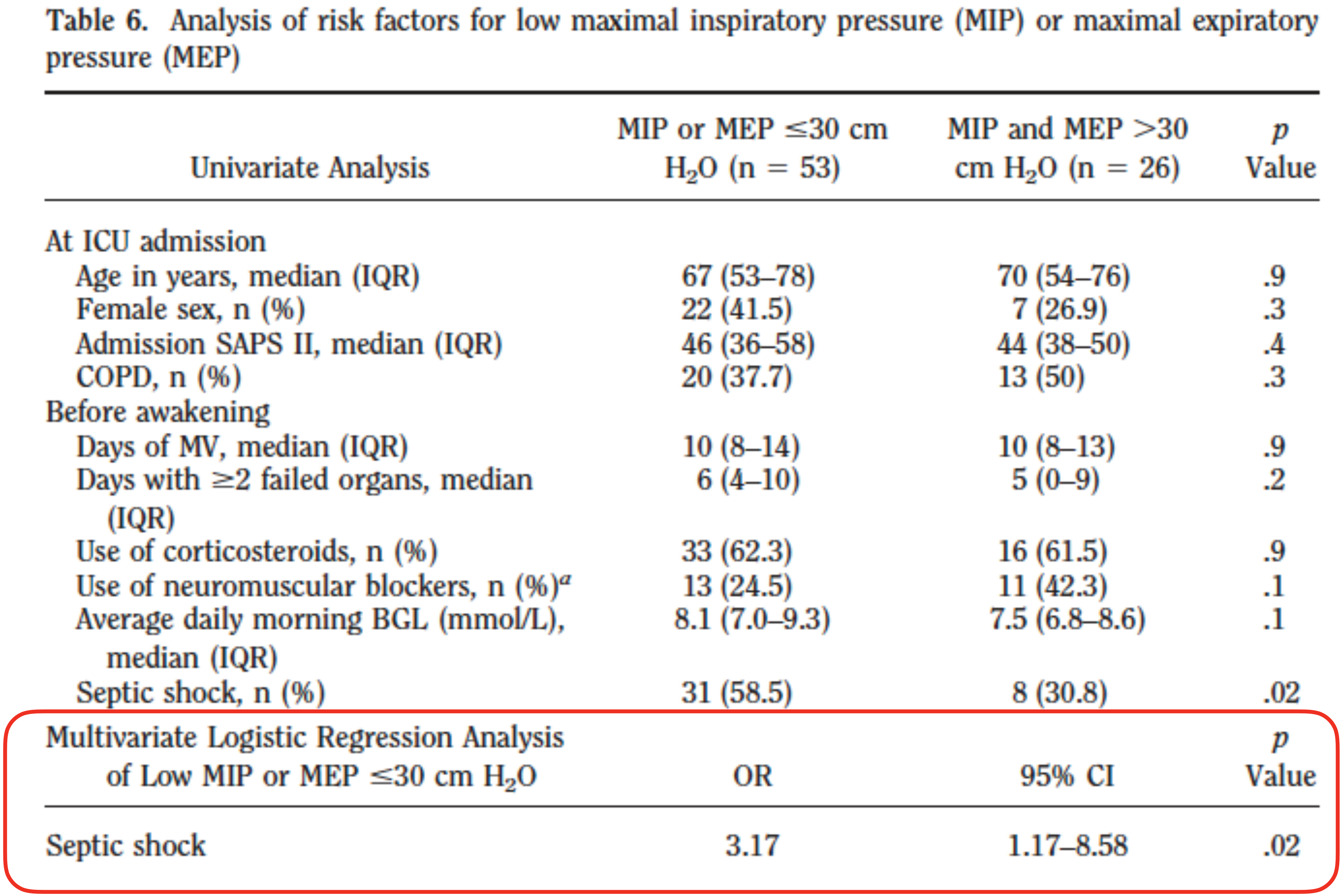


Table 6. Analysis of risk factors for low maximal inspiratory pressure (MIP) or maximal expiratory pressure (MEP)

Univariate Analysis	MIP or MEP ≤30 cm H_2O (n = 53)	MIP and MEP >30 cm H_2O (n = 26)	*p* Value
At ICU admission			
Age in years, median (IQR)	67 (53–78)	70 (54–76)	.9
Female sex, n (%)	22 (41.5)	7 (26.9)	.3
Admission SAPS II, median (IQR)	46 (36–58)	44 (38–50)	.4
COPD, n (%)	20 (37.7)	13 (50)	.3
Before awakening			
Days of MV, median (IQR)	10 (8–14)	10 (8–13)	.9
Days with ≥2 failed organs, median (IQR)	6 (4–10)	5 (0–9)	.2
Use of corticosteroids, n (%)	33 (62.3)	16 (61.5)	.9
Use of neuromuscular blockers, n (%)[a]	13 (24.5)	11 (42.3)	.1
Average daily morning BGL (mmol/L), median (IQR)	8.1 (7.0–9.3)	7.5 (6.8–8.6)	.1
Septic shock, n (%)	31 (58.5)	8 (30.8)	.02

Multivariate Logistic Regression Analysis of Low MIP or MEP ≤30 cm H_2O	OR	95% CI	*p* Value
Septic shock	3.17	1.17–8.58	.02

Crit Care Med 2007; 35:2007–2015

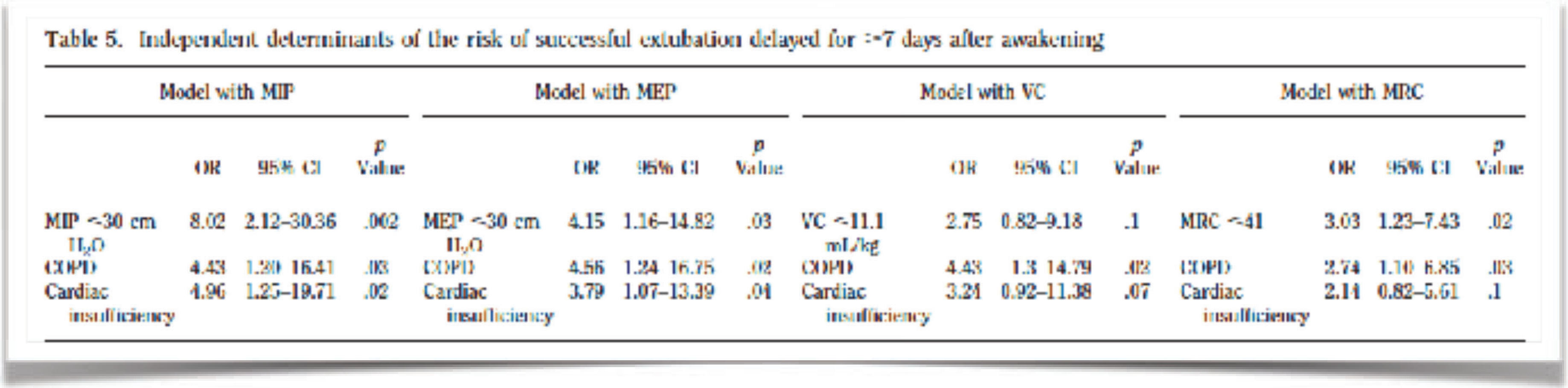
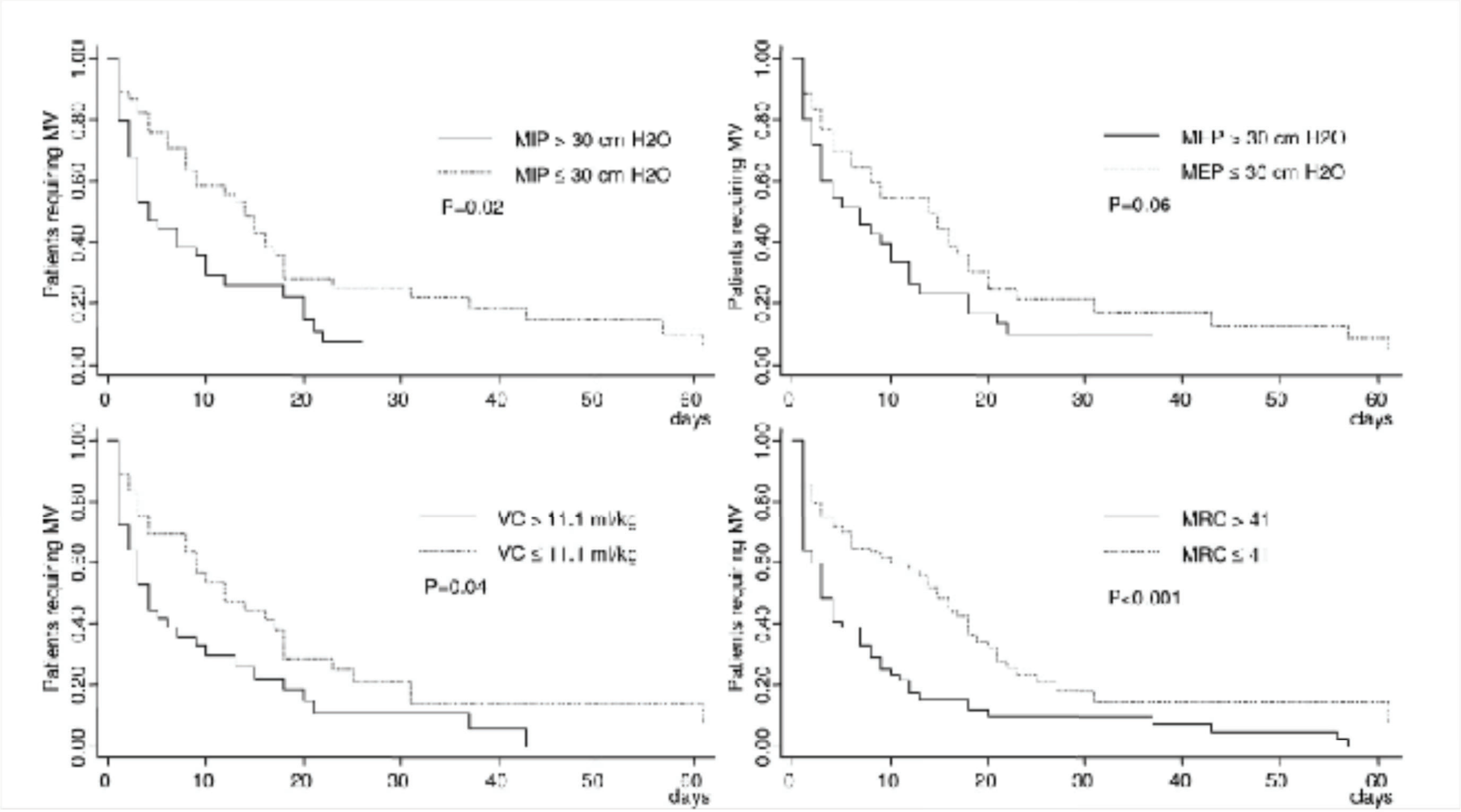


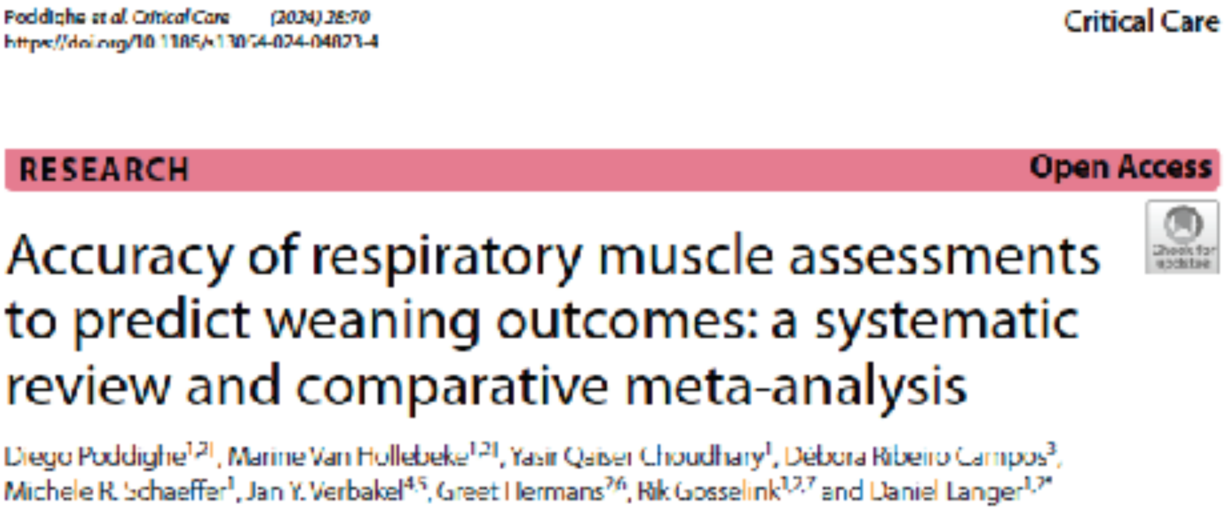
Table 5. Independent determinants of the risk of successful extubation delayed for ≥7 days after awakening

Model with MIP				Model with MEP				Model with VC				Model with MRC			
	OR	95% CI	*p* Value		OR	95% CI	*p* Value		OR	95% CI	*p* Value		OR	95% CI	*p* Value
MIP <30 cm H_2O	8.02	2.12–30.36	.002	MEP <30 cm H_2O	4.15	1.16–14.82	.03	VC <11.1 mL/kg	2.75	0.82–9.18	.1	MRC <41	3.03	1.23–7.43	.02
COPD	4.43	1.20–16.41	.03	COPD	4.56	1.24–16.75	.02	COPD	4.43	1.3–14.79	.02	COPD	2.74	1.10–6.85	.03
Cardiac insufficiency	4.96	1.25–19.71	.02	Cardiac insufficiency	3.79	1.07–13.39	.04	Cardiac insufficiency	3.24	0.92–11.38	.07	Cardiac insufficiency	2.14	0.82–5.61	.1

Crit Care Med 2007; 35:2007–2015



Crit Care Med 2007; 35:2007–2015



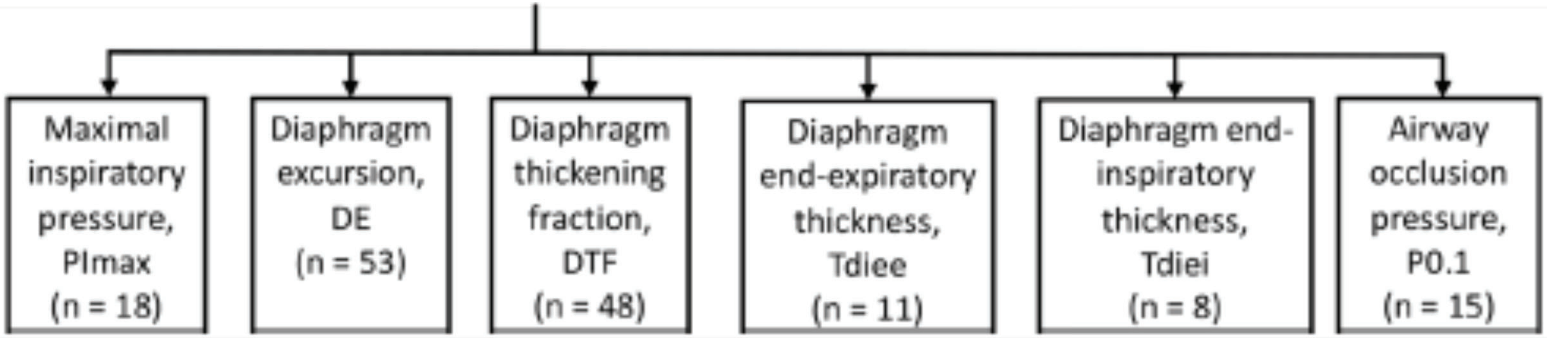
Poddighe et al. Critical Care (2024) 28:70
https://doi.org/10.1186/s13054-024-04823-4

Critical Care

RESEARCH **Open Access**

Accuracy of respiratory muscle assessments to predict weaning outcomes: a systematic review and comparative meta-analysis

Diego Poddighe[1,2†], Marine Van Hollebeke[1,2†], Yasir Qaiser Choudhary[1], Débora Ribeiro Campos[3], Michele R. Schaeffer[1], Jan Y. Verbakel[4,5], Greet Hermans[2,6], Rik Gosselink[1,2,7] and Daniel Langer[1,2*]



Maximal inspiratory pressure, PImax (n = 18)

Diaphragm excursion, DE (n = 53)

Diaphragm thickening fraction, DTF (n = 48)

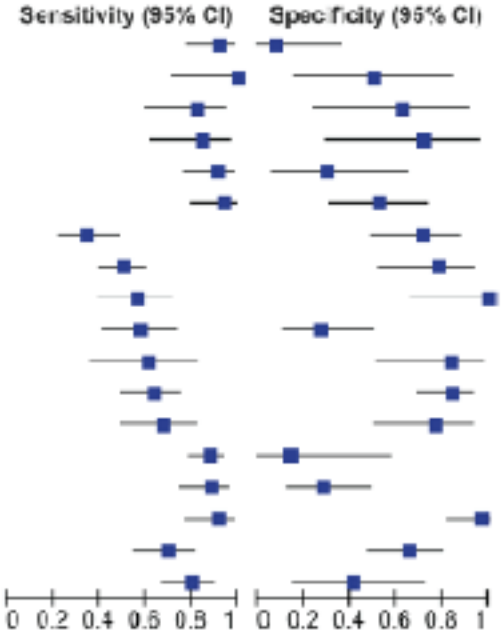
Diaphragm end-expiratory thickness, Tdiee (n = 11)

Diaphragm end-inspiratory thickness, Tdiei (n = 8)

Airway occlusion pressure, P0.1 (n = 15)

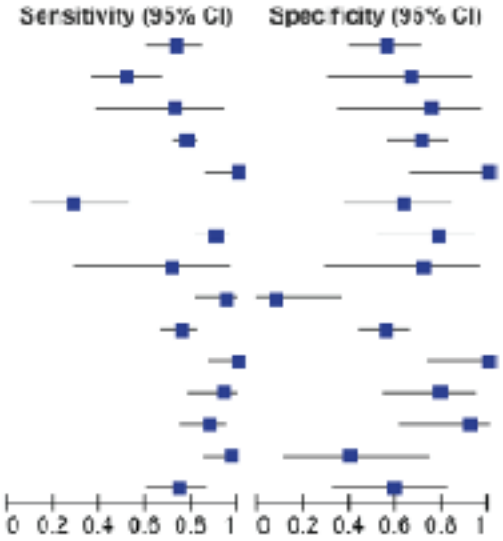
Maximal inspiratory pressure

Study	TP	FP	FN	TN	n	> cmH$_2$O Threshold	Condition	Risk of bias	Sensitivity (95% CI)	Specificity (95% CI)
Conti 2004	34	12	3	1	50	16.0	SBT	Low	0.92 [0.78, 0.98]	0.08 [0.00, 0.36]
Bruton 2002	11	4	0	4	19	17.5	NR	High	1.00 [0.72, 1.00]	0.50 [0.16, 0.84]
Saeed 2016	18	3	4	5	30	20.0	SBT	High	0.82 [0.60, 0.95]	0.63 [0.24, 0.91]
Flevari 2016	17	2	3	5	27	20.0	SBT	Low	0.85 [0.62, 0.97]	0.71 [0.29, 0.96]
Sassoon 1993	32	7	3	3	45	20.0	NR	Low	0.91 [0.77, 0.98]	0.30 [0.07, 0.65]
Jiang 2004	30	11	2	12	55	20.0	MV	High	0.94 [0.79, 0.99]	0.52 [0.31, 0.73]
De Jonghe 2007	19	7	36	17	79	30.0	MV	High	0.35 [0.22, 0.49]	0.71 [0.49, 0.87]
Medrinal 2016	53	4	53	14	124	30.0	MV	Low	0.50 [0.40, 0.60]	0.78 [0.52, 0.94]
Shamil 2022	23	0	18	9	50	30.0	SBT	High	0.56 [0.40, 0.72]	1.00 [0.66, 1.00]
Tenza-Lozano 2018	23	16	17	6	62	30.0	NR	Low	0.57 [0.41, 0.73]	0.27 [0.11, 0.50]
Carrie 2017	11	2	7	10	30	30.0	NR	Low	0.61 [0.36, 0.83]	0.83 [0.52, 0.98]
de Souza 2012	38	7	22	36	103	30.0	MV	Low	0.63 [0.50, 0.75]	0.84 [0.69, 0.93]
Spadaro 2016	23	4	11	13	51	30.0	SBT	High	0.68 [0.49, 0.83]	0.76 [0.50, 0.93]
O'Keefe 2001	77	6	11	1	95	30.0	MV	High	0.88 [0.79, 0.94]	0.14 [0.00, 0.58]
Vieira 2022	37	20	5	8	70	30.0	SBT	High	0.88 [0.74, 0.96]	0.29 [0.13, 0.49]
Zaytoun 2021	33	1	3	27	64	30.0	NR	High	0.92 [0.78, 0.98]	0.96 [0.82, 1.00]
Lim 2015	34	13	15	24	86	33.0	MV	High	0.69 [0.55, 0.82]	0.65 [0.47, 0.80]
Capdevila 1995	44	7	11	5	67	50.0	SBT	High	0.80 [0.67, 0.90]	0.42 [0.15, 0.72]



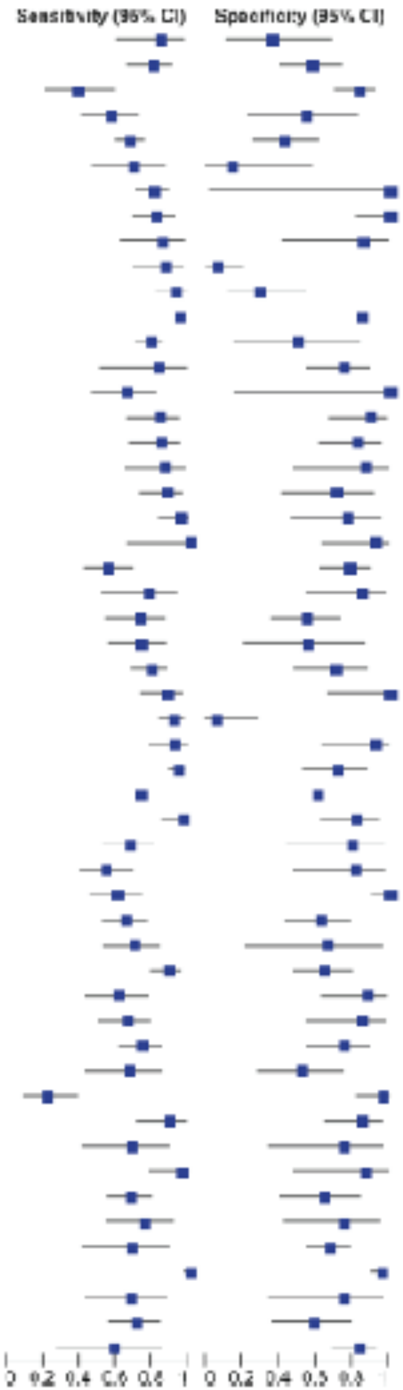
Airway occlusion pressure

Study	TP	FP	FN	TN	n	< cmH$_2$O Threshold	Condition	Risk of bias	Sensitivity (95% CI)	Specificity (95% CI)
de Souza 2012	44	19	16	24	103	2.3	MV	Low	0.73 [0.60, 0.84]	0.56 [0.40, 0.71]
Fernandez 2004	25	3	23	6	57	2.6	SBT	Low	0.52 [0.37, 0.67]	0.67 [0.30, 0.93]
Hurtado 2001	8	2	3	6	19	3.0	MV	Low	0.73 [0.39, 0.94]	0.75 [0.35, 0.97]
Azeredo 2017	215	16	62	38	331	3.1	MV	Low	0.78 [0.72, 0.82]	0.70 [0.56, 0.82]
Okamoto 1990	24	0	0	9	33	3.5	SBT	Low	1.00 [0.86, 1.00]	1.00 [0.66, 1.00]
Thabet 2020	6	7	15	12	40	3.6	SBT	Low	0.29 [0.11, 0.52]	0.63 [0.38, 0.84]
Liu 2010	66	4	7	14	91	3.7	SBT	Low	0.90 [0.81, 0.96]	0.78 [0.52, 0.94]
Montgomery 1987	5	2	2	5	14	3.8	SBT	High	0.71 [0.29, 0.96]	0.71 [0.29, 0.96]
Conti 2004	35	12	2	1	50	4.0	SBT	High	0.95 [0.82, 0.99]	0.08 [0.00, 0.36]
Vallverdu 1998	94	41	31	51	217	4.5	MV	Low	0.75 [0.67, 0.82]	0.55 [0.45, 0.66]
Rivera 1997	28	0	0	12	40	4.6	SBT	Low	1.00 [0.88, 1.00]	1.00 [0.74, 1.00]
Kaur 2022	29	4	2	15	50	4.7	SBT	High	0.94 [0.79, 0.99]	0.79 [0.54, 0.94]
Capdevila 1995	48	1	7	11	67	5.0	SBT	High	0.87 [0.76, 0.95]	0.92 [0.62, 1.00]
Sassoon 1993	34	6	1	4	45	5.5	NR	Low	0.97 [0.85, 1.00]	0.40 [0.12, 0.74]
Chittock 2000	38	7	13	10	68	7.5	SBT	Low	0.75 [0.60, 0.86]	0.59 [0.33, 0.82]



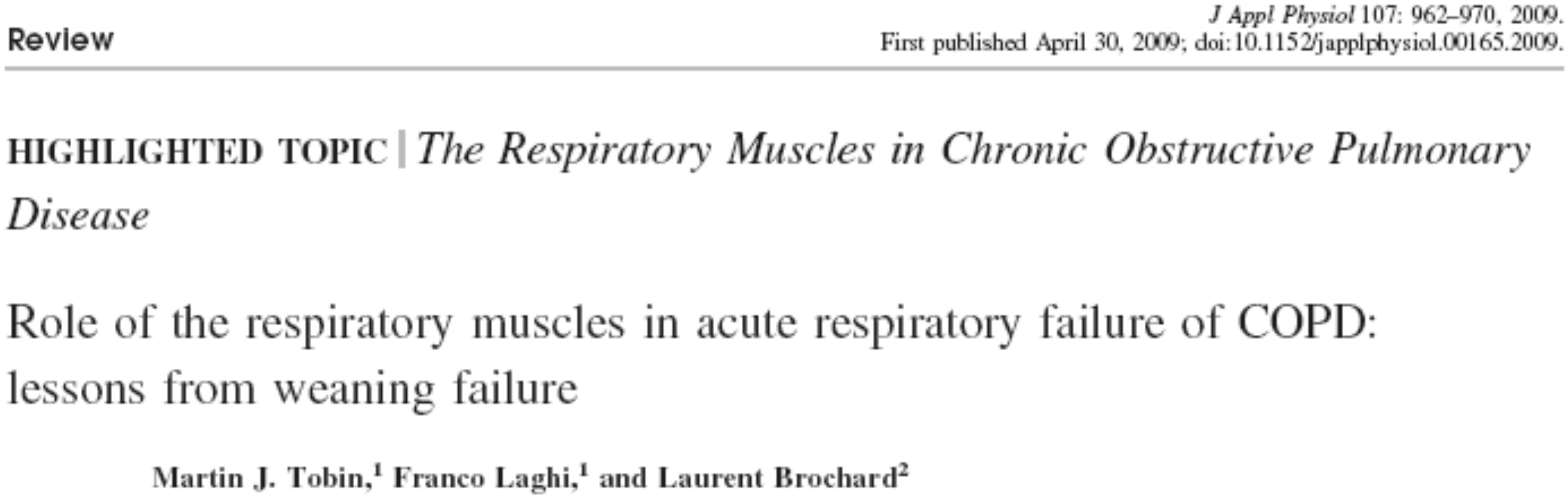
Diaphragm excursion

Study	TP	FP	FN	TN	n	≥ mm Threshold	Condition	Risk of bias	Sensitivity (95% CI)	Specificity (95% CI)
Elgazzar 2019	16	7	3	4	30	9.1	SBT	Low	0.84 [0.60, 0.97]	0.36 [0.11, 0.69]
Huang 2023	40	15	10	22	88	9.95	MV	High	0.80 [0.66, 0.90]	0.58 [0.41, 0.74]
Kim 2011	11	9	17	45	82	10.0	SBT	Low	0.39 [0.22, 0.59]	0.83 [0.71, 0.92]
Haji 2018	24	5	18	6	53	10.0	SBT	High	0.57 [0.41, 0.72]	0.55 [0.23, 0.83]
Vivier 2019	106	13	50	14	183	10.0	SBT	High	0.68 [0.60, 0.75]	0.42 [0.25, 0.61]
Baess 2016	16	6	7	1	30	10.0	SBT	Low	0.70 [0.47, 0.87]	0.14 [0.00, 0.58]
Varon-Vega 2021	67	0	16	1	84	10.0	SBT	Low	0.81 [0.71, 0.89]	1.00 [0.03, 1.00]
Osman 2017	42	0	9	18	69	10.0	SBT	Low	0.82 [0.69, 0.92]	1.00 [0.81, 1.00]
Flevari 2016	17	1	3	6	27	10.0	SBT	Low	0.85 [0.62, 0.97]	0.86 [0.42, 1.00]
Spadaro 2021	26	30	4	2	62	10.0	MV	Low	0.87 [0.69, 0.96]	0.06 [0.01, 0.21]
Palkar 2018	49	14	4	6	73	10.0	SBT	Low	0.92 [0.82, 0.98]	0.30 [0.12, 0.54]
Elrabili 2019	16	2	1	11	30	10.0	SBT	Low	0.94 [0.71, 1.00]	0.85 [0.55, 0.98]
Eksombatchai 2023	96	4	26	4	130	10.5	NR	High	0.79 [0.70, 0.86]	0.50 [0.16, 0.84]
Huang 2017	10	7	2	21	40	10.7	SBT	Low	0.83 [0.52, 0.98]	0.75 [0.55, 0.89]
Mariani 2015	21	0	11	2	34	11.0	SBT	Low	0.66 [0.47, 0.81]	1.00 [0.16, 1.00]
Kaur 2022	26	2	5	17	50	11.0	SBT	High	0.84 [0.66, 0.95]	0.89 [0.67, 0.99]
Jiang 2004	27	4	5	19	55	11.0	SBT	High	0.84 [0.67, 0.95]	0.83 [0.61, 0.95]
Saeed 2016	19	1	3	7	30	11.0	SBT	High	0.86 [0.65, 0.97]	0.88 [0.47, 1.00]
Farghaly 2017	35	4	5	10	54	11.0	SBT	High	0.88 [0.73, 0.96]	0.71 [0.42, 0.92]
Banerjee 2018	38	3	2	10	53	11.0	SBT	Low	0.95 [0.83, 0.99]	0.77 [0.46, 0.95]
Helmy 2021	9	1	0	12	22	[illegible]	[illegible]	[illegible]	0.66, 1.00]	0.92 [0.64, 1.00]
Xu 2022	33	8	26	29	96	[illegible]	[illegible]	[illegible]	0.42, 0.69]	0.78 [0.62, 0.90]
Alam 2022	14	2	4	11	31	[illegible]	[illegible]	[illegible]	0.52, 0.94]	0.85 [0.55, 0.98]
Samanta 2017	24	14	9	17	64	[illegible]	[illegible]	[illegible]	0.54, 0.87]	0.55 [0.36, 0.73]
Hirolli 2023	25	4	9	5	43	12.0	SBT	High	0.74 [0.56, 0.87]	0.56 [0.21, 0.86]
Hayat 2017	60	7	16	17	100	12.0	SBT	High	0.79 [0.68, 0.87]	0.71 [0.49, 0.87]
Shamil 2022	38	0	5	9	52	12.0	SBT	High	0.88 [0.74, 0.96]	1.00 [0.66, 1.00]
Fossat 2022	76	15	7	1	100	12.0	SBT	High	0.92 [0.83, 0.97]	0.06 [0.00, 0.30]
Abbas 2018	34	1	3	12	50	12.0	SBT	Low	0.92 [0.78, 0.98]	0.92 [0.64, 1.00]
Saravan 2022	160	8	11	21	200	12.1	SBT	High	0.94 [0.89, 0.97]	0.72 [0.53, 0.87]
Vieira 2022	33	14	12	22	81	12.5	SBT	High	0.73 [0.58, 0.85]	0.61 [0.43, 0.77]
Elshazly 2020	33	5	1	23	62	12.5	SBT	Low	0.97 [0.85, 1.00]	0.82 [0.63, 0.94]
Luo 2017	34	2	16	8	60	12.6	SBT	High	0.68 [0.53, 0.80]	0.80 [0.44, 0.97]
Theerawit 2018	28	2	23	9	62	12.8	SBT	Low	0.55 [0.40, 0.69]	0.82 [0.48, 0.98]
Mawla 2022	31	0	20	39	90	13.0	SBT	Low	0.61 [0.46, 0.74]	1.00 [0.91, 1.00]
Li 2021	45	12	24	20	101	13.0	SBT	Low	0.65 [0.53, 0.76]	0.63 [0.44, 0.79]
Gok 2021	28	2	12	4	46	13.1	SBT	High	0.70 [0.53, 0.83]	0.67 [0.22, 0.96]
Song 2022	65	13	8	24	110	13.5	SBT	High	0.89 [0.80, 0.95]	0.65 [0.47, 0.80]
Spadaro 2016	21	2	13	15	51	14.0	SBT	High	0.62 [0.44, 0.78]	0.88 [0.64, 0.99]
Yoo 2018	31	2	16	11	60	14.0	SBT	High	0.66 [0.51, 0.79]	0.85 [0.55, 0.98]
Khan 2018	46	7	16	21	90	14.0	SBT	High	0.74 [0.62, 0.84]	0.75 [0.55, 0.89]
Thabet 2020	14	9	7	10	40	14.1	SBT	Low	0.67 [0.43, 0.85]	0.53 [0.29, 0.76]
Zaytoun 2021	8	1	28	24	61	16.0	SBT	High	0.22 [0.10, 0.39]	0.96 [0.80, 1.00]
Ali 2017	26	4	3	22	64	16.0	MV	High	0.88 [0.72, 0.96]	0.85 [0.65, 0.96]
Al Tayar 2022	11	2	5	6	24	16.0	SBT	High	0.69 [0.41, 0.89]	0.75 [0.35, 0.97]
Saeed 2019	23	1	1	7	32	16.0	MV	Low	0.96 [0.79, 1.00]	0.88 [0.47, 1.00]
Mohamed 2021	41	7	19	13	80	17.0	SBT	High	0.68 [0.55, 0.80]	0.65 [0.41, 0.85]
Zhang 2020	19	3	6	9	37	17.2	SBT	High	0.76 [0.55, 0.91]	0.75 [0.43, 0.95]
Amara 2023	11	21	5	44	81	17.9	NR	Low	0.69 [0.41, 0.89]	0.68 [0.55, 0.79]
Abdelhafeez 2019	117	5	0	118	240	18.4	SBT	High	1.00 [0.97, 1.00]	0.96 [0.91, 0.99]
Eid 2021	13	2	6	6	27	22.1	SBT	High	0.68 [0.43, 0.87]	0.75 [0.35, 0.97]
Carrie 2017	32	9	13	13	67	27.0	SBT	Low	0.71 [0.56, 0.84]	0.59 [0.36, 0.79]
Saad 2022	7	8	5	40	60	61.0	SBT	Low	0.58 [0.28, 0.85]	0.83 [0.70, 0.93]



DTF n°1

Faiblesse musculaire



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]

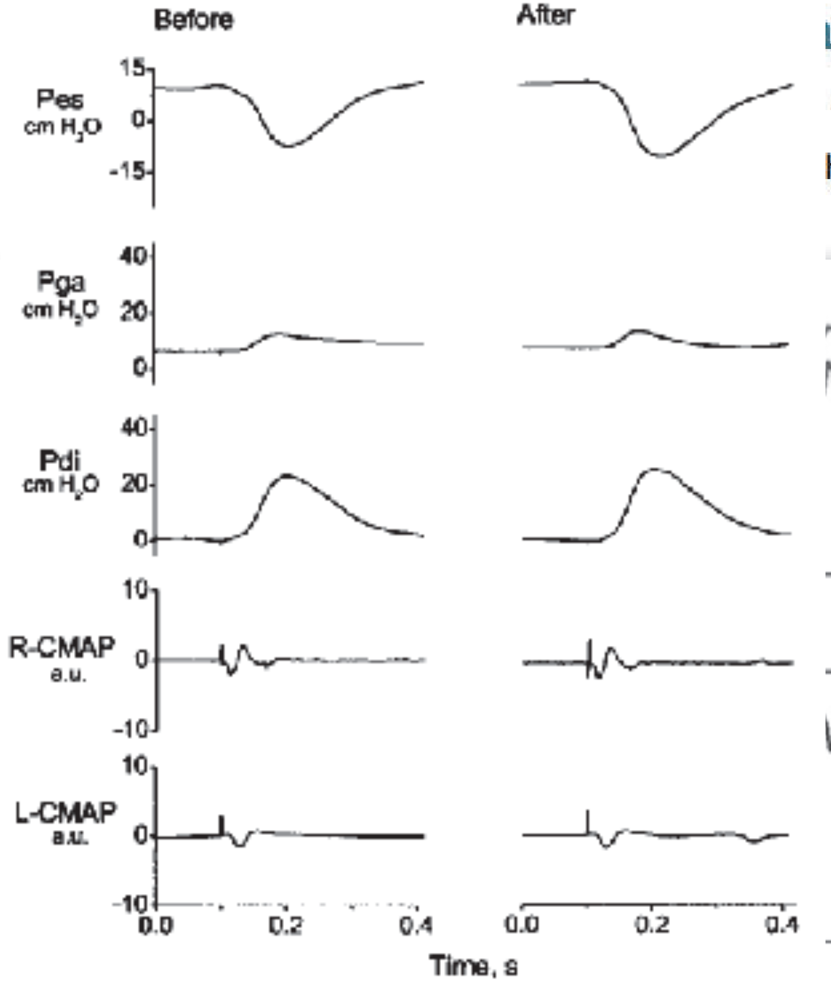
Is Weaning Failure Caused by Low-Frequency Fatigue of the Diaphragm?

Voir de la fatigue ?

Franco Laghi, Steven E. Cattapan, Amal Jubran, Sairam Parthasarathy, Paul Warshawsky, Yoon-Sub A. Choi, and Martin J. Tobin

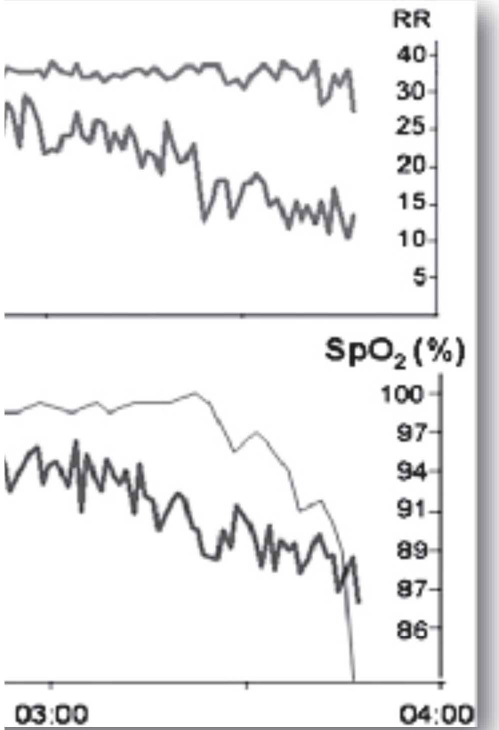
Am J Respir Crit Care Med Vol 167. pp 120–127, 2003

Respiratory and Critical Care Medicine



gm Fatigue under
Assist

hard M.D., , Alain Mercat M.D., , and

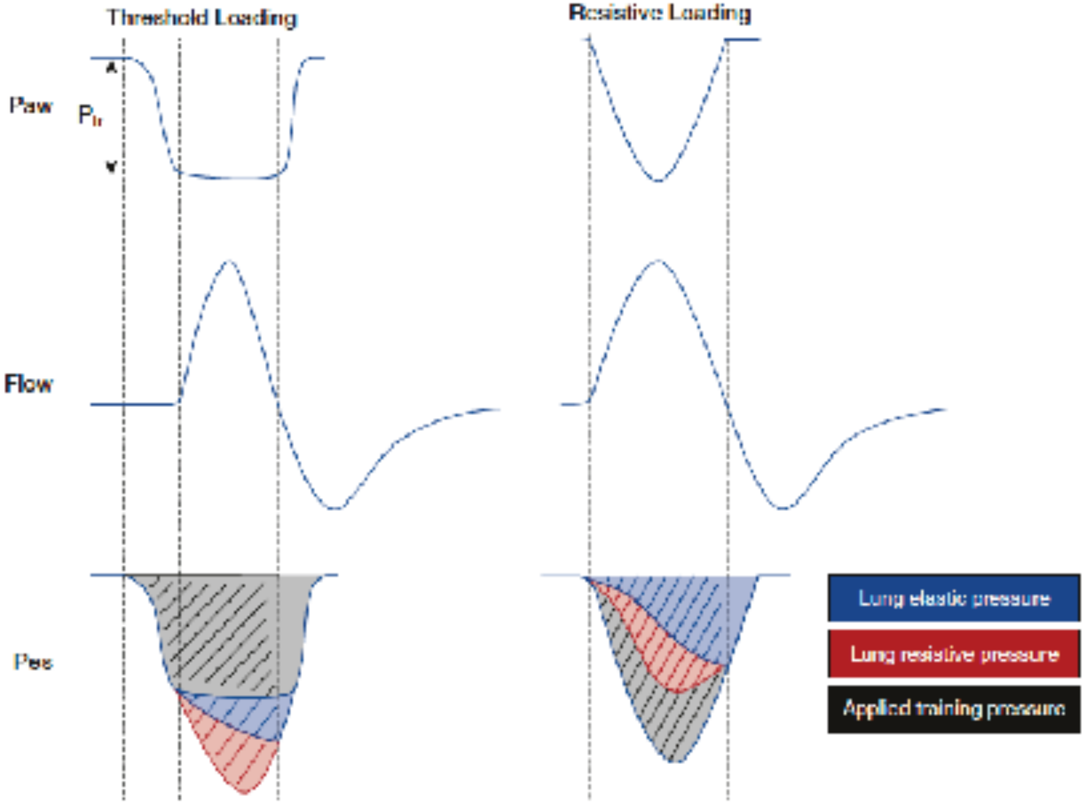


ORIGINAL RESEARCH

Inspiratory Muscle Rehabilitation in Critically Ill Adults

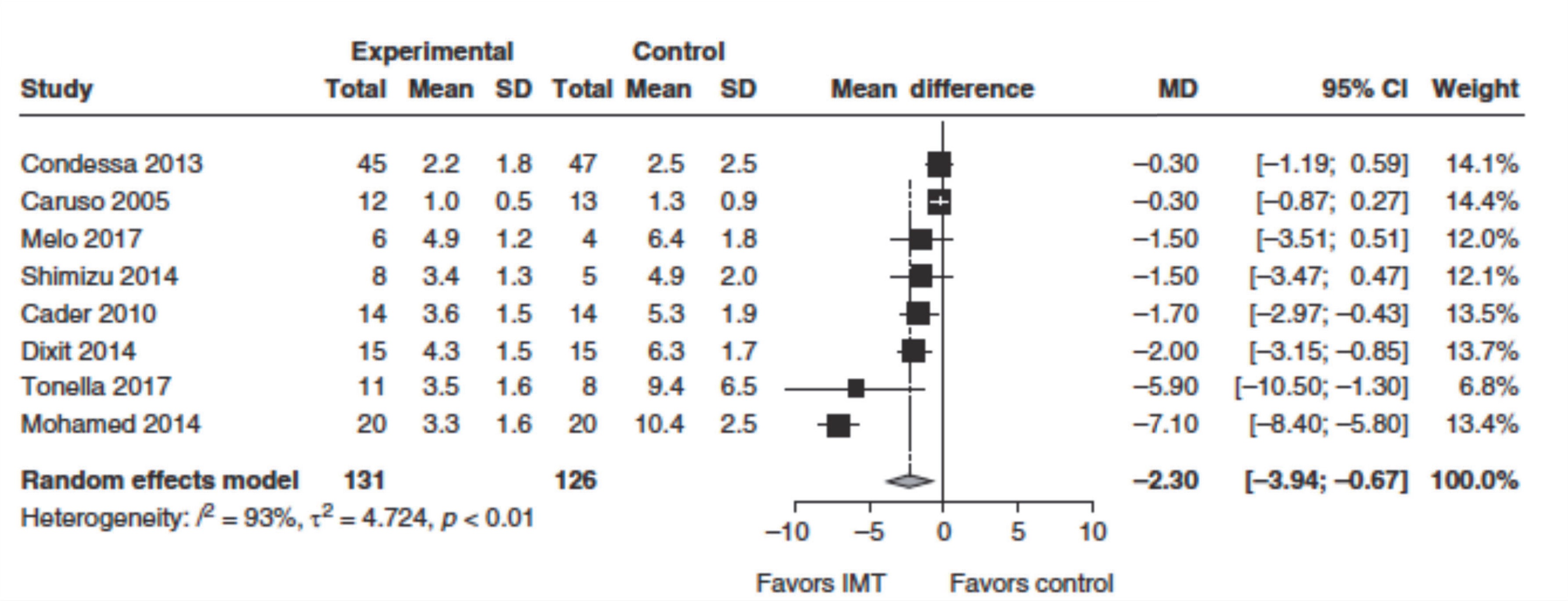
A Systematic Review and Meta-Analysis

Stefannie Vorona[1], Umberto Sabatini[1], Sulaiman Al-Maqbali[1], Michele Bertoni[1], Martin Dres[2,3], Bernie Bissett[4,5], Frank Van Haren[5,6,7], A. Daniel Martin[8], Cristian Urrea[1], Debbie Brace[1], Matteo Parotto[9,10,11], Margaret S. Herridge[1,9,12], Neill K. J. Adhikari[9,13,14], Eddy Fan[1,9,12,15], Luana T. Melo[16], W. Darlene Reid[9,16], Laurent J. Brochard[2,9,12], Niall D. Ferguson[1,9,12,14,15], and Ewan C. Goligher[1,9,15]


Threshold Loading
Resistive Loading
Paw
P_{th}
Flow
Pes
Lung elastic pressure
Lung resistive pressure
Applied training pressure

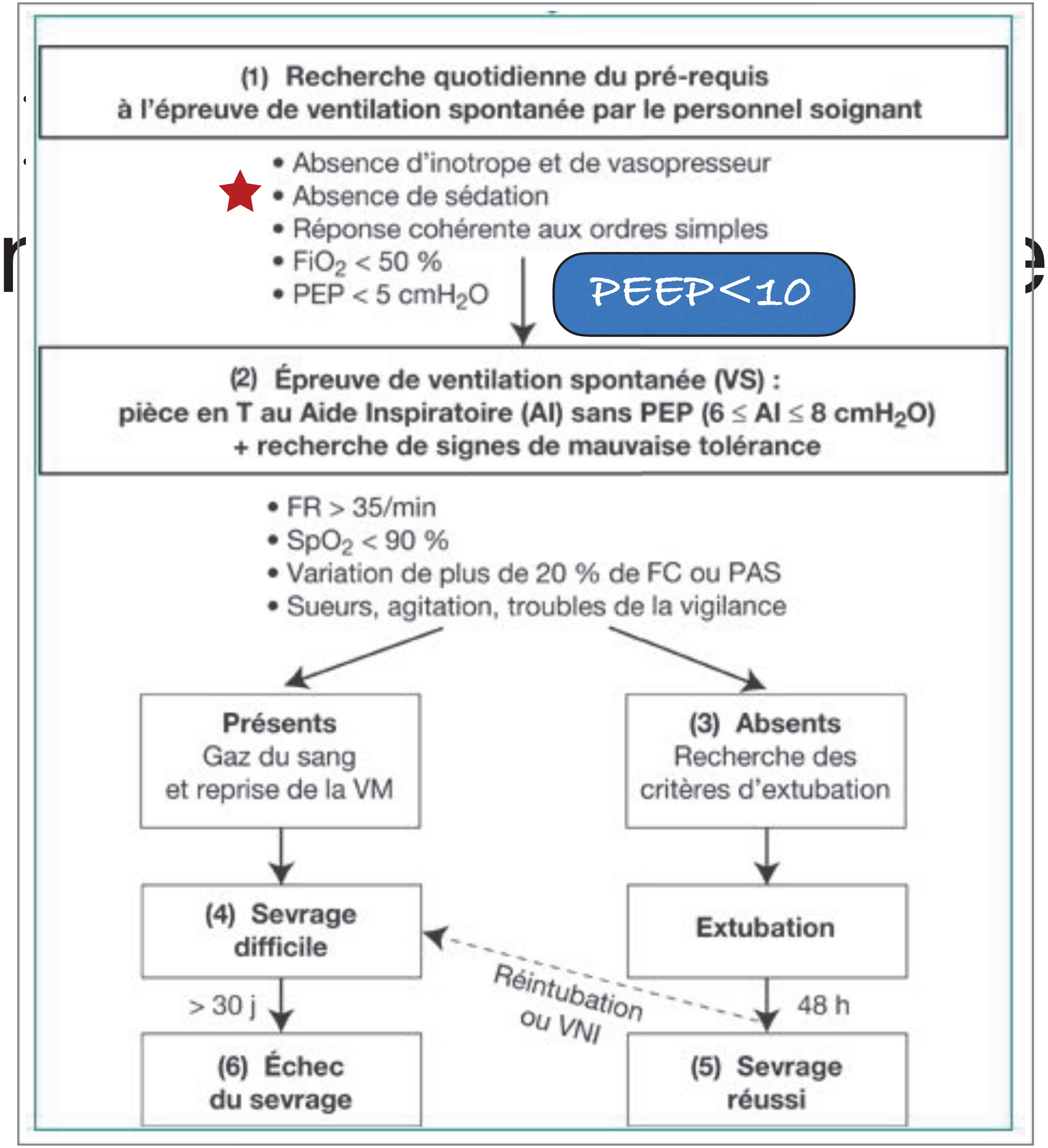
Outcome	Impact Effect (95% CI)	No. of Participants (RCTs)	Quality of the Evidence (GRADE)
Change in maximal inspiratory pressure from baseline after IMT	Mean difference in change 6 (5 to 8) cm H_2O higher in IMT group than in control group Pooled ratio of means for change in MIP relative to baseline MIP, 1.21 (1.16 to 1.26)	647 (15 RCTs)	⊕○○○ Very low*,†,‡
Change in maximal inspiratory pressure from baseline after IMT (sensitivity analysis excluding studies at high risk of bias)	Mean difference 9 (7 to 12) cm H_2O higher in IMT group than in control group	175 (3 RCTs)	⊕⊕⊕⊕ High
Maximal inspiratory pressure after IMT	Mean difference 7 (6 to 8) cm H_2O higher in IMT group than in control group	575 (15 RCTs)	⊕⊕○○ Low*,‡
Change in maximal expiratory pressure from baseline after IMT	Mean difference in change 9 (5 to 14) cm H_2O higher in IMT group than in control group Pooled ratio of means for change in MEP relative to baseline MEP, 1.39 (1.27 to 1.54)	153 (4 RCTs)	⊕⊕⊕○ Moderate*
Change in maximal expiratory pressure from baseline after IMT (sensitivity analysis excluding studies at high risk of bias)	Mean difference in change 9 (5 to 14) cm H_2O higher in IMT group than in control group	106 (2 RCTs)	⊕⊕⊕⊕ High
Duration of ventilation	Pooled duration of ventilation was 4.1 (0.8 to 7.4) d shorter in IMT group than in control group	325 (9 RCTs)	⊕○○○ Very low*,†,‡,§
Duration of ventilation (sensitivity analysis excluding studies at high risk of bias)	Pooled duration of ventilation was 4.6 (−1.0 to 10.1) d shorter in IMT group than in control group	220 (4 RCTs)	⊕⊕○○ Low†,§
Duration of weaning from mechanical ventilation	Pooled duration of weaning from mechanical ventilation was 2.3 (0.7 to 3.9) d shorter in IMT group than in control group	257 (8 RCTs)	⊕○○○ Very low*,†,§
Duration of weaning (sensitivity analysis excluding studies at high risk of bias)	Pooled duration of weaning from mechanical ventilation was 3.2 (0.6 to 5.8) d shorter in IMT group than in control group	208 (5 RCTs)	⊕⊕○○ Low†,§
ICU length of stay	Length of stay in ICU was 3.1 (−1.0 to 7.1) d shorter in IMT group than in control group	28 (2 RCTs)	⊕○○○ Very low*,‡,§
Mortality in ICU	Pooled relative risk of death in ICU was 0.67 (0.20 to 2.20) in IMT group compared with control group	197 (3 RCTs)	⊕⊕○○ Low‡,§

The impact of inspiratory muscle training (IMT) on the duration of weaning from mechanical ventilation



Study	Experimental Total	Experimental Mean	Experimental SD	Control Total	Control Mean	Control SD	MD	95% CI	Weight
Condessa 2013	45	2.2	1.8	47	2.5	2.5	−0.30	[−1.19; 0.59]	14.1%
Caruso 2005	12	1.0	0.5	13	1.3	0.9	−0.30	[−0.87; 0.27]	14.4%
Melo 2017	6	4.9	1.2	4	6.4	1.8	−1.50	[−3.51; 0.51]	12.0%
Shimizu 2014	8	3.4	1.3	5	4.9	2.0	−1.50	[−3.47; 0.47]	12.1%
Cader 2010	14	3.6	1.5	14	5.3	1.9	−1.70	[−2.97; −0.43]	13.5%
Dixit 2014	15	4.3	1.5	15	6.3	1.7	−2.00	[−3.15; −0.85]	13.7%
Tonella 2017	11	3.5	1.6	8	9.4	6.5	−5.90	[−10.50; −1.30]	6.8%
Mohamed 2014	20	3.3	1.6	20	10.4	2.5	−7.10	[−8.40; −5.80]	13.4%
Random effects model	**131**			**126**			**−2.30**	**[−3.94; −0.67]**	**100.0%**

Heterogeneity: $I^2 = 93\%$, $\tau^2 = 4.724$, $p < 0.01$



(1) Recherche quotidienne du pré-requis à l'épreuve de ventilation spontanée par le personnel soignant

- Absence d'inotrope et de vasopresseur
- ★ Absence de sédation
- Réponse cohérente aux ordres simples
- $FiO_2 < 50$ %
- PEP < 5 cmH_2O

PEEP<10

(2) Épreuve de ventilation spontanée (VS) : pièce en T au Aide Inspiratoire (AI) sans PEP ($6 \leq AI \leq 8$ cmH_2O) + recherche de signes de mauvaise tolérance

- FR > 35/min
- $SpO_2 < 90$ %
- Variation de plus de 20 % de FC ou PAS
- Sueurs, agitation, troubles de la vigilance

Présents
Gaz du sang
et reprise de la VM

(3) Absents
Recherche des
critères d'extubation

(4) Sevrage difficile

Extubation

> 30 j

48 h

Réintubation ou VNI

(6) Échec du sevrage

(5) Sevrage réussi

LA VENTILATION ASSISTEE LORS DU SEVRAGE

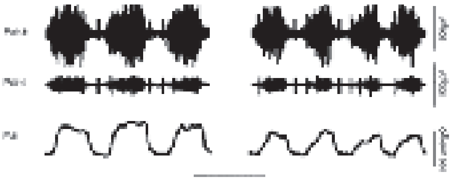
- Niveau d’aide
- Synchronisation

Problématiques du mode lors du sevrage

- Synchroniser le patient au respirateur/limiter les asynchronies
- Adapter l'aide inspiratoire aux besoins du patient
    - VSAI: aide fixe à adapter manuellement
    - Intelligence artificielle en VSAI: Smartcare
    - Neurally Adjusted Ventilatory Assist: NAVA
    - Proportionnal Assist Ventilation: PAV+

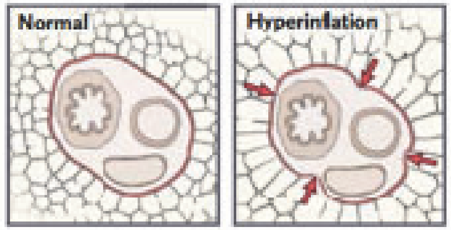
Début effort intense

1 minutes après après

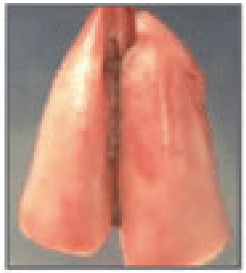


JAP 2001;90:1691-1699

Ventilation à haut volume

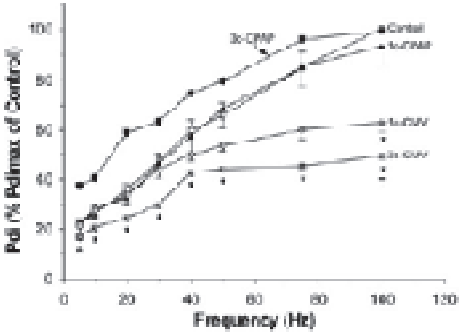


Rupture de paroi fuite aérique



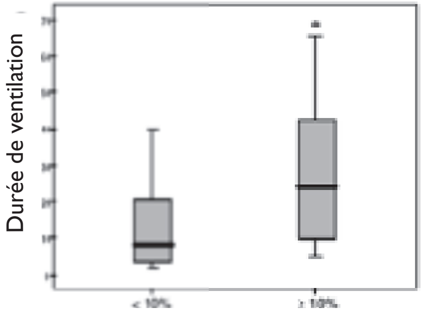
Surdistension

N Engl J Med 2013;369:2126-36



JAP 2002;92:2585-2595

Dysfonctions



Index d'asynchronies

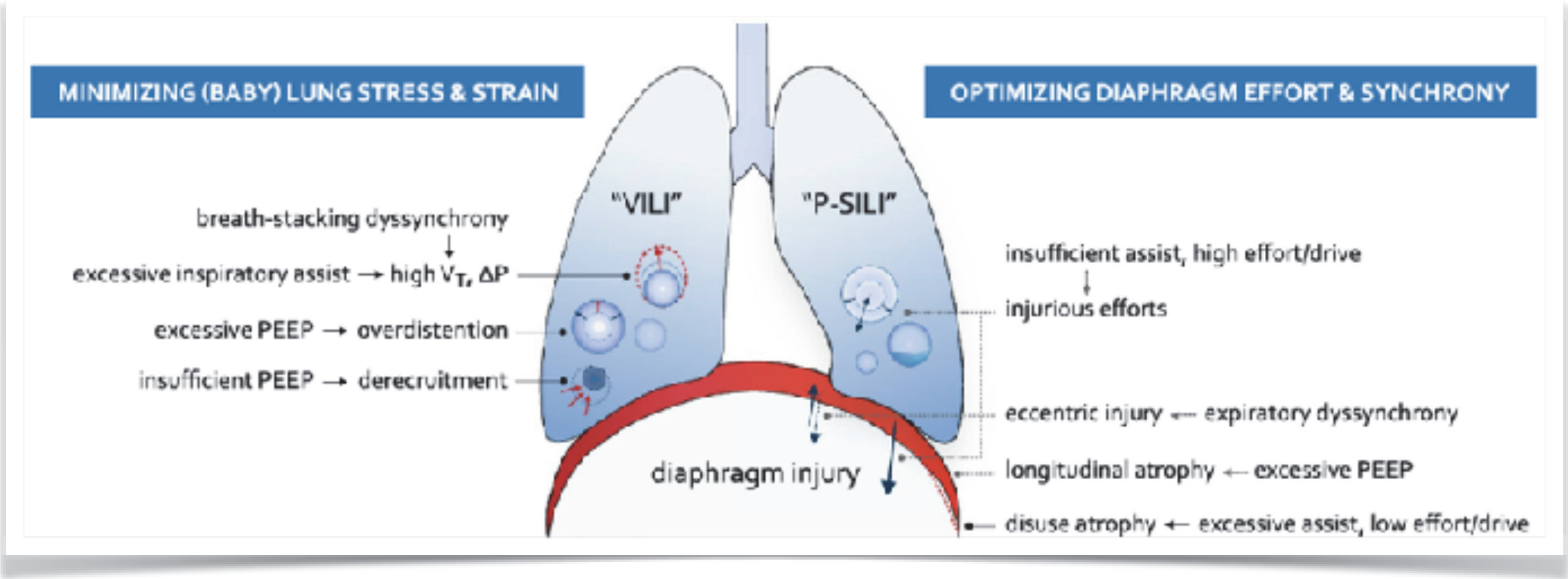
Intensive Care Med 2006;32:1515-1522

Niveau d'assistance

Intensive Care Med (2020) 46:2314–2326
https://doi.org/10.1007/s00134-020-06288-9

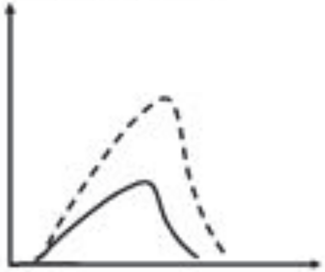
NARRATIVE REVIEW

Clinical strategies for implementing lung and diaphragm-protective ventilation: avoiding insufficient and excessive effort

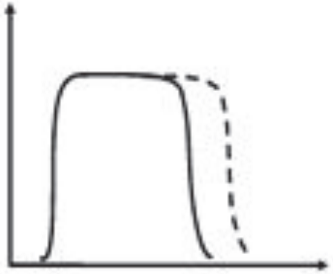

MINIMIZING (BABY) LUNG STRESS & STRAIN
OPTIMIZING DIAPHRAGM EFFORT & SYNCHRONY
"VILI"
"P-SILI"
breath-stacking dyssynchrony
excessive inspiratory assist → high V_T, ΔP
excessive PEEP → overdistention
insufficient PEEP → derecruitment
insufficient assist, high effort/drive
injurious efforts
eccentric injury ← expiratory dyssynchrony
longitudinal atrophy ← excessive PEEP
disuse atrophy ← excessive assist, low effort/drive
diaphragm injury

Pmus + Pvent = Volume x E + Débit x R

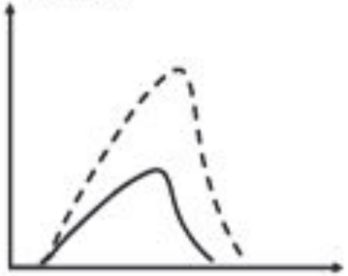
PAV+ et NAVA (Paw)



VSAI (Paw)



Effort (Pmus)



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Journal of Medicine

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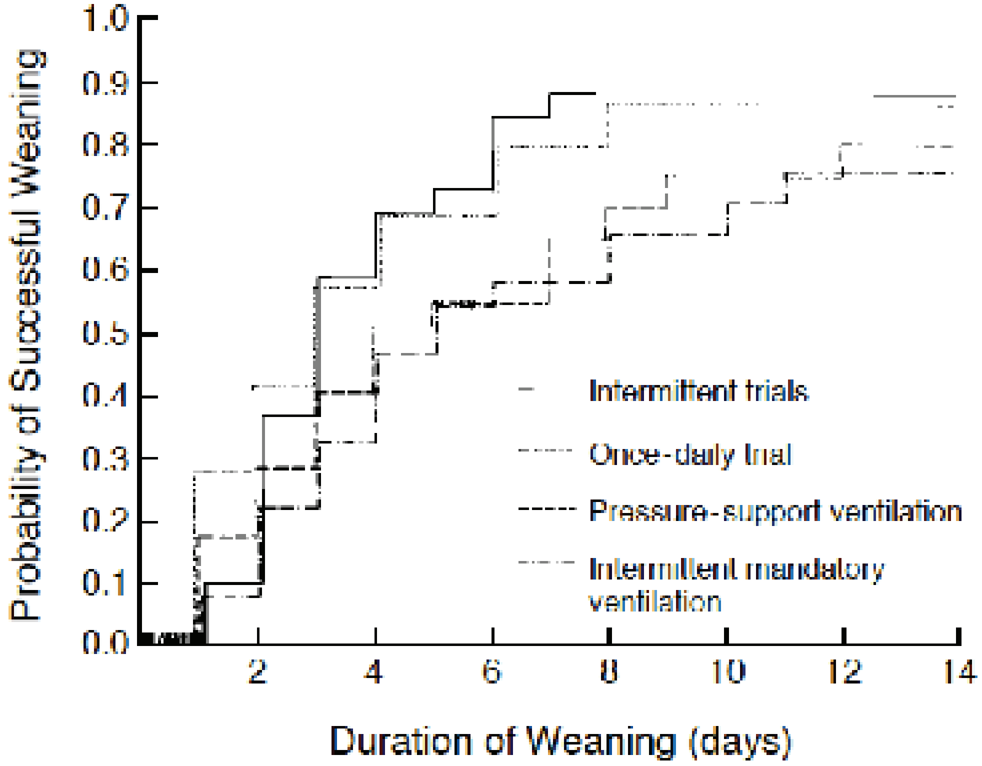
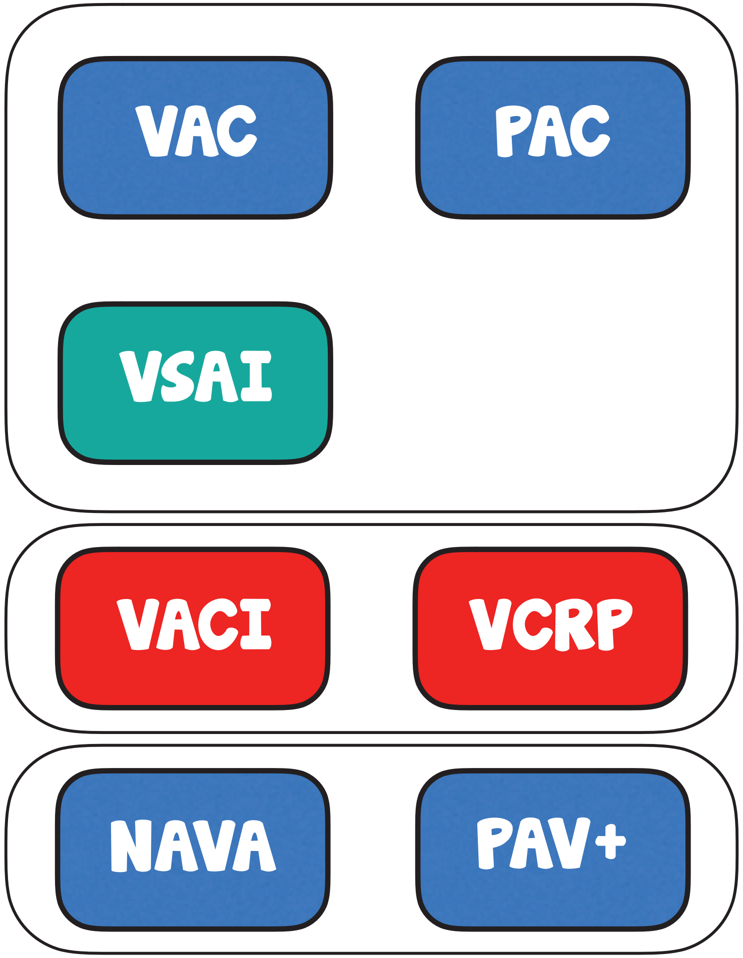
Volume 332 FEBRUARY 9, 1995 Number 6

A COMPARISON OF FOUR METHODS OF WEANING PATIENTS FROM MECHANICAL VENTILATION

Andrés Esteban, M.D., Ph.D., Fernando Frutos, M.D., Martin J. Tobin, M.D., Inmaculada Alía, M.D.,
José F. Solsona, M.D., Inmaculada Valverdú, M.D., Rafael Fernández, M.D.,
Miguel A. de la Cal, M.D., Salvador Benito, M.D., Ph.D., Roser Tomás, M.D.,
Demetrio Carriedo, M.D., Santiago Macías, M.D., and Jesús Blanco, M.D.,
for the Spanish Lung Failure Collaborative Group*



VS et modes



VAC

PAC

VSAI

VACI

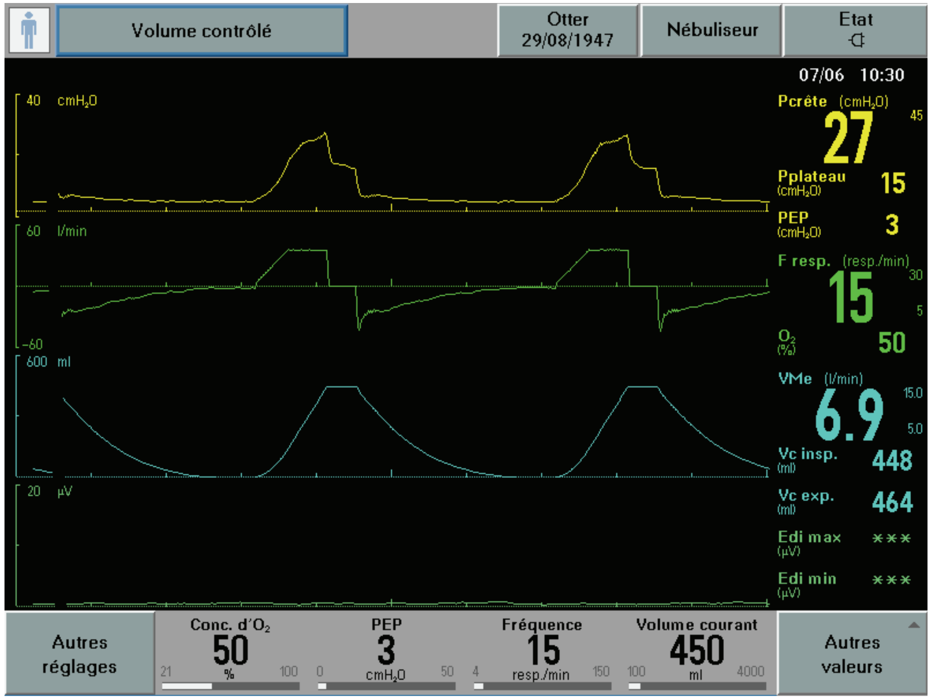
VCRP

NAVA

PAV+

Le Niveau d'Aide

- En fonction du VTE 6 à 8 ml.kg PBW
- En fonction de l'effort: Pocc, P 0,1t, Pmo, EAdi Index Pdi, PTP oeso, Pmus

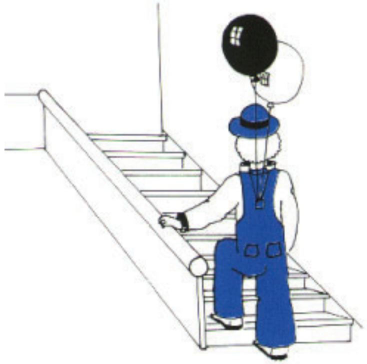

Volume contrôlé
Nébuliseur
Etat
40 cmH$_2$O
60 l/min
-60
600 ml
20 µV
45
30
5
15.0
5.0
Autres réglages
Autres valeurs
21
100
0
50
4
150
100
4000

Otter
29/08/1947

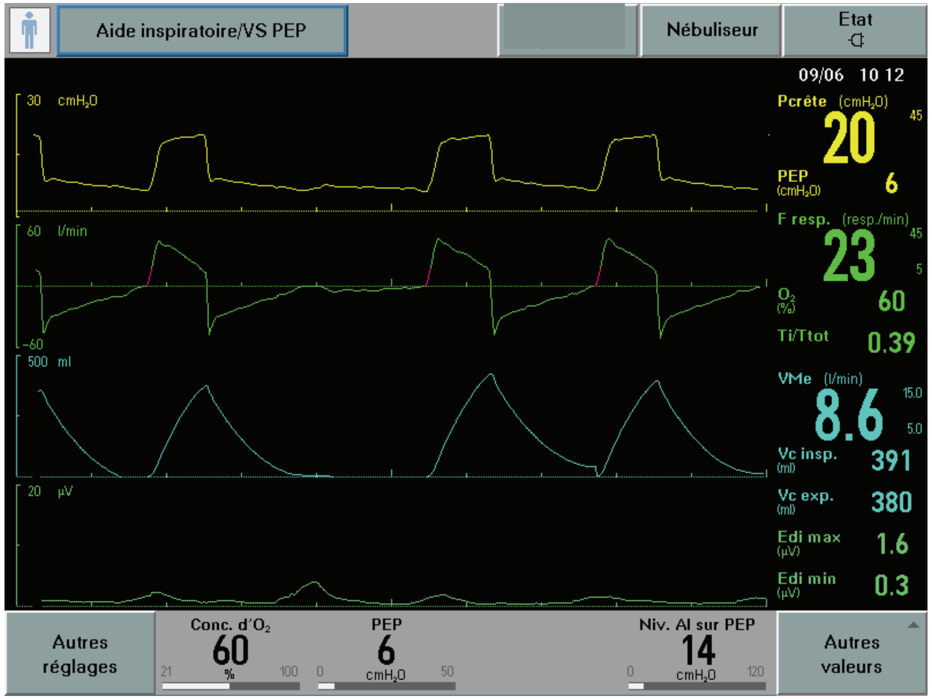
07/06 10:30

Pcrête (cmH$_2$O) 27
Pplateau (cmH$_2$O) 15
PEP (cmH$_2$O) 3
F resp. (resp./min) 15
O$_2$ (%) 50
VMe (l/min) 6.9
Vc insp. (ml) 448
Vc exp. (ml) 464
Edi max (µV) ***
Edi min (µV) ***

Conc. d'O$_2$ 50 %
PEP 3 cmH$_2$O
Fréquence 15 resp./min
Volume courant 450 ml



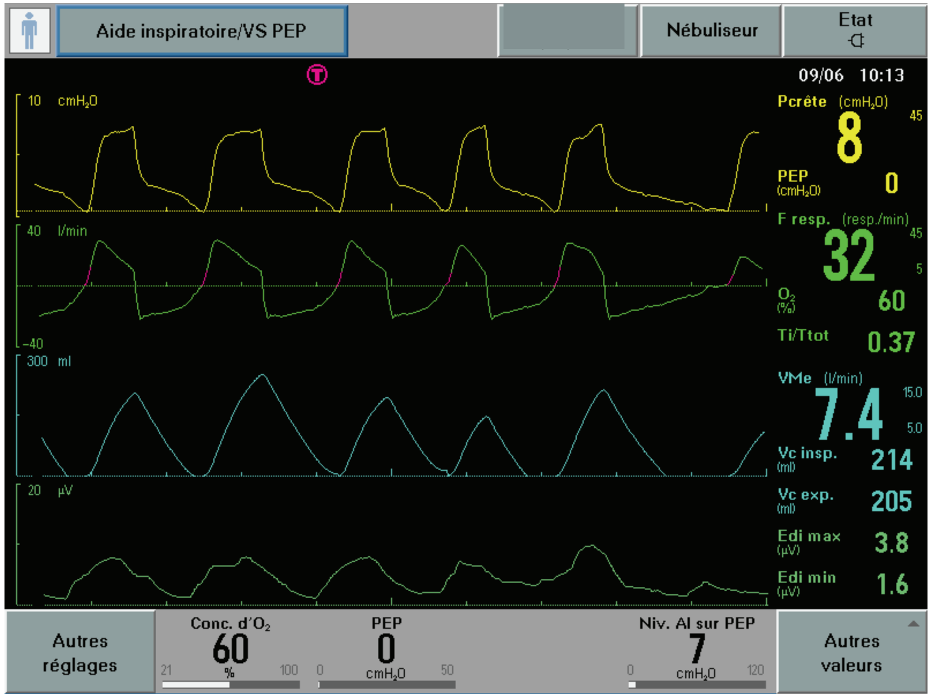
Le bon niveau d'aide dans le sevrage ?


Aide inspiratoire/VS PEP
Nébuliseur
Etat
30 cmH$_2$O
60 l/min
-60
500 ml
20 µV
45
45
5
15.0
5.0
Autres réglages
Autres valeurs
21
100
0
50
0
120

09/06 10 12

Pcrête (cmH$_2$O) 20
PEP (cmH$_2$O) 6
F resp. (resp./min) 23
O$_2$ (%) 60
Ti/Ttot 0.39
VMe (l/min) 8.6
Vc insp. (ml) 391
Vc exp. (ml) 380
Edi max (µV) 1.6
Edi min (µV) 0.3

Conc. d'O$_2$ 60 %
PEP 6 cmH$_2$O
Niv. AI sur PEP 14 cmH$_2$O


Aide inspiratoire/VS PEP
Nébuliseur
Etat
10 cmH$_2$O
40 l/min
-40
300 ml
20 µV
45
45
5
15.0
5.0
Autres réglages
Autres valeurs
21
100
0
50
0
120

09/06 10:13

Pcrête (cmH$_2$O) 8
PEP (cmH$_2$O) 0
F resp. (resp./min) 32
O$_2$ (%) 60
Ti/Ttot 0.37
VMe (l/min) 7.4
Vc insp. (ml) 214
Vc exp. (ml) 205
Edi max (µV) 3.8
Edi min (µV) 1.6

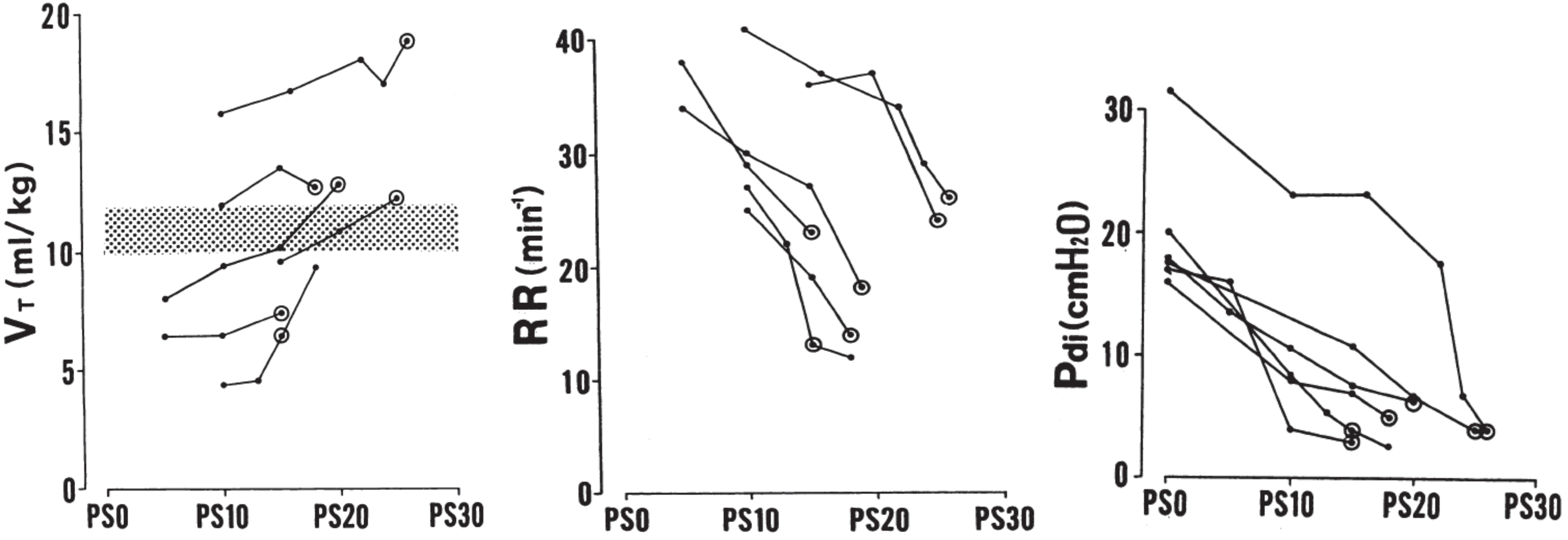
Conc. d'O$_2$ 60 %
PEP 0 cmH$_2$O
Niv. AI sur PEP 7 cmH$_2$O

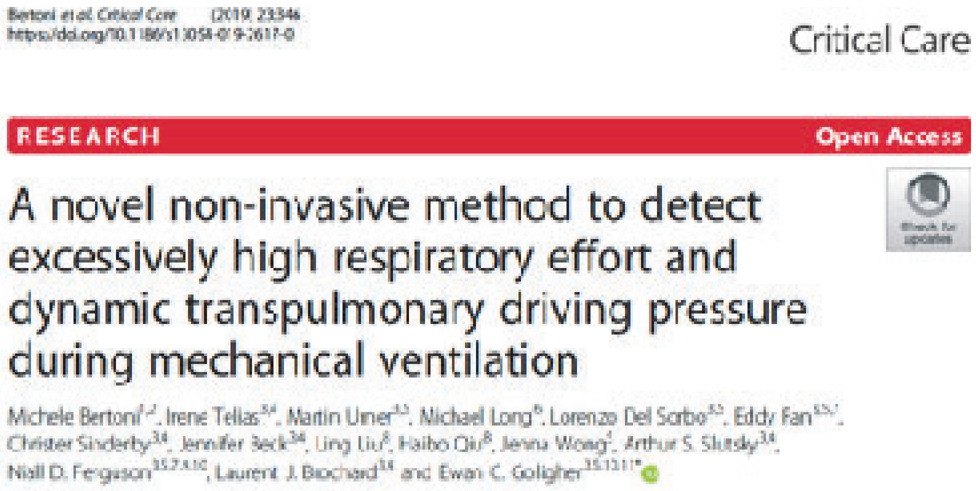
Determination of the optimal pressure support level evaluated by measuring transdiaphragmatic pressure.

T Kimura, J Takezawa, K Nishiwaki and Y Shimada

Chest 1991;100;112-117

Niveau d'aide ?





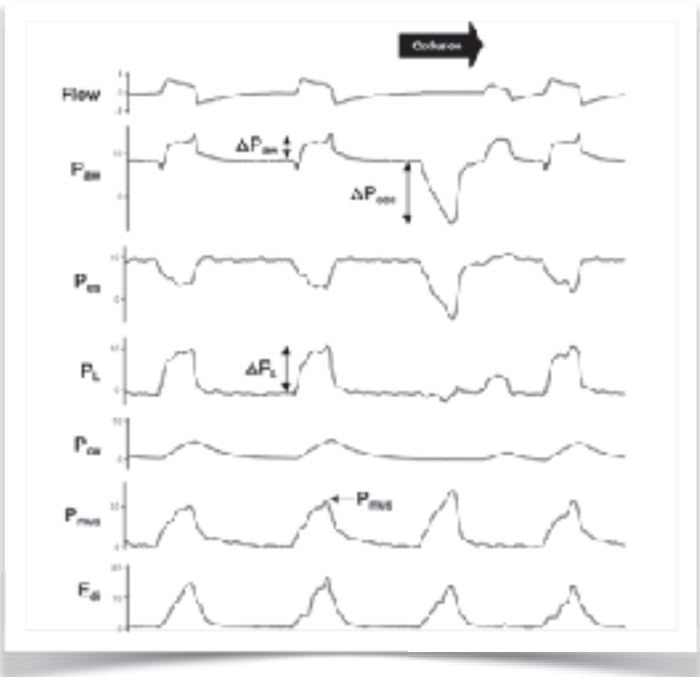
Bertoni *et al. Critical Care* (2019) 23:346
https://doi.org/10.1186/s13054-019-2617-0

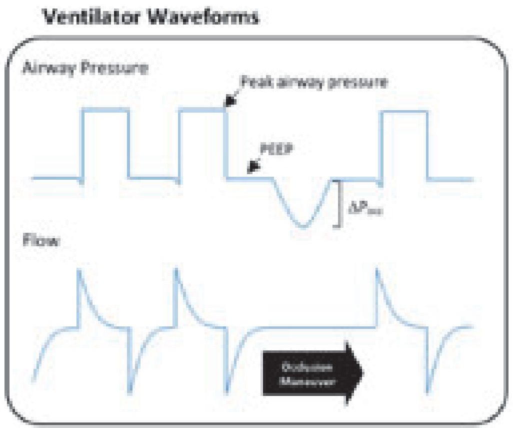
Critical Care

RESEARCH **Open Access**

A novel non-invasive method to detect excessively high respiratory effort and dynamic transpulmonary driving pressure during mechanical ventilation

Michele Bertoni[1,2], Irene Telias[3,4], Martin Urner[4,5], Michael Long[6], Lorenzo Del Sorbo[4,5], Eddy Fan[4,5,7], Christer Sinderby[3,4], Jennifer Beck[3,4], Ling Liu[8], Haibo Qiu[8], Jenna Wong[1], Arthur S. Slutsky[3,4], Niall D. Ferguson[3,5,7,9,10], Laurent J. Brochard[3,4] and Ewan C. Goligher[3,5,11,12]*



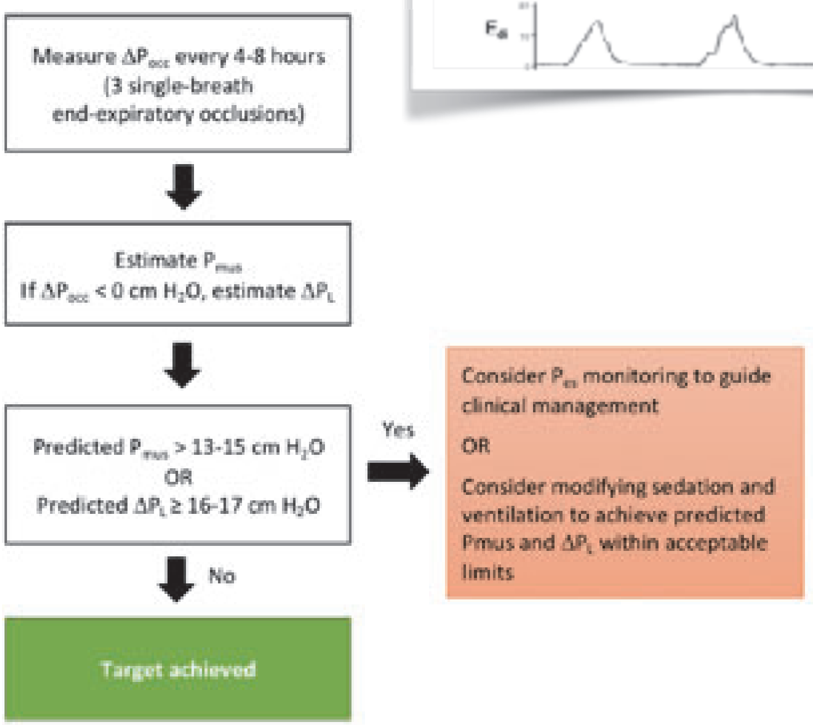


Computations

Predicted Pmus = -3/4 x ΔP_{occ}

Predicted ΔP_L = (Peak airway pressure - PEEP) - 2/3 x ΔP_{occ}

Note: ΔP_{occ} is always ≤ 0 cm H_2O (the magnitude of decrease in airway pressure from inspiratory effort during the occlusion)



Measure ΔP_{occ} every 4-8 hours
(3 single-breath
end-expiratory occlusions)

Estimate P_{mus}
If ΔP_{occ} < 0 cm H_2O, estimate ΔP_L

Predicted P_{mus} > 13-15 cm H_2O
OR
Predicted $\Delta P_L \geq$ 16-17 cm H_2O

Yes

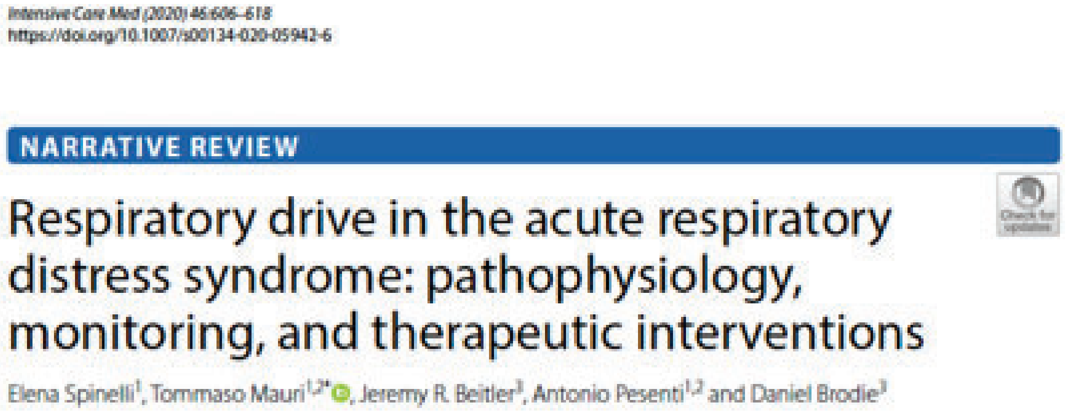
Consider P_{es} monitoring to guide clinical management

OR

Consider modifying sedation and ventilation to achieve predicted Pmus and ΔP_L within acceptable limits

No

Target achieved

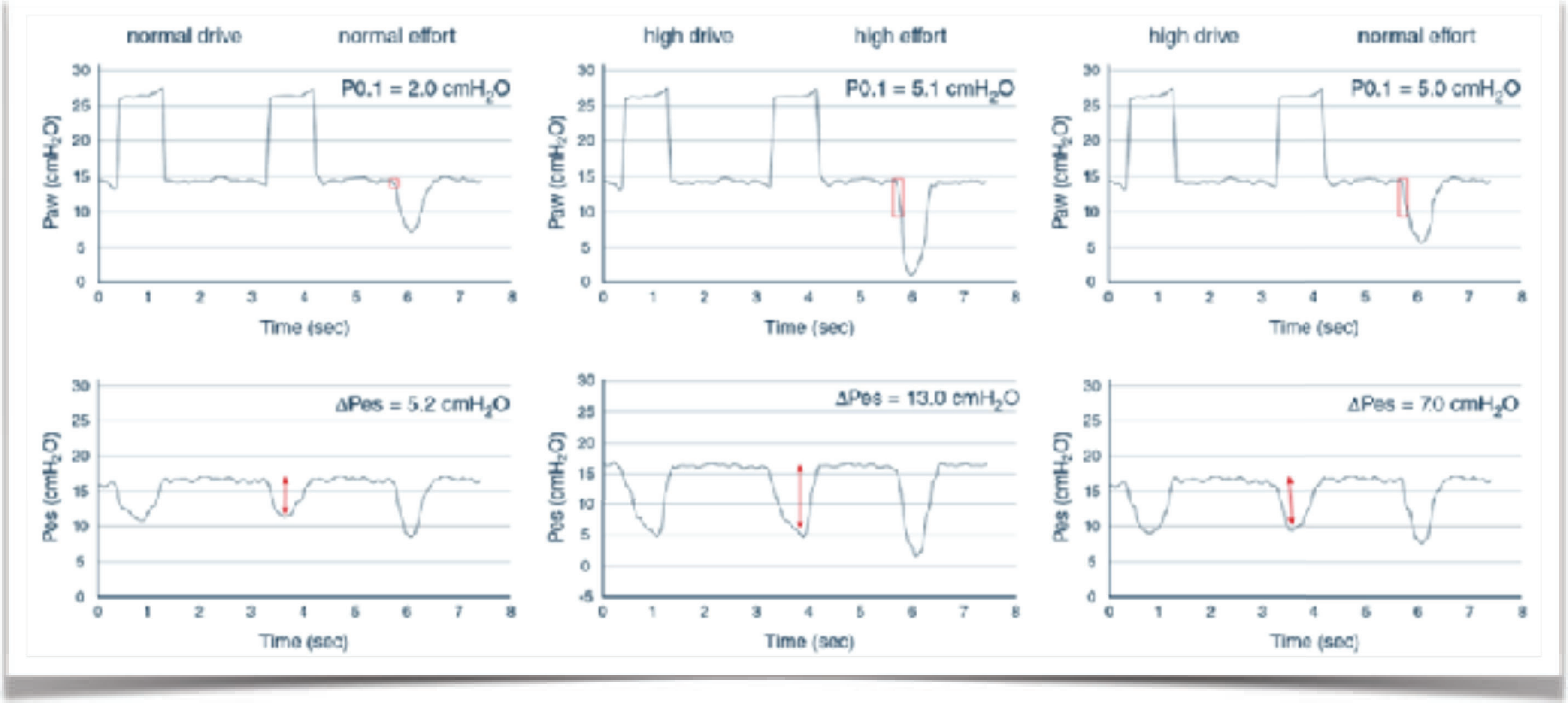


Intensive Care Med (2020) 46:606–618
https://doi.org/10.1007/s00134-020-05942-6

NARRATIVE REVIEW

Respiratory drive in the acute respiratory distress syndrome: pathophysiology, monitoring, and therapeutic interventions

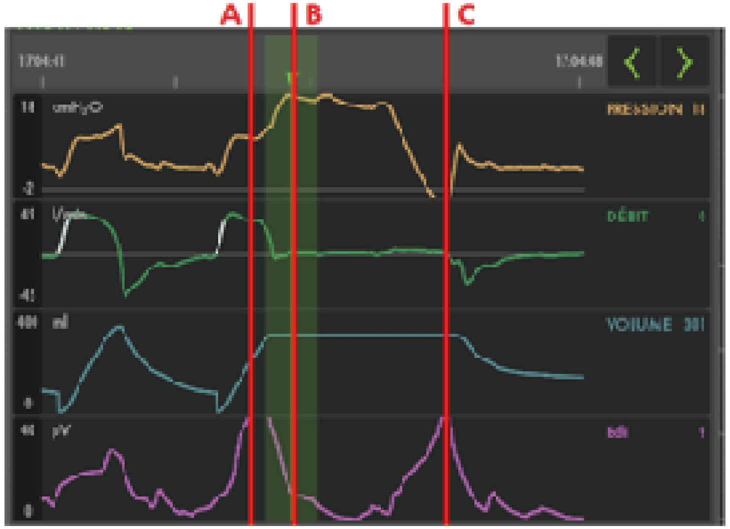
Elena Spinelli[1], Tommaso Mauri[1,2*], Jeremy R. Beitler[3], Antonio Pesenti[1,2] and Daniel Brodie[3]



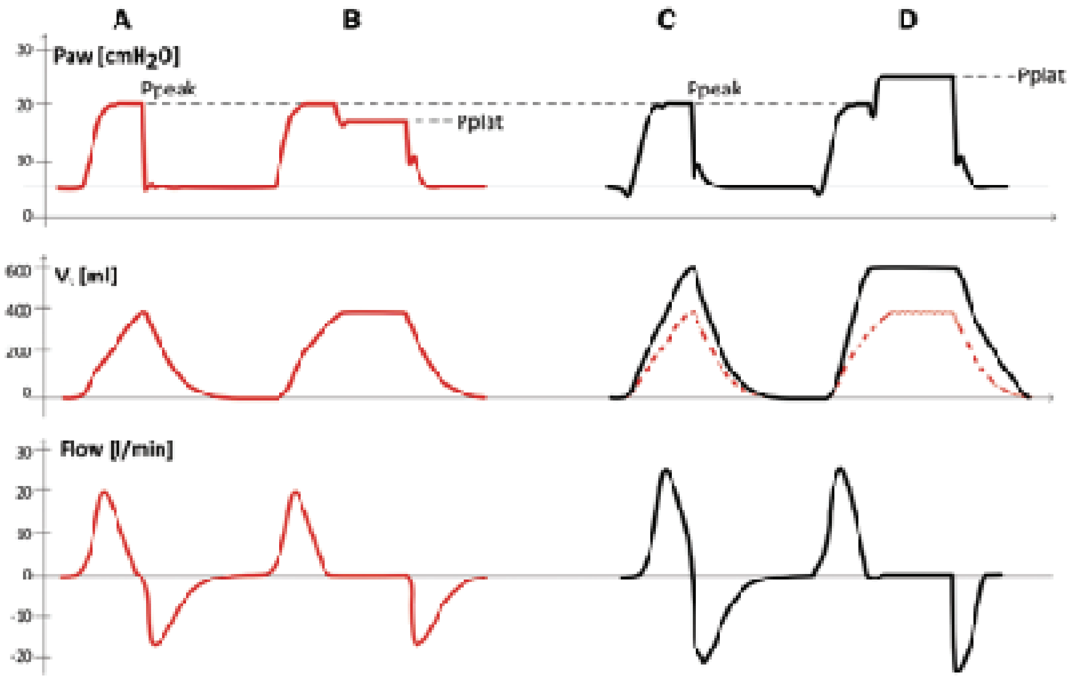
Driving Pressure Is Associated with Outcome during Assisted Ventilation in Acute Respiratory Distress Syndrome

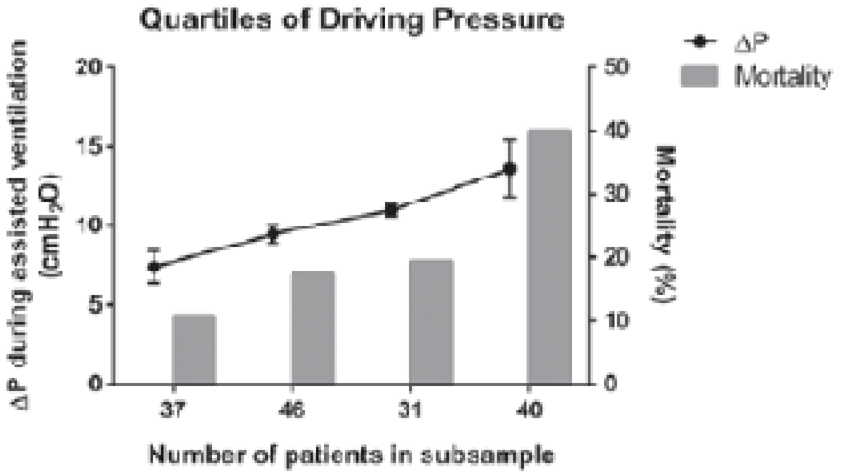
Giacomo Bellani, M.D., Ph.D., Alice Grassi, M.D.,
Simone Sosio, M.D., Stefano Gatti, M.D.,
Brian P. Kavanagh, M.B., Antonio Pesenti, M.D.,
Giuseppe Foti, M.D.

ANESTHESIOLOGY 2019; 131:594–604


A
B
C
cmH₂O
PRESSION
DÉBIT
ml
VOLUME
µV
Edi

Pression Motrice en VSAI





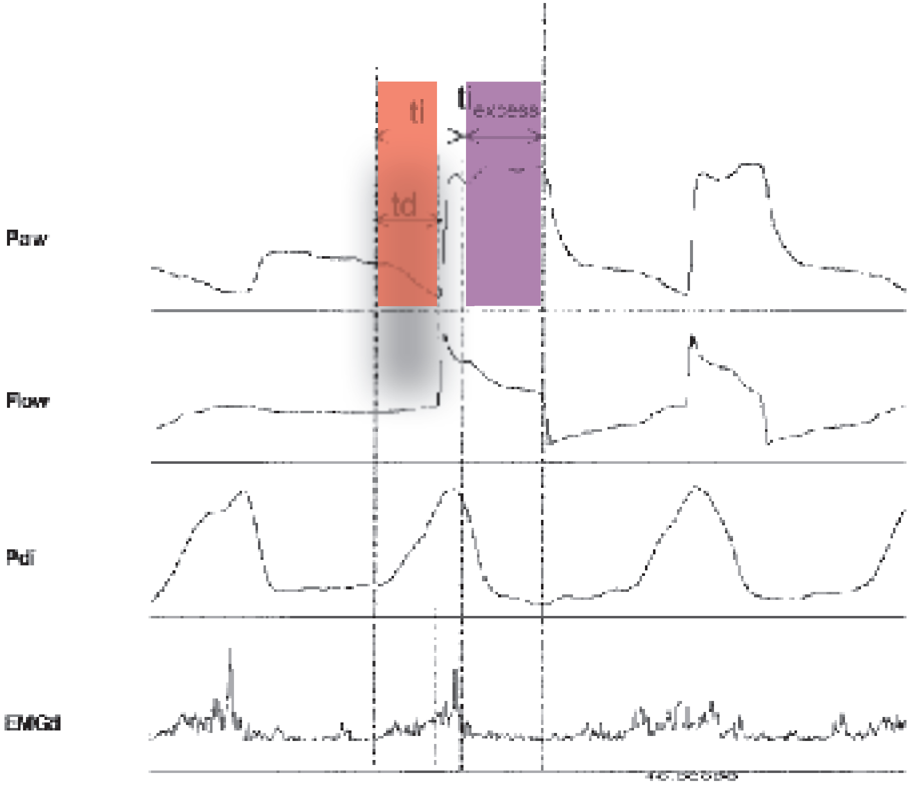
LA SYNCHRONIE PATIENT VENTILATEUR

La synchronie

Impact of Expiratory Trigger Setting on Delayed Cycling and Inspiratory Muscle Workload

Didier Tassaux, Marc Gainnier, Anne Battisti, and Philippe Jolliet

Am J Respir Crit Care Med Vol 172. pp 1283–1289, 2005

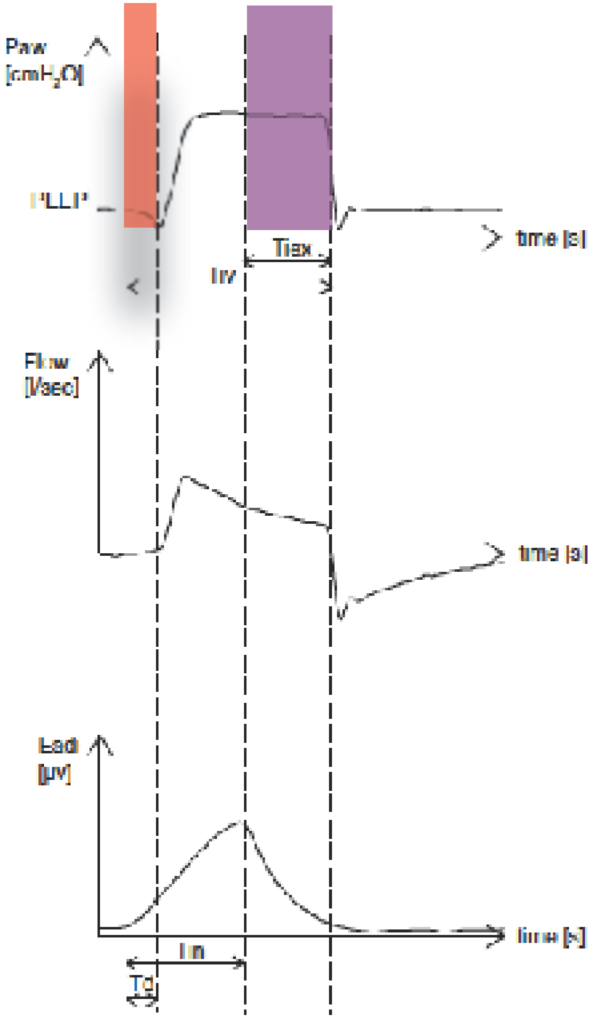


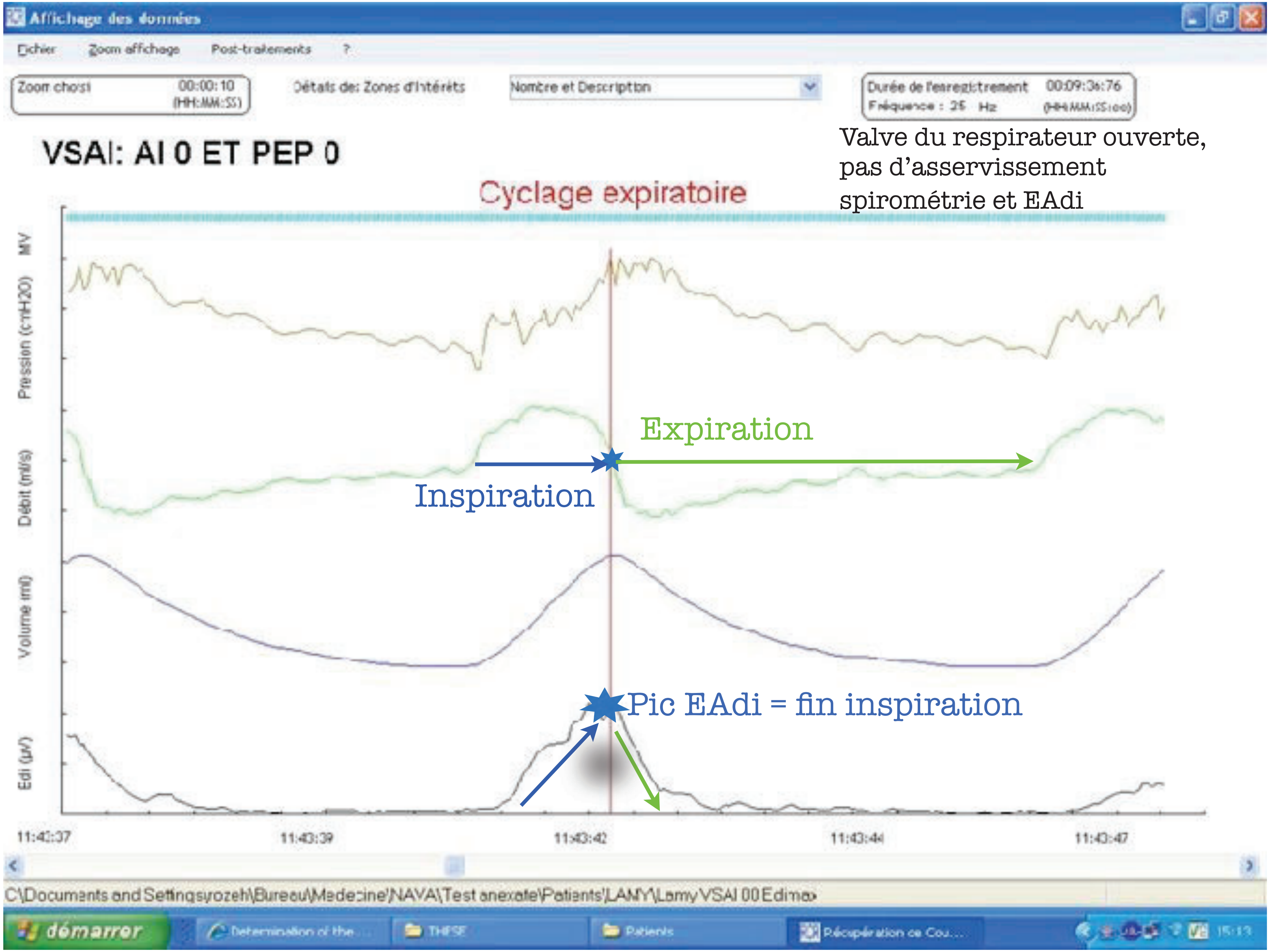
Intensive Care Med
DOI 10.1007/s00134-010-2052-5

ORIGINAL

Lise Piquilloud
Laurence Vignaux
Emilie Bialais
Jean Roeseler
Thierry Sottiaux
Pierre-François Laterre
Philippe Jolliet
Didier Tassaux

Neurally adjusted ventilatory assist improves patient–ventilator interaction


Paw
[cmH$_2$O]
PEEP
time [s]
Tiex
Tiv
Flow
[l/sec]
time [s]
Eadi
[µv]
time [s]
Tin
Td



Affichage des données
Fichier
Zoom affichage
Post-traitements
?
Détails des Zones d'Intérêts
Cyclage expiratoire
MV
Pression (cmH20)
Débit (ml/s)
Volume (ml)
Edi (µV)
Expiration
Inspiration
Pic EAdi = fin inspiration
11:43:37
11:43:39
11:43:42
11:43:44
11:43:47
démarrer
Determination of the...
THESE
Patients
Récupération de Cou...
15:13

Zoom choisi 00:00:10 (HH:MM:SS)

Nombre et Description

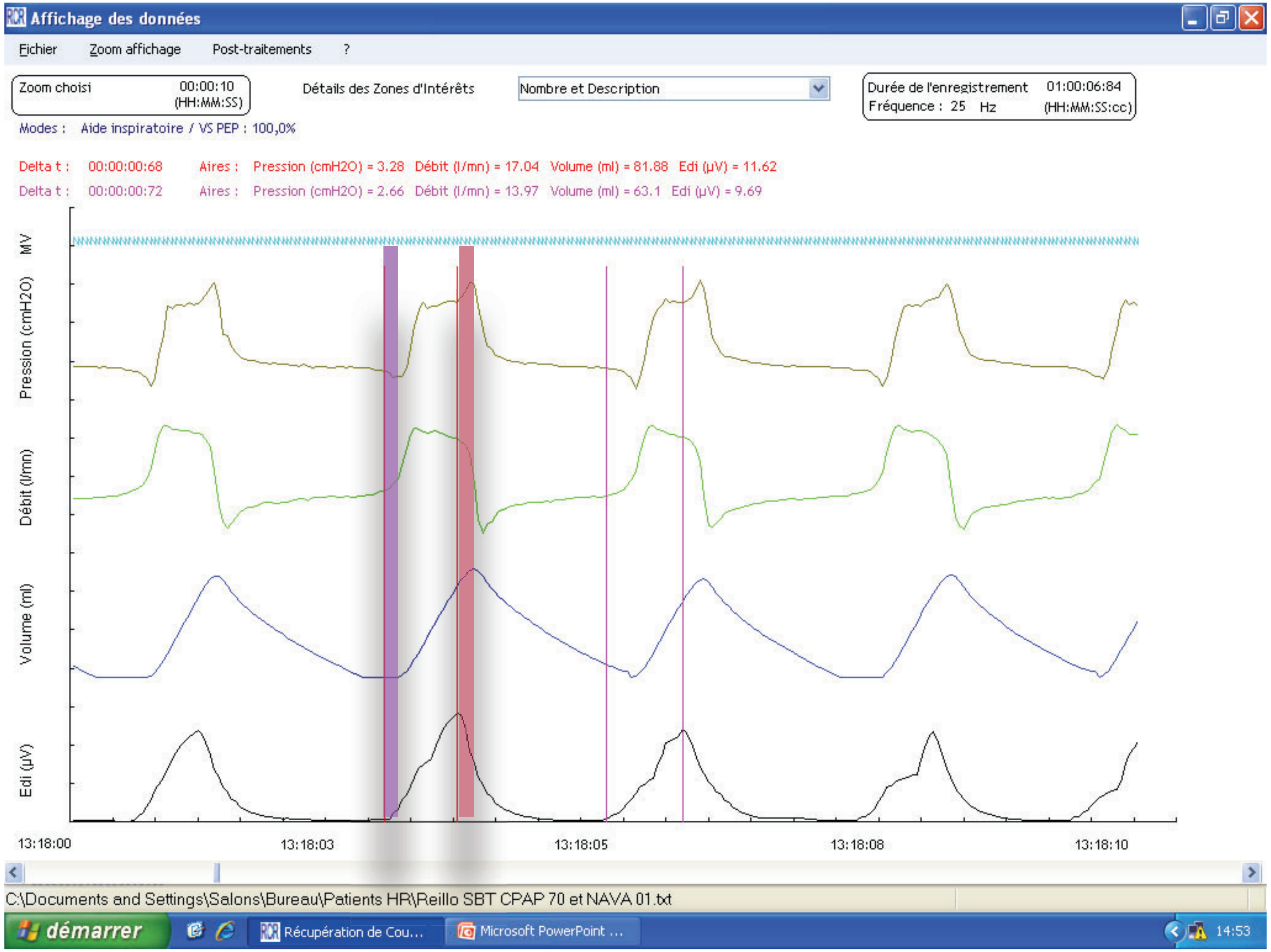
Durée de l'enregistrement 00:09:36:76 (HH:MM:SS:cc)
Fréquence : 25 Hz

VSAI: AI 0 ET PEP 0

Valve du respirateur ouverte,
pas d'asservissement
spirométrie et EAdi

C:\Documents and Settings\yozeh\Bureau\Medecine\NAVA\Test anexate\Patients\LAMY\Lamy VSAI 00 Edimax

L'aide inspiratoire crée de l'asynchronie


Affichage des données
Fichier
Zoom affichage
Post-traitements
?
MV
Pression (cmH2O)
Débit (l/mn)
Volume (ml)
Edi (µV)
13:18:00
13:18:03
13:18:05
13:18:08
13:18:10
démarrer
Récupération de Cou...
Microsoft PowerPoint ...
14:53

Zoom choisi 00:00:10 (HH:MM:SS)

Détails des Zones d'Intérêts: Nombre et Description

Durée de l'enregistrement 01:00:06:84 (HH:MM:SS:cc)
Fréquence : 25 Hz

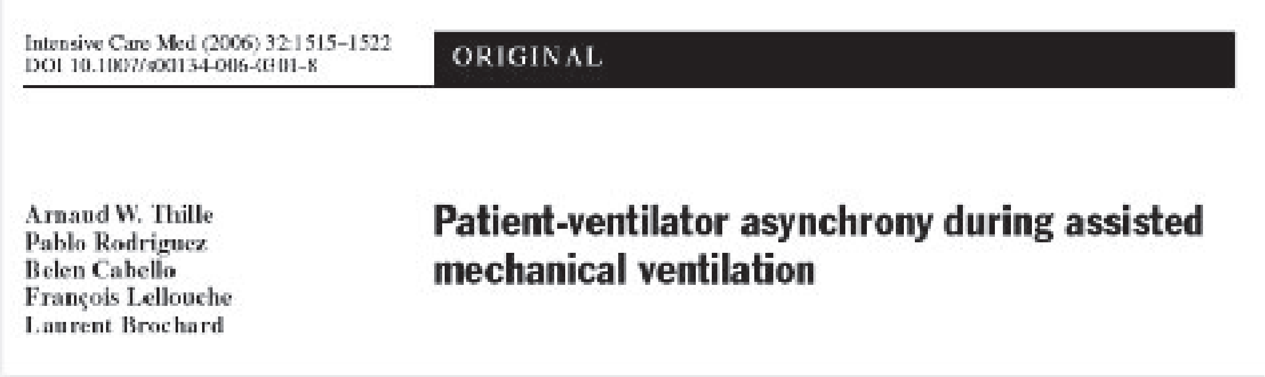
Modes : Aide inspiratoire / VS PEP : 100,0%

Delta t : 00:00:00:68 Aires : Pression (cmH2O) = 3.28 Débit (l/mn) = 17.04 Volume (ml) = 81.88 Edi (µV) = 11.62

Delta t : 00:00:00:72 Aires : Pression (cmH2O) = 2.66 Débit (l/mn) = 13.97 Volume (ml) = 63.1 Edi (µV) = 9.69

C:\Documents and Settings\Salons\Bureau\Patients HR\Reillo SBT CPAP 70 et NAVA 01.txt

Problématiques des asynchronies?

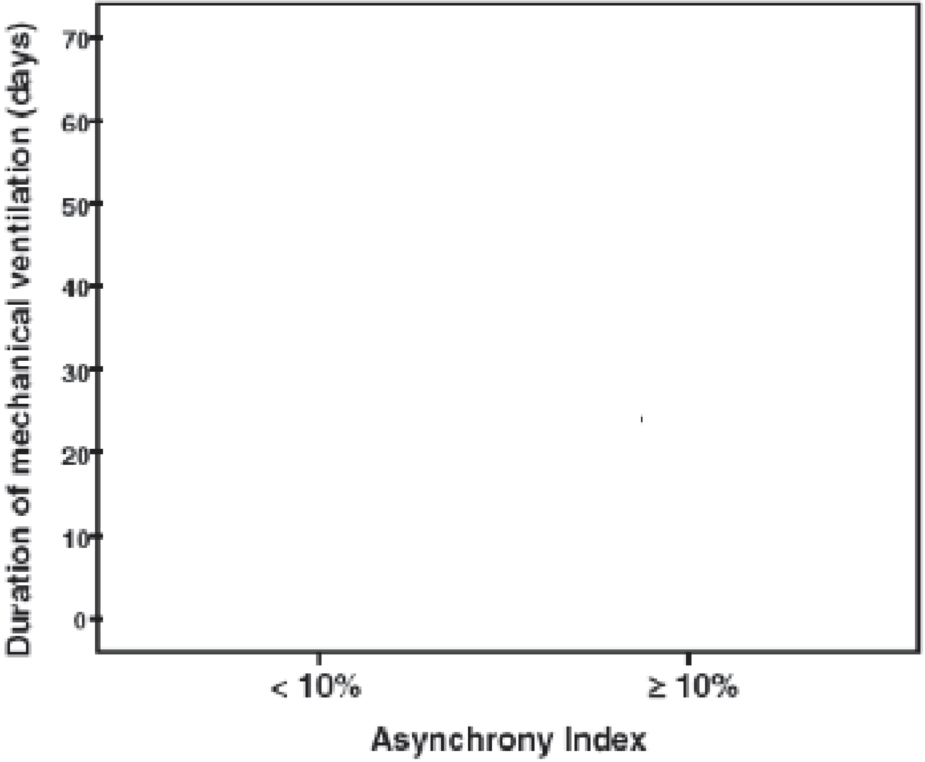


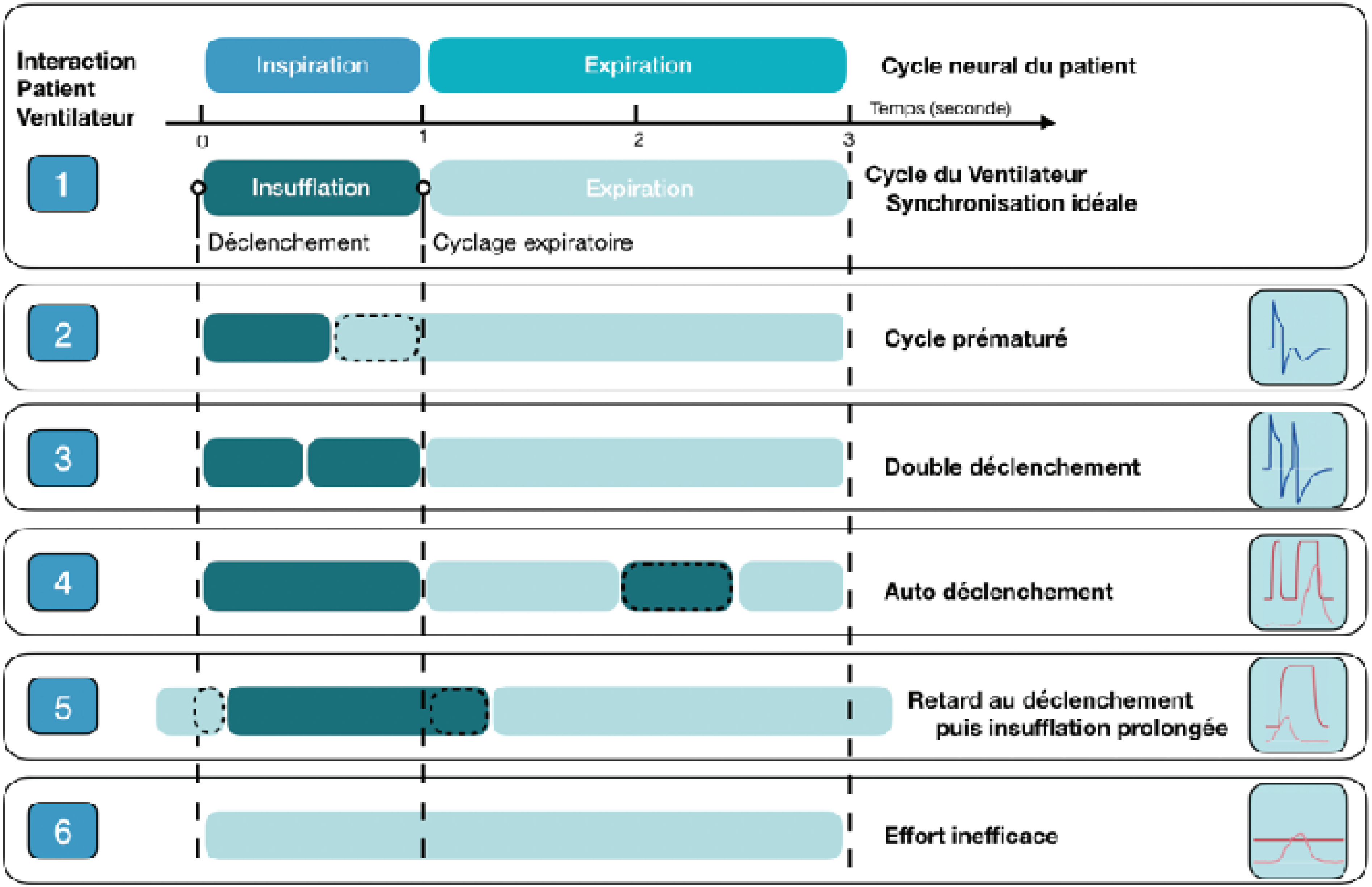
Intensive Care Med (2006) 32:1515–1522
DOI 10.1007/s00134-006-0301-8

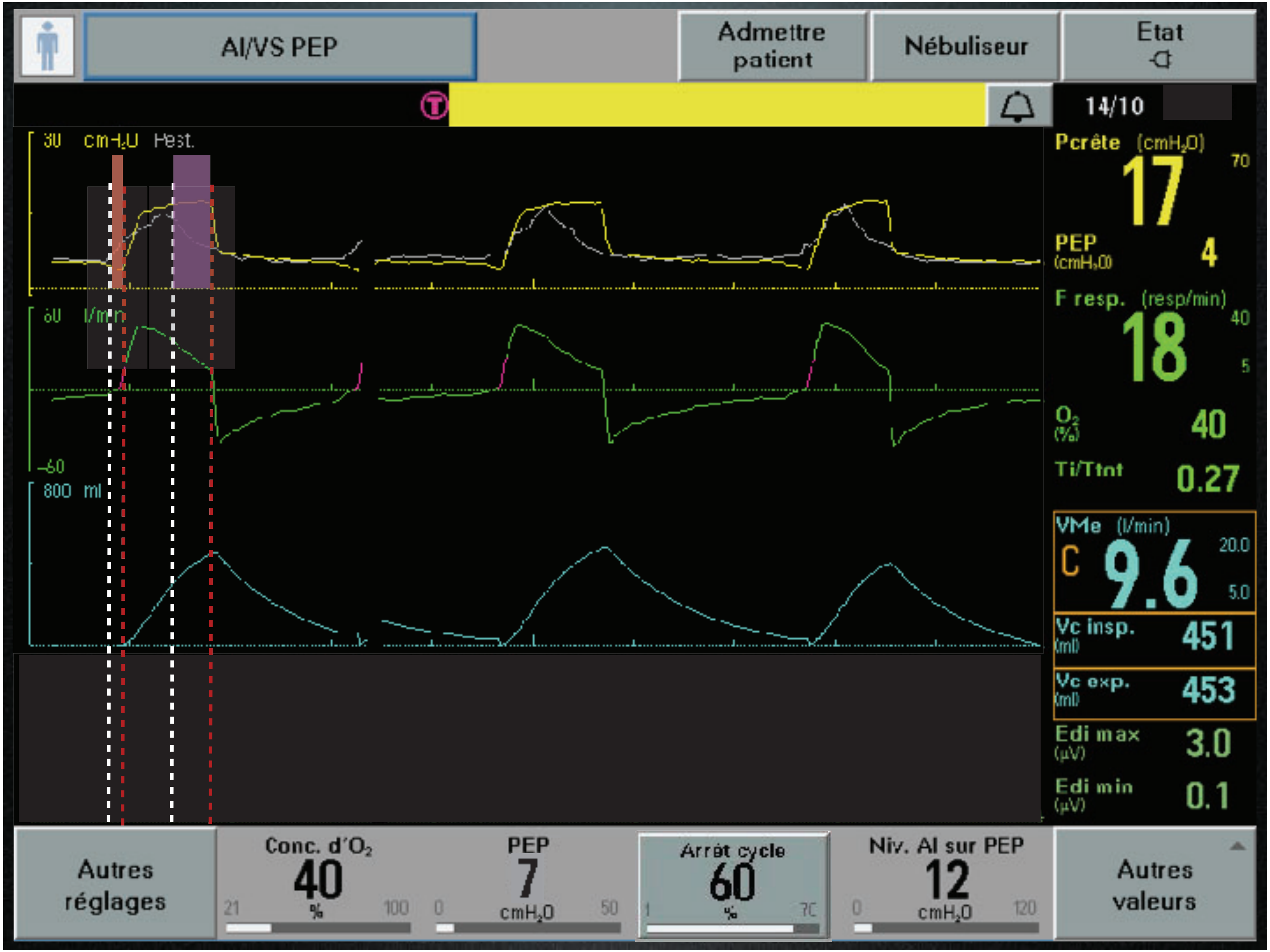
ORIGINAL

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

Patient-ventilator asynchrony during assisted mechanical ventilation




Interaction Patient Ventilateur
Inspiration
Expiration
Cycle neural du patient
Temps (seconde)
0
1
2
3
1
Insufflation
Expiration
Cycle du Ventilateur
Synchronisation idéale
Déclenchement
Cyclage expiratoire
2
Cycle prématuré
3
Double déclenchement
4
Auto déclenchement
5
Retard au déclenchement
puis insufflation prolongée
6
Effort inefficace


AI/VS PEP
Admettre patient
Nébuliseur
Etat
14/10
30 cmH2O Rest.
60 l/min
–60
800 ml
Autres réglages
Autres valeurs

Pcrête (cmH2O) 17 (70)

PEP (cmH2O) 4

F resp. (resp/min) 18 (40, 5)

O2 (%) 40

Ti/Ttot 0.27

VMe (l/min) C 9.6 (20.0, 5.0)

Vc insp. (ml) 451

Vc exp. (ml) 453

Edi max (µV) 3.0

Edi min (µV) 0.1

Conc. d'O2 40 % (21–100)

PEP 7 cmH2O (0–50)

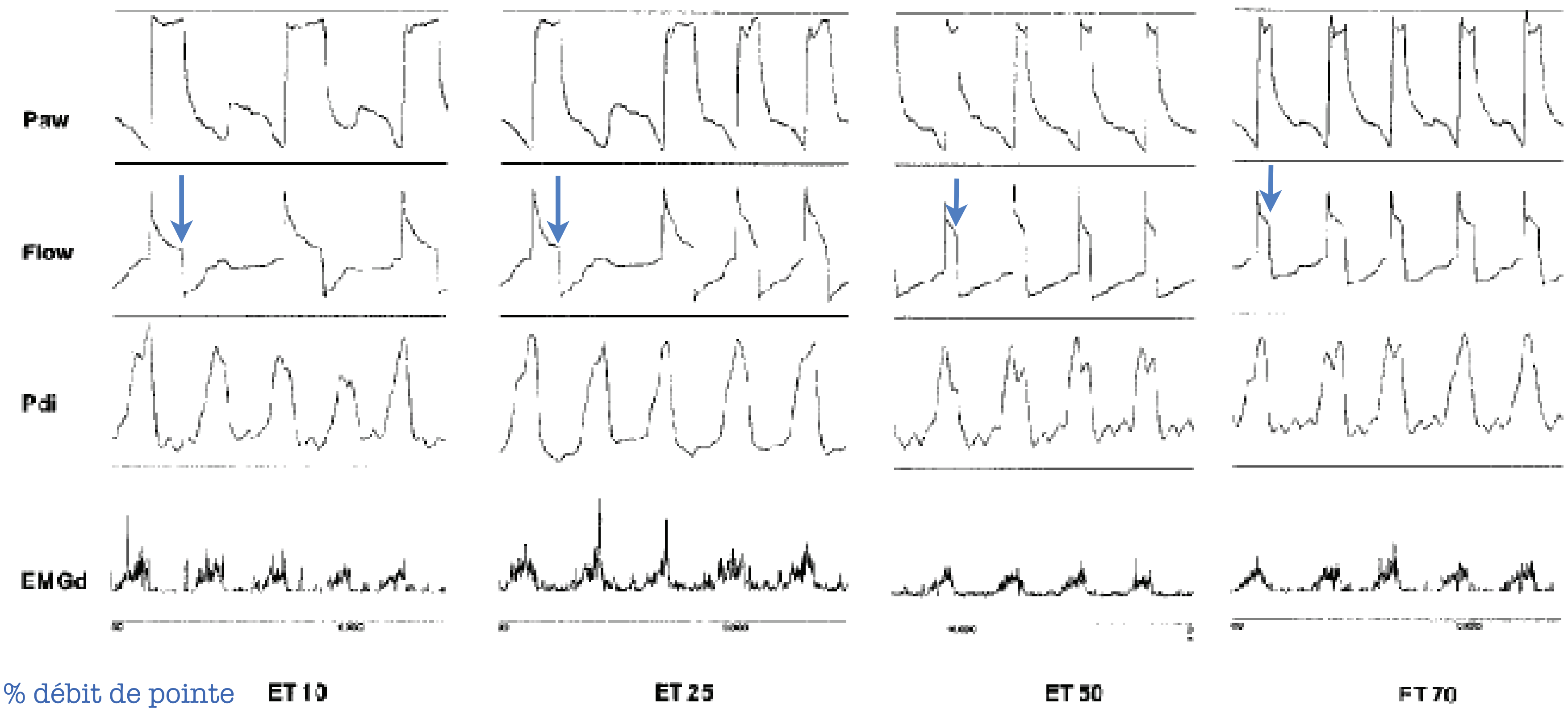
Arrêt cycle 60 % (1–70)

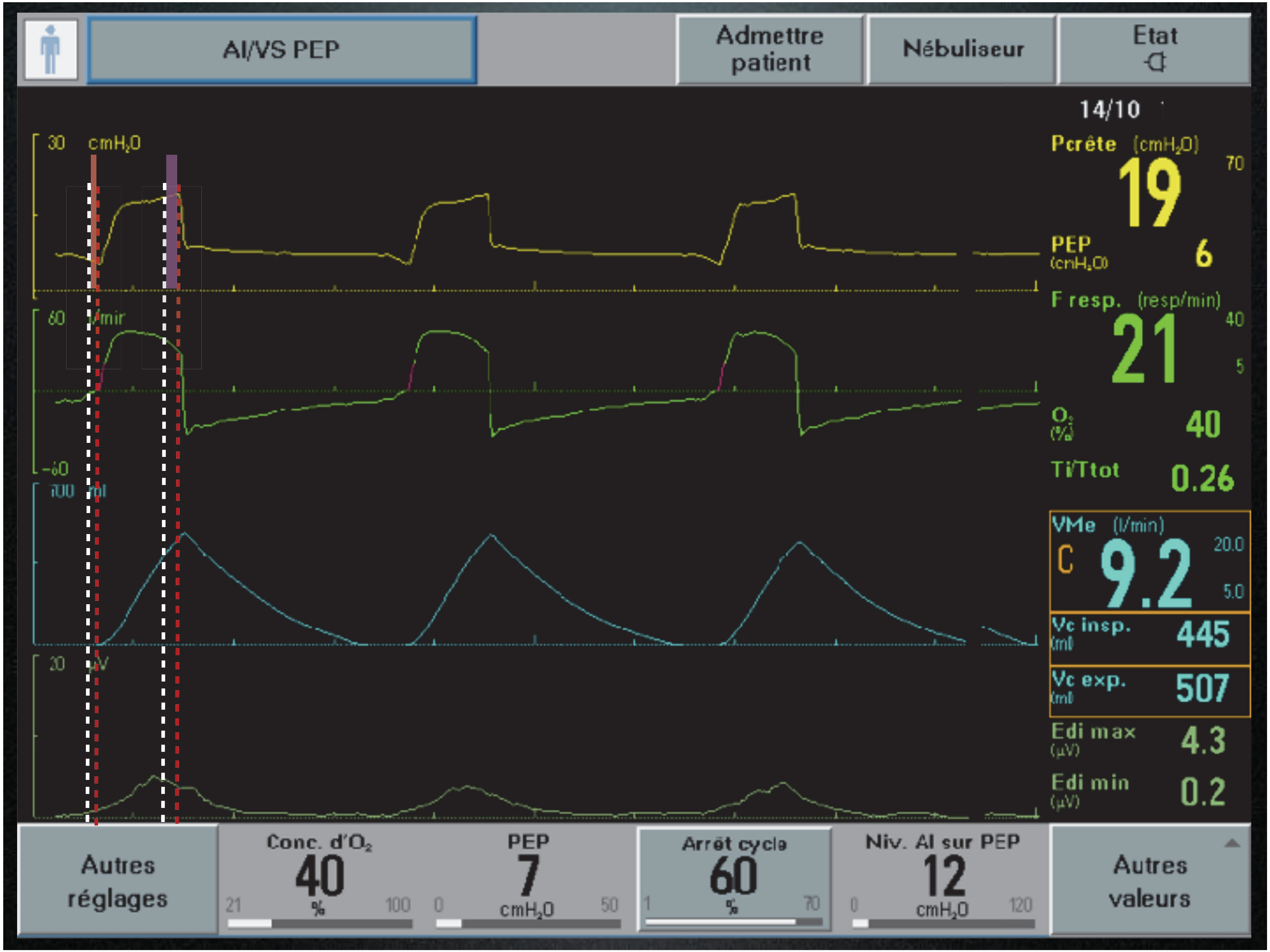
Niv. AI sur PEP 12 cmH2O (0–120)

Impact of Expiratory Trigger Setting on Delayed Cycling and Inspiratory Muscle Workload

Didier Tassaux, Marc Gainnier, Anne Battisti, and Philippe Jolliet

Am J Respir Crit Care Med Vol 172. pp 1283–1289, 2005




AI/VS PEP
Admettre patient
Nébuliseur
Etat
14/10
30 cmH2O
60 l/min
-60
100 ml
20 µV
Autres réglages
Autres valeurs

Pcrête (cmH₂O) 19 (70)

PEP (cmH₂O) 6

F resp. (resp/min) 21 (40, 5)

O₂ (%) 40

Ti/Ttot 0.26

VMe (l/min) C 9.2 (20.0, 5.0)

Vc insp. (ml) 445

Vc exp. (ml) 507

Edi max (µV) 4.3

Edi min (µV) 0.2

Conc. d'O₂ 40 % (21–100)

PEP 7 cmH₂O (0–50)

Arrêt cycle 60 % (1–70)

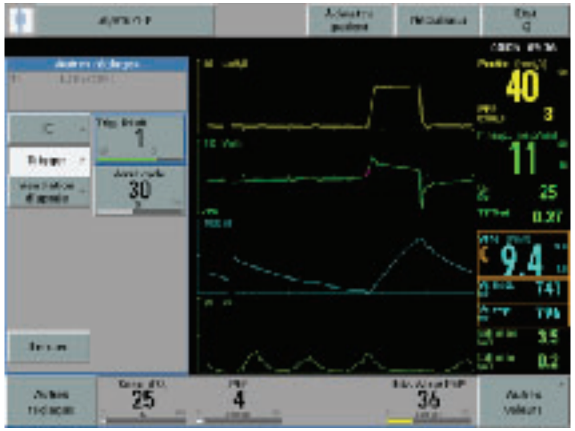
Niv. AI sur PEP 12 cmH₂O (0–120)

Intensive Care Med (2008) 34:1477–1486
DOI 10.1007/s00134-008-1121-9

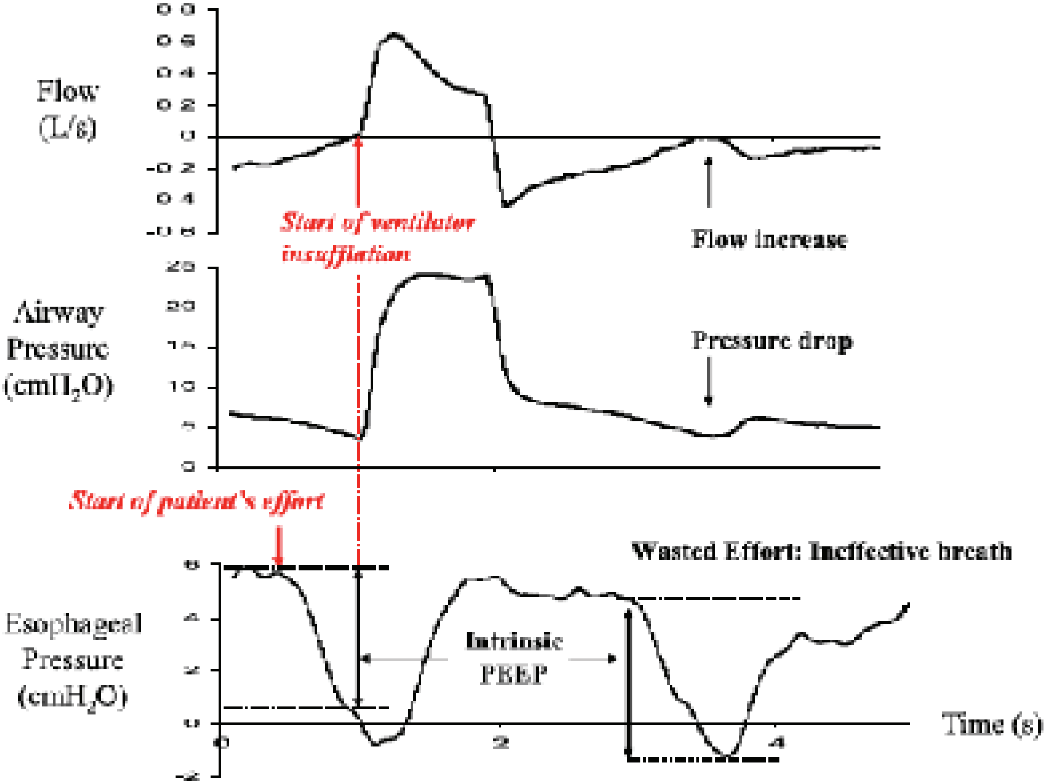
ORIGINAL

Arnaud W. Thille
Belen Cabello
Fabrice Galia
Aissam Lyazidi
Laurent Brochard

Reduction of patient-ventilator asynchrony by reducing tidal volume during pressure-support ventilation


40
8
11
25
9.4
25
4
36

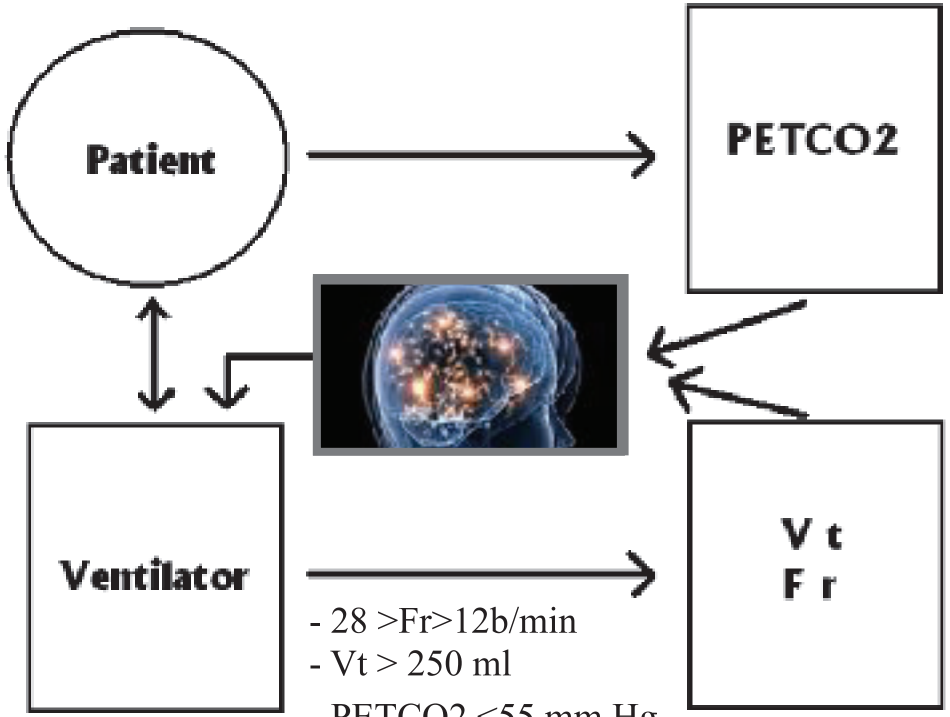
32
8
40
25
9.0
25
8
24



Système Smartcare

VS-PEEP
21
480
5
23
143
763

- Système Néoganesh: règles, scénarios pour être dans une zone de confort: VTE FR E_TCO_2 évaluation 2-3 min



Patient

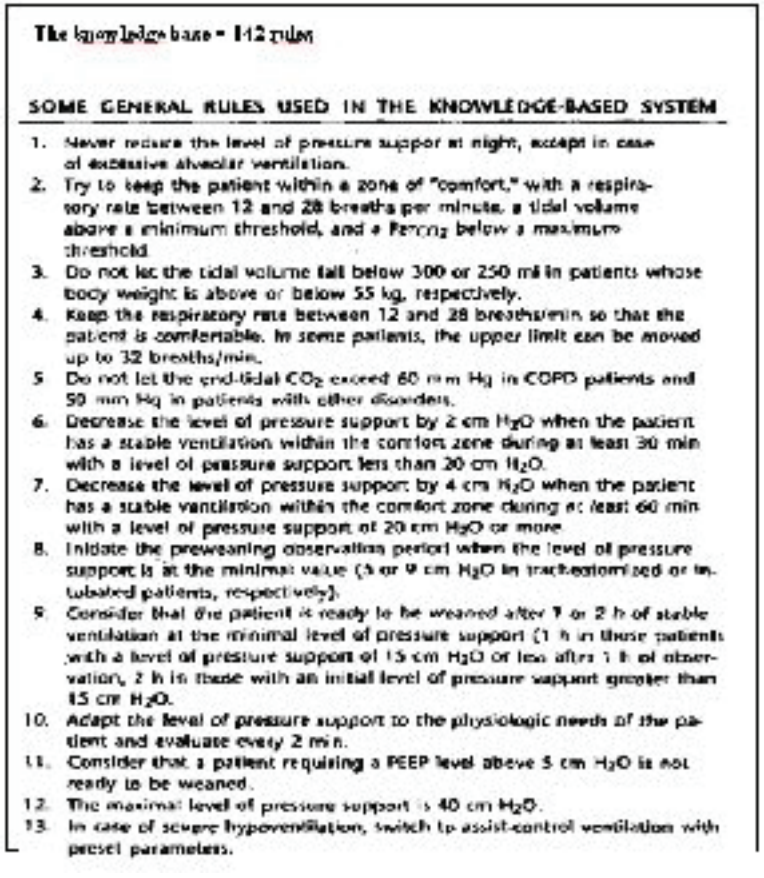
PETCO2

Ventilator

Vt
Fr

- 28 >Fr>12b/min
- Vt > 250 ml
- PETCO2 <55 mm Hg

Dojat M - Am J Respir Crit Care Med 1996; 153: 997-1004



The knowledge base = 142 rules

SOME GENERAL RULES USED IN THE KNOWLEDGE-BASED SYSTEM

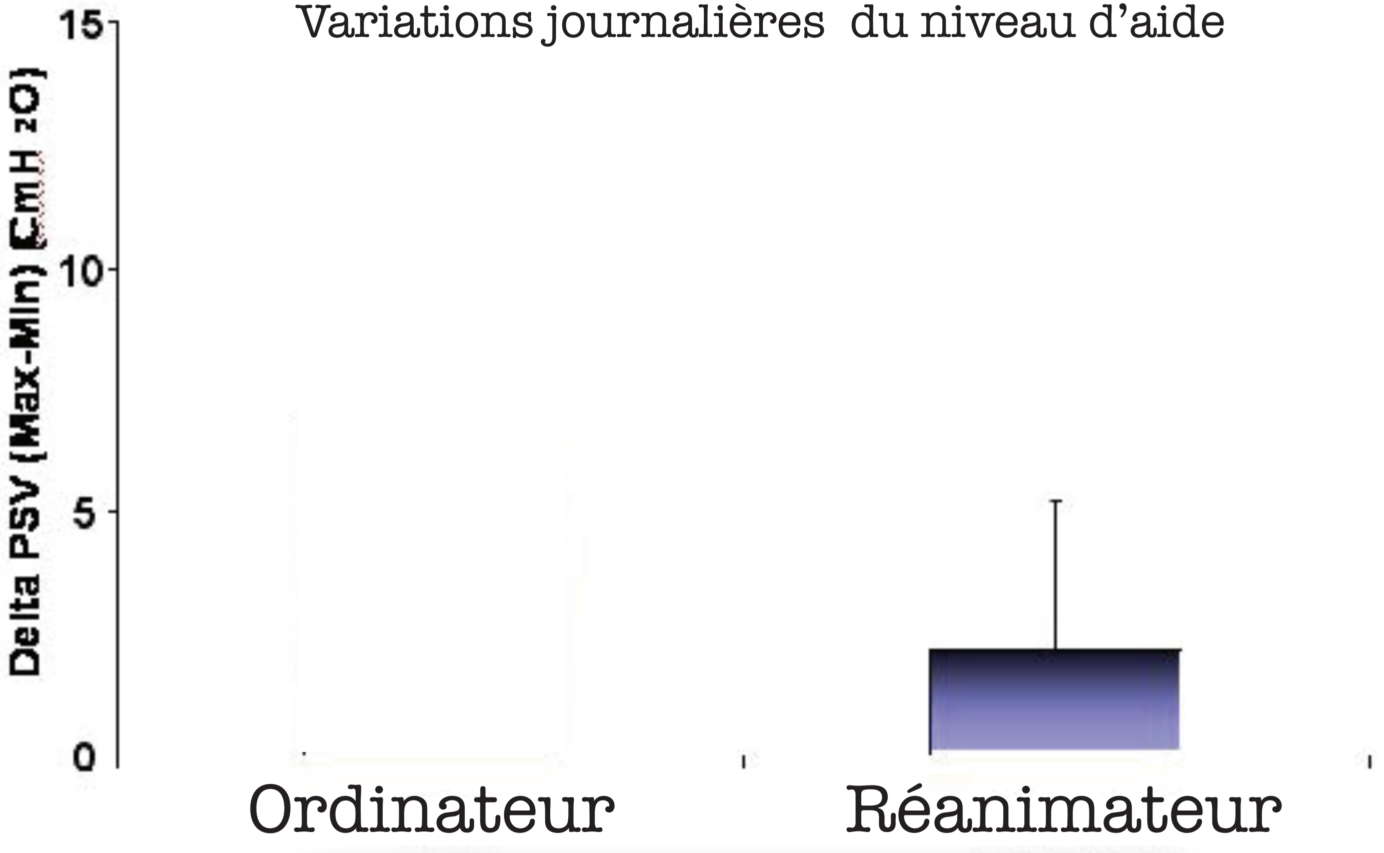
1. Never reduce the level of pressure suppor at night, except in case of excessive alveolar ventilation.
2. Try to keep the patient within a zone of "comfort," with a respiratory rate between 12 and 28 breaths per minute, a tidal volume above a minimum threshold, and a P_{ETCO_2} below a maximum threshold.
3. Do not let the tidal volume fall below 300 or 250 ml in patients whose body weight is above or below 55 kg, respectively.
4. Keep the respiratory rate between 12 and 28 breaths/min so that the patient is comfortable. In some patients, the upper limit can be moved up to 32 breaths/min.
5. Do not let the end-tidal CO_2 exceed 60 mm Hg in COPD patients and 50 mm Hg in patients with other disorders.
6. Decrease the level of pressure support by 2 cm H_2O when the patient has a stable ventilation within the comfort zone during at least 30 min with a level of pressure support less than 20 cm H_2O.
7. Decrease the level of pressure support by 4 cm H_2O when the patient has a stable ventilation within the comfort zone during at least 60 min with a level of pressure support of 20 cm H_2O or more.
8. Initiate the preweaning observation period when the level of pressure support is at the minimal value (5 or 9 cm H_2O in tracheotomized or intubated patients, respectively).
9. Consider that the patient is ready to be weaned after 1 or 2 h of stable ventilation at the minimal level of pressure support (1 h in those patients with a level of pressure support of 15 cm H_2O or less after 1 h of observation, 2 h in those with an initial level of pressure support greater than 15 cm H_2O.
10. Adapt the level of pressure support to the physiologic needs of the patient and evaluate every 2 min.
11. Consider that a patient requiring a PEEP level above 5 cm H_2O is not ready to be weaned.
12. The maximal level of pressure support is 40 cm H_2O.
13. In case of severe hypoventilation, switch to assist-control ventilation with preset parameters.

A Multicenter Randomized Trial of Computer-driven Protocolized Weaning from Mechanical Ventilation

François Lellouche, Jordi Mancebo, Philippe Jolliet, Jean Roeseler, Fréderique Schortgen, Michel Dojat, Belen Cabello, Lila Bouadma, Pablo Rodriguez, Salvatore Maggiore, Marc Reynaert, Stefan Mersmann, and Laurent Brochard

Am J Respir Crit Care Med Vol 174. pp 894–900, 2006

Variations journalières du niveau d'aide



ge

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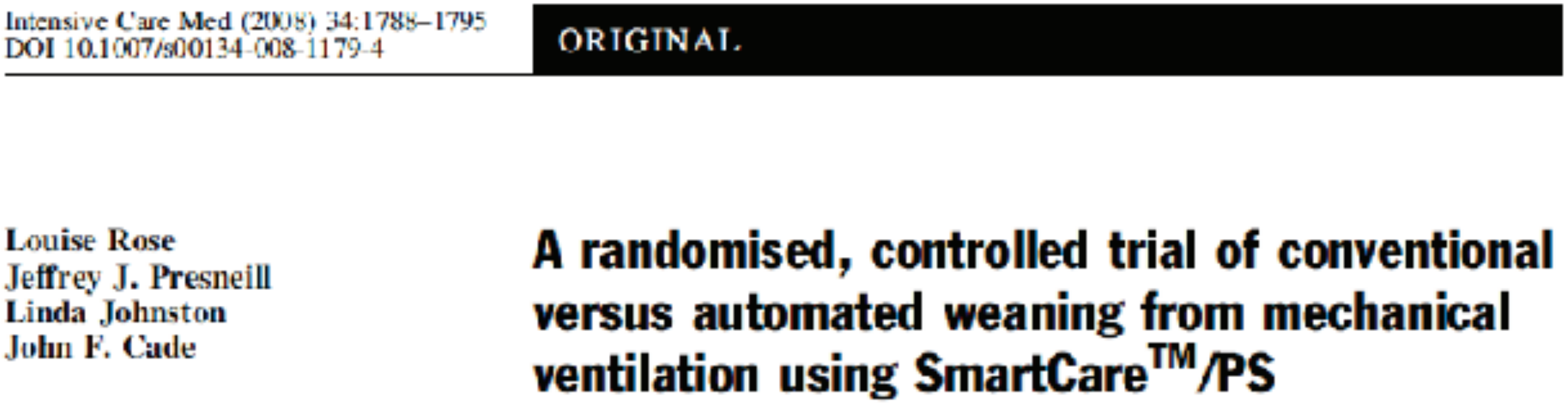
ation

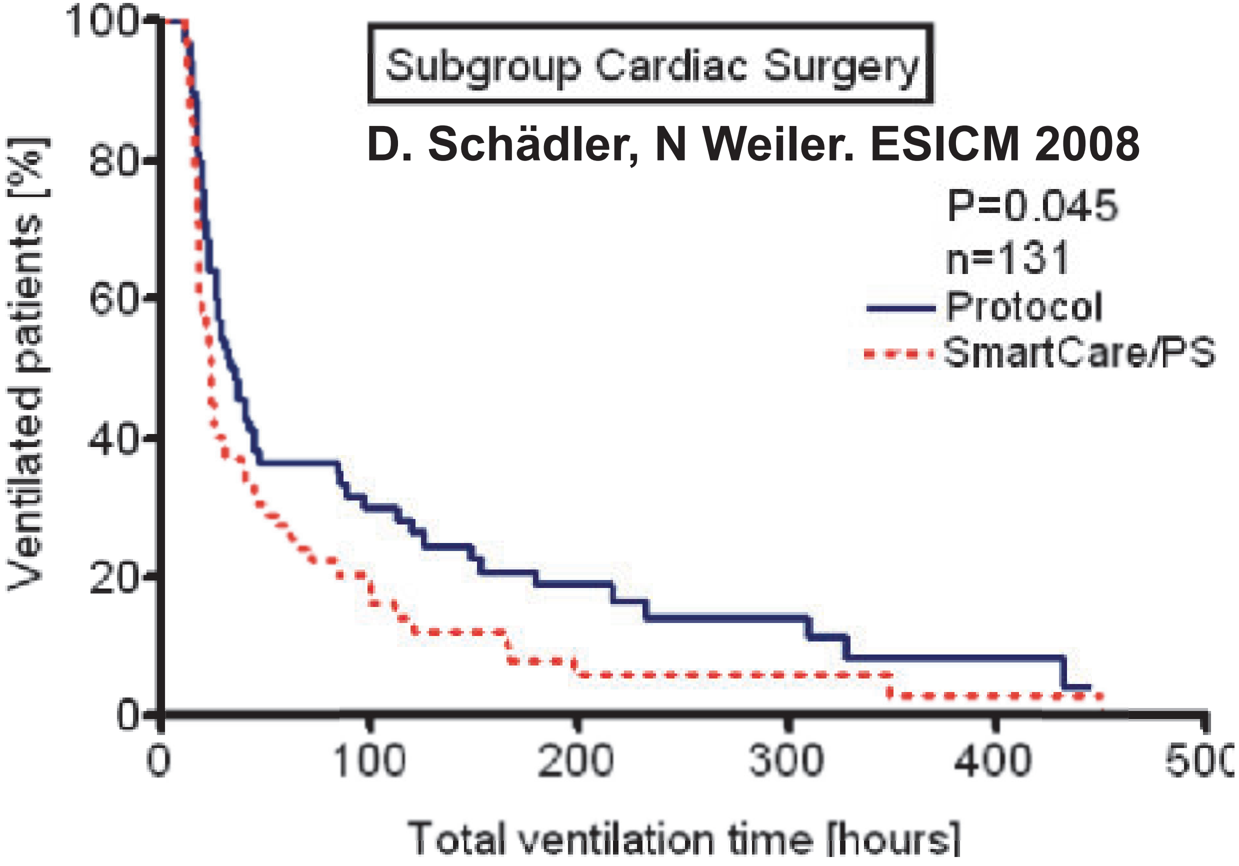


Intensive Care Med (2008) 34:1788–1795
DOI 10.1007/s00134-008-1179-4

ORIGINAL

Louise Rose
Jeffrey J. Presneill
Linda Johnston
John F. Cade

A randomised, controlled trial of conventional versus automated weaning from mechanical ventilation using SmartCare^{TM}/PS

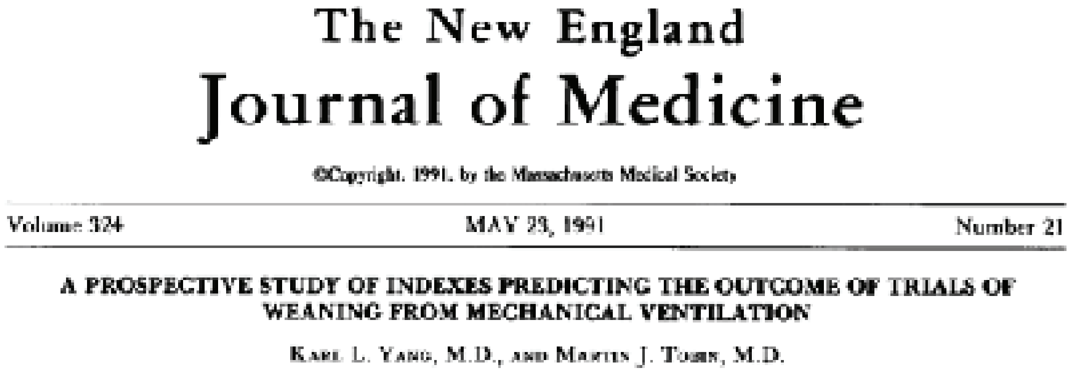


Subgroup Cardiac Surgery

D. Schädler, N Weiler. ESICM 2008

SEPARATION DU VENTILATEUR

- INDEX PREDICTIFS
- TEST



The New England
Journal of Medicine

©Copyright, 1991, by the Massachusetts Medical Society

Volume 324 MAY 23, 1991 Number 21

A PROSPECTIVE STUDY OF INDEXES PREDICTING THE OUTCOME OF TRIALS OF WEANING FROM MECHANICAL VENTILATION

Karl L. Yang, M.D., and Martin J. Tobin, M.D.

Premier Index FR/VT

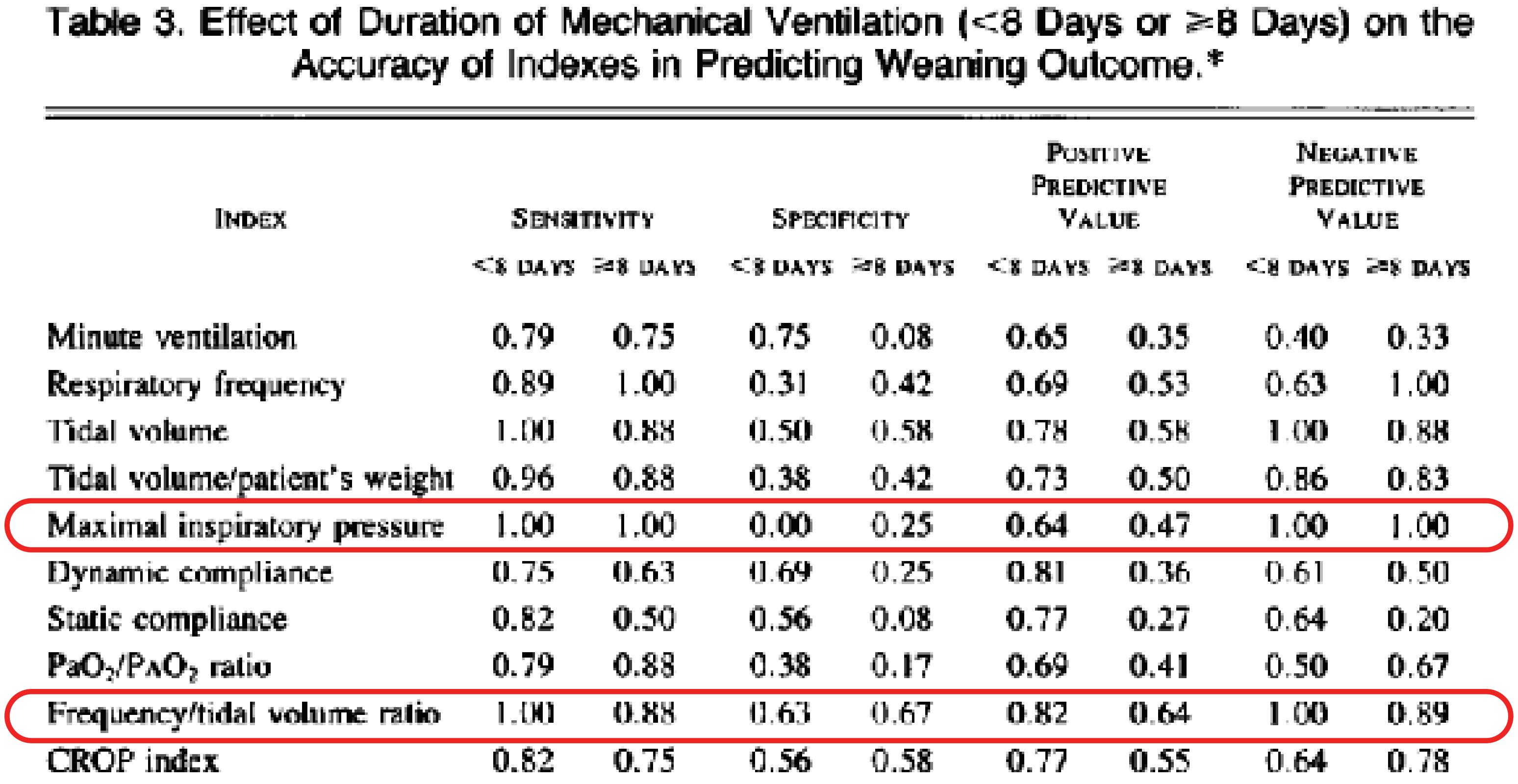


Table 3. Effect of Duration of Mechanical Ventilation (<8 Days or ≥8 Days) on the Accuracy of Indexes in Predicting Weaning Outcome.*

INDEX	SENSITIVITY		SPECIFICITY		POSITIVE PREDICTIVE VALUE		NEGATIVE PREDICTIVE VALUE	
	<8 DAYS	≥8 DAYS	<8 DAYS	≥8 DAYS	<8 DAYS	≥8 DAYS	<8 DAYS	≥8 DAYS
Minute ventilation	0.79	0.75	0.75	0.08	0.65	0.35	0.40	0.33
Respiratory frequency	0.89	1.00	0.31	0.42	0.69	0.53	0.63	1.00
Tidal volume	1.00	0.88	0.50	0.58	0.78	0.58	1.00	0.88
Tidal volume/patient's weight	0.96	0.88	0.38	0.42	0.73	0.50	0.86	0.83
Maximal inspiratory pressure	1.00	1.00	0.00	0.25	0.64	0.47	1.00	1.00
Dynamic compliance	0.75	0.63	0.69	0.25	0.81	0.36	0.61	0.50
Static compliance	0.82	0.50	0.56	0.08	0.77	0.27	0.64	0.20
PaO_2/PAO_2 ratio	0.79	0.88	0.38	0.17	0.69	0.41	0.50	0.67
Frequency/tidal volume ratio	1.00	0.88	0.63	0.67	0.82	0.64	1.00	0.89
CROP index	0.82	0.75	0.56	0.58	0.77	0.55	0.64	0.78

Identifying patients capable of breathing spontaneously and duration of mechanical ventilation

- **Intervention Group**

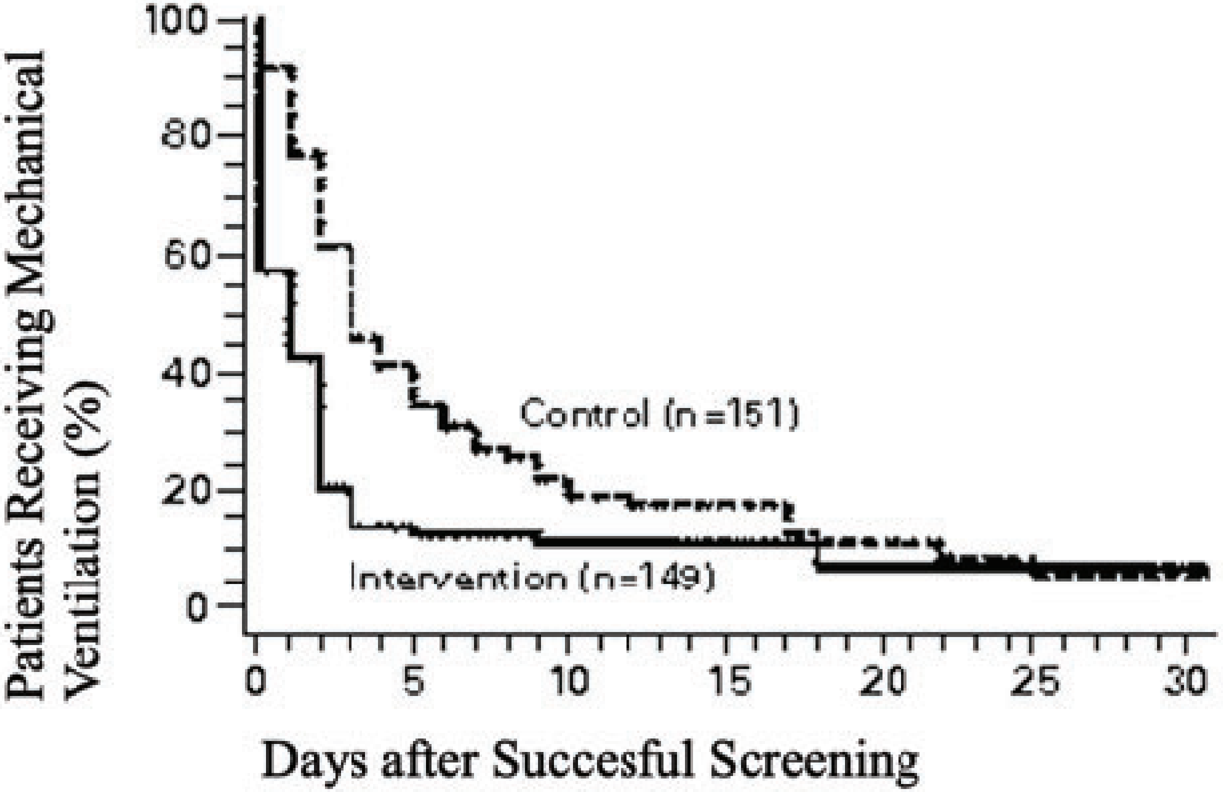
1) A daily screening of respiratory function (by the respiratory therapists of the unit)

- **$PaO_2/FIO_2 > 200$**
- **PEEP< 5 cm H_2O**
- **Adequate cough**
- **$f/V_T < 105$ c/min**
- **No vasopressor agents or sedatives**

2) A 2-hour trial of spontaneous breathing

3) Notification of the physician of the successful results

FEUX VERT



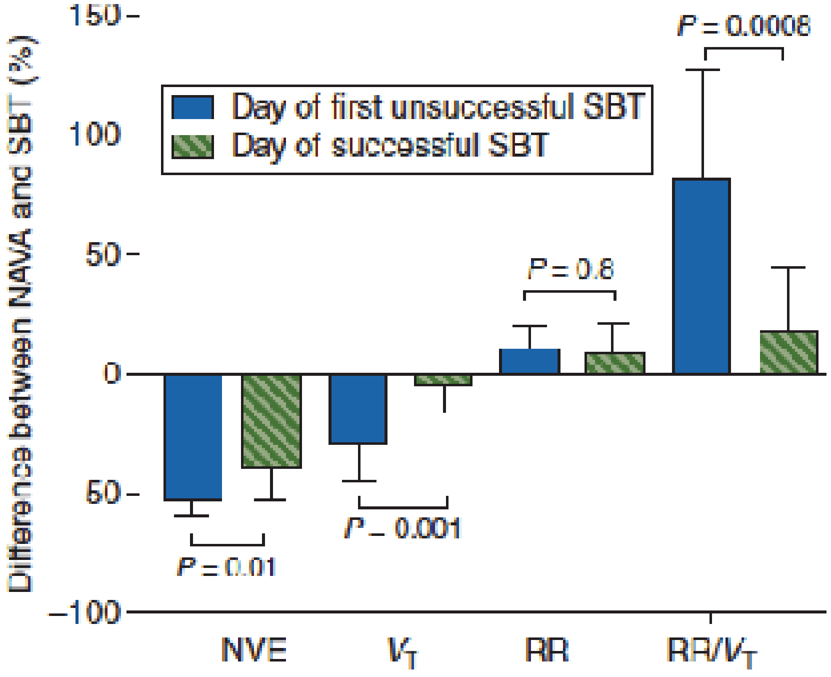
Ely E.W. et coll. N Engl J Med 1996; 335: 1864-9.

British Journal of Anaesthesia Page 1 of 6
doi:10.1093/bja/aet258

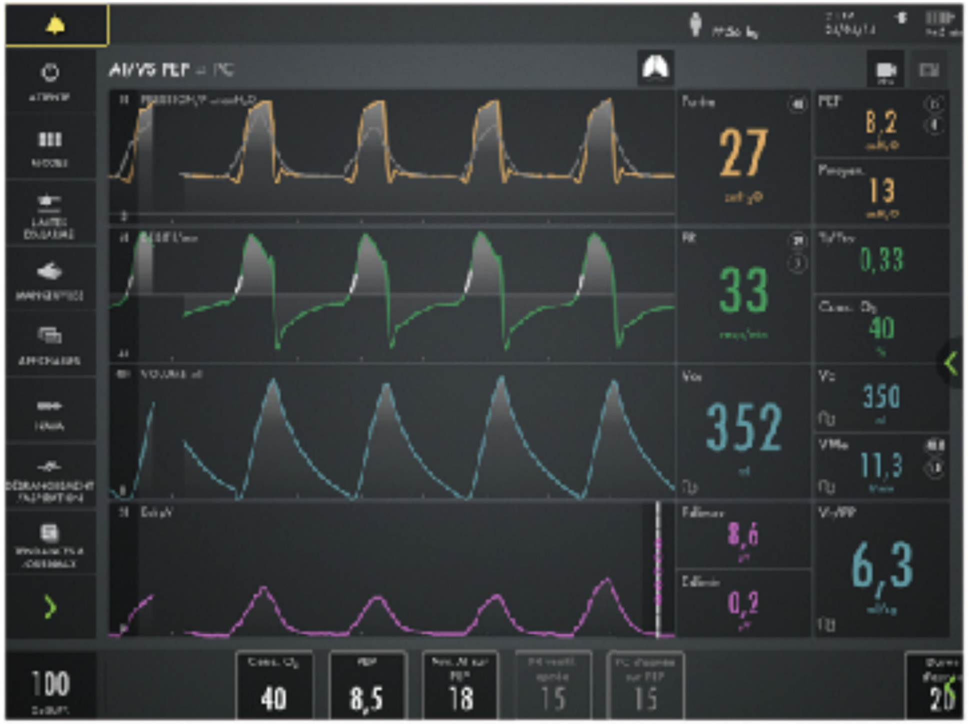
BJA

Neuro-ventilatory efficiency during weaning from mechanical ventilation using neurally adjusted ventilatory assist

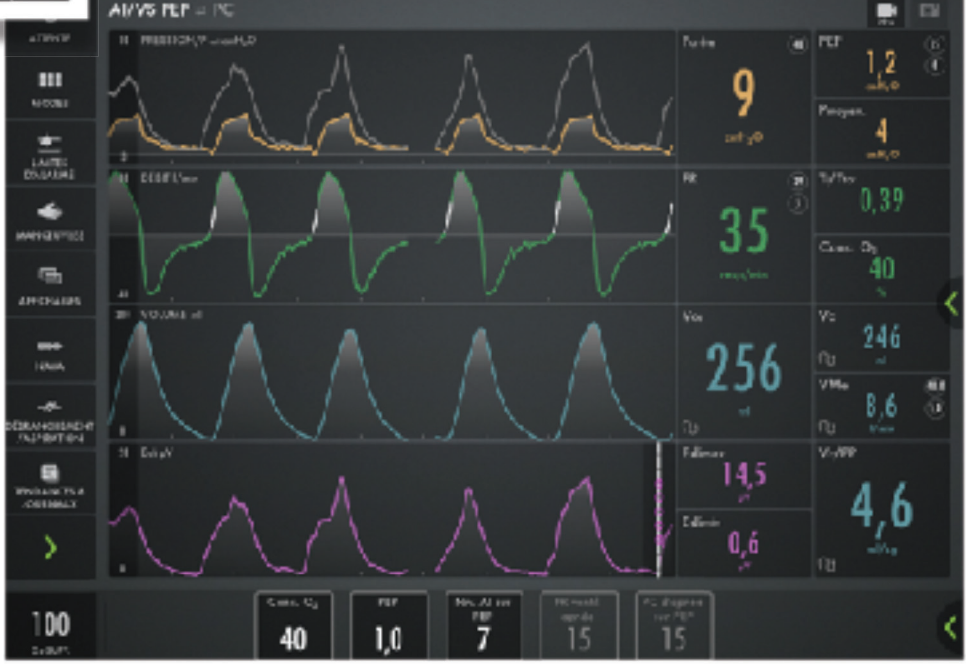
H. Rozé[1,2,3]*, B. Repusseau[1], V. Perrier[1], A. Germain[1], R. Séramondi[1], A. Dewitte[1,3], C. Fleureau[1] and A. Ouattara[1,2]



Augmentation de l'EAdi pour un même niveau de pression entre le début et la fin du sevrage


AI/VS PEP – PC
PRESSION/P cmH2O
DEBIT l/min
VOLUME ml
Edi µV
27
cmH2O
PEP
8,2
Pmoyen.
13
FR
33
resp/min
Ti/Ttot
0,33
Conc. O2
40
%
Vte
352
ml
Vti
350
VMe
11,3
l/min
Edi crête
8,6
µV
Edi min
0,2
Vt/PP
6,3
ml/kg
100
Conc. O2
40
PEP
8,5
Niv. AI sur PEP
18
15
15
20

TEST VSAI 7/0


AI/VS PEP – PC
PRESSION/P cmH2O
DEBIT l/min
VOLUME ml
Edi µV
9
cmH2O
PEP
1,2
Pmoyen.
4
FR
35
resp/min
Ti/Ttot
0,39
Conc. O2
40
%
Vte
256
ml
Vti
246
VMe
8,6
l/min
Edi crête
14,5
µV
Edi min
0,6
Vt/PP
4,6
ml/kg
100
Conc. O2
40
PEP
1,0
Niv. AI sur PEP
7
15
15

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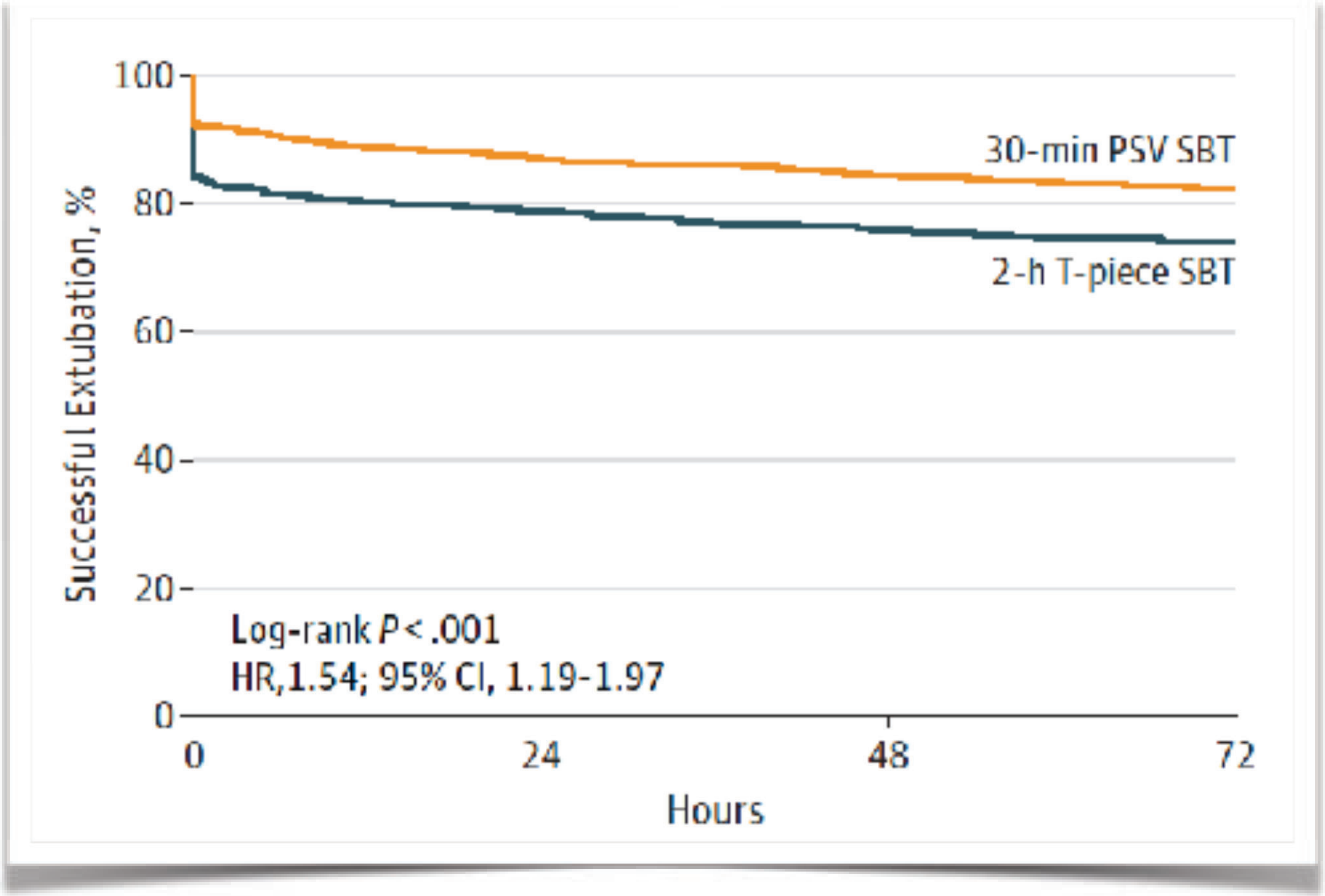
Effect of Pressure Support vs T-Piece Ventilation Strategies During Spontaneous Breathing Trials on Successful Extubation Among Patients Receiving Mechanical Ventilation

A Randomized Clinical Trial

Carles Subirà, MD; Gonzalo Hernández, MD, PhD; Antònia Vázquez, MD, PhD; Raquel Rodríguez-García, MD; Alejandro González-Castro, MD; Carolina García, MD; Olga Rubio, MD, PhD; Lara Ventura, MD; Alexandra López, MD; María-Carmen de la Torre, MD, PhD; Elena Keough, MD; Vanesa Arauzo, MD; Cecilia Hermosa, MD; Carmen Sánchez, MD; Ana Tizón, MD; Eva Tenza, MD, PhD; César Laborda, MD; Sara Cabañes, MD; Victoria Lacueva, MD; María del Mar Fernández, MD, PhD; Anna Arnau, MSc, PhD; Rafael Fernández, MD, PhD



JAMA. 2019;321(22):2175-2182.

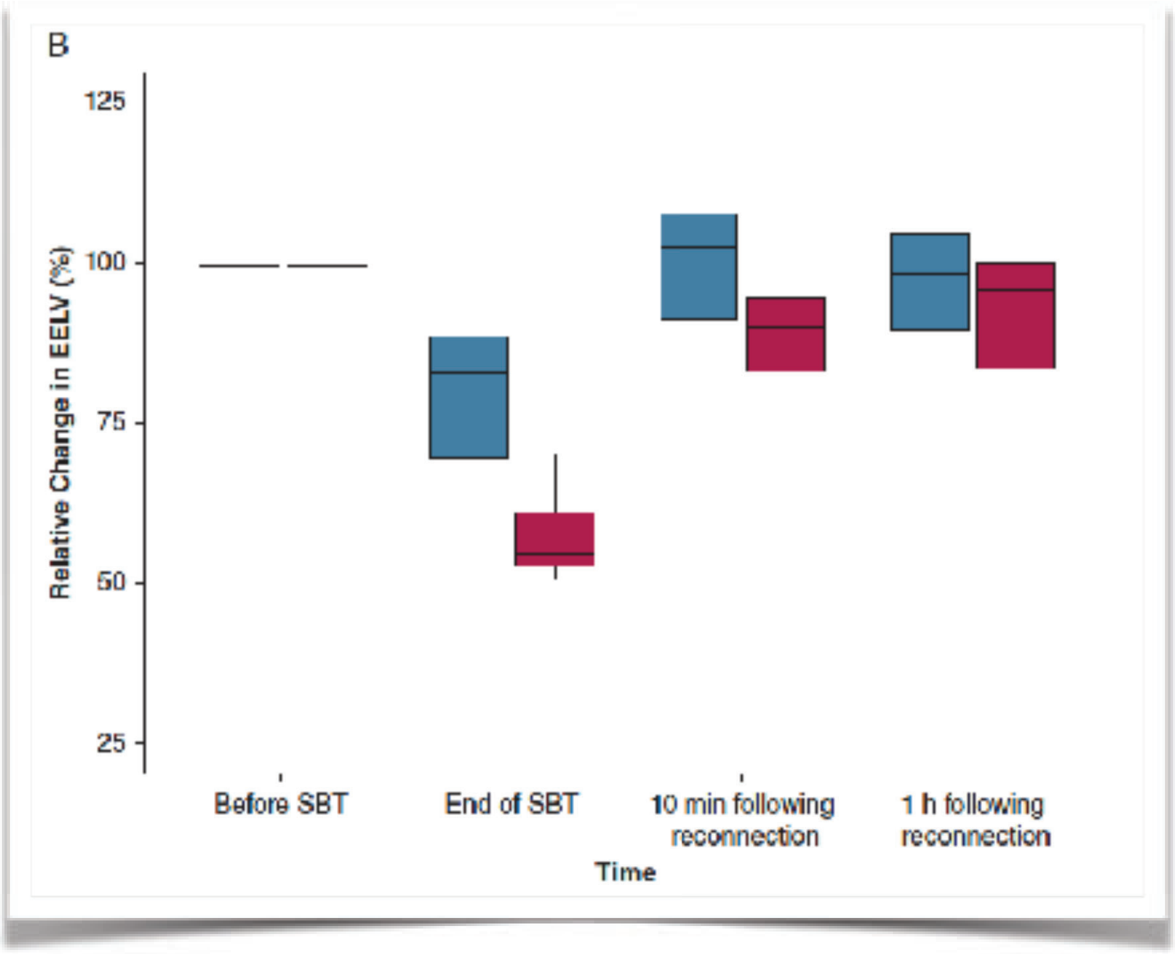
[Critical Care Original Research] CHEST

Physiologic Effects of Reconnection to the Ventilator for 1 Hour Following a Successful Spontaneous Breathing Trial

Rémi Coudroy, PhD; Alice Lejars, MD; Maeva Rodriguez, MD; Jean-Pierre Frat, PhD; Christophe Rault, PhD;
François Arrivé, MD; Sylvain Le Pape, PhD; and Arnaud W. Thille, PhD

🟦 **VSAI 7/0**

🟥 **Tube en T**



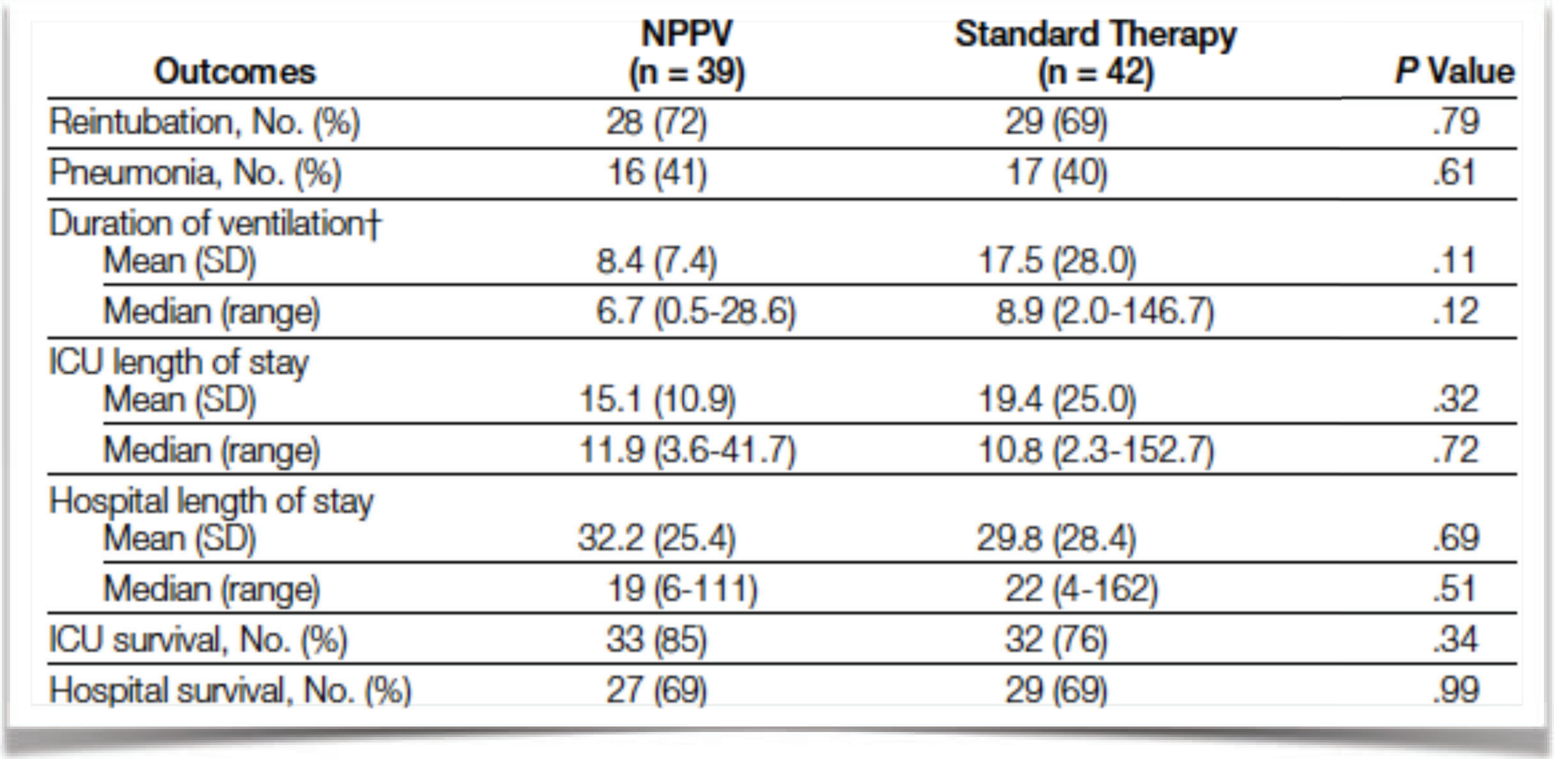
CHEST 2024;

Noninvasive Positive-Pressure Ventilation for Postextubation Respiratory Distress

A Randomized Controlled Trial

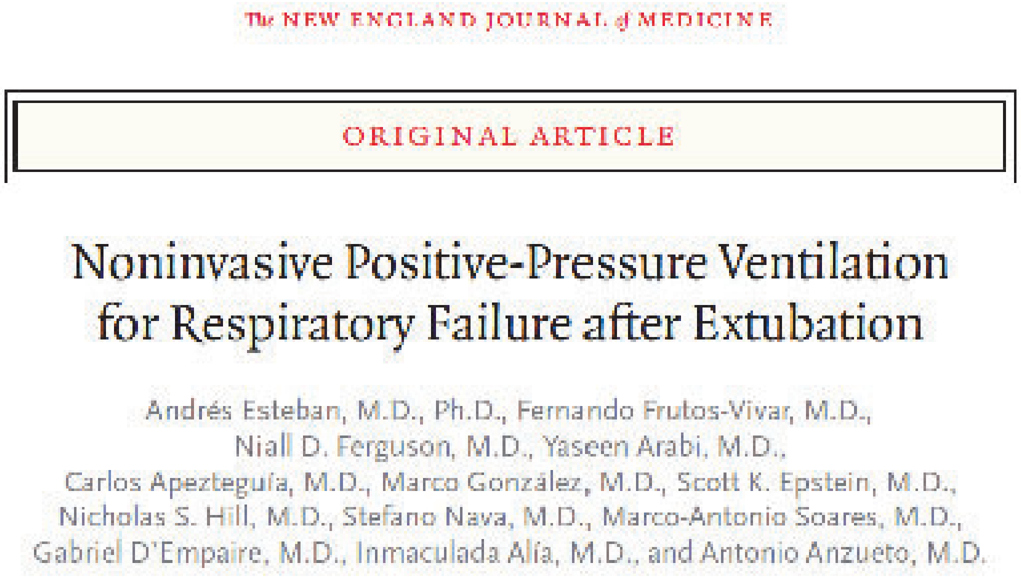
JAMA

Sean P. Keenan, MD, FRCPC, MSc
Caroline Powers, RRT
David C. McCormack, MD, FRCPC
Gary Block, MD, FRCPC



Outcomes	NPPV (n = 39)	Standard Therapy (n = 42)	*P* Value
Reintubation, No. (%)	28 (72)	29 (69)	.79
Pneumonia, No. (%)	16 (41)	17 (40)	.61
Duration of ventilation†			
Mean (SD)	8.4 (7.4)	17.5 (28.0)	.11
Median (range)	6.7 (0.5-28.6)	8.9 (2.0-146.7)	.12
ICU length of stay			
Mean (SD)	15.1 (10.9)	19.4 (25.0)	.32
Median (range)	11.9 (3.6-41.7)	10.8 (2.3-152.7)	.72
Hospital length of stay			
Mean (SD)	32.2 (25.4)	29.8 (28.4)	.69
Median (range)	19 (6-111)	22 (4-162)	.51
ICU survival, No. (%)	33 (85)	32 (76)	.34
Hospital survival, No. (%)	27 (69)	29 (69)	.99

JAMA. 2002;287:3238-3244

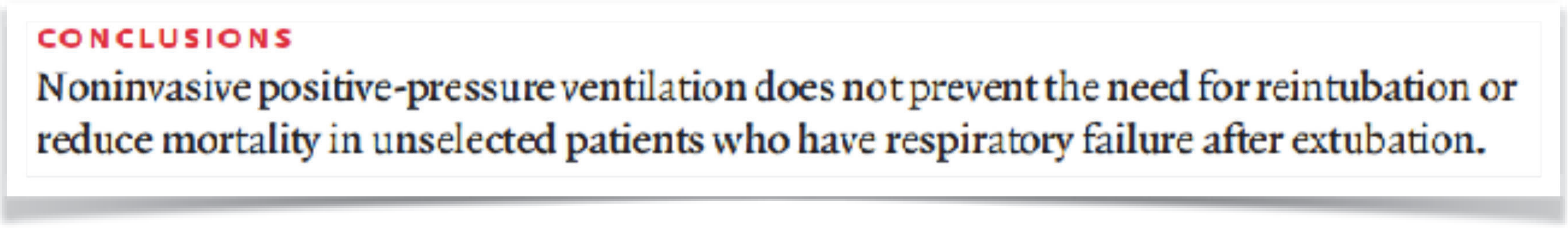


The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Noninvasive Positive-Pressure Ventilation for Respiratory Failure after Extubation

Andrés Esteban, M.D., Ph.D., Fernando Frutos-Vivar, M.D.,
Niall D. Ferguson, M.D., Yaseen Arabi, M.D.,
Carlos Apezteguía, M.D., Marco González, M.D., Scott K. Epstein, M.D.,
Nicholas S. Hill, M.D., Stefano Nava, M.D., Marco-Antonio Soares, M.D.,
Gabriel D'Empaire, M.D., Inmaculada Alía, M.D., and Antonio Anzueto, M.D.



CONCLUSIONS

Noninvasive positive-pressure ventilation does not prevent the need for reintubation or reduce mortality in unselected patients who have respiratory failure after extubation.

N Engl J Med 2004;350:2452-60.

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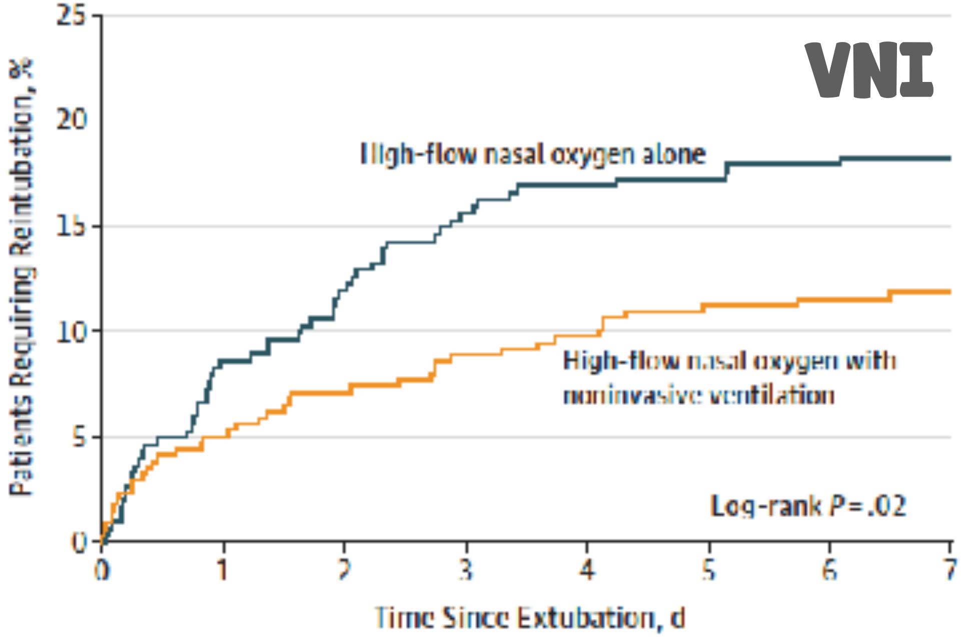
Effect of Postextubation High-Flow Nasal Oxygen With Noninvasive Ventilation vs High-Flow Nasal Oxygen Alone on Reintubation Among Patients at High Risk of Extubation Failure

A Randomized Clinical Trial

Sélection de patients à risque d'échec

Arnaud W. Thille, MD, PhD; Grégoire Muller, MD; Arnaud Gacouin, MD; Rémi Coudroy, MD; Maxens Decavèle, MD; Romain Sonneville, MD, PhD; François Beloncle, MD; Christophe Girault, MD; Laurence Dangers, MD; Alexandre Lautrette, MD, PhD; Séverin Cabasson, MD; Anahita Rouzé, MD; Emmanuel Vivier, MD; Anthony Le Meur, MD; Jean-Damien Ricard, MD, PhD; Keyvan Razazi, MD; Guillaume Barberet, MD; Christine Lebert, MD; Stephan Ehrmann, MD, PhD; Caroline Sabatier, MD; Jeremy Bourenne, MD; Gael Pradel, MD; Pierre Bailly, MD; Nicolas Terzi, MD, PhD; Jean Dellamonica, MD, PhD; Guillaume Lacave, MD; Pierre-Éric Danin, MD; Hodanou Nanadoumgar, MD; Aude Gibelin, MD; Lassane Zanre, MD; Nicolas Deye, MD, PhD; Alexandre Demoule, MD, PhD; Adel Maamar, MD; Mai Anh Nay, MD; René Robert, MD, PhD; Stéphanie Ragot, PharmD, PhD; Jean-Pierre Frat, MD; for the HIGH-WEAN Study Group and the REVA Research Network

VNI 12H/J 48H



No. at risk

High-flow nasal oxygen								
Alone	302	276	265	253	248	246	244	243
With noninvasive ventilation	339	321	314	308	305	294	292	291

JAMA | Original Investigation | CARING FOR THE CRITICALLY ILL PATIENT

JAMA

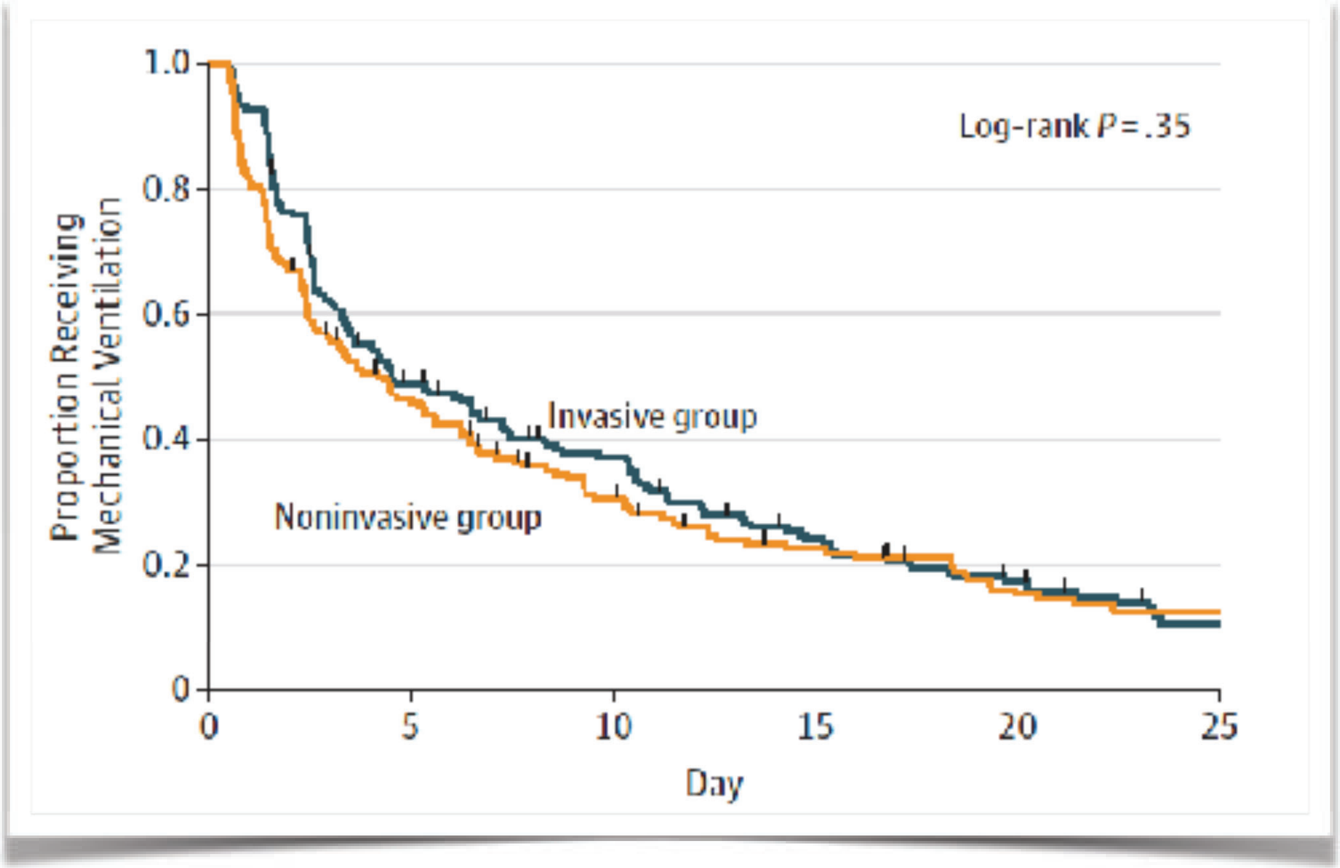
The Journal of the American Medical Association

Effect of Protocolized Weaning With Early Extubation to Noninvasive Ventilation vs Invasive Weaning on Time to Liberation From Mechanical Ventilation Among Patients With Respiratory Failure

The Breathe Randomized Clinical Trial

Gavin D. Perkins, MD; Dipesh Mistry, PhD; Simon Gates, PhD; Fang Gao, MD; Catherine Snelson, MB; Nicholas Hart, PhD; Luigi Camporota, PhD; James Varley, MB; Coralie Carle, MB; Elankumaran Paramasivam, MB; Beverley Hoddell; Daniel F. McAuley, MD; Timothy S. Walsh, MD; Bronagh Blackwood, PhD; Louise Rose, PhD; Sarah E. Lamb, DPhil; Stavros Petrou, PhD; Duncan Young, DM; Ranjit Lall, PhD; for the Breathe Collaborators

Pas de précipitation



JAMA. 2018;320(18):1881-1888.

Conclusion

- Protocole de sevrage
- Screening quotidien des patients
- Adapter le niveau d’aide
- Améliorer l'interaction patient ventilateur
  - Synchronisation
  - Proportionnalité
  - Nouvel outil de monitorage au lit du patient: l’EAdi