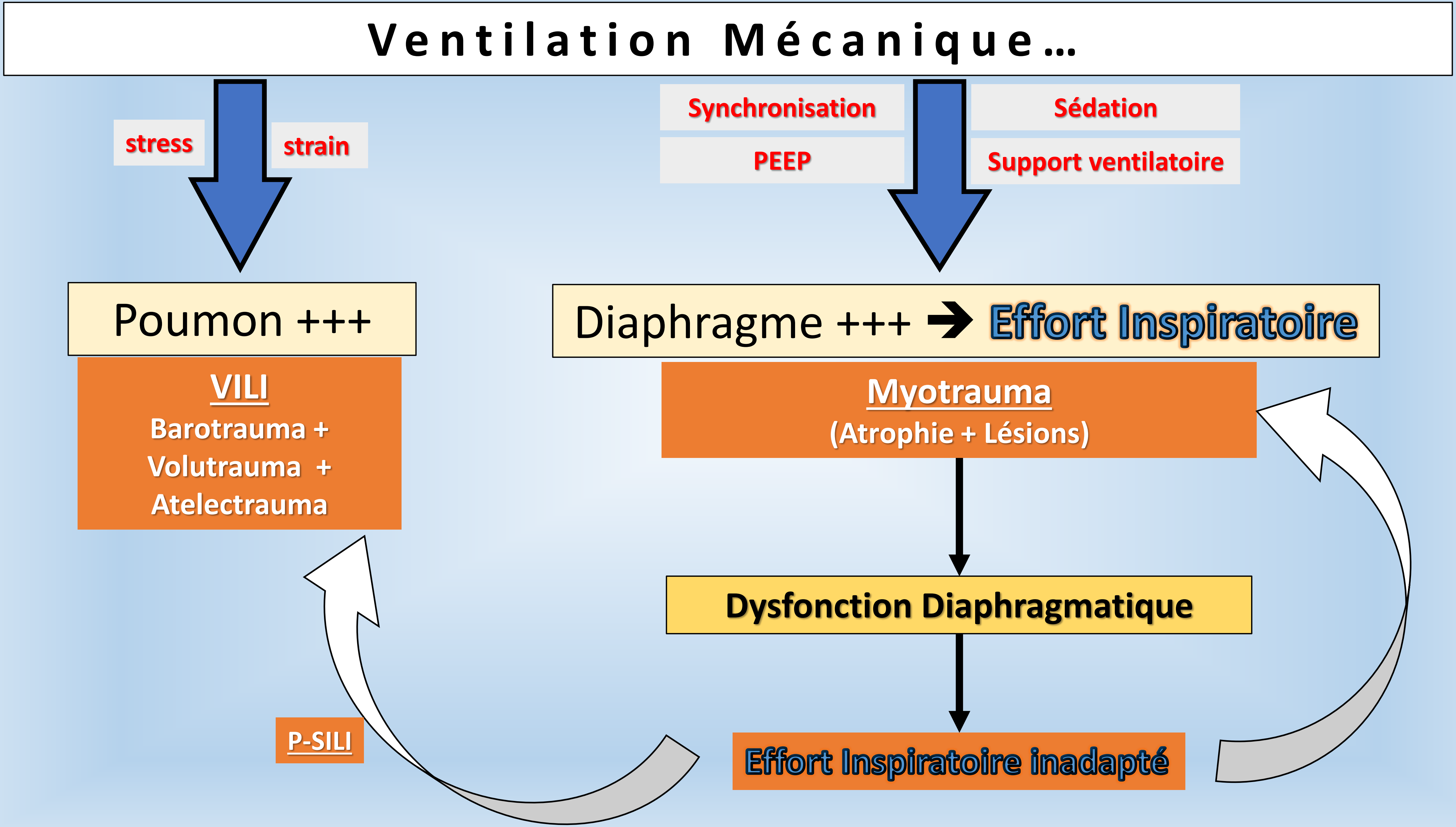
SAARSIU

Ventilation Mécanique : Gestion de l'Effort Inspiratoire

Salem ABAD , Douera

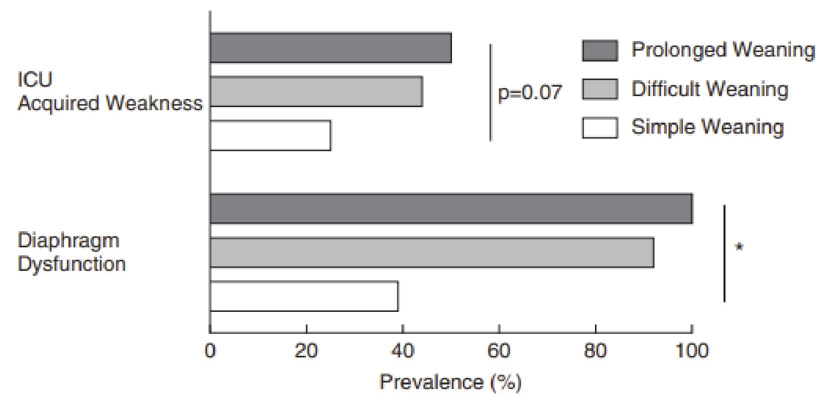
mindray
healthcare within reach

MEDICO MEDLINE


Ventilation Mécanique…
stress
strain
Synchronisation
Sédation
PEEP
Support ventilatoire
Poumon +++
VILI
Barotrauma +
Volutrauma +
Atelectrauma
Diaphragme +++ → Effort Inspiratoire
Myotrauma
(Atrophie + Lésions)
Dysfonction Diaphragmatique
Effort Inspiratoire inadapté
P-SILI

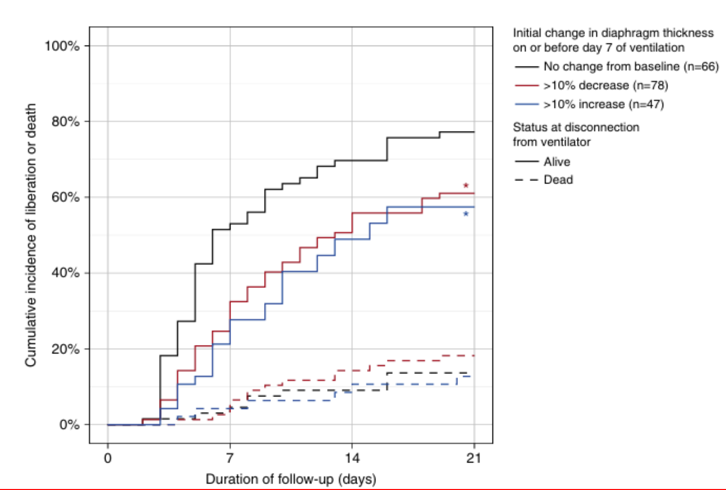
Coexistence and Impact of Limb Muscle and Diaphragm Weakness at Time of Liberation from Mechanical Ventilation in Medical Intensive Care Unit Patients

Martin Dres[1,2]*, Bruno-Pierre Dubé[1,3]*, Julien Mayaux[2], Julie Delemazure[2], Danielle Reuter[2], Laurent Brochard[4,5], Thomas Similowski[1,2], and Alexandre Demoule[1,2]



Mechanical Ventilation–induced Diaphragm Atrophy Strongly Impacts Clinical Outcomes

Ewan C. Goligher[1,2,3,4], Martin Dres[5,6], Eddy Fan[1,2,4,7], Gordon D. Rubenfeld[1,4,7,8], Damon C. Scales[1,4,7,8], Margaret S. Herridge[1,2,4,9], Stefannie Vorona[2], Michael C. Sklar[5,10], Nuttapol Rittayamai[5], Ashley Lanys[5], Alistair Murray[2], Deborah Brace[2], Cristian Urrea[2], W. Darlene Reid[11], George Tomlinson[2], Arthur S. Slutsky[1,4,5], Brian P. Kavanagh[1,3,10,12], Laurent J. Brochard[1,4,5]*, and Niall D. Ferguson[1,2,3,4,7,9]*



Diaphragmatic myotrauma: a mediator of prolonged ventilation and poor patient outcomes in acute respiratory failure

Ewan C Goligher, Laurent J Brochard, W Darlene Reid, Eddy Fan, Olli Saarela, Arthur S Slutsky, Brian P Kavanagh, Gordon D Rubenfeld, Niall D Ferguson

Exposure: diaphragm thickening fraction (15–30% vs >30% or <15%)†							
Duration of ventilation in ICU survivors	Changes in diaphragm thickness from baseline	145	0·03	0·01	0·001	0·10	0·02
Risk of complications of ARF	Changes in diaphragm thickness from baseline	185	0·04	0·01	0·002	0·15	0·01
Length of ICU stay in ICU survivors	Changes in diaphragm thickness from baseline	143	0·01	0·01	0·002	0·06	0·008

Objectifs
Ventilation Mécanique :

Echanges gazeux

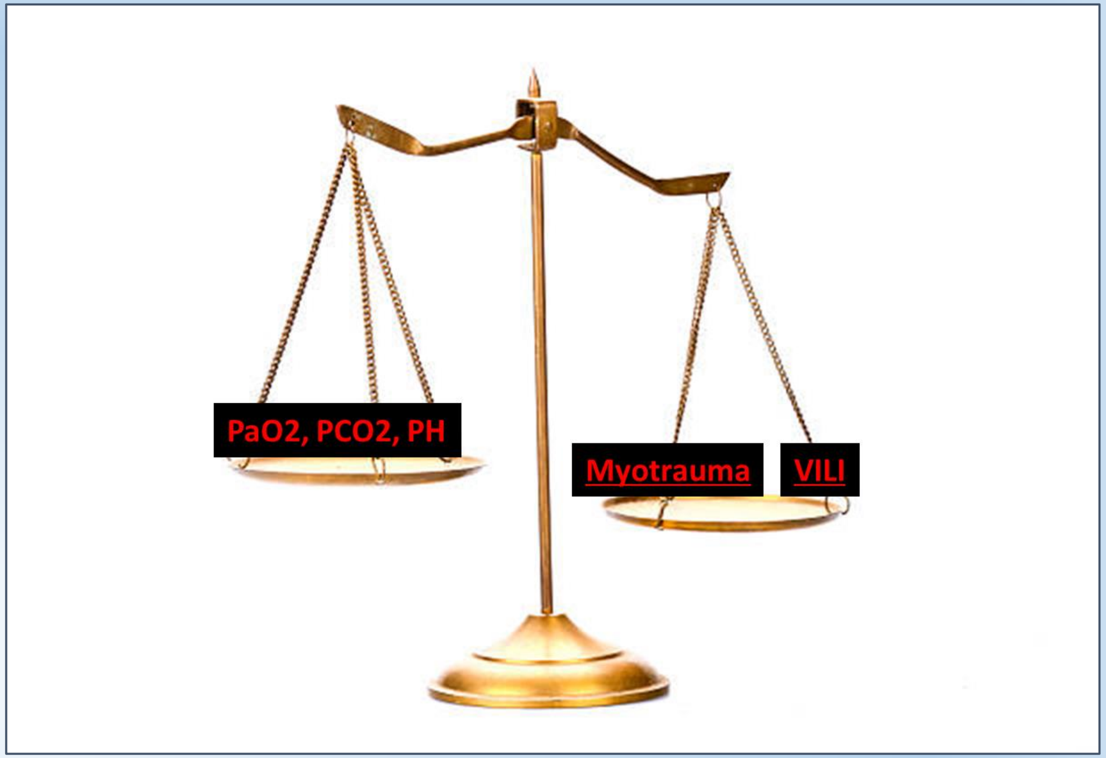
Vital
(PaO2, PCO2, PH)

Mécanique Respiratoire

Protection Poumon
(stress, strain ➔ VILI)

Diaphragme

Protection Diaphragme
(Myotrauma ➔ Dysfonction Diaphragmatique)



Effort Inspiratoire inadapté :

- ➔ *Insuffisant, absent*
- ➔ *Excessif*
- ➔ *Asynchronie (ventilateur)*

Monitorage + Gestion

Effort inspiratoire

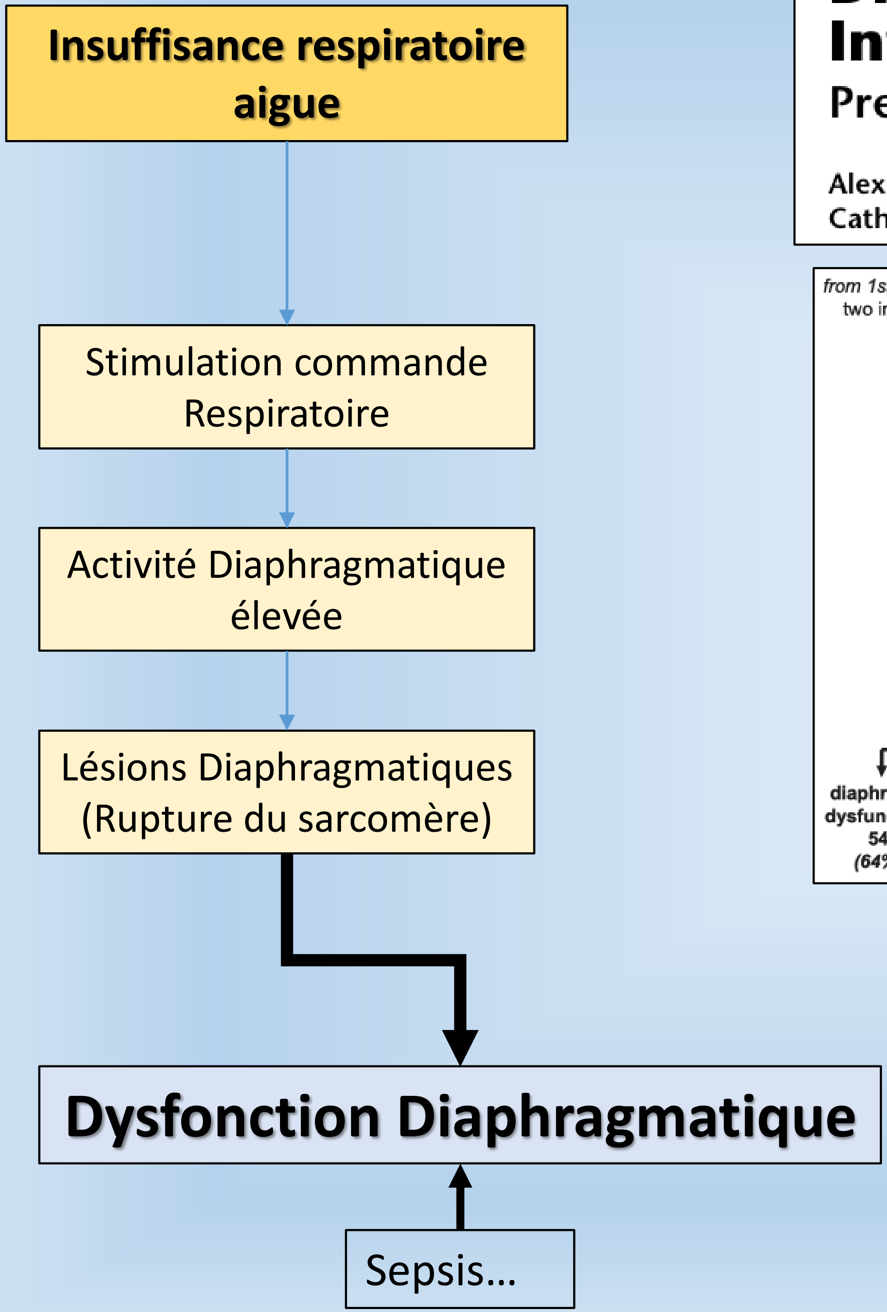
Problématique du Myotrauma…

1	Facteurs de risque ?
2	Monitorage de l'effort inspiratoire ?
3	Gestion Effort inspiratoire inadapté ?

1 Facteurs physiopathologiques à l’origine du Myotrauma ?

2 Monitorage de l’effort inspiratoire ?

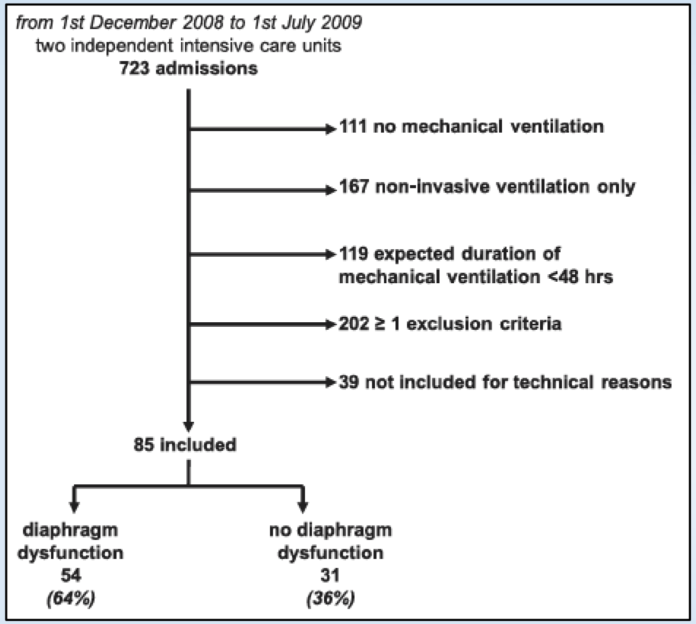
3 Gestion Effort inspiratoire inadapté ?

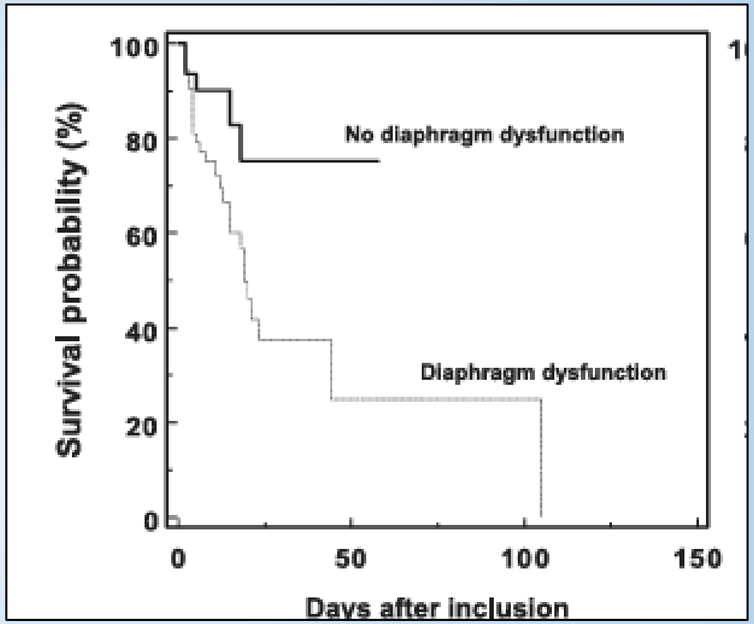


Diaphragm Dysfunction on Admission to the Intensive Care Unit

Prevalence, Risk Factors, and Prognostic Impact—A Prospective Study

Alexandre Demoule[1,2,3], Boris Jung[4,5], Hélène Prodanovic[2], Nicolas Molinari[6], Gerald Chanques[4,5], Catherine Coirault[3], Stefan Matecki[5,7], Alexandre Duguet[1,2], Thomas Similowski[1,2*], and Samir Jaber[4,5*]

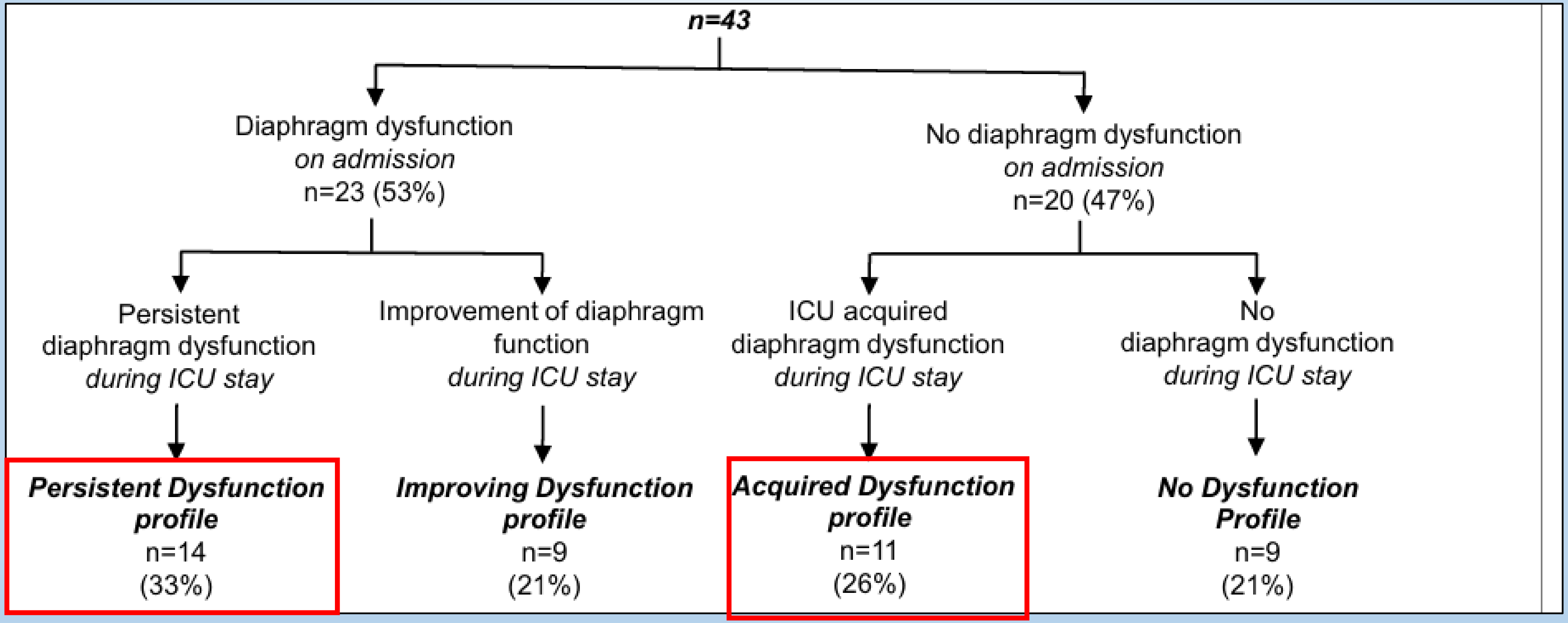




		Diaphragm Dysfunction (*Defined as Ptr, stim < 11 cm H_2O*)		
	All Patients (*n* = *85*)	Yes (*n* = *54*)	No (*n* = *31*)	*P* Value
SOFA	8 (5–11)	8 (6–11)	7 (3–9)	0.015
Sepsis, n (%)	52 (61)	41 (76)	11 (35)	0.001
Hypnotics, n (%)	71 (84)	48 (89)	23 (74)	0.079
Opioids, n (%)	60 (71)	38 (70)	22 (71)	0.954
Steroids, n (%)	42 (49)	28 (52)	14 (45)	0.553

Patterns of diaphragm function in critically ill patients receiving prolonged mechanical ventilation: a prospective longitudinal study

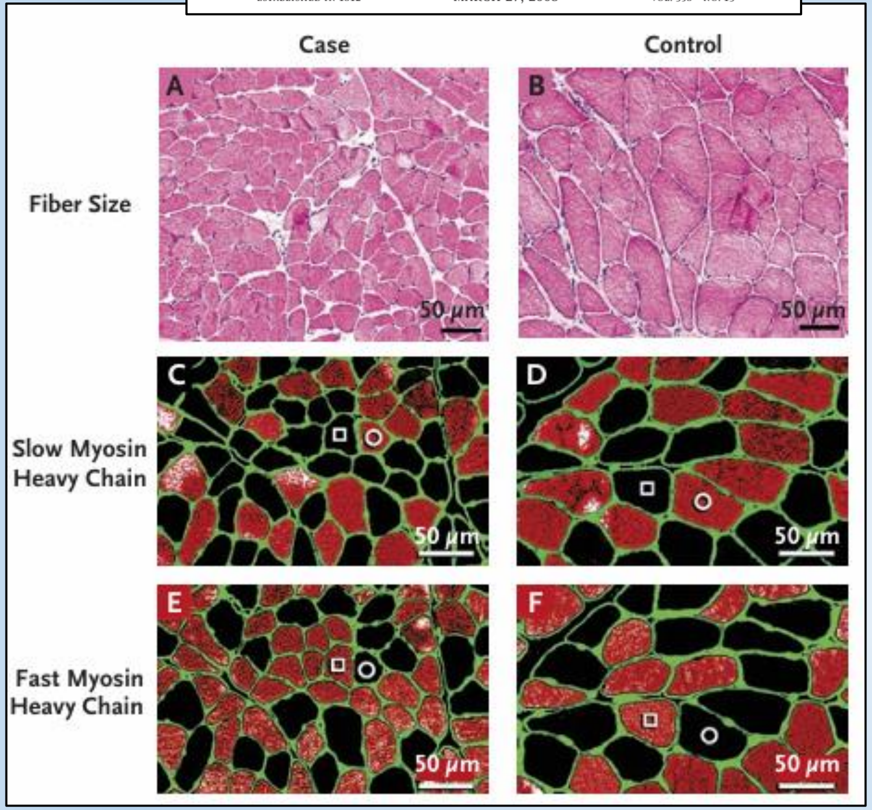
Alexandre Demoule[1,2,7*], Nicolas Molinari[3], Boris Jung[4,5], Hélène Prodanovic[2], Gerald Chanques[4,5], Stefan Matecki[6], Julien Mayaux[2], Thomas Similowski[1,2] and Samir Jaber[4,5]

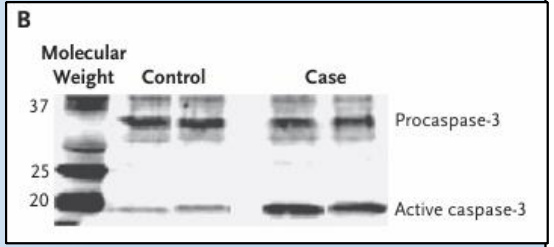


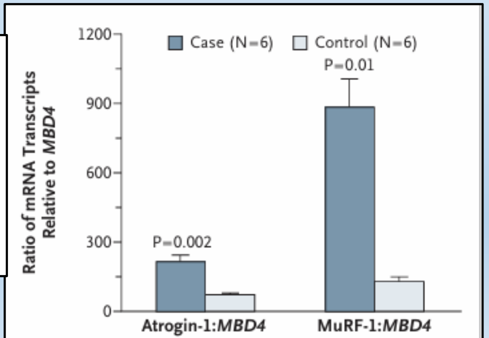
Rapid Disuse Atrophy of Diaphragm Fibers in Mechanically Ventilated Humans

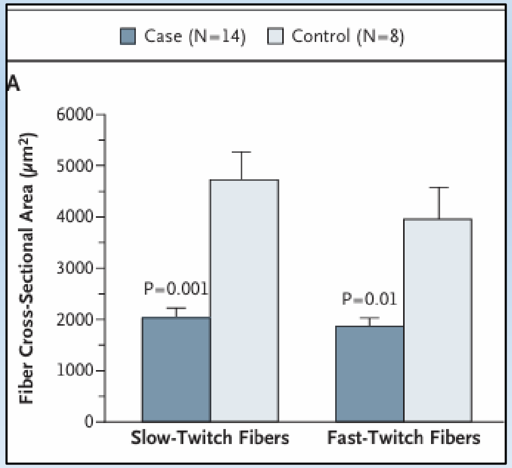
Sanford Levine, M.D., Taitan Nguyen, B.S.E., Nyali Taylor, M.D., M.P.H., Michael E. Friscia, M.D.,
Murat T. Budak, M.D. … eva, M.D.,
Seema Sonnad, Ph.D., La … Ph.D., Ed.D.,

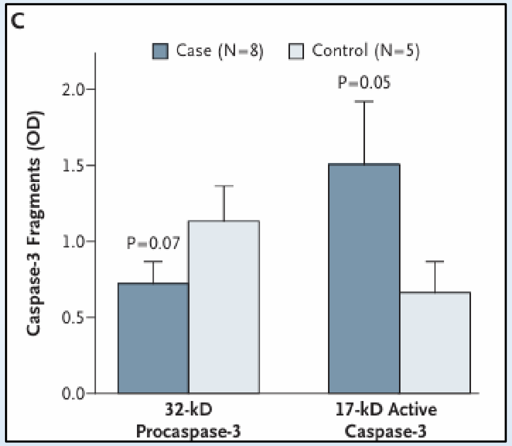
The NEW ENGLAND JOURNAL of MEDICINE
ESTABLISHED IN 1812 MARCH 27, 2008 VOL. 358 NO. 13

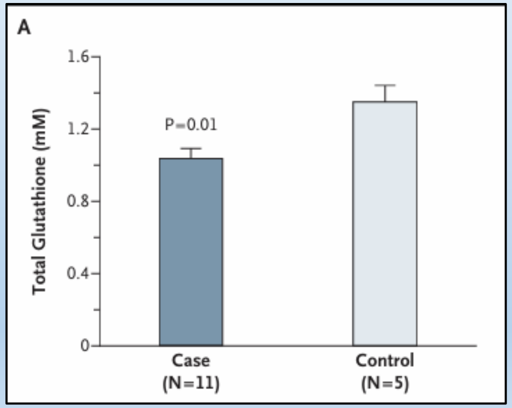












Sédation:
Narcotiques, curares

↓

Inhibition commande Respiratoire

↓

Activité Diaphragmatique freinée

↓

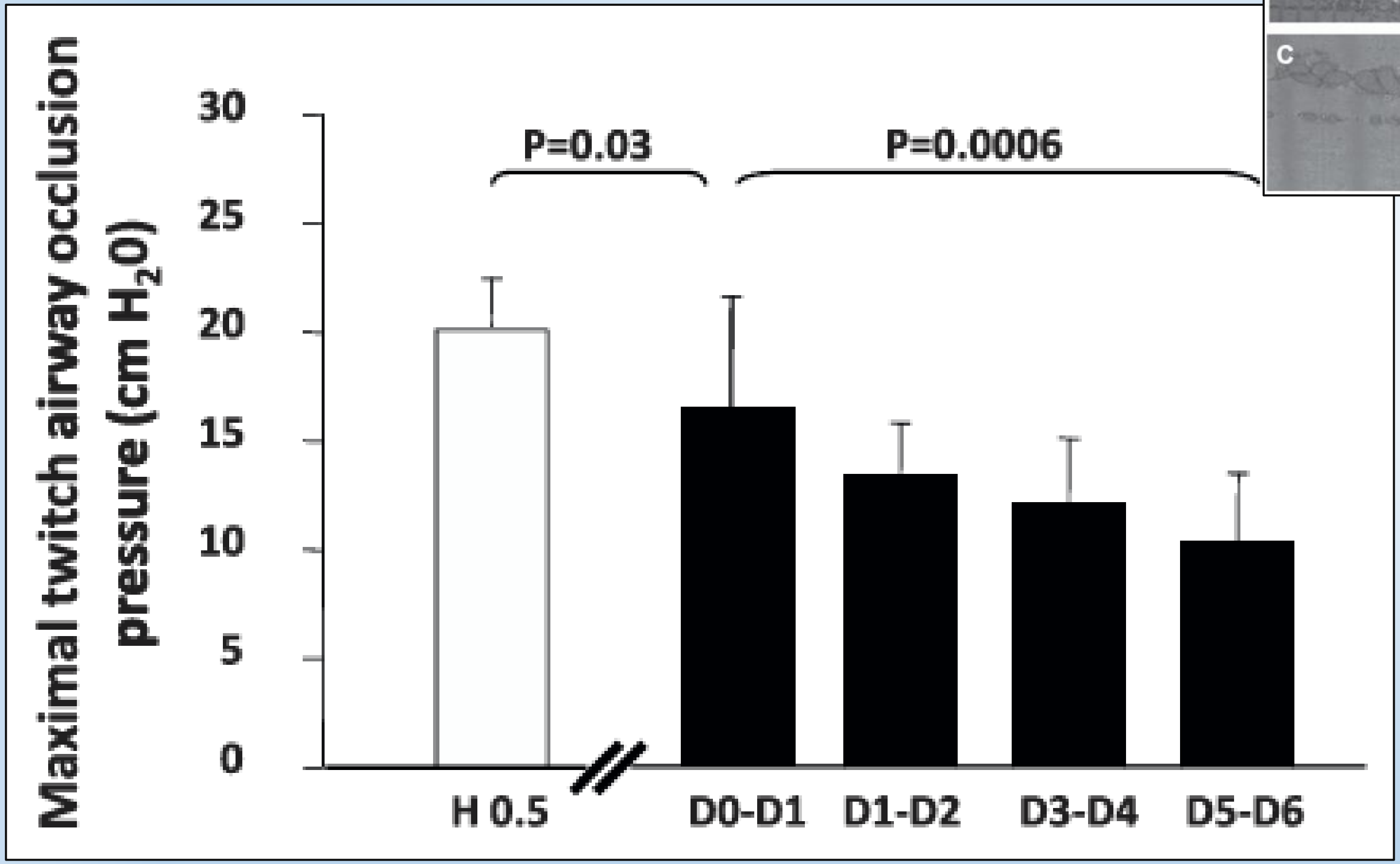
Atrophie Diaphragmatique (Perte de masse musculaire)

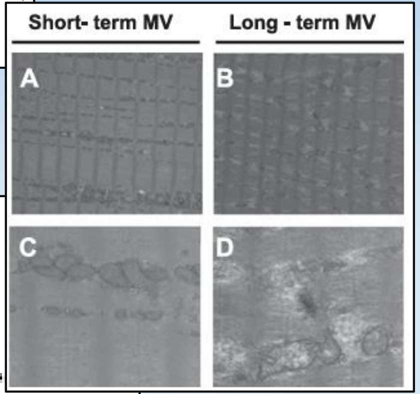
↓

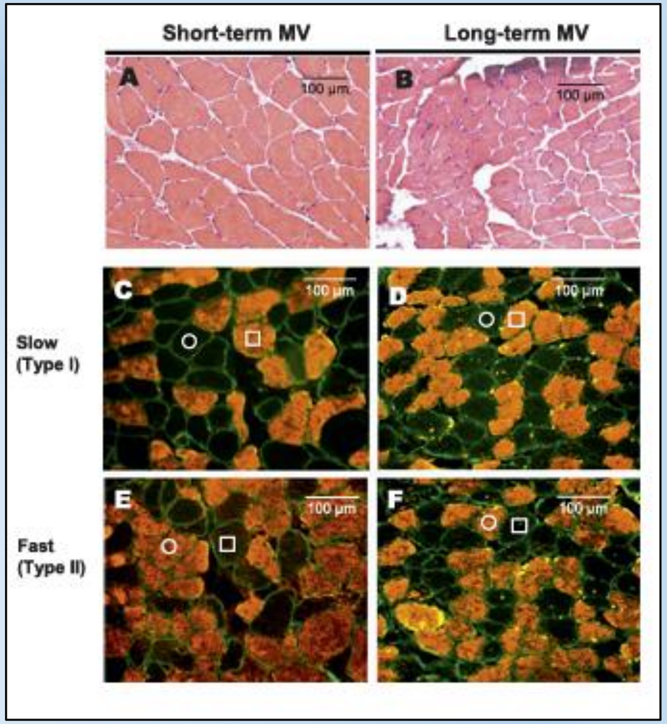
Dysfonction Diaphragmatique

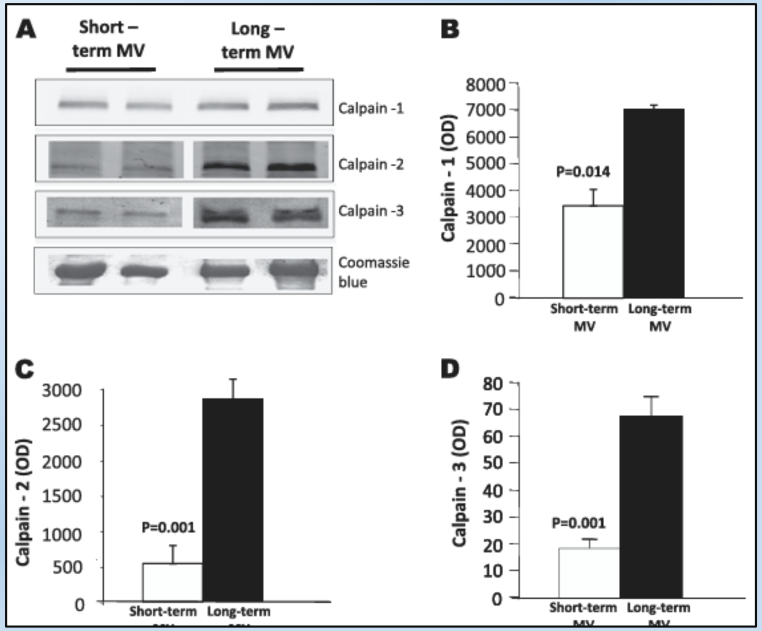
Rapidly Progressive Diaphragmatic Weakness and Injury during Mechanical Ventilation in Humans

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[1,2], Christelle Koechlin-Ramonatxo[7], Mustapha Sebbane[1,2], 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[2], and Stefan Matecki[2,10]





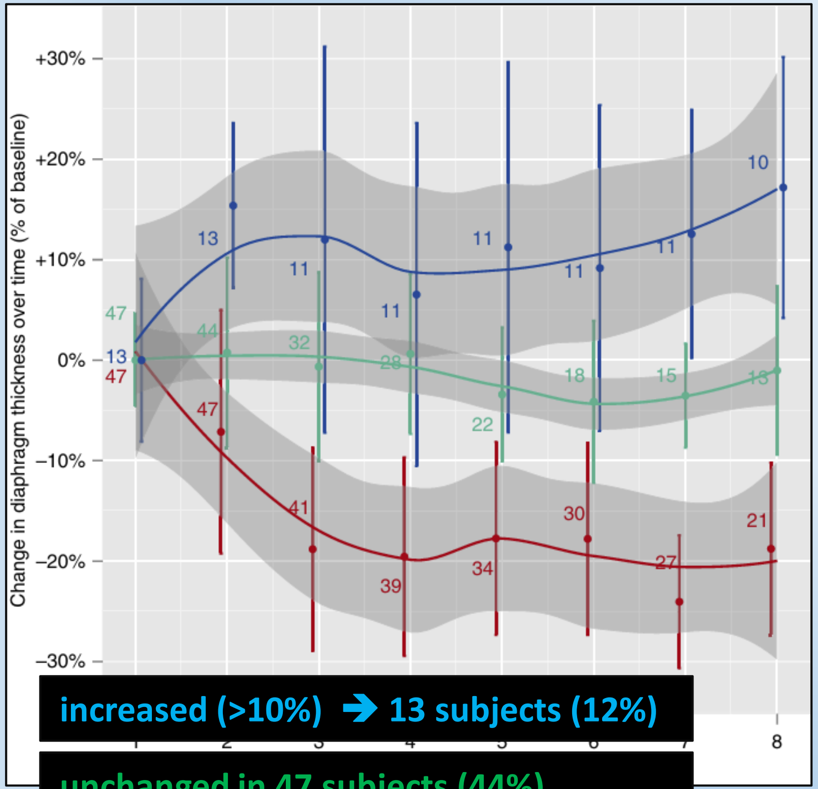




Evolution of Diaphragm Thickness during Mechanical Ventilation
Impact of Inspiratory Effort

Ewan C. Goligher[1,2,3,4], Eddy Fan[1,2,4,5], Margaret S. Herridge[1,2,4,6], Alistair Murray[1,4], Stefannie Vorona[1,4], Debbie Brace[1,4], Nuttapol Rittayamai[1,7], Ashley Lanys[1,4,7], George Tomlinson[2], Jeffrey M. Singh[1,2,4], Steffen-Sebastian Bolz[3], Gordon D. Rubenfeld[1,2,5,8], Brian P. Kavanagh[1,3,9,10], Laurent J. Brochard[1,2,7], and Niall D. Ferguson[1,2,3,4,5,6]

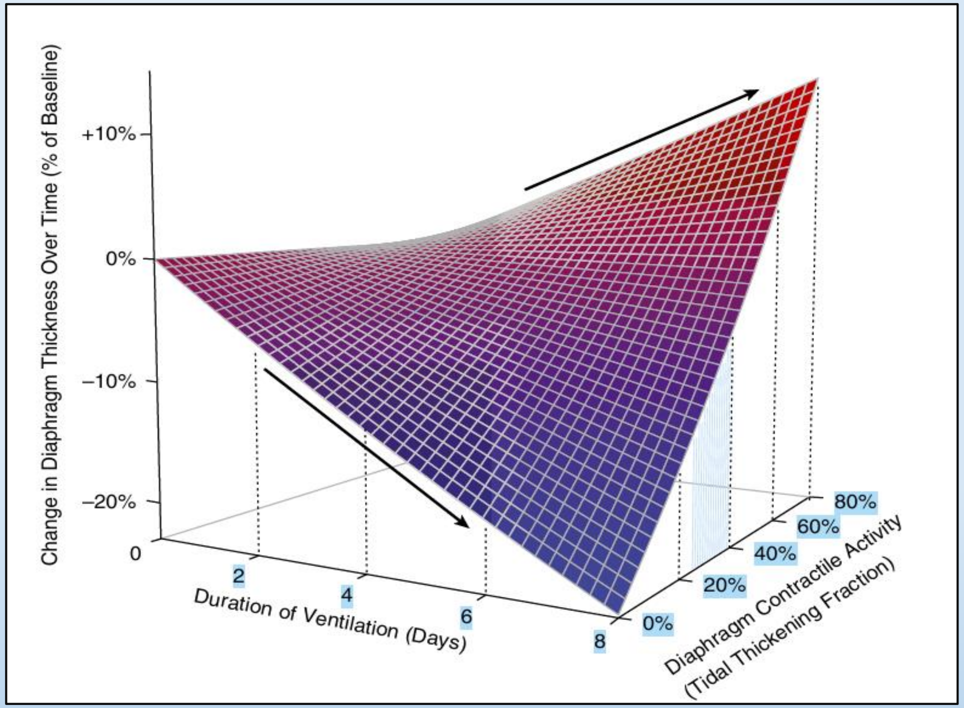
	Overall Study Population (*n* = *107*)	Change in Diaphragm Thickness during the First Week of Mechanical Ventilation: >10% Decrease (*n* = *47*)	Within 10% of Baseline (*n* = *47*)	>10% Increase (*n* = *13*)	*P* Value
Applied driving pressure, cm H_2O, mean (SD)	11.0 (6.3)	12.2 (6.3)	10.4 (5.4)	8.5 (8.6)	0.04†



increased (>10%) ➔ 13 subjects (12%)

unchanged in 47 subjects (44%)

decreased (>10%) ➔ 47 subjects (44%)



Group: Diaphragm Thickness Change
- >10% loss on or before day 8
- <10% change on or before day 8
- >10% gain on or before day 8

Support ventilatoire élevé

↓

Efforts Insuffisants

→ Activité Diaphragmatique freinée

Sédation: *Narcotiques, curares*

↓

Inhibition commande Respiratoire

↓

Activité Diaphragmatique freinée

↓

Atrophie Diaphragmatique

↓

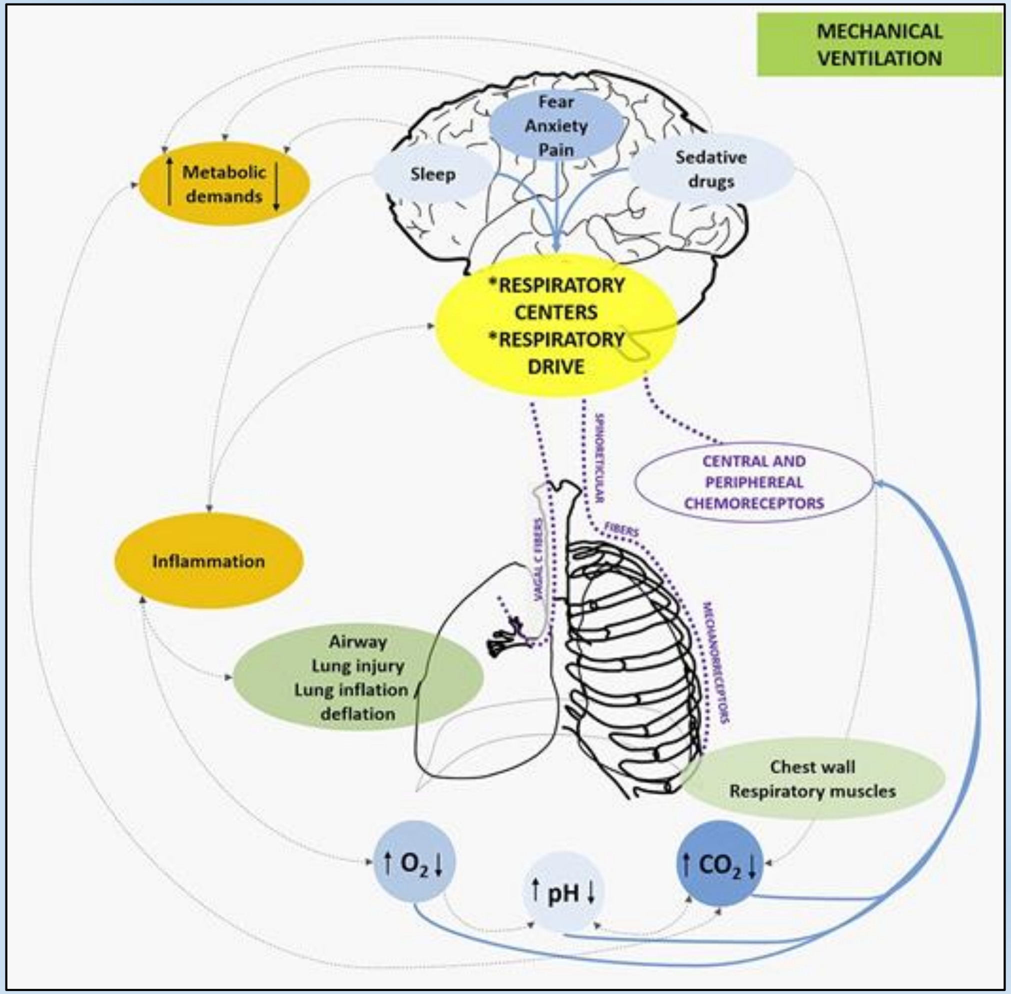
Dysfonction Diaphragmatique

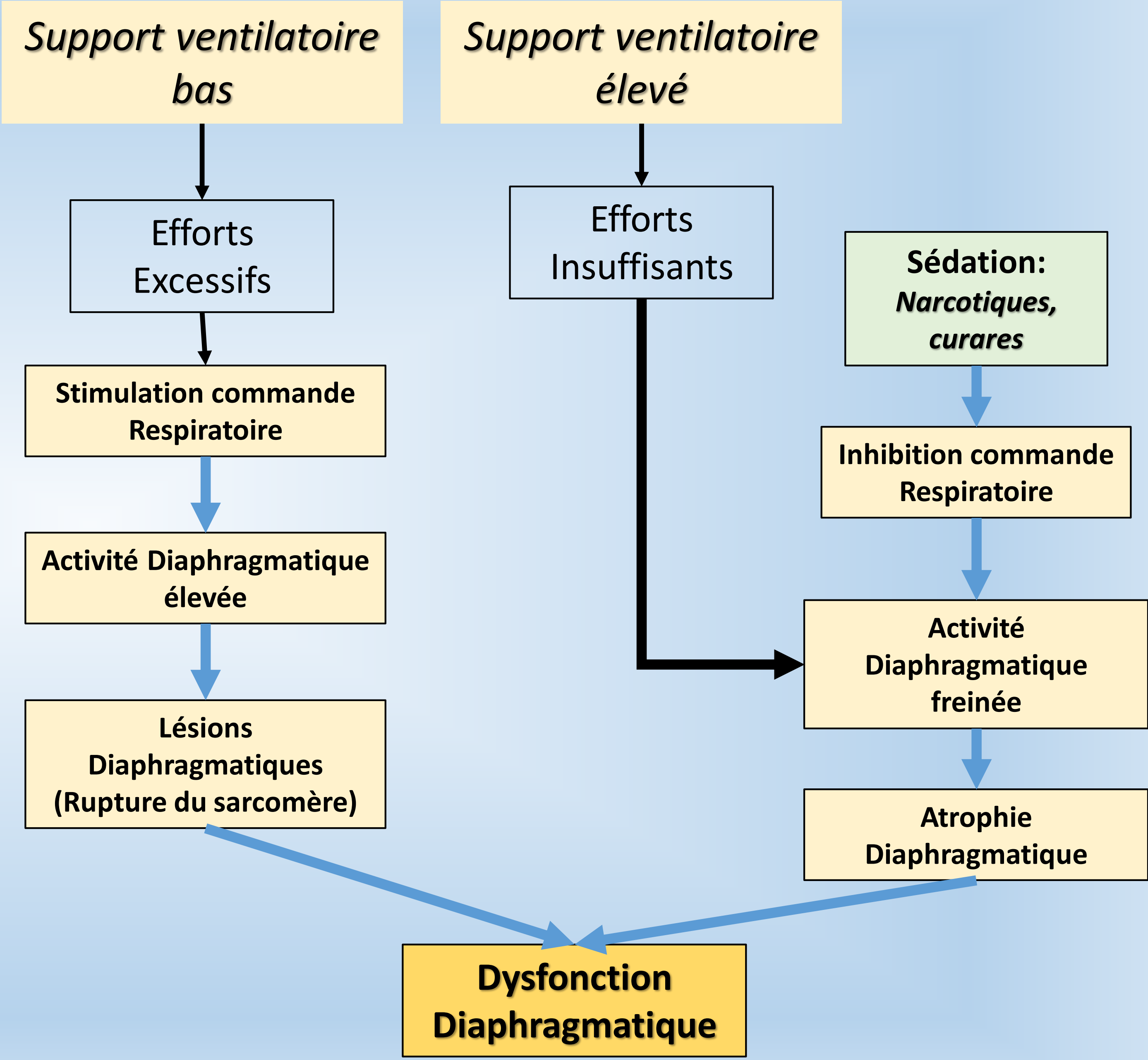
WHAT'S NEW IN INTENSIVE CARE

Is my patient's respiratory drive (too) high?

Irene Telias[1,2,3,4], Laurent Brochard[1,2*] and Ewan C. Goligher[1,3]

HIGH RESPIRATORY DRIVE



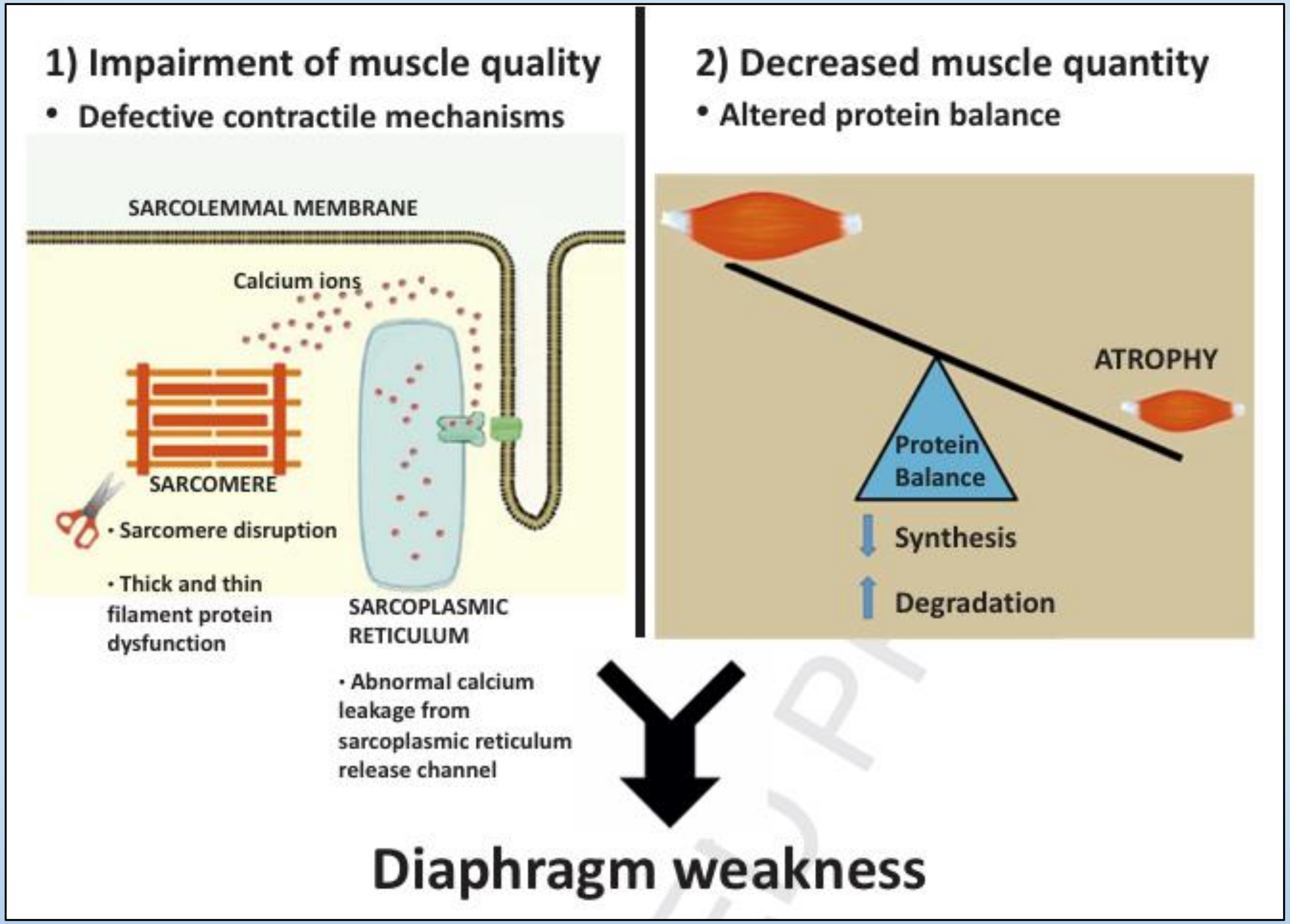


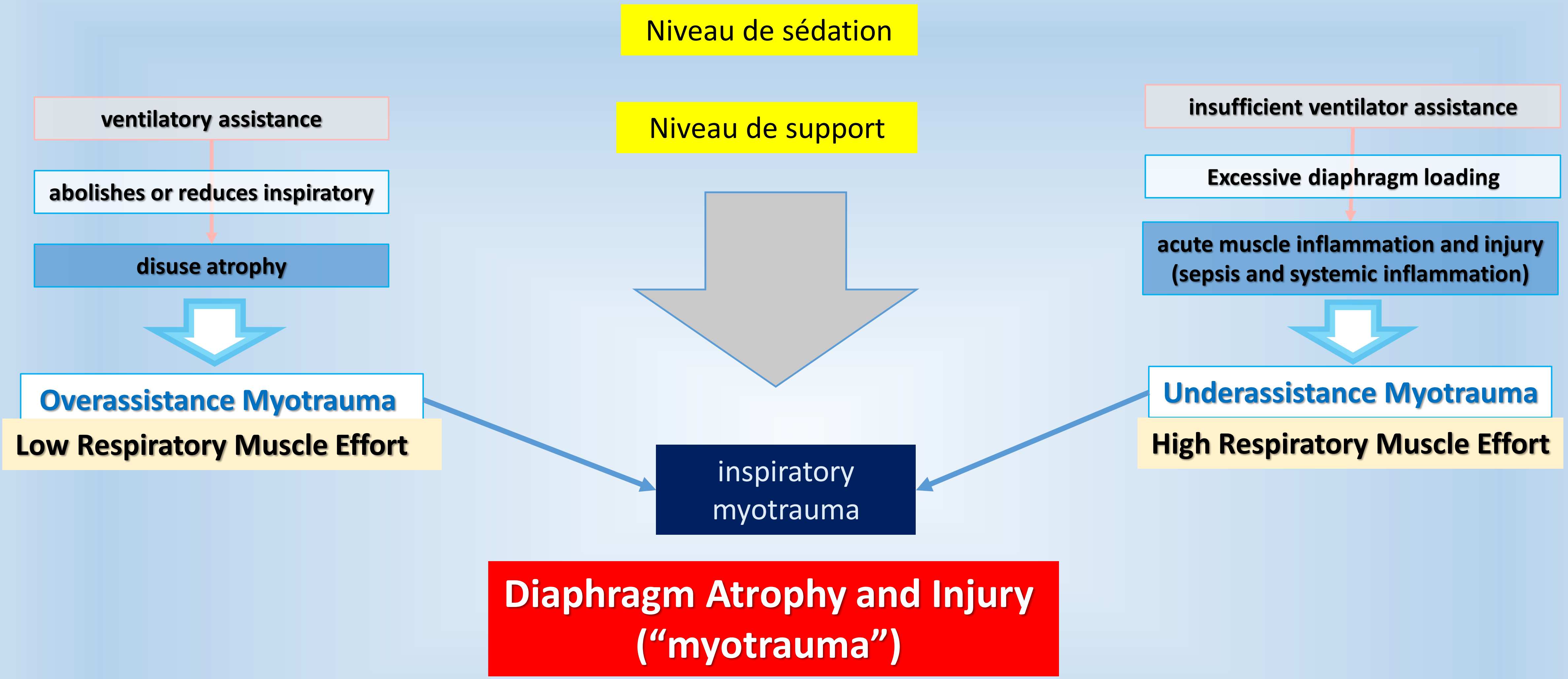
Diaphragm Weakness in the Critically Ill

Basic Mechanisms Reveal Therapeutic Opportunities

Basil J. Petrof, MD

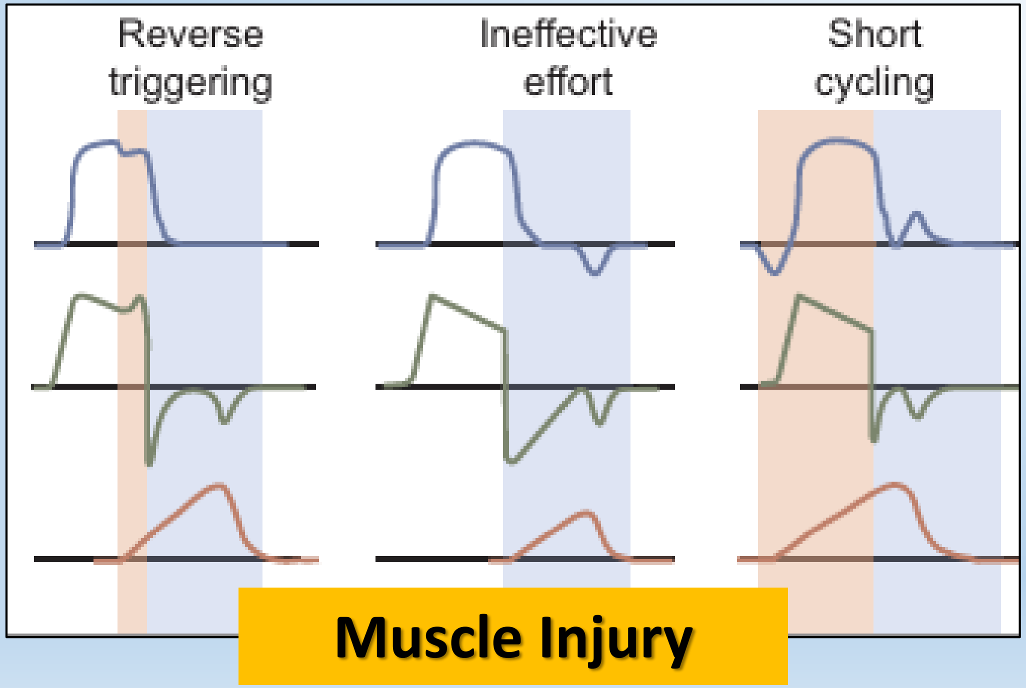
CHEST

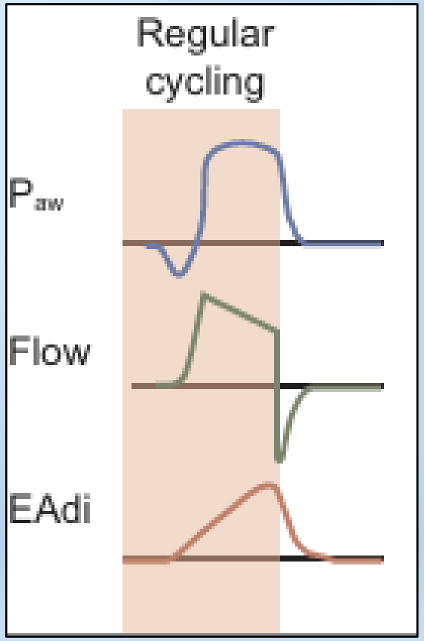



Niveau de sédation
Niveau de support
ventilatory assistance
abolishes or reduces inspiratory
disuse atrophy
Overassistance Myotrauma
Low Respiratory Muscle Effort
insufficient ventilator assistance
Excessive diaphragm loading
acute muscle inflammation and injury (sepsis and systemic inflammation)
Underassistance Myotrauma
High Respiratory Muscle Effort
inspiratory myotrauma
Diaphragm Atrophy and Injury (“myotrauma”)

Eccentric Contractions of the Diaphragm During Mechanical Ventilation

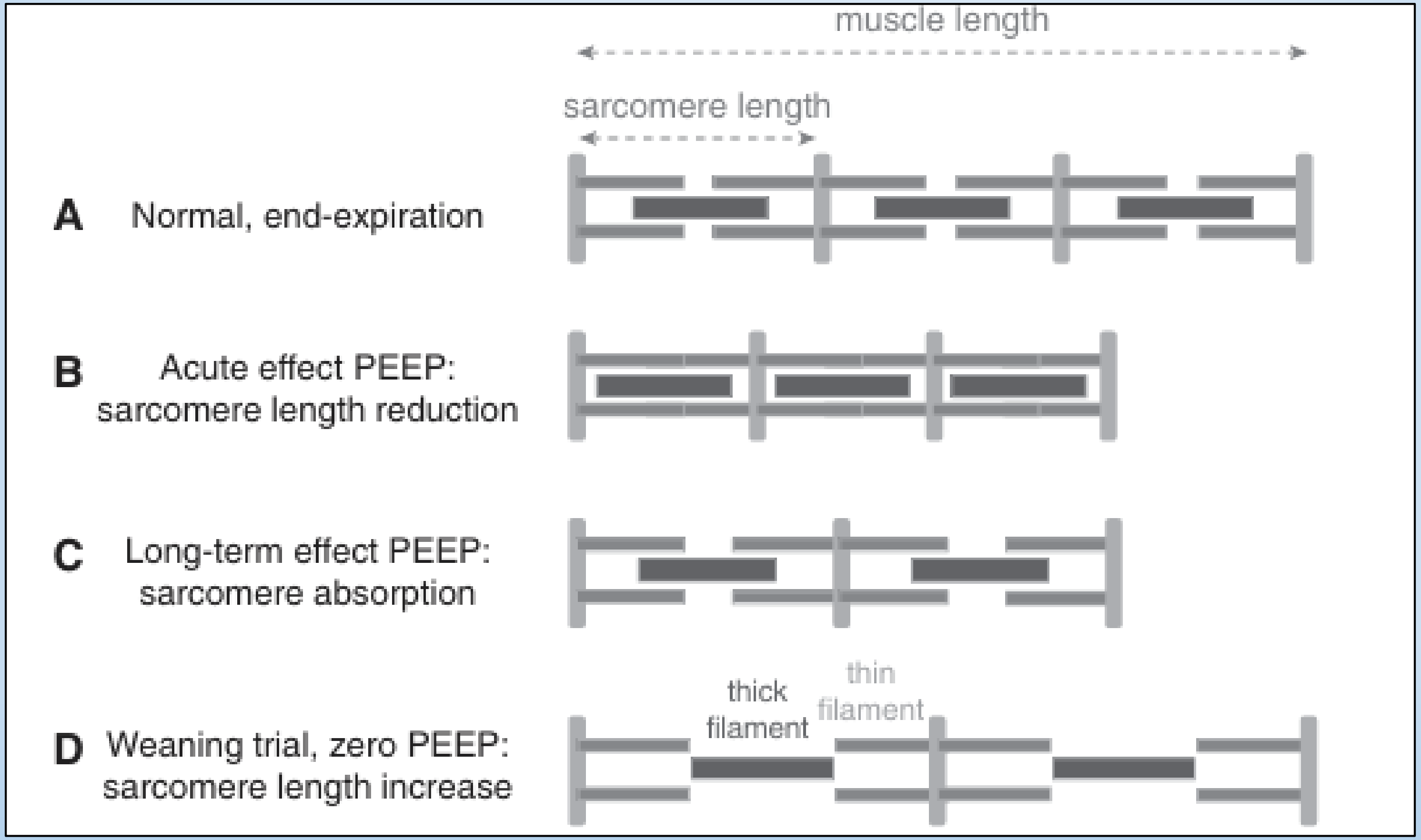
Patricio García-Valdés, Tiziana Fernández, Yorschua Jalil, Luis Peñailillo, and L Felipe Damiani





Positive End-Expiratory Pressure Ventilation Induces Longitudinal Atrophy in Diaphragm Fibers

Johan Lindqvist[1*], Marloes van den Berg[2*], Robbert van der Pijl[1,2], Pleuni E. Hooijman[2], Albertus Beishuizen[3], Judith Elshof[4], Monique de Waard[4], Armand Girbes[4], Angelique Spoelstra-de Man[4], Zhong-Hua Shi[5], Charissa van den Brom[6], Sylvia Bogaards[2], Shengyi Shen[1], Joshua Strom[1], Henk Granzier[1], Jeroen Kole[2], René J. P. Musters[2], Marinus A. Paul[7], Leo M. A. Heunks[4], and Coen A. C. Ottenheijm[1,2]



1 Facteurs physiopathologiques à l’origine du Myotrauma ?

2 **Monitorage de l’effort inspiratoire ?**

3 Gestion Effort inspiratoire inadapté ?

Monitorage de l'effort inspiratoire

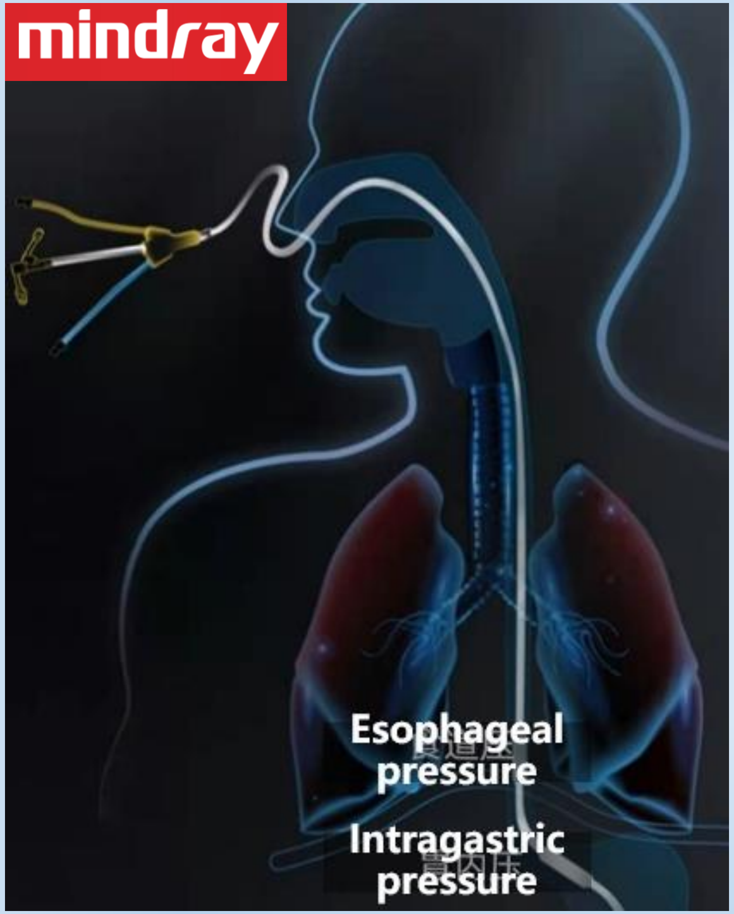
With Esophageal Pressure

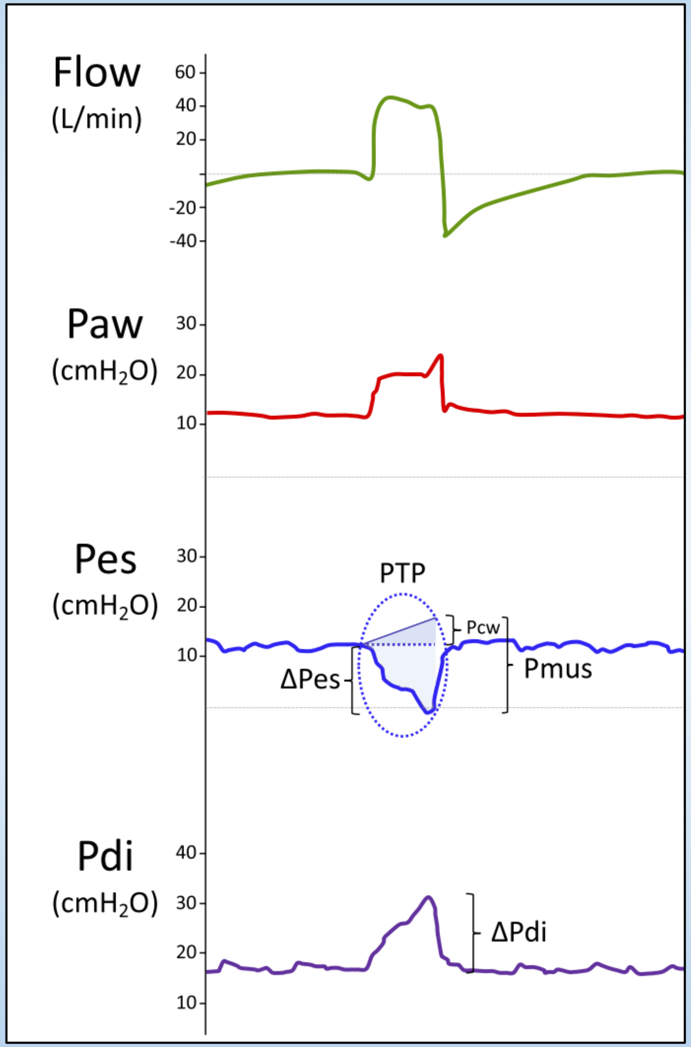
Without Esophageal Pressure

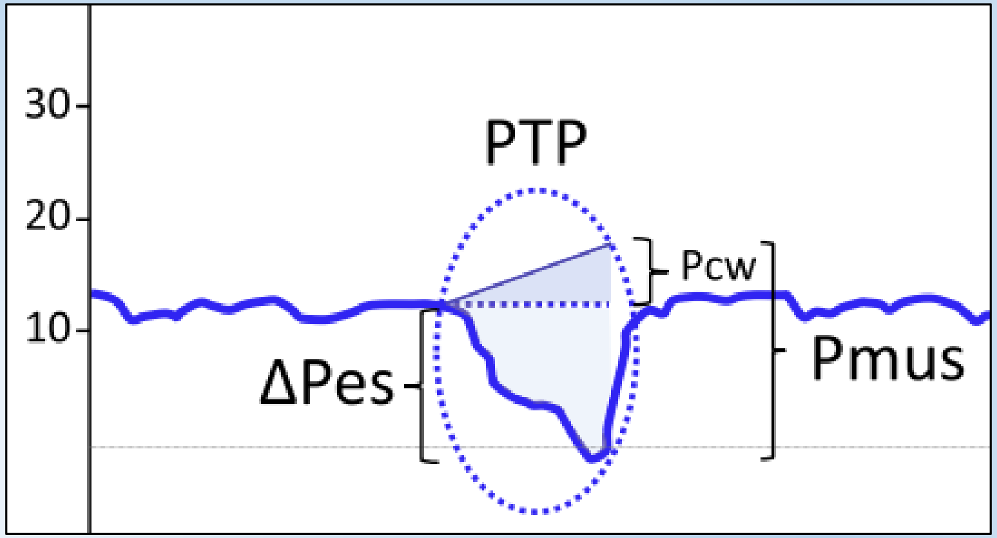
Gold standard ← **Simples, disponibles**

Effort Inspiratoire

With Esophageal Pressure







ΔPes : – 3 à – 8 cmH2O

ΔPdi : > 3 à < 12 cmH2O

Pmus : ≥ 5 et < 15 cmH2O

PTP/min : 50 et 200 cmH2O*s/min

Without Esophageal Pressure

Détecter

→ *absent*

Absence de déclenchement (seuil bas)

→ *Insuffisant*

Déclenchement (seuil bas)

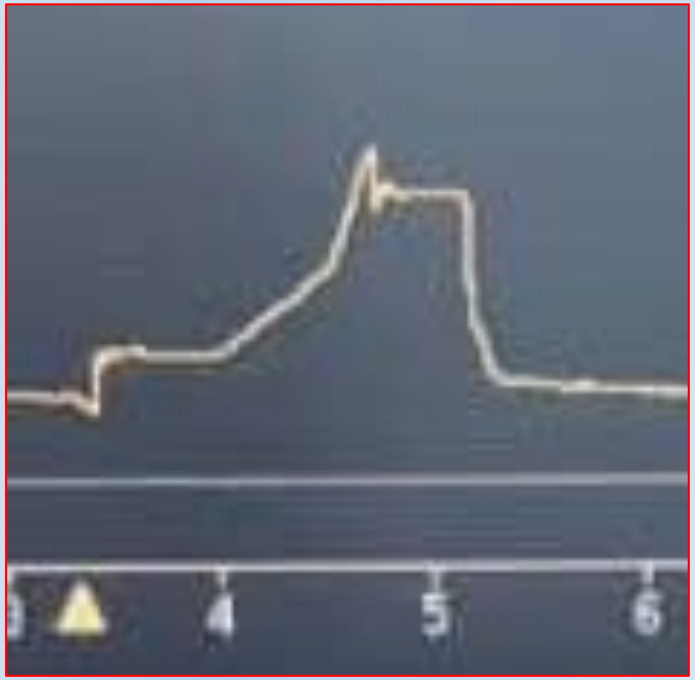
→ *Excessif*

Asynchronie débit

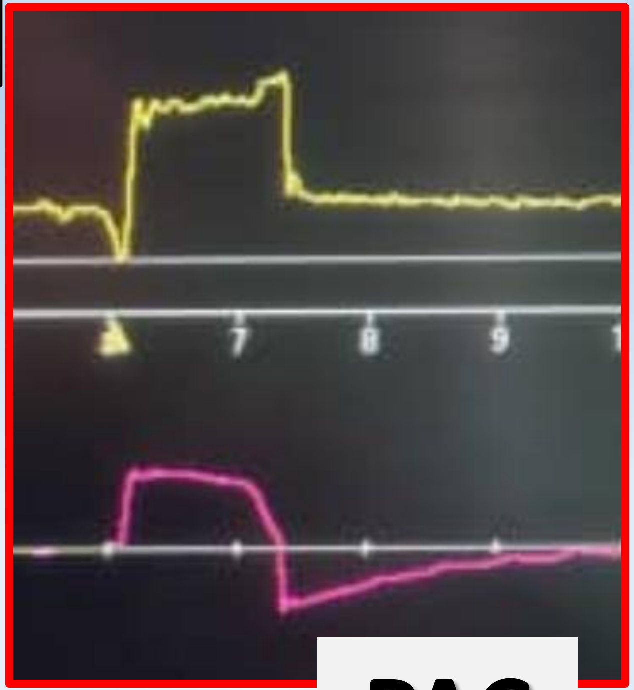
Pressure Muscle Index (PMI)

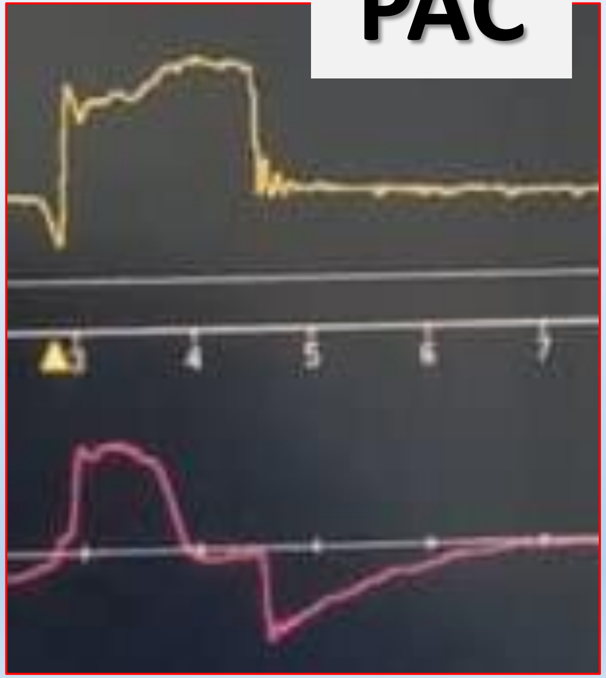
Pause INSPIRATOIRE

Detecter Asynchronie débit

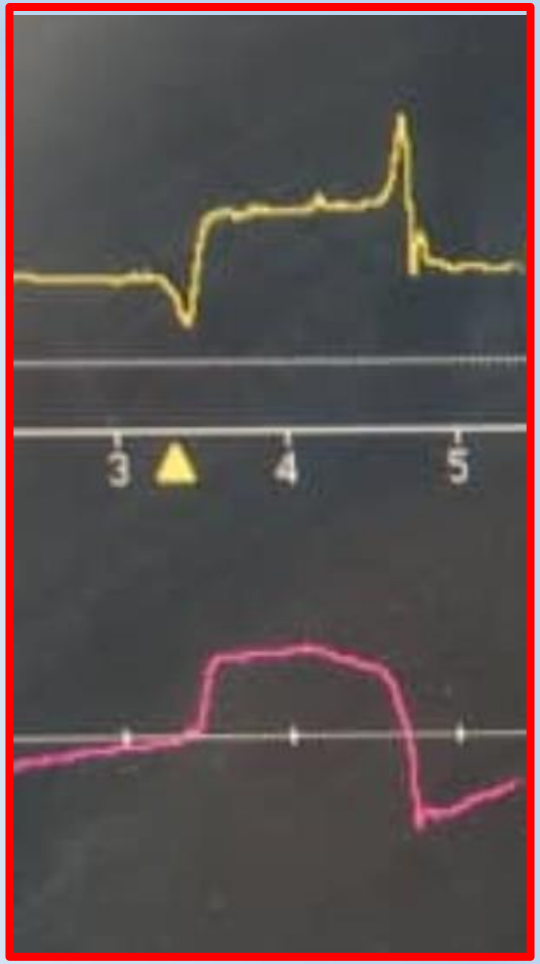


VAC





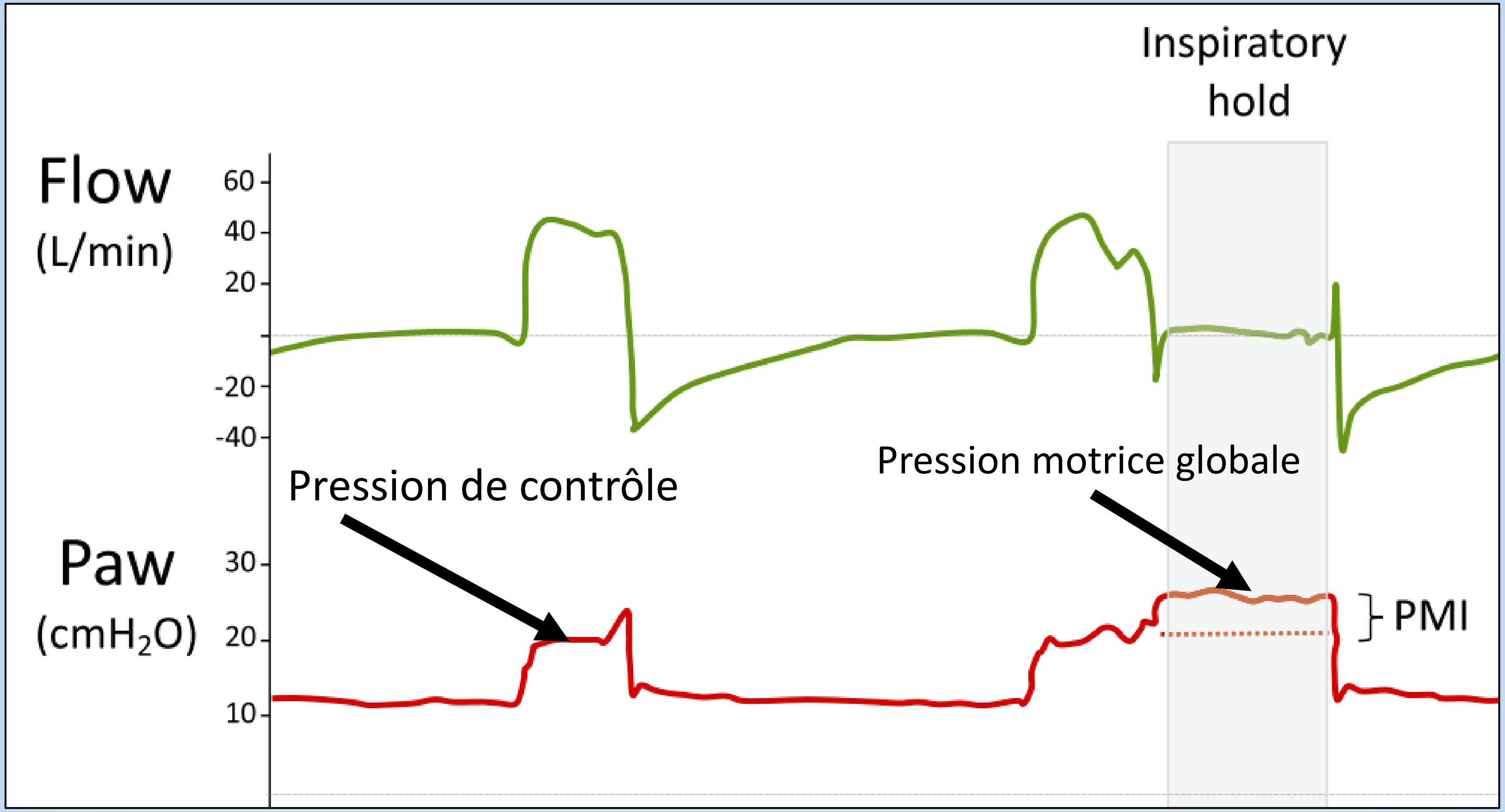
PAC



PSV

pressure muscle index (PMI)

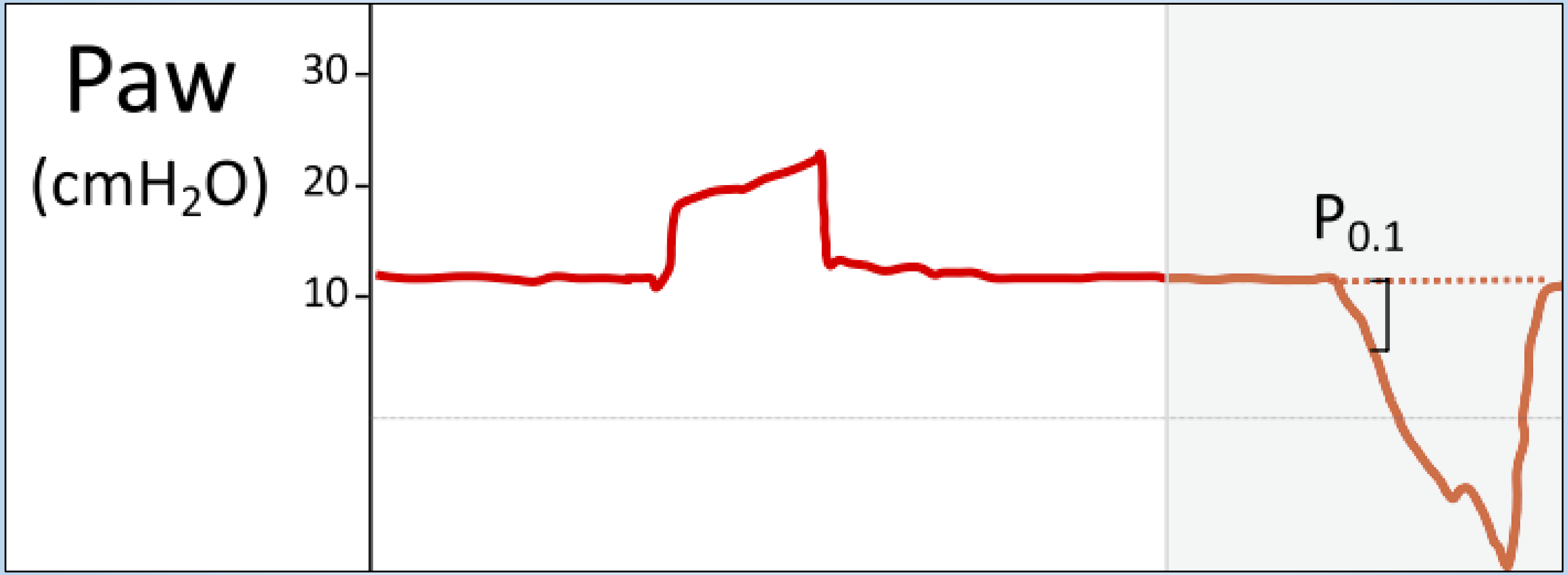
Pause INSPIRATOIRE



PMI ➔ différence entre Pplat et la pression maximale

➔ contribution des muscles respiratoires à la pression de distension globale statique.

La pression d'occlusion des voies respiratoires (P0,1)



P0,1 < 1,0 cmH2O ➔ prédit PTP <50 cmH2O*sec/min

P0,1 > 4,0 cmH2O ➔ prédit PTP >200 cmH2O*sec/min

Pause EXPIRATOIRE *WHOLE BREATH OCCLUSION*

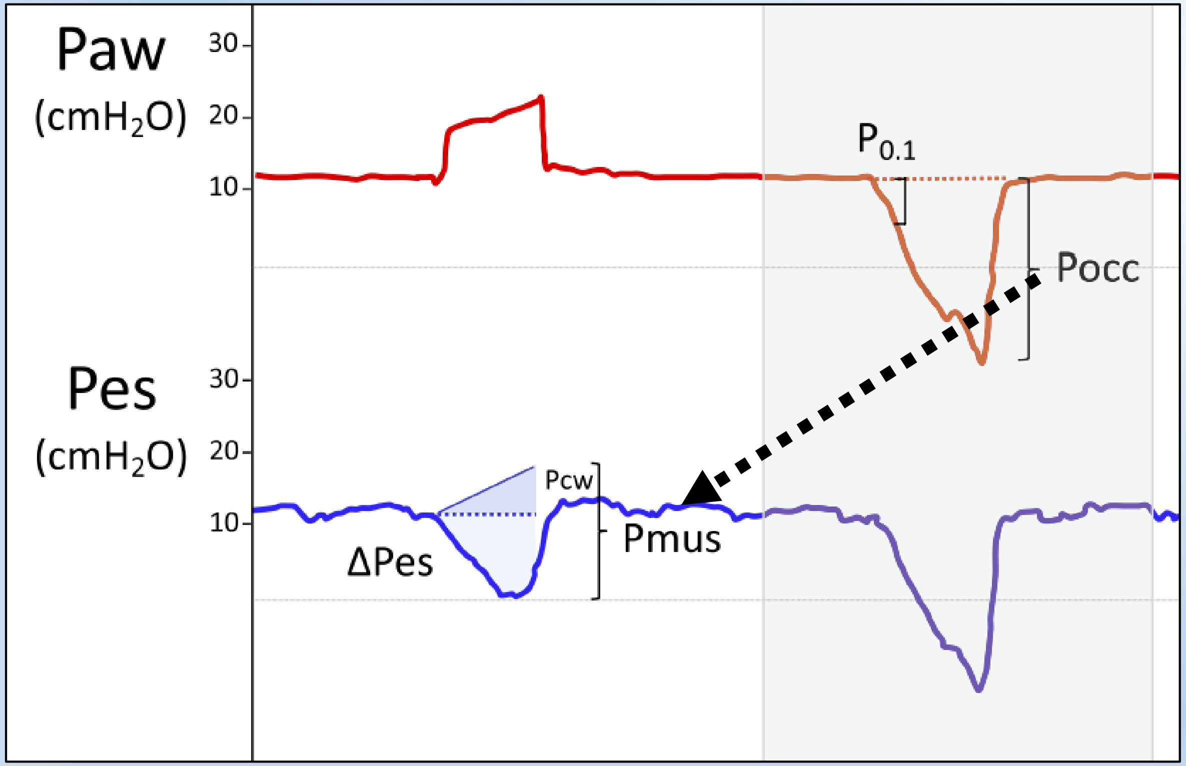
Airway pressure swing (ΔPocc)

- **Respiratory Effort**

Predicted P_{mus} = -3/4 x Pocc

➢ (ΔPocc 8–20 cmH2O)

➢ Predicted Pmus 5–15 cmH2O



- *Non-invasive*
- *Easily measured at the bedside*
- *Can predict respiratory muscle effort (Pmus) and transpulmonary pressure swing (ΔPL,dyn)*

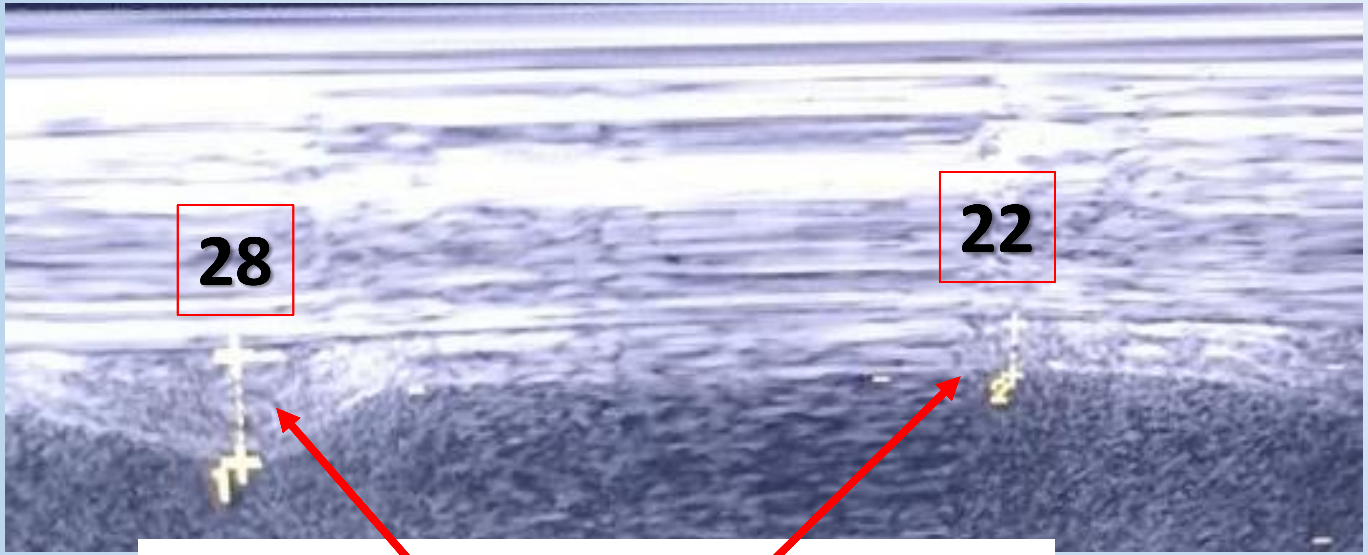
Diaphragm inspiratory thickening fraction (TFdi)

Diaphragmatic Effort (tidal TFdi)

ULTRASOUND

TFdi 15–30%

- *Non-invasive assessment of diaphragmatic contractility*



Tfdi = Tei - Tee / Tee

Tfdi = 27 %

1 Facteurs physiopathologiques à l'origine du Myotrauma ?

2 Monitorage de l'effort inspiratoire ?

3 Gestion Effort inspiratoire inadapté ?

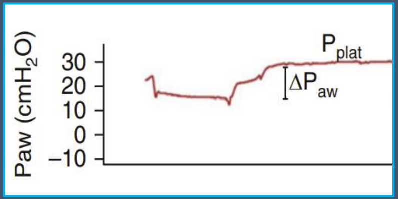
- ➔ ***Insuffisant, absent***
- ➔ ***Excessif***
- ➔ ***Asynchronie (ventilateur)***

➔ Protection poumon (VILI)

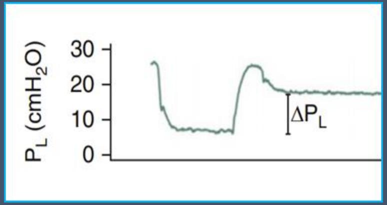
Vt : 4–6 ml/PBW

Plateau Pressure < 30 cmH2O

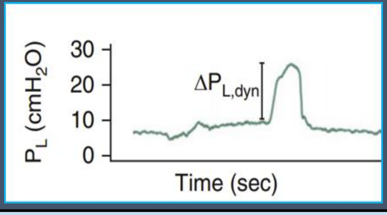
ΔPaw < 15 cmH2O



(ΔPL)< 15 cmH2O



ΔPL,dyn<15–20 cmH2O



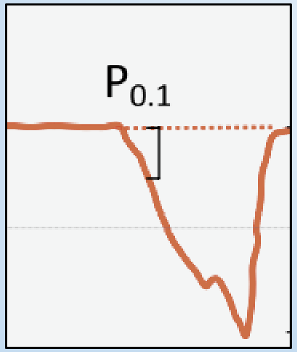
Gestion Effort inspiratoire inadapté ?

➔ *Insuffisant, absent*

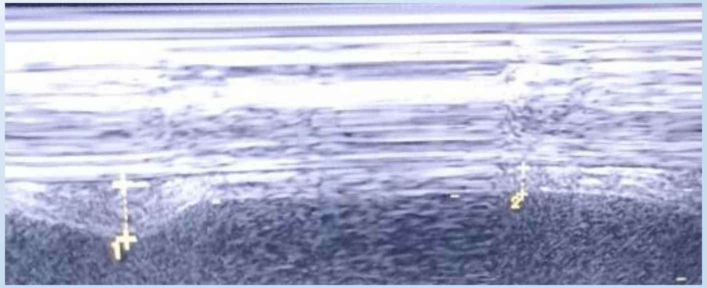
➔ Protection Diaphragme (Myotrauma)

- ➔ Lever précoce de la sédation
- ➔ Baisse seuil de sensibilité trigger inspiratoire
- ➔ Modes Assistés : baisser le degré de l'assistance

P0,1 > 1 cmH20



TFdi > 15 %



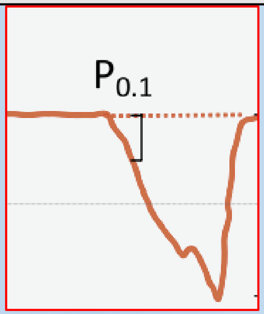
Gesstion Effort inspiratoire inadapté ?

→ *Excessif*

→ Protection Diaphragme (Myotrauma)+++

→ Titration sédation
→ Titration du degré de l'assistance

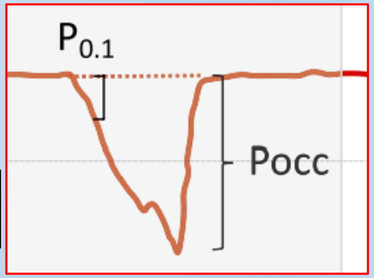
P0,1 < 4cmH20



TFdi < 30%

ΔPocc 8–20 cmH2O

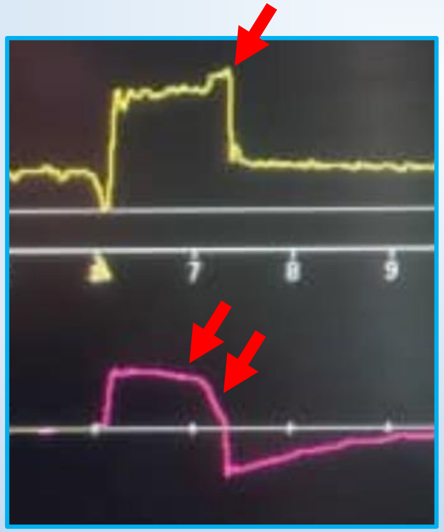
Predicted Pmus 5–10 cmH2O

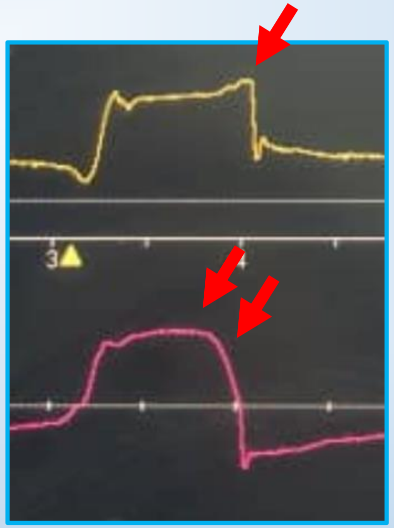


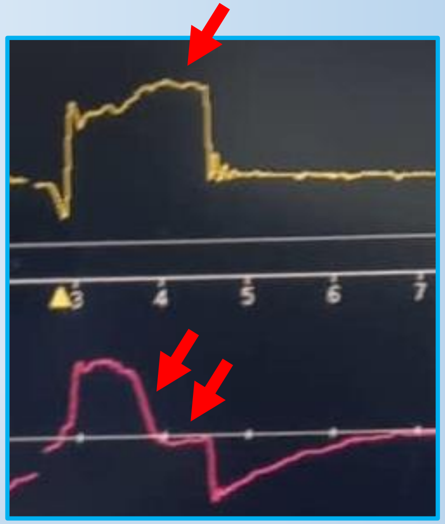
➔ Titration sédation
➔ Titration du degré de l'assistance

Ventilation Pression Contrôlé ++++

Variations de l'effort Inspiratoire → **Variations Débit inspiratoire**



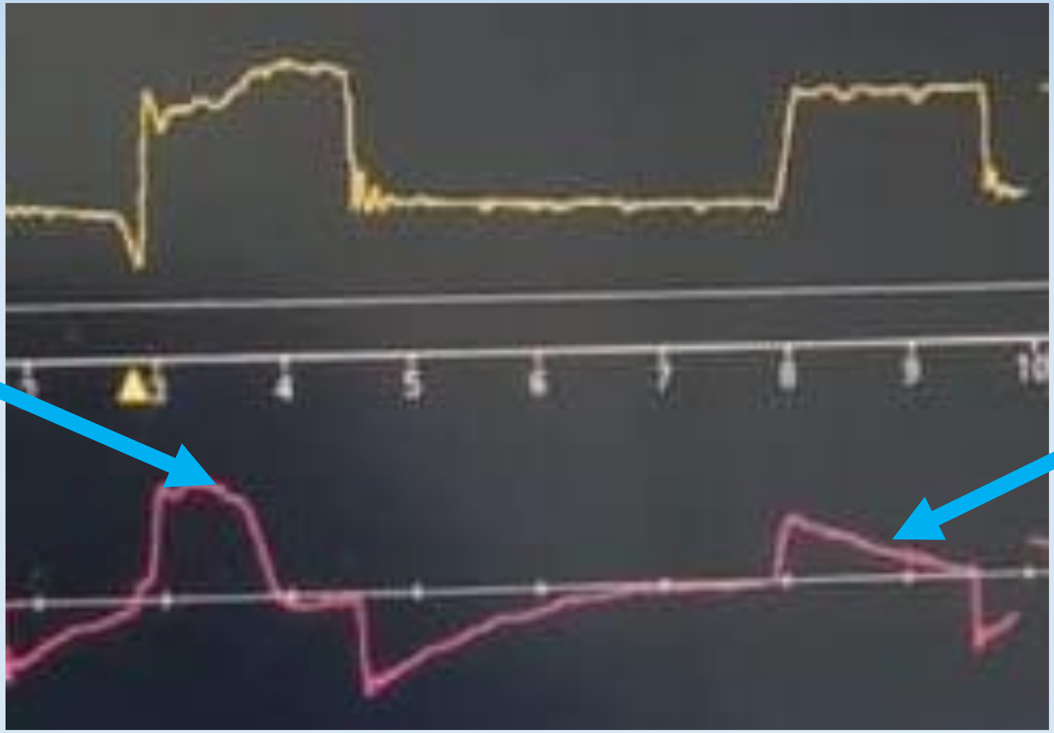




Sédation sans monitorage de l'effort inspiratoire

Effort excessif

Aucun effort



acute muscle inflammation and injury
(sepsis and systemic inflammation)

Underassistance Myotrauma

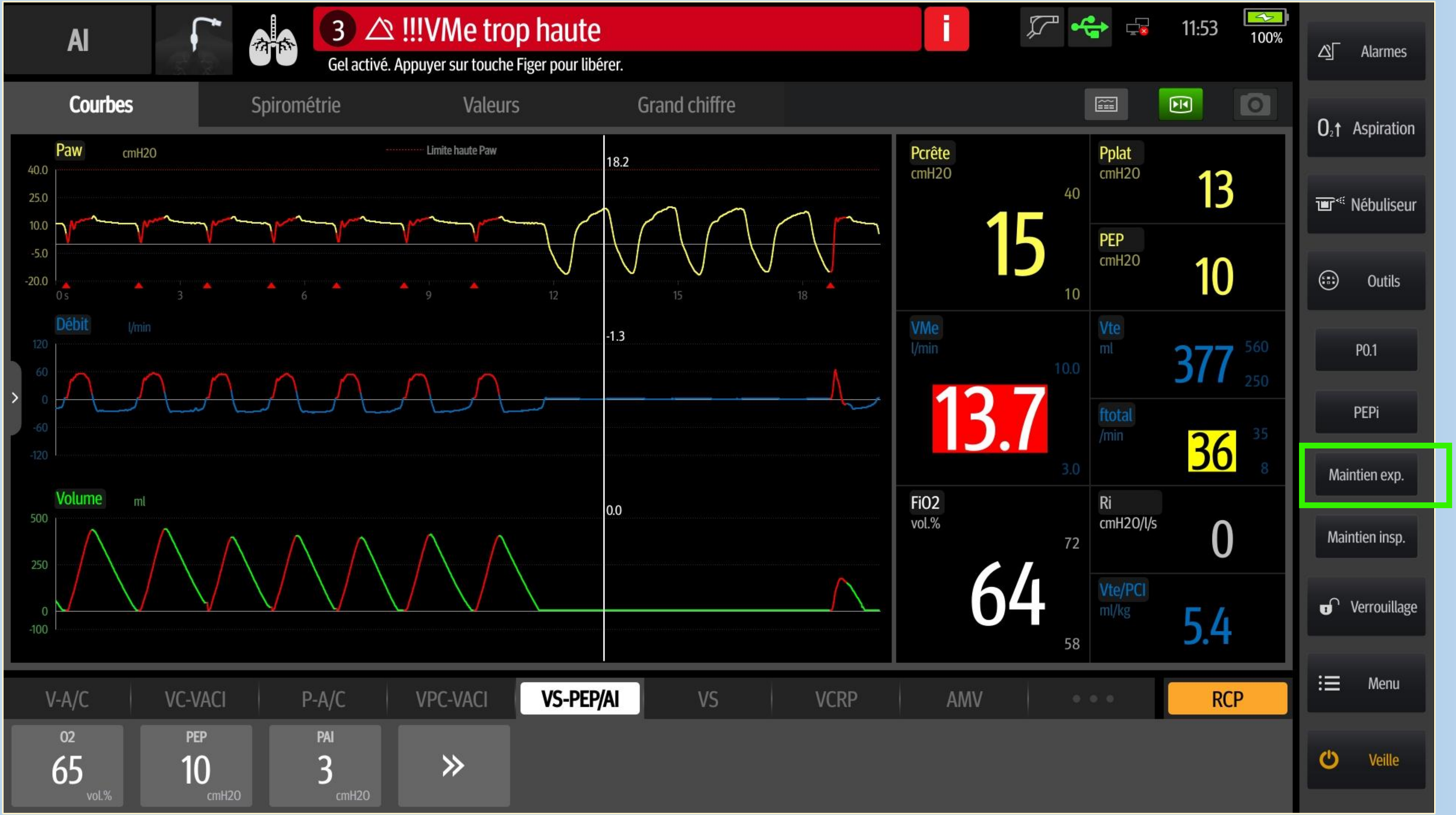
High Respiratory Muscle Effort

disuse atrophy

Overassistance Myotrauma

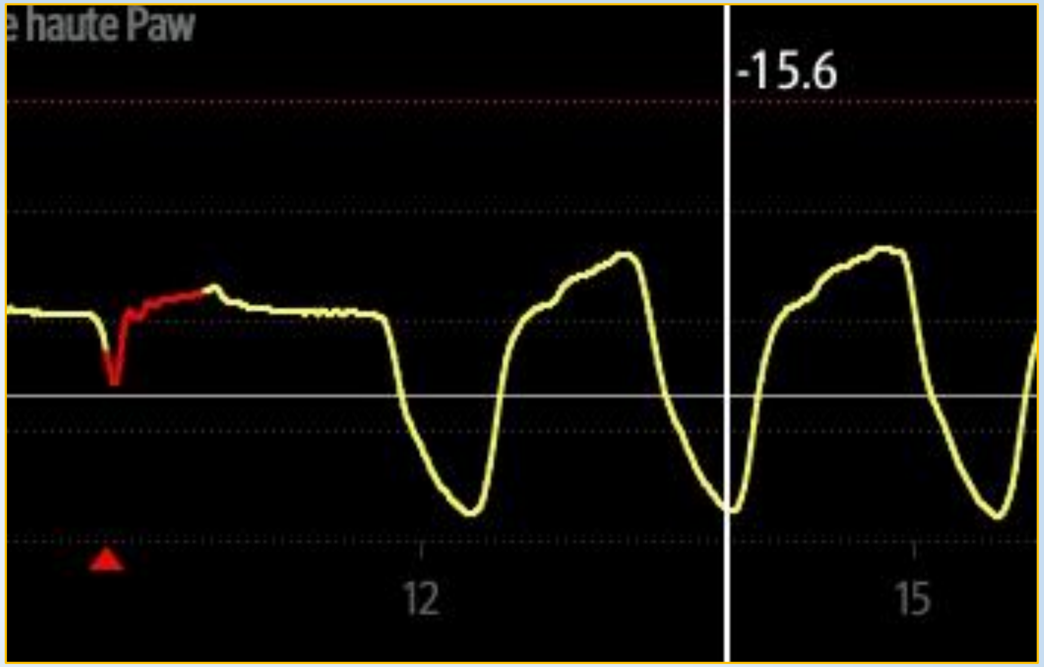
Low Respiratory Muscle Effort

Sédation ciblée sur l'effort inspiratoire



- Predicted Pmus 5–10 cmH2O (ΔPocc 8–20 cmH2O)

P0.1 cmH2O	-16.4



ΔPocc = 18 - (-15.6) = 23.6 cmH2O

Predicted P_{mus} = -3/4 x Pocc

Predicted Pmus = 3/4 . 23.6 = **17.7**

- ➢ Predicted Pmus 5–10 cmH2O (ΔPocc 8–20 cmH2O)

Titration : sédation

P0.1 cmH2O	-1.8

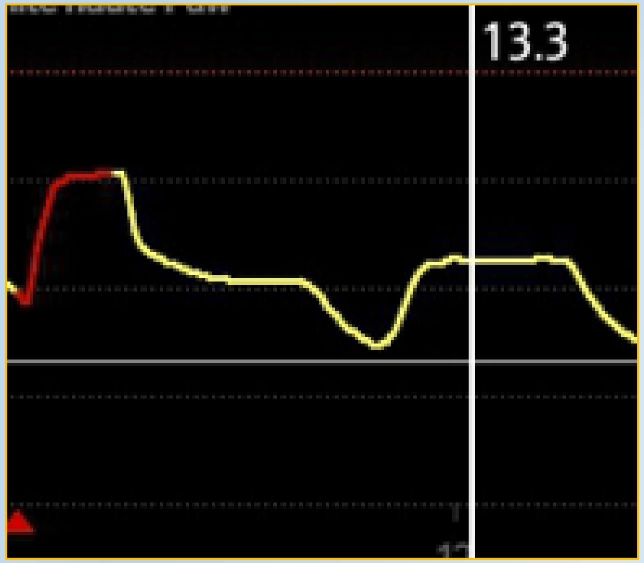
ΔPocc = 13.5 - (-3.5)= 17 cmH2O

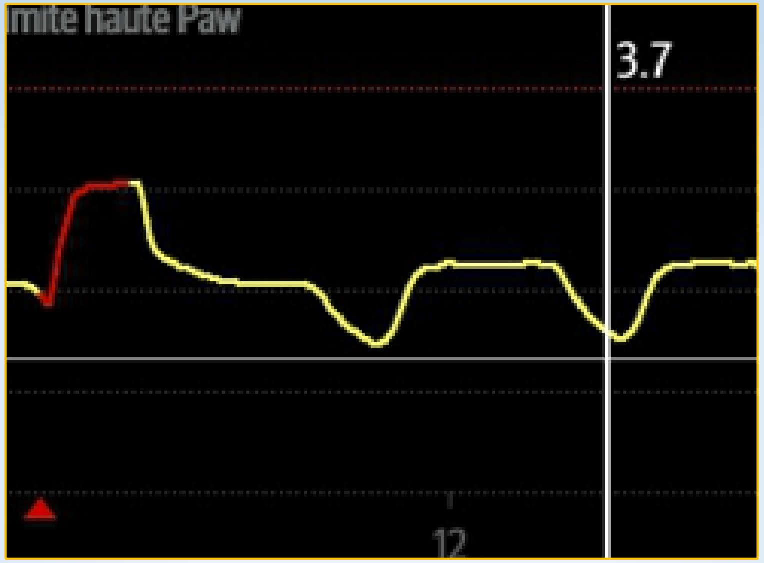
$$\text{Predicted } P_{mus} = -3/4 \times Pocc$$

Predicted Pmus = 3/4 . 17 = **12.75**

- Predicted Pmus 5–10 cmH2O (ΔPocc 8–20 cmH2O)

Titration : sédation





P0.1 cmH2O	-2.5

ΔPocc = 13. 3 - (+3.7)= 9.6 cmH2O

$$\text{Predicted } P_{mus} = -3/4 \times \text{Pocc}$$

Predicted Pmus = 3/4 . 9.6= **7.2**

Gestion Effort inspiratoire inadapté ?

→ *Asynchronie (ventilateur)*

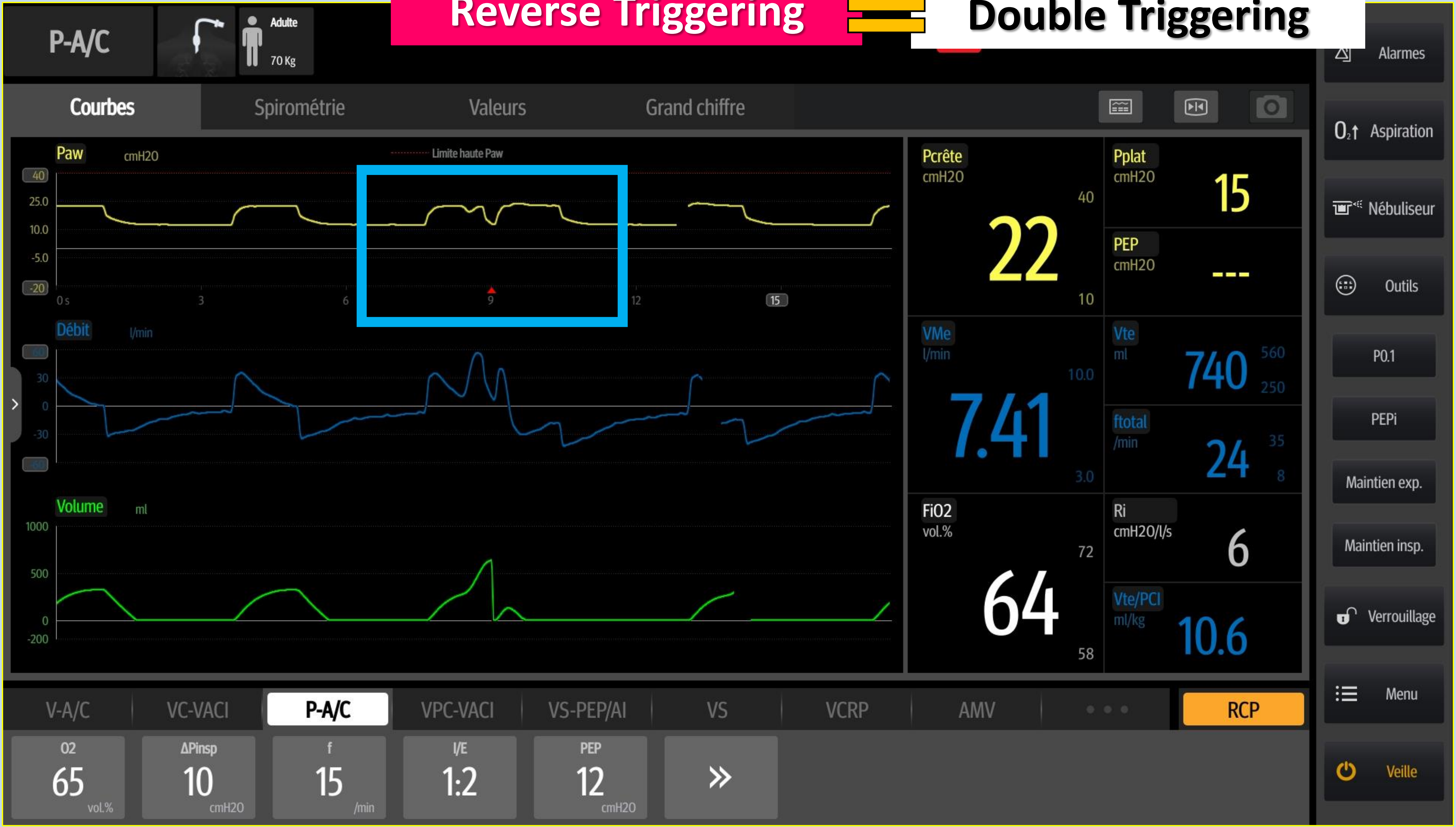
→ Protection Diaphragme (Myotrauma)

→ **Reverse Triggering**

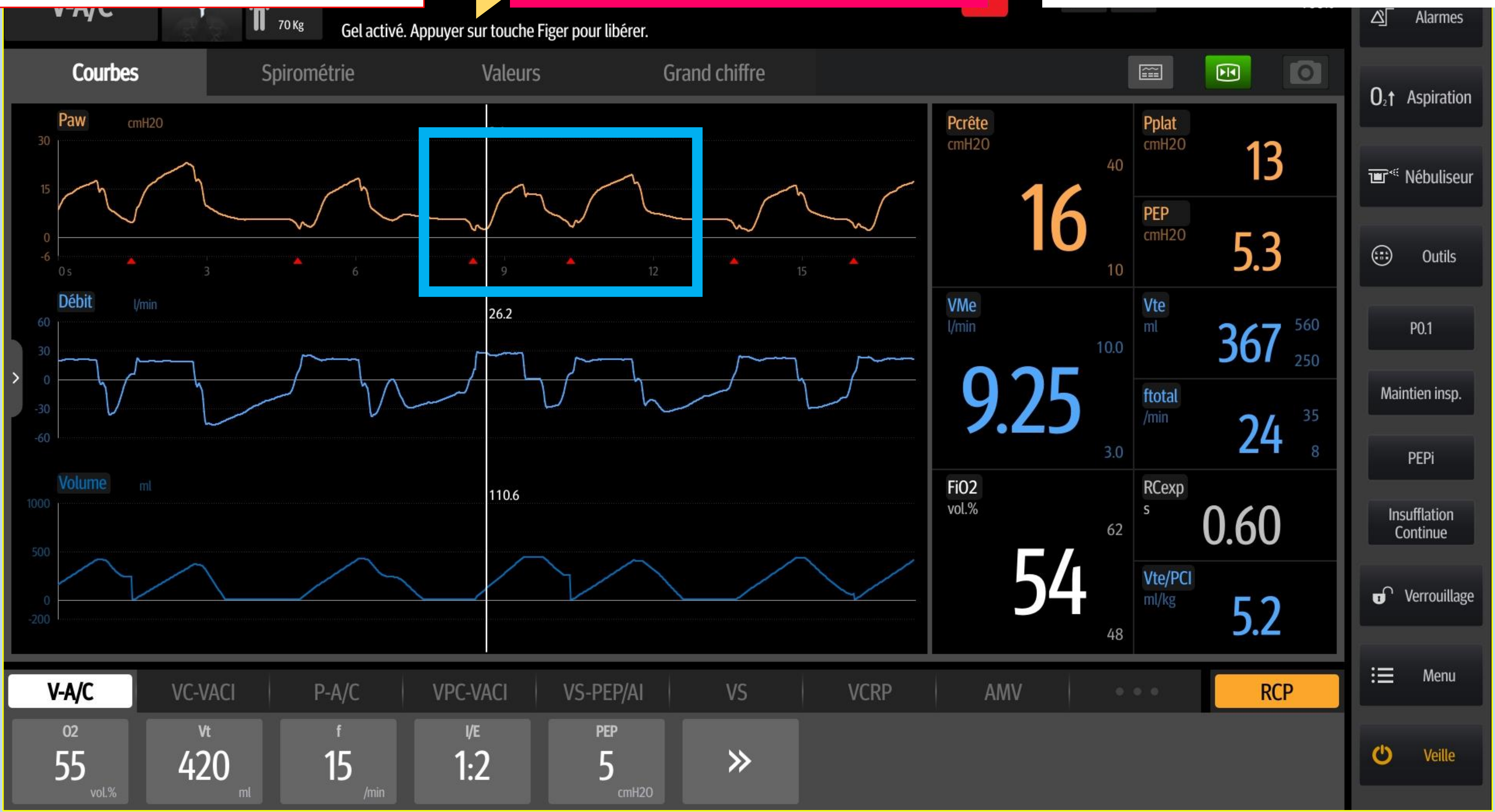
→ **Premature Cycling**

→ **Efforts inefficaces**

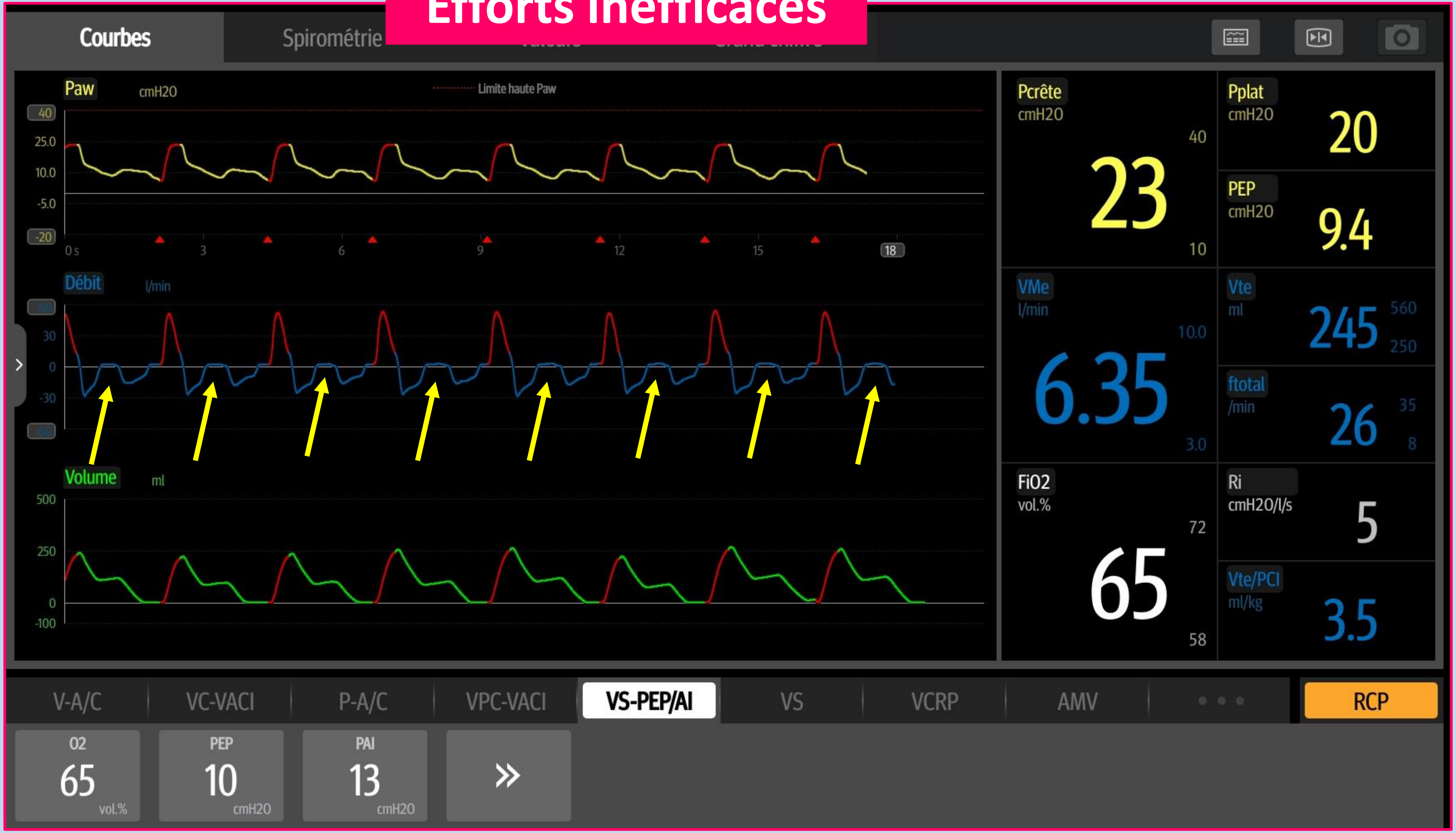
Reverse Triggering = Double Triggering



Effort Excessif → Premature Cycling = Double Triggering

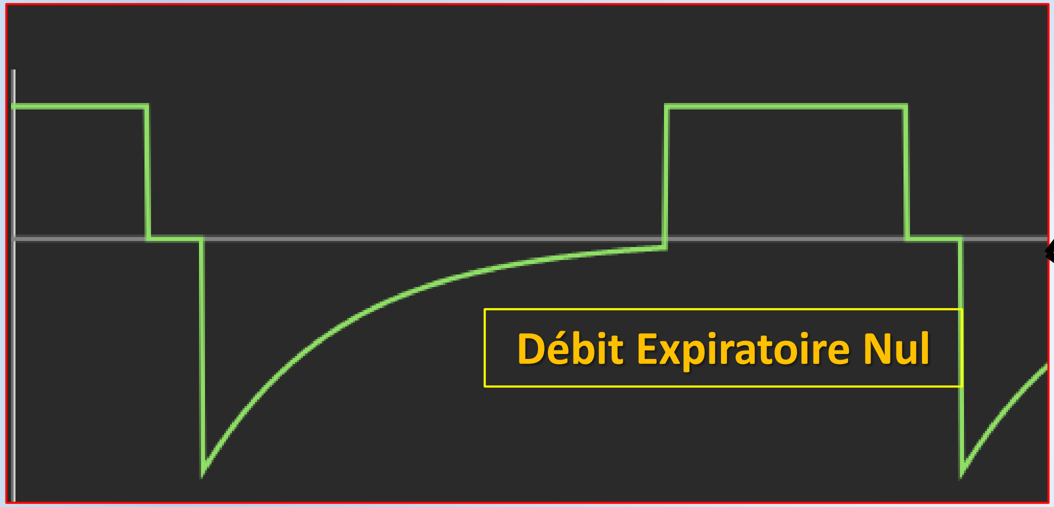


Efforts inefficaces



Efforts inefficaces

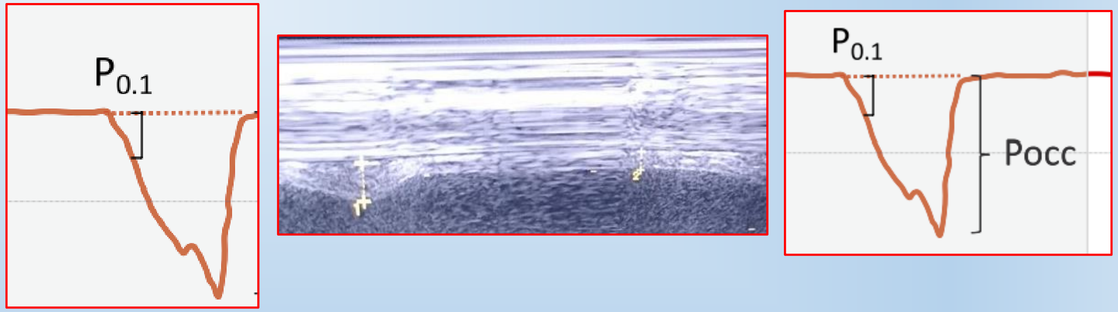
Absence d'Auto-PEP



Pression **ALVEOLAIRE** = Pression **VOIES AERIENNES**

- ➔ **Lever la sédation**
- ➔ **Baisse seuil de sensibilité trigger inspiratoire**

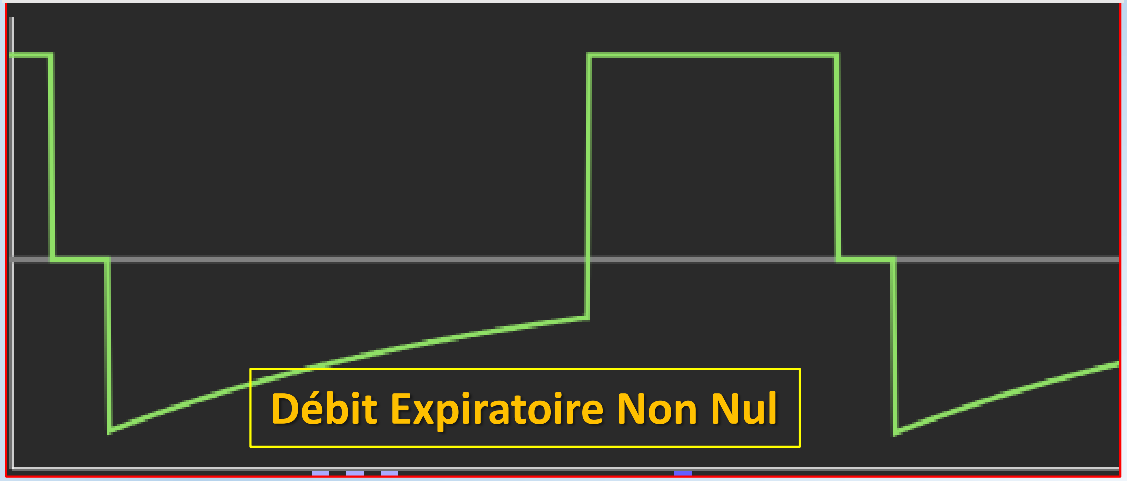
- ➔ **Dysfonction musculaire**



Monitorage effort inspiratoire

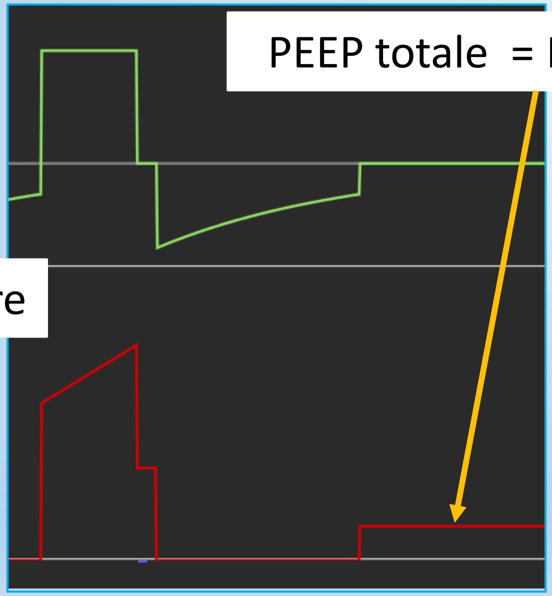
Présence D'auto-PEP

Pression **ALVEOLAIRE** >>> Pression **VOIES AERIENNES**



PEEP totale = PEEPi + ZEEP

Pause expiratoire



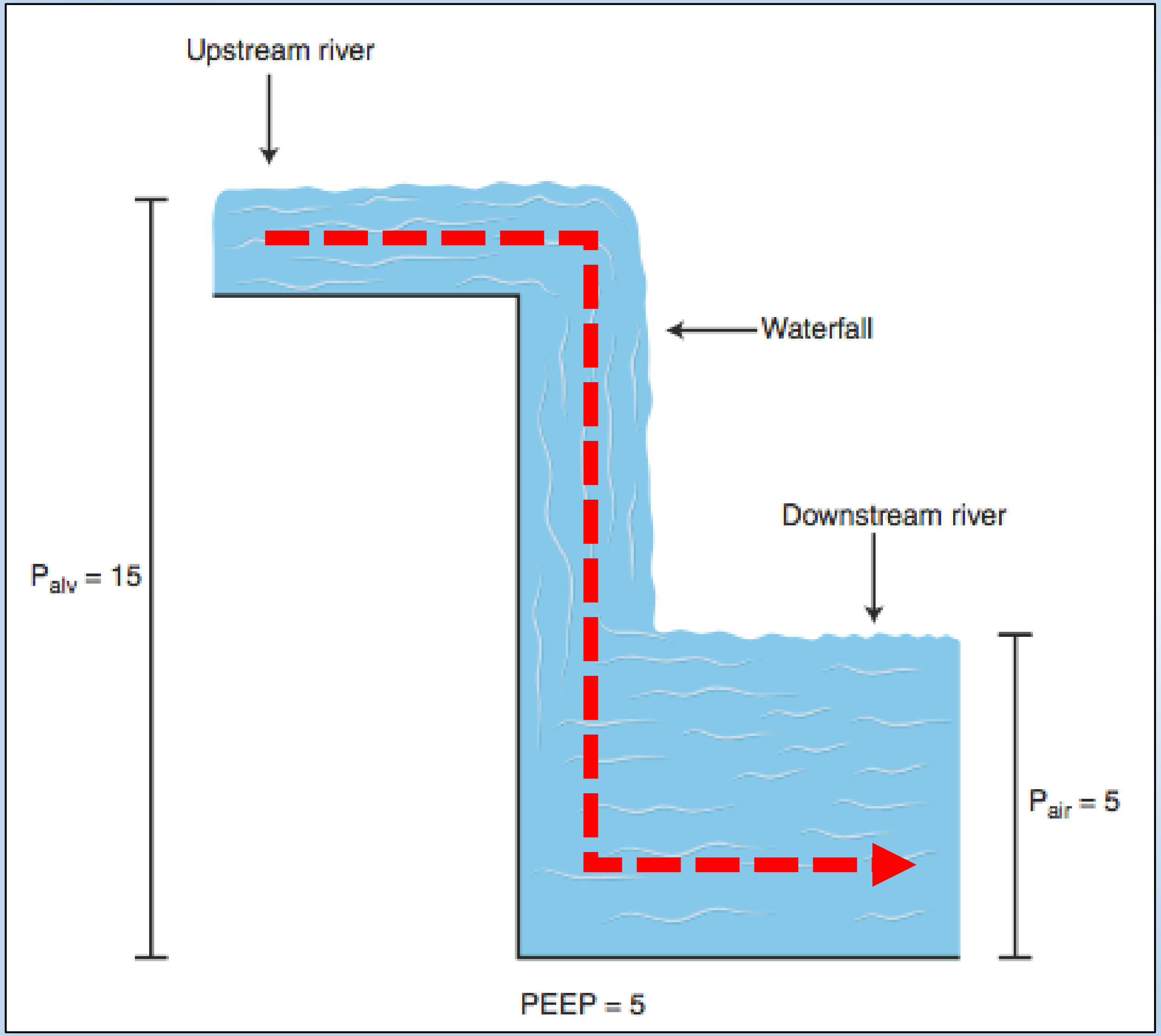
Efforts inefficaces

WATERFFALL EFFECT ?

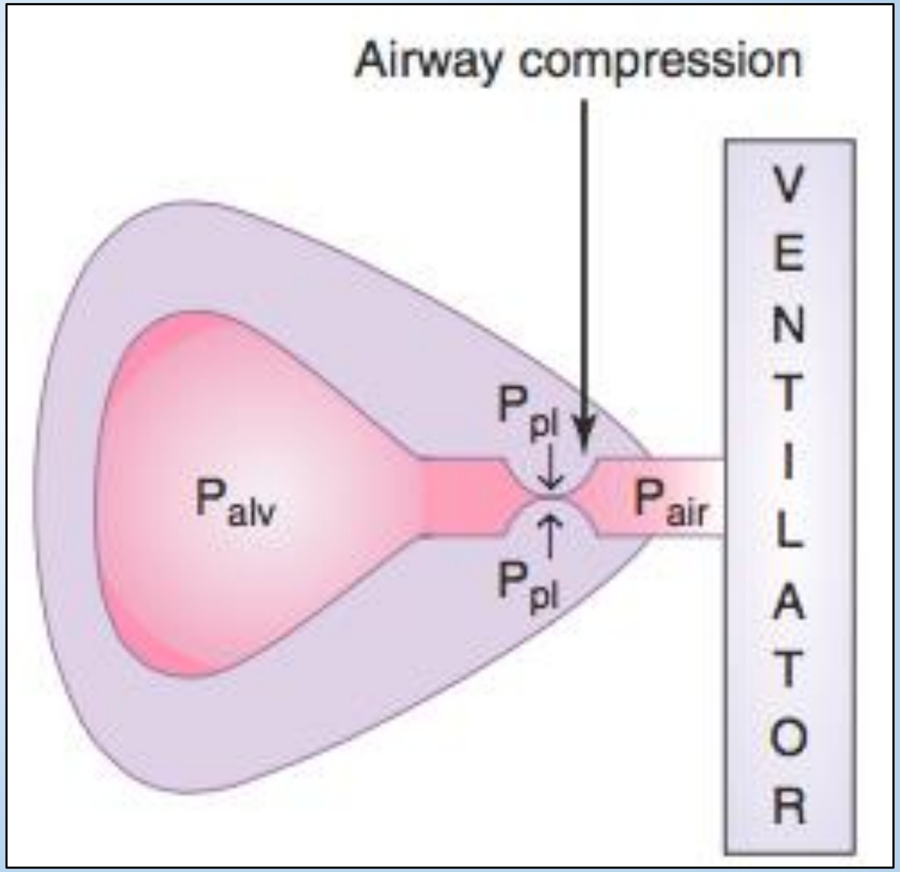
PEP Absorber?

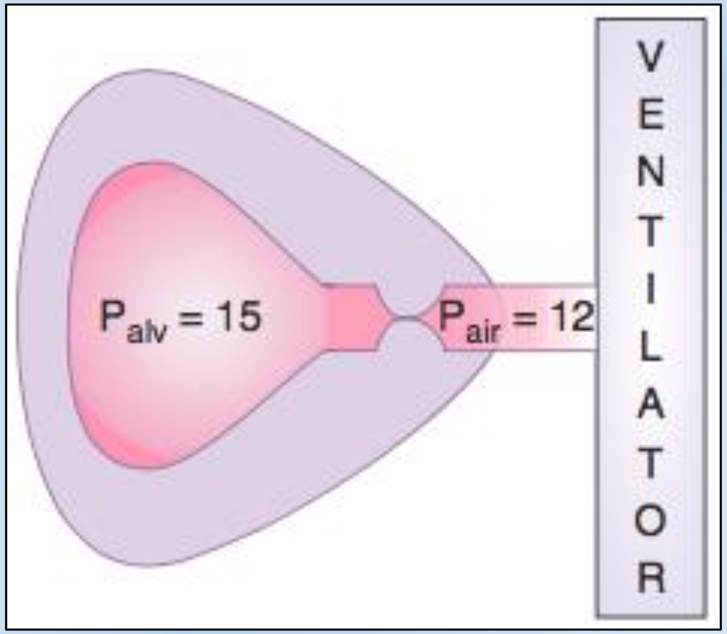
PEP ??

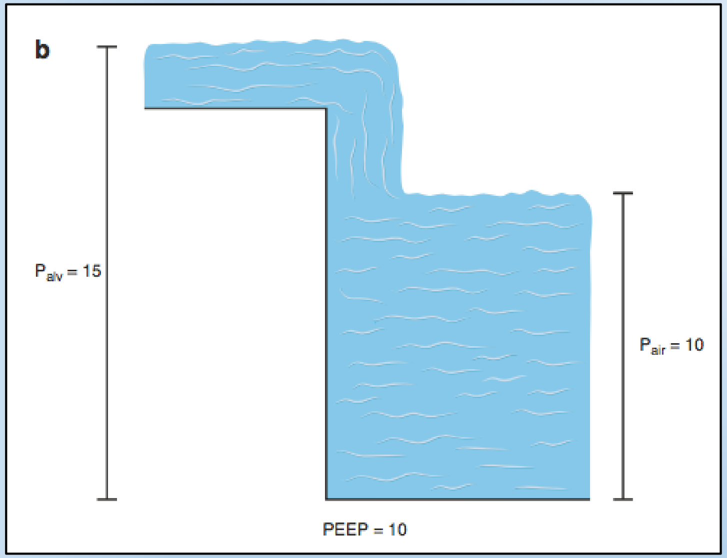
Augmenter le temps expiratoire → n'améliore pas l'AutoPEP



Théorie De La Cascade (Waterfall)



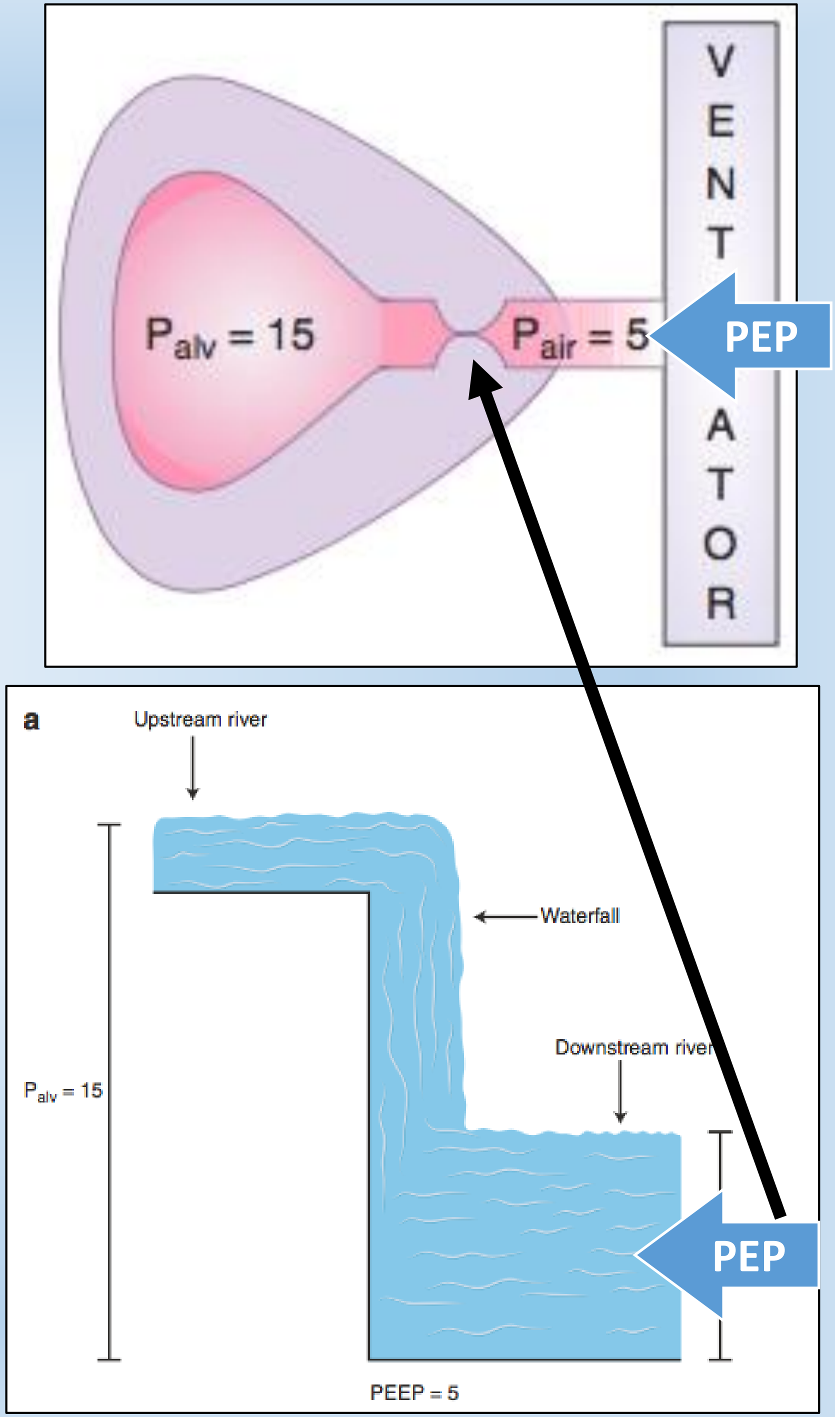




Augmenter le temps expiratoire
➔ n'améliore pas l'AutoPEP

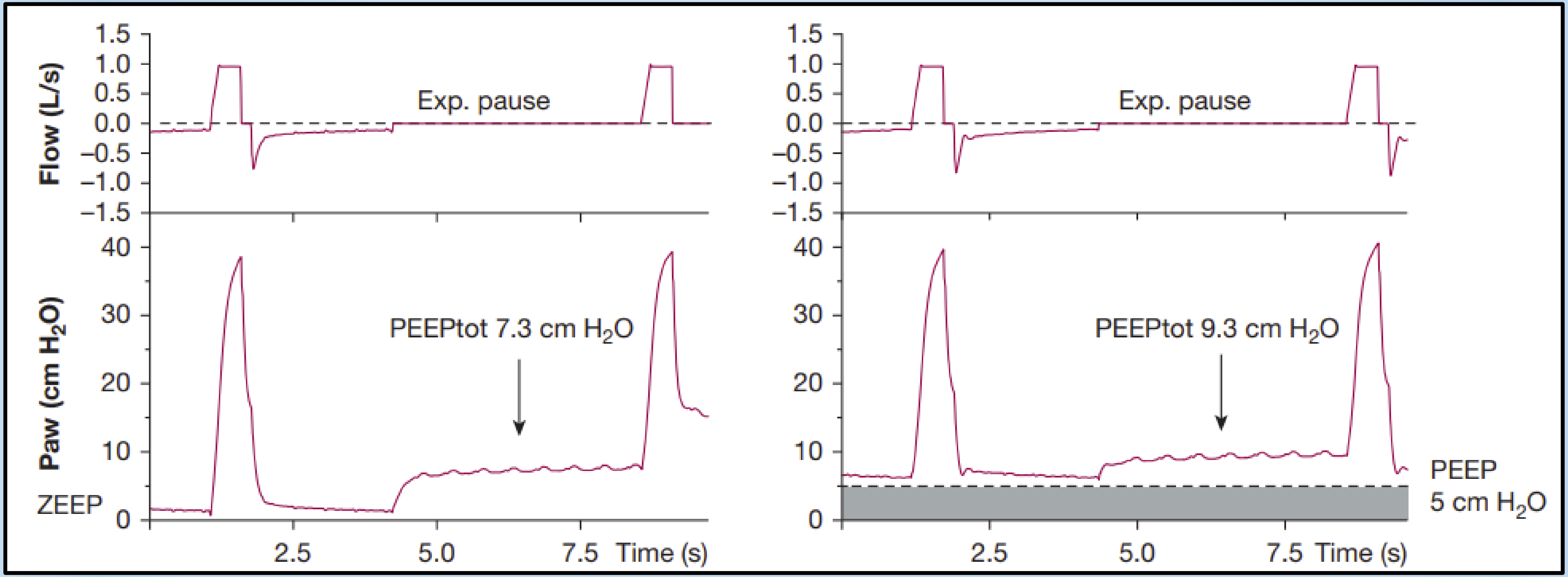
PEEP =
approximately 75% of
the measured autoPEEP

➔ Amélioration gradient pression motrice
➔ Amélioration débit expiratoire
➔ Baisse pression alvéolaire
➔ Baisse PEEPi
➔ Baisse PEEP Totale



"PEEP Absorber" Behavior

la PEEP totale a augmenté d'une quantité inférieure à la PEEP appliquée lorsque celle-ci était inférieure à l'auto-PEEP



PEPi = PEPTotale (7.3) – PEP (2) = 5.3

PEPi = PEPTotale (9.3) – PEP (7) = 2.3

INEFFECTIVE TRIGGERING

- ***Asthme***

Augmentation Raw

↓

Ralentis. débit expiratoire

↓

Arrêt précoce débit expiratoire

↓

Piégeage d'air

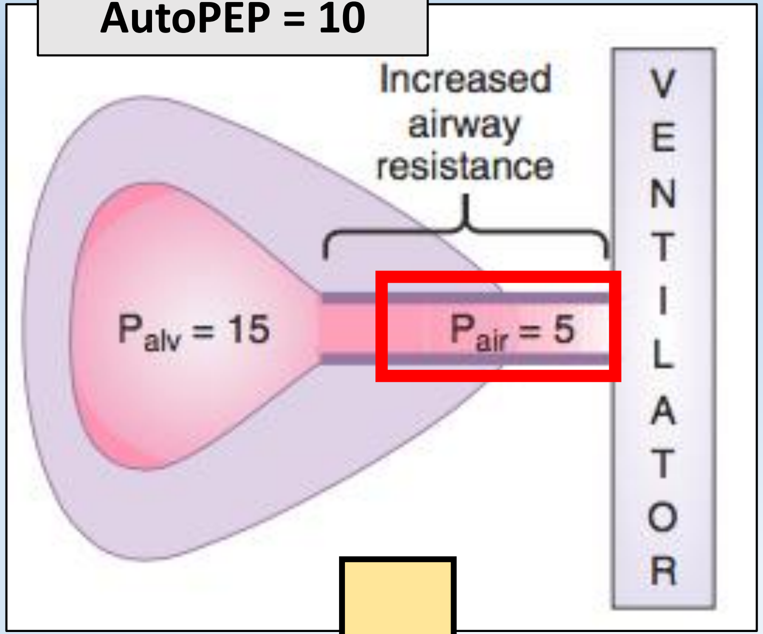
↓

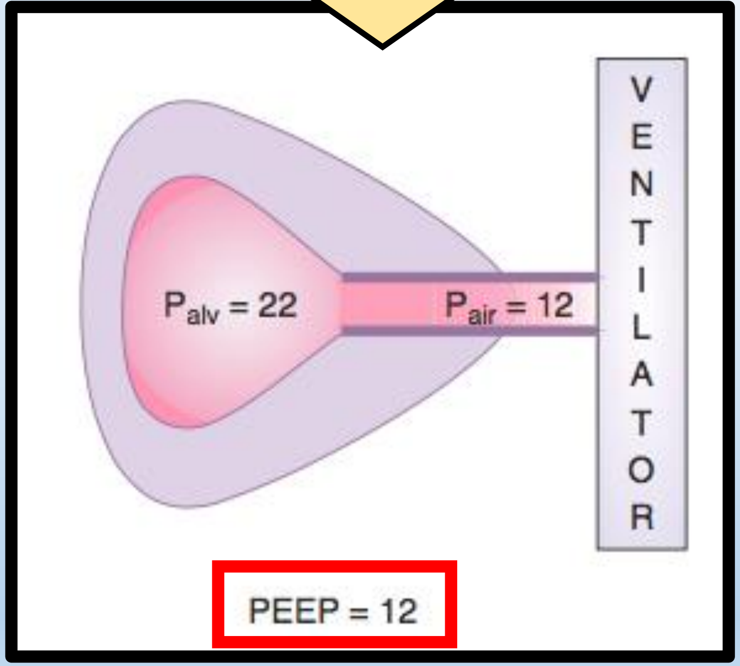
Dynamic hyperinflation

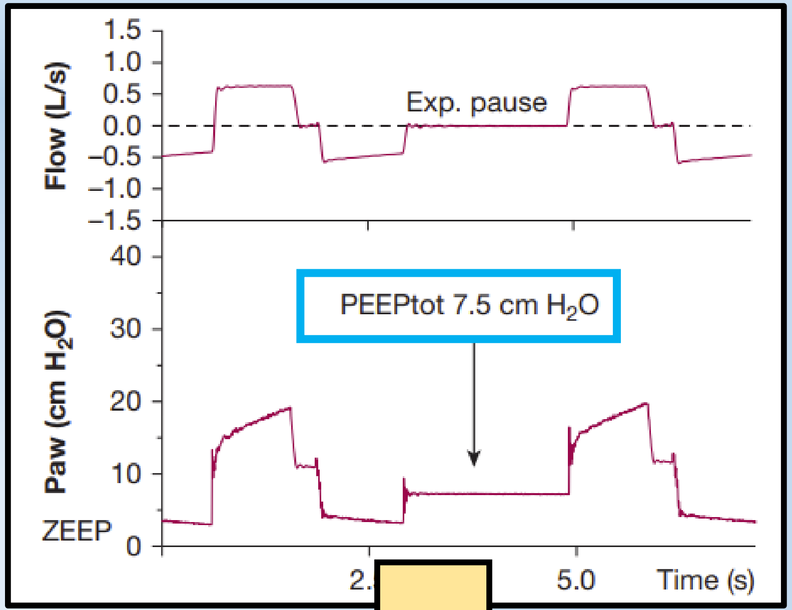
↓

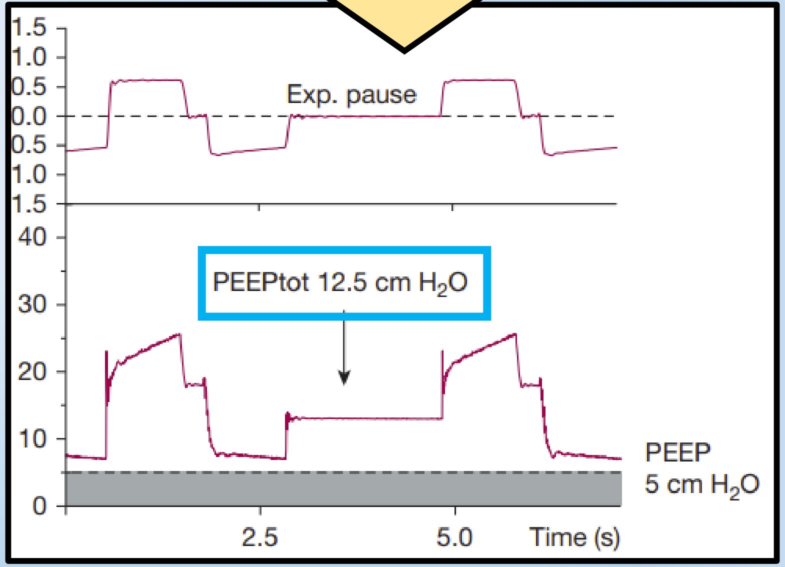
Auto-PEEP

AutoPEEP = 10









la PEEP totale a augmenté d'une quantité équivalente à la PEEP appliquée

CRITICAL CARE PERSPECTIVE

Lung- and Diaphragm-Protective Ventilation

Ewan C. Goligher[1,2,3], Martin Dres[4,5], Bhakti K. Patel[6], Sarina K. Sahetya[7], Jeremy R. Beitler[8], Irene Telias[1,2,9], Takeshi Yoshida[10], Katerina Vaporidi[11], Domenico Luca Grieco[12,13], Tom Schepens[14], Giacomo Grasselli[15,16], Savino Spadaro[17], Jose Dianti[1,2,18], Marcelo Amato[19], Giacomo Bellani[20], Alexandre Demoule[4,5], Eddy Fan[1,2,3,21], Niall D. Ferguson[1,2,3,21,22], Dimitrios Georgopoulos[11], Claude Guérin[23], Robinder G. Khemani[24,25], Franco Laghi[26,27], Alain Mercat[28], Francesco Mojoli[29], Coen A. C. Ottenheijm[30], Samir Jaber[31], Leo Heunks[32]*, Jordi Mancebo[33]*, Tommaso Mauri[13,14], Antonio Pesenti[13,14], and Laurent Brochard[1,9]*; for the Pleural Pressure Working Group, Acute Respiratory Failure Section of the European Society of Intensive Care Medicine

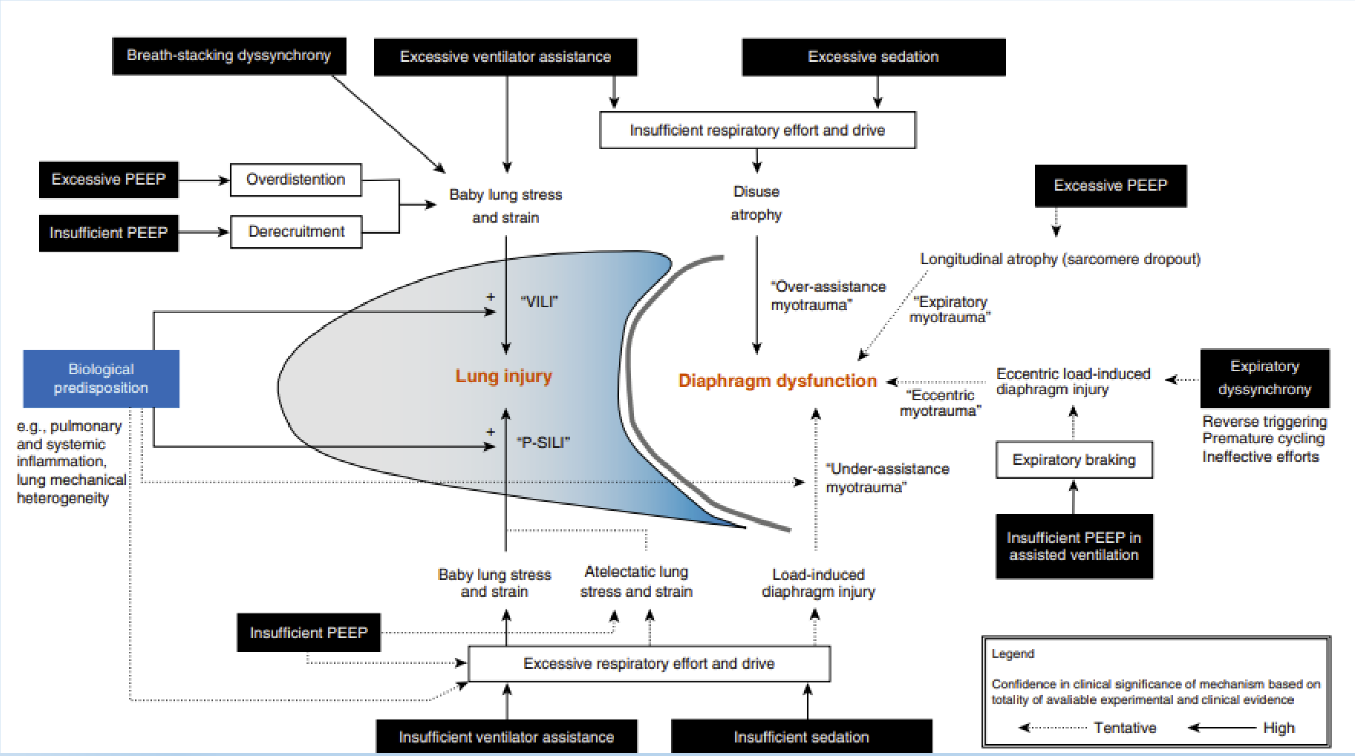


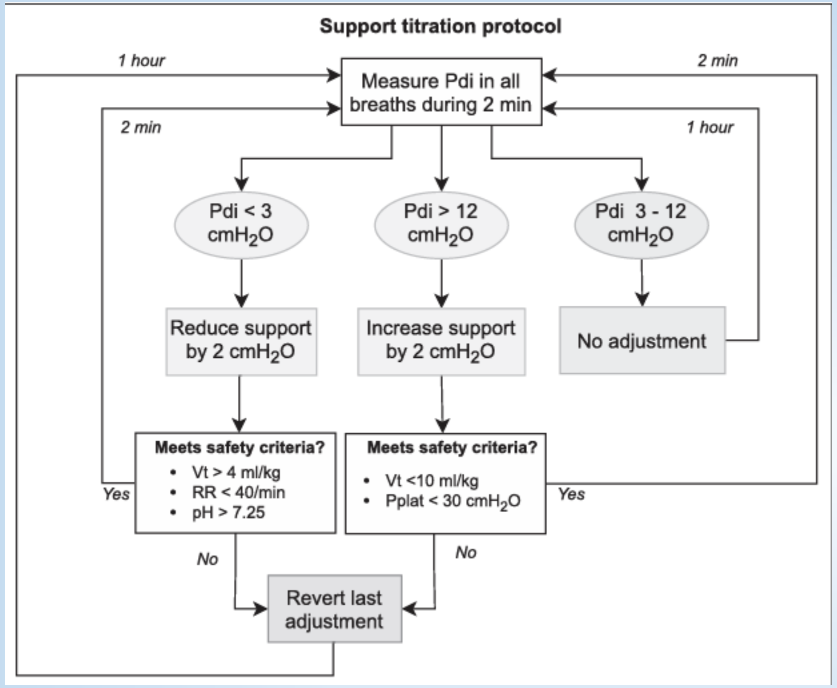
Table 3. Potential Therapeutic Targets for Diaphragm Protection

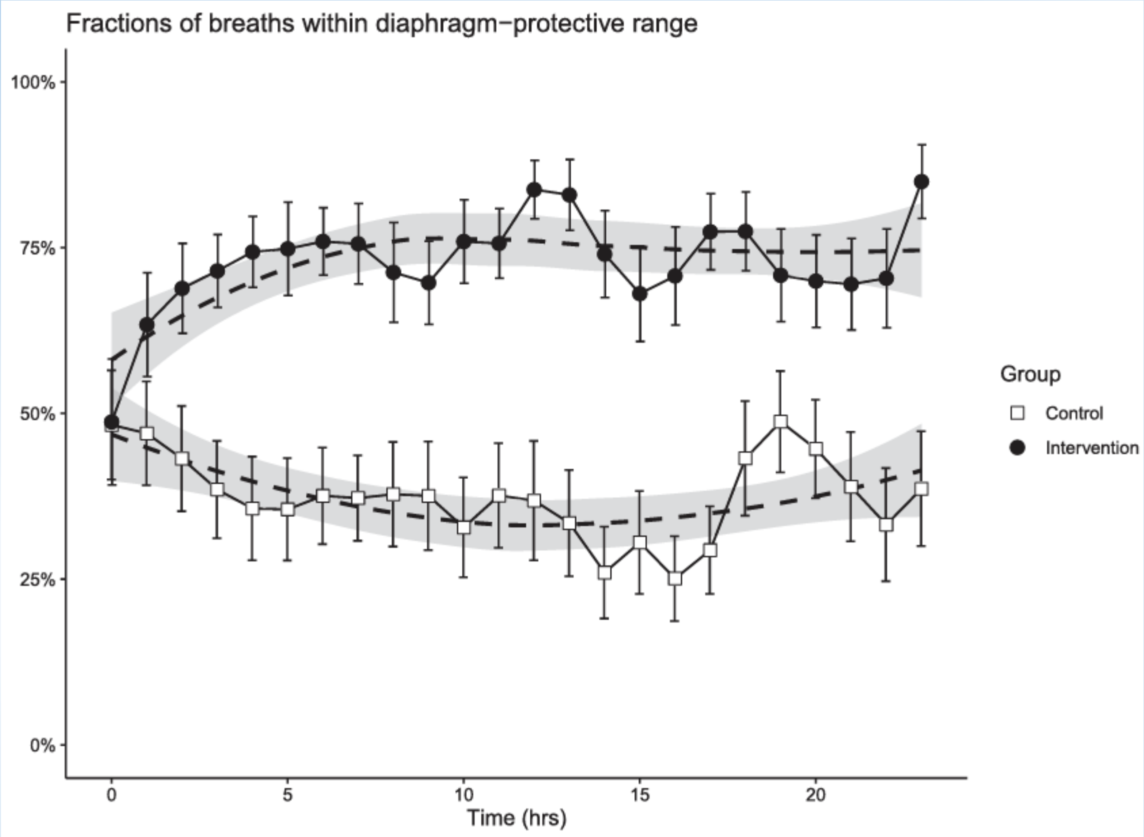
Goal	Potential Therapeutic Target*
Prevent overassistance myotrauma	Any 1 of: Pmus ⩾ 3 to 5 cm H_2O ΔPdi ⩾ 3 to 5 cm H_2O ΔPes ⩽ −3 to −2 cm H_2O $P_{0.1}$ > 1 to 1.5 cm H_2O TFdi ⩾ 15% EAdi ⩾ target value selected on the basis of Pocc-EAdi index and above targets
Prevent underassistance myotrauma	Any 1 of: Pmus ⩽ 10 to 15 cm H_2O ΔPdi ⩽ 10 to 15 cm H_2O ΔPes ⩾ −12 to −8 cm H_2O Pocc ⩾ −20 to −15 cm H_2O $P_{0.1}$ < 3.5 to 5 cm H_2O TFdi ⩽ 30% to 40% EAdi ⩽ limit value selected on the basis of Pocc-EAdi index and above targets
Prevent eccentric myotrauma	Avoid ineffective triggering and reverse triggering Avoid premature cycling Minimize expiratory braking

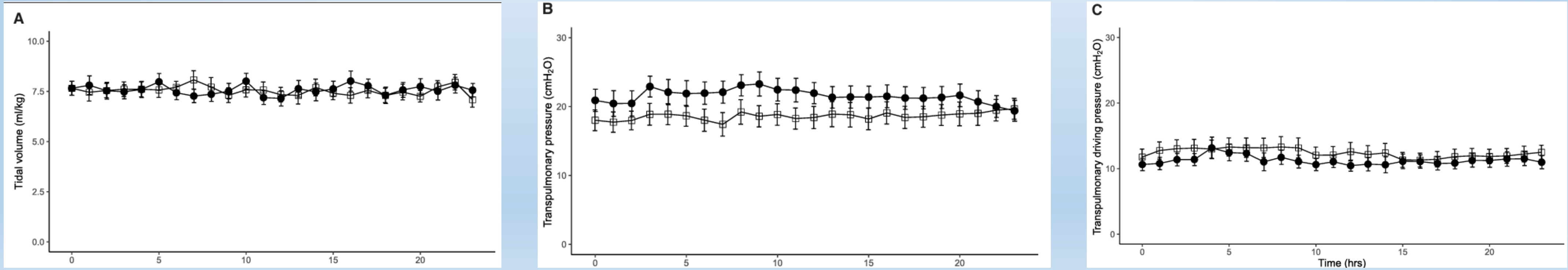
- ❑ faisabilité ?
- ❑ Moyens : Pharmacologiques, ventilatoires..?
- ❑ Impact Outcome :
  - ➢ Mortalité ?
  - ➢ Durée ventilation ?
  - ➢ Sevrage ?

Lung- and Diaphragm-Protective Ventilation by Titrating Inspiratory Support to Diaphragm Effort: A Randomized Clinical Trial

Heder J. de Vries, MD[1,2]
Annemijn H. Jonkman, PhD[1,2]
Harm J. de Grooth, MD, PhD[1]
Jan Willem. Duitman, PhD[3]
Armand R. J. Girbes, MD, PhD[1]
Coen A. C. Ottenheijm, PhD[2,4]
Marcus J. Schultz, MD, PhD[5–7]
Peter M. van de Ven, PhD[8]
Yingrui Zhang, MD[1,9]
Angelique M. E. de Man, MD, PhD[1]
Pieter R. Tuinman, MD, PhD[1]
Leo M. A. Heunks, MD, PhD[1,2]

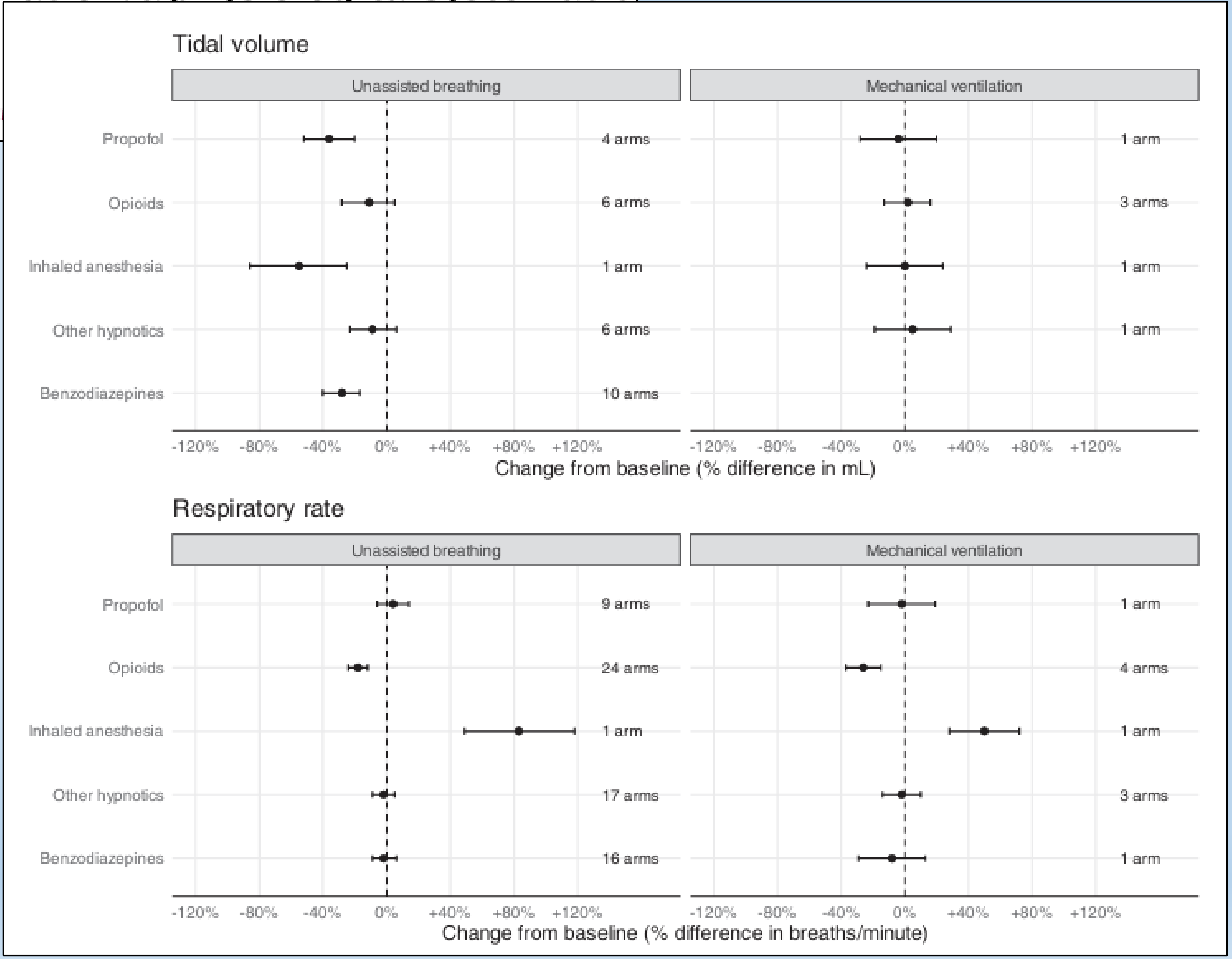






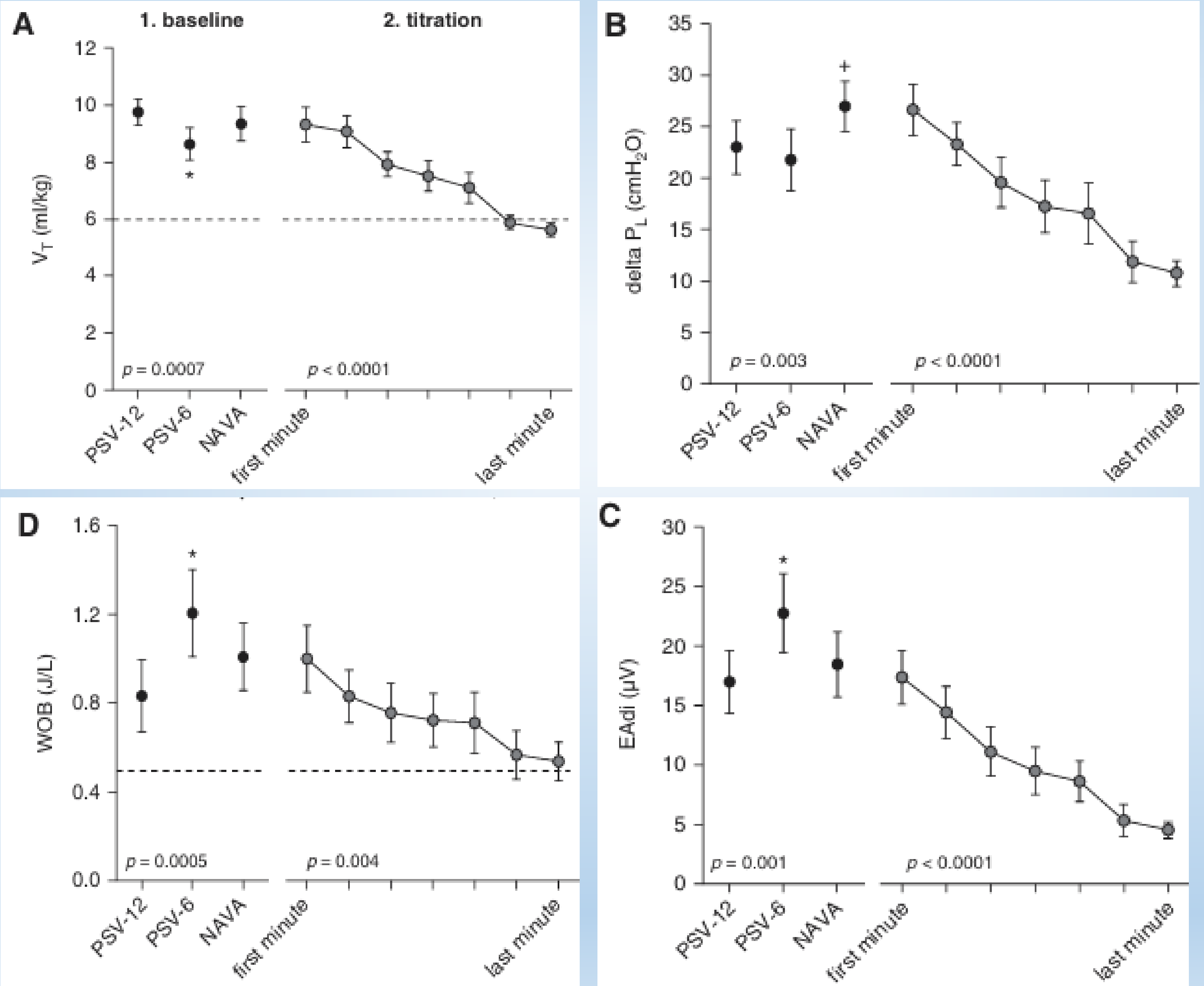
The influence of drugs used for sedation during mechanical ventilation on respiratory pattern during unassisted breathing and assisted mechanical ventilation: a physiological systematic review and meta-analysis

Danica Quickfall,[a] Michael C. Sklar,[b,c] George Tomlinson,[d] Ani Orcha



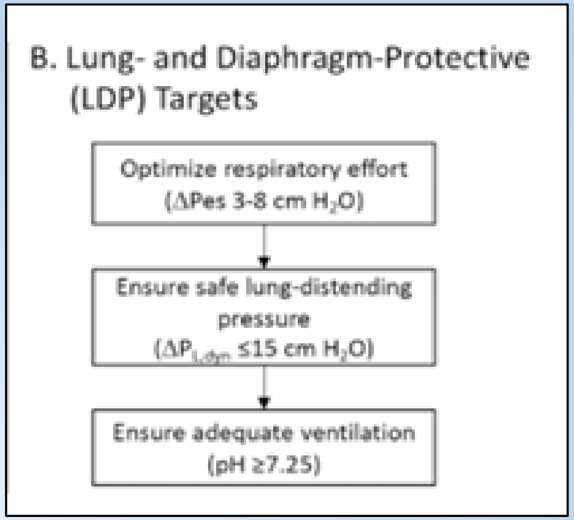
Partial Neuromuscular Blockade during Partial Ventilatory Support in Sedated Patients with High Tidal Volumes

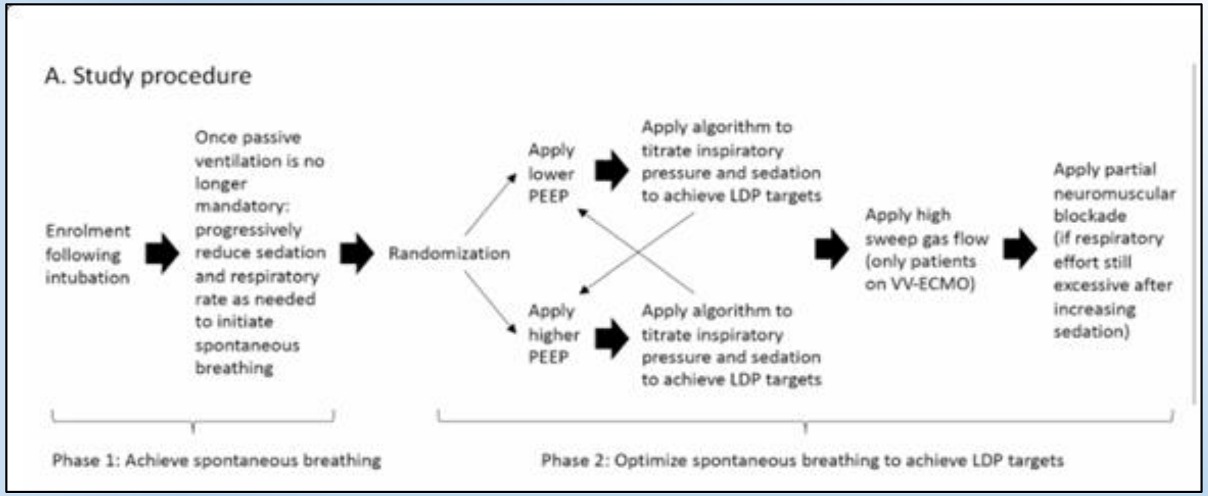
Jonne Doorduin[1], Joeke L. Nollet[1], Lisanne H. Roesthuis[1], Hieronymus W. H. van Hees[2], Laurent J. Brochard[3,4], Christer A. Sinderby[3,4], Johannes G. van der Hoeven[1], and Leo M. A. Heunks[1]

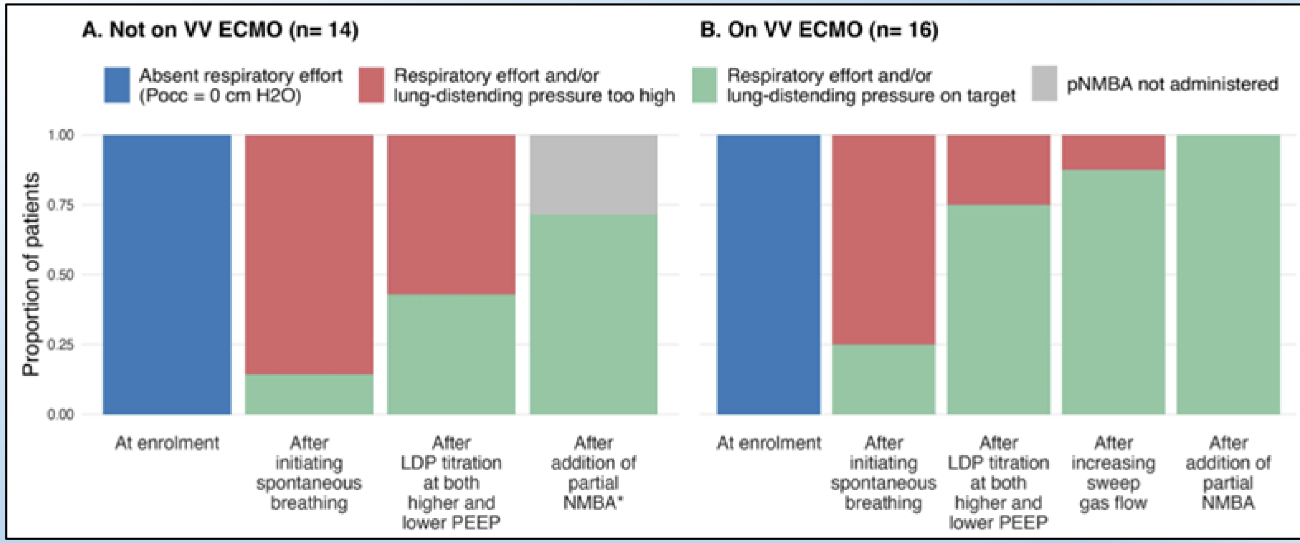


Strategies for lung- and diaphragm-protective ventilation in acute hypoxemic respiratory failure: a physiological trial

Jose Dianti[1,2], Samira Fard[3], Jenna Wong[2], Timothy C. Y. Chan[4], Lorenzo Del Sorbo[1,2], Eddy Fan[1,2], Marcelo B. Passos Amato[5], John Granton[1,2], Lisa Burry[1,6,7], W. Darlene Reid[1,8], Binghao Zhang[4], Damian Ratano[1], Shaf Keshavjee[9], Arthur S. Slutsky[1,10], Laurent J. Brochard[1,10], Niall D. Ferguson[1,2,11,12,13] and Ewan C. Goligher[1,2,11,13*]

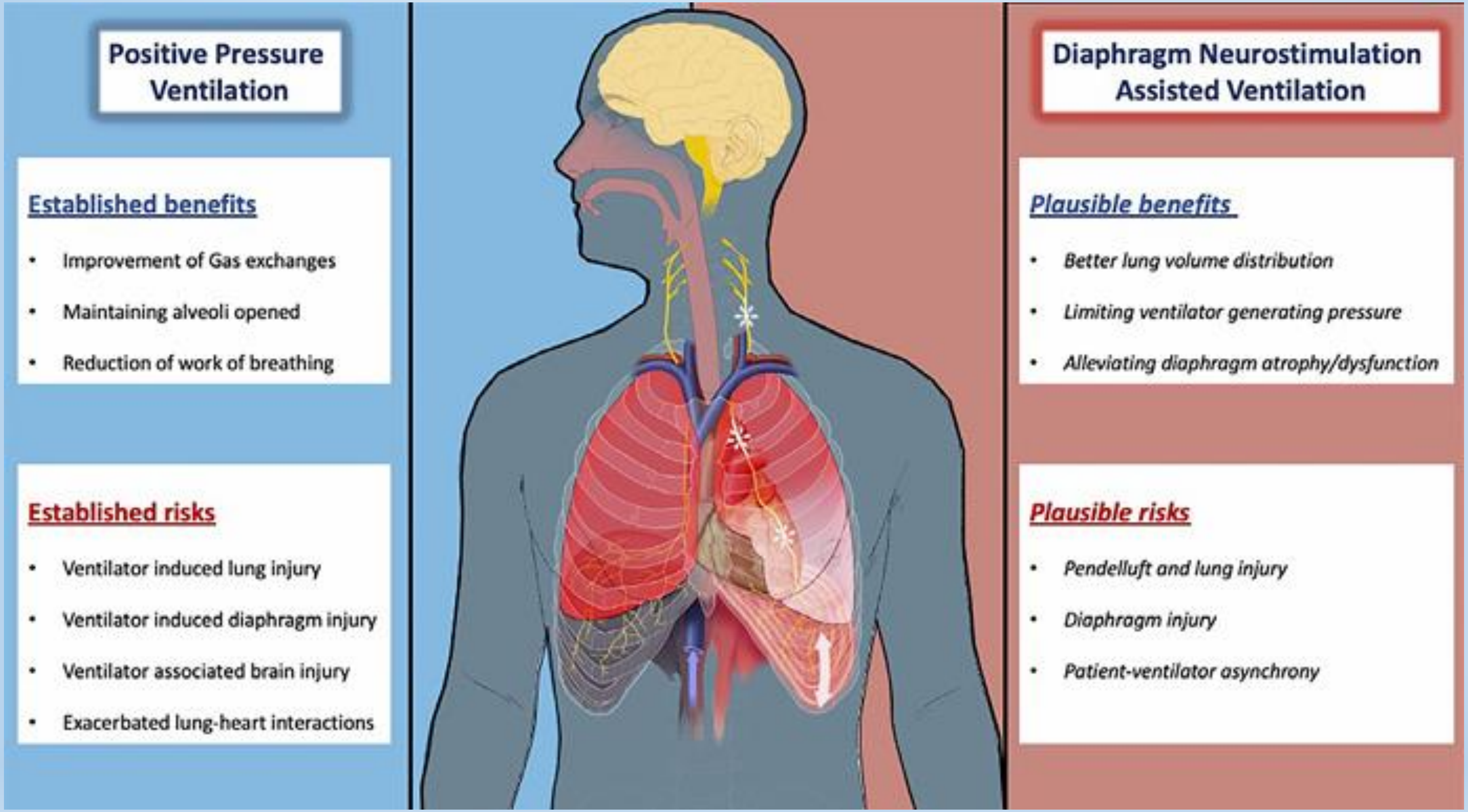




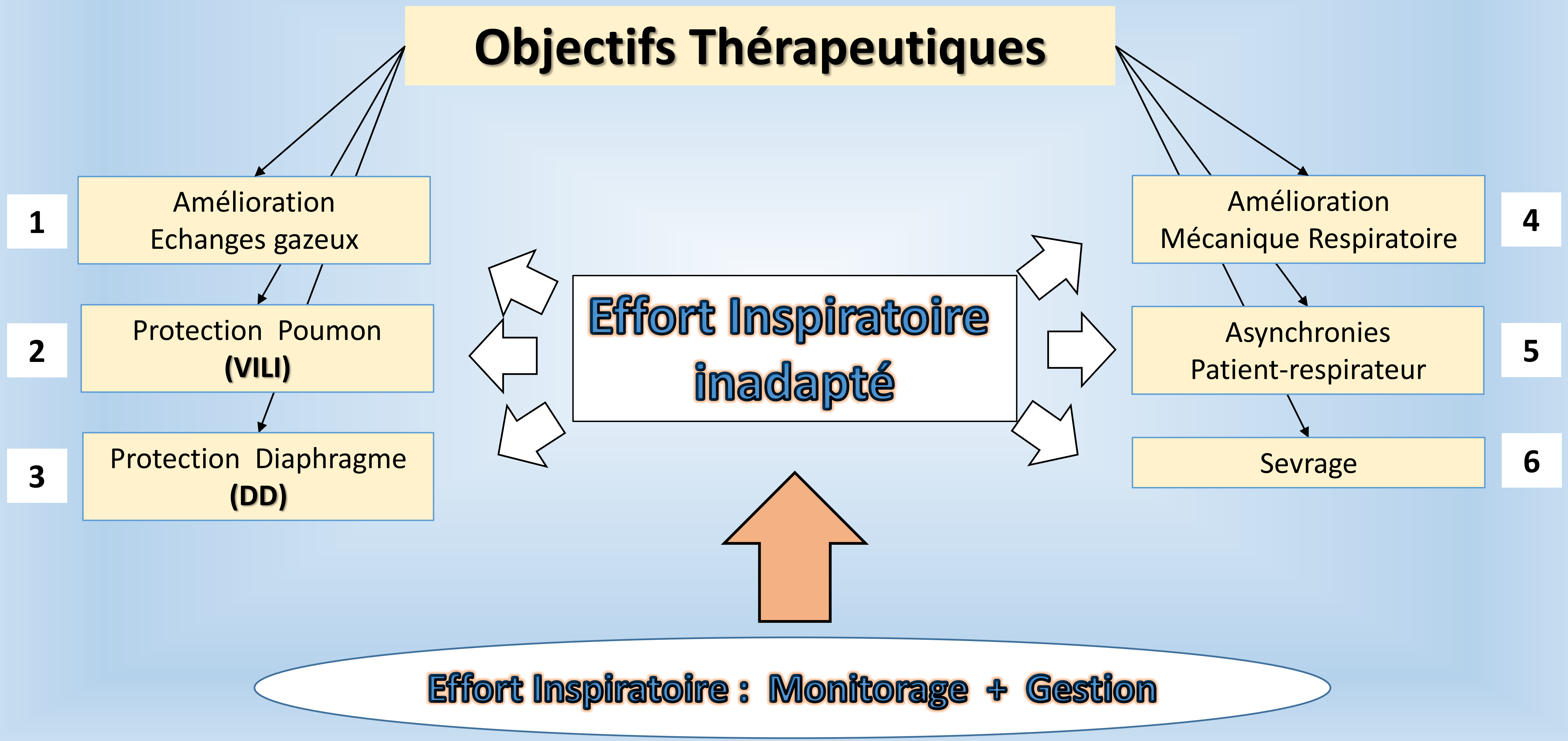


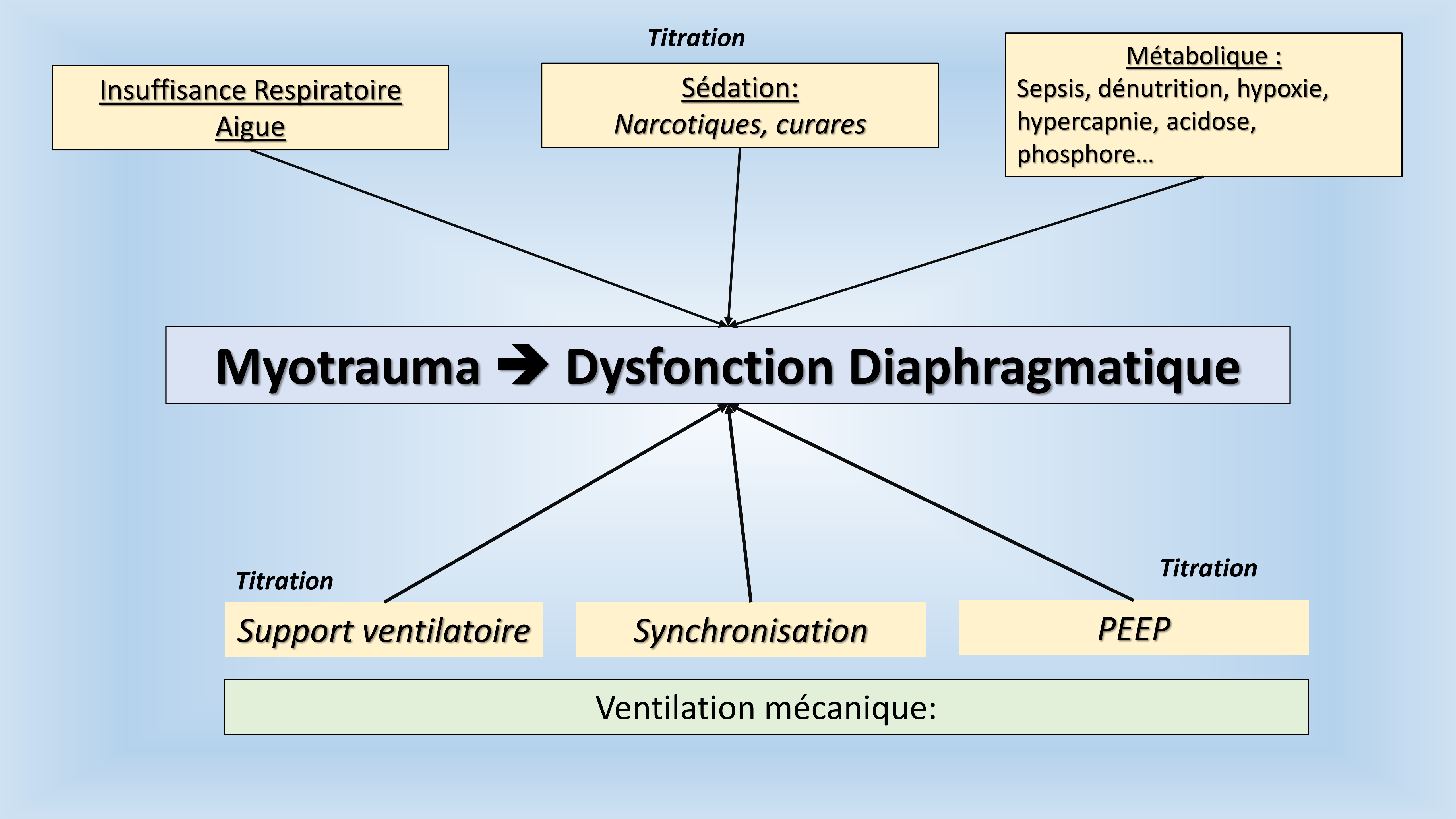
Diaphragm Neurostimulation Assisted Ventilation in Critically Ill Patients

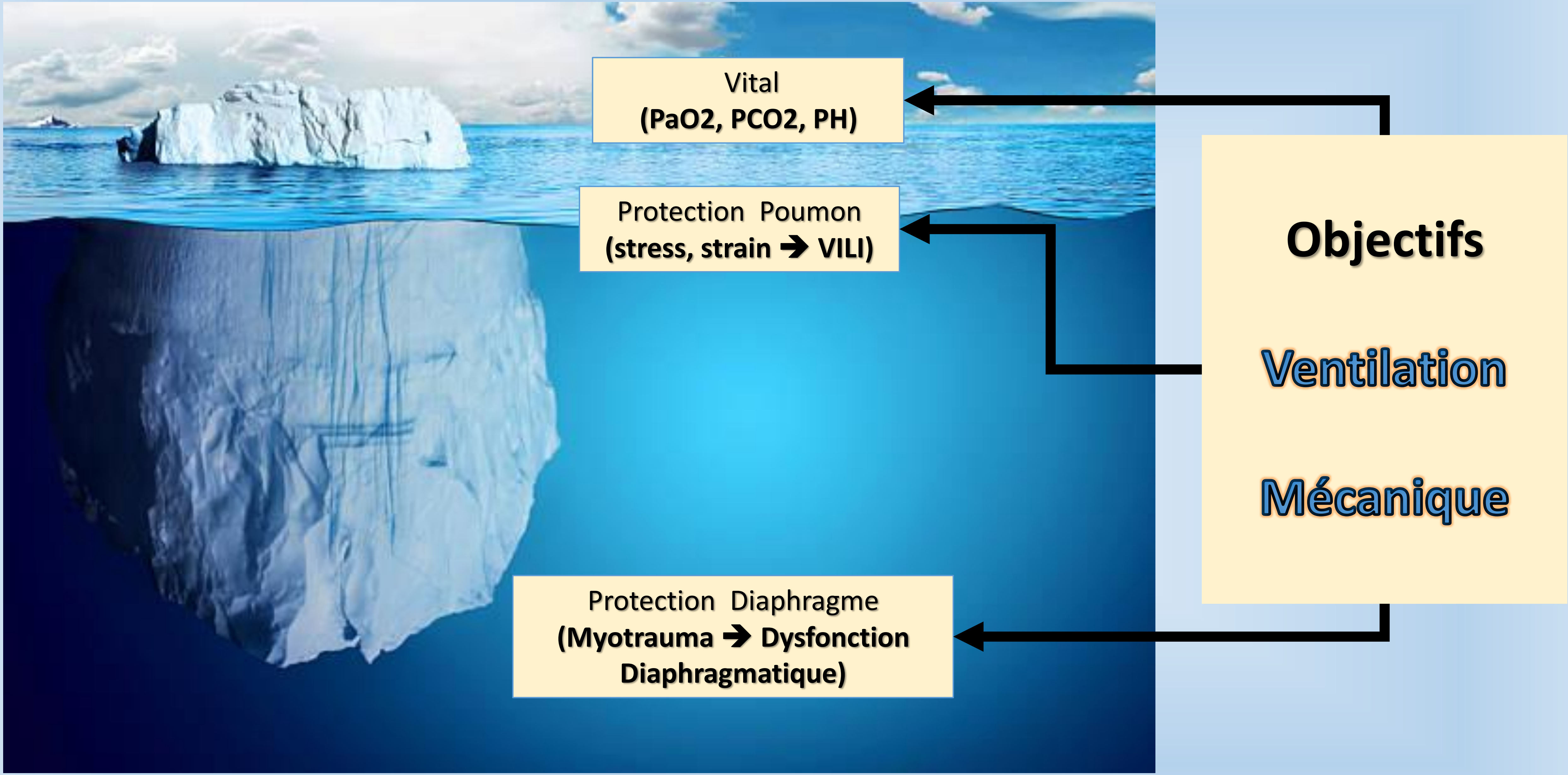
Harry Etienne[1,2], Idunn S. Morris[3,4,5,6], Greet Hermans[7,8], Leo Heunks[9], Ewan C. Goligher[3,4,5,10], Samir Jaber[11], Capucine Morelot-Panzini[1,12], Jalal Assouad[1,2], Jésus Gonzalez-Bermejo[1,13], Laurent Papazian[14], Thomas Similowski[1,15], Alexandre Demoule[1,16], and Martin Dres[1,16]



Ventilation Mécanique :




Titration
Insuffisance Respiratoire Aigue
Sédation:
Narcotiques, curares
Métabolique :
Sepsis, dénutrition, hypoxie, hypercapnie, acidose, phosphore…
Myotrauma ➔ Dysfonction Diaphragmatique
Titration
Titration
Support ventilatoire
Synchronisation
PEEP
Ventilation mécanique:


Vital
(PaO2, PCO2, PH)
Protection Poumon
(stress, strain → VILI)
Protection Diaphragme
(Myotrauma → Dysfonction Diaphragmatique)
Objectifs
Ventilation
Mécanique


SAARSIU
MERCI
mindray
healthcare within reach
MEDICO
MEDLINE
SV800
8.9
5.85
363
2.0
Auto
0.20