RÉHABILITATION PRÉCOCE DES PATIENTS DE RÉANIMATION

Guillaume FOSSAT

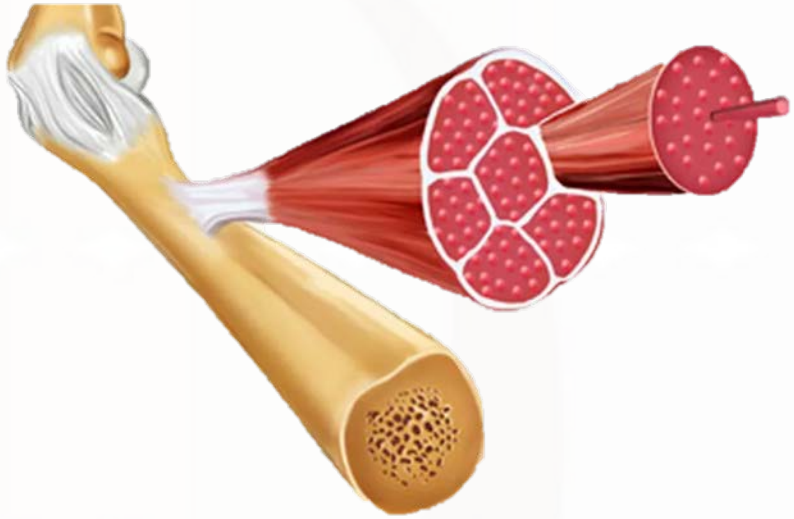
Kinésithérapeute Clinicien Chercheur

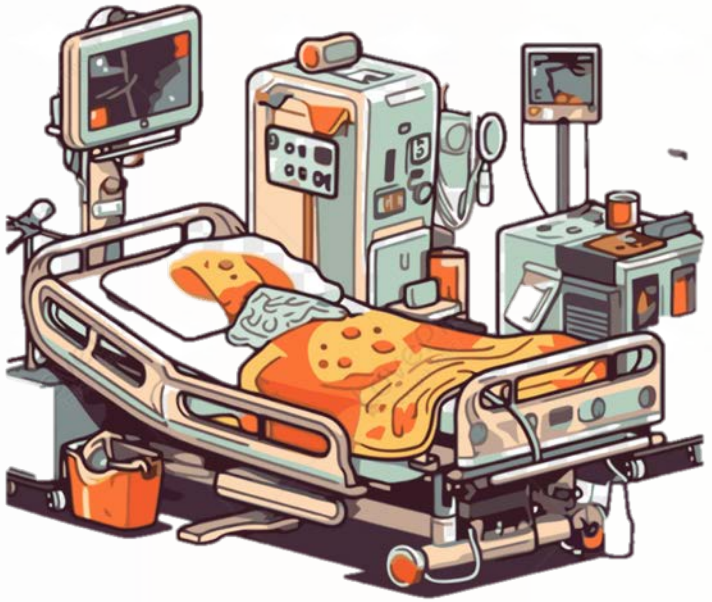
MIR CHU Orléans

PhD student, Université de Rouen

guillaume.fossat@chu-orleans.fr

Aucun conflit d'intérêt





PATHOLOGIES MUSCULAIRES ACQUISES EN RÉANIMATION

IMMOBILITÉ / ABSENCE DE CONTRAINTE

1. Production de marqueurs de l'inflammation => protéolyse musculaire
2. Diminution des filaments d'actine => diminution de force (5%/sem)
3. Diminution de la synthèse protéique
4. Accélération de la dégradation protéique

Etat septique accélère ces phénomènes

Catabolisme protéique = 2% par j de réanimation

Section de la fibre diminue de 4% par j de réanimation

FAIBLESSE ACQUISE EN RÉANIMATION

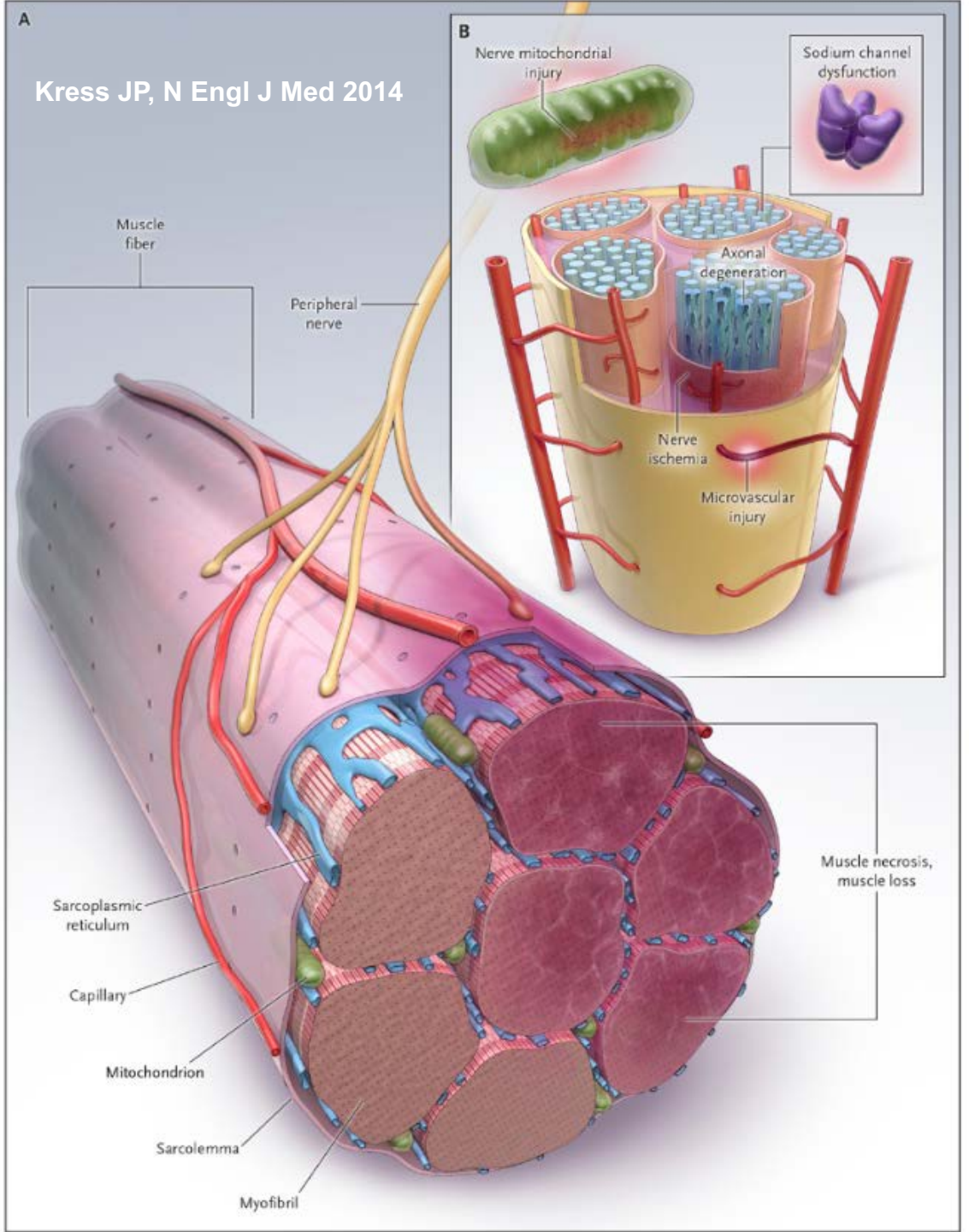
Intensive Care Unit Acquired Weakness

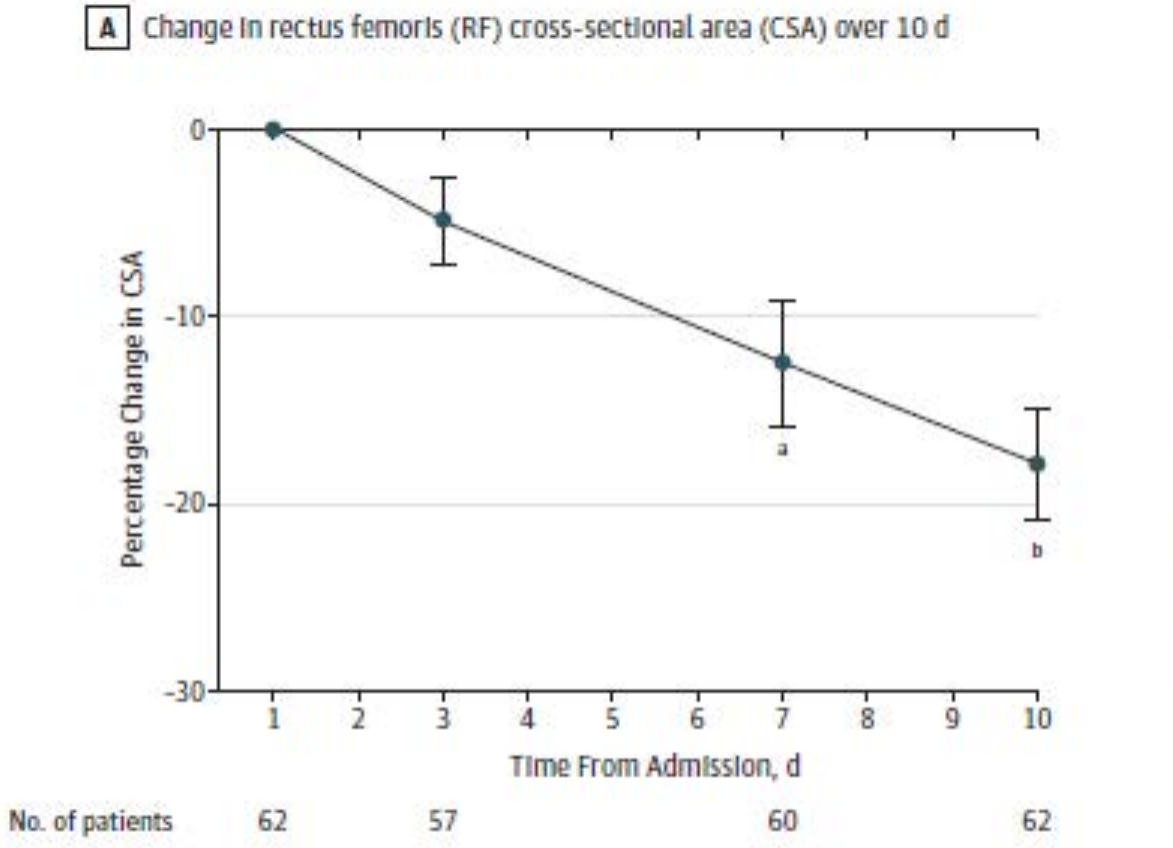
Faiblesse musculaire cliniquement observée avec comme seule cause le séjour en réanimation

3 types de ICUAW

1. Polyneuropathie avec atteinte axonale sensorimotrice.
2. Myopathie de réanimation avec atteinte musculaire.
3. Neuro-myopathie de réanimation avec implication neuromusculaire.

Schefold ; J Cachexia Sarcopenia Muscle ; 2010

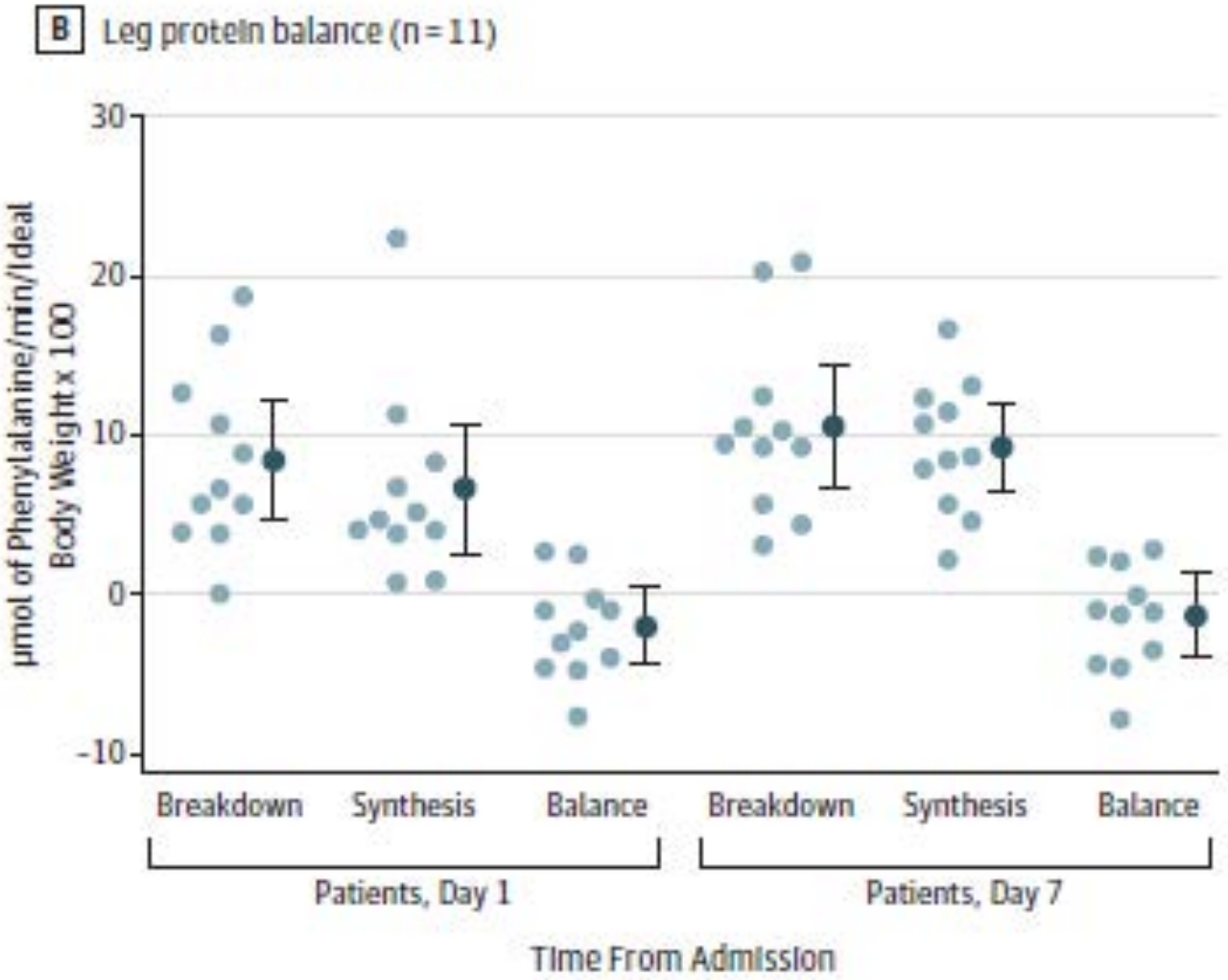




Summary data (dark circles) are expressed as medians and 95% confidence intervals.

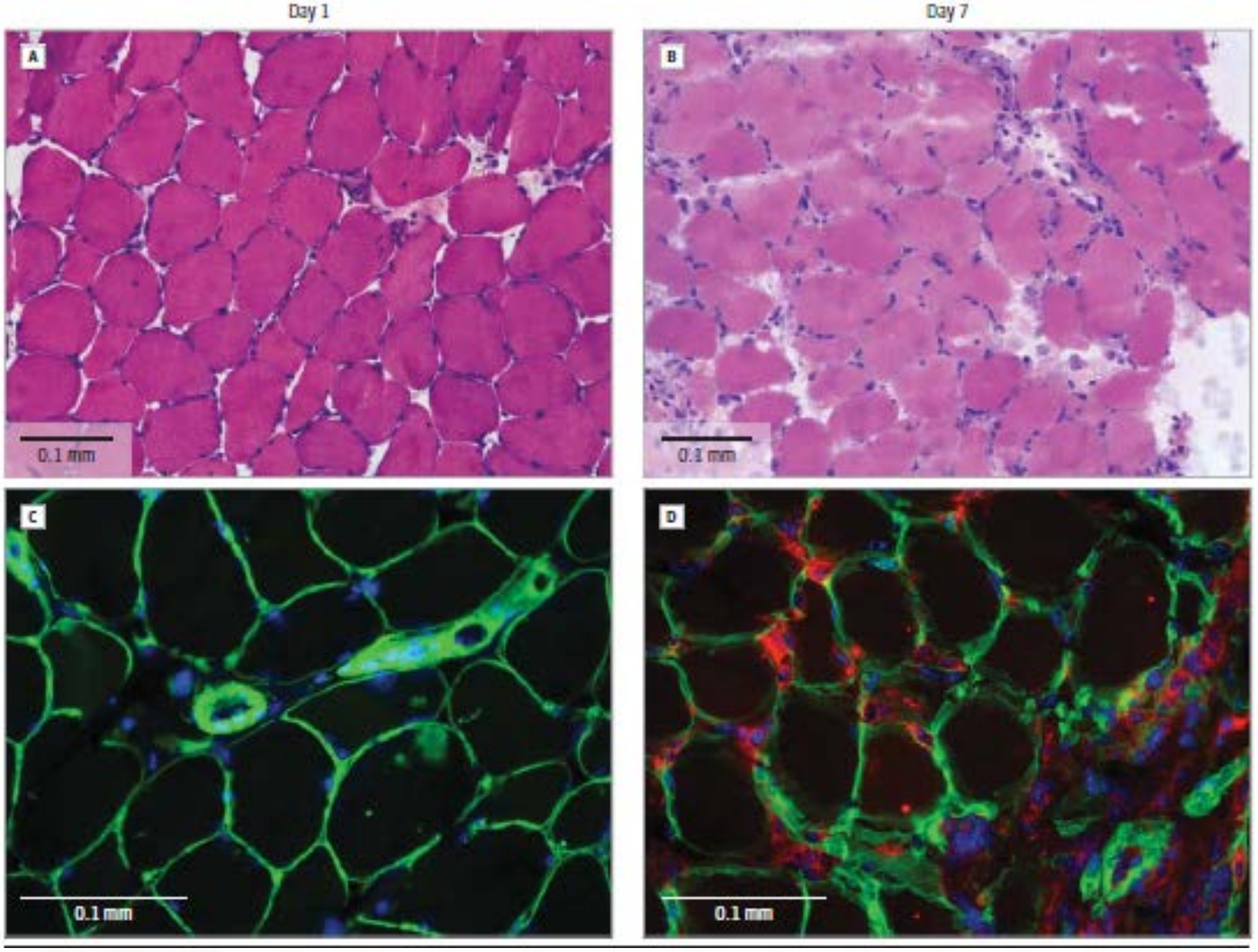
[a] $P=.002$ for change from day 1 to day 7 by repeated measures 2-way analysis of variance.

[b] $P<.001$ for change from day 1 to day 10.

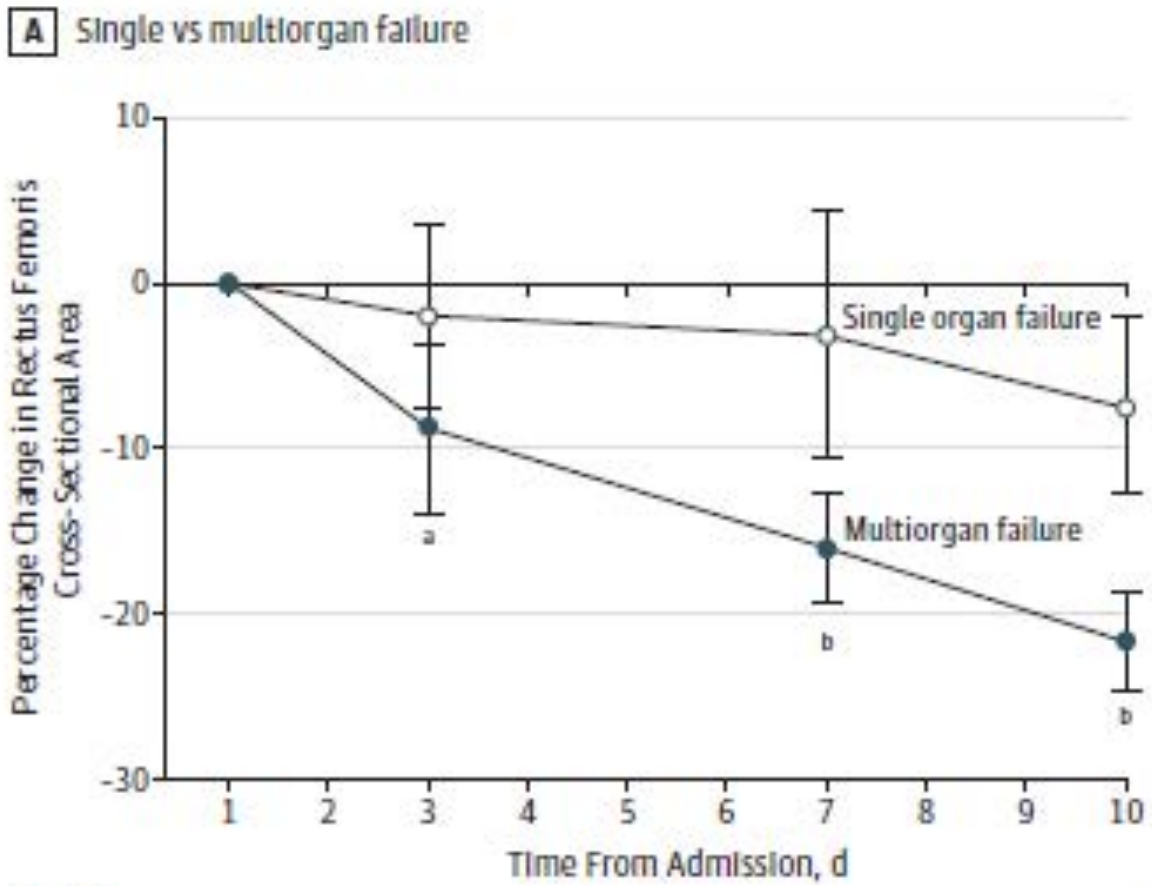


Une atteinte précoce et rapide

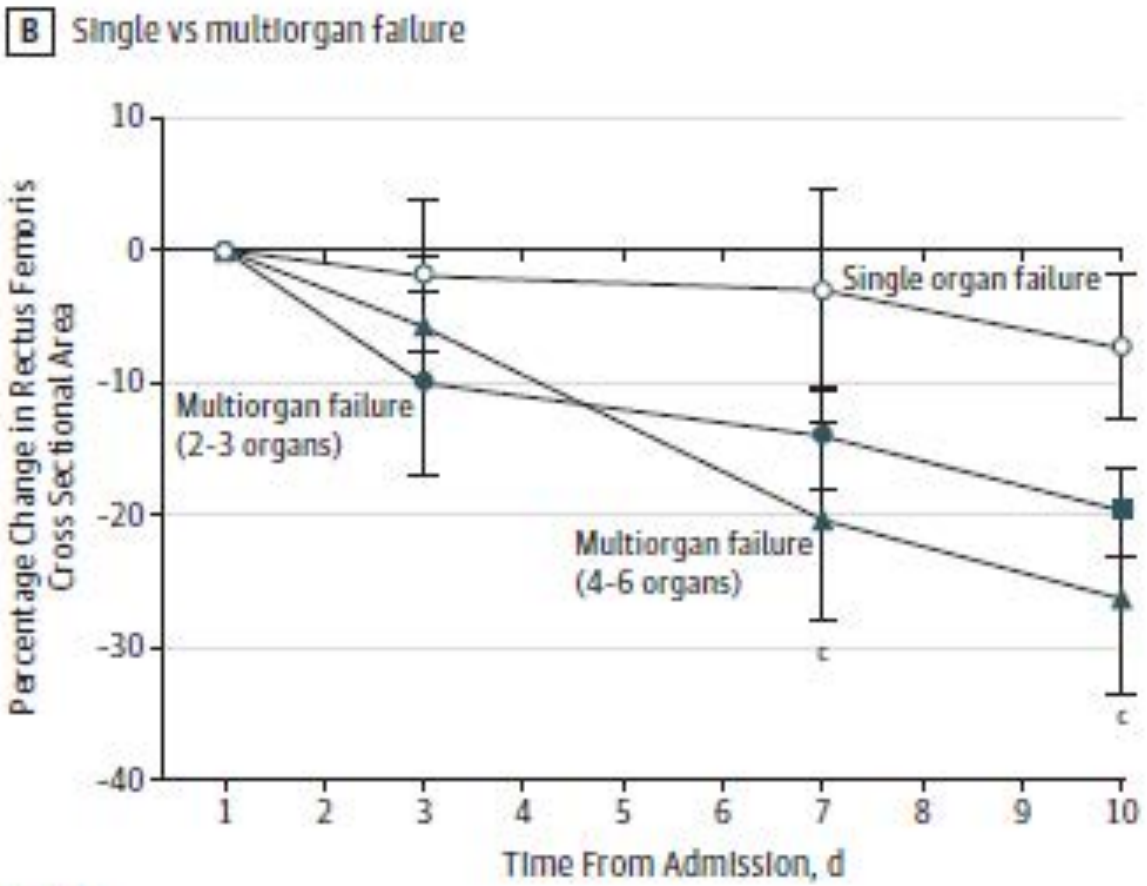
Puthucheary, JAMA, 2013



Puthucheary, JAMA, 2013



No. of patients				
Single organ failure	15	14	15	15
Multiorgan failure	47	43	45	47



No. of patients				
Single organ failure	15	14	15	15
Multiorgan failure				
2-3 Organs	33	31	32	33
4-6 Organs	14	12	13	14

Majorée par la défaillance multi-organes

Puthucheary, JAMA, 2013

REVIEW Open Access

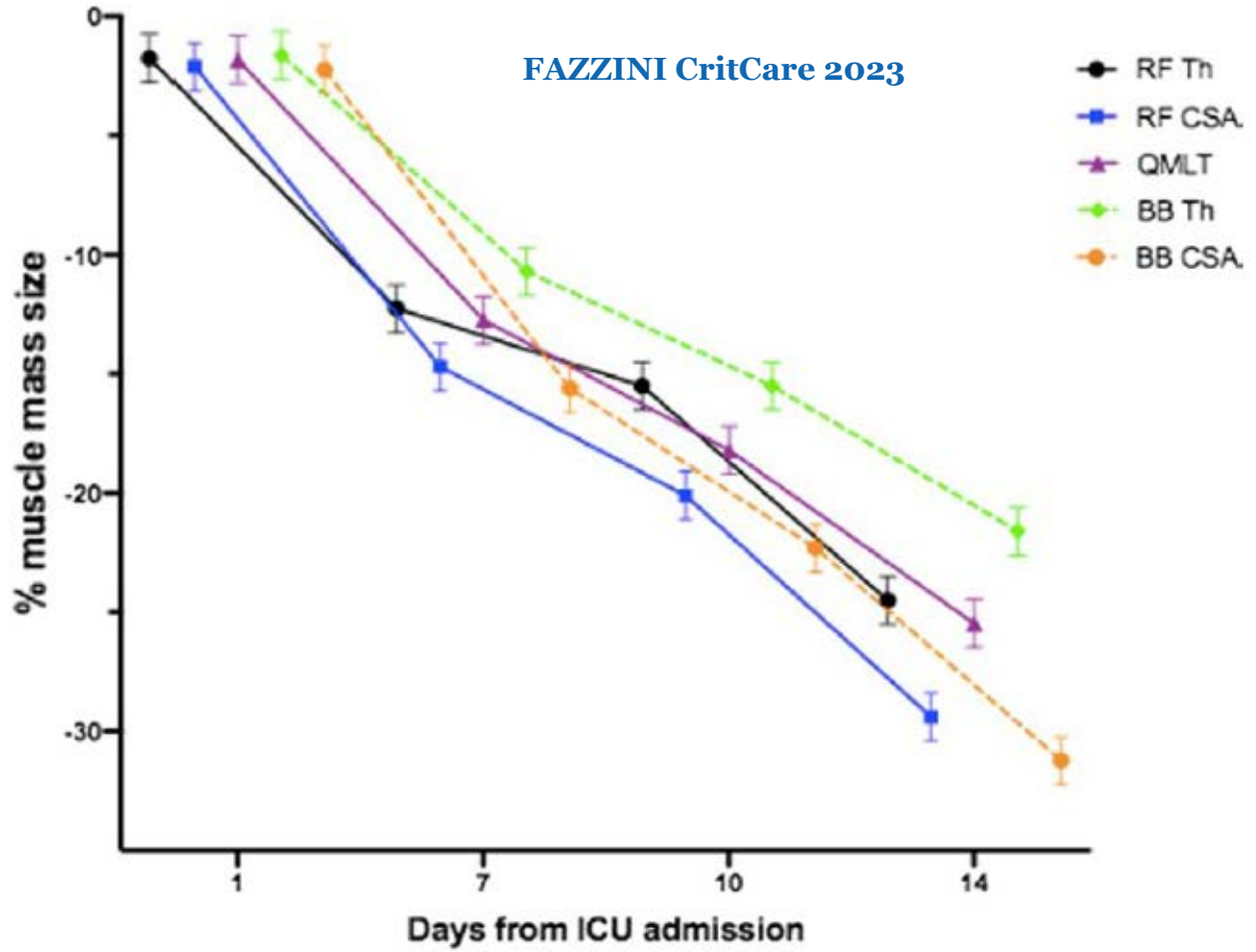
The rate and assessment of muscle wasting during critical illness: a systematic review and meta-analysis

Brigitta Fazzini[1*], Tobias Märkl[2], Christos Costas[3], Manfred Blobner[4,5,6], Stefan J. Schaller[4,5], John Prowle[1,3], Zudin Puthucheary[1,3†] and Henning Wackerhage[2*†]

Conclusion

Critically ill patients suffer from early and marked muscle wasting. Ultrasound is the most used assessment tool in evaluating loss in muscle mass over time. The muscle mass is about 2% per day, but this rate is different between muscles and depends upon the measurement taken. The prevalence of ICU-AW is 50% amongst critically ill and those have worst outcomes.

FAZZINI CritCare 2023



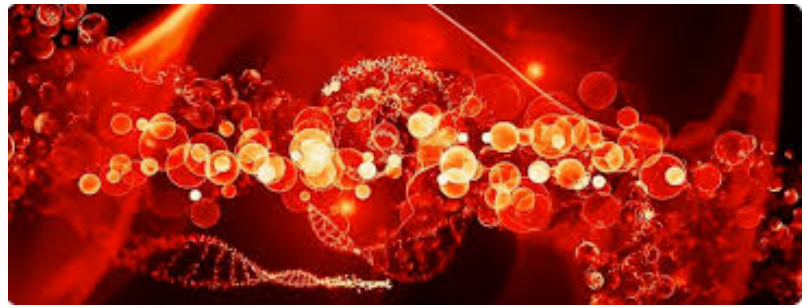
% RF th	-1.75	-12.25	-15.5	-24.5
% RF CSA	-2.10	-14.7	-20.1	-29.4
% QMLT	-1.82	-12.74	-18.2	-25.48
% BB Th	-1.64	-10.7	-15.5	-21.6
% BB CSA	-2.23	-15.61	-22.30	-31.22

Fig. 2 Loss in muscle mass from day 1 to day 14 of ICU admission. Abbreviations: percentage, %; rectus femoris: RF; cross-sectional area: CSA, thickness: Th, quadriceps muscle layer thickness: QMLT; biceps brachii: BB

FACTEURS DE RISQUES

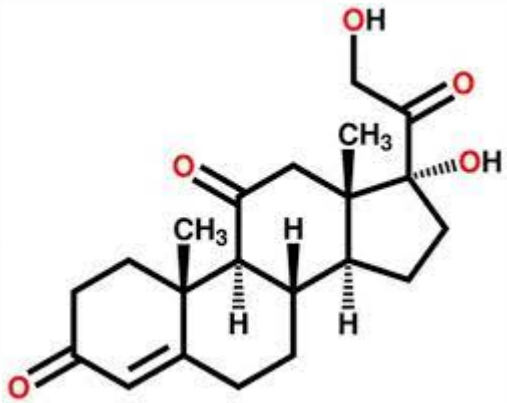
Immobilité prolongée

Hyperglycémie



Inflammation systémique

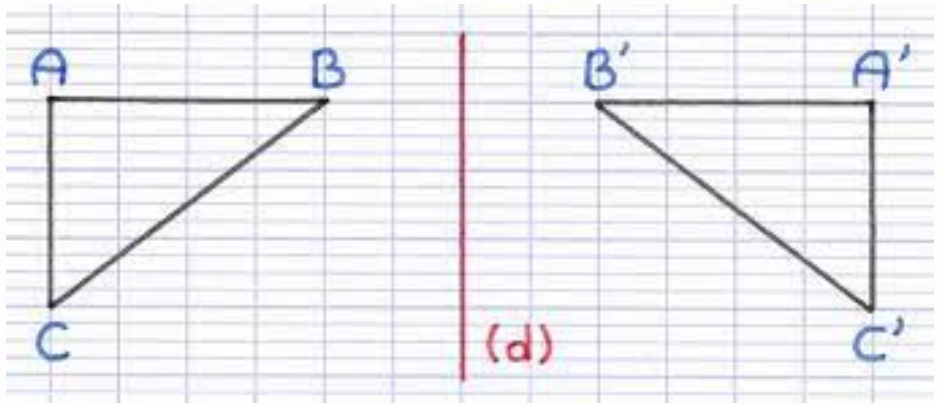
Sédation profonde

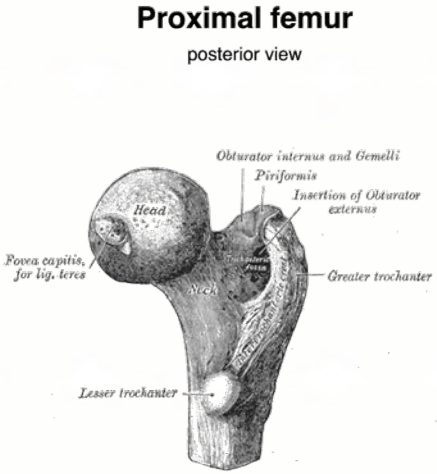


Corticostéroïdes

Curares

CLINIQUEMENT





Déficit bilatéral

Symétrique

Proximal

Score MRC

0 = pas de contraction visible

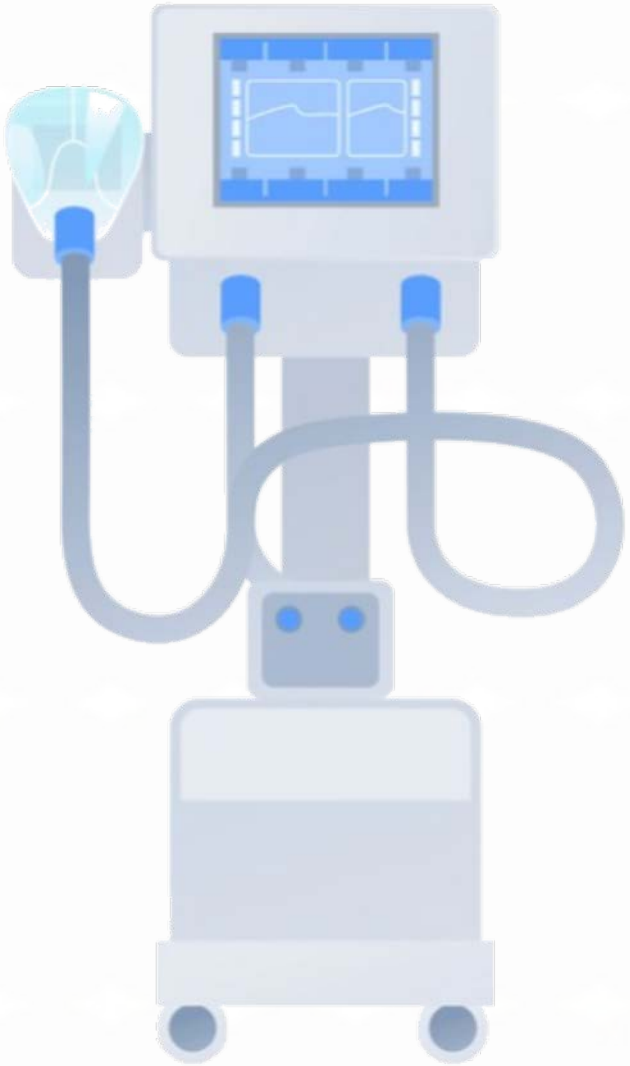
5 = force normale

Score < 48 => ICUAW

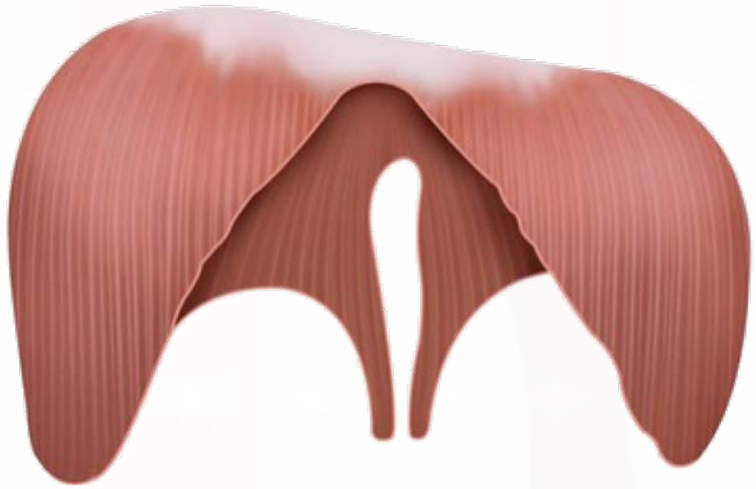
		GAUCHE	DROITE
Abduction du bras	Absence de contraction visible	0	0
	Contraction visible sans mouvement du membre	1	1
	Mouvement insuffisant pour vaincre la pesanteur	2	2
	Mouvement permettant de vaincre la pesanteur	3	3
	Mouvement contre pesanteur et contre résistance	4	4
	Force musculaire normale	5	5
Flexion de l'avant-bras	Absence de contraction visible	0	0
	Contraction visible sans mouvement du membre	1	1
	Mouvement insuffisant pour vaincre la pesanteur	2	2
	Mouvement permettant de vaincre la pesanteur	3	3
	Mouvement contre pesanteur et contre résistance	4	4
	Force musculaire normale	5	5
Extension du poignet	Absence de contraction visible	0	0
	Contraction visible sans mouvement du membre	1	1
	Mouvement insuffisant pour vaincre la pesanteur	2	2
	Mouvement permettant de vaincre la pesanteur	3	3
	Mouvement contre pesanteur et contre résistance	4	4
	Force musculaire normale	5	5
Flexion de la cuisse	Absence de contraction visible	0	0
	Contraction visible sans mouvement du membre	1	1
	Mouvement insuffisant pour vaincre la pesanteur	2	2
	Mouvement permettant de vaincre la pesanteur	3	3
	Mouvement contre pesanteur et contre résistance	4	4
	Force musculaire normale	5	5
Extension de la Jambe	Absence de contraction visible	0	0
	Contraction visible sans mouvement du membre	1	1
	Mouvement insuffisant pour vaincre la pesanteur	2	2
	Mouvement permettant de vaincre la pesanteur	3	3
	Mouvement contre pesanteur et contre résistance	4	4
	Force musculaire normale	5	5
Flexion dorsale du pied	Absence de contraction visible	0	0
	Contraction visible sans mouvement du membre	1	1
	Mouvement insuffisant pour vaincre la pesanteur	2	2
	Mouvement permettant de vaincre la pesanteur	3	3
	Mouvement contre pesanteur et contre résistance	4	4
	Force musculaire normale	5	5
	Totaux :		

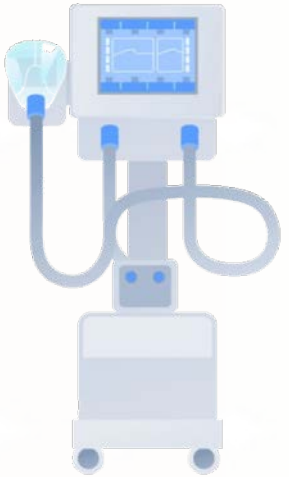
Score total= ☐☐ / 60

Existe-t-il un lien entre atteintes diaphragmatique et musculaire ?



VENTILATION MÉCANIQUE ≈ 40 / 70%





Travail actif contre résistance 24/24h

Ø Travail

Raccourcissement actif cyclique

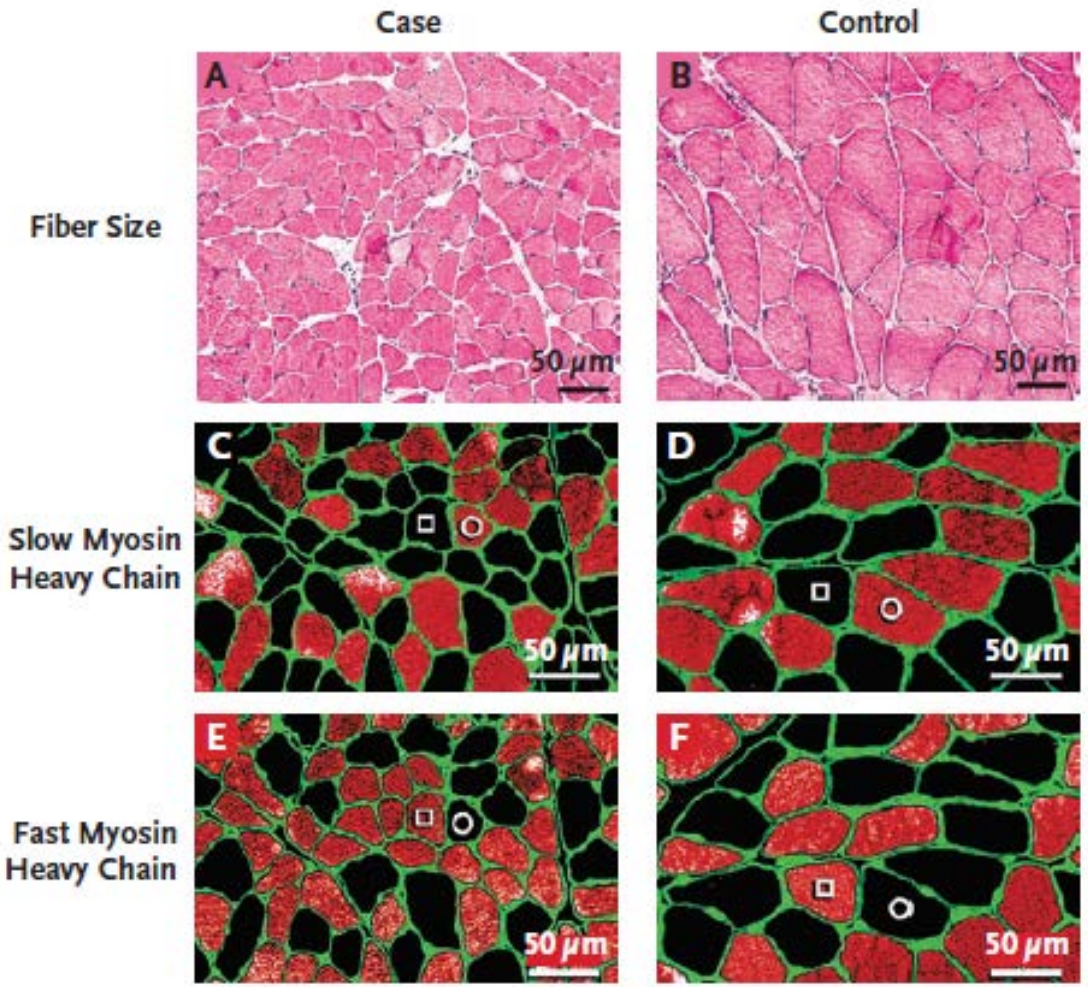
Raccourcissement passif continu (PEEP)

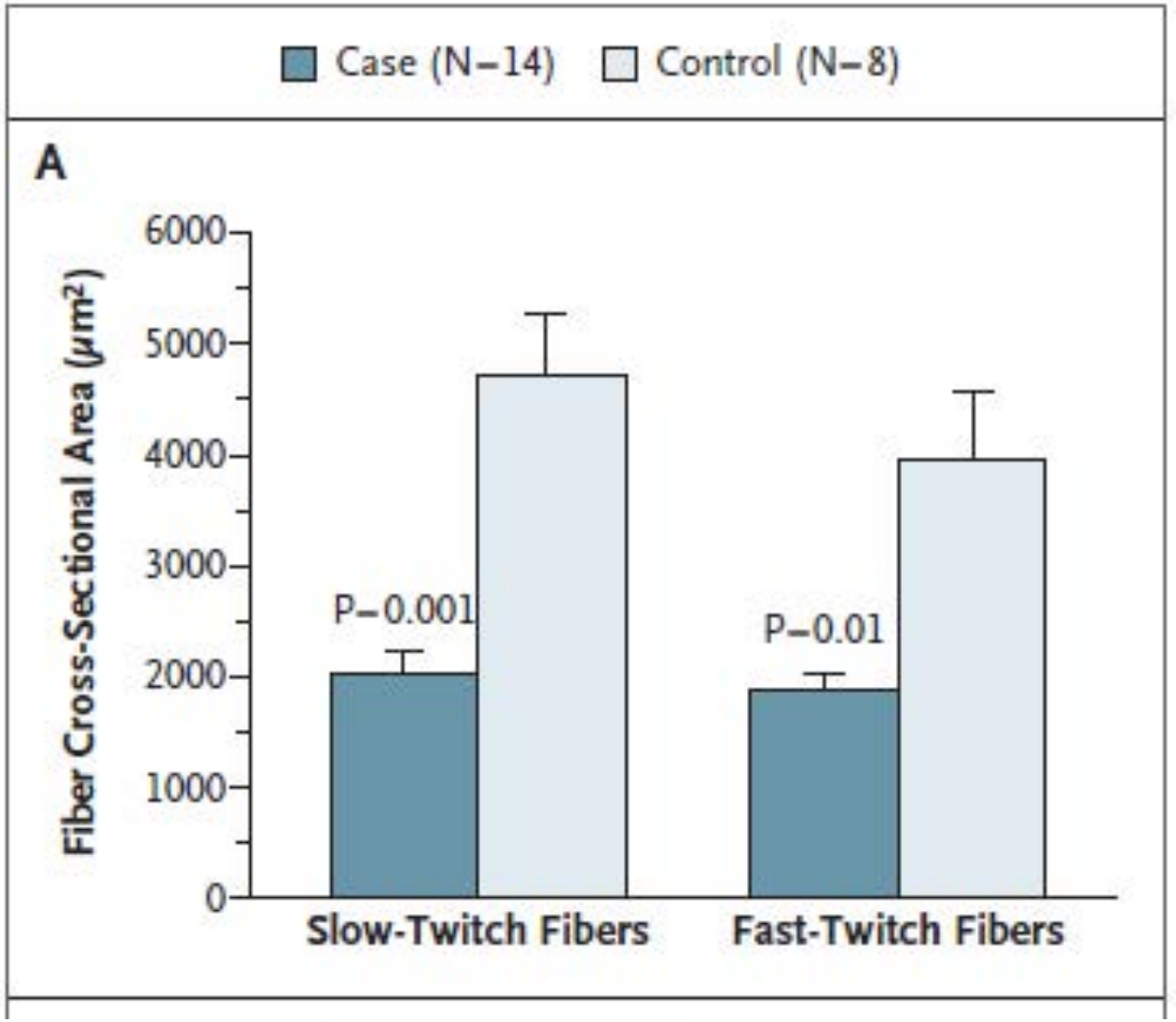
Génération de pression négative intra thoracique

Pression positive intra thoracique

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

Rapid Disuse Atrophy of Diaphragm Fibers in Mechanically Ventilated Humans





LEVINE, NEJM, 2008

MRC score et diaphragme

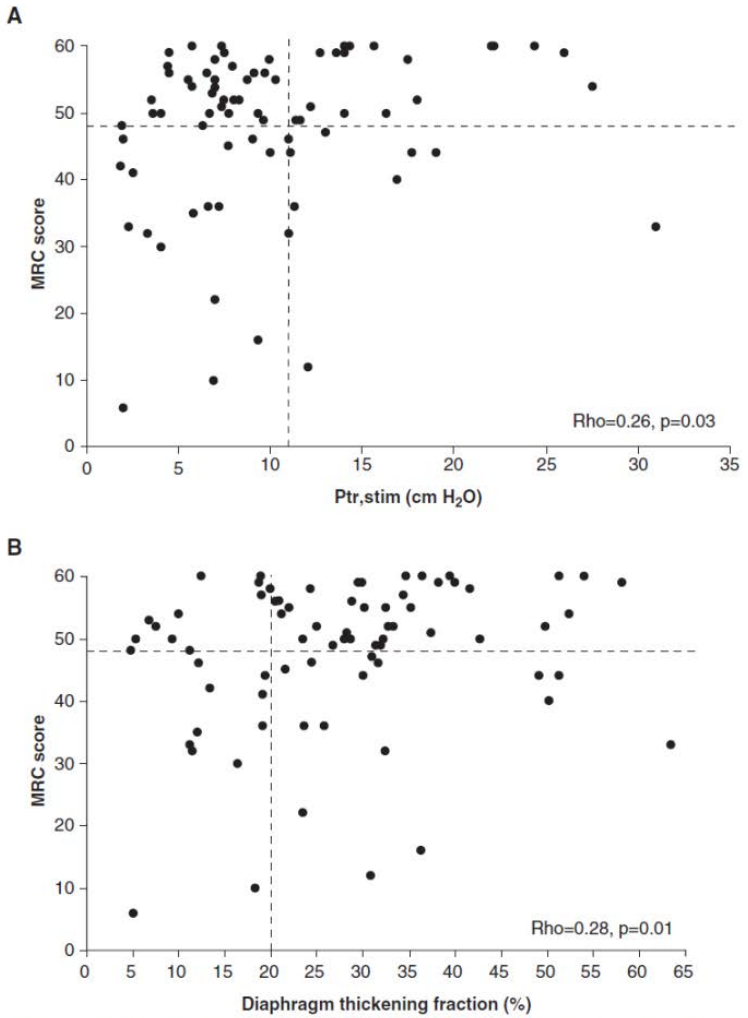


Figure 2. Correlation analysis between the Medical Research Council (MRC) score and either the change in tracheal pressure induced by bilateral phrenic nerve stimulation (Ptr,stim) (*A*) or the diaphragm thickening fraction (*B*). *Dashed lines* represent the cutoff of Ptr,stim to diagnose diaphragm dysfunction in the critically ill (−11 cm H_2O) (8), the cutoff of diaphragm thickening fraction to diagnose diaphragm dysfunction (20%) (40), and the cutoff of MRC to diagnose intensive care unit–acquired weakness (48).

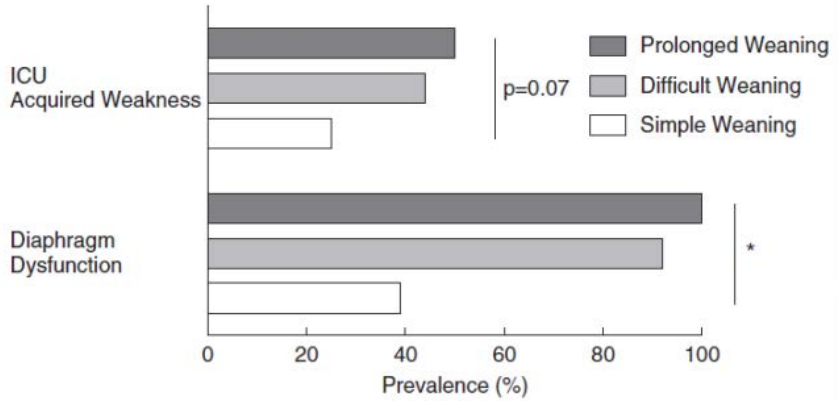


Figure 3. Histogram showing the respective prevalence of intensive care unit (ICU)-acquired weakness and diaphragm dysfunction according to the international weaning classification categories. *$P < 0.05$ (chi-square test among three groups).

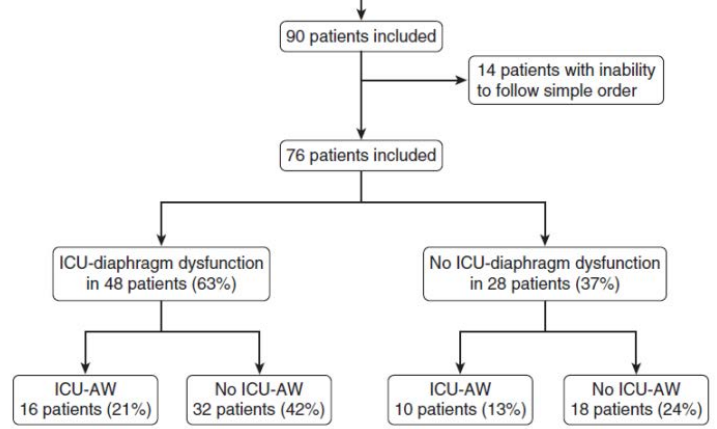


Figure 1. Study flowchart. ICU-AW = intensive care unit–acquired weakness; PEEP = positive end-expiratory pressure.

- MV > 24 heures, 1ère SBT
  - Twitch Trach Press < 11cmH2O => Diaphragm Dysfunction
  - Thickening Fraction and Excursion (US)
  - MRC < 48 => ICUAW
- More diaphragmatic dysfunction in weaning failure patient

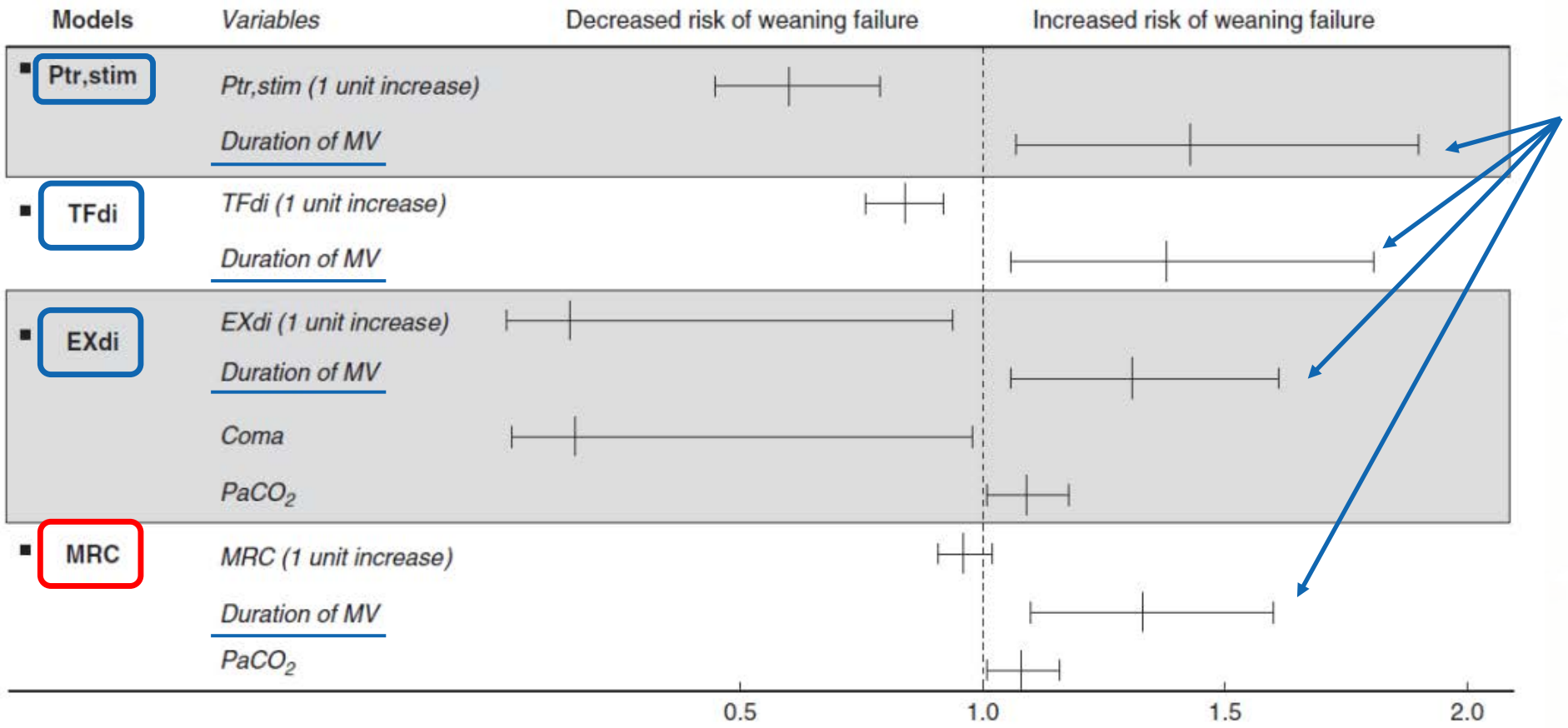


Figure 4. Forest plot showing the factors significantly associated with weaning failure: results of four multivariate logistic regressions, each separately including Ptr,stim, TFdi, EXdi, or MRC score. The Forest plot shows that an increase in the duration of mechanical ventilation before inclusion was independently associated with weaning failure in the four models. Diaphragm dysfunction was independently associated with weaning failure in the models including Ptr,stim (each 1-unit increase of Ptr,stim decreased the risk of weaning failure; odds ratio [OR], 0.60; 95% confidence interval [CI], 0.45–0.79; $P < 0.001$), TFdi (each 1-unit increase of TFdi decreased the risk of weaning failure; OR, 0.84; 95% CI, 0.76–0.92; $P < 0.001$), and EXdi (each 1-unit increase of EXdi decreased the risk of weaning failure; OR, 0.15; 95% CI, 0.02–0.94; $P = 0.04$). MRC score was not associated with weaning failure (OR, 0.96; 95% CI, 0.91–1.02; $P < 0.20$). In the model with EXdi, data were available for 58 of 76 patients. EXdi = diaphragmatic excursion; MRC = Medical Research Council score; MV = mechanical ventilation; Ptr,stim = endotracheal tube pressure induced by bilateral phrenic nerve stimulation during airway occlusion; TFdi = diaphragm thickening fraction.

Peut-on éviter l'atteinte musculaire?

Mobilisation précoce

“The concept of mobilization is large, complex, and interdisciplinary”

Arias-Fernandez P and al, J. Phys. Ther. Sci. 30: 1193–1201, 2018

Moyens

Mobilisation au lit

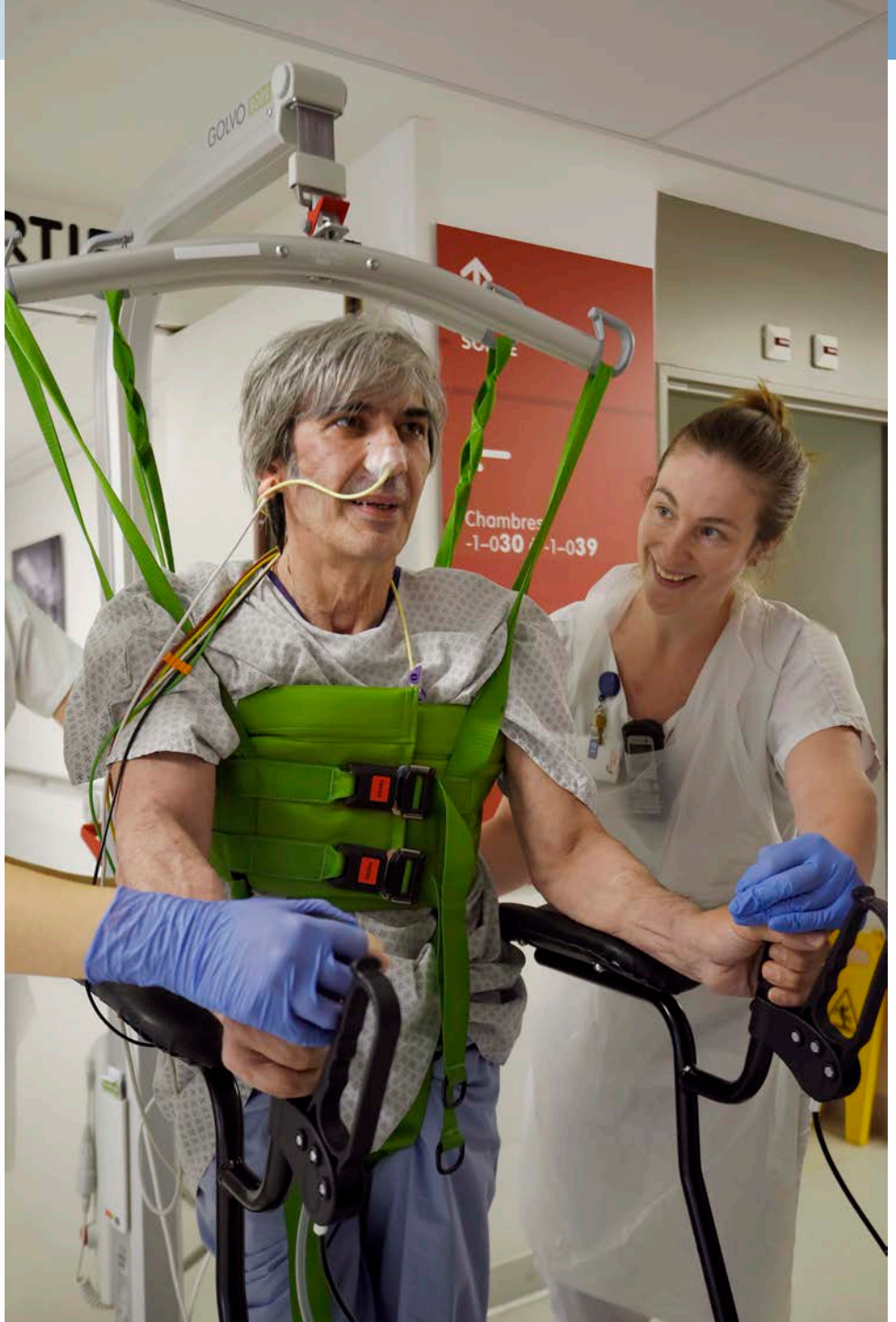
Electrothérapie

Cycloergomètre (sédation?)

Verticalisation

Mise au fauteuil

Déambulation


Chambres
-1-030
-1-039


86
98
15
137/94 (106)
Nimbus


LINET
122/94

La mobilisation est-elle sûre pour le patient?

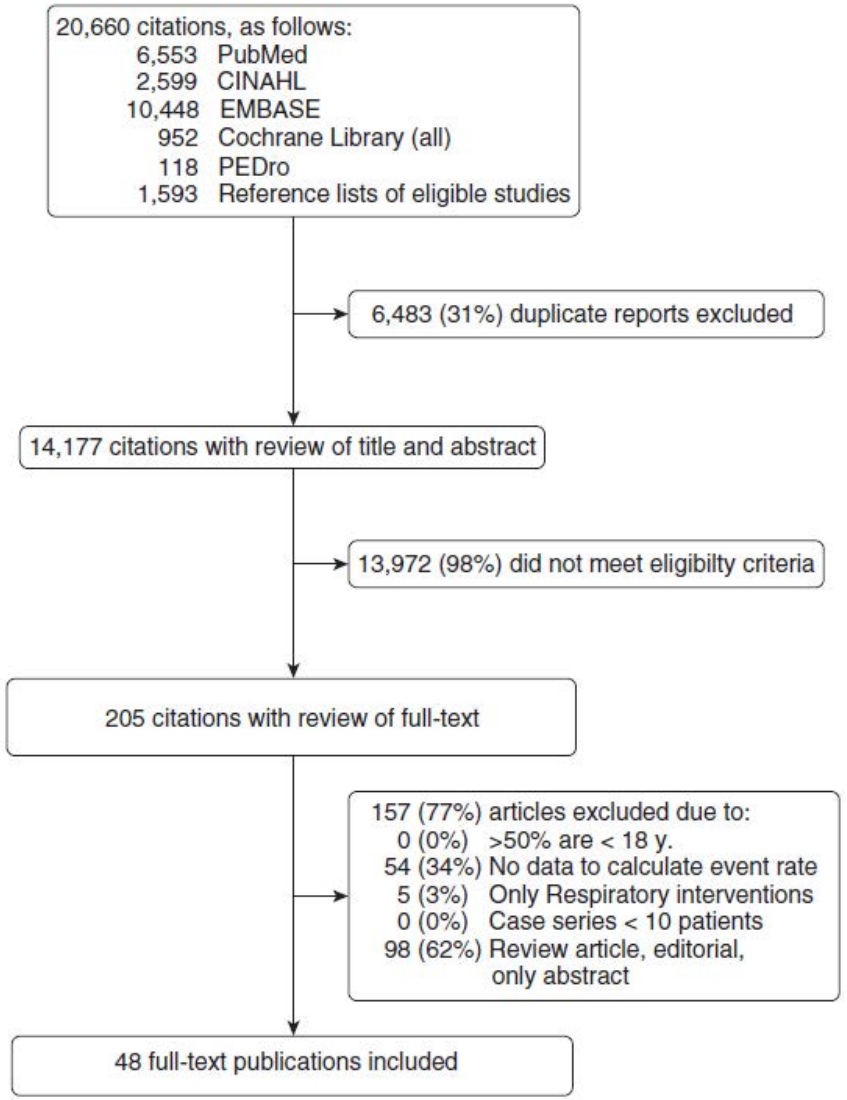


Figure 1. Literature research.

SYSTEMATIC REVIEW

Safety of Patient Mobilization and Rehabilitation in the Intensive Care Unit

Systematic Review with Meta-Analysis

Peter Nydahl[1]*, Thiti Sricharoenchai[2]*, Saurabh Chandra[3], Firuzan Sari Kundt[4], Minxuan Huang[5], Magdalena Fischill[6], and Dale M. Needham[7]

Table 2. Potential safety events

Type of Potential Safety Events	No. of Studies, Reporting these Events (%)	No. of Patients	No. of Mobilization/ Rehabilitation Sessions	No. of Reported Events (% of Mobilization/ Rehabilitation Sessions)
Fall	27 (57)	5,972	16,342	11 (0.07)
Endotracheal tube removal	28 (58)	6,303	17,148	2 (0.01)
Intravascular catheter event*	31 (65)	6,134	16,397	35 (0.2)
Other catheter or tube removal	25 (52)	4,959	15,761	15 (0.09)
Cardiac arrest	26 (54)	5,830	14,438	4 (0.03)
Hemodynamic changes	33 (69)	6,593	18,083	126 (0.7)
Desaturation†	33 (69)	5,753	16,487	78 (0.5)
Other‡	32 (67)	6,579	17,132	312 (1.8)

*This type of events includes removal and dysfunction of intravascular catheter.
†Different subgroups were used in meta-analysis by definition of safety events: oxygen saturation <80, <85, <88, and <90%.
‡The following events (for each study) were included in "Other" events: decline in ventilator status that required an increase in positive end-expiratory pressure, change of ventilation mode, rejected by patient, agitation, anxiety, diaphoresis, dizziness, elevated intracranial pressure, gastrointestinal bleeding, patient unavailable, insecure airway, patient distress, ventilator asynchrony, severe breathlessness by Borg scale, paradoxical breathing, dizziness, perspiration, faintness; hypotension without any definition, loss of muscle tone, disconnection from ventilator, arrhythmia, anxiety or confusion, ventilator asynchrony, bleeding, and syncope. Lee and colleagues (73) reported multifaceted events, including desaturation, tachycardia, and dizziness.

Conclusions

Early mobilization and physical rehabilitation of critically ill patients appears to be safe, with a low risk of potential safety events, even when implemented as part of routine clinical practice. Safety events that resulted in additional consequences for patient management were very rare. Notably, heterogeneity in the definition of safety assessments within the existing literature emphasizes the need for increased awareness and implementation of existing recommendations. ■

Faut-il mobiliser précocement et activement ?

JAMA Network

Can early in-bed leg cycling and electrical stimulation of the quadriceps muscles improve muscle function in critically ill adults?

CONCLUSION Early in-bed cycling and electrical stimulation of the quadriceps muscles did not improve muscle strength in critically ill patients

POPULATION

201 Men 111 Women

Patients likely to remain in the ICU for >48 hours and who could ambulate before their ICU admission

Mean age: 66 years

LOCATIONS

1
Single center in France

INTERVENTION

314 Patients randomized
(312 analyzed because 2 patients withdrew consent)

158
Early in-bed cycling
daily 15-minute session
Electrical stimulation
of the quadriceps muscles
In addition to standardized early rehabilitation

154
Standardized early rehabilitation

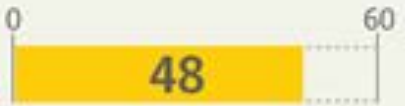
PRIMARY OUTCOME

Muscle strength at ICU discharge on a scale of 0-60 (a higher score reflects better strength)

FINDINGS

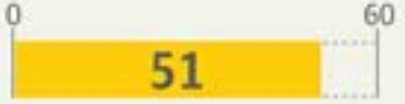
Muscle strength at ICU discharge (0-60)

Early in-bed cycling, electrical stimulation, and standardized early rehabilitation



(Interquartile range, 29 to 58)

Standardized early rehabilitation



(Interquartile range, 37 to 58)

Median difference between groups:

-3.0

(95% CI, -7.0 to 2.8)

Fossat G, Baudin F, Courtes L, et al. Effect of in-bed leg cycling and electrical stimulation of the quadriceps on global muscle strength in critically ill adults: a randomized clinical trial [published July 24, 2018]. *JAMA*. doi:10.1001/jama.2018.9592

Physical Rehabilitation in the ICU: A Systematic Review and Meta-Analysis*

DATA SOURCES: A systematic search of Ovid MEDLINE, Cochrane Library, EMBASE, and CINAHL plus databases was undertaken on the May 28, 2020.

5,352 participants.

Random-effects meta-analysis was performed

physical rehabilitation in the ICU. Standard practice has likely evolved over time since the earliest trials found benefits (11, 38, 39). For example, in the 23 trials published since 2017 (40–62), 19 (40–50, 52, 53, 55, 57–60, 62) reported that physical rehabilitation was available to the control group greater than or equal to 5 days per week. In contrast, out of 19 trials published before 2015 (11, 38, 39, 63–78), only four (39, 69, 70, 74) reported that physical rehabilitation was available to the control group greater than or equal to 5 days per week.

Impact sur le sevrage?

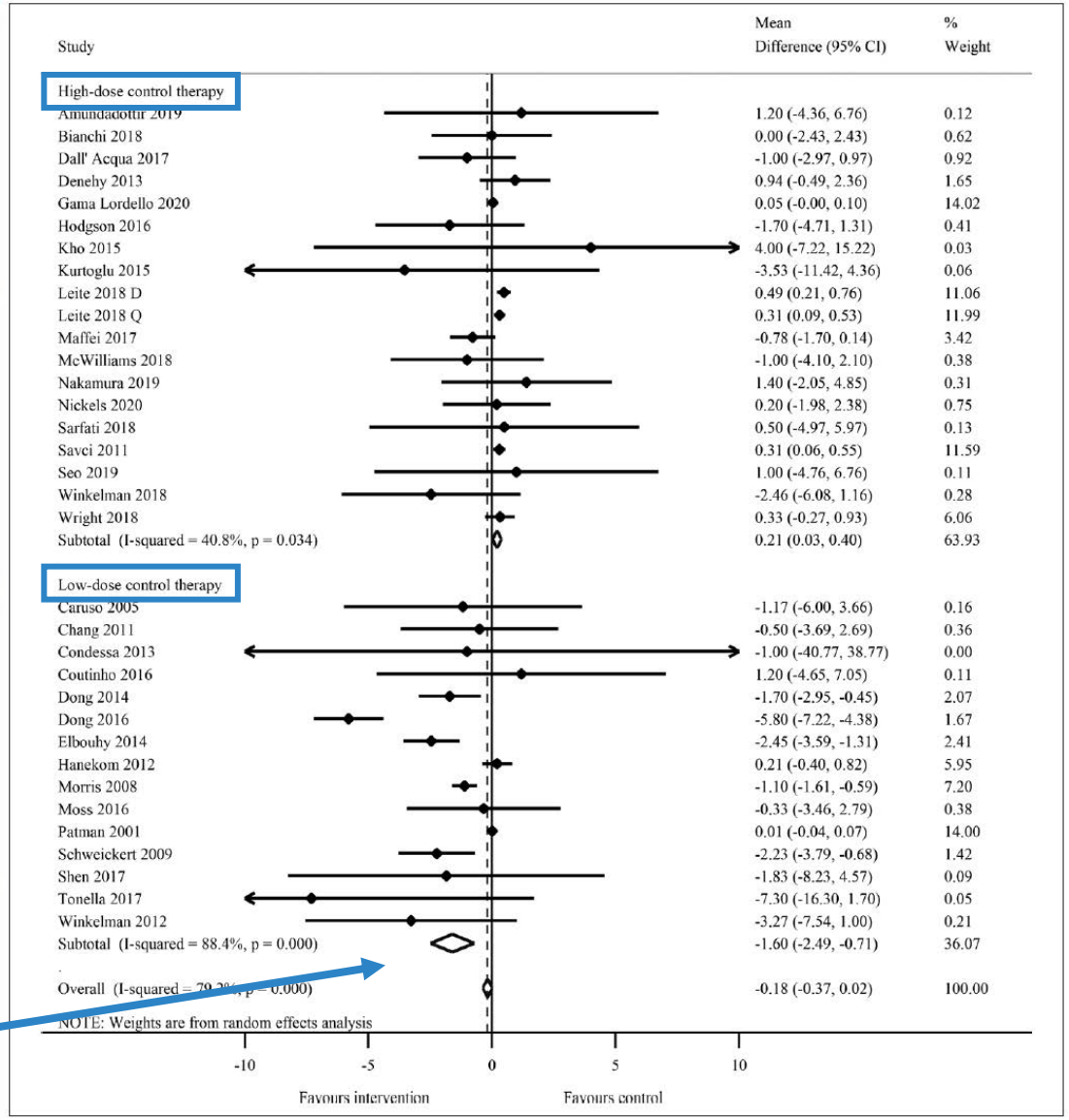


Figure 1. Meta-analysis and pooled effect sizes (raw mean difference [d]) on the duration of mechanical ventilation for physical rehabilitation and standard care with subgroup analysis according to the dosage of control intervention.

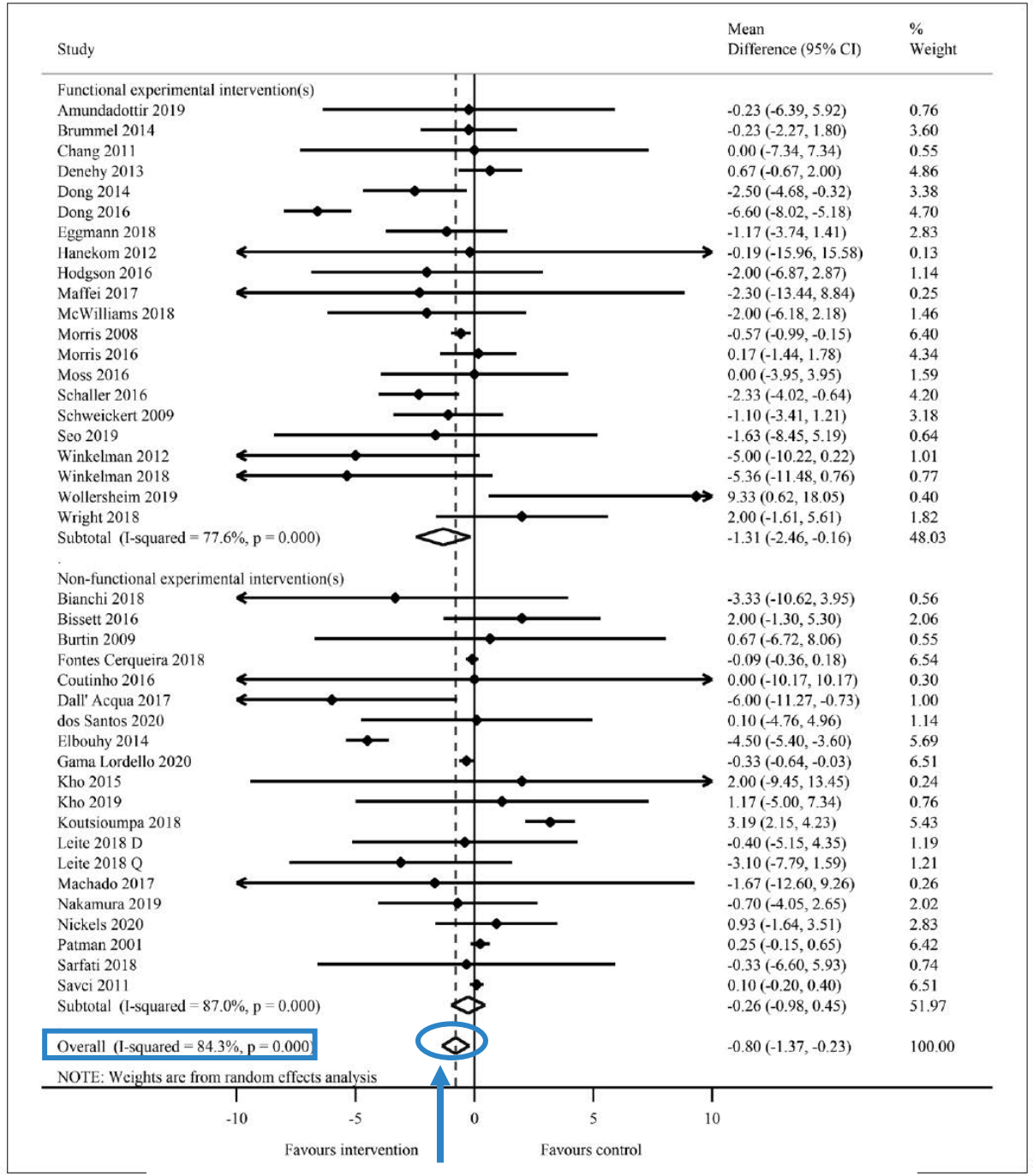


Figure 2. Meta-an standard care with

Impact sur la durée de séjour en ICU

tion and

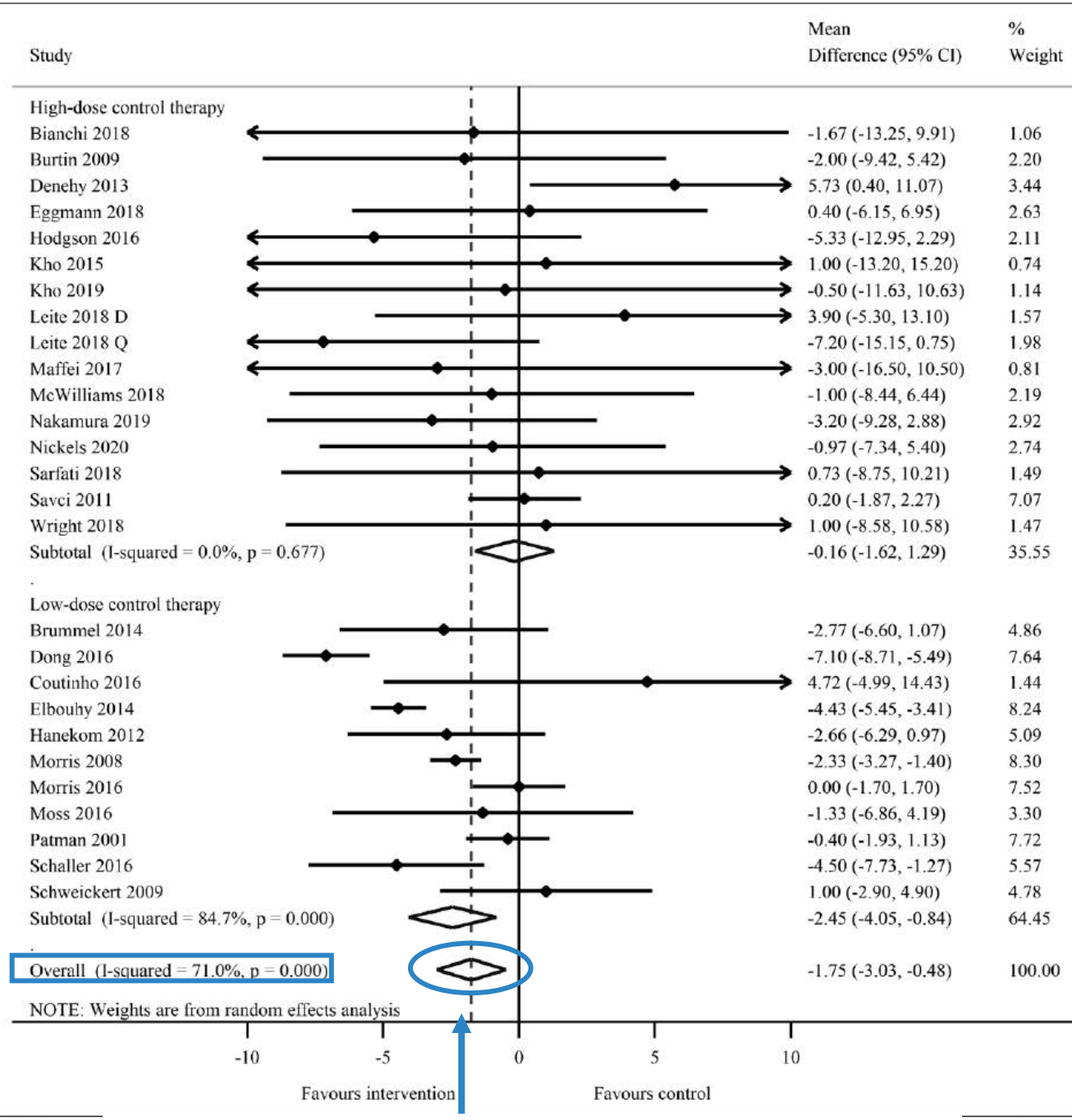


Figure 3. Meta- standard care wi

Impact sur la durée de séjour à l'hôpital

l rehabilitatio

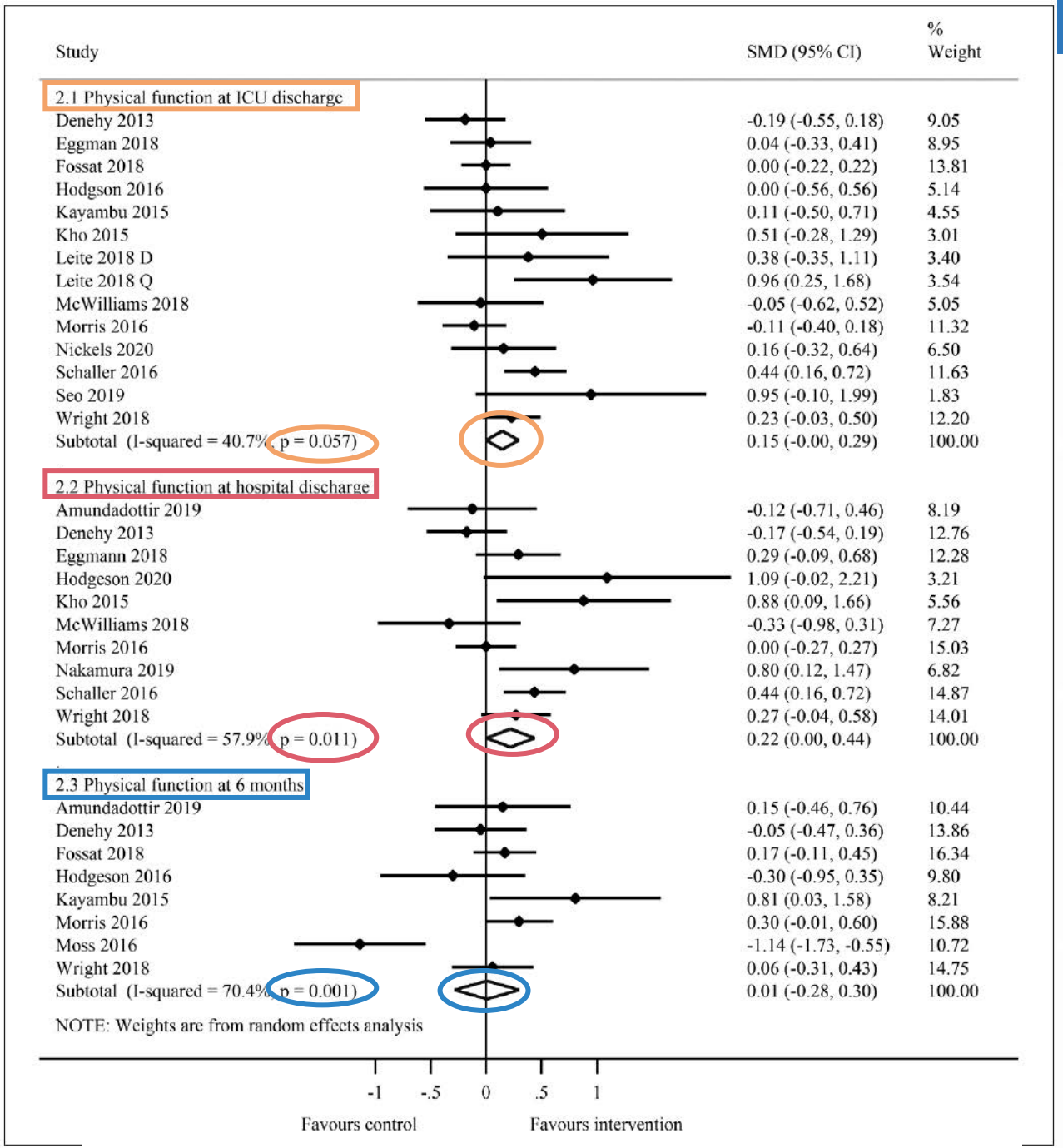
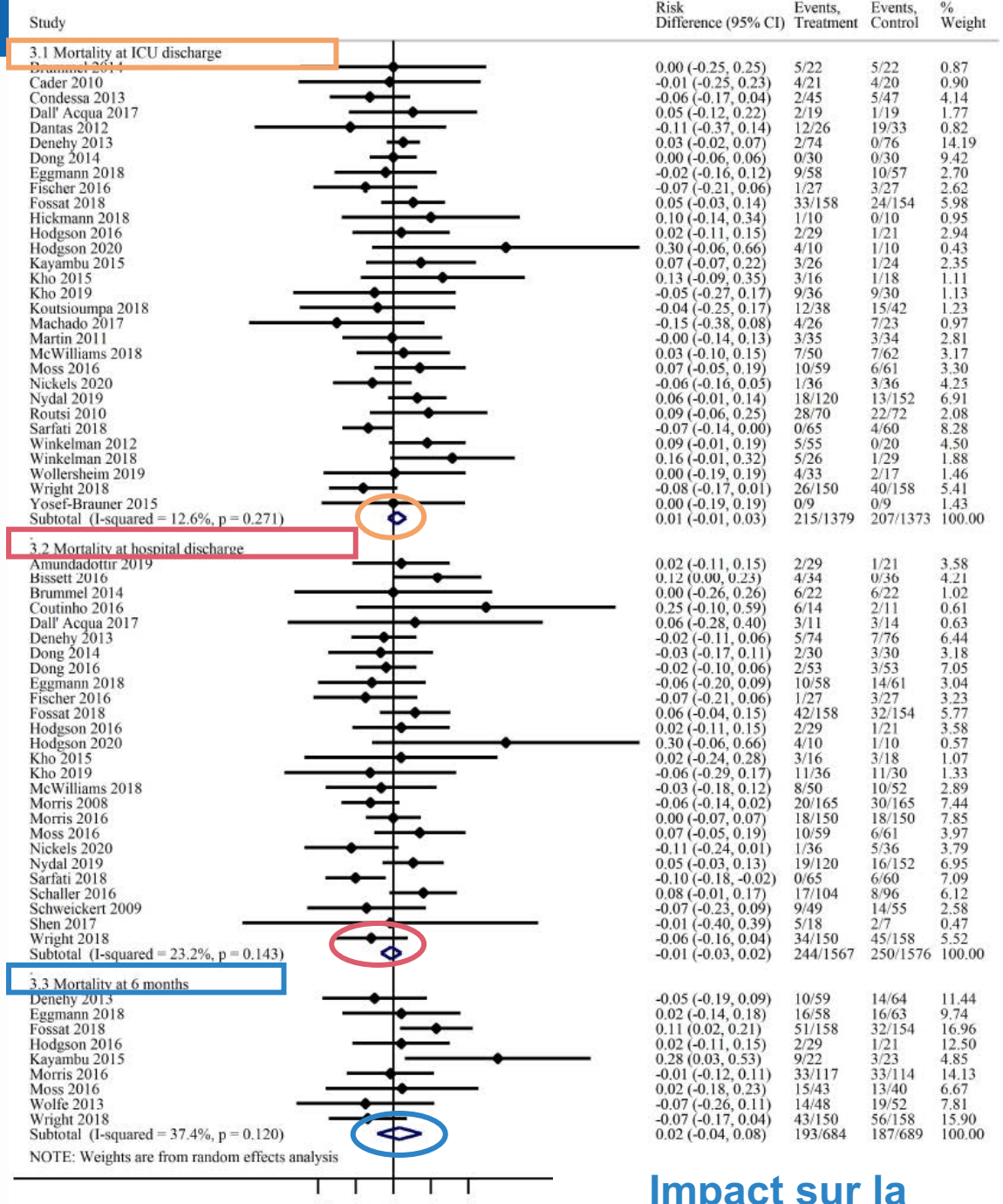


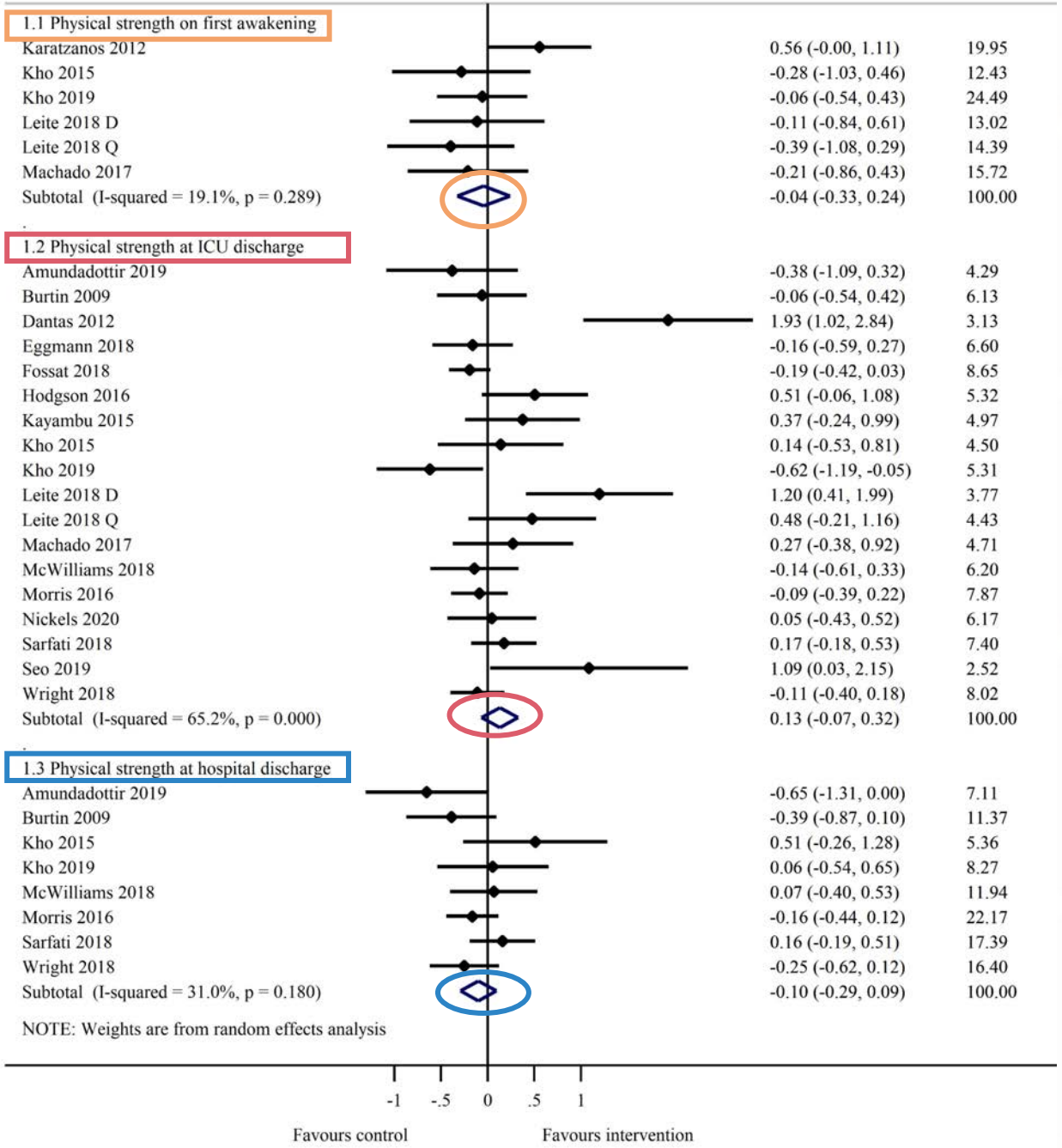
Figure 4.
rehabilitati

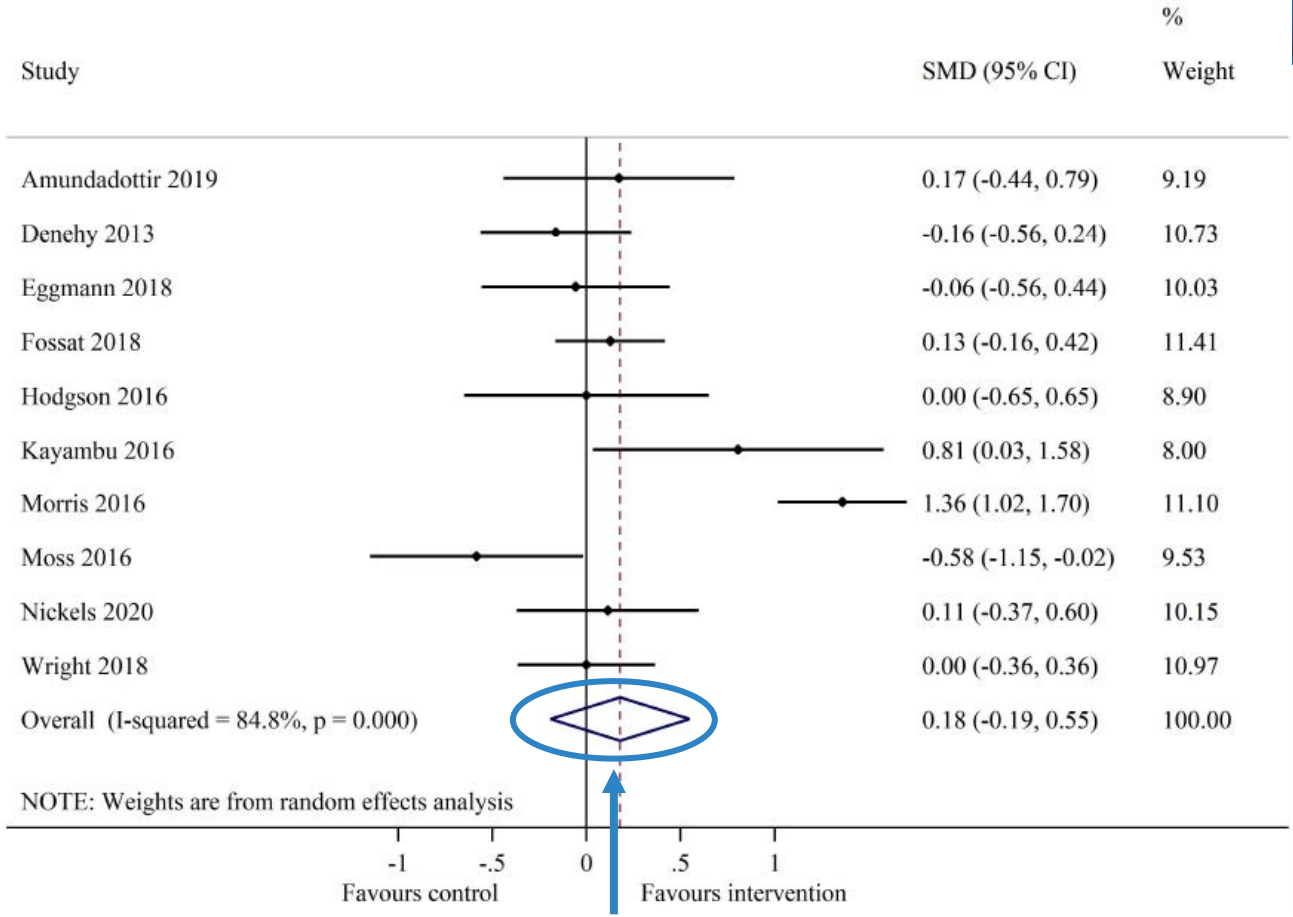
Impact sur la fonction physique



Impact sur la mortalité

Impact sur la force musculaire





Impact sur QDV à 6 mois

CONCLUSIONS

Physical rehabilitation that commences in the ICU improves physical function at hospital discharge and reduces ICU and hospital LOS. However, it does not appear to impact MV duration, muscle strength, HRQoL, and mortality.

Le devenir des patients?

A J180

Wieske et al. Critical Care (2015) 19:196
DOI 10.1186/s13054-015-0937-2

CRITICAL CARE

RESEARCH Open Access

Impact of ICU-acquired weakness on post-ICU physical functioning: a follow-up study

Luuk Wieske[1,2*†], Daniela S Dettling-Ihnenfeldt[3†], Camiel Verhamme[2], Frans Nollet[3], Ivo N van Schaik[2], Marcus J Schultz[1], Janneke Horn[1†] and Marike van der Schaaf[3†]

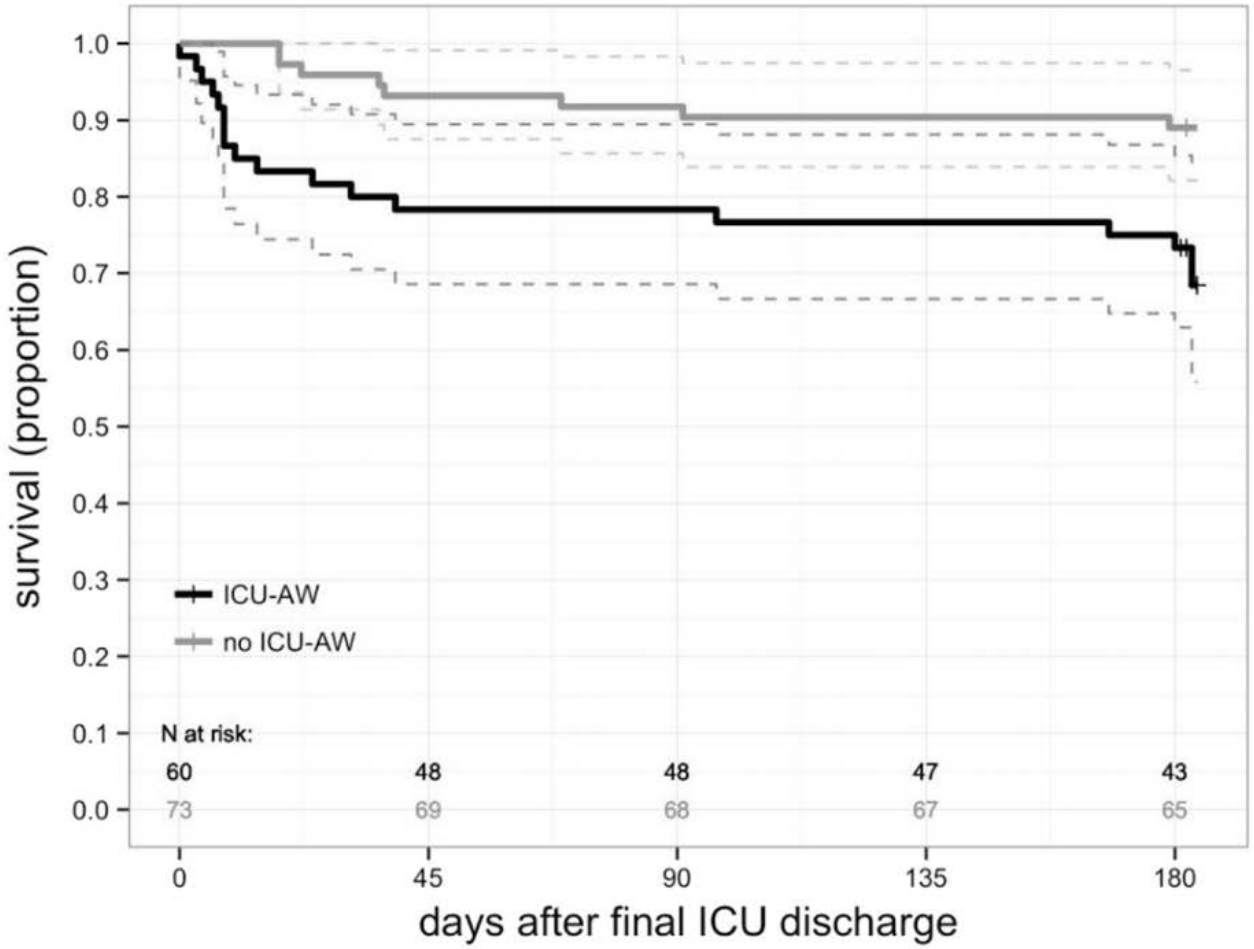


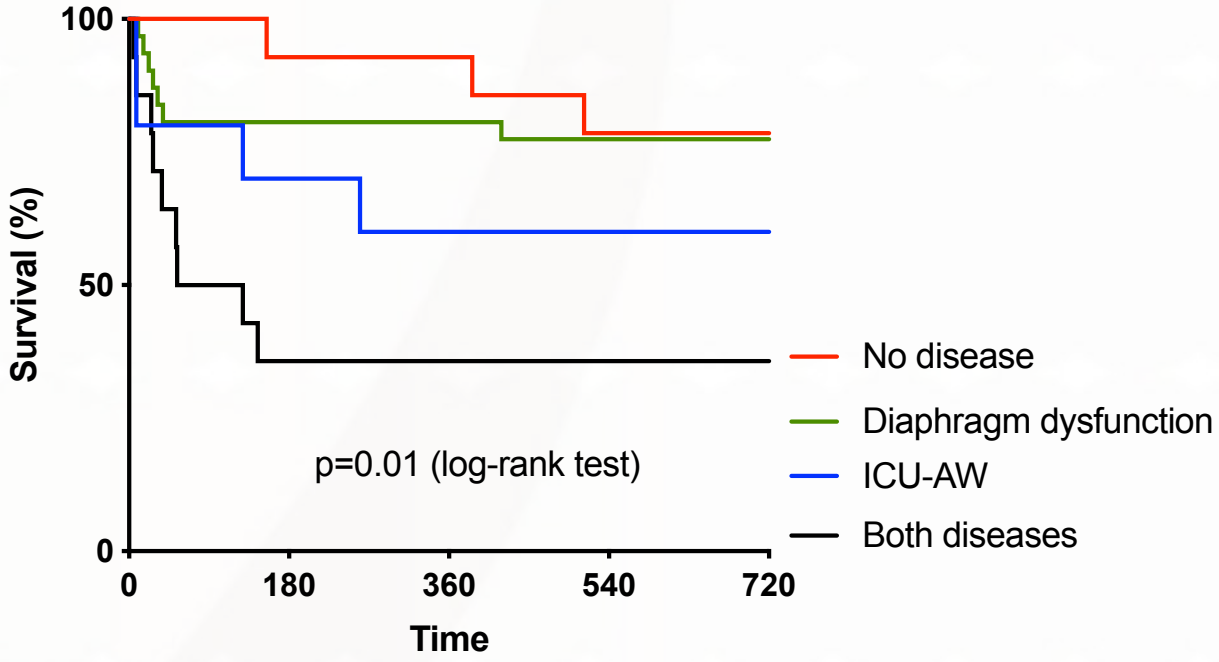
Figure 2 Post-ICU survival curves for patients with and without ICU-acquired weakness. Survival curves for patients with (black line) and without (grey line) intensive care unit-acquired weakness (ICU-AW) starting at final ICU discharge until end of follow-up; that is, 6 months after final ICU discharge. Dotted lines represent the 95% confidence interval; censored patients presented with +.

Conclusions

We found, in patients mechanically ventilated for 2 days or more, that development of ICU-AW was independently associated with increased post-ICU mortality and clinically relevant lower physical functioning at 6 months after discharge from the ICU. These findings implicate ICU-AW as an important mediator of physical impairments in survivors of critical illness. As such, studies on prevention or treatment of ICU-AW are urgently needed.

Diaphragme/Muscles et devenir à long terme

- Première SBT => Ptr,stim by phrenic nerve stimulation
  - <11 cmH2O => Diaphragm dysfunction
  - MRC<48 => ICUAW
  - SF36
- Poorest outcome when DD et ICUAW at 2 years



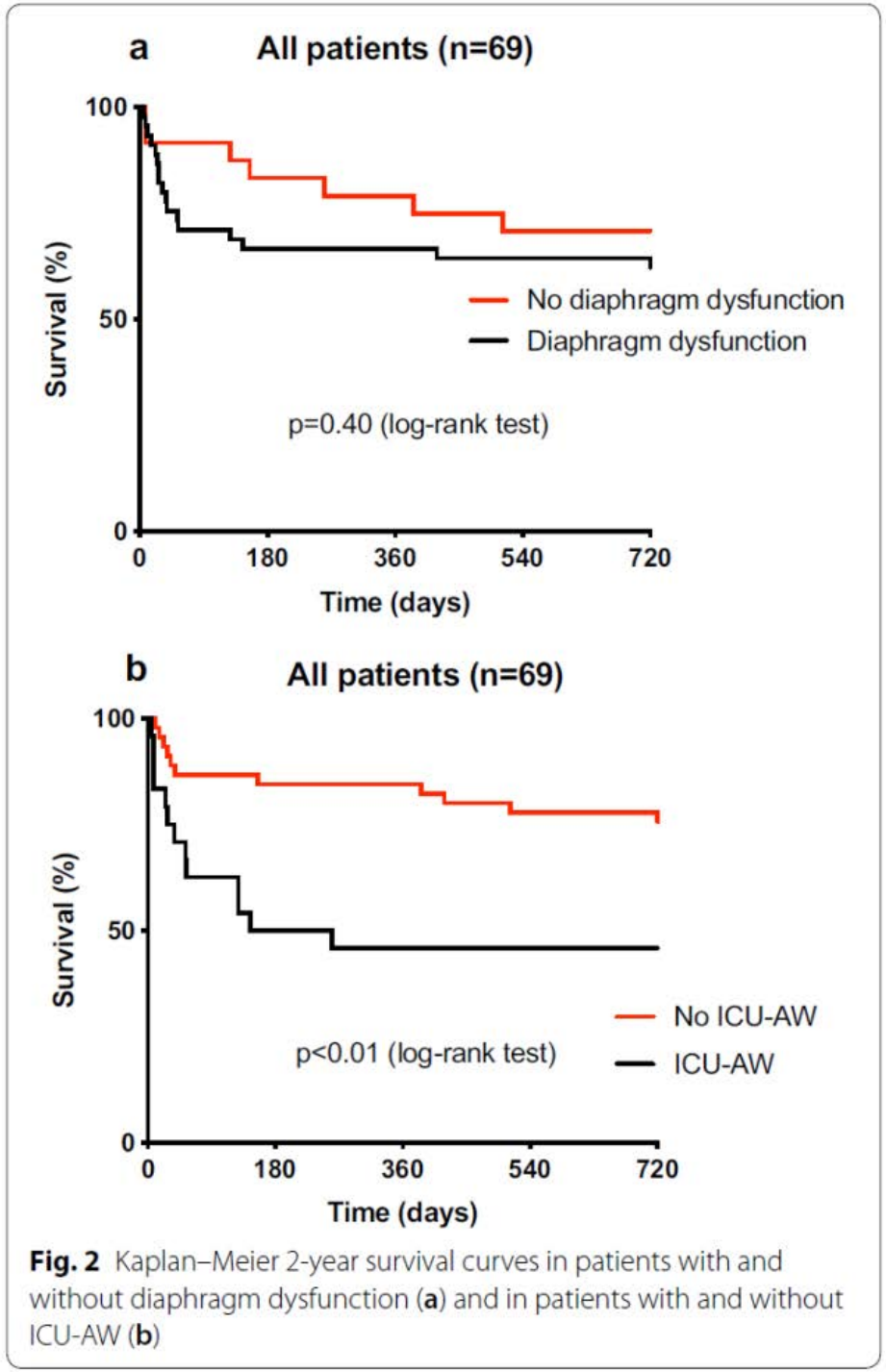


Fig. 2 Kaplan–Meier 2-year survival curves in patients with and without diaphragm dysfunction (**a**) and in patients with and without ICU-AW (**b**)

Le devenir à 5 ans en fonction du MRC

ORIGINAL

Five-year impact of ICU-acquired neuromuscular complications: a prospective, observational study

Nathalie Van Aerde[1], Philippe Meersseman[2], Yves Debaveye[1,3], Alexander Wilmer[2], Jan Gunst[1,3], Michael P. Casaer[1,3], Frans Bruyninckx[4], Pieter J. Wouters[1,3], Rik Gosselink[5], Greet Van den Berghe[1,3] and Greet Hermans[1,2*]

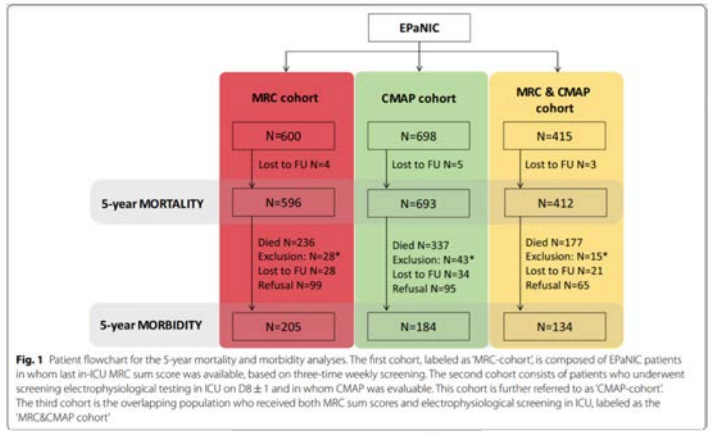
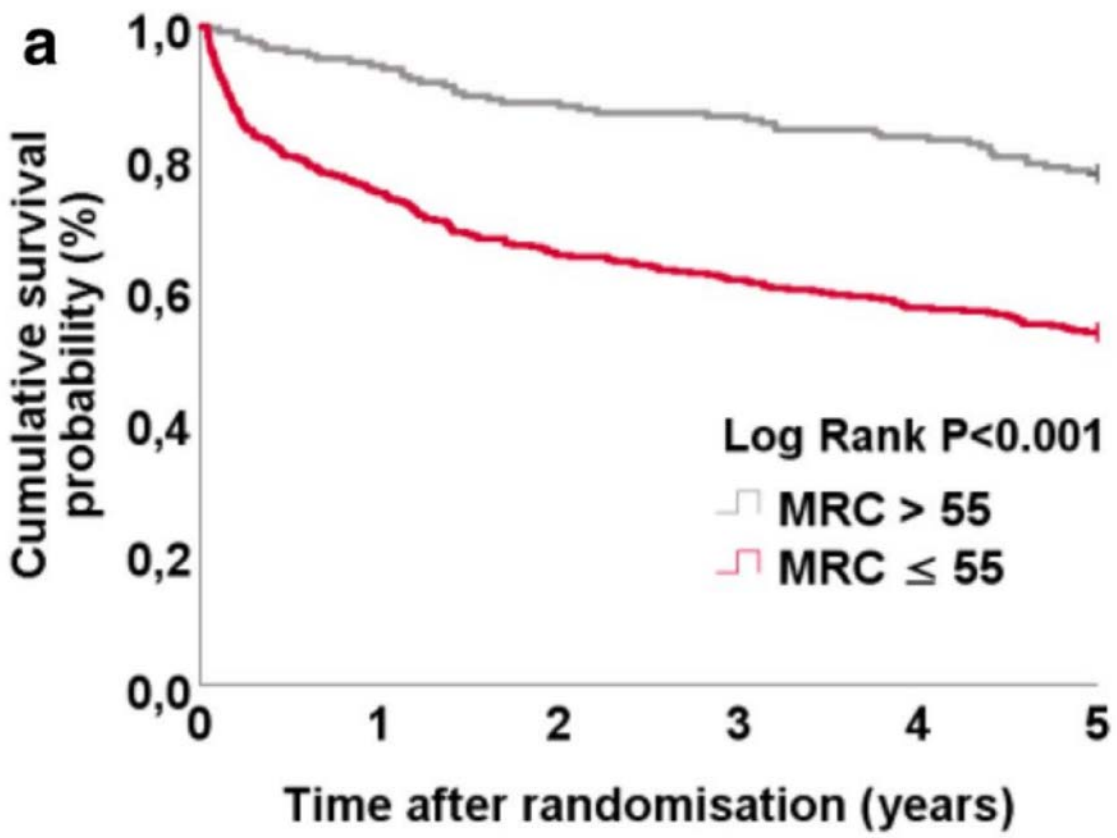
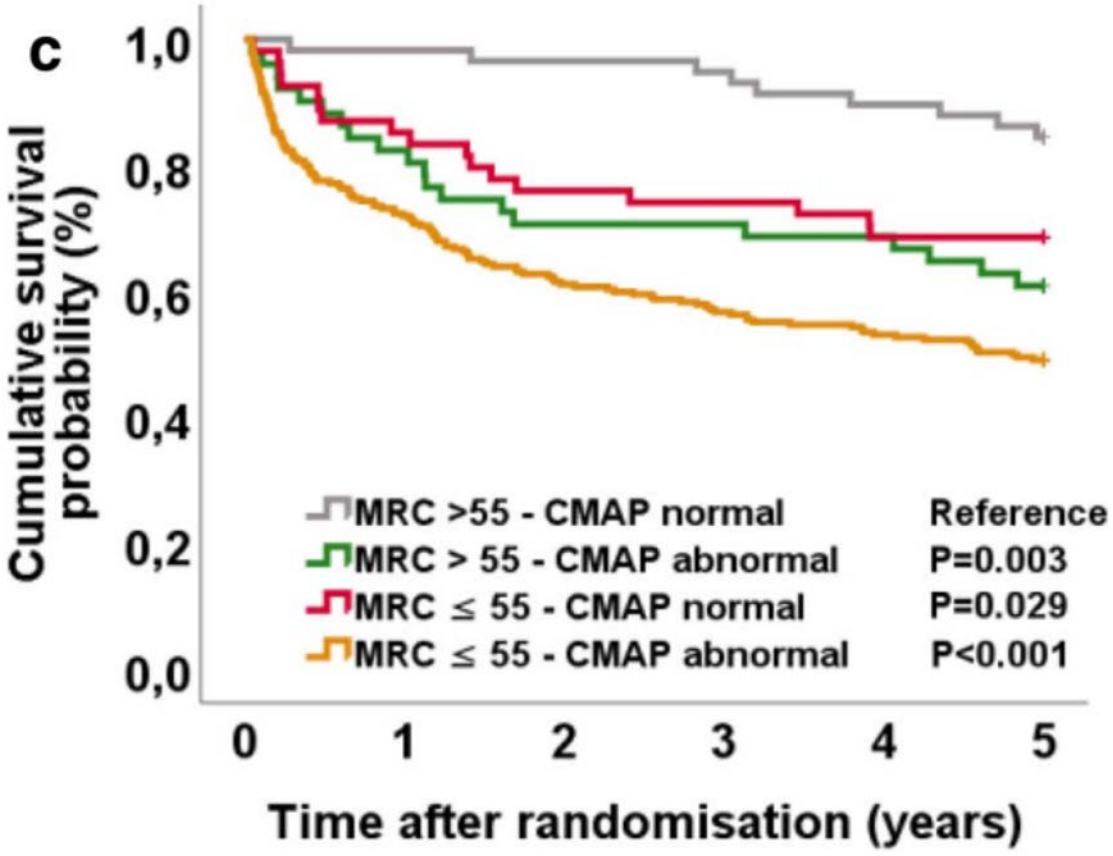


Fig. 1 Patient flowchart for the 5-year mortality and morbidity analyses. The first cohort, labeled as 'MRC-cohort', is composed of EPaNIC patients in whom last in-ICU MRC sum score was available, based on three-time weekly screening. The second cohort consists of patients who underwent screening electrophysiological testing in ICU on D8 ± 1 and in whom CMAP was evaluable. This cohort is further referred to as 'CMAP-cohort'. The third cohort is the overlapping population who received both MRC sum scores and electrophysiological screening in ICU, labeled as the 'MRC&CMAP cohort'





Merci pour votre attention

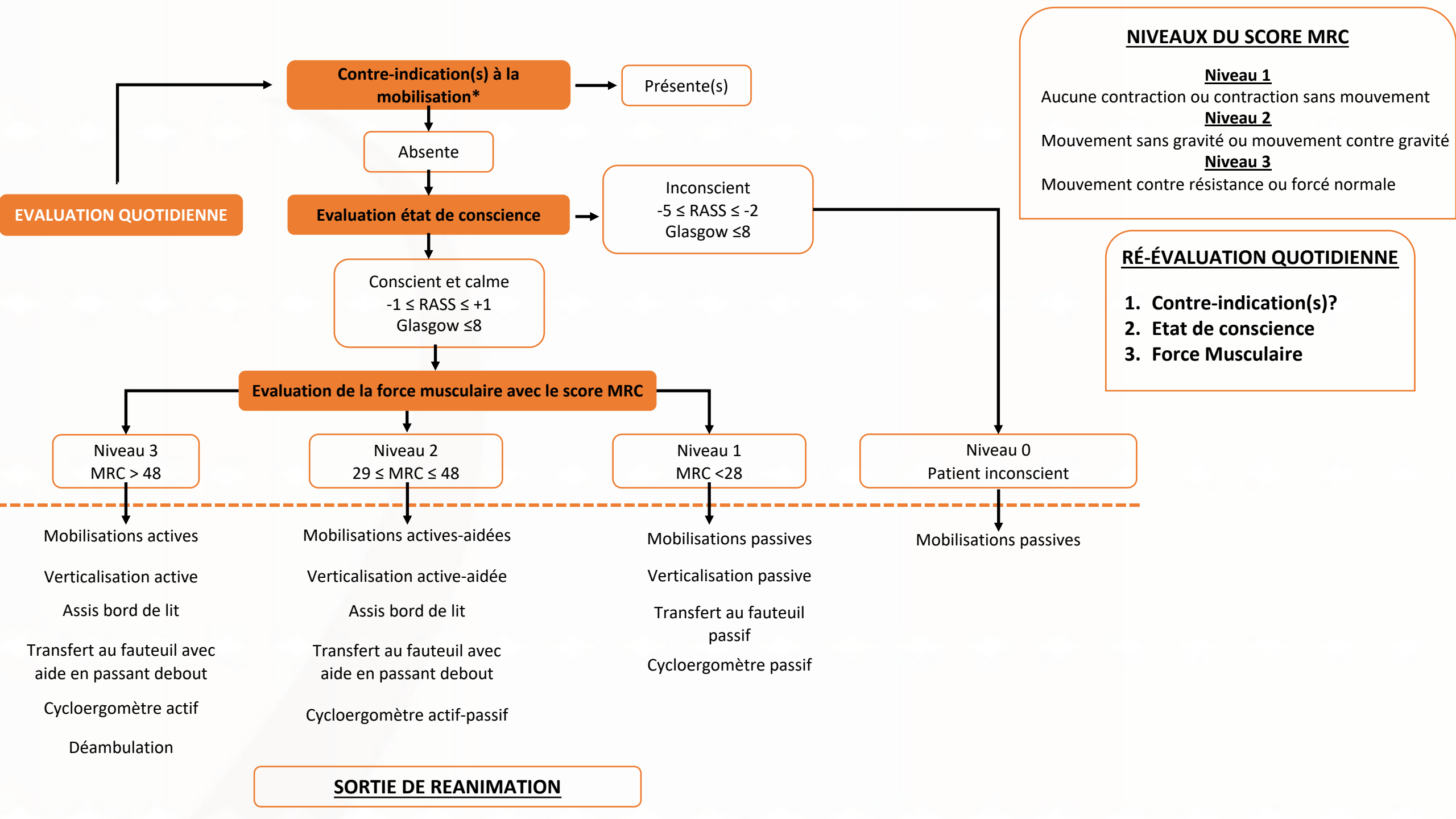
CONFERENCE REPORTS AND EXPERT PANEL

Guideline on positioning and early mobilisation in the critically ill by an expert panel

Check for updates

Intensive Care Med (2024) 50:1211–1227

Stefan J. Schaller[1*], Flora T. Scheffenbichler[2], Thomas Bein[3], Manfred Blobner[2,4], Julius J. Grunow[1], Uwe Hamsen[5,6], Carsten Hermes[7,8], Arnold Kaltwasser[9], Heidrun Lewald[4], Peter Nydahl[10,11], Anett Reißhauer[12], Leonie Renzewitz[13,14], Karsten Siemon[15], Thomas Staudinger[16], Roman Ullrich[17,18], Steffen Weber-Carstens[1], Hermann Wrigge[19,20], Dominik Zergiebel[21] and Sina M. Coldewey[22,23*]


EVALUATION QUOTIDIENNE
Contre-indication(s) à la mobilisation*
Présente(s)
Absente
Evaluation état de conscience
Inconscient
-5 ≤ RASS ≤ -2
Glasgow ≤8
Conscient et calme
-1 ≤ RASS ≤ +1
Glasgow ≤8
Evaluation de la force musculaire avec le score MRC
Niveau 3
MRC > 48
Niveau 2
29 ≤ MRC ≤ 48
Niveau 1
MRC <28
Niveau 0
Patient inconscient
Mobilisations actives
Verticalisation active
Assis bord de lit
Transfert au fauteuil avec aide en passant debout
Cycloergomètre actif
Déambulation
Mobilisations actives-aidées
Verticalisation active-aidée
Assis bord de lit
Transfert au fauteuil avec aide en passant debout
Cycloergomètre actif-passif
Mobilisations passives
Verticalisation passive
Transfert au fauteuil passif
Cycloergomètre passif
Mobilisations passives
SORTIE DE REANIMATION
NIVEAUX DU SCORE MRC
Niveau 1
Aucune contraction ou contraction sans mouvement
Niveau 2
Mouvement sans gravité ou mouvement contre gravité
Niveau 3
Mouvement contre résistance ou forcé normale
RÉ-ÉVALUATION QUOTIDIENNE
1. Contre-indication(s)?
2. Etat de conscience
3. Force Musculaire