COMMENT RÉENTRAÎNER LES MUSCLES PÉRIPHÉRIQUES CHEZ LE PATIENT BPCO ?

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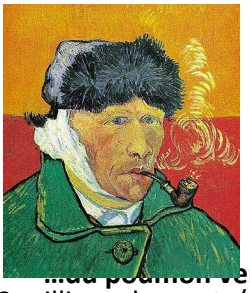
15/01/2016

PLAN

1. Pourquoi s'intéresser au muscle dans une maladie respiratoire ?
2. Faut-il évaluer cette maladie musculaire?
3. Comment la prendre en charge?

LE MUSCLE: EST-CE SI IMPORTANT ?

La BPCO, une maladie meurtrière …

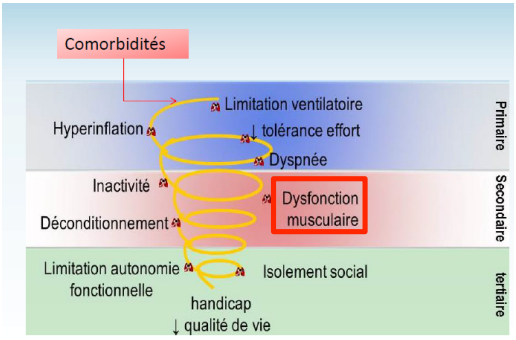


…du poumon vers le muscle

3 millions de morts/an

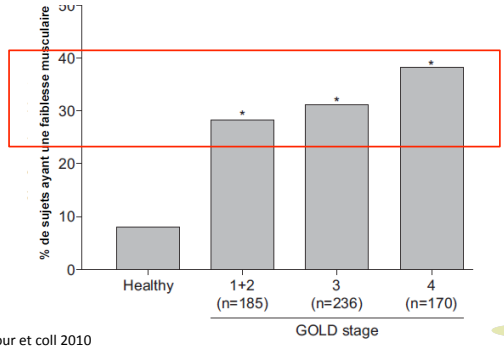
Murray et al. 1997
Raherison et al. 2009

LA SPIRALE DU DÉCONDITIONNEMENT



Adapté de la Clinique du Souffle la Solane, Osséja, France, 1999.

FAIBLESSE MUSCULAIRE



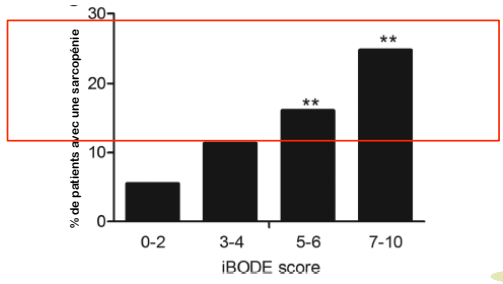
Seymour et coll 2010

ORIGINAL ARTICLE

Sarcopenia in COPD: prevalence, clinical correlates and response to pulmonary rehabilitation

Sarah E Jones,[1] Matthew Maddocks,[2] Samantha S C Kon,[1] Jane L Canavan,[1] Claire M Nolan,[1,3] Amy L Clark,[3] Michael I Polkey,[1] William D-C Man[1,3]

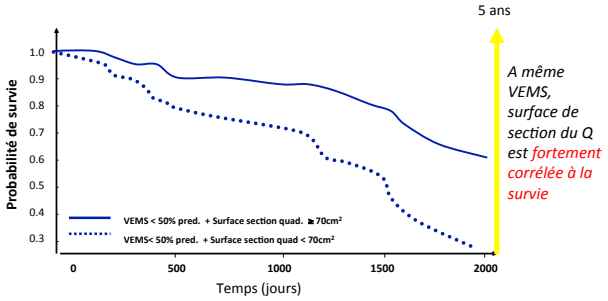
Thorax 2015;**70**:213–218.



	No sarcopenia (n=220)	Low SMI only (n=27)	Low function only (n=285)	Sarcopenia (n=90)
	66 (10)	69 (7)	73 (9)*	73 (8)*
	147:73	14:13	136:149*	57:33
	3 (1)	3 (1)	4 (1)*	4 (1)*
edicted)	46.3 (18.6)	37.9 (16.6)	45.6 (17.7)	40.5 (19.6)
king aid (n/%)	5/2	0/0	54/19*	15/17*
	28.8 (5.7)	21.1 (3.0)*	29.2 (6.2)	21.4 (4.0)*
	26.6 (6.9)	18.8 (5.0)*	22.9 (6.5)	18.9 (5.1)*
)	9.2 (1.8)	6.8 (1.4)*	8.6 (1.8)*	6.9 (1.3)*
g)	33.9 (8.6)	29.6 (7.5)	22.6 (8.4)*	21·5 (7.3)*
(kg)	32.2 (10.5)	23.0 (7.6)*	23.3 (8.2)*	19.8 (7.6)*
redicted	70.1 (17.0)	63.1 (14.4)	56.3 (14.3)*	54.9 (16.3)*
)	1.07 (0.16)	1.00 (0.16)	0.77 (0.21)*	0.77 (0.22)*
	12.4 (10.4, 14.8)	14.1 (11.4, 13.9)	16.1 (12.8, 26.7)*	19.6 (12.9, 60.0)*
	11 (1)	11 (1)	8 (3)*	8 (3)*
	309 (153)	257 (99)	152 (106)*	157 (118)*
	47.3 (16.1)	51.0 (14.0)	55.9 (17.1)*	57.1 (17.5) *
atient days previous 12 months	0 (0, 2)	0 (0, 2)	0 (0, 5)	0 (0, 4)
exacerbations previous 12 months	2 (1, 3)	2 (1, 5)	2 (1, 4)	2 (1, 4)
physical activity				
xpenditure (kcal/week)	780.3 (388.1, 1567.5)	695.6 (288.8, 1506.3)	380.0 (89.1, 868.1)*	376.3 (56.9, 734.4)*
noderate activity (min/week)	224.0 (108-8, 450.6)	193.1 (82.5, 432.5)	110.3 (27.3, 241.9)*	107.5 (22.5, 207.5)*
ysical activity (n=129)				
) count	5127 (2475, 6815)	3916 (1679, 5411)	2697 (1129, 4995)	1482 (1205, 3301)
activity level (METS/day)	1.45 (0.22)	1.60 (0.21)	1.38 (0.85)	1.36 (0.12)
noderate intensity activity ≥3 METS (min/day)	47 (20, 106)	108 (63, 223)	30 (8, 69)	35 (5, 82)
ergy expenditure (kcal/day)	246 (106, 473)	466 (219, 847)	134 (42, 329)	105 (25, 276)

t difference to 'no sarcopenia' reference group.
etre gait speed; 5STS, five-repetition sit-to-stand test; BMI, body mass index; CAT, COPD Assessment Test; iBODE, body mass index, obstruction, dyspnoea, exercise c

LA CUISSE : BAROMÈTRE DE LA VIE !

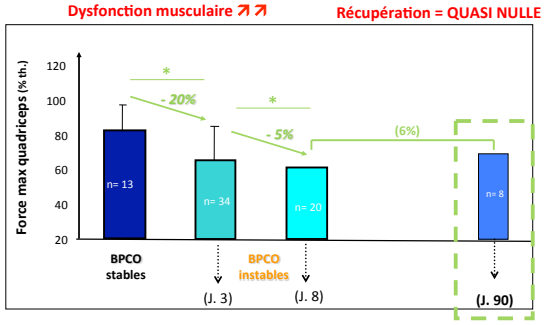


La perte de masse musculaire: un élément secondaire? NON!!

Marquis et coll. 2002

EXACERBATION, LE CHAOS MUSCULAIRE!

Dysfonction musculaire ↗↗ **Récupération = QUASI NULLE**



Celli et coll. 2007
Pitta et coll. 2006
Spruit et coll. 2003

LA BPCO EST UNE MALADIE À POINT DE DÉPART RESPIRATOIRE OU MUSCULAIRE?

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Cigarette Smoke–induced Oxidative Stress

A Role in Chronic Obstructive Pulmonary Disease Skeletal Muscle Dysfunction

Esther Barreiro[1,2], Víctor I. Peinado[2,3], Juan B. Galdiz[4], Elisabet Ferrer[2,3], Judith Marin-Corral[1], Francisco Sánchez[1,2], Joaquim Gea[1,2], and Joan Albert Barberà[2,3], on behalf of the ENIGMA in COPD Project

Animal Experiments

Experimental groups. Groups of seven male Hartley guinea pigs were exposed to the smoke of seven commercial cigarettes (24 h, 5 d/wk) for periods of 3, 4, and 6 months (15–17, 27). Corresponding control animals underwent the same procedures except for CS exposure. Twenty-four hours after the end of each experimental period, diaphragm, gastrocnemius, and lungs were obtained from all animals.

Cochons d'Inde

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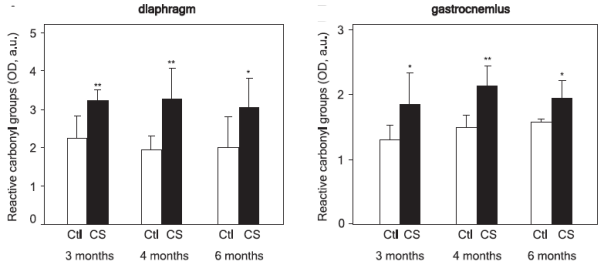

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Structure pulmonaire

	3 mo		4 mo		6 mo	
	Control ($n = 7$)	CS Exposed ($n = 7$)	Control ($n = 7$)	CS Exposed ($n = 7$)	Control ($n = 7$)	CS Exposed ($n = 7$)
Lung structure						
Goblet cell metaplasia, cells/mm	0.4 (1.9)	0.4 (1.4)	1.0 (3.3)	4.3 (8.0)*	0.5 (1.6)	3.6 (6.3)*
Mean linear intercept, µm	60 (18)	61 (18)	74 (24)	72 (20)	75 (29)	72 (37)

Moreover, the effects of oxidants on muscles occurred at an earlier stage than the effects observed in the respiratory system. These findings reinforce the concept that CS per se is likely to be involved in direct tissue toxicity in the skeletal muscles of CS-exposed guinea pigs, regardless of lung and bronchial alterations.

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	Control Subjects ($n = 10$)	Smokers ($n = 9$)	COPD ($n = 10$)
Age, yr	56 (6)	53 (9)	58 (3)
BMI, kg/m²	26.7 (4.0)	27.4 (5.1)	26.5 (4.2)
FFMI, kg/m²	20.0 (2.4)	18.1 (2.6)	18.6 (2.9)
FEV_1, % pred	94 (13)	89 (5)	30 (6)*†
FVC, % pred	91 (11)	93 (9)	75 (11)‡§
FEV_1/FVC, %	79 (7)	76 (10)	32 (8)*†
QMVC, kg	38.50 (1.7)	36.78 (1.5)‖	28.20 (1.31)*†

> 20PA

Values are expressed as means (SD).
* $P = 0.001$, between patients with COPD and healthy control subjects.
† $P = 0.001$, between patients with COPD and healthy smokers.
‡ $P = 0.01$, between patients with COPD and healthy control subjects.
§ $P = 0.05$, between patients with COPD and healthy smokers.
‖ $P = 0.05$, between healthy smokers and healthy control subjects.

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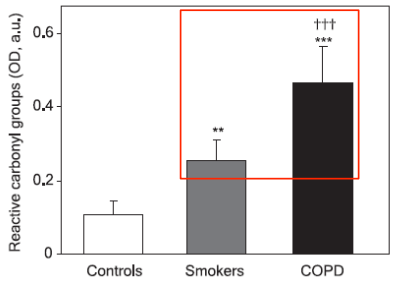

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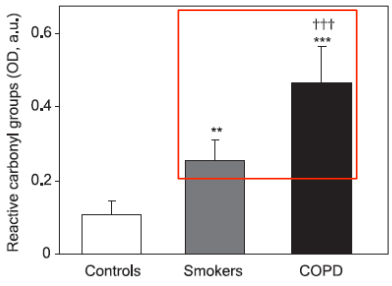

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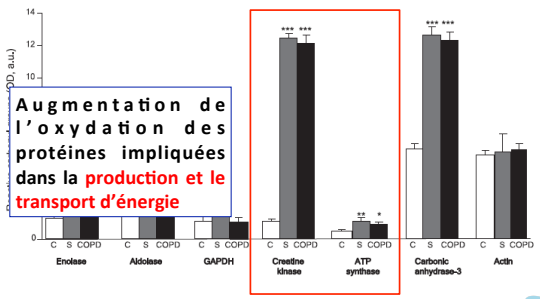

Augmentation de l'oxydation des protéines impliquées dans la production et le transport d'énergie

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EN RÉSUMÉ…

LE MUSCLE À BOUT DE SOUFFLE

Pourquoi s'intéresser au muscle dans une maladie respiratoire ?

- Dysfonction musculaire+++ indépendamment de la maladie pulmonaire
- Aggrave la maladie primaire

↘ PRONOSTIC VITAL…!

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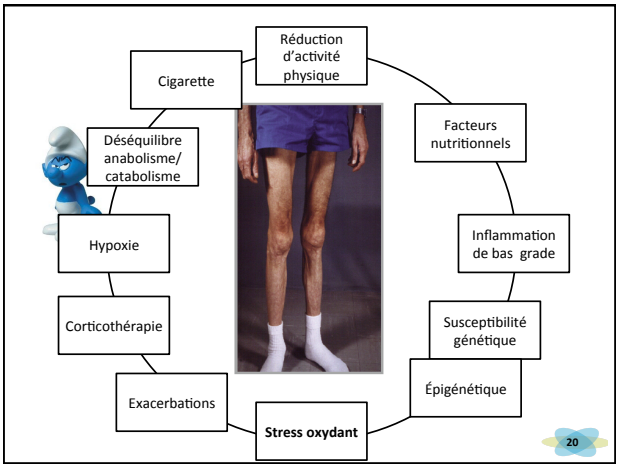
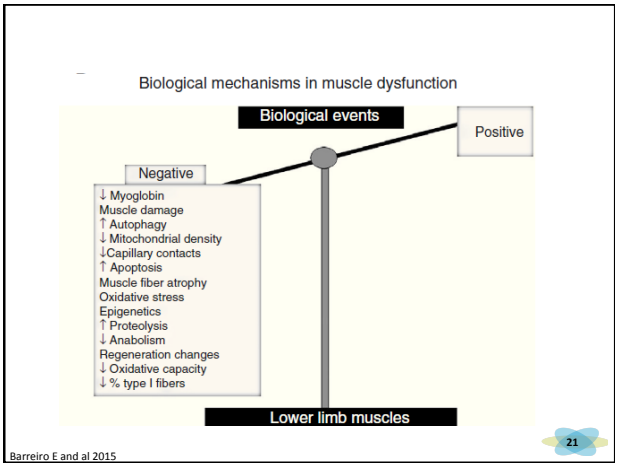
Quelques hypothèses explicatives

…une histoire en cours d'écriture!!

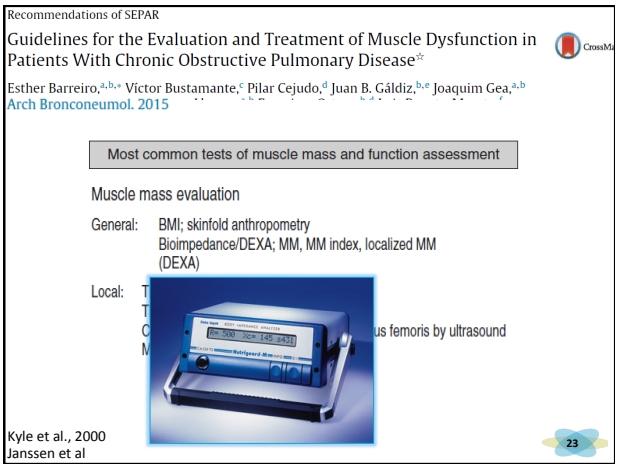




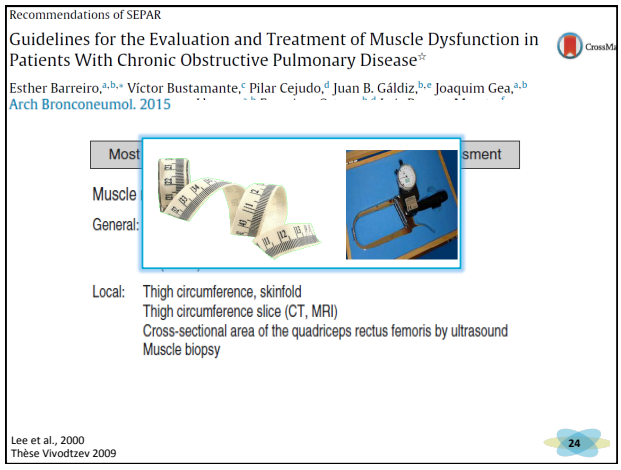
Barreiro E and al 2015

PLAN

1. Pourquoi s'intéresser au muscle dans une maladie respiratoire ?
2. Faut-il évaluer cette maladie musculaire?
3. Comment la prendre en charge?



Kyle et al., 2000
Janssen et al



Lee et al., 2000
Thèse Vivodtzev 2009

Recommendations of SEPAR

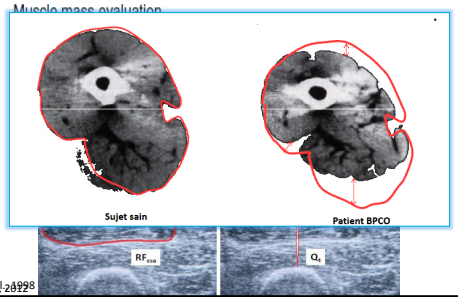
Guidelines for the Evaluation and Treatment of Muscle Dysfunction in Patients With Chronic Obstructive Pulmonary Disease☆

Esther Barreiro,[a,b,*] Víctor Bustamante,[c] Pilar Cejudo,[d] Juan B. Gáldiz,[b,e] Joaquim Gea,[a,b]

Arch Bronconeumol. 2015

Most common tests of muscle mass and function assessment

Muscle mass evaluation



Bernard S et al, 1998

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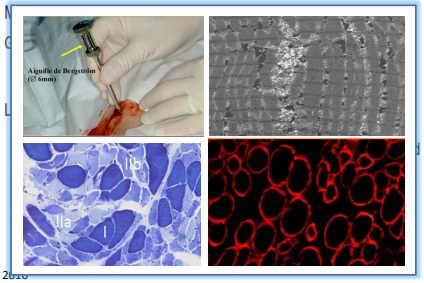

Schefold et coll, 2010
Abdellaoui et coll,

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Arch Bronconeumol. 2015

Most common tests of muscle mass and function assessment

Muscle function evaluation

General: Exercise testing: ergometry, 6-minute walk test,
Activity measures: questionnaires, accelerometers

Local:

- Strength measurements:
  Volitional: maximal voluntary contraction (MVC), handgrip, thigh extension
  Non-volitional: Supramaximal twitch of thumb abductor, quadriceps, etc.
- Resistance measurements:
  Volitional: endurance time at 10% of MVC
  Non-volitional: EMG fatigue after repetitive neuromuscular stimulation

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- Score clinique *Medical Research Council* (MRC)

Simple (rapide et économique)

- Mesure de la Force Maximale Volontaire (FMV)
- Mesure de l'endurance

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Recommendations of SEPAR

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Esther Barreiro,[a,b,*] Víctor Bustamante,[c] Pilar Cejudo,[d] Juan B. Gáldiz,[b,e] Joaquim Gea,[a,b]

- Evaluation manuelle assistée par dynamomètre

Matériel (simple et peu coûteux)

Mesure (fiabilité, reproductibilité)

Andrews et coll, 1996
O'Shea et coll, 2007

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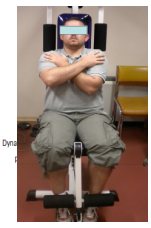
- Evaluation manuelle assistée par dynamomètre

Système d'acquisition & ordinateur



Système de poulies + banc de Koch

Dynamomètre

Serres et coll, 1998

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- Evaluation manuelle assistée par dynamomètre

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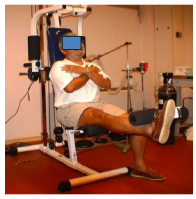
- Endurance musculaire (plusieurs modalités de contraction)
  - -Isométrique (60-80% de la FMV)
  - -Dynamique (10%-20%-30% ou 40% de la FMV)



✓Temps de repos
✓Charge adaptée : pour limiter le temps (lassitude/fatigue centrale)
✓Critère d'arrêt (compensation, …)

Allaire et coll 2004
Serres et coll, 1998

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EN RÉSUMÉ…

INDIVIDUALISÉ LE REE

Faut-il évaluer cette maladie musculaire?

-Altérations anatomiques du système nerveux → existence d'une perte d'excitation nerveuse qui pourrait altérer la commande motrice volontaire (BCPO?)

-Altération du métabolisme musculaire → inhibitions de la commande motrice volontaire

Alexandre F and al 2014

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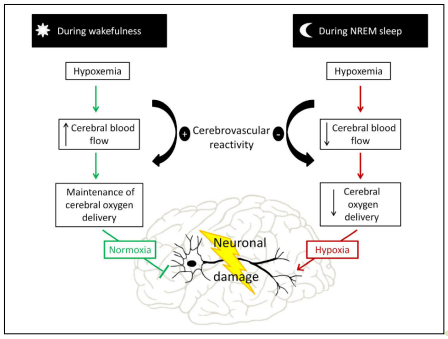
Is nocturnal desaturation a trigger for neuronal damage in chronic obstructive pulmonary disease?

Francois Alexandre [a,b,*], Nelly Heraud [b], Alain Varray [a]

Medical Hypotheses 84 (2015) 25–30



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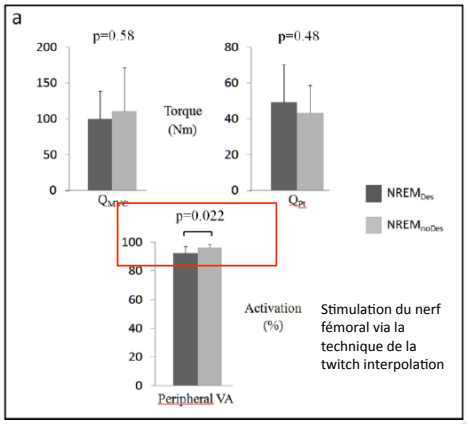

Stimulation du nerf fémoral via la technique de la twitch interpolation

Alexandre and al données non publiées

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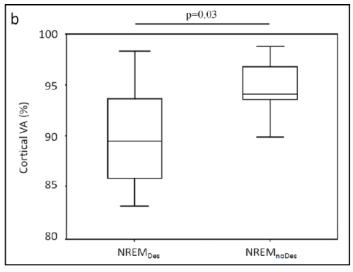

Stimulation magnétique transcrânienne

Patients dést → marqueur de lésion cérébral ↗ (perte d'excitabilité cortical et un déficit d'activation volontaire)
→ aucune différence FMV

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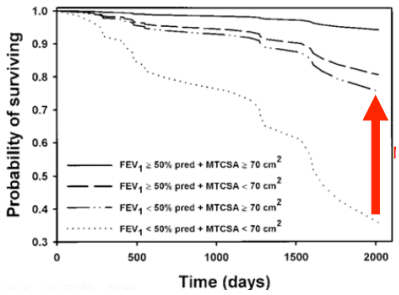
PEUT-ON AMÉLIORER LE PRONOSTIC ?



Marge de l'effet du REE

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PLAN

1. Pourquoi s'intéresser au muscle dans une maladie respiratoire ?
2. Faut-il évaluer cette maladie musculaire?
3. Comment la prendre en charge?

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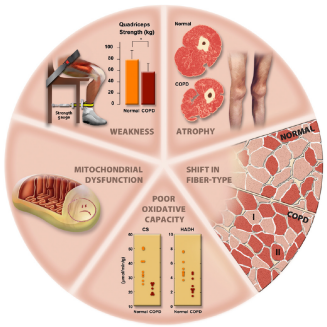
UNE PRISE EN CHARGE ADAPTÉE !

- Besoins du patient
- Capacités du patient
- Objectifs (patient/ l'équipe)
- Ressources (CHU/SSR/ cabinet/ domicile)



Maltais and al AMJCCM 2014
Barreiro and al Arch Bronconeumol 2015

TYPE D'ENTRAINEMENT!

Entrainement en endurance (globale)

- Adaptations cardiovasculaires
- Effet également sur la fonction musculaire
- Augmentation de l'endurance musculaire locale
- Adaptations bioénergétiques (augmentation surface de section des fibres, amélioration du métabolisme, capillarisation, …)

Maltais and al AMJCCM 2014
Barreiro and al Arch Bronconeumol 2015

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TYPE D'ENTRAINEMENT!

Entrainement en endurance (globale)

AMERICAN THORACIC SOCIETY DOCUMENTS

An Official American Thoracic Society/European Respiratory Society Statement: Update on Limb Muscle Dysfunction in Chronic Obstructive Pulmonary Disease

François Maltais, Marc Decramer, Richard Casaburi, Esther Barreiro, Yan Burelle, Richard Debigaré, P. N. Richard Dekhuijzen, Frits Franssen, Ghislaine Gayan-Ramirez, Joaquim Gea, Harry R. Gosker, Rik Gosselink, Maurice Hayot, Sabah N. A. Hussain, Wim Janssens, Micheal I. Polkey, Josep Roca, Didier Saey, Annemie M. W. J. Schols, Martijn A. Spruit, Michael Steiner, Tanja Taivassalo, Thierry Troosters, Ioannis Vogiatzis, and Peter D. Wagner; on behalf of the ATS/ERS Ad Hoc Committee on Limb Muscle Dysfunction in COPD

This official statement of the American Thoracic Society (ATS) and the European Respiratory Society (ERS) was approved by the ATS Board of Directors, November 2013, and by the ERS Executive Committee, September 2013

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TYPE D'ENTRAINEMENT!

Entrainement en endurance (globale)

effects, with a recommended minimum of 8 weeks to achieve a substantial effect (500). The number of sessions per week also varies; although outpatient programs commonly include 2 to 3 days a week, inpatient programs are usually planned for 5 days a week. The session length per day is generally 1 to 4 hours (501). The optimal exercise intensity is unknown. Nevertheless, high level of intensity of exercise (>60% maximal work rate) for 20 to 60 minutes per session is more potent in terms of inducing a physiological response to training than less intense exercise (<40% maximal work rate) (288). However, many individuals with chronic lung disease are unable to train at that level, and substantially lower intensity of exercise is an alternative (500). One option is interval exercise training, in which the long

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TYPE D'ENTRAINEMENT!

Entrainement en endurance (globale)

	Aerobic/Endurance training
Objective	Improve aerobic capacity. Improve limb muscle function
Frequency	3–4 days/week
Mode	20–30 min
Intensity	60%–80% of WRmax
Duration	8–12 weeks

Interval Training

1-2min
(60) 80-120% FMT

Maltais and al AMJCCM 2014
Barreiro and al 2015
Beauchamp and al 2009

CHEST Original Research
PULMONARY REHABILITATION

Effects of One-Legged Exercise Training of Patients With COPD*

Thomas E. Dolmage, MSc; and Roger S. Goldstein, MD, FCCP

TYPE D'ENTRAINEMENT!

Renforcement musculaire

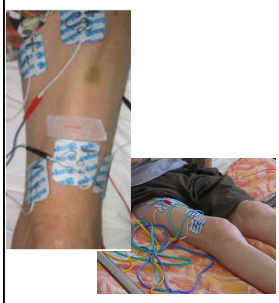
	Strength training
Objective	Overload large upper and lower limb muscle groups. Increase muscle strength and endurance
Frequency	2–3 days/week
Mode	2–4 series of 6–12 repetitions
Intensity	30% 85% of 1 RM
Duration	8–12 weeks

Maltais and al AMJCCM 2014
Barreiro and al Arch Bronconeumol 2015

TYPE D'ENTRAINEMENT!

Renforcement musculaire

Techniques alternatives/ complémentaire



- **STIMULATION ELECTRIQUE NEUROMUSCULAIRE**
  - Envoyer au niveau du muscle un courant électrique adapté qui, par le biais d'impulsions, stimule les fibres musculaires de l'unité motrice correspondante et permet leur recrutement
  - Améliorations intrinsèques
- **STIMULATION MAGNÉTIQUE**

Maltais and al AMJCCM 2014
Barreiro and al Arch Bronconeumol 2015

TYPE D'ENTRAINEMENT!

Stimulation du nerf fémoral

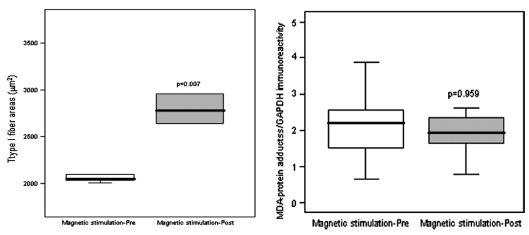
Stimulateur

Techniques alternatives/ complémentaire

- **STIMULATION ELECTRIQUE NEUROMUSCULAIRE:**
  - Envoyer au niveau du muscle un courant électrique adapté qui, par le biais d'impulsions, stimule les fibres musculaires de l'unité motrice correspondante et permet leur recrutement
  - Améliorations intrinsèques
- **STIMULATION MAGNÉTIQUE**

Redox balance following magnetic stimulation training in the quadriceps of patients with severe COPD

VÍCTOR BUSTAMANTE[1], JUAN CASANOVA[1], ELENA LÓPEZ DE SANTAMARÍA[1], SANDRA MAS[2], JACOBO SELLARÉS[2], JOAQUIM GEA[2], JUAN B. GÁLDIZ[1], & ESTHER BARREIRO[2] ON BEHALF OF THE ENIGMA IN COPD PROJECT



TYPE D'ENTRAINEMENT!

Nutritional supplementation for stable chronic obstructive pulmonary disease (Review)

Ferreira IM, Brooks D, White J, Goldstein R

THE COCHRANE COLLABORATION®

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CONCLUSION

1. Pourquoi s'intéresser au muscle dans une maladie respiratoire ? → **Relation av QV, tolérance à l'effort et pronostic survie**
2. Faut-il évaluer cette maladie musculaire? → **individualisation de notre prise en charge**
3. Comment la prendre en charge? → PEC globale et **locale**

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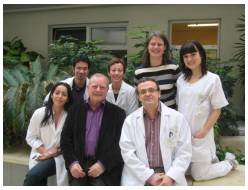

Je vous remercie

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