

Désencombrement instrumental

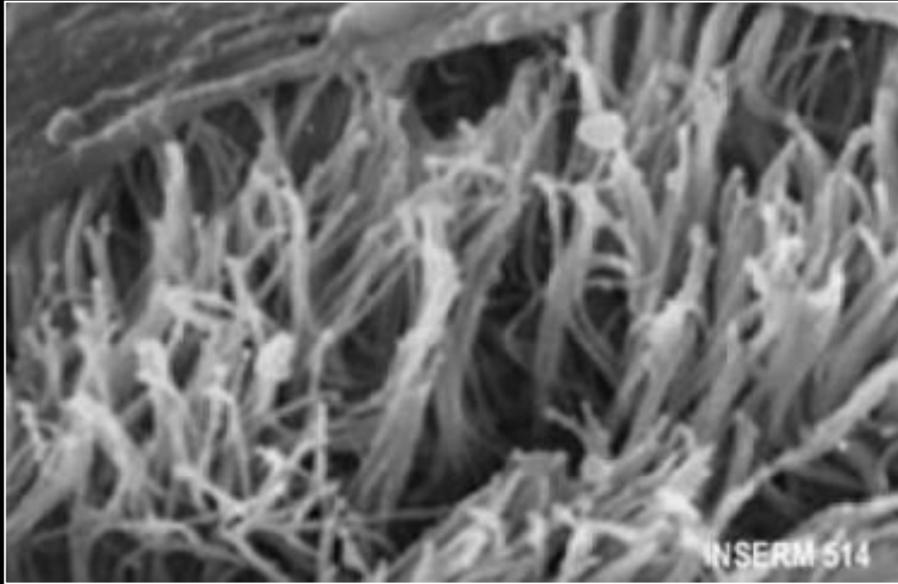
3ÈME JOURNÉE MARSEILLAISE DE LA
SOCIÉTÉ DE KINÉSITHÉRAPIE DE RÉANIMATION



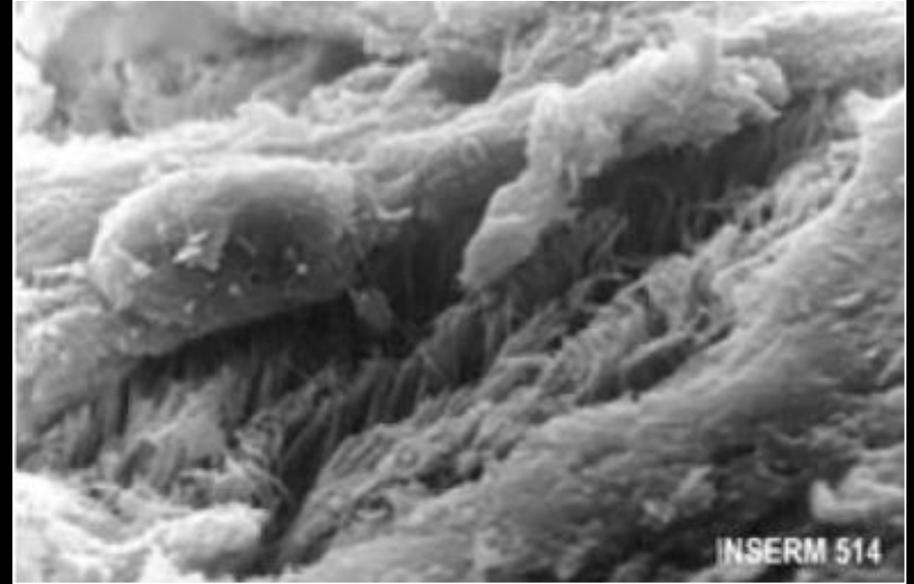
Samedi 02 décembre 2017

SKR 
Société de Kinésithérapie de Réanimation

Guillaume RIFFARD
CHU Saint-Etienne

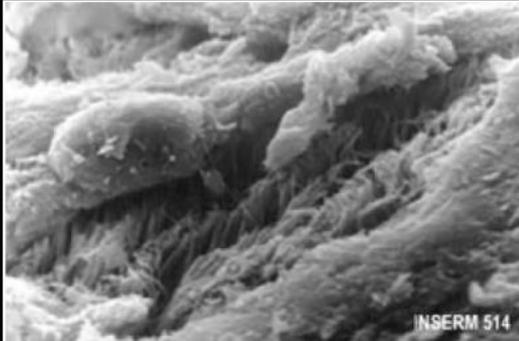


Mucus évacué par le tapis
mucociliaire



Mucus épaissi, non évacué

Technique de désencombrement bronchique



Mucus épaissi, non évacué



- Pensez à l'hydratation du malade
- Pensez à l'humidification des gaz inspirés



Optiflow Nasal Interface



Tracheostomy Interface

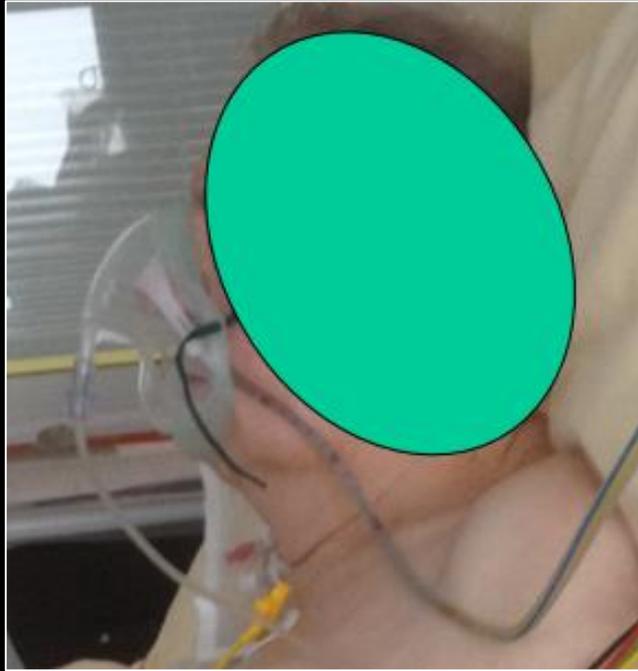


Adapter w/ Oxygen Mask



Adapter w/ Tracheostomy Mask

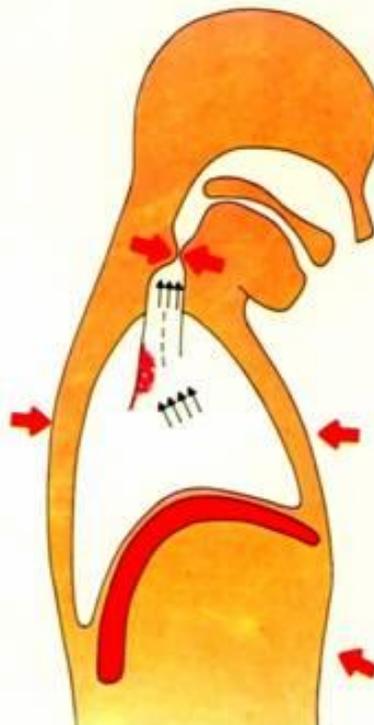




Le mécanisme de la toux.



Inspiration



Compression



Expulsion

Tableau I. Tableau comparatif des débits expiratoires de pointe à la toux obtenus avec différentes techniques chez un patient ayant un DEP à la toux spontané inférieur à 180 l/min (d'après Bach [9]).

Ventilation spontanée + pressions manuelles	200 l/min
Ventilation non invasive + pressions manuelles	240 l/min
Relaxation de pression/ <i>Air Stacking</i> + pressions manuelles	300 l/min
Cough-Assist [®] + pressions manuelles	448 l/min

Kinesither Rev 2010;(103):11-17

9. Bach JR. Mechanical insufflation–exsufflation: a comparison of peak expiratory flows with manually assisted and unassisted coughing techniques. Chest 1993;104:1553-62.

Tableau I. Tableau comparatif des débits expiratoires de pointe à la toux obtenus avec différentes techniques chez un patient ayant un DEP à la toux spontané inférieur à 180 l/min (d'après Bach [9]).

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CPAP Has No Effect on Clearance, Sputum Properties, or Expectorated Volume in Cystic Fibrosis

Evanirso Silva Aquino MSc, Francine Shimura, Adriana Silveira Santos, Danielle Miyuki Goto PhD, Cristiane Cenachi Coelho MSc, Marcelo Bicalho de Fuccio MD, Paulo Hilario Nascimento Saldiva MD PhD, Geraldo Lorenzi-Filho MD PhD, Bruce K Rubin MEngr MD MBA FAARC, and Naomi Kondo Nakagawa PhD

RESPIRATORY CARE • NOVEMBER 2012 VOL 57 No 11

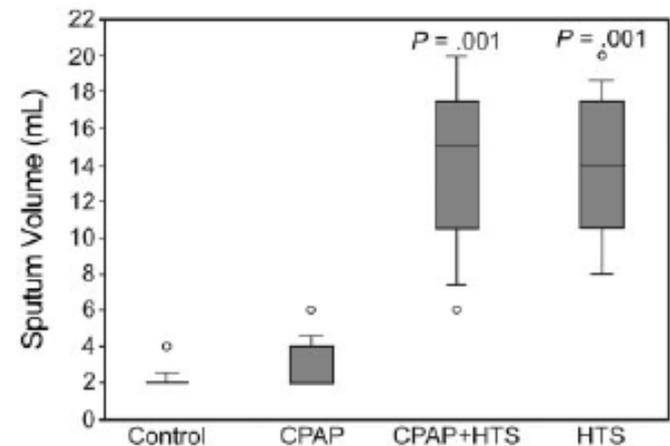


Fig. 2. Sputum volume after control (directed coughs), CPAP, CPAP plus hypertonic saline (HTS), and HTS alone.

CPAP alone had no effect on mucus clearance, sputum properties, or expectorated sputum volume, and did not potentiate the effect of hypertonic saline alone in patients with cystic fibrosis.

Chest Physiotherapy in Cystic Fibrosis: Improved Tolerance With Nasal Pressure Support Ventilation

Brigitte Fauroux, MD*; Michèle Boulé, MD, PhD†; Frédéric Lofaso, MD, PhD§; Françoise Zérah, MD§; Annick Clément, MD, PhD*; Alain Harf, MD, PhD§; and Daniel Isabey, PhD§

PEDIATRICS
OFFICIAL JOURNAL OF THE AMERICAN ACADEMY OF PEDIATRICS

Vol. 103, No. 3 March 1999

Non-invasive ventilation assists chest physiotherapy in adults with acute exacerbations of cystic fibrosis

A E Holland, L Denehy, G Ntoumenopoulos, M T Naughton, J W Wilson

Thorax 2003;58:880-884

Chest Physiotherapy With Positive Airway Pressure: A Pilot Study of Short-Term Effects on Sputum Clearance in Patients With Cystic Fibrosis and Severe Airway Obstruction

Giulia Placidi RRT, Marta Cornacchia RRT, Guido Polese MD, Luisa Zanolla MD, Baroukh M Assael MD, and Cesare Braggion MD

RESPIRATORY CARE • OCTOBER 2006 VOL 51 NO 10

- 3 études démontrent l'intérêt d'utiliser la PPC ou la VNI-2P pendant les séances de désencombrement bronchique :



- Augmentation de la performance des muscles respiratoires et réduction des épisodes de désaturation pendant la séance
- Réduction de la dyspnée et séance décrite comme moins fatigante par les patients

Tableau I. Tableau comparatif des débits expiratoires de pointe à la toux obtenus avec différentes techniques chez un patient ayant un DEP à la toux spontané inférieur à 180 l/min (d'après Bach [9]).

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Cough-Assist [®] + pressions manuelles	448 l/min







Long-Term Effects of Lung Volume Recruitment on Maximal Inspiratory Capacity and Vital Capacity in Duchenne Muscular Dystrophy

Sherri L Katz, Nicholas Barrowman, Andrea Monsour, Santana Su, Lynda Hoey, and Douglas McKim



- 16 patients, myopathie de Duchenne, hyperinsufflation 2x/jour
- 3 à 5 insufflation, jusqu'à la capacité inspiratoire maximum avec insufflateur manuel (BAVU) (pression obtenue entre 45 à 60 cmH₂O)

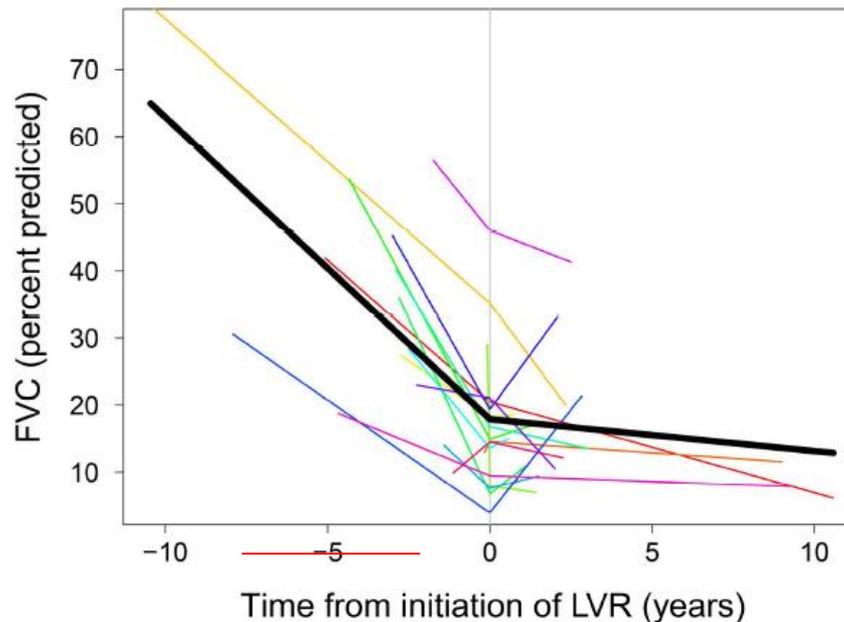


Figure 2. Segmented linear model fits of rate of decline of forced vital capacity (FVC, % predicted) over time. Individual fits are shown in color. The inflection point is at time 0, representing the introduction of LVR. The black line represents a linear mixed effect model including all individuals. Prior to LVR initiation, the rate of decline of FVC (% predicted) was -4.5 per year; following LVR initiation it was -0.5 per year, a difference of 4.0 per year (95% CI 3.2, 4.8; $p < 0.001$).

158x122mm (300 x 300 DPI)

The Short-Term Effects of Intermittent Positive Pressure Breathing Treatments on Ventilation in Patients With Neuromuscular Disease

Claude Guérin MD PhD, Bernard Vincent, Thierry Petitjean MD, Pierre Lecam MD, Christiane Luizet, Muriel Rabilloud MD, and Jean-Christophe Richard MD PhD

RESPIRATORY CARE • JULY 2010 VOL 55 No 7

RESPIRATORY
CARE

- *Lors de l'utilisation de l'IPPB en décubitus dorsal, risque d'hyperinflation de la partie pulmonaire antérieure*
- *Tendance à une distribution plus homogène de la ventilation à travers les poumons en décubitus latéral (droit et gauche)*

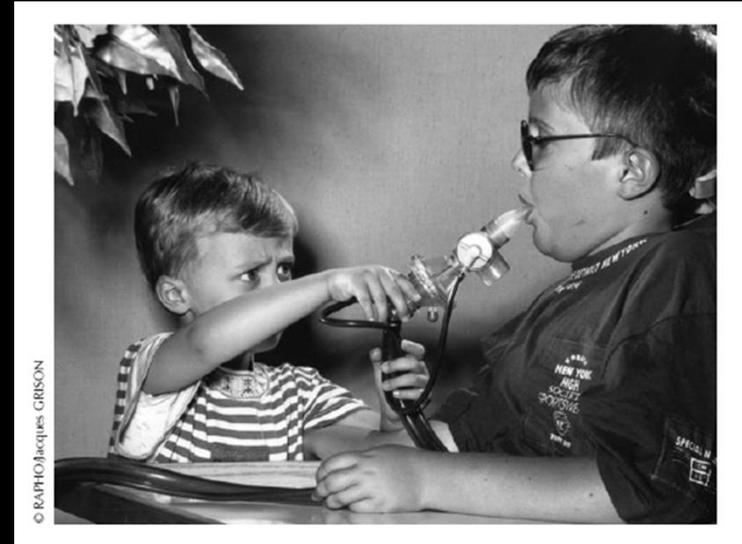


Le réglage du débit

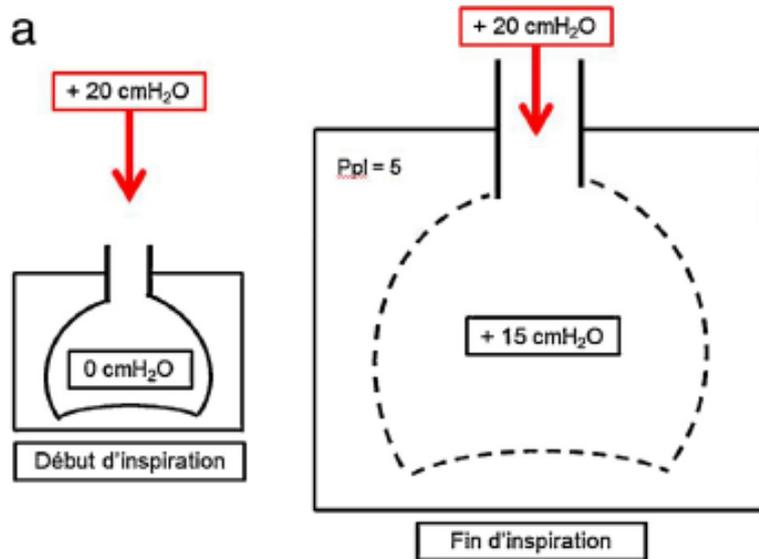


Les pièges à éviter

- ✓ Patient qui met la langue dans l'embout
 - la pression monte d'un coup
- ✓ Patient qui ferme la glotte
 - les joues se gonflent
- ✓ Patient qui commence l'inspiration et se bloque avant l'insufflation complète
 - la pression monte, mais le thorax n'est pas bien mobilisé en expansion

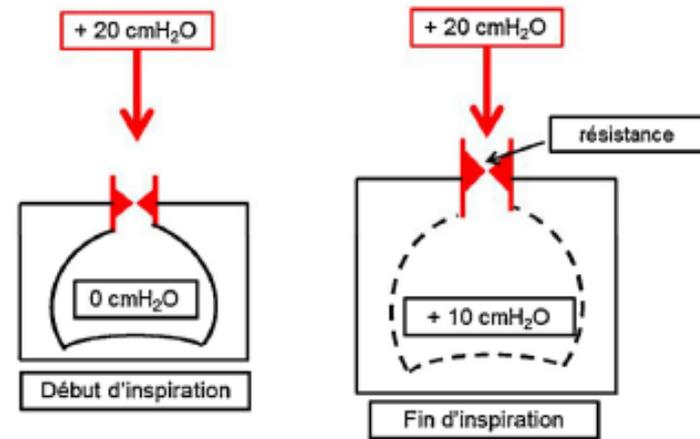


a



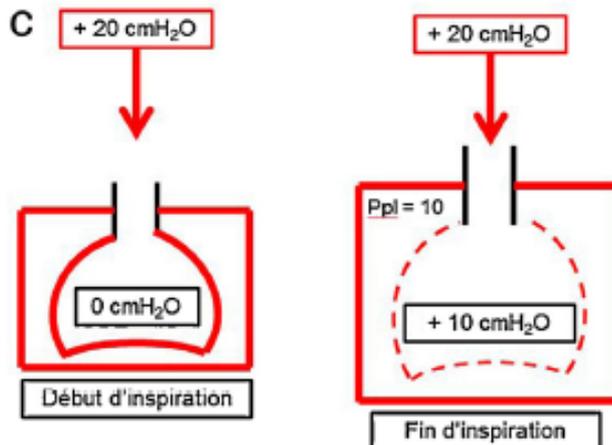
Paroi thoracique compliante et résistances quasiment nulles

b



Paroi thoracique compliant e mais résistances élevées

c



Paroi thoracique rigide et résistances quasiment nulles

Distension gastrique après IPPB

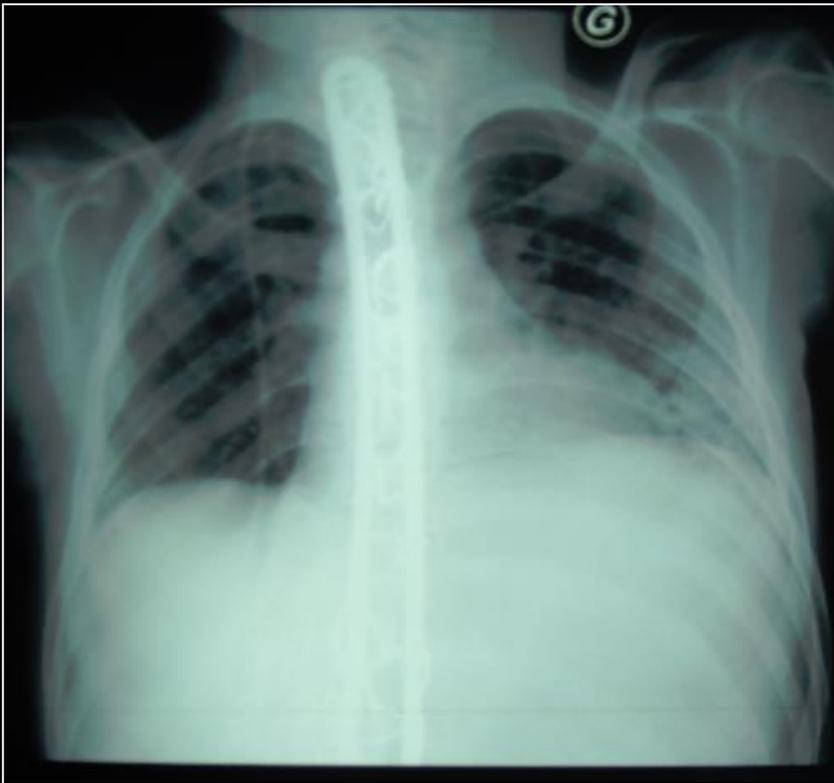
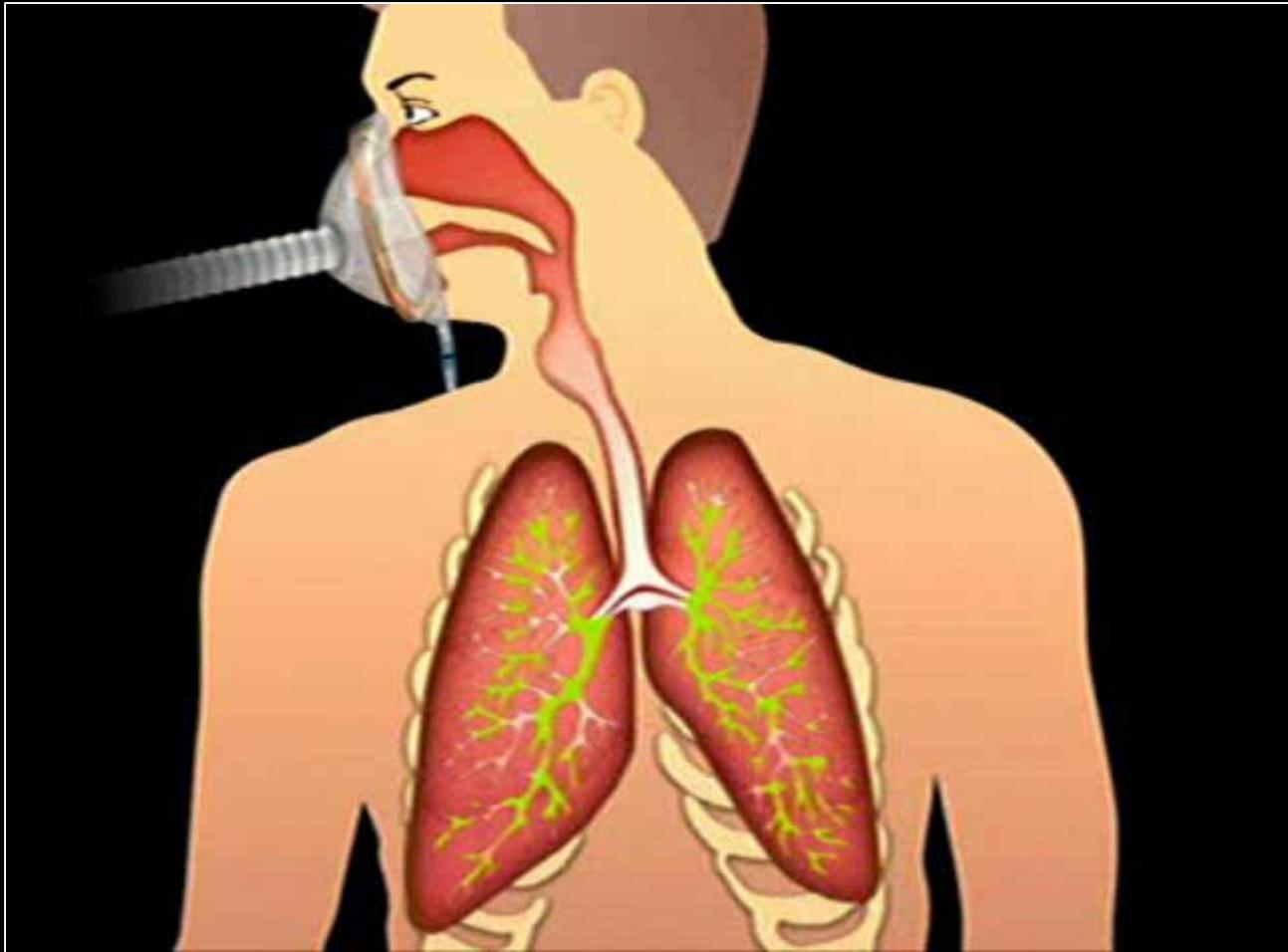


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Cough-Assist [®] + pressions manuelles	448 l/min







Insufflation-exsufflation mécanique (MI-E) : des arguments forts pour son utilisation

- Dans la prise en charge des maladies neuromusculaires, la MI-E peut limiter les hospitalisations, le recours à l'intubation et à la trachéotomie*
- MI-E permet de diminuer la durée des séances de désencombrement, au prix d'un moindre effort : moins de baisse de SpO₂, moins de sensation de dyspnée*

Vianello A, Corrado A, Arcaro G, Gallan F, Ori C, Minuzzo M, Bevilacqua M. Mechanical insufflation-exsufflation improves outcomes for neuromuscular disease patients with respiratory tract infections. *Am J Phys Med Rehabil* 2005;84(2):83–88.

Vitacca M, Paneroni M, Trainini D, Bianchi L, Assoni G, Saleri M, et al. At home and on demand mechanical cough assistance program for patients with amyotrophic lateral sclerosis. *Am J Phys Med Rehabil* 2010;89(5):401–406.

Winck JC, Gonçalves MR, Lourenço C, Viana P, Almeida J, Bach JR. Effects of mechanical insufflation-exsufflation on respiratory parameters for patients with chronic airway secretion encumbrance. *Chest* 2004;126(3):774–780.

Fauroux B, Guillemot N, Aubertin G, Nathan N, Labit A, Clément A, Lofaso F. Physiologic benefits of mechanical insufflation-exsufflation in children with neuromuscular diseases. *Chest* 2008;133(1):161–168.

Bento J, Gonçalves M, Silva N, Pinto T, Marinho A, Winck JC. Indications and compliance of home mechanical insufflation-exsufflation in patients with neuromuscular diseases *Arch Bronconeumol* 2010;46(8):420–425.

Chatwin M, Simonds AK. The addition of mechanical insufflation/exsufflation shortens airway-clearance sessions in neuromuscular patients with chest infection. *Respir Care* 2009;54(11):1473–1479.

J Crit Care, 2011 Oct;26(5):517-24. Epub 2011 Jan 26.

Prevention of extubation failure in high-risk patients with neuromuscular disease.

Vianello A, Arcaro G, Braccioni F, Gallan F, Marchi MR, Chizio S, Zampieri D, Pegoraro E, Salvador V.

Kinesither Rev 2010;(104-105):19-22



Figure 1. Radiographie de Thorax de M. C. avant la séance de Cough-Assist[®].

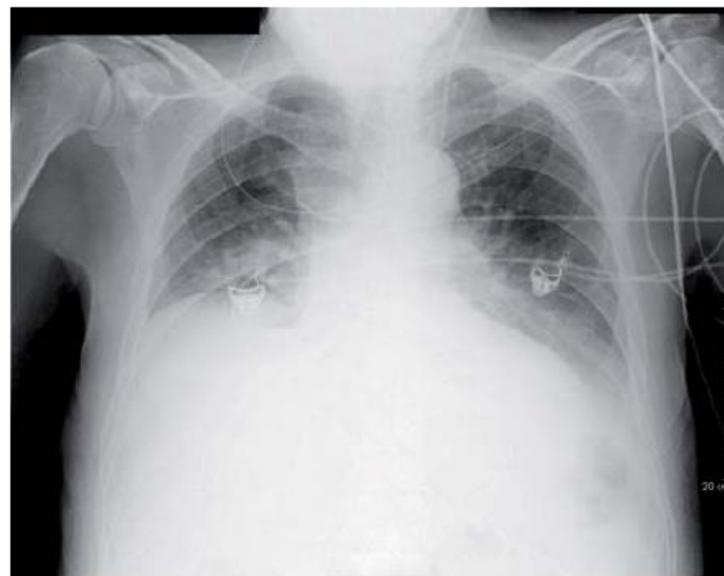
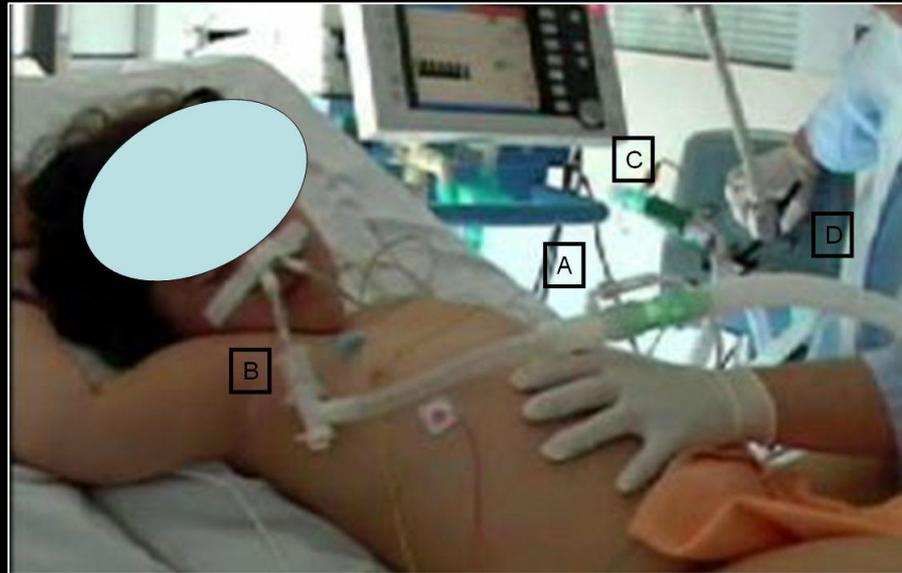


Figure 3. Radiographie de thorax de M. C. après la séance de Cough-Assist[®].

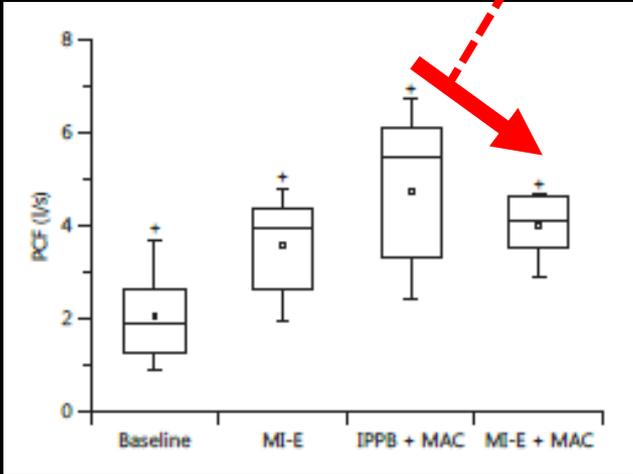
- la MI-E peut produire une « toux artificielle », même chez des patients inconscients ou sédatisés



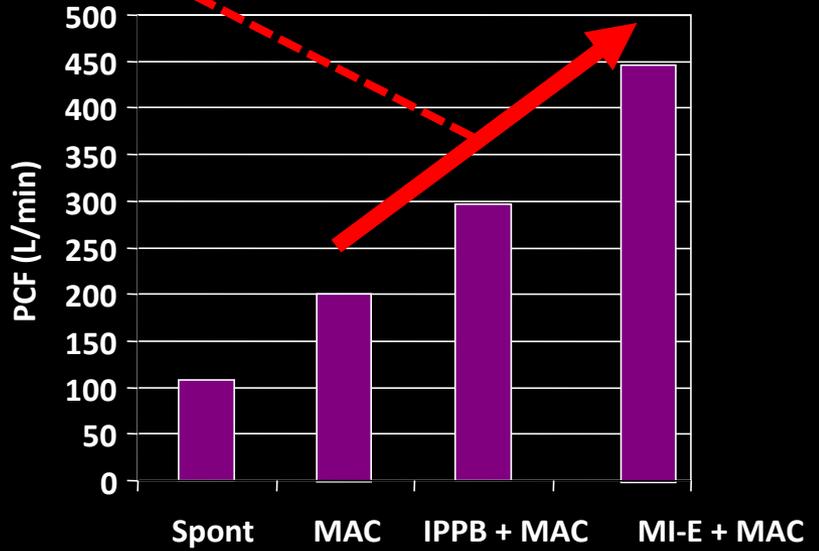
Miske LJ, Hickey EM, Kolb SM, Weiner DJ, Panitch HB. Use of the mechanical in-exsufflator in pediatric patients with neuromuscular disease and impaired cough. *Chest* 2004;125(4):1406–1412.

Pillastrini P, Bordini S, Bazzocchi G, Belloni G, Menarini M. Study of the effectiveness of bronchial clearance in subjects with upper spinal cord injuries: examination of a rehabilitation programme involving mechanical insufflation and exsufflation. *Spinal Cord* 2006; 44(10):614–616.

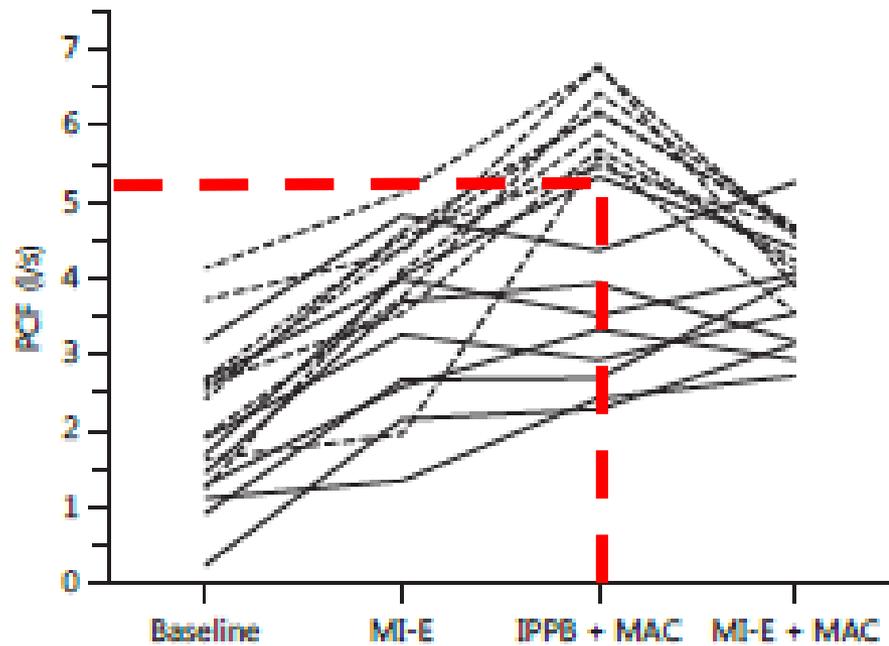




Lacombe; Respiration 2014

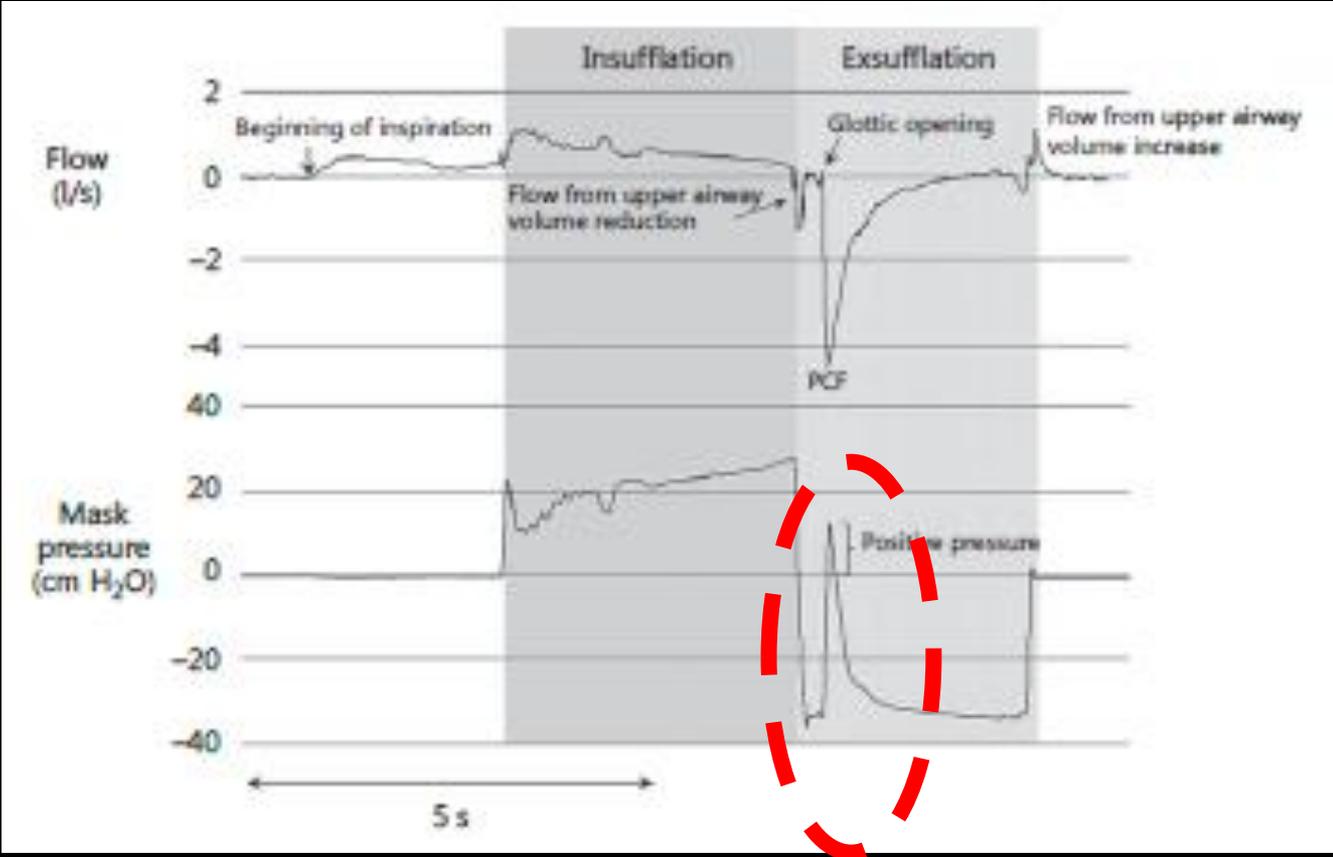


Bach; Chest 1993



Since the 9 patients who had a transient positive-pressure swing during cough were among the 10 with a PCF above 5 liters/s with IPPPB + MAC, our results suggest that MI-E may be without additional benefit when PCF with MAC or IPPB + MAC is above 5 liters/s.

(5l/s = 300l/min)



Limites de la MI-E : patients avec des syndromes respiratoires obstructifs

Table 2 Peak cough expiratory flow rate (PCEF), cough expiratory volume (CEV), and peak value time (PVT) in subjects during the various assisted cough techniques

	Normal subjects (n=9)	COPD (n=8)	Neuromuscular weakness	
			Without scoliosis (n=8)	With scoliosis (n=4)
Baseline				
PCEF (l/min)	668 (310–700)	370 (267–483)	104 (43–188)	288 (175–367)
CEV (l)	2.4 (1.31–4.91)	1.62 (0.4–2.91)	0.5 (0.3–0.8)	0.9 (0.50–1.1)
PVT (ms)	35 (30–45)	32 (25–40)	80 (40–220)	44 (40–50)
Manually assisted cough				
PCEF (l/min)	624 (326–700)	226 (120–315)*	185 (93–355)*	193 (185–287)
CEV (l)	2.91 (1.31–5.31)	0.8 (0.20–1.51)	0.7 (0.31–1.07)	0.5 (0.41–1.01)
PVT (ms)	50 (40–85)**	45 (30–60)*	118 (35–360)*	50 (35–55)
Mechanical insufflation				
PCEF (l/min)	676 (494–695)	288 (218–370)	156 (61–247)	231 (148–597)
CEV (l)	2.2 (0.8–5.91)	0.43 (0.2–0.91)	0.6 (0.3–1.61)	0.7 (0.3–1.3)
PVT (ms)	35 (30–40)	33 (30–40)	85 (20–420)	45 (30–60)
In combination				
PCEF (l/min)	624 (288–695)	245 (218–370)*	248 (110–343)*	362 (218–440)
CEV (l)	2.2 (0.7–5.41)	0.8 (0.2–1.09)	0.6 (0.40–2.19)	0.6 (0.4–1.01)
PVT (ms)	55 (40–100)	40 (35–50)	75 (20–420)	50 (45–120)

Data are expressed as median (range).

*p<0.01.

Effect of manually assisted cough and mechanical insufflation on cough flow of normal subjects, patients with chronic obstructive pulmonary disease (COPD), and patients with respiratory muscle weakness

Limites de la MI-E : patients avec SLA bulbaire

Table 2 Description of laryngeal response patterns during the MI-E protocol (n=40)

Subjects (N=20)	Glottic level	Supraglottic level		Tongue base and hypopharyngeal level	
	True vocal folds (TVF)	Aryepiglottic folds (AEF)	Epiglottis (EG)	Base of the tongue (BT)	Hypopharynx (HP)
Healthy (n=20)	Adequate control* in all	Adequate control [†] in all	Retroflex movement in 8/20	Backward in 4/20	Constriction in 12/20 of varying degrees
ALS without bulbar symptoms (n=6)	Adequate control* in all	Adequate control [†] in all	Retroflex movement in 1/6	Backward in all	Constriction in all of varying degrees
Progressive bulbar ALS (n=7)	Adequate control* in all	Adduction in insufflation in all	Retroflex movement †-'floppy' in 1/7	Backward in 5/7	Constriction in all, and very narrow in 4/7
Pseudobulbar ALS (n=7)	Inadequate control§ in insufflation; in 3/7 and in 1/7 in exsufflation	Adduction in insufflation in all (but in 4/7, only at higher pressures: ≥+40 cm H ₂ O)	Retroflex movement in 2/7	Backward in all	Constriction in all, and very narrow in 1/7

*Normal cough, that is, TVF abduction in insufflation, glottic closure when coughing and TVF abduction+sequential closures and/or narrowing in exsufflation.

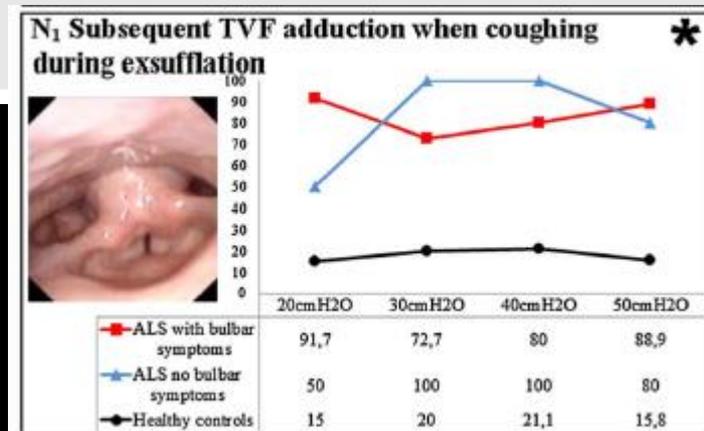
[†]AEF follows the movements of the TVF.

§Very small TVF opening in insufflation or in exsufflation.

ALS, amyotrophic lateral sclerosis; MIE, mechanical insufflation-exsufflation.

Laryngeal response patterns influence the efficacy of mechanical assisted cough in amyotrophic lateral sclerosis

Andersen T, et al. *Thorax* 2016;



Laryngeal response patterns influence the efficacy
of mechanical assisted cough in
amyotrophic lateral sclerosis

Supplementary video 1:

ALS CASE WITHOUT BULBAR SYMPTOMS

Tiina Andersen, Astrid Sandnes, Anne Kristine Brekka, Magnus Hilland,
Hege Clemm, Ove Fondenes, Ole-Bjørn Tysnes, John-Helge Heimdal,
Thomas Halvorsen, Maria Vollsæter & Ola Drange Røksund

Laryngeal response patterns influence the efficacy
of mechanical assisted cough in
amyotrophic lateral sclerosis

Supplementay video 4:

ALS CASE WITH PSEUDOBULBAR PARESE

Tiina Andersen, Astrid Sandnes, Anne Kristine Brekka, Magnus Hilland,
Hege Clemm, Ove Fondenes, Ole-Bjørn Tysnes, John-Helge Heimdal,
Thomas Halvorsen, Maria Vollsæter & Ola Drange Røksund

Un adjuvant indispensable aux techniques de désencombrement :

Le positionnement

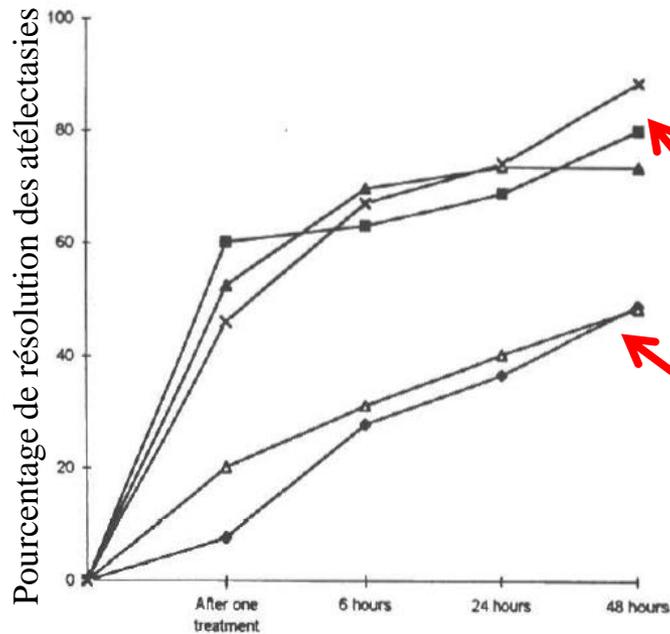
Traitement en cas d'atélectasie

Acute lobar atelectasis: A comparison of five physiotherapy regimens

Kathy Stiller, Sue Jenkins, Ruth Grant, Tim Geake, James Taylor and Bob Hall

Physiotherapy Theory and Practice (1996) 12, 197-209
© 1996 Erlbaum (UK) Taylor & Francis Ltd

35 patients
(30 intubés, 5 non intubés)
(hyperinsufflation avec BAVU)

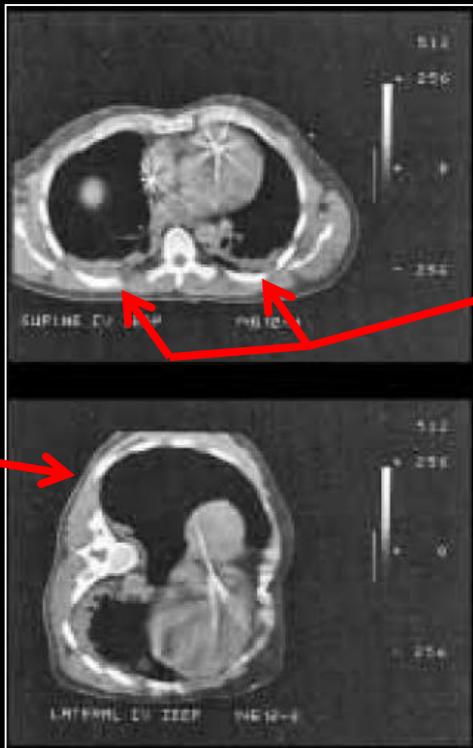


Groupes plusieurs séances
d'hyperinsufflation + décubitus
supra latéral +/- vibrations

Groupes hyperinsufflation
seule ou 1 seule séance de
hyperinsufflation + décubitus
supra latéral



**Réaliser plusieurs séances, avec support instrumental inspiratoire,
en décubitus supralatéral**

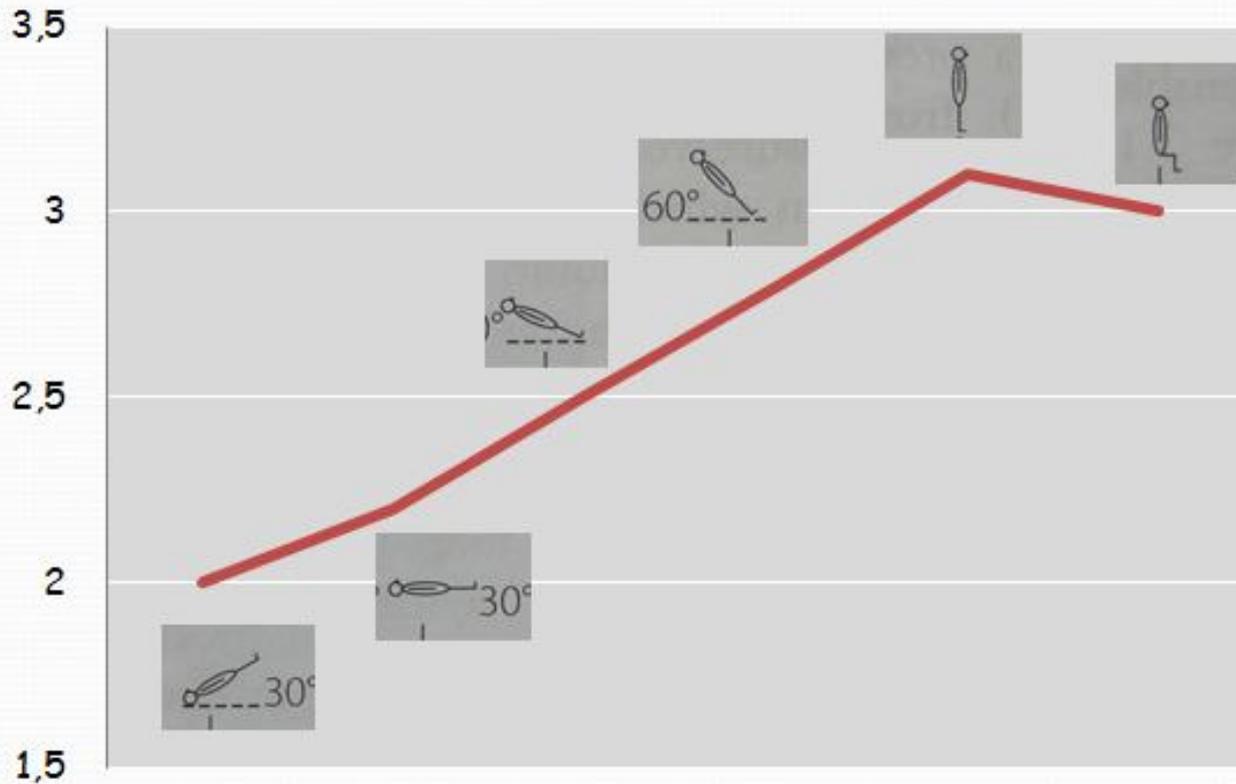


- Patient anesthésié couché sur le dos
- Atelectasie dans les régions postérieures des 2 poumons

- Même patient anesthésié couché sur le côté gauche
- Diminution de l'atelectasie dans le poumon droit placé en supralatéral

Se redresser pour mieux ventiler !!

Capacité Résiduelle fonctionnelle (l)



Nunn's applied respiratory physiology, 6e édition (2006), Edition Elsevier

Changer de positions ++



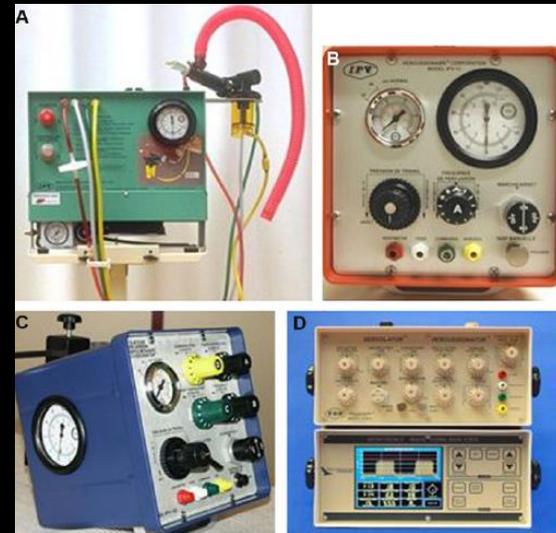
Les manœuvres de désencombrement doivent associer :

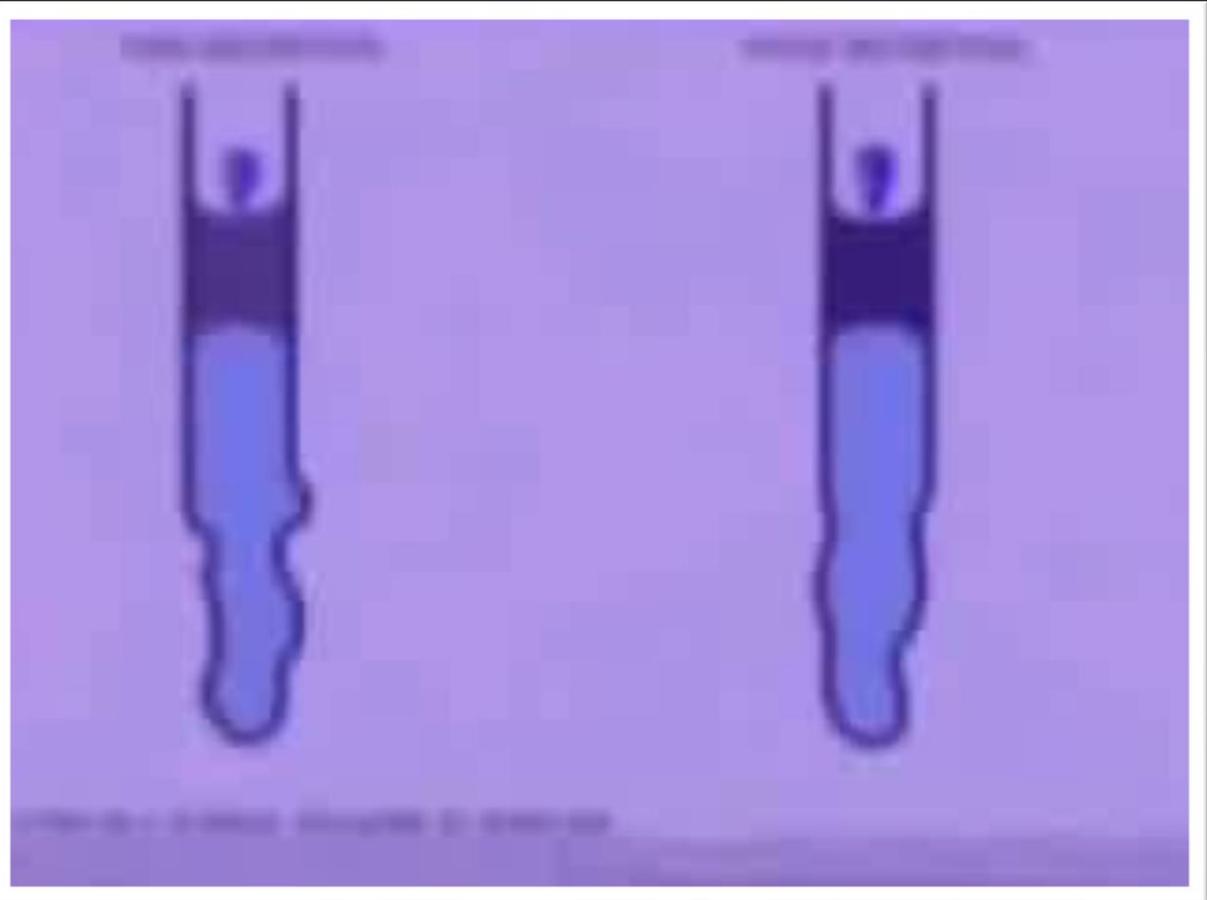
- Des techniques manuelles
- Un support instrumental inspiratoire
- Des changements de position
- Répétez la prise en charge plusieurs fois par jour





Ventilation à Percussions Intrapulmonaires





Ventilation à Percussions Intrapulmonaire

- L'IPV ne doit pas être perçue comme une alternative à la VNI : moindre diminution du travail inspiratoire avec l'IPV qu'avec la VNI
- L'IPV semble représenter une aide au désencombrement périphérique difficilement mobilisable malgré des séances de kinésithérapie respiratoire bien conduite sous VNI.

Physiological response to intrapulmonary percussive ventilation in stable COPD patients

Stefano Nava^{*,1}, Nicola Barbarito, Giancarlo Piaggi, Elisa De Mattia¹, Serena Cirio

Effect of intrapulmonary percussive ventilation on expiratory flow limitation in chronic obstructive pulmonary disease patients

Frédéric Vargas MD, PhD^{a,b,*}, Alexandre Boyer MD^a, Hoang Nam Bui MD^a, Hervé Guenard MD^b, Didier Gruson MD, PhD^a, Gilles Hilbert MD, PhD^{a,b}

Intrapulmonary percussive ventilation in acute exacerbations of COPD patients with mild respiratory acidosis: a randomized controlled trial [ISRCTN17802078]

Frédéric Vargas,^{1,2} Hoang Nam Bui,¹ Alexandre Boyer,¹ Louis Rachid Salmi,³ Georges Gbikpi-Benissan,¹ Hervé Guenard,² Didier Gruson,¹ and Gilles Hilbert^{1,2}

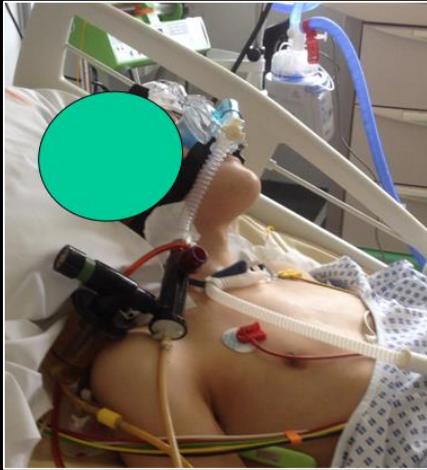
Intrapulmonary percussive ventilation improves the outcome of patients with acute exacerbation of chronic obstructive pulmonary disease using a helmet*

Vittorio Antonaglia, MD; Umberto Lucangelo, MD; Walter A. Zin, MD, DSc; Alberto Peratoner, MD; Loredana De Simoni, MD; Guido Capitanio, MD; Sara Pascotto, MD; Antonino Gullo, MD

Intensive Care Med. 2011 Aug;37(8):1269-76. Epub 2011 Jun 9.

Intrapulmonary percussive ventilation superimposed on spontaneous breathing: a physiological study in patients at risk for extubation failure.

Dimassi S, Vargas F, Lyazidi A, Roche-Campo F, Dellamonica J, Brochard L.



« L'IPV est facile à utiliser avec des patients non-collaboratifs.»

« Il semble aider dans le rétablissement d'infiltrat pulmonaire et d'atélectasies, avec le grand avantage de ne pas nécessiter la participation volontaire du patient.»

Langenderfer M . Alternatives to percussion and postural drainage: a review of mucus clearance therapies: percussion and postural drainage, autogenic drainage, positive expiratory pressure, flutter valve, intrapulmonary percussive ventilation, and high-frequency chest compression with the thairapy vest . *J. Cardiopulm. Rehabil* . 1998 ; **18** : 283 – 9 .

Malgré le manque d'étude de haut niveau, des cas cliniques sont toujours publiés

Fujita M, Tsuruta R, Oda Y, et al. Severe Legionella pneumonia successfully treated by independent lung ventilation with intrapulmonary percussive ventilation. *Respirology* 2008;13:475–7.

Noninvasive High-Frequency Percussive Ventilation in the Prone Position after Lung Transplantation

P. Feltracco, E. Serra, S. Barbieri, M. Milevoj, E. Michieletto, C. Carollo, F. Rea, G. Zanusi, R. Boetto, and C. Ori

Transplantation Proceedings, 44, 2016–2021 (2012)

Dmello D, Navak RP, Matuschak GM. High-frequency percussive ventilation for airway clearance in cystic fibrosis: a brief report. *Lung* 2010;3:511–3.



Figure 1. Radiographie pulmonaire réalisée après intensification de la ventilation non invasive (VNI) et séance de désencombrement bronchique par Cough-Assist®. On note la présence d'une atelectasie lobaire inférieure gauche, avec attraction du médiastin. Noter la distension gastrique, certainement en lien avec les hyper-insufflations et l'intensification de la VNI.

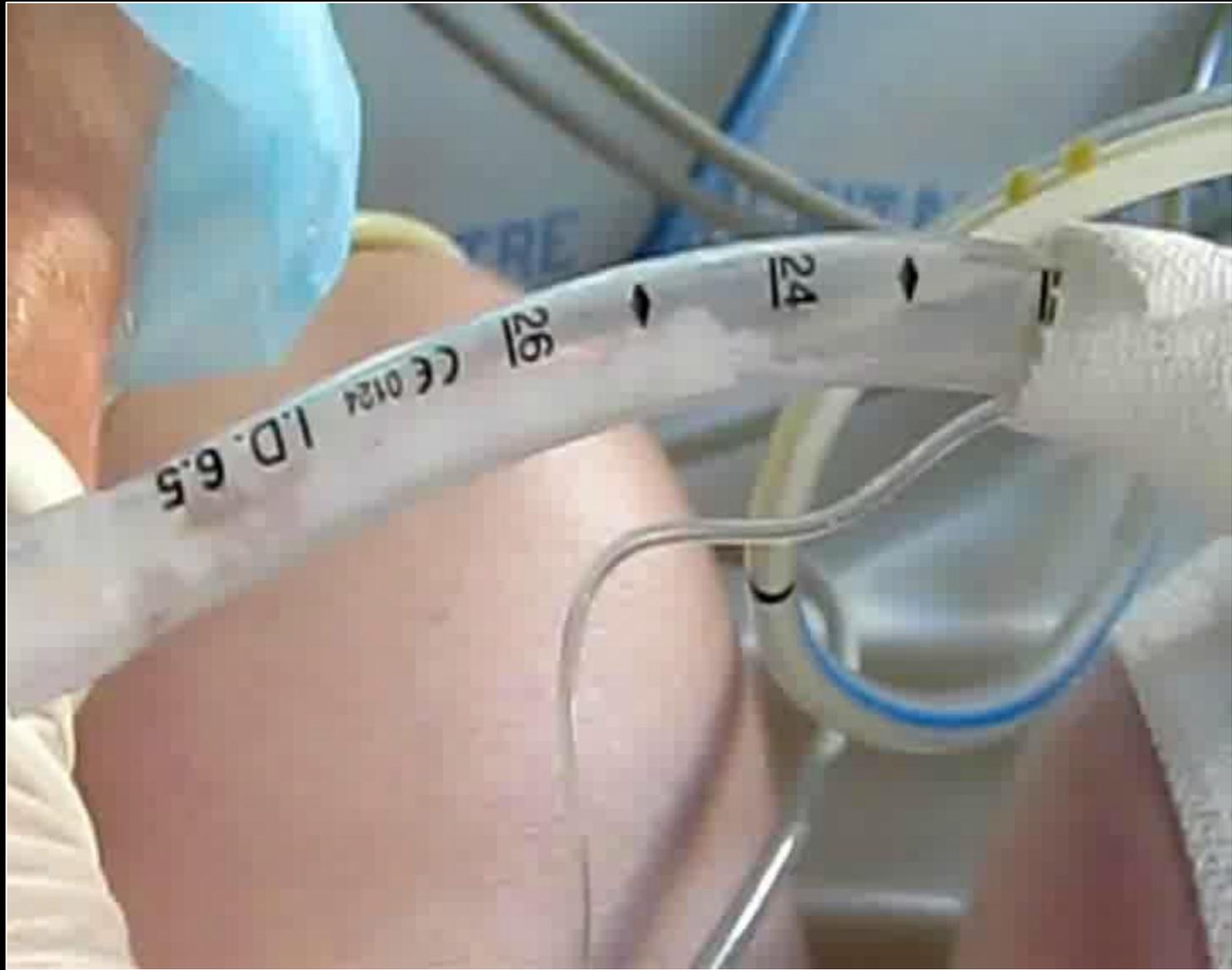


Figure 2. Radiographie pulmonaire réalisée après adjonction de ventilation à percussion intrapulmonaire (IPV). L'atelectasie lobaire inférieure gauche est levée.

Kinesither Rev 2011;(114):15-18



Kinesither Rev 2011;(114):15-18



D'autres techniques

Les vibrations mécaniques

- Technique qui ne montre pas sa supériorité par rapport à d'autres techniques (Flume et al., 2009)
- Peut être une alternative à d'autre prise en charge (Mcool et al., 2006; Giovanna et al., 2009)



Figure 3: High frequency chest wall oscillation device.

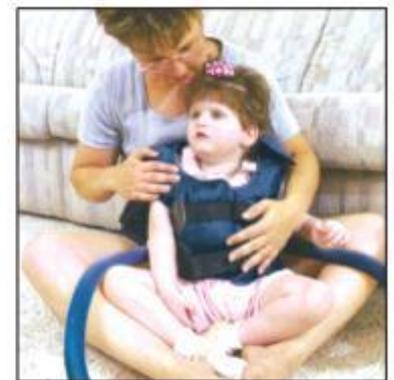


Figure 4: Using HFCWO device-Vest.

Abdominal functional electrical stimulation to enhance mechanical insufflation-exsufflation

Euan J. McCaughey^{1,2,3}, Alan N. McLean^{3,4}, David B. Allan^{3,4}, Henrik Gollee^{2,3}

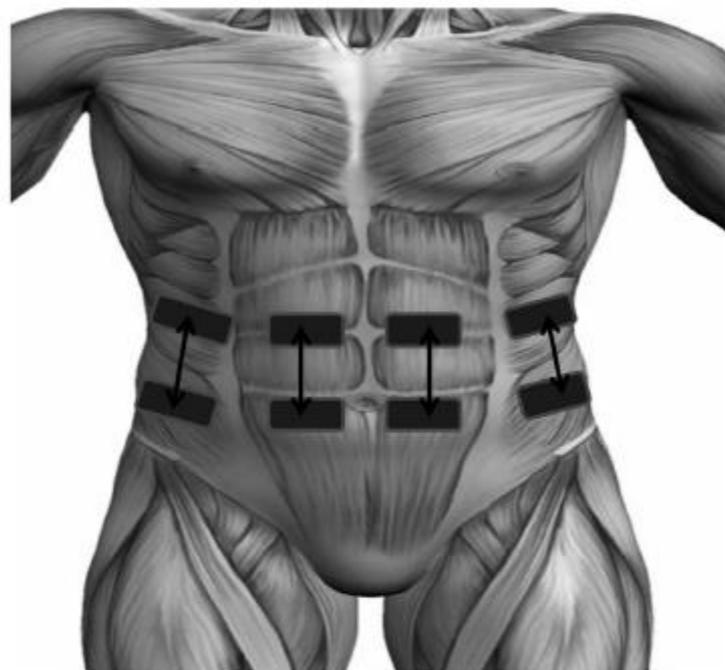


Figure 1 Schematic diagram of electrode placement showing four electrode pairs positioned to stimulate the motor points of the external oblique (outer electrodes) and rectus abdominis (inner electrodes) muscles on both sides of the body.

A Study on the Cough Augmentation Using a Belt-Driven Assistive

Sang-Yoep Lee, Kyu-Jin Cho, *Member, IEEE*

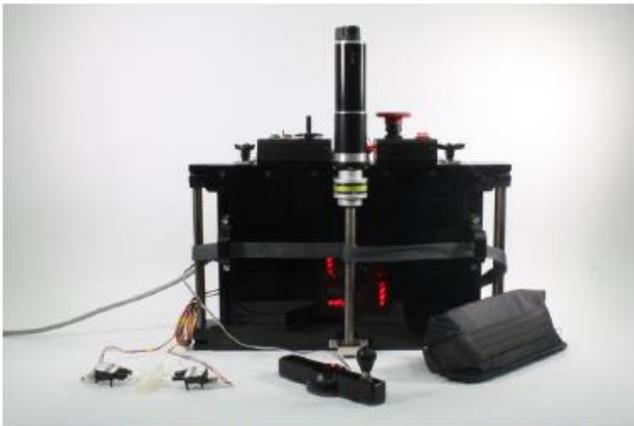


Figure 2. Frontal view and elements of suggested belt-driven assistive robot.



Figure 3. The abdomen pressing part of the belt-driven assistive robot.



Figure 7. Side view of the experimental setup.

Merci pour votre attention

