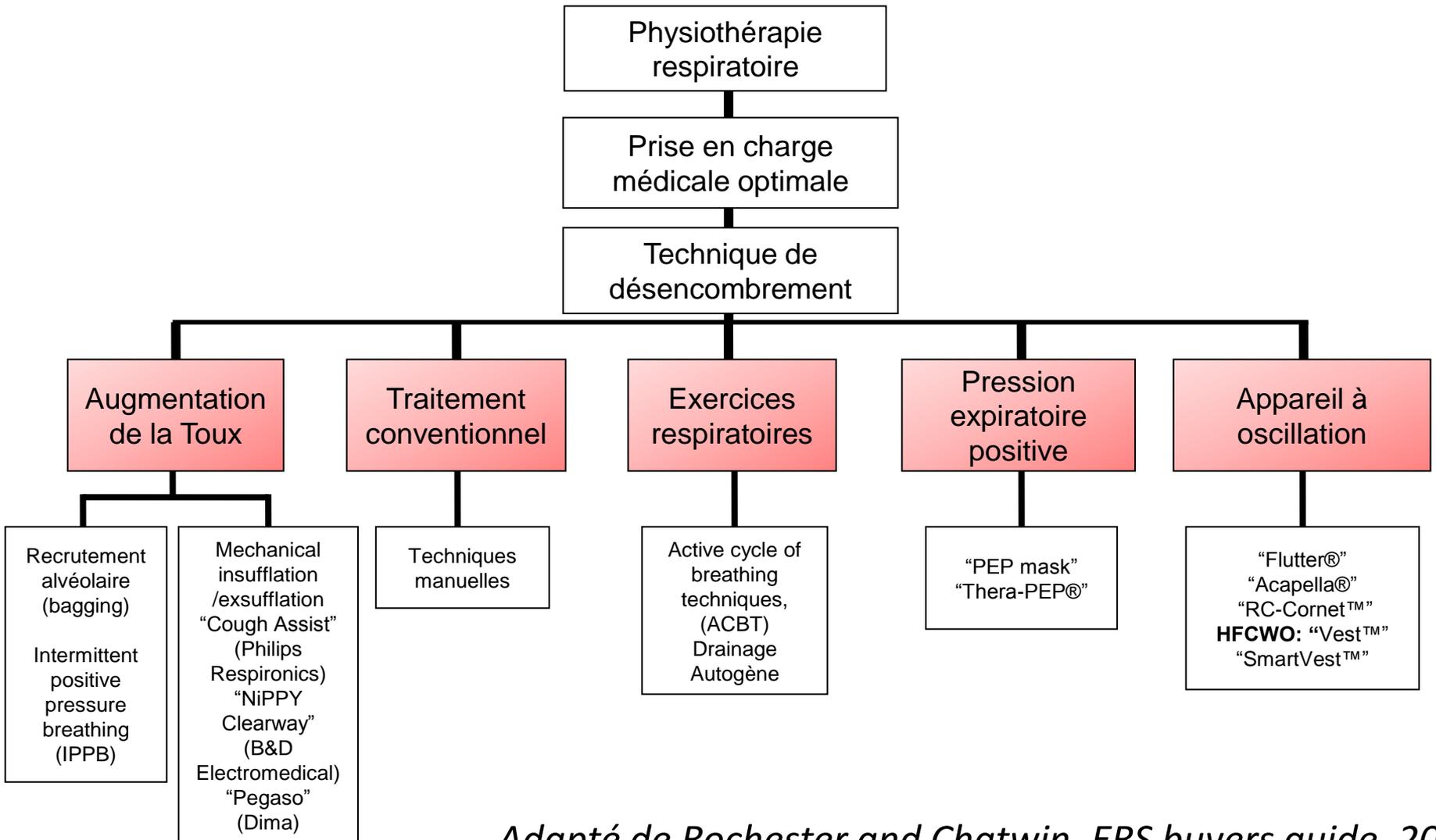




Techniques instrumentales de désencombrement

Olivier Contal, PhD
Guillaume Riffard

Méthodes de désencombrement



Adapté de Rochester and Chatwin, ERS buyers guide, 2012

Stratégies de désencombrement

Pourquoi utiliser des techniques instrumentales?

Objectifs		Principes
Ventilation alvéolaire	⇒	volume
		↕
désencombrement	⇒	Débit

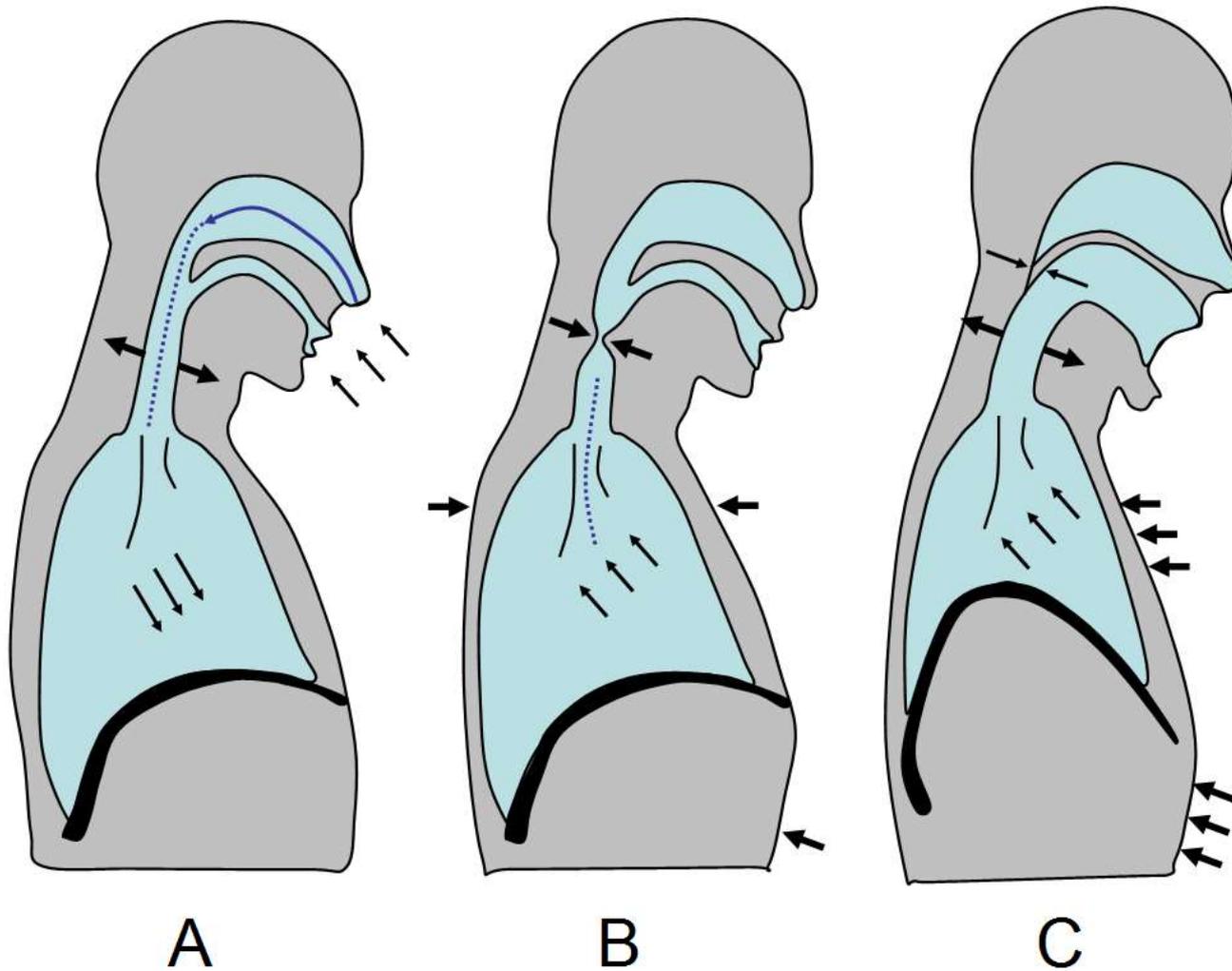
Cas clinique 1

- Patient SLA
- 55 ans
- Mise en place de VNI au long cours
- Référé pour évaluer nécessité de désencombrement instrumental

Évaluation

- Encombrement
- Toux

Les 3 phases de la toux



Débit de pointe à la toux

- Débit de toux normal entre 360 et 840 l/min

Leiner et al, 1963 Am Rev Respir Dis

- Patient à risque si débit de toux < 160 l/min

Bach et al., 1997, Chest

- Patient SLA avec atteinte bulbaire < 250 l/min

Sancho et al. 2007 AJRRCM

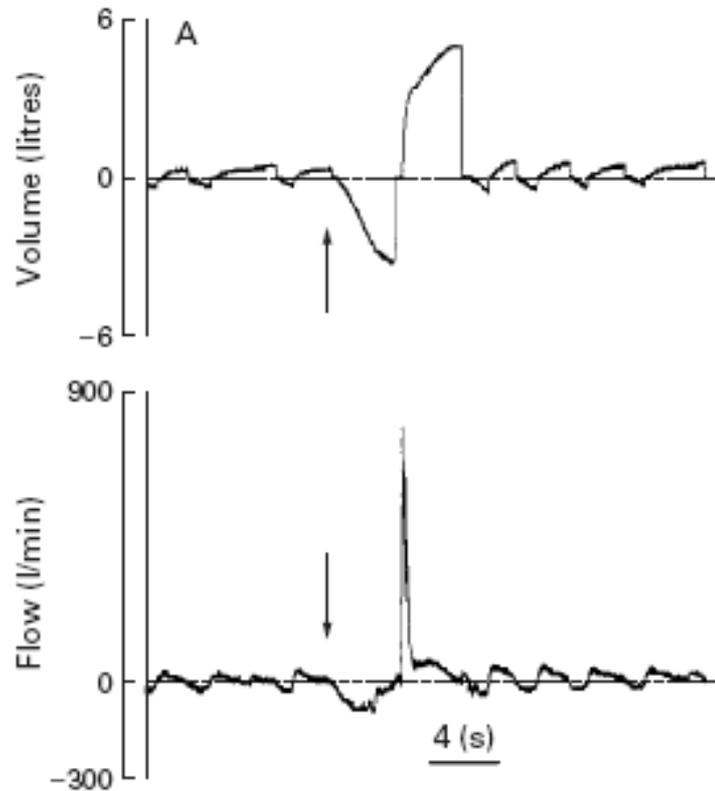


La toux

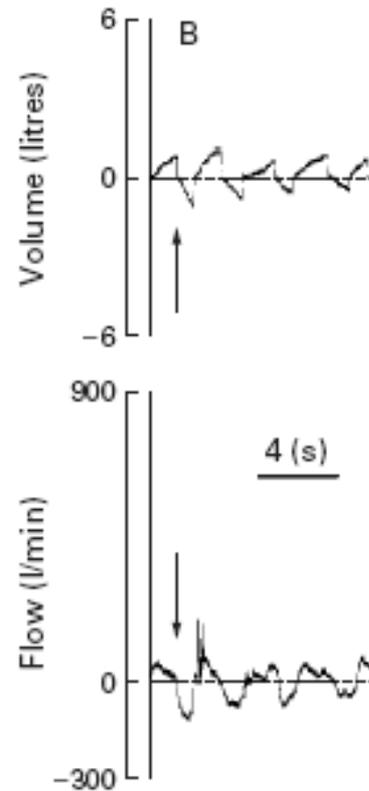
vitalweb.fr <https://www.vitalweb.fr/EspacePro/EncycloVNI/videos/1/VIDE0toux.html>



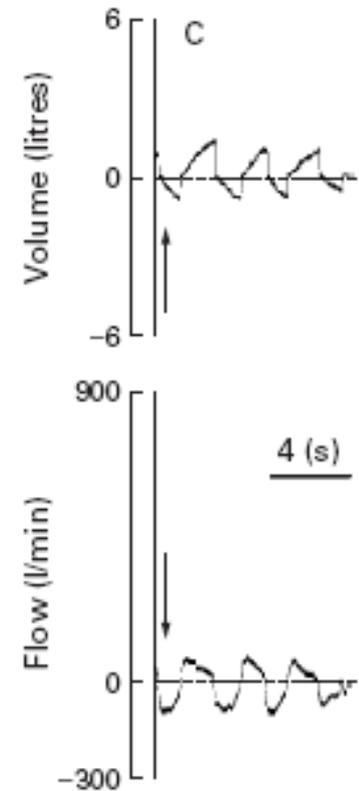
La toux



Sujet Normal



BPCO



Maladie
neuromusculaire

Méthodes de désencombrement

Physiothérapie
respiratoire

Prise en charge
médicale optimale

Technique de
désencombrement

Augmentation
de la Toux

Traitement
conventionnel

Exercices
respiratoires

Pression
expiratoire
positive

Appareil à
oscillation

Recrutement
alvéolaire
(bagging)

Intermittent
positive
pressure
breathing
(IPPB)

Mechanical
insufflation
/exsufflation
"Cough Assist"
(Philips
Respironics)
"NiPPY
Clearway"
(B&D
Electromedical)
"Pegaso"
(Dima)

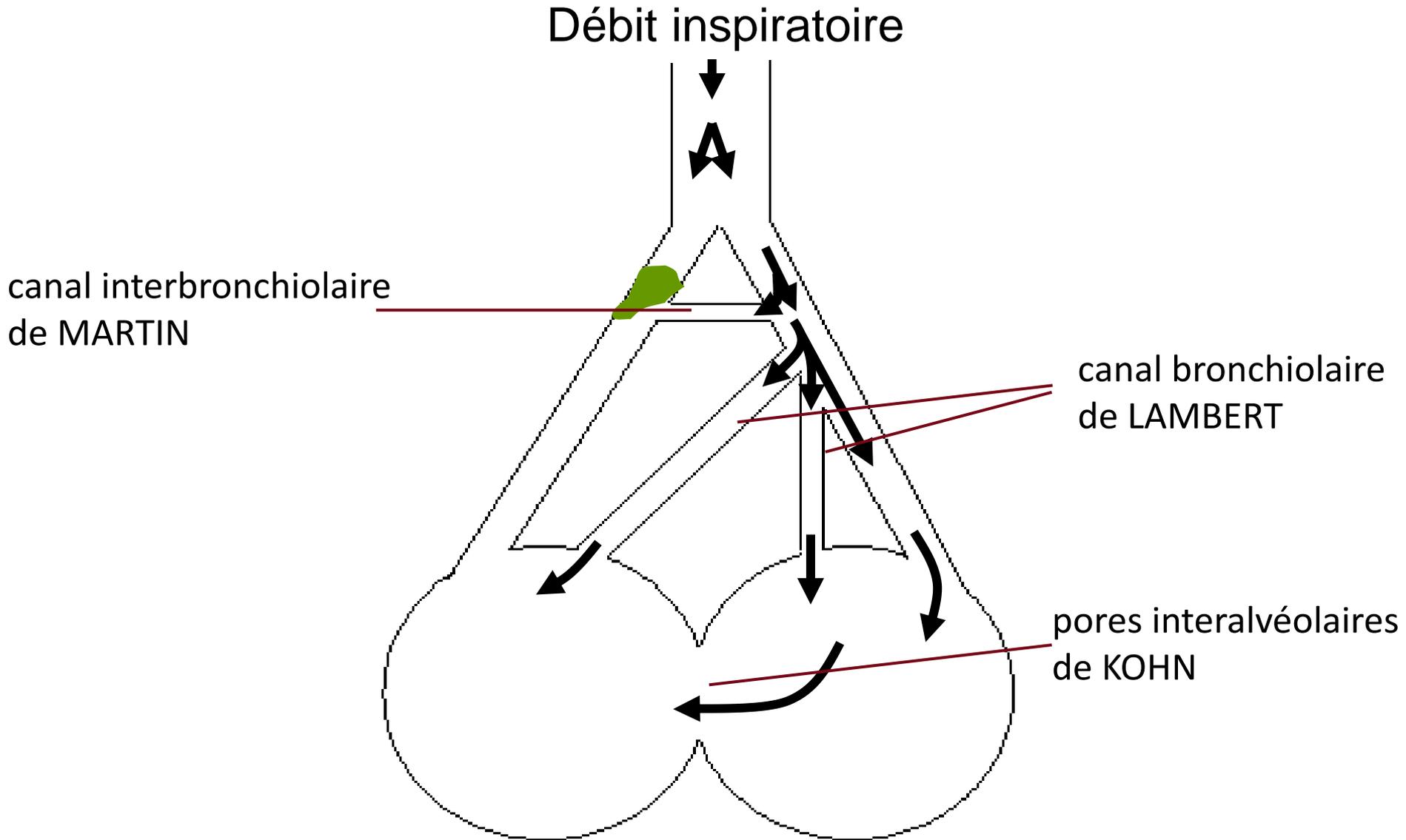
Techniques
manuelles

Active cycle of
breathing
techniques,
(ACBT)
Drainage
Autogène

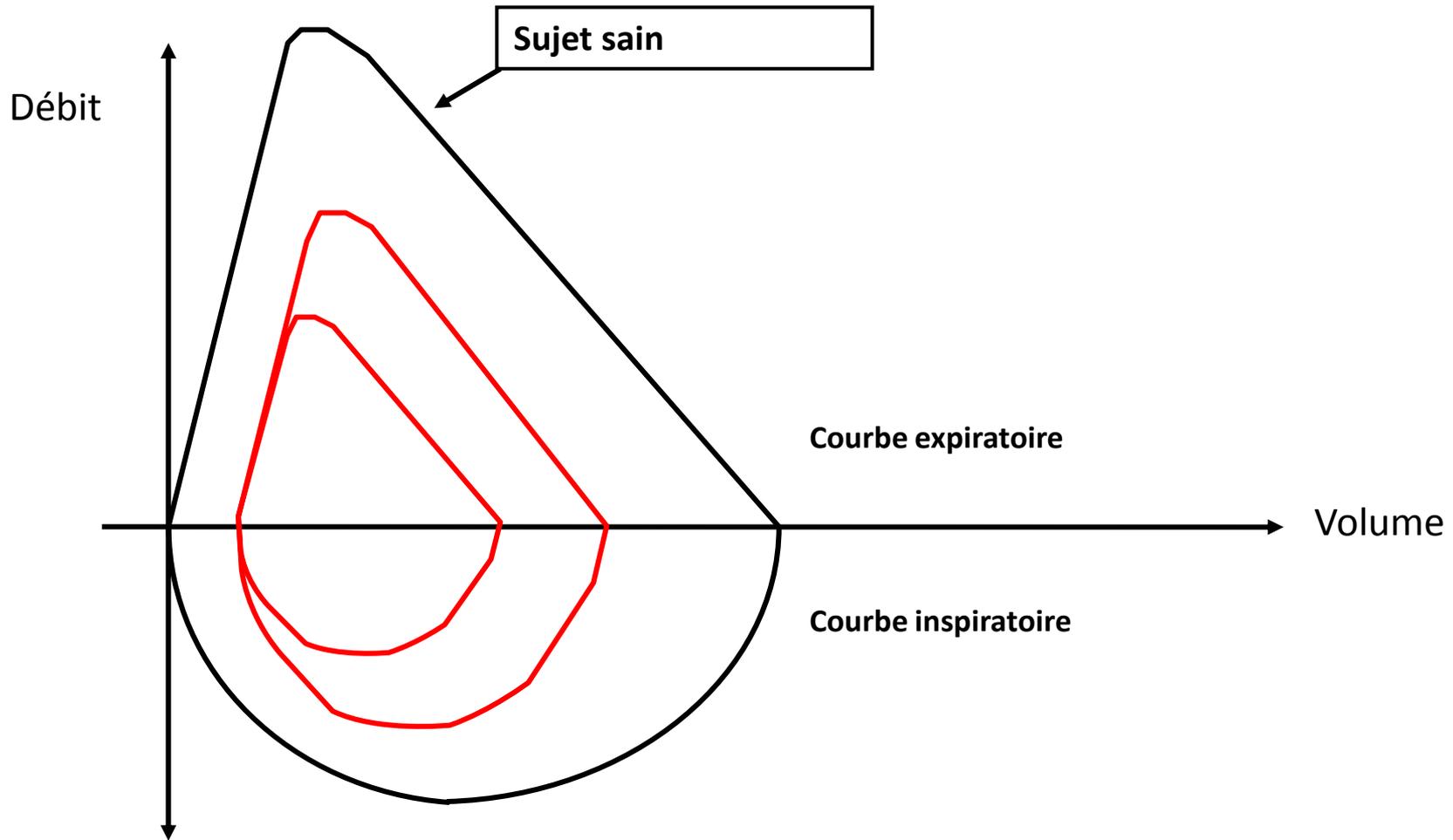
"PEP mask"
"Thera-PEP®"

"Flutter®"
"Acapella®"
"RC-Cornet™"
HFCWO: "Vest™"
"SmartVest™"

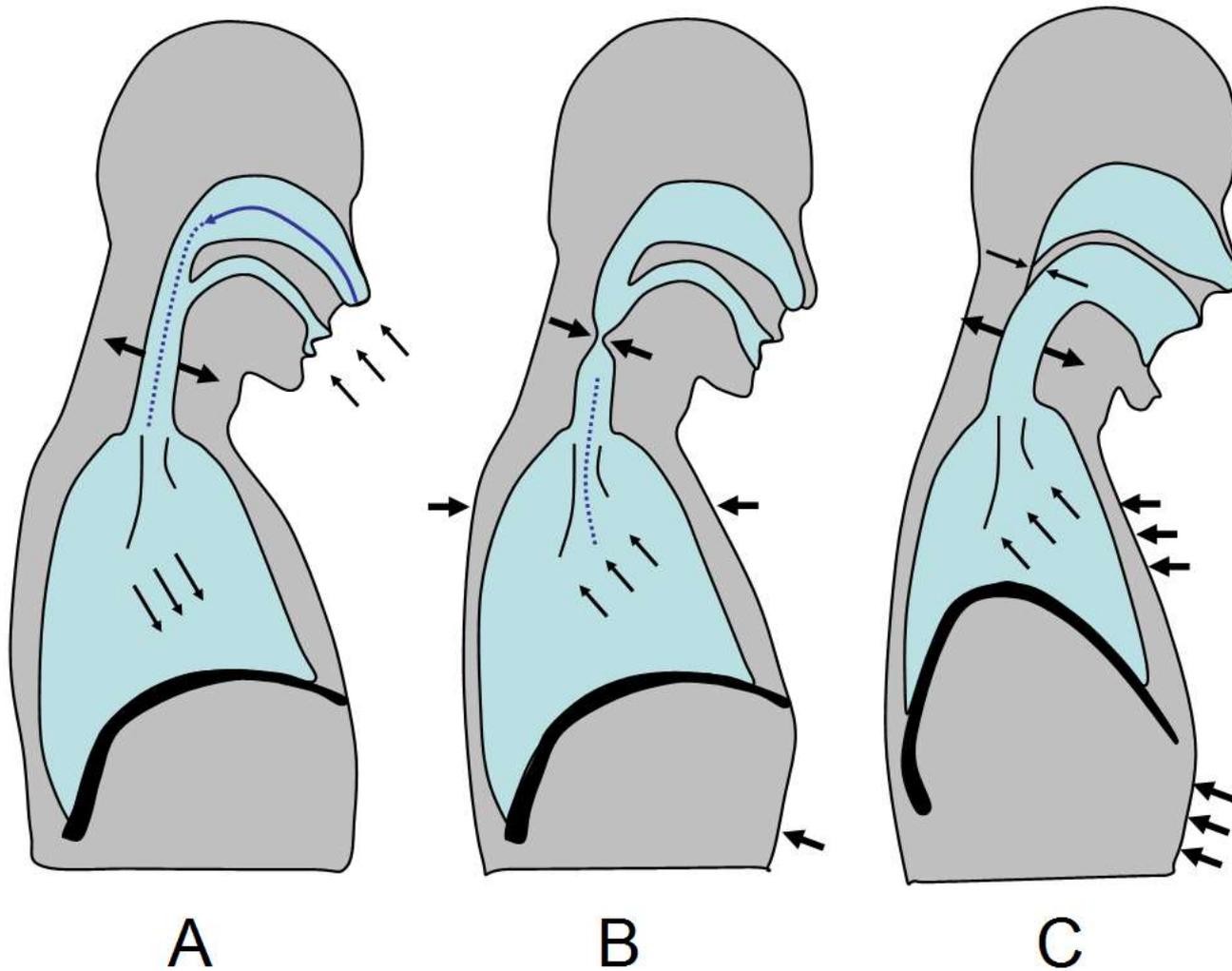
Ventilation collatérale



Courbe débit/volume dans le syndrome restrictif

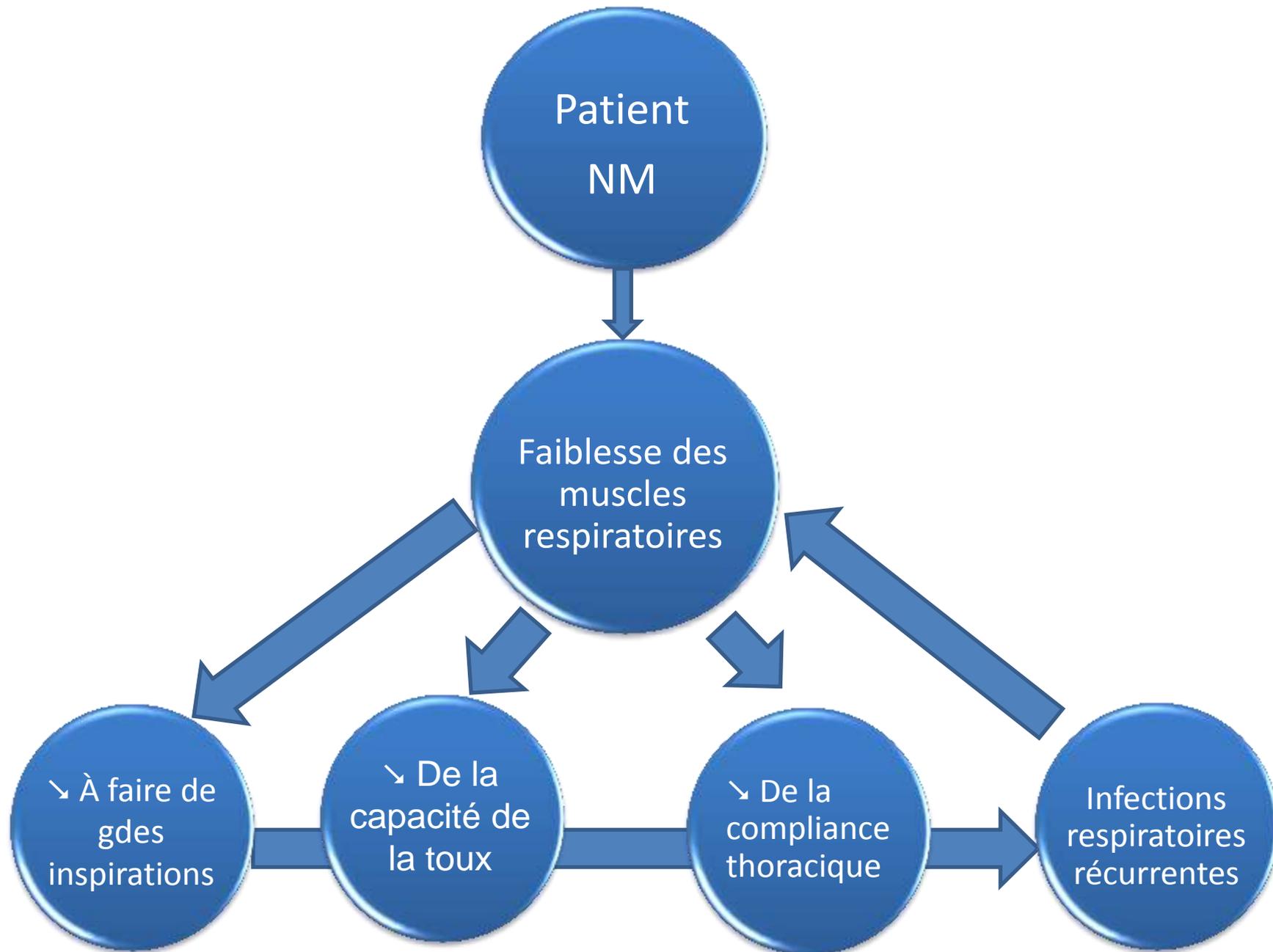


Les 3 phases de la toux



Quels appareils





Patient
NM

Faiblesse des
muscles
respiratoires

↘ À faire de
gdes
inspirations

↘ De la
capacité de
la toux

↘ De la
compliance
thoracique

Infections
respiratoires
récurrentes

Méthodes de désencombrement

Physiothérapie
respiratoire

Prise en charge
médicale optimale

Technique de
désencombrement

Augmentation
de la Toux

Traitement
conventionnel

Exercices
respiratoires

Pression
expiratoire
positive

Appareil à
oscillation

Recrutement
alvéolaire
(bagging)

Intermittent
positive
pressure
breathing
(IPPB)

Mechanical
insufflation
/exsufflation
"Cough Assist"
(Philips
Respironics)
"NiPPY
Clearway"
(B&D
Electromedical)
"Pegaso"
(Dima)

Techniques
manuelles

Active cycle of
breathing
techniques,
(ACBT)
Drainage
Autogène

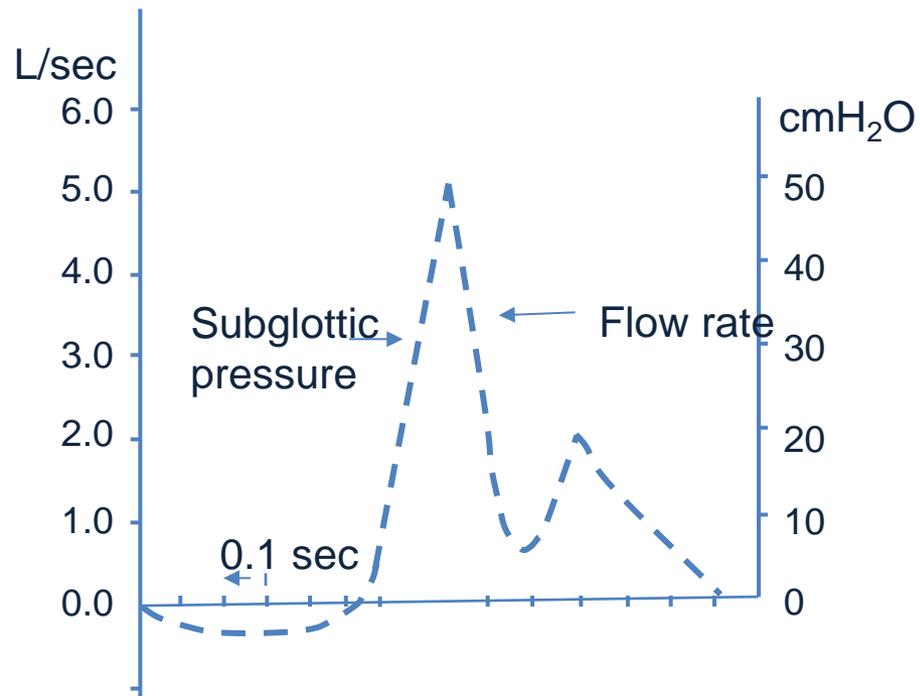
"PEP mask"
"Thera-PEP®"

"Flutter®"
"Acapella®"
"RC-Cornet™"
HFCWO: "Vest™"
"SmartVest™"

Volume de réserve inspiratoire

- Différentes techniques pour augmenter le VRI
 - Ventilateur
 - IPPB
 - Ballon d'insufflation

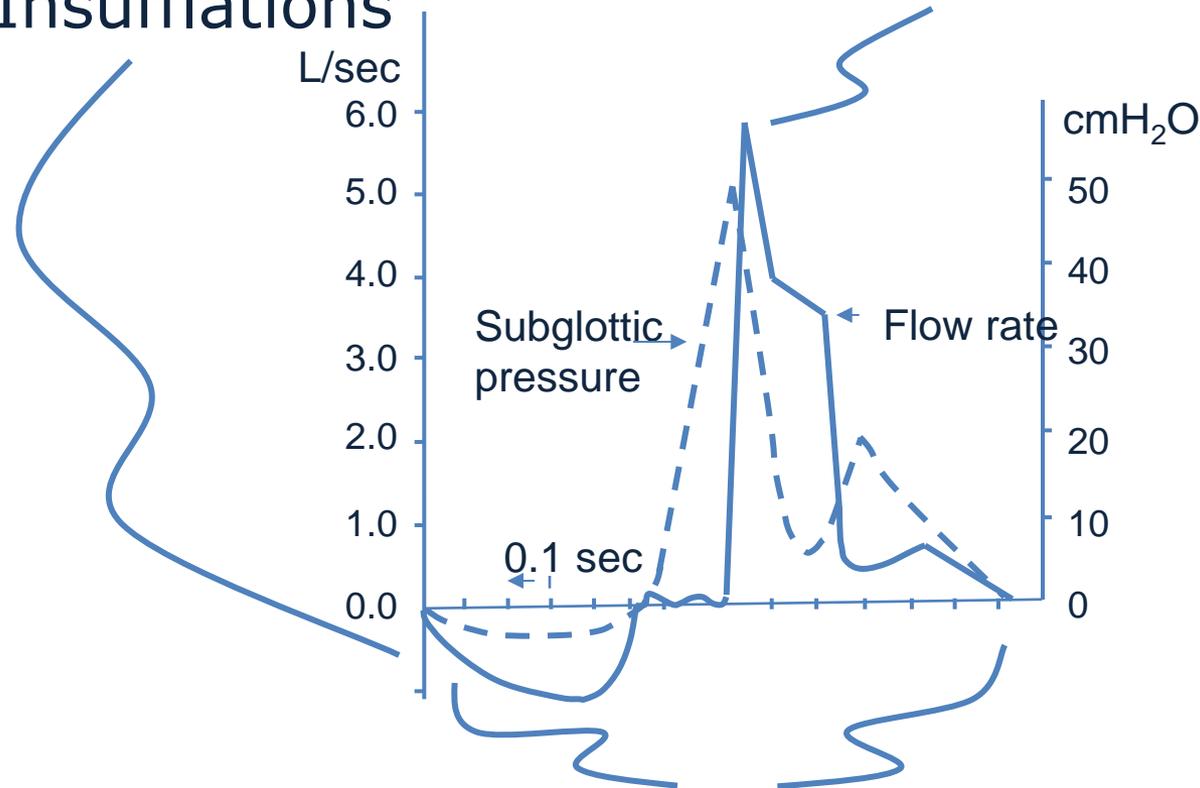
Augmentation de la toux



Augmentation de la toux

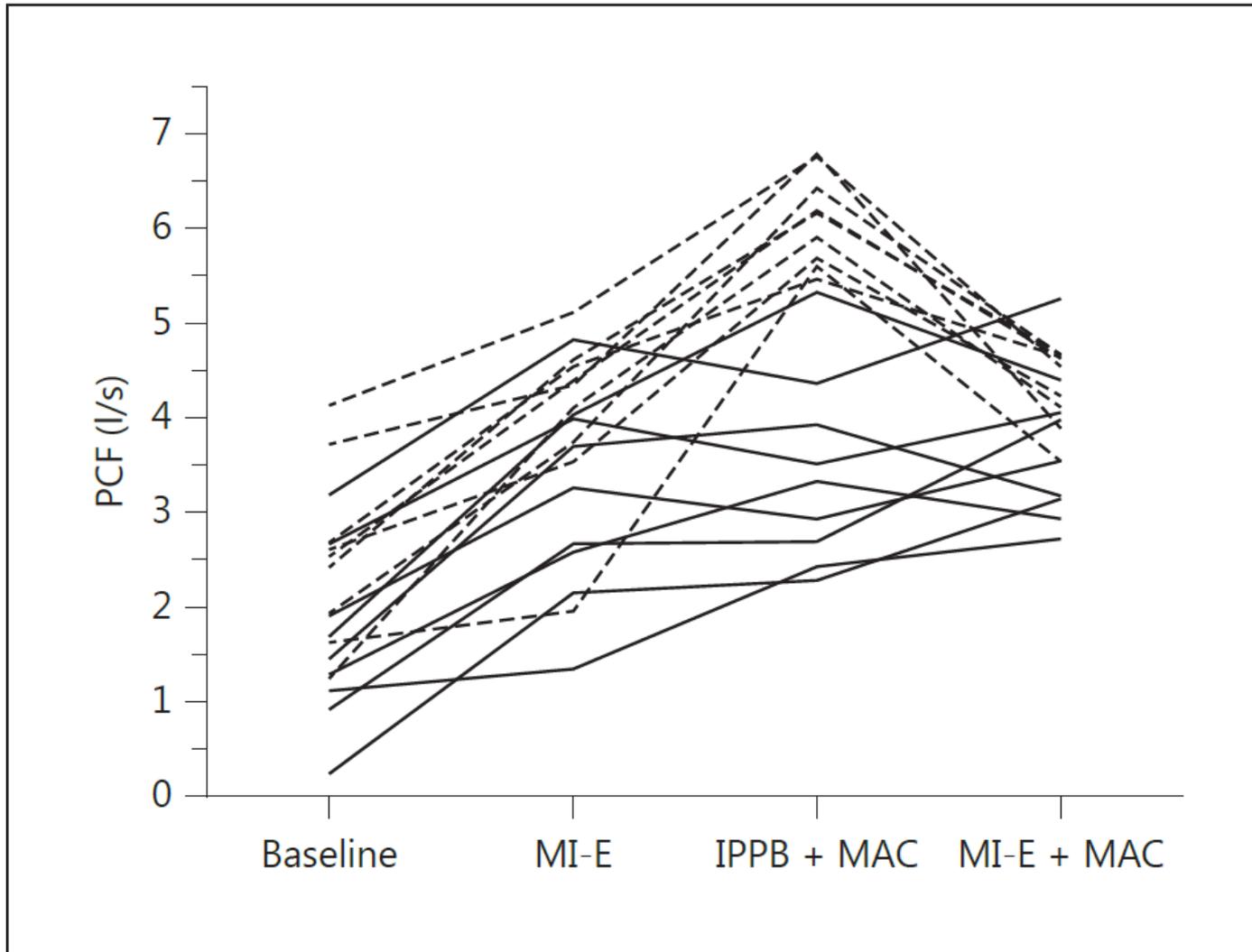
Breath Stacking, IPPB
Manuel / Mechanical
Insufflations

Assistance à la toux manuelle

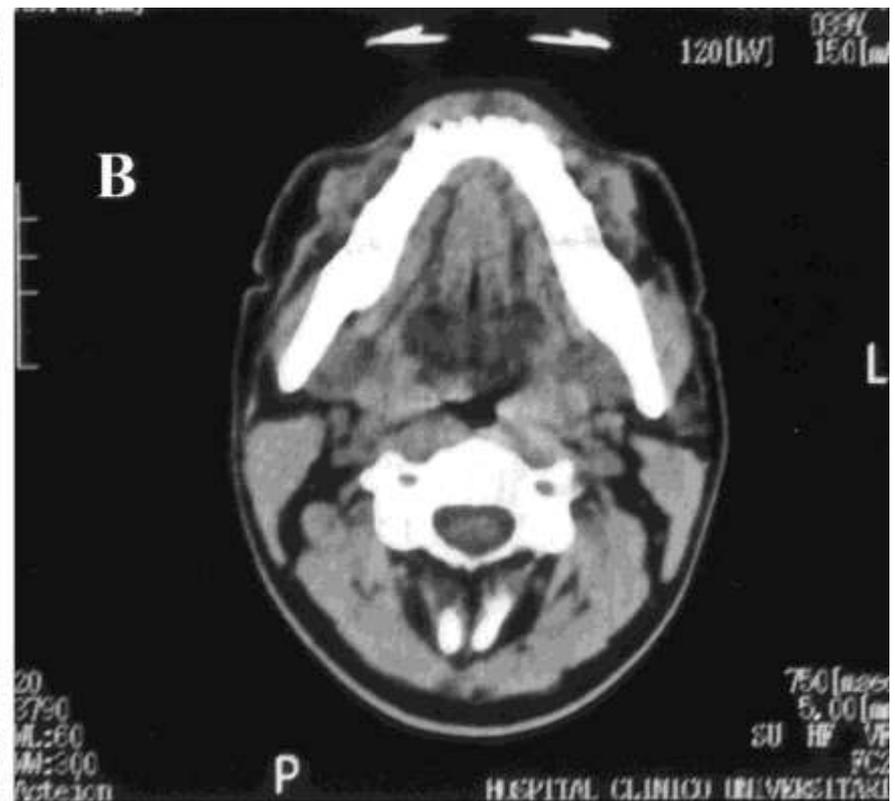
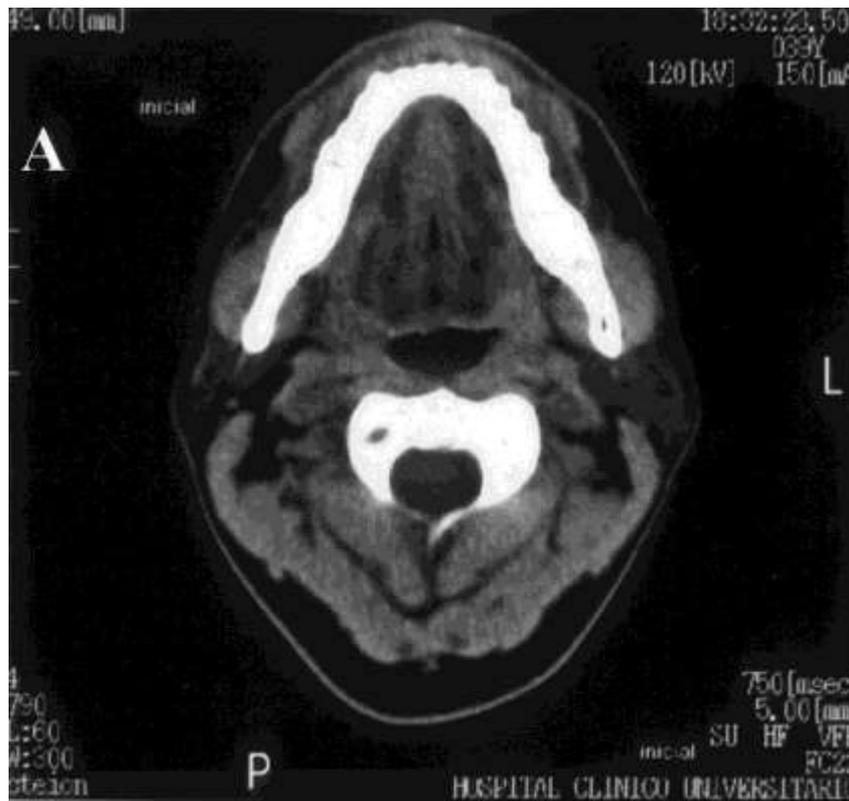


Mechanical Insufflation / Exsufflation

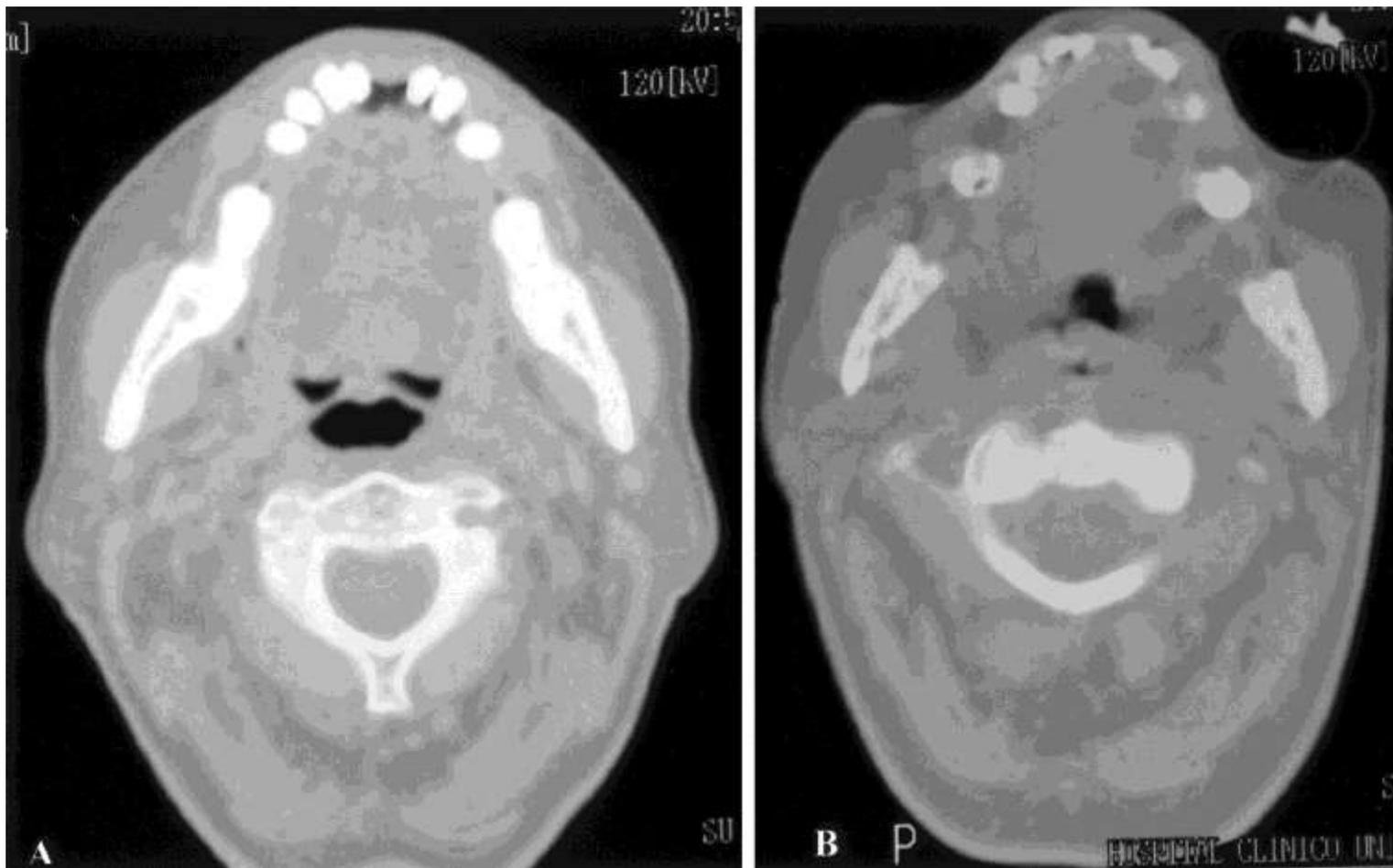
Quels appareils



Exsufflation chez un patient SLA



Avec atteinte bulbaire



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

Supplementay 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

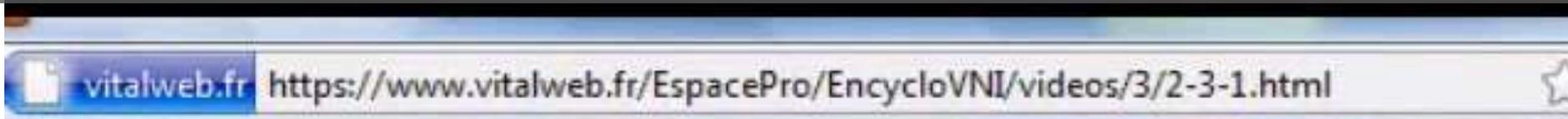
Laryngeal response patterns influence the efficacy
of mechanical assisted cough in
amyotrophic lateral sclerosis

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

Bagging



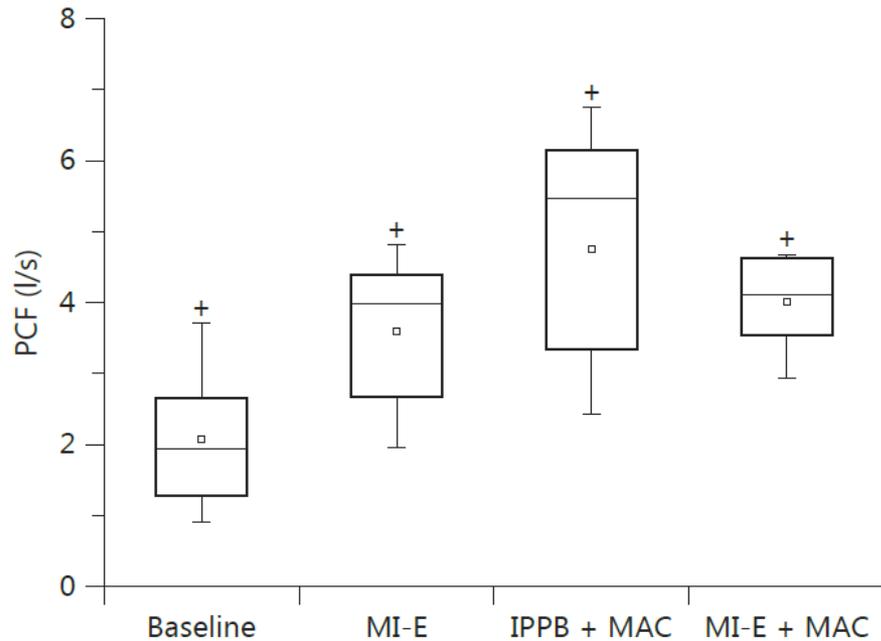
Ventilateur VS bagging

	Ventilator (<i>n</i> = 27)	Resuscitator Bag (<i>n</i> = 25)	<i>P</i>
Age, y	25.3 ± 5.1	24.7 ± 5.7	.60
BMI, kg/m ²	17 ± 6.5	17.1 ± 6.6	.96
FVC, mL	809 ± 555	807 ± 495	.99
FVC, % predicted	17 ± 10	16 ± 8	.95
P _{E_{max}} , cm H ₂ O	18.3 ± 10.9	17.7 ± 7.5	.82
CPF, L/min	132 ± 55	125 ± 52	.68
CPF _{MAC} , L/min	210 ± 55	205 ± 52	.74
NIV tidal volume, mL	716 ± 88	724 ± 92	.75
MIPPV use, <i>n</i>	19	16	NA
Vent-free time, h	7.2 ± 6.3	7 ± 5.5	.90

	Ventilator	Resuscitator Bag	<i>P</i>
Able to perform air stacking, <i>n</i> (%)	24/27 (89)	22/25 (88)	NA
Insufflations to maximal insufflation capacity, <i>n</i>	2.6 ± 0.6	1.8 ± 0.6	<.001
CPF _{AS} , L/min	199 ± 48	186 ± 50	.33
Maximal insufflation capacity, mL	1,481 ± 477	1,344 ± 520	.33
Expected expired volume, mL	1,770 ± 404	NA	NA
Ventilator leak, mL	289 ± 468	NA	NA
P _{E_{maxAS}} , cm H ₂ O	28 ± 10	26 ± 9	.45

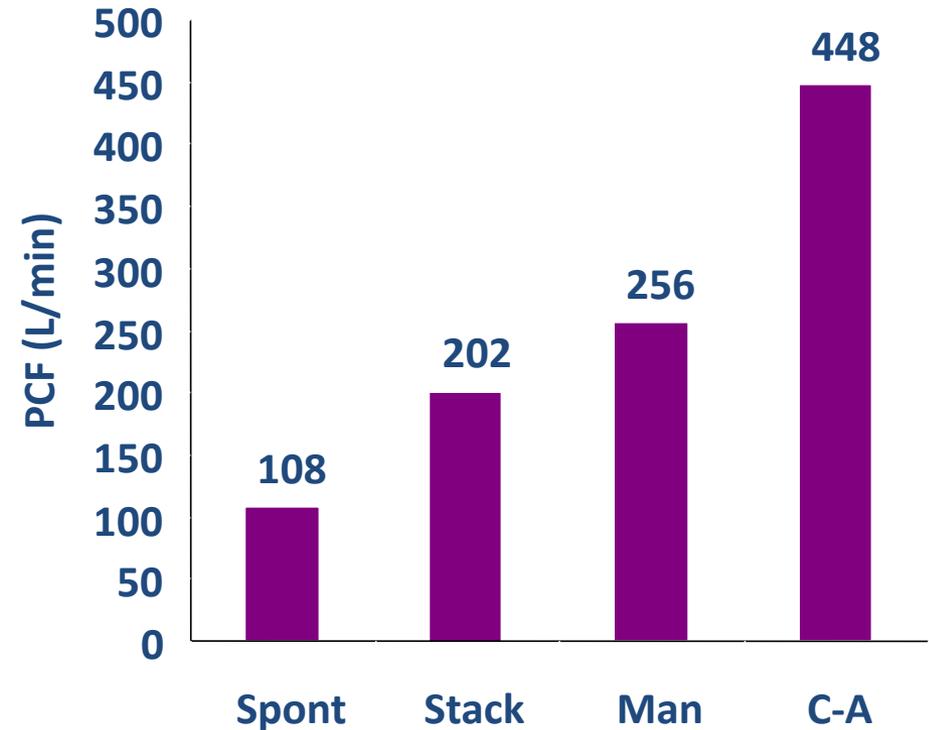
Comparaison des débits à la toux avec différentes techniques de toux assistée

- 18 patients restrictifs



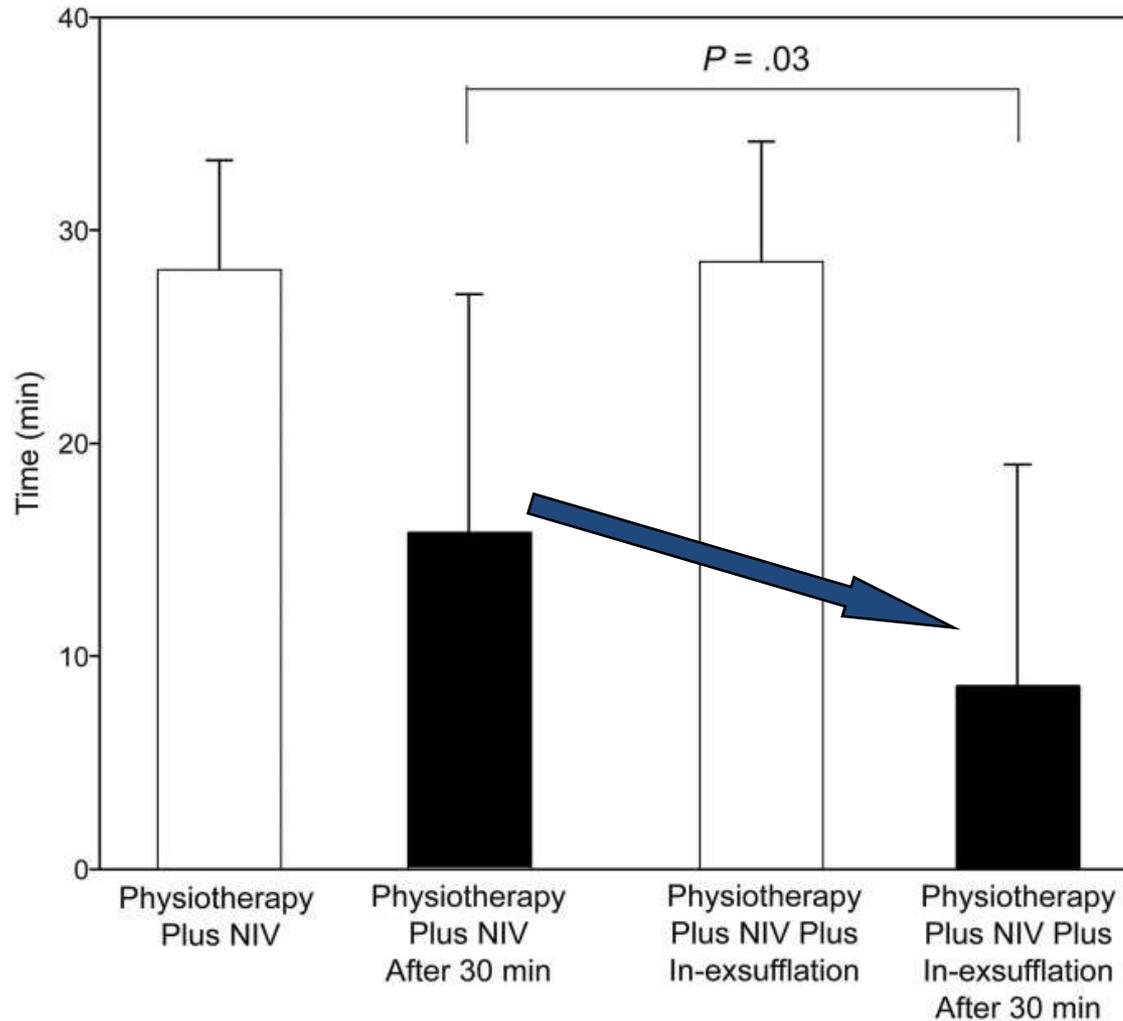
Lacombe; Respiration 2014

- 21 patients restrictifs



Bach; Chest 1993

Comparaison des débits à la toux avec différentes techniques de toux assistée



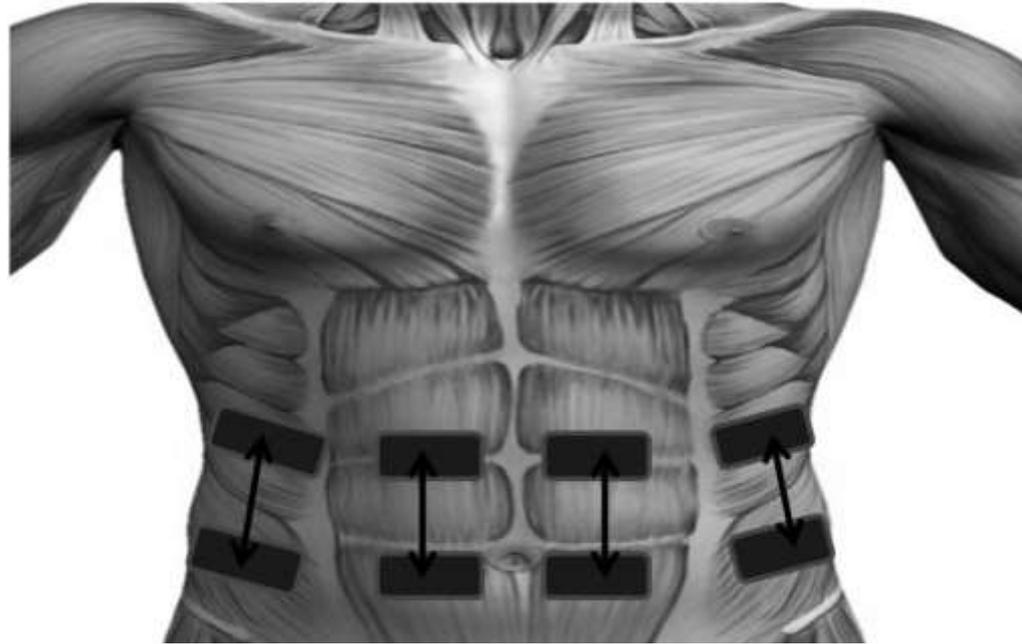
Exemple pratique



Le réglage du débit

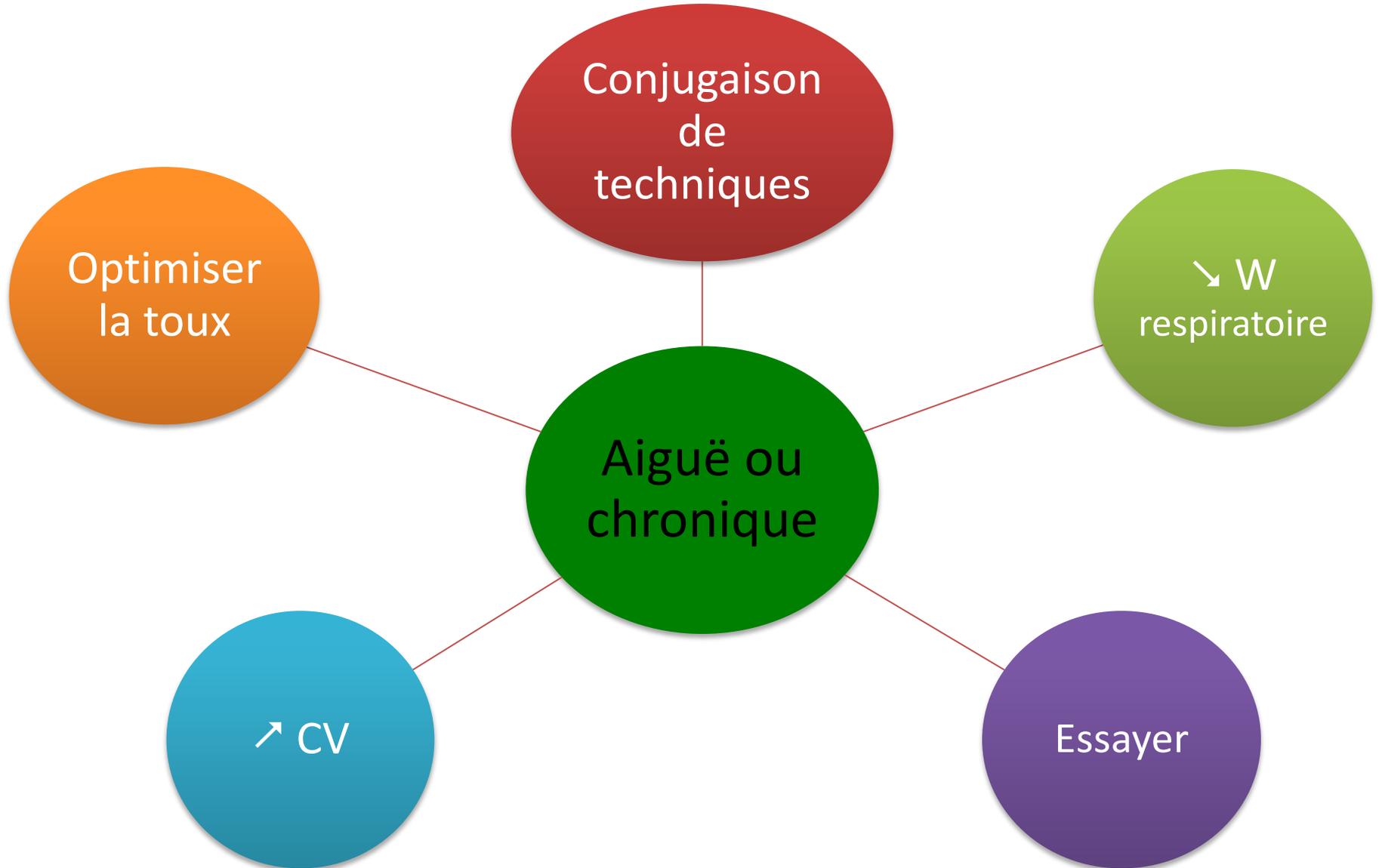


Le Futur?



Assessment Session	FVC (L)		PEF (L/s)	
	Unstimulated	Stimulated	Unstimulated	Stimulated
A0	1.60	1.84	1.97	2.18
A7	1.99	2.28	2.00	2.39

Conclusion cas clinique 1



Cas clinique 1'

- Patient SLA
- 55 ans
- Mise en place de VNI au long cours
- ~~• Référé pour évaluer nécessité de désencombrement instrumental~~
- En réanimation, intubé

RESEARCH

Open Access

Effects of mechanical insufflation-exsufflation in preventing respiratory failure after extubation: a randomized controlled trial

Miguel H Gonçalves^{1,2*}, Teresa Honrado², João Carlos Winck¹ and José Artur Paiva²

Étude randomisée, 75 patients ventilés plus de 48h, extubation conventionnelle *versus* extubation + MI-E (avant et après l'extubation) (+40cmH2O/-40cmH2O)

Table 2 Postextubation outcomes data

	Group A (n = 40)	Group B (MI-E) (n = 35)
NIV application, n (%)	20 (50%)	14 (40%)
Reasons for NIV (n)		
Respiratory rate > 35 beats/min	5 (25%)	9 (64%)
SpO ₂ < 90%	4 (20%)	1 (7%)
20% variation of HR or BP	1 (5%)	-
PaO ₂ < 60; PaCO ₂ >45	10 (50%)	4 (29%)
Total period of MV (days)	17.8 ± 6.4 ^a	11.7 ± 3.5 ^a
Patients reintubated (n, %)	19 (48%)	6 (17%) ^a

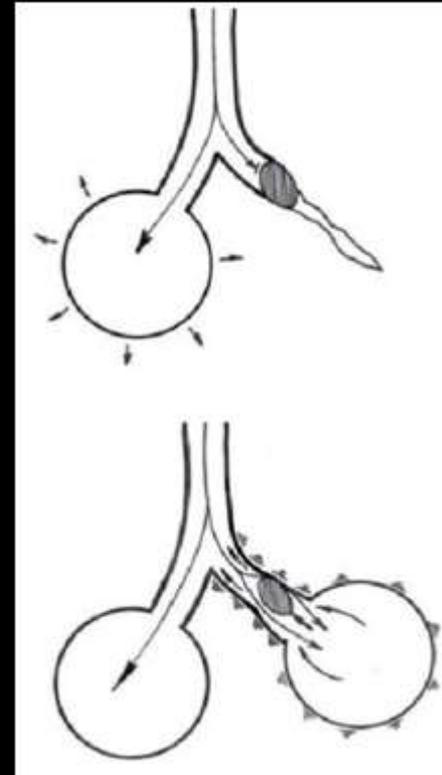


Des adjuvants indispensables aux techniques de désencombrement :

Les changements de posture

Les limites des techniques manuelles

- Pour qu'une technique expiratoire puisse drainer des sécrétions, il faut que l'inspiration précédente est emmenée de l'air dans le territoire encombré...
- « Ne manquer pas d'inspiration !! »
- Et utiliser des postures favorisant le recrutement pulmonaire



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



- *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)*



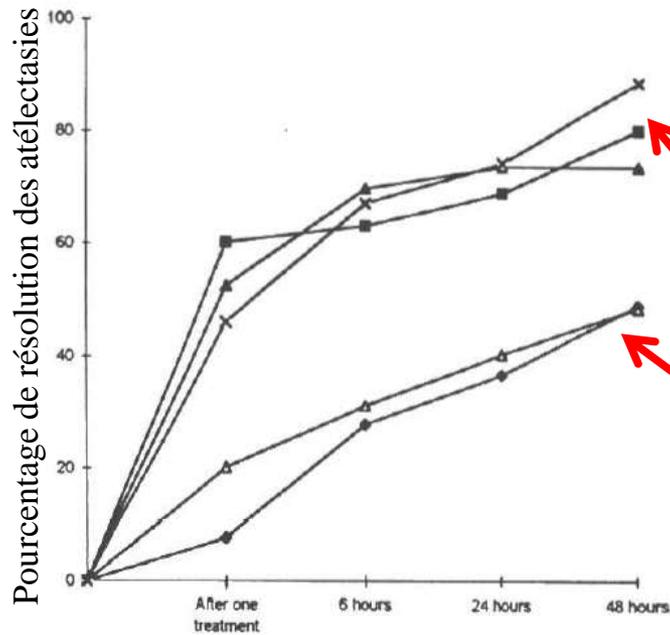
Traitement en cas d'atélectasie

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)

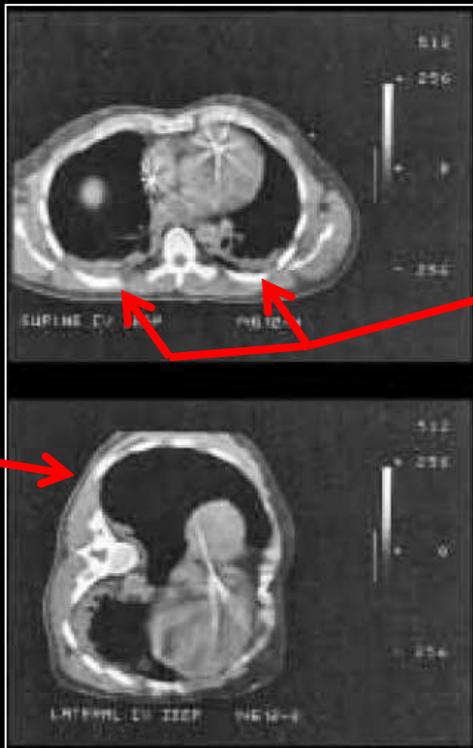


Groupes plusieurs séances
d'hyperinsufflation + décubitus
supra latéral +/- vibrations

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

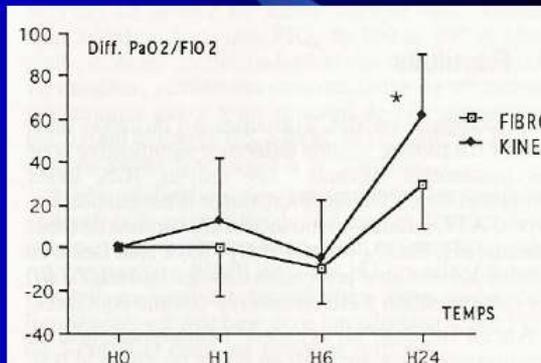
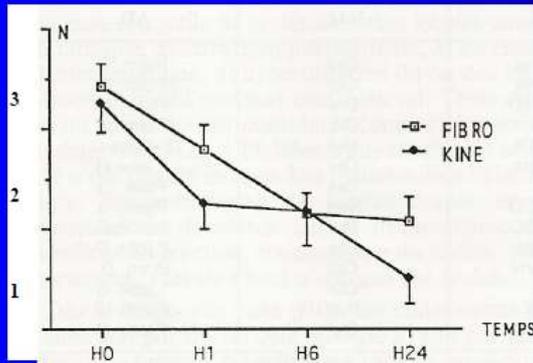
Acute lobar atelectasis: a prospective comparison of fiberoptic bronchoscopy and respiratory therapy.

Marini JJ, Pierson DJ, Hudson LD.

Am Rev Respir Dis 1979; 119:971-978

- 31 patients : atélectasie aigue
- Physiothérapie versus bronchoscopie
- Pas de différence, taux de réussite : 80% dans les 2 groupes

Fourrier F, Fourrier L, Lestavel P, et al. Acute lobar atelectasis in ICU patients: comparative randomized study of fiberoptic bronchoscopy versus respiratory therapy [abstract]. Intensive Care Med 1994; 20:S40



Nombre de lobes atteints

Rapport PaO₂/FIO₂

- Supériorité de l'association décubitus latéral + kinésithérapie respiratoire versus fibroscopie

Thoracic Ultrasound: Potential New Tool for Physiotherapists in Respiratory Management. A Narrative Review

Aymeric Le Neindre, Silvia Mongodi, François Philippart, Bélaïd Bouhemad

Journal of Critical Care

2015.

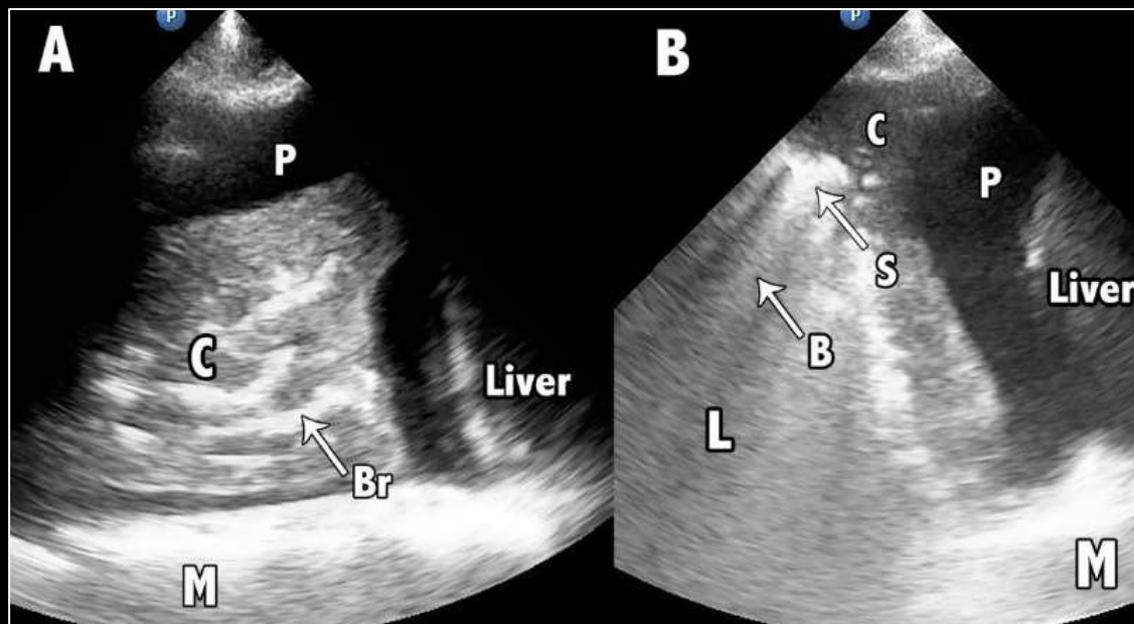
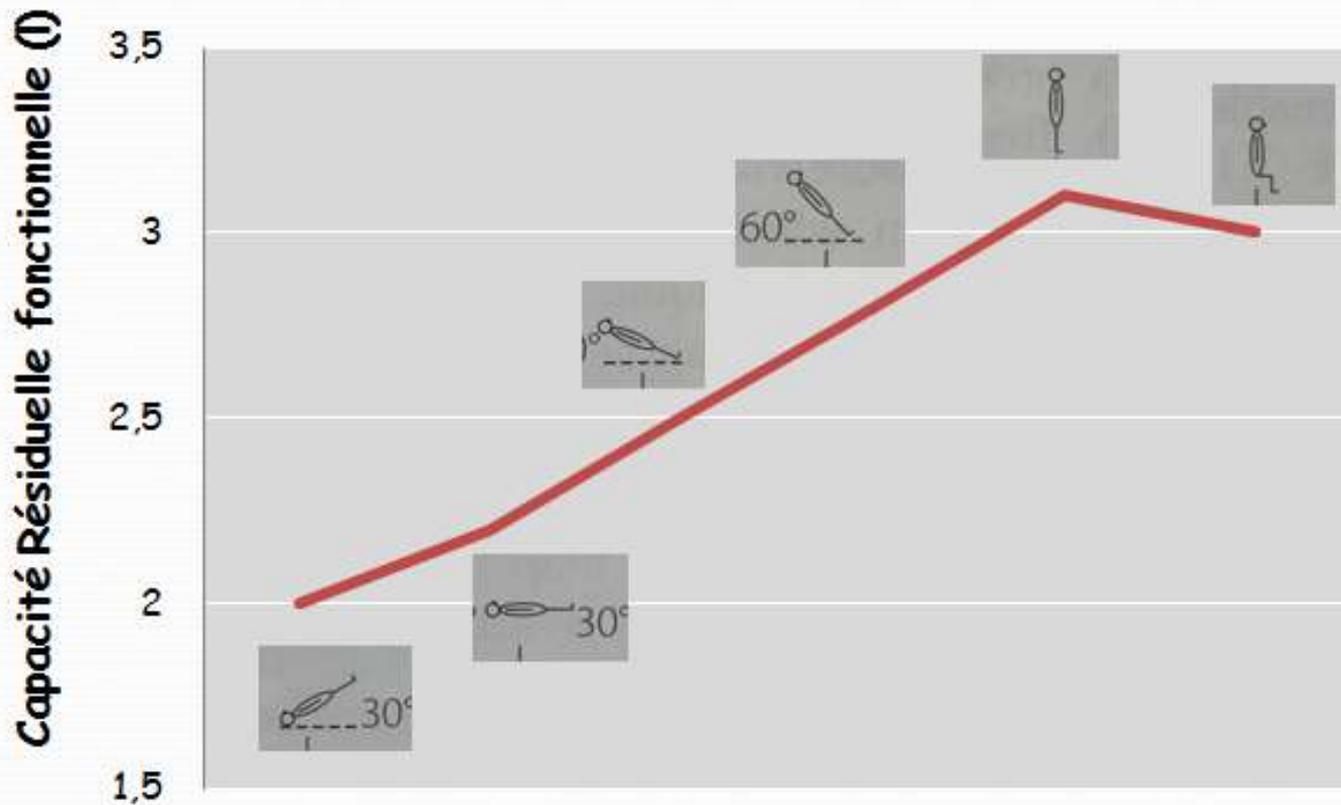


Fig. 4. Treatment of obstructive atelectasis with chest physiotherapy

C = consolidation; Br = air bronchogram; M = mediastinum; B = B-lines; L = lung; S = shred-sign; P = pleural effusion.

Se redresser pour mieux ventiler !!



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

Jean-Christophe M. Richard
Salvatore Maurizio Maggiore
Jordi Mancebo
François Lemaire
Bjorn Jonson
Laurent Brochard

Effects of vertical positioning on gas exchange and lung volumes in acute respiratory distress syndrome

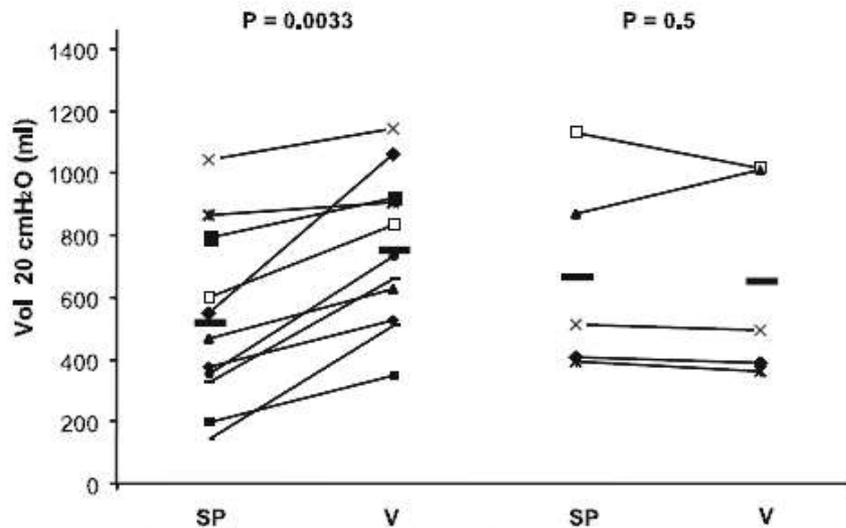
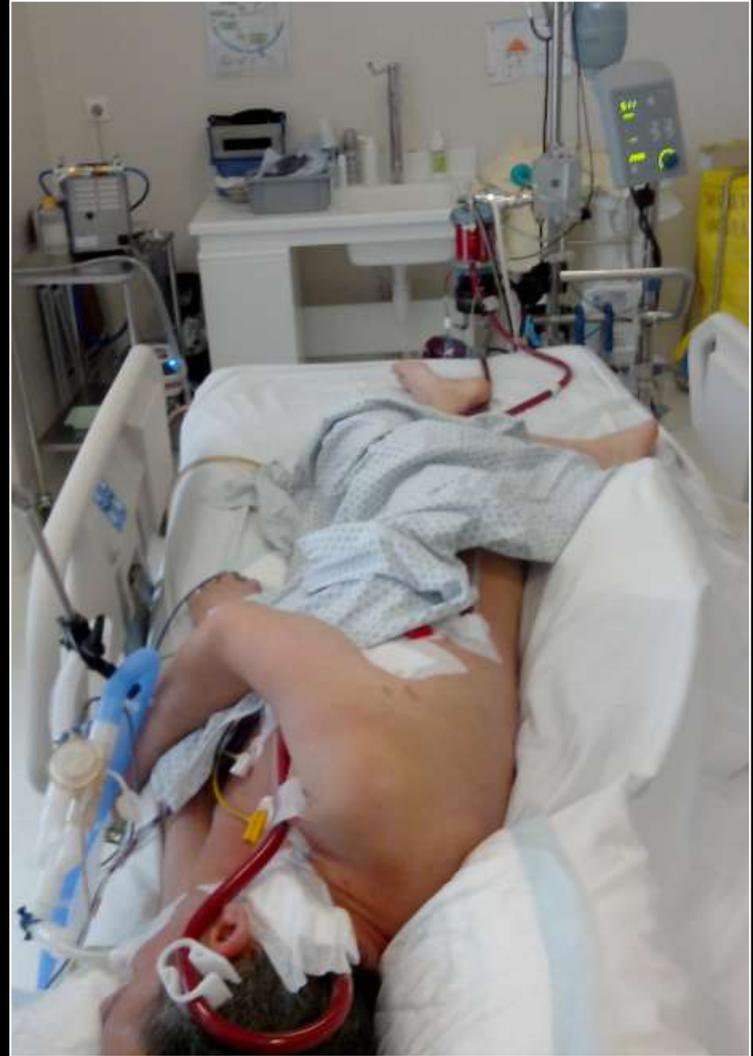


Fig. 1 Individual and mean (*bold*) values of volume measured at 20 cmH₂O (*Vol 20*) on the PV curve from PEEP, supine (*SP*) and in the vertical position (*V*) in responders (*left*) and nonresponders (*right*)



ELECTRONIC SUPPLEMENTARY MATERIAL

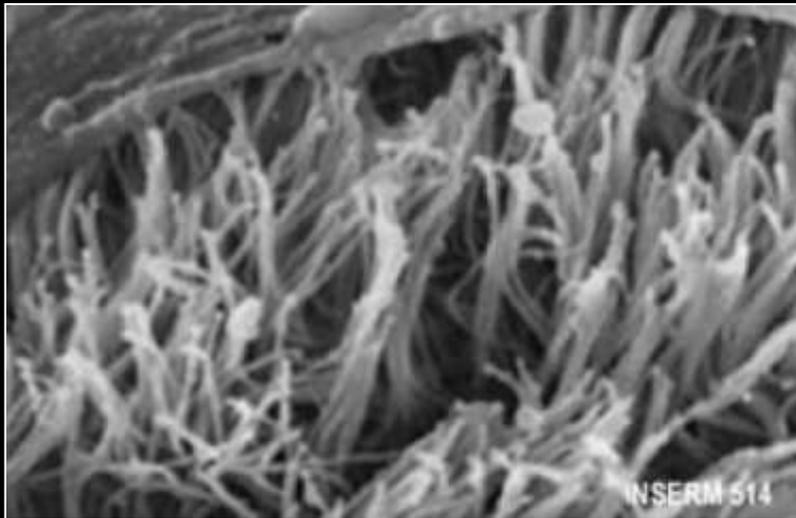


Cas clinique 2

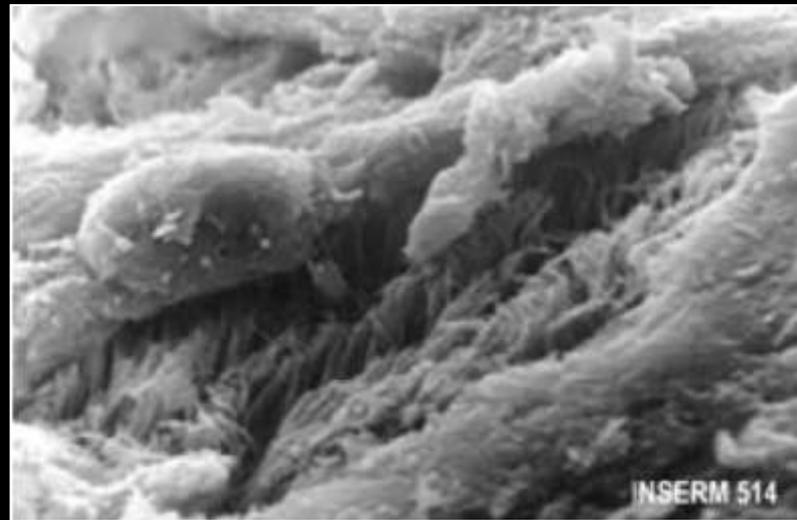
- Patient mucoviscidosique
- 25 ans
- En réanimation pour décompensation respiratoire aigue

Technique de désencombrement bronchique

- Avant toutes techniques, il est indispensable de s'intéresser à l'hygrométrie dans les voies aériennes

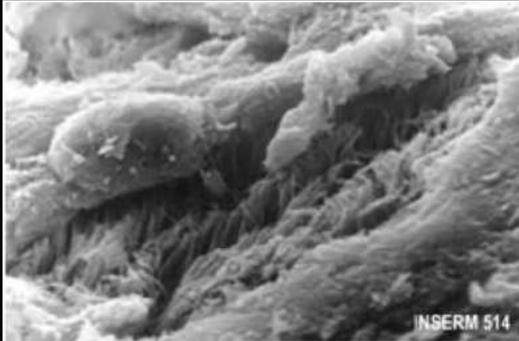


Mucus évacué par le tapis mucociliaire



Mucus épaissi, non évacué

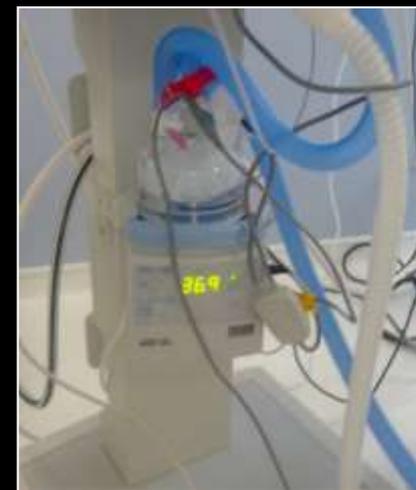
Technique de désencombrement bronchique



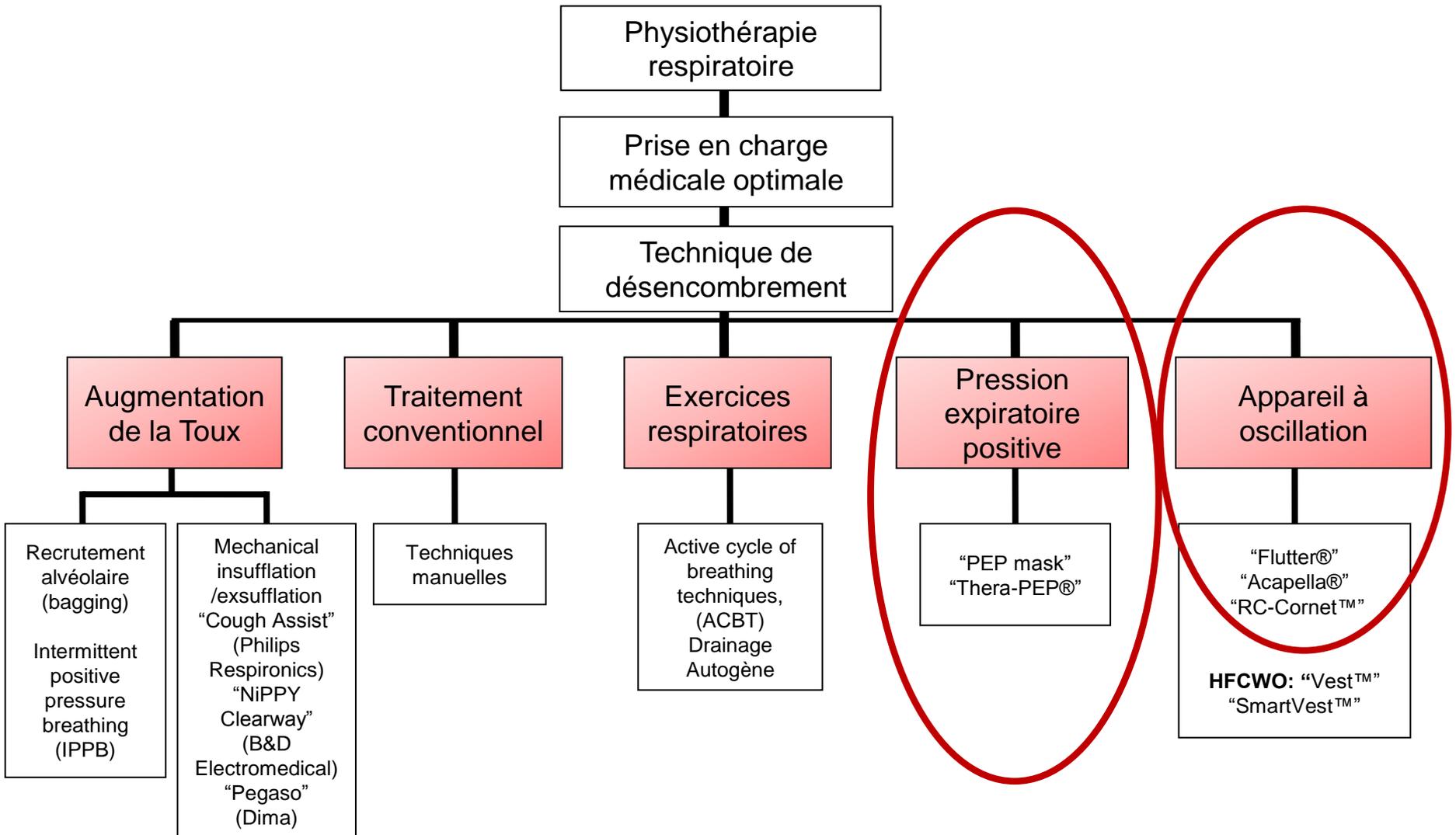
Mucus épaissi, non évacué



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

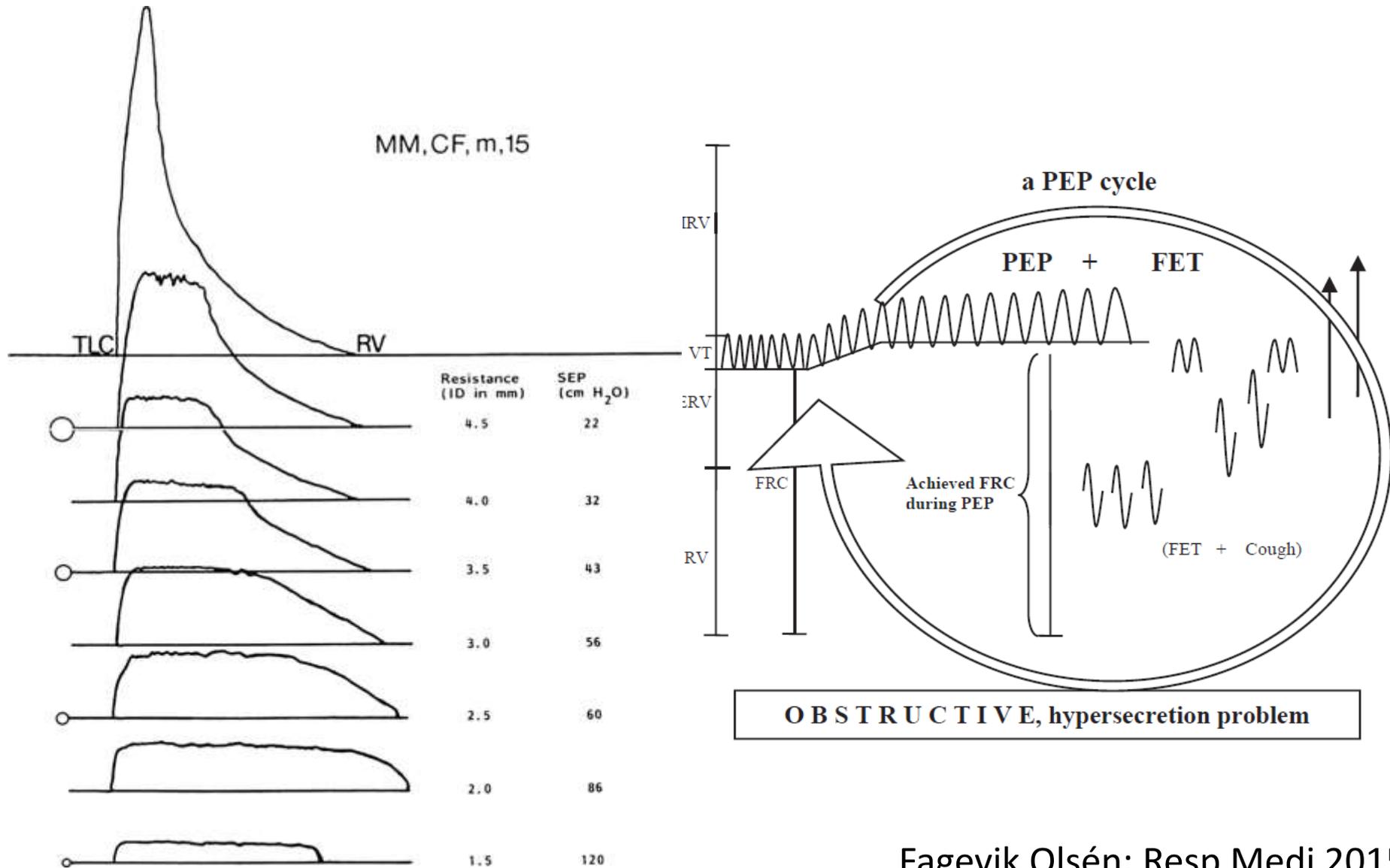


Méthodes de désencombrement

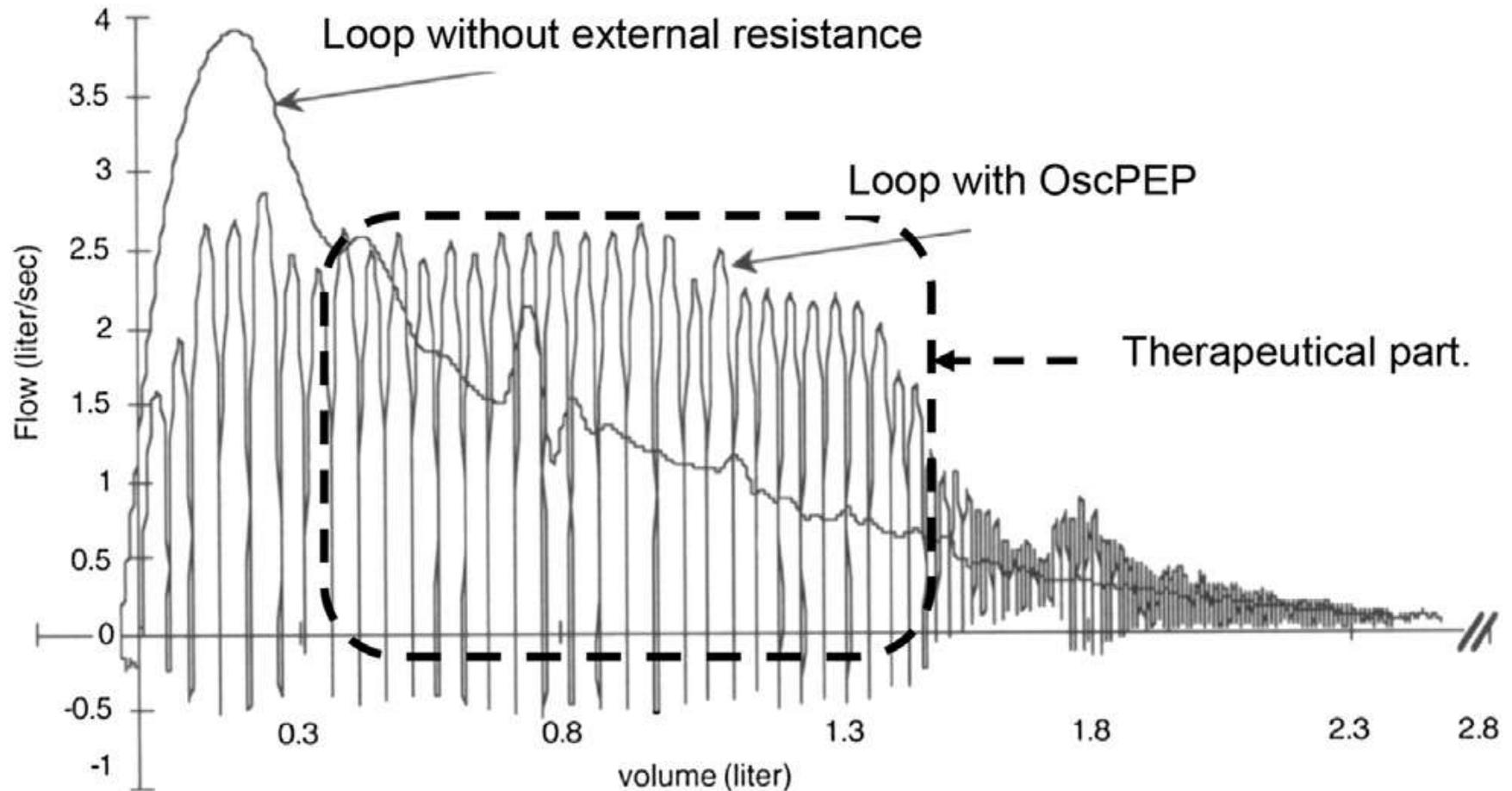


Pression Expiratoire Positive et Oscillations

Hi-PEP et syndrome obstructif



Oscillation - PEP et désencombrement



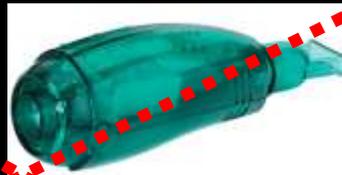
Chest Physiotherapy With Positive Airway Pressure:
A Pilot Study of Short-Term Effects on Sputum Clearance
in Patients With Cystic Fibrosis and Severe Airway Obstruction

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

CONCLUSIONS: There were no differences in

sputum clearance or pulmonary-function measures between mask PEP and short-term administration of either CPAP or NPPV combined with directed cough. After mask PEP these patients felt more tired than after CPAP or NPPV secretion-clearance therapy.



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

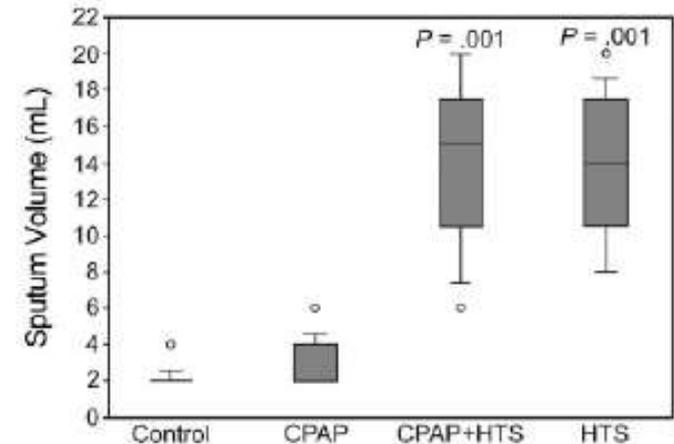


Fig. 2. Sputum volume after control (directed coughs), CPAP, CPAP plus hypertonic saline (HTS), and HTS alone.

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 Zerah, 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 Assuel MD, and Cesare Braggion MD

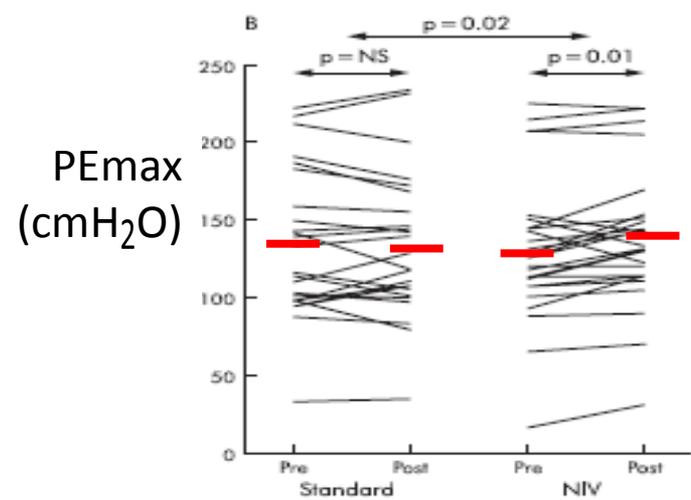
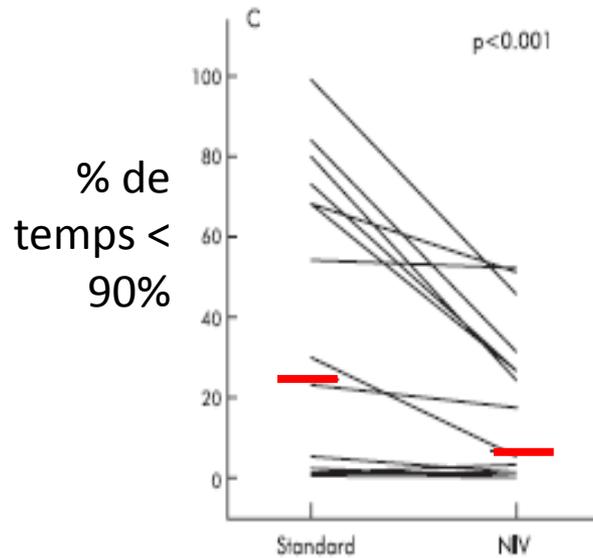
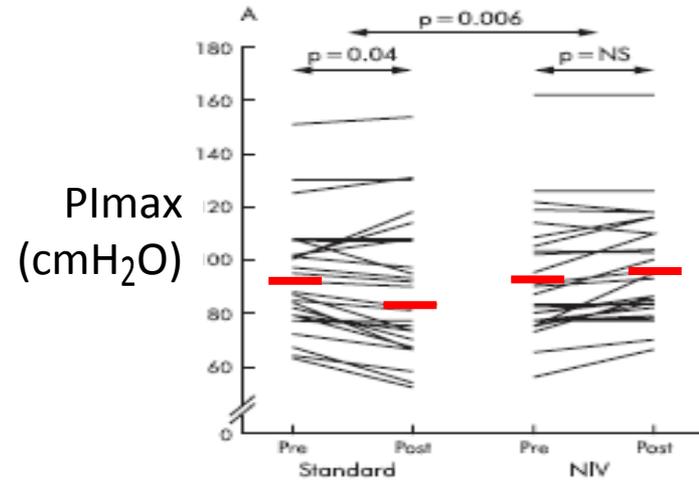
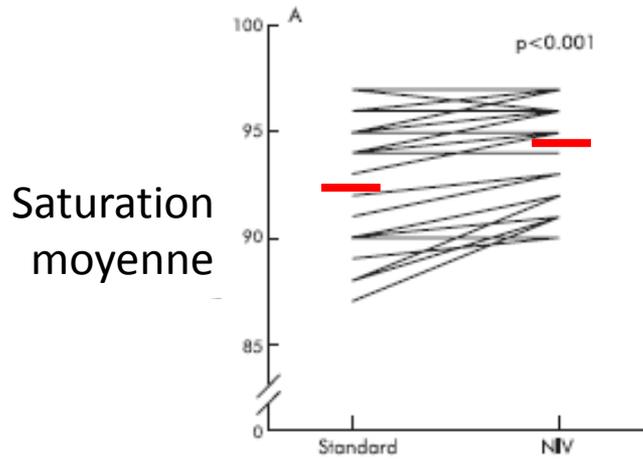
RESPIRATORY CARE • OCTOBER 2006 VOL 51 NO 10

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

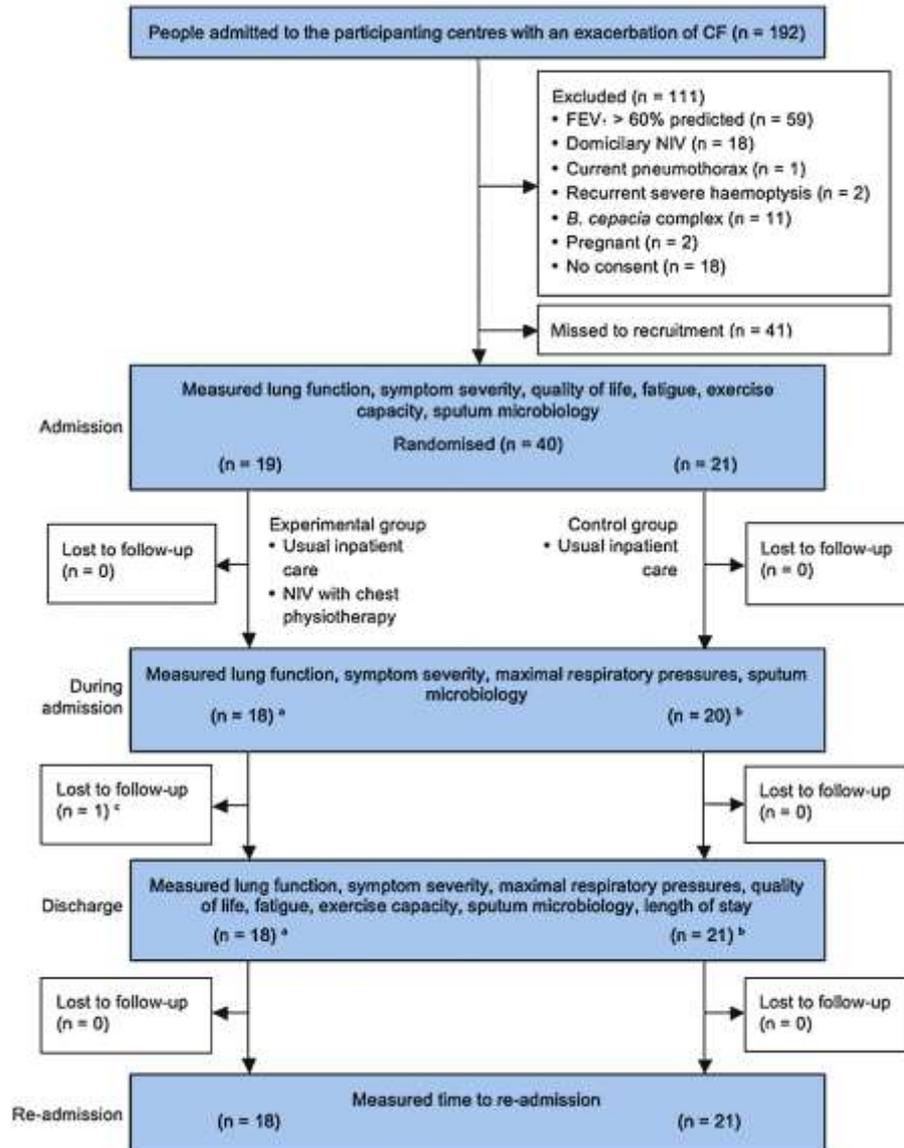


- Augmentation de la performance des muscles respiratoires et réduction des épisodes de désaturation pendant la séance
- Réduction de la dyspnée et séance décrite comme moins fatigante par les patients

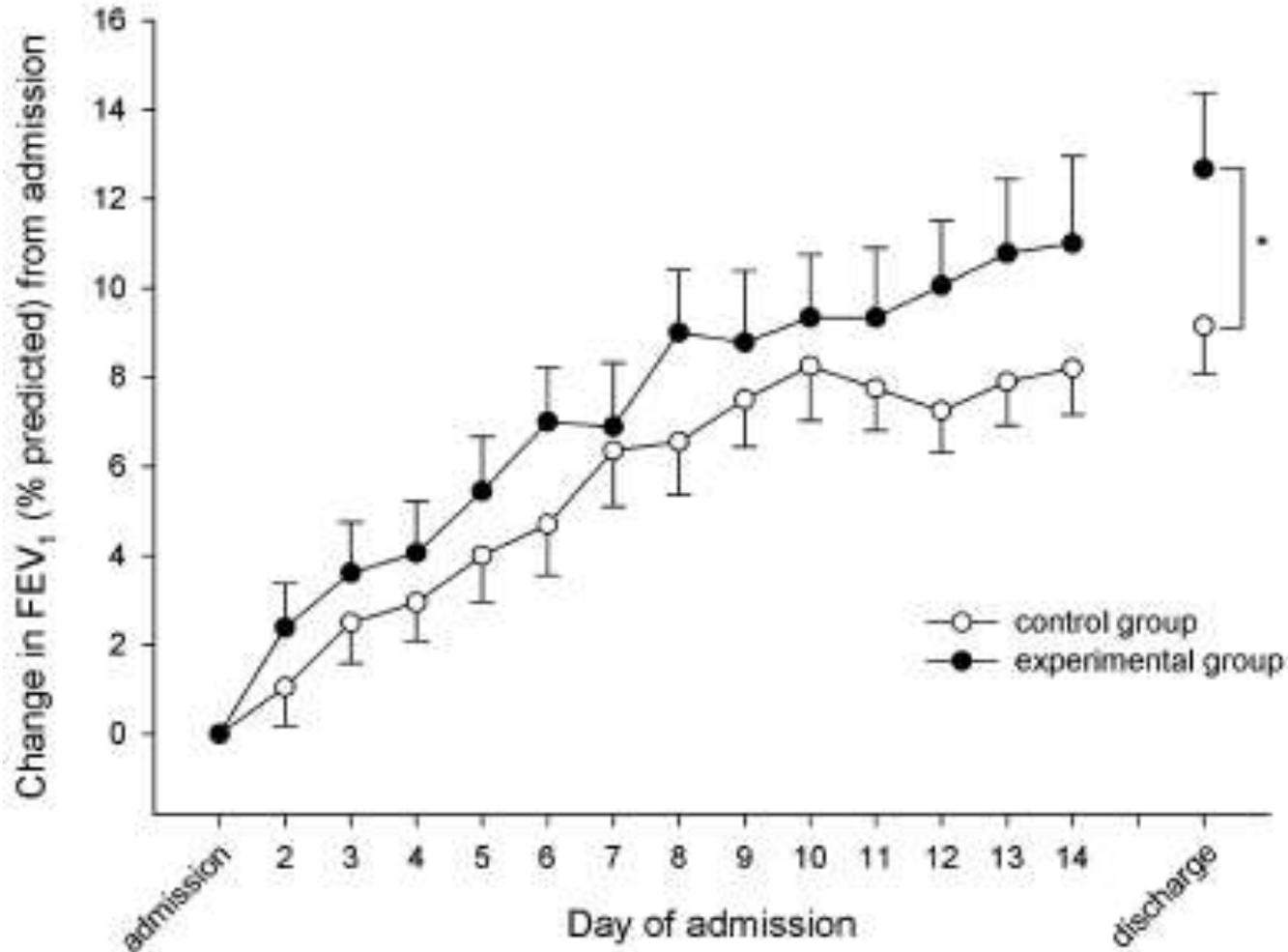
Mucoviscidose et VNI



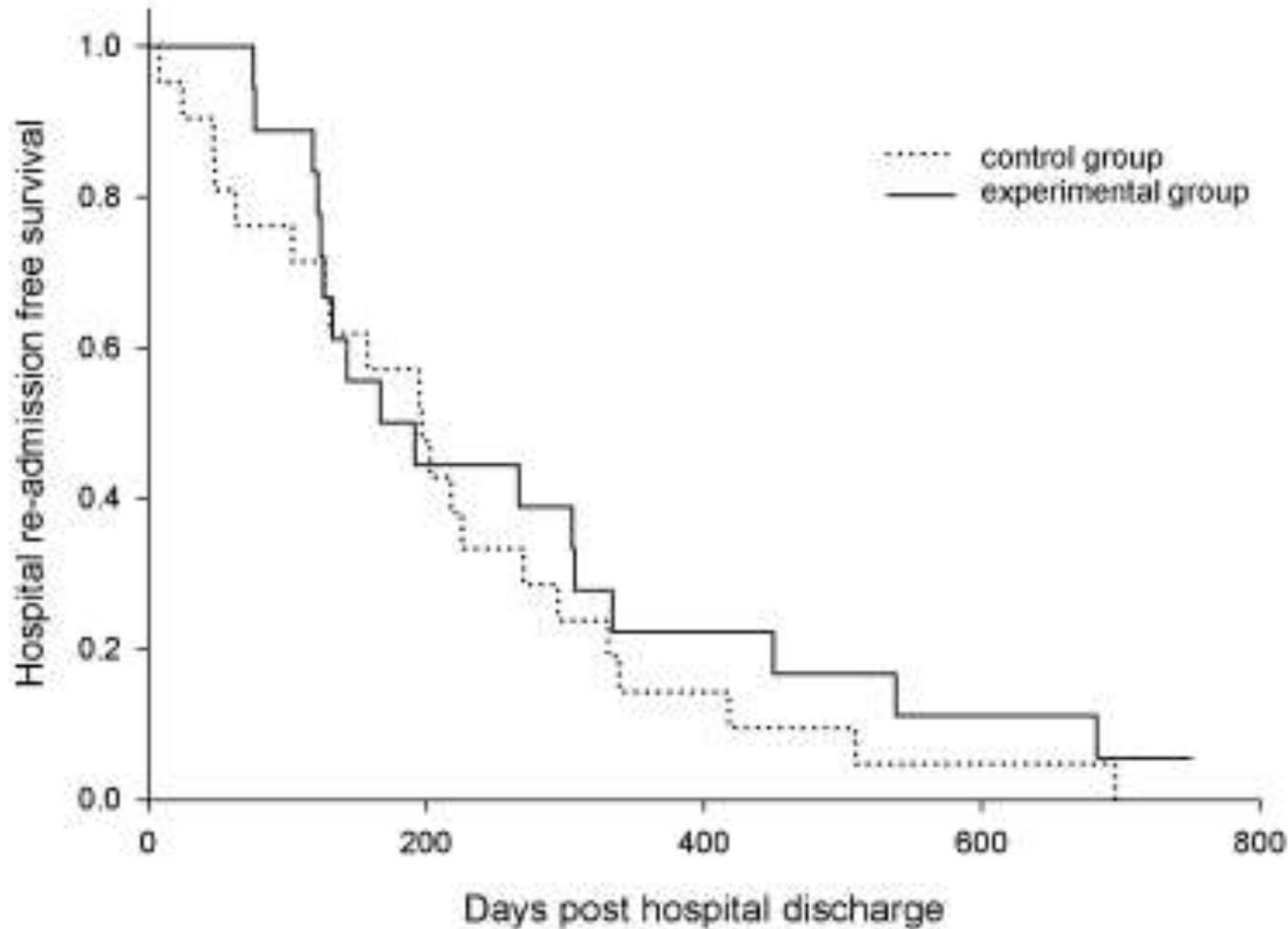
Désencombrement + VNI lors d'une exacerbation chez patient CF



Désencombrement + VNI lors d'une exacerbation chez patient CF



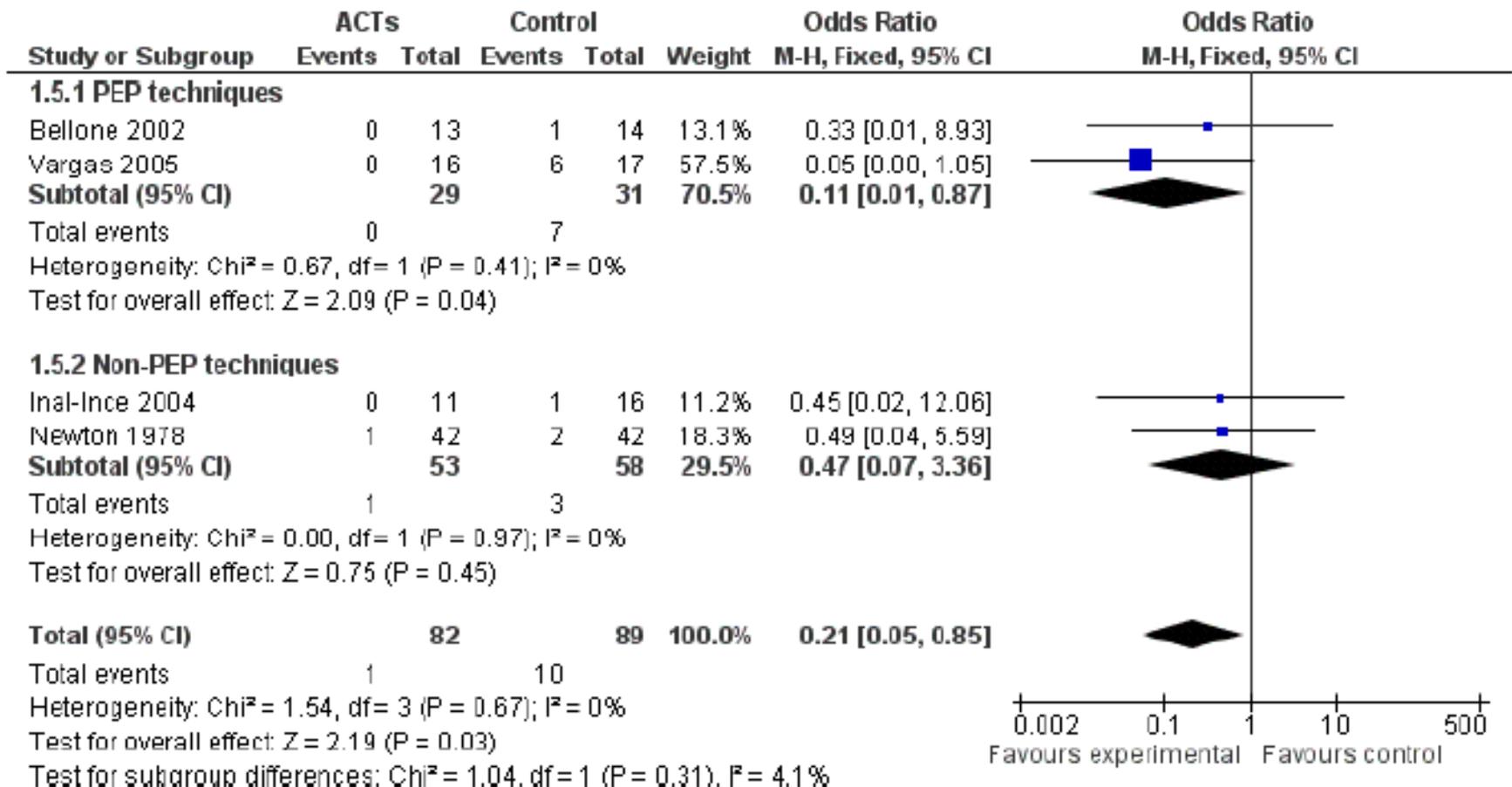
Désencombrement + VNI lors d'une exacerbation chez patient CF



Cas clinique 3

- Patient BPCO
- 65 ans
- En réanimation pour décompensation respiratoire aigue

Désencombrement et besoin d'augmenter la ventilation mécanique



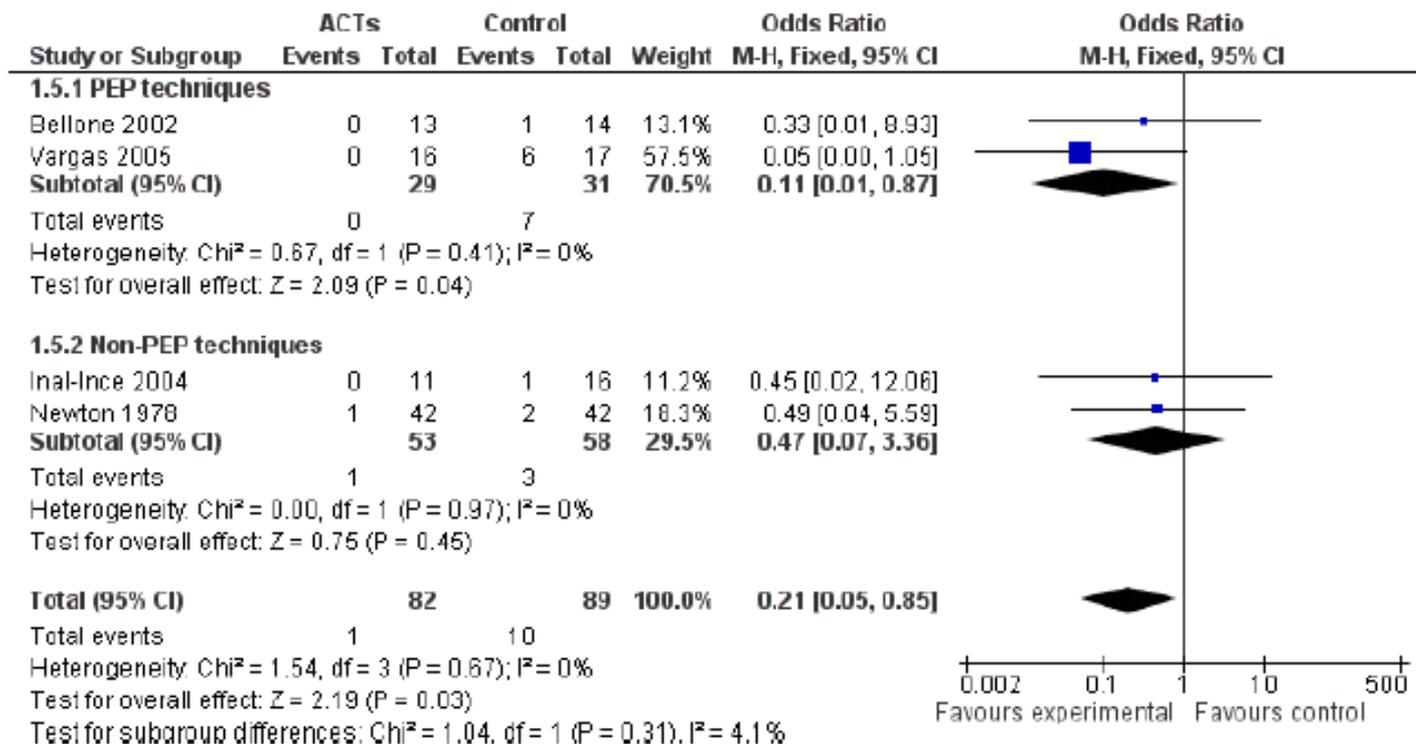
Airway clearance techniques for chronic obstructive pulmonary disease (Review)

Osadnik CR, McDonald CF, Jones AP, Holland AE

2012, Issue 3



Figure 4. Forest plot of comparison: 1 Acute COPD: ACTs vs no ACTs (control), outcome: 1.5 Need for increased ventilatory assistance (invasive or non-invasive).



BPCO et désencombrement instrumental

Changes in Lung Volumes, Gas Exchange, Dyspnoea and Quality of Life Scales, and Muscle Strength and Biochemical Parameters Before and After Treatment in the Three Groups.

	Control				IPPB				T-PEP				Difference between the two methods and control group (covariance analysis)	
	Before treatment		At the last treatment		Before treatment		At the last treatment		Before treatment		At the last treatment		IPPB	T-PEP
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	P-value	P-value
Age	70	6			70	9			73	6				
FVC%	63	11	57	14	58	11	67	12	63	11	70	12	<.001	<.001
FEV1%	30	7	28	8	37	9	44	11	31	11	38	11	<.01	<.05
FEV1/FVC	37	5	37	5	48	10	51	12	38	6	43	12	ns	ns
TLC%	130	23	139	20	128	31	117	28	154	31	127	19	<.05	<.001
RV%	208	68	212	62	203	34	171	33	287	75	217	46	ns	<.01
DLCO%	49	18	46	16	54	11	55	12	54	22	56	21	ns	ns
MIP, kPa	5	1	4	1	4	2	5	2	3	2	4	2	<.01	ns
MEP, kPa	5	1	5	1	5	2	6	2	4	2	6	4	ns	<.05
PaO ₂ , mmHg	64	8	63	8	66	11	68	6	72	8	74	7	ns	ns
PaCO ₂ , mmHg	46	9	46	9	48	6	48	6	45	10	43	9	ns	ns
pH	7	0	7	0	7	0	7	0	7	0	7	0	ns	ns
MRC	3	1	4	1	4	0	3	1	4	0	4	1	<.001	<.05
CAT	27	6	27	6	26	7	18	7	27	6	20	7	<.001	<.05
BCSS	5	2	5	2	6	2	3	1	6	2	4	2	ns	ns
Red cells	4 507 250	281 847	3 938 250	1 420 499	4 644 875	525 462	4 444 625	301 775	4 485 000	365 865	4 548 000	397 043	ns	ns
White cells	8714	1616	8795	1764	8081	1100	8571	689	8670	1254	8344	1461	ns	ns
Lymphocytes	2959	546	2969	634	1849	340	1918	248	2691	925	2435	831	ns	ns
C-r prot	0	0	0	0	0	0	0	0	1	0	0	0	ns	ns
γ-Globul	12	1	13	1	13	2	12	2	12	1	12	1	ns	ns

BPCO et désencombrement instrumental

	IPPB				T-PEP				Difference between IPPB and T-PEP (covariance analysis)
	Before treatment		At the last treatment		Before treatment		At the last treatment		
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	P-value
Age	70	9			73	6			
FVC%	58	11	67	12	63	11	70	12	ns
FEV1%	37	9	44	11	31	11	38	11	ns
FEV1/FVC	48	10	51	12	38	6	43	12	ns
TLC%	128	31	117	28	154	31	127	19	ns
RV%	203	34	171	33	287	75	217	46	ns
DLCO%	54	11	55	12	54	22	56	21	ns
MIP, kPa	4	2	5	2	3	2	4	2	ns
MEP, kPa	5	2	6	2	4	2	6	4	ns
PaO ₂ , mmHg	66	11	68	6	72	8	74	7	ns
PaCO ₂ , mmHg	48	6	48	6	45	10	43	9	ns
pH	7	0	7	0	7	0	7	0	ns
MRC	4	0	3	1	4	0	4	1	<.05
CAT	26	7	18	7	27	6	20	7	<.01
BCSS	6	2	3	1	6	2	4	2	ns
Red cells	4 644 875	525 462	4 444 625	301 775	4 485 000	365 865	4 548 000	397 043	ns
White cells	8081	1100	8571	689	8670	1254	8344	1461	ns
Lymphocytes	1849	340	1918	248	2691	925	2435	831	ns
C-r prot	0	0	0	0	1	0	0	0	ns
γ-Globul	13	2	12	2	12	1	12	1	ns

Comparison of Intermittent Positive Pressure Breathing and Temporary Positive Expiratory Pressure in Patients With Severe Chronic Obstructive Pulmonary Disease[☆]

Antonello Nicolini,^{a,*} Elena Mollar,^a Bruna Grecchi,^b Norma Landucci^a

Arch Bronconeumol. 2014;**50**(1):18–24

Table 1
Changes in Lung Volumes, Gas Exchange, Dyspnoea and Quality of Life Scales, and Muscle Strength and Biochemical Parameters Before and After Treatment in the Three Groups.

	Control				IPPB				T-PEP				Difference between the two methods and control group (covariance analysis)	
	Before treatment		At the last treatment		Before treatment		At the last treatment		Before treatment		At the last treatment		IPPB	T-PEP
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	P-value	P-value
Age	70	6			70	9			73	6				
FVC%	63	11	57	14	58	11	67	12	63	11	70	12	<.001	<.001
FEV1%	30	7	28	8	37	9	44	11	31	11	38	11	<.01	<.05
FEV1/FVC	37	5	37	5	48	10	51	12	38	6	43	12	ns	ns
TLC%	130	23	139	20	128	31	117	28	154	31	127	19	<.05	<.001
RV%	208	68	212	62	203	34	171	33	287	75	217	46	ns	<.01
DLCO%	49	18	46	16	54	11	55	12	54	22	56	21	ns	ns
MIP, kPa	5	1	4	1	4	2	5	2	3	2	4	2	<.01	ns
MEP, kPa	5	1	5	1	5	2	6	2	4	2	6	4	ns	<.05
PaO ₂ , mmHg	64	8	63	8	66	11	68	6	72	8	74	7	ns	ns
PaCO ₂ , mmHg	46	9	46	9	48	6	48	6	45	10	43	9	ns	ns
pH	7	0	7	0	7	0	7	0	7	0	7	0	ns	ns
MRC	3	1	4	1	4	0	3	1	4	0	4	1	<.001	<.05
BNP	27	6	27	6	26	7	18	7	27	6	20	7	ns	ns
BCSS	5	2	5	2	6	2	3	1	6	2	4	2	ns	ns
Red cells	4507	250	3938	250	4644	875	4444	625	4485	000	4548	000	ns	ns
White cells	8714	1616	8795	1764	8081	1100	8571	689	8670	1254	8344	1461	ns	ns
Lymphocytes	2959	546	2969	634	1849	340	1918	248	2691	925	2435	831	ns	ns
C-r prot	0	0	0	0	0	0	0	0	1	0	0	0	ns	ns
γ-Globul	12	1	13	1	13	2	12	2	12	1	12	1	ns	ns

FVC, forced vital capacity; BCS, breathless cough sputum score; DLCO, lung diffusing for carbon monoxide; FEV1, forced expiratory volume 1 s; PaO₂, oxygen arterial pressure; C-r prot, C reactive protein; FEV1/FVC, ratio; PaCO₂, carbon dioxide arterial pressure; γ-globul, gamma globulin; TLC, total lung capacity; MRC, Medical Research Council scale; MIP, maximal inspiratory pressure; RV, residual volume; CAT, COPD assessment test; MEP, maximal expiratory pressure; IPPB, intermittent positive pressure breathing; T-PEP, temporary positive expiratory pressure; ns, not significant.

Limites des insufflations chez les patients 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 (0.4–2.94)	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 (0.20–1.31)	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)	0.49 (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 (0.2–1.31)	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).

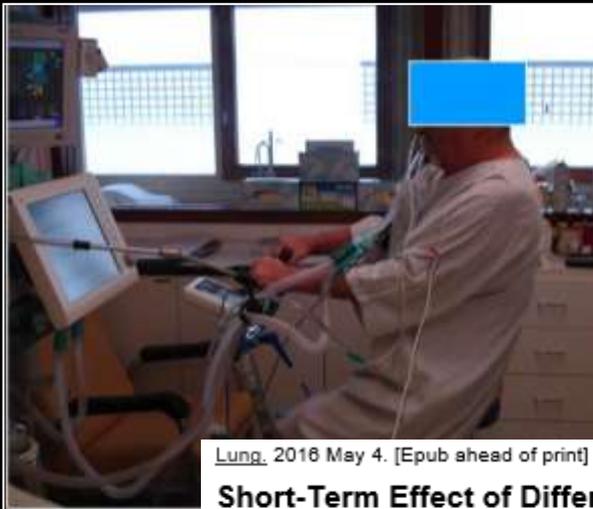
*p<0.01.

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

P Sivasothy, L Brown, I E Smith, J M Shneerson

Thorax 2001;56:438–444

Privilégier la réhabilitation (qui participera au désencombrement !!)



Lung. 2016 May 4. [Epub ahead of print]

Short-Term Effect of Different Physical Exercises and Physiotherapy Combinations on Sputum Expectoration, Oxygen Saturation, and Lung Function in Young Patients with Cystic Fibrosis.

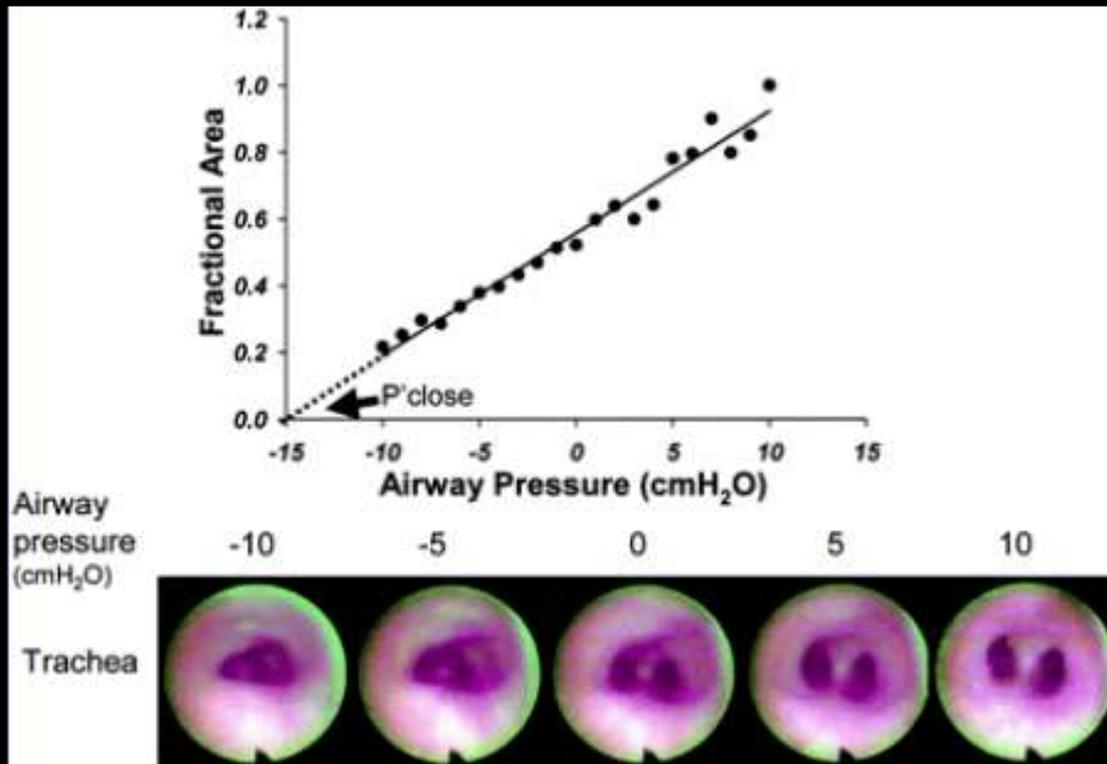
Kriemler S¹, Radtko T², Christen G³, Kerstan-Huber M⁴, Hebestreit H⁵.

Cas clinique 4

- Patient présentant une dyskinésie trachéobronchique

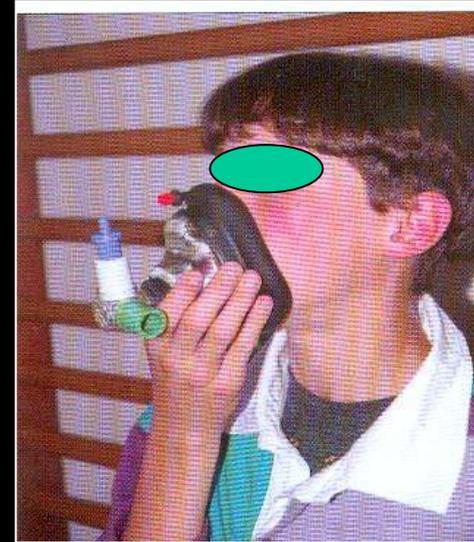
Dyskinésie trachéobronchique et trachéobronchomalacie

- Un traitement : la pression positive



Dyskinésie trachéobronchique et trachéobronchomalacie

- En pratique : utiliser un frein expiratoire

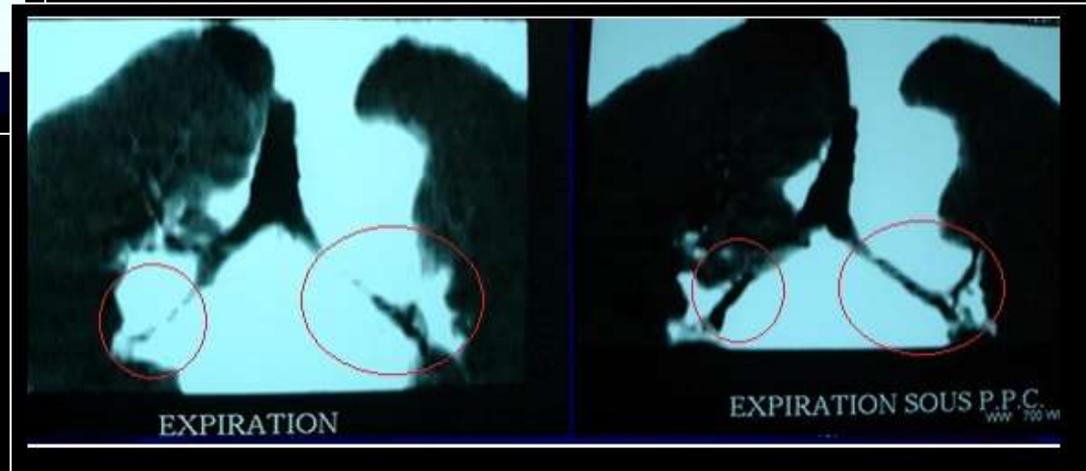
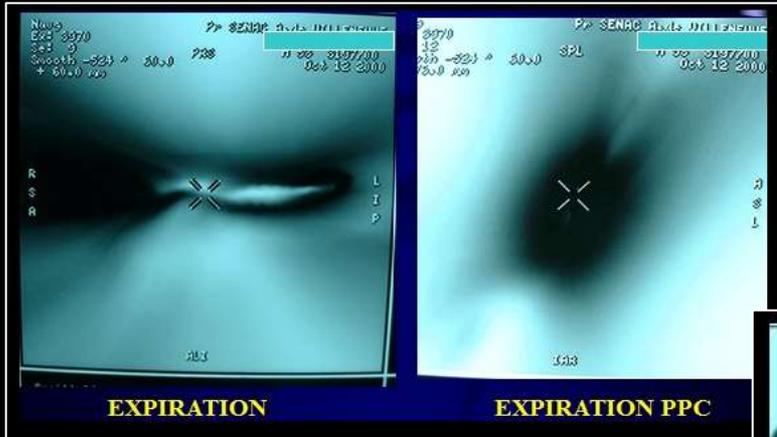


Sirithangkul S, Ranganathan S, Robinson PJ, Robertson CF. **Positive expiratory pressure to enhance cough effectiveness in tracheomalacia.** J Med Assoc Thai. 2010 Nov;93 Suppl 6:S112-8.

Intérêt de la PPC en aide au désencombrement chez le patient présentant une trachéo-bronchomalacie

D. Billet^{a,*}, É. Bernu^b

Revue de Pneumologie clinique (2016) 72, 305–309



En inspiration, on note une légère augmentation du calibre des gros troncs sous PPC (Fig. S1). En expiration, on note un maintien de l'ouverture de la lumière bronchique plus importante sous PPC (Fig. S2). En bronchoscopie virtuelle, alors que la lumière bronchique est totalement obturée en expiration spontanée, elle reste nettement ouverte sous PPC

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.

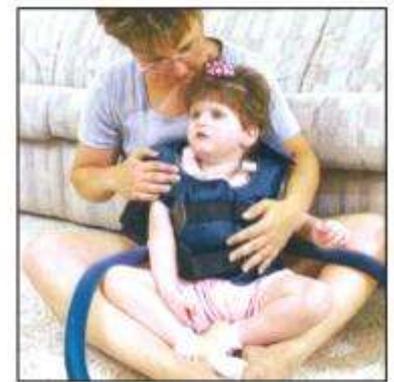


Figure 4: Using HFCWO device-Vest.

Bronchiectasies et Vest®

	Control group (Ctrl) difference <i>After-before</i>		CPT treatment difference <i>After-before</i>		HFCWO treatment difference <i>After-before</i>		Difference between after and before		
	Mean	SD	Mean	SD	Mean	SD	CPT	HFCWO	HFCWO
							vs Ctrl	vs Ctrl	vs CPT
<i>P-value (covariance analysis)</i>									
WC (103 cell)	957.0	915.7	407.0	2211.2	-673.8	1093.6	0.42	0.02	0.123
RC (106 cell)	-82.0	62.3	26.0	164.7	73.0	202.5	0.13	0.03	0.503
Neutr %	5.4	9.2	1.2	4.2	-4.0	8.5	0.23	0.01	0.136
Lymph %	-1.4	3.7	-1.4	2.8	0.6	7.2	0.99	0.37	0.377
FVC (ml)	-37.0	35.0	54.5	153.7	192.1	80.9	0.06	0.001	0.006
FEV1 (ml)	-21.0	30.7	-94.0	128.3	135.5	93.4	0.09	0.001	0.001
Tiff.Ind.	-0.6	1.3	-0.6	3.5	3.1	6.7	0.99	0.07	0.072
TLC (ml)	46.0	95.6	-88.0	312.4	-657.0	1088.9	0.65	0.02	0.063
RV (ml)	65.0	58.5	-145.0	327.8	-580.0	1118.1	0.49	0.04	0.160
Mip (cmH2O)	-4.1	2.5	2.1	13.2	9.8	10.1	0.16	0.003	0.088
Mep (cmH2O)	-8.3	3.9	2.4	23.6	6.5	7.2	0.10	0.03	0.530
paO2 (mmHg)	-1.4	3.5	0.8	9.5	1.7	8.8	0.54	0.38	0.786
paCO2 (mmHg)	0.9	1.8	1.1	2.5	-0.9	2.7	0.82	0.10	0.066
ph	-0.004	0.010	0.001	0.023	0.016	0.028	0.59	0.049	0.143
BCSS	3.1	1.4	0.2	1.8	-2.7	1.8	0.001	0.001	0.001
MMRC	1.0	0.8	-0.5	1.1	-0.7	0.8	0.001	0.001	0.629
CAT	9.9	3.6	0.4	6.8	-8.0	4.0	0.001	0.001	0.001
C-R Prot.	1.3	1.1	0.0	0.9	-1.0	0.8	0.01	0.001	0.019

Applications

- Chez quels patients??

Conclusion

- Techniques instrumentales de désencombrement :
 - Des limites importantes dans les pathologies obstructives
 - Des arguments forts dans les pathologies restrictives :
 - En associant des changements de position
 - En répétant les séances

