Les techniques instrumentales de désencombrement

Guillaume RIFFARD
CHU Saint-Etienne

16e congrès de pneumologie de langue française
Lyon – Palais des Congrès
du vendredi 27 au
dimanche 29 janvier 2012
Le poumon au cœur de l'infection
Respirer avec
une maladie neuromusculaire

Déclaration de conflits d'intérêt

pas de conflits d'intérêt

Un vaste sujet, en 20 minutes…

La spiromètrie incitative

JIKRI 16 et 17/11/2000 **Recommandations** Lyon

Recommandations des Journées Internationales de Kinésithérapie Respiratoire Instrumentale (JIKRI)

Les techniques de spirométrie incitative doivent faire partie de l'arsenal thérapeutique du kinésithérapeute en rééducation respiratoire *(niveau III)*. Le kinésithérapeute doit assurer l'apprentissage, le contrôle et l'évaluation de ce type d'appareil.

La spirométrie incitative inspiratoire est préconisée dans la prévention de l'atélectasie et de l'encombrement bronchique *(niveau III)*.

- Quelles nouveautés depuis les JIKRI ?

Respir Care. 2011 Oct;56(10):1600-4.

Incentive spirometry: 2011.

Restrepo RD, Wettstein R, Wittnebel L, Tracy M.

Department of Respiratory Care, The University of Texas Health Sciences Center at San Antonio, San Antonio, Texas 78229, USA. restrepor@uthscsa.edu

Respir Care. 2011 Oct;56(10):1600-4.

Incentive spirometry: 2011.

Restrepo RD, Wettstein R, Wittnebel L, Tracy M.

Department of Respiratory Care, The University of Texas Health Sciences Center at San Antonio, San Antonio, Texas 78229, USA. restrepor@uthscsa.edu

Abstract

We searched the MEDLINE, CINAHL, and Cochrane Library databases for articles published between January 1995 and April 2011. The update of this clinical practice guideline is the result of reviewing a total of 54 clinical trials and systematic reviews on incentive spirometry. The following recommendations are made following the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) scoring system. 1: Incentive spirometry alone is not recommended for routine use in the preoperative and postoperative setting to prevent postoperative pulmonary complications. 2: It is recommended that incentive spirometry be used with deep breathing techniques, directed coughing, early mobilization, and optimal analgesia to prevent postoperative pulmonary complications. 3: It is suggested that deep breathing exercises provide the same benefit as incentive spirometry in the preoperative and postoperative setting to prevent postoperative pulmonary complications. 4: Routine use of incentive spirometry to prevent atelectasis in patients after upper-abdominal surgery is not recommended. 5: Routine use of incentive spirometry to prevent atelectasis after coronary artery bypass graft surgery is not recommended. 6: It is suggested that a volume-oriented device be selected as an incentive spirometry device.

Cochrane Database Syst Rev. 2007 Jul 18;(3):CD004466.

Incentive spirometry for preventing pulmonary complications after coronary artery bypass graft.

Freitas ER, Soares BG, Cardoso JR, Atallah AN.

AUTHORS' CONCLUSIONS: Individual small trials suggest that there is no evidence of benefit from incentive spirometry in reducing pulmonary complications and in decreasing the negative effects on pulmonary function in patients undergoing CABG. In view of the modest number of patients studied, methodological shortcomings and poor reporting of the included trials, these results should be interpreted cautiously. An appropriately powered trial of high methodological rigour is needed to determine those patients who may derive benefit from incentive spirometry following CABG.

Cochrane Database Syst Rev. 2009 Jul 8;(3):CD006058.

Incentive spirometry for prevention of postoperative pulmonary complications in upper abdominal surgery.

Guimarães MM, El Dib R, Smith AF, Matos D.

AUTHORS' CONCLUSIONS: We found no evidence regarding the effectiveness of the use of incentive spirometry for prevention of postoperative pulmonary complications in upper abdominal surgery. This review underlines the urgent need to conduct well-designed trials in this field. There is a case for large randomized trials of high methodological rigour in order to define any benefit from the use of incentive spirometry regarding mortality.

Rev Bras Fisioter. 2011 Sep-Oct;15(5):343-50. Epub 2011 Oct 14.

Incentive spirometry in major surgeries: a systematic review.

Carvalho CR, Paisani DM, Lunardi AC.

CONCLUSION: There was no evidence to support the use of incentive spirometry in the management of surgical patients. Despite this, the use of incentive spirometry remains widely used without standardization in clinical practice.

Diaphragmatic mobility in healthy subjects during incentive spirometry with a flow-oriented device and with a volume-oriented device*

Wellington Pereira dos Santos Yamaguti, Eliana Takahama Sakamoto, Danilo Panazzolo, Corina da Cunha Peixoto, Giovanni Guido Cerri, André Luis Pereira Albuquerque

J Bras Pneumol. 2010;36(6):738-745

- 17 adultes sains
- Mesure de la mobilité diaphragmatique par échographie

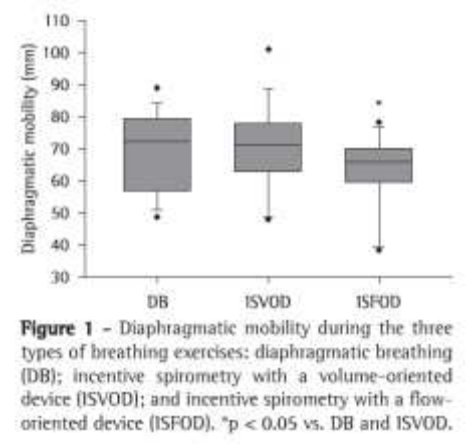

Figure 1 - Diaphragmatic mobility during the three types of breathing exercises: diaphragmatic breathing (DB); incentive spirometry with a volume-oriented device (ISVOD); and incentive spirometry with a flow-oriented device (ISFOD). *p < 0.05 vs. DB and ISVOD.

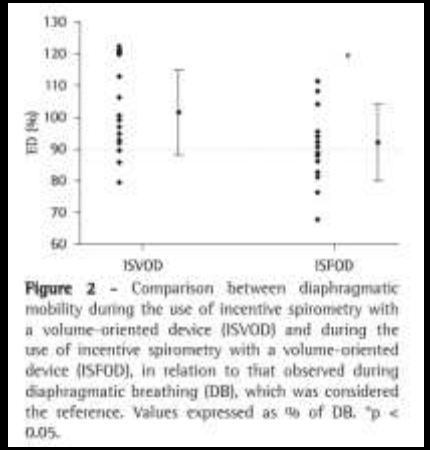

Figure 2 - Comparison between diaphragmatic mobility during the use of incentive spirometry with a volume-oriented device (ISVOD) and during the use of incentive spirometry with a volume-oriented device (ISFOD), in relation to that observed during diaphragmatic breathing (DB), which was considered the reference. Values expressed as % of DB. *p < 0.05.

Conclusions: Incentive spirometry with a volume-oriented device and diaphragmatic breathing promoted greater diaphragmatic mobility than did incentive spirometry with a flow-oriented device.

Un intérêt de spirométrie incitative :

J Cardiothorac Surg. 2011 May 12;6:70.

Estimation of lung vital capacity before and after coronary artery bypass grafting surgery: a comparison of incentive spirometer and ventilometry.

Pinheiro AC, Novais MC, Neto MG, Rodrigues MV, de Souza Rodrigues E Jr, Aras R Jr, Carvalho VO.

Faculdade Social, Salvador, Bahia, Brazil.

- 52 patients, chirurgie cardiaque

CONCLUSION There was a high correlation between DVC measures with ventilometer and incentive spirometer in pre and post CABG surgery. Despite this, arises the necessity of further studies to evaluate the repercussion of this method in lowering costs at hospitals.

Résistance expiratoire fixe

JIKRI 16 et 17/11/2000 Recommandations Lyon

Recommandations des Journées Internationales de Kinésithérapie Respiratoire Instrumentale (JIKRI)

1. Les résistances obtenues avec un appareil de calibre fixe préalablement déterminé :

La seule ventilation contre résistance n'est pas une technique de mobilisation des sécrétions, mais prépare aux techniques de désencombrement bronchique au cours de séquences répétées.
L'association PEP et TEF a fait la preuve de son efficacité (niveau de preuve II 1) ; avec des résultats discordants pour la CRF (niveau II 3) ; avec une technique parfaitement définie (pression à mi-expiration entre 10 et 20 cmH_2O et augmentation de la CRF contrôlée).

Résistance expiratoire oscillante

Recommandations des Journées Internationales de Kinésithérapie Respiratoire Instrumentale (JIKRI)

2. Les résistances obtenues avec un appareil de calibre variable :

Cette technique, lorsque bien réalisée (position de l'appareil adapté et expiration lente non maximale) a fait preuve de son efficacité sur :

- le volume d'expectoration (niveau III)
- l'augmentation de la CRF (niveau II 3)
- la réduction de la fréquence d'hospitalisation (BPCO) (niveau II 1)
- l'amélioration du VEMS dans une étude à long terme chez le BPCO (niveau II 1)

Deux études randomisées en double aveugle ont démontré l'amélioration des qualités rhéologiques des sécrétions ex vivo par effet thixotropique (mucoviscidose) (niveau I)

- Quelles nouveautés depuis les JIKRI ?

Positive Expiratory Pressure and Oscillatory Positive Expiratory Pressure Therapies

Timothy R Myers RRT-NPS

RESPIRATORY CARE • OCTOBER 2007 VOL 52 NO 10

Summary of PEP Therapy

From these relatively small (total n = 97 subjects) and few (6) studies of low-pressure PEP in patients with CF it is somewhat difficult to draw an objective clinical or scientific conclusion.[9-12,13,14] These studies would lead one to think that PEP therapy may improve pulmonary function status and may facilitate secretion removal, but the methods of airway clearance were not different than other airway-clearance techniques or devices. The same types of conclusions can be extrapolated from the 3 studies in CF patients (n = 40 patients) with high-pressure PEP therapy.[3,15,16] There appears to be some improvement in lung function across all 3 studies. Though, again, the number of patients is too few to provide a scientific conclusion, the 3 studies of high-pressure PEP therapy appeared to produce significantly more sputum than their study comparators.

The other 5 PEP studies reported above were conducted in patients with 4 different disease states or conditions (chronic bronchitis, postoperative patients, severely disabled children, and HIV). In the study in patients (n = 44) with chronic bronchitis, PEP had little to no impact on mucus production, but provided a clinical benefit in decreasing infections and exacerbations.[17] Two large PEP studies (n = 257) in postoperative patients found no significant differences in the outcomes studied, with the exception of a patient preference for PEP therapy.[18,19] The studies in severely disabled children and children with HIV were too small (n = 17 and 8, respectively) to draw any conclusion on the effectiveness of PEP therapy.[20,21]

Positive Expiratory Pressure and Oscillatory Positive Expiratory Pressure Therapies

Timothy R Myers RRT-NPS

RESPIRATORY CARE • OCTOBER 2007 VOL 52 NO 10

Summary of Oscillatory PEP Therapy

From the relatively small (total $n = 155$) and few (7) studies of OPEP in patients with CF,[7,23–28] it is somewhat difficult to draw an objective clinical or scientific conclusion. These studies would lead one to believe that OPEP therapy may facilitate mucus secretion removal; however; OPEP is not different than other airway-clearance techniques or devices. The other 4 OPEP studies reported above were conducted in patients with 4 different disease states or conditions: asthma, chronic bronchitis, panbronchiolitis, and bronchiectasis. The studies in patients with asthma or bronchiectasis showed improved lung function, but no change or improvement in mucus production.[29,32] In the 2 studies that involved chronic bronchitis or panbronchiolitis, though the total study sample populations were small (10 and 9, respectively), the outcomes would lead one to speculate that OPEP may improve sputum production in these patient populations.[30,31] However, more robust trials are indeed needed to provide scientific validity.

Positive Expiratory Pressure and Oscillatory Positive Expiratory Pressure Therapies

Timothy R Myers RRT-NPS

RESPIRATORY CARE • OCTOBER 2007 VOL 52 NO 10

Summary of PEP Versus OPEP

Five studies have compared PEP to OPEP, four of which were in patients with CF. Those 4 studies included roughly 150 participants, and they found no difference in patient outcomes between PEP and OPEP, with the possible exception of transient blood gas changes.[33–36] In the one study of a disease entity (bronchiectasis) other than CF, the sample size (n = 8) was too small to draw a scientific opinion or conclusion.[37]

Quelles nouveautés depuis cet article de 2007 ?

Physiother Theory Pract. 2010 Apr 22;26(3):143-9.

Acapella vs. PEP mask therapy: a randomised trial in children with cystic fibrosis during respiratory exacerbation.

West K, Wallen M, Follett J.

Physiotherapy Department, The Children's Hospital at Westmead, Westmead, New South Wales, Australia. kerryw@chw.edu.au

- Étude randomisée, Acapella *versus* PEP mask
- 33 patients atteints de mucoviscidose hospitalisés pour exacerbation
- 10 séries de 10 respirations, 2×/jours, pendant 10 jours
- Pas de différence significative sur la fonction pulmonaire (CV, DEP, DEP(25-75, VEMS), performance à l'exercice, production de mucus.

J Med Assoc Thai. 2010 Nov;93 Suppl 6:S112-8.

Positive expiratory pressure to enhance cough effectiveness in tracheomalacia.

Sirithangkul S, Ranganathan S, Robinson PJ, Robertson CF.

Department of Pediatrics, Phramongkutklao Hospital, Bangkok, Thailand. sanitras@hotmail.com

- 40 enfants de 8 à 18 ans, avec trachéomalacie (dyskinésie trachéobronchique)
- Amélioration du expiratoire à la toux pour des PEP entre 5 et 15 cmH_2O (valve de PEP ajustable)

Effects of a Flutter Mucus-Clearance Device on Pulmonary Function Test Results in Healthy People 85 Years and Older in China

Qi-xing Wang, Xiang-yu Zhang MD, and Qiang Li MD

RESPIRATORY CARE • NOVEMBER 2010 VOL 55 NO 11

- Étude randomisée incluant 60 patients
- Pas de différence sur épisode de fièvre, prise d'antibiotique ou de séjour à l'hôpital
- Mais amélioration de la capacité vitale forcée

Table 4. Number of Cases With Fever, Antibiotic Therapy, and Hospital Visits

	Intervention Group (n = 27)	Control Group (n = 28)	P
Fever	0	2	.49
Antibiotic therapy	1	3	.63
Hospital visit	2	3	> .99

Table 2. Pulmonary Function on Day 28

	Intervention Group (n = 27) (mean ± SD)	Control Group (n = 28) (mean ± SD)	P
PEF (L/min)	117.6 ± 50.4	103.9 ± 41.5	.20
FEV_1 (L)	1.01 ± 0.37	1.02 ± 0.35	.96
FVC (L)	2.06 ± 0.73	1.77 ± 0.63	.79
FEV_1/FVC (%)	51 ± 17	59 ± 14	.24

PEF = peak expiratory flow
FVC = forced vital capacity

Conclusion :

AUTHORS' CONCLUSIONS: There was no clear evidence that oscillation was a more or less effective intervention overall than other forms of physiotherapy. More adequately-powered long-term randomised controlled trials are needed.

Cochrane Database Syst Rev. 2009 Jan 21;(1):CD006842.

Oscillating devices for airway clearance in people with cystic fibrosis.

Morrison L, Agnew J.

self-administered techniques are more frequently used. These self-administered techniques do not necessitate postural drainage or indeed the assistance of another person.

Oscillating devices for airway clearance in people with cystic fibrosis (Review)

2011, Issue 1 Morrison L, Agnew J

THE COCHRANE COLLABORATION®

La ventilation non-invasive

Recommandations des Journées Internationales de Kinésithérapie Respiratoire Instrumentale (JIKRI)

2. Ventilation spontanée en aide inspiratoire (VSAI)

C'est une opportunité chez le malade non ventilé pour aider au désencombrement.

Niveau III.

4. La VS-PEP

Utilisée seule, elle n'a pas démontré à ce jour son action sur le désencombrement. Elle pourrait avoir un effet sur celui-ci dans le cas d'instabilité des voies aériennes extra-thoraciques.
Cette remarque s'applique également à l'adjonction d'une PEEP à tous les autres modes de ventilation non-invasifs.

Niveau III.

Différence entre les systèmes PEP et la pression positive continue (PPC)

Ventilation spontanée

Système PEP

PPC

- Quelles nouveautés depuis les JIKRI ?

Indications de la Ventilation Non Invasive classées selon leur niveau de recommandation (voir introduction)

Intérêt certain (GI+) Il faut faire	Décompensation de BPCO OAP
Intérêt non établi de façon certaine (G2+)	IRA hypoxémique de l'immunodéprimé
Il faut probablement faire	Post-opératoire chirurgie thoracique et abdominale Stratégie de sevrage de la ventilation invasive chez les BPCO Prévention d'une IRA post extubation Traumatisme thoracique fermé isolé Décompensation de MNM chroniques et autres IRC restrictives Mucoviscidose décompensée Forme apnéisante de la bronchiolite aiguë Laryngotrachéomalacie
Aucun avantage démontré (G2-) Il ne faut probablement pas faire	Pneumopathie hypoxémiante SDRA Traitement de l'IRA post extubation MNM aiguës réversibles
Situations sans cotation possible	AAG Syndrome d'obésité hypoventilation Bronchiolite aiguë du nourrisson (hors forme apnéisante)

L'intérêt reconnu de la VNI dans ces situations généralement accompagnées d'hypersécrétion bronchique, va à l'encontre du mythe de la « pression positive qui pousse les sécrétions au fond du poumon »…

Indications de la Ventilation Non Invasive classées selon leur niveau de recommandation (voir introduction)

Intérêt certain (GI+) Il faut faire	Décompensation de BPCO OAP
Intérêt non établi de façon certaine (G2+)	IRA hypoxémique de l'immunodéprimé
Il faut probablement faire	Post-opératoire chirurgie thoracique et abdominale Stratégie de sevrage de la ventilation invasive chez les BPCO Prévention d'une IRA post extubation Traumatisme thoracique fermé isolé Décompensation de MNM chroniques et autres IRC restrictives Mucoviscidose décompensée Forme apnéisante de la bronchiolite aiguë Laryngotrachéomalacie
Aucun avantage démontré (G2-) Il ne faut probablement pas faire	Pneumopathie hypoxémiante SDRA Traitement de l'IRA post extubation MNM aiguës réversibles
Situations sans cotation possible	AAG Syndrome d'obésité hypoventilation Bronchiolite aiguë du nourrisson (hors forme apneisante)

Et pourtant, seulement 3 études étudiant l'impact de la VNI *pendant* la kinésithérapie respiratoire

Cystic Fibrosis

Table 1: Summary of Three Cross-over Randomised Studies Evaluating the Effectiveness of a Combination of Airway Clearance Techniques with Non-invasive Positive Pressure Ventilation Compared with Standard Sessions, Which Included Airway Clearance Techniques Alone

Study	N	Study Subjects Age# (years)	FEV_1* (% pred.)	Clinical Setting	ACT Combined with NIPPV	NIPPV	Main Results
Fauroux, 1999[20]	16	13 (4)	52 (6)	Stable	FET	Pressure support ventilation	Decreases in MIP, MEP, SpO_2 and fatigue were limited using NIPPV+FET compared with FET alone. Spirometry parameters and wet weight of sputum did not change after either session.
Holland, 2003[21]	26	27 (6)	34 (12)§	Pulmonary exacerbation	ACBT	Bi-level ventilation	Decreases in MIP, SpO_2 and dyspnoea were limited using NIPPV+ACBT compared with ACBT alone. There were no differences in FEV_1, FVC and wet weight of sputum, but FEF_{25-75} increased following NIPPV.
Placidi, 2006[22]	17	27 (7)	25 (6)§	Pulmonary exacerbation	Directed cough	Bi-level ventilation and CPAP	There were no changes in spirometry and SpO_2 and no differences in wet and dry weight of sputum after PEPm, bi-level ventilation and CPAP combined with standardised directed cough and directed cough alone (control). There was less fatigue after bi-level and CPAP than after PEPm.

 # = data are mean with SD inparentheses; § = values were recorded at hospitalisation; FEV1 = forced expiratory volume in one second; ACT = airway clearance technique; NIPPV = non-invasive positive pressure ventilation; FET = forced expiratory technique; MIP = maximal inspiratory pressure; MEP = maximal expiratory pressure; SpO_2 = arterial oxygen saturation assessed by pulse oximetry; ACBT = active cycle of breathing technique; FVC = forced vital capacity; FEF_{25-75} = forced expiratory flow during the middle half of FVC; CPAP = continuous positive airway pressure.

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

- Étude randomisée, 16 patients atteints de mucoviscidose (âge 13 +/- 4 ans)
- « chest physiotherapy » *versus* « CPT » + VNI

Conclusions. Our study is the first to show that PSV performed with a nasal mask during the CPT was associated with an improvement in respiratory muscle performance and with a reduction in oxygen desaturation. The improvement in patient comfort may help to improve compliance with CPT in CF patients. *Pediatrics*

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

- Étude randomisée incluant 26 patients (mucoviscidose)
- Âge moyen : 27 ans; VEMS : 34% de la théorique
- Active cycle of breathing technique (ACBT) / ACBT + VNI

Conclusion: Reduced inspiratory muscle strength and oxygen desaturation during chest physiotherapy are associated with inspiratory muscle weakness and severity of lung disease in adults with exacerbations of CF. Addition of NIV improves inspiratory muscle function, oxygen saturation and small airway function and reduces dyspnoea.

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

- 17 patients atteints de mucoviscidose
- PEP mask / CPAP / NPPV

Table 2. Sputum Weight, Number of Spontaneous and Directed Coughs, and Lung Function Values*

	Mask PEP	CPAP	NPPV	Control	p (via ANOVA) for Treatment vs Control
Sputum					
Wet weight (g)	15.78 ± 5.49†	13.66 ± 5.47	13.20 ± 5.00	13.98 ± 4.96	< 0.05
Dry weight (g)	0.94 ± 0.57	0.77 ± 0.43	0.88 ± 0.62	0.97 ± 0.76	0.29
Spontaneous coughs (n)	13 ± 9‡	6 ± 5	8 ± 7	8 ± 6	< 0.001
Directed coughs (n)	50 ± 17	50 ± 17	50 ± 17	50 ± 17	0.42
FVC					
Before (L)	1.94 ± 0.63	1.97 ± 0.59	1.88 ± 0.57	1.89 ± 0.57	
After (L)	2.00 ± 0.62	2.03 ± 0.63	1.93 ± 0.57	1.95 ± 0.58	0.99
FEV_1					
Before (L)	0.99 ± 0.27	0.98 ± 0.25	0.95 ± 0.25	0.96 ± 0.26	
After (L)	1.00 ± 0.27	1.01 ± 0.26	0.95 ± 0.25	0.99 ± 0.29	0.19
FEF_{25-75}					
Before (L/s)	0.28 ± 0.12	0.28 ± 0.10	0.27 ± 0.11	0.28 ± 0.11	
After (L/s)	0.27 ± 0.11	0.29 ± 0.10	0.27 ± 0.11	0.28 ± 0.12	0.20
S_{pO_2}					
Before (%)	95.1 ± 1.5	94.9 ± 1.6	94.7 ± 1.8	94.8 ± 1.7	
After (%)	94.9 ± 1.2	94.7 ± 1.3	94.8 ± 1.4	94.6 ± 1.4	0.007

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 *versus* Pressure support ?

Continuous Positive Airway Pressure Versus Noninvasive Pressure Support Ventilation to Treat Atelectasis After Cardiac Surgery

Patrick Pasquina, RN*, Paolo Merlani, MD†, Jean Max Granier, RN*, and Bara Ricou, MD†

Anesth Analg 2004;99:1001-1008

Evolution radiologique n (%)

Table 3. Radiological Evaluation

Variable	CPAP (n = 75)	NIPSV (n = 75)	P value
Worse	8 (11)	1 (1)	0.03
No change	37 (49)	29 (39)	0.25
Improvement	30 (40)	45 (60)	0.02

doi:10.1510/icvts.2008.188334

INTERACTIVE CARDIOVASCULAR AND THORACIC SURGERY

Interactive CardioVascular and Thoracic Surgery 7 (2008) 1152-1154

www.icvts.org

Best evidence topic - Thoracic general

Does non-invasive ventilation associated with chest physiotherapy improve outcome after lung resection?

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Received 14 July 2008; received in revised form 29 August 2008; accepted 1 September 2008

Summary

A best evidence topic was constructed according to a structured protocol. The question addressed was whether the use of non-invasive ventilation (NIV) associated with chest physiotherapy (CPT) is effective in preventing respiratory complications in patients undergoing lung resection surgery. Of the 172 papers found using a report search, five presented the best evidence to answer the clinical question. The authors, journal, date and country of publication, study type, group studied, relevant outcomes and results of these papers are given. We conclude that, on the whole, the five studies were all in favor of NIV as an adjuvant to CPT for improving outcome after lung resection surgery. Indeed, the interest and benefit has been shown not only in the treatment of postoperative acute respiratory failure, but also in the prevention and treatment of respiratory complications (atelectasis, pneumonia and bronchial congestion). Hence, current evidence shows NIV associated with acute CPT management to be safe and effective in reducing postoperative complications and in improving patient recovery, thus enhancing the choice of available medical care and bettering outcome in lung resection surgery.

Les vibrations mécaniques

JIKRI 16 et 17/11/2000 **Recommandations**

Recommandations des Journées Internationales de Kinésithérapie Respiratoire Instrumentale (JIKRI)

Figure 3: High frequency chest wall oscillation device

Figure 4: Using HFCWO device-Vest

Actuellement, au vu de ces données, les vibrations mécaniques ne peuvent être recommandées comme techniques de physiothérapie instrumentale pouvant avoir un intérêt dans le désencombrement bronchique.

- Quelles nouveautés depuis les JIKRI ?

Phillips 2004 :

- Capacité vitale forcée + ↗ avec ACBT par rapport à HFCWO
- **Confort HFCWO ➤ ACBT**

Osman 2008 :

- Vol sécrétion ACBT ➤ HFCWO
- Satisfaction ACBT ➤ HFCWO

Modi 2001-2006:

- Pas ≠ en terme tolérance et confort entre HFCWO et Flutter

Oermann 2001 :

- Pas ≠ VEMs et capacité vitale forcée entre HFCWO et Flutter
- Satisfaction = HFCWO et Flutter

Diapo J, Roeseler

Oscillating devices for airway clearance in people with cystic fibrosis (Review)

2011, Issue 1

Morrison L, Agnew J

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Analysis 4.1. Comparison 4 Flutter versus HFCWO, Outcome 1 FEV_1 [% predicted].

Review: Oscillating devices for airway clearance in people with cystic fibrosis

Comparison: 4 Flutter versus HFCWO

Outcome: 1 FEV_1 [% predicted]

Study or subgroup	Favours Flutter N	Mean(SD)	Favours Vest N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 Over two weeks and up to one month						
Oermann 2001	24	54.9 (3)	24	56.5 (3.5)		-1.60 [-3.44, 0.24]

Oscillating devices for airway clearance in people with cystic fibrosis (Review)

2011, Issue 1

Morrison L, Agnew J

THE COCHRANE COLLABORATION®

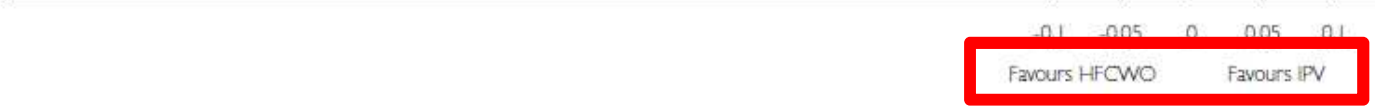
Analysis 5.1. Comparison 5 IPV versus HFCWO, Outcome 1 Dry sputum weight [g].

Review: Oscillating devices for airway clearance in people with cystic fibrosis

Comparison: 5 IPV versus HFCWO

Outcome: 1 Dry sputum weight [g]

Study or subgroup	Favours IPV N	Mean(SD)	Favours HFCWO N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
Varekojis 2003b	142	0.34 (0.25)	143	0.26 (0.19)		0.08 [0.03, 0.13]



Neurology. 2006 Sep 26;67(6):991-7.

High-frequency chest wall oscillation in ALS: an exploratory randomized, controlled trial.

Lange DJ, Lechtzin N, Davey C, David W, Heiman-Patterson T, Gelinas D, Becker B, Mitsumoto H; HFCWO Study Group.

Department of Neurology, Mt. Sinai School of Medicine, One Gustave L. Levy Place, Box 1052, New York, NY 10029, USA. dale.lange@mssm.edu

Abstract

OBJECTIVES: To evaluate changes in respiratory function in patients with ALS after using high-frequency chest wall oscillation (HFCWO).

METHODS: This was a 12-week randomized, controlled trial of HFCWO in patients with probable or definite ALS, an Amyotrophic Lateral Sclerosis Functional Rating Scale respiratory subscale score < or = 11 and > or = 5, and forced vital capacity (FVC) > or = 40% predicted.

RESULTS: We enrolled 46 patients (58.0 +/- 9.8 years; 21 men, 25 women); 22 used HFCWO and 24 were untreated. Thirty-five completed the trial: 19 used HFCWO and 16 untreated. HFCWO users had less breathlessness ($p = 0.021$) and coughed more at night ($p = 0.048$) at 12 weeks compared to baseline. At 12 weeks, HFCWO users reported a decline in breathlessness ($p = 0.048$); nonusers reported more noise when breathing ($p = 0.027$). There were no significant differences in FVC change, peak expiratory flow, capnography, oxygen saturation, fatigue, or transitional dyspnea index. When patients with FVC between 40 and 70% predicted were analyzed, FVC showed a significant mean decrease in untreated patients but not in HFCWO patients; HFCWO patients had significantly less increased fatigue and breathlessness. Satisfaction with HFCWO was 79%.

CONCLUSION: High-frequency chest wall oscillation was well tolerated, considered helpful by a majority of patients, and decreased symptoms of breathlessness. In patients with impaired breathing, high-frequency chest wall oscillation decreased fatigue and showed a trend toward slowing the decline of forced vital capacity.

IPPB

Recommandations des Journées Internationales de Kinésithérapie Respiratoire Instrumentale (JIKRI)

1. I.P.P.B.

L'étude exhaustive de la littérature que nous a présenté l'expert ne permet pas de trouver un consensus validé sur l'emploi de l'I.P.P.B. dans le désencombrement.
Mais l'expérience de plusieurs membres du jury est en faveur de son efficacité dans certaines conditions.
Pour évaluer cette technique, des études contrôlées sont indispensables, en précisant :

- la pathologie
- la position du malade
- les indications
- les résultats spirométriques (avec une majoration du volume mobilisé d'au moins 20%)
- les réglages adoptés à chaque malade
- la technique de désencombrement utilisée par le kinésithérapeute.

Niveau III.

- Quelles nouveautés depuis les JIKRI ?

AARC Clinical Practice Guideline

Intermittent Positive Pressure Breathing—2003 Revision & Update

RESPIRATORY CARE • MAY 2003 VOL 48 NO 5

- AARC : American Association for Respiratory Care

L'IPPB n'est pas une thérapie de premier choix pour l'expansion pulmonaire ou l'aérosolthérapie médicamenteuse chez les malades qui respirent spontanément quand d'autres thérapies moins onéreuses et moins invasives peuvent être utilisées de façon fiable.

2.0 INDICATIONS:

2.1 Le besoin d'améliorer l'expansion pulmonaire

2.1.1La présence clinique d'atélectasie pulmonaire quand les autres formes de thérapie ont été infructueuses (spirométrie incitative, physiothérapie, les soupirs, la PEP) ou quand le malade ne peut pas coopérer.

2.1.2L'incapacité d'évacuer suffisamment les sécrétions du fait de la pathologie limitant sévèrement la capacité pour ventiler ou tousser efficacement et l'échec aux autres modes de traitement.

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/*Air Stacking* + 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 comparision of peak expiratory flows with manually assisted and unassisted coughing techniques. Chest 1993;104:1553-62.

Figure 2. *Air-stacking* réalisé à l'aide d'un ballon insufflateur manuel.

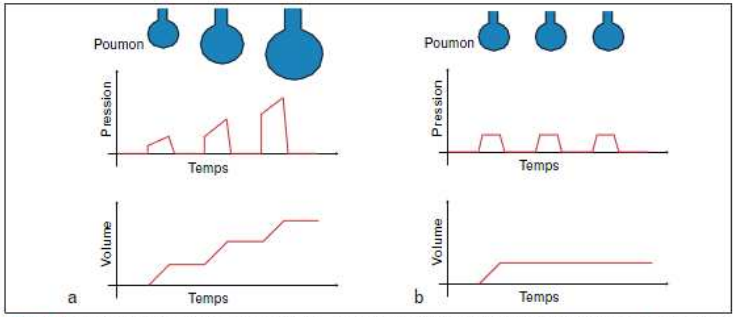


Figure 4. a) en mode volumétrique, la consigne donnée à la machine est d'envoyer un volume prédéterminé. La machine adapte la pression nécessaire pour délivrer ce volume. Lors de l'air-stacking, les volumes s'ajoutent car la machine (ou la main du thérapeute qui utilise un ballon insufflateur manuel) augmente la pression à chaque cycle. b) En mode pressionnel, la consigne donnée à la machine est d'arrêter l'insufflation lorsque la pression prédéterminée est atteinte. Si l'on tente d'empiler plusieurs volumes, la machine s'arrête au même niveau de pression que le cycle précédent, ce qui ne permet pas d'aller plus loin dans la capacité pulmonaire.

IPPB-Assisted Coughing in Neuromuscular Disorders

Christian Dohna-Schwake, MD,[1]* Regine Ragette, MD,[2] Helmut Teschler, MD,[2]
Thomas Voit, MD,[1] and Uwe Mellies, MD[1]

Pediatric Pulmonology 41:551–557 (2006)

- 29 patients MNM
- Age de 6 à 20 ans
- PCF < 160 l/min

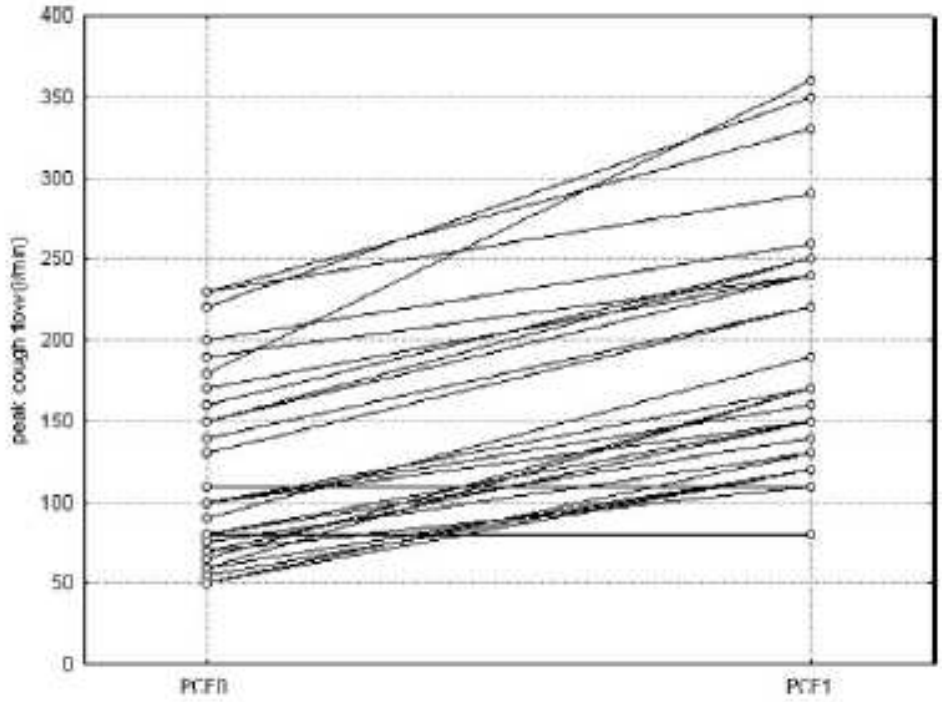


Fig. 3. Improvement of peak cough flows in 27/29 pediatric patients with various muscle disorders. PCF0, PCF at spontaneous breathing; PCF1, PCF after IPPB hyperinsufflation.

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

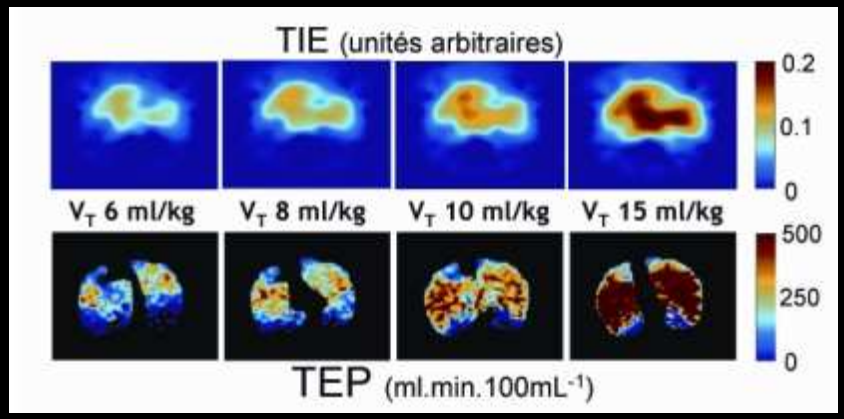
- But : évaluer la distribution de la ventilation dans le poumon lors de l'IPPB, afin d'évaluer le risque d'hyperinflation régional

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

- Méthode : tomographie par impédance électrique
- Patients : pathologies neuromusculaires



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

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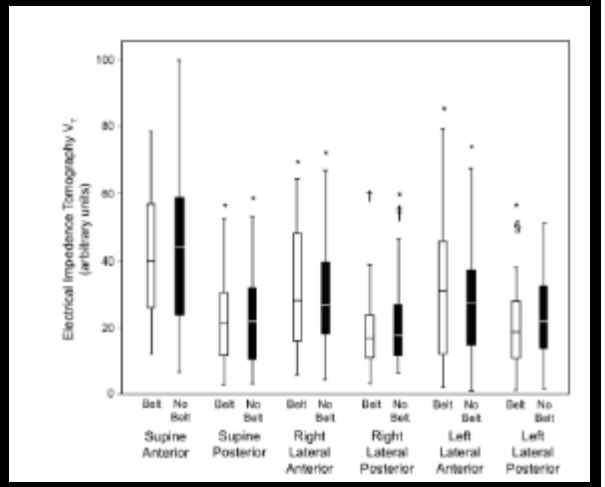
RESPIRATORY CARE • JULY 2010 VOL 55 NO 7

- Résultats :
  - 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)

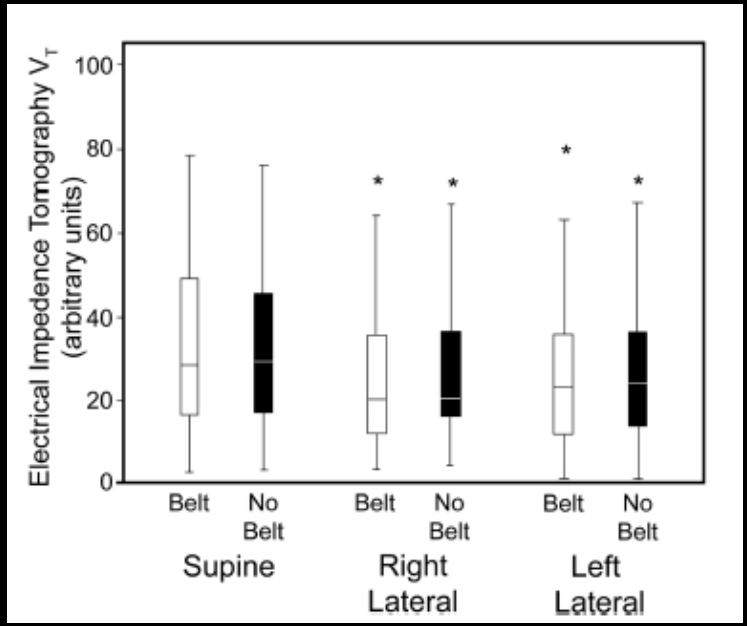


The Short-Term Effects of Intermittent Positive Pressure Breathing Treatments on Ventilation in Patients With Neuromuscular Disease

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

- Résultats :
  - La mise en place d'une ceinture abdominale ne modifie pas la distribution de la ventilation



Asian Cardiovasc Thorac Ann. 2011 Feb;19(1):10-3.

Intermittent positive-pressure breathing after lung surgery.

Ludwig C, Angenendt S, Martins R, Mayer V, Stoelben E.

Department of Thoracic Surgery, Merheim Lung Clinic, Cologne State Hospital, Ostmerheimer Strasse 200, Cologne, Germany. ludwigc@kliniken-koeln.de

Asian Cardiovasc Thorac Ann. 2011 Feb;19(1):10-3.

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Department of Thoracic Surgery, Merheim Lung Clinic, Cologne State Hospital, Ostmerheimer Strasse 200, Cologne, Germany. ludwigc@kliniken-koeln.de

Abstract

Intermittent positive-pressure breathing is thought to avoid atelectasis and improve pulmonary function after major lung resections. Since no clear scientific data was available to confirm this, our objective was to determine whether atelectasis can be avoided and if postoperative lung function is improved. Prospective analysis was carried out in 135 patients operated on between 2007 and 2009; 55 received intermittent positive-pressure breathing. Pre- and postoperative lung function tests were similar in both groups. Pulmonary complications were observed in 19% of patients without intermittent positive-pressure breathing and 27% of those who received this treatment. We were unable to find evidence that additional improvement in postoperative pulmonary function is achieved when adding intermittent positive-pressure breathing to the standard physical therapy.

- 135 patients randomisés en 2 groupes : avec et sans IPPB
- Résultats : pas d'évidence d'amélioration de la fonction pulmonaire post-opératoire en ajoutant la pression positive intermittente à la physiothérapie standard.

Intermittent Positive-Pressure Breathing Effects in Patients With High Spinal Cord Injury

Isabelle Laffont, MD, PhD, Djamel Bensmail, MD, Sylvie Lortat-Jacob, MD, Line Falaize, AAS, Claudette Hutin, BSc, PT, Elisabeth Le Bomin, BSc, PT, Maria Ruquet, AAS, Pierre Denys, MD, PhD, Frédéric Lofaso, MD, PhD

Arch Phys Med Rehabil Vol 89, August 2008

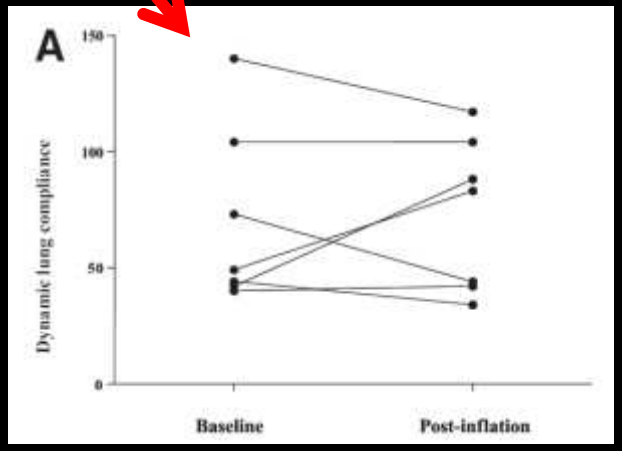
- Étude randomisée croisée, 14 patients tétraplégiques depuis moins de 6 mois
- IPPB pendant 2 mois : 20 min * 2/jours, 5j/7
- Mesures : EFR, compliance, travail ventilatoire

Intermittent Positive-Pressure Breathing Effects in Patients With High Spinal Cord Injury

Isabelle Laffont, MD, PhD, Djamel Bensmail, MD, Sylvie Lortat-Jacob, MD, Line Falaize, AAS, Claudette Hutin, BSc, PT, Elisabeth Le Bomin, BSc, PT, Maria Ruquet, AAS, Pierre Denys, MD, PhD, Frédéric Lofaso, MD, PhD

Arch Phys Med Rehabil Vol 89, August 2008

- Résultats : pas de différence significative sur les paramètres de la fonction pulmonaire ou sur la mécanique du système respiratoire, à court et à long terme.



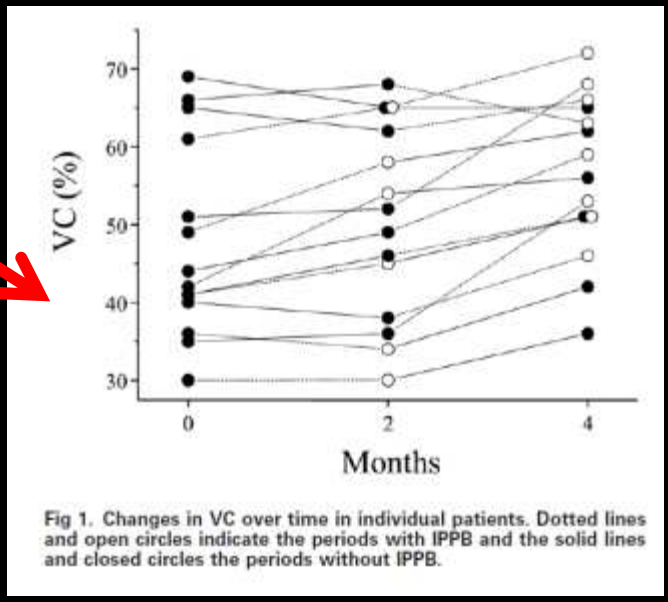


Fig 1. Changes in VC over time in individual patients. Dotted lines and open circles indicate the periods with IPPB and the solid lines and closed circles the periods without IPPB.

Intermittent Positive-Pressure Breathing Effects in Patients With High Spinal Cord Injury

Isabelle Laffont, MD, PhD, Djamel Bensmail, MD, Sylvie Lortat-Jacob, MD, Line Falaize, AAS, Claudette Hutin, BSc, PT, Elisabeth Le Bomin, BSc, PT, Maria Ruquet, AAS, Pierre Denys, MD, PhD, Frédéric Lofaso, MD, PhD

Arch Phys Med Rehabil Vol 89, August 2008

- Conclusion des auteurs : limiter l'emploi de l'IPPB pour aider au désencombrement lors des épisodes infectieux
- Au long court, privilégier les méthodes d'entraînement des muscles respiratoires (++ travail des muscles expiratoires)

Supramaximal Inflation Improves Lung Compliance in Subjects With Amyotrophic Lateral Sclerosis*

Noah Lechtzin, David Shade, Lora Clawson and Charles M. Wiener

Chest 2006;129;1322-1329

- 14 patients atteints de sclérose latérale amyotrophique
- Étude prospective : mesure de la compliance pulmonaire statique, avant et après 5 minutes d'IPPB (réalisées avec un ventilateur)

Supramaximal Inflation Improves Lung Compliance in Subjects With Amyotrophic Lateral Sclerosis*

Noah Lechtzin, David Shade, Lora Clawson and Charles M. Wiener

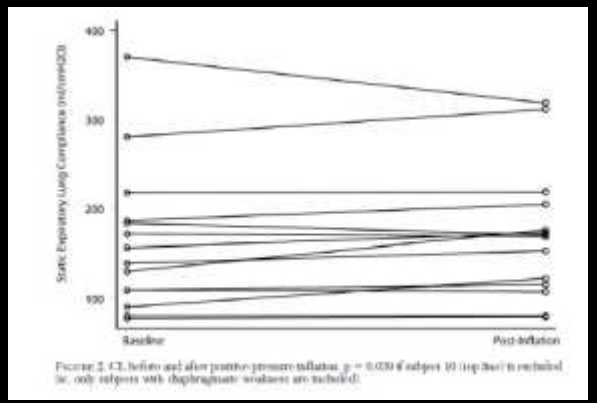
Chest 2006;129;1322-1329

- Résultats : augmentation de la compliance statique immédiatement après les séances
- Mais augmentation tout de même modérée…

Table 3—*CL Before and After Supramaximal Lung Inflation in Subjects With ALS**

Patient No.	Baseline CL, cm H_2O	CL After Lung Inflation, cm H_2O	Change in CL, cm H_2O
Subjects with ALS			
1	109	115	6
2	80	80	0
3	139	153	14
4	171	168	− 3
5	186	204	18
6	77	79	2
7	217	218	1
8	183	170	− 13
9	130	175	45
10	370	318.3	− 51.7
11	280	311	31
12	109	107	− 2
13	156	172	16
14	90	122	32
Mean ± SD	164.1 ± 82.1	170.9 ± 74.1	6.8 ± 23.2†
Volunteers			
1	304	281	− 21
2	206	204	− 2
3	202	139	− 63
4	238	235	− 3
Mean ± SD	237.5 ± 47.2	214.8 ± 59.6	− 22.8 ± 28.5‡

*Patients CL values are significantly lower than those of volunteers ($p = 0.04$).
†The mean change in CL is 11.3 if only patients with a Pdi < 80 cm H_2O are included ($p = 0.04$).
‡$p = 0.07$ (CL before lung inflation vs after lung inflation).



The Effects of Intermittent Positive Pressure and Incentive Spirometry in the Postoperative of Myocardial Revascularization

Walmir Romanini[1,2], Andrea Pires Muller[1,2], Katherine Athayde Teixeira de Carvalho[1], Marcia Olandoski[1], José Rocha Faria-Neto[1], Felipe Luiz Mendes[2], Evandro Antonio Sardetto[2], Francisco Diniz Afonso da Costa[1,2], Luiz César Guarita-Souza[1]

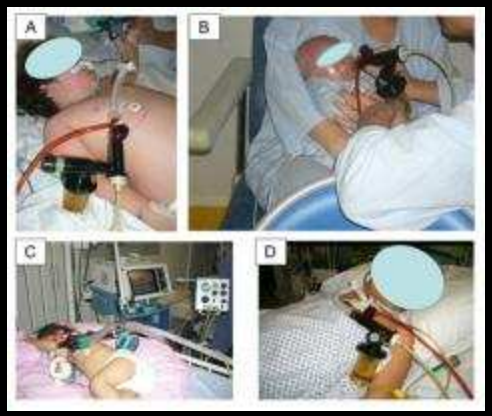
Arq Bras Cardiol 2007; 89(2) : 94-99

- Étude prospective randomisée, 40 patients :
  - 20 patients : 10 min IPPB, 5 min repos, 10 min IPPB
  - 20 patients : spirométrie incitative (Voldyne) avec les mêmes conditions
- Résultats : IPPB entraîne une meilleure SaO2 à 72h post-op, mais SI plus efficace dans l'amélioration de la force des muscles respiratoires

- Critique de la littérature : absence d'information sur le réglage du débit, dont l'intérêt pour le désencombrement semble important…

- Conclusion :
  - IPPB comme aide au désencombrement bronchique en cas d'inefficacité de la toux
  - Importance ++ des changements de position

Ventilation à percussions intrapulmonaires



Recommandations des Journées Internationales de Kinésithérapie Respiratoire Instrumentale (JIKRI)

3.3. Place des vibrations internes ou endobronchiques dans le désencombrement bronchique

3.3.1. Effets

Au vu de la littérature, la ventilation à percussions intrapulmonaires (IPV®) pourrait avoir un effet positif sur le drainage bronchique en augmentant le volume des sécrétions expectorées [niv.III][10].

3.3.2. Indications

La ventilation à percussions intrapulmonaires peut être proposée dans le désencombrement bronchique [niv.III][10,11].

Aucun critère ne permet à ce jour de prédire la réponse clinique à ce type de traitement.

- Quelles nouveautés depuis les JIKRI ?

Comparison of Lung Deposition in Two Types of Nebulization*

Intrapulmonary Percussive Ventilation vs Jet Nebulization

Gregory Reychler, PT; André Keyeux, MD; Caroline Cremers, PT; Claude Veriter, Ing; Daniel O. Rodenstein, PhD; and Giuseppe Liistro, PhD

CHEST / 125 / 2 / FEBRUARY, 2004

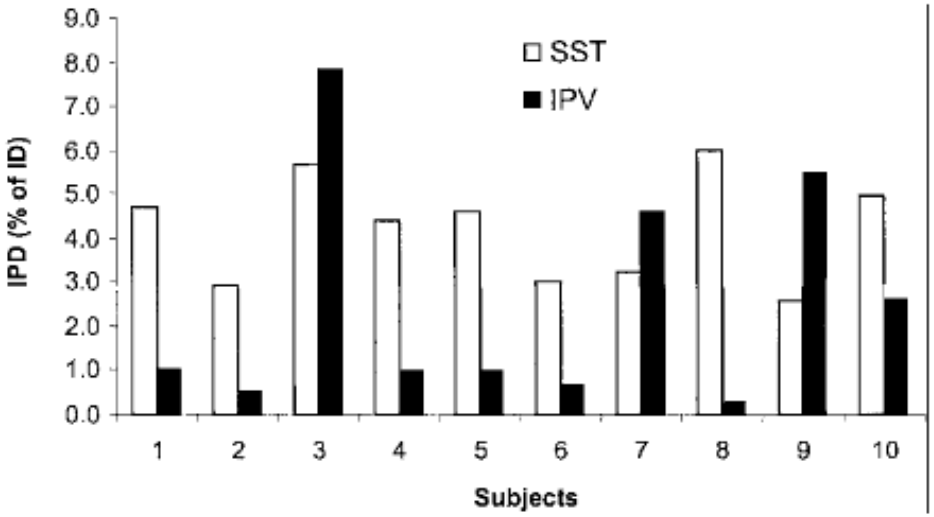


FIGURE 2. Individual data of IPD obtained with SST and IPV showing the difference of interindividual variability.

Respir Care. 2011 Jul;56(7):984-8. Epub 2011 Feb 21.

Safety and efficacy of short-term intrapulmonary percussive ventilation in patients with bronchiectasis.

Paneroni M, Clini E, Simonelli C, Bianchi L, Degli Antoni F, Vitacca M.

Servizio di Riabilitazione Cardio-Respiratoria, Salvatore Maugeri Foundation, Istituto di Ricovero e Cura a Carattere Scientifico, Institute of Lumezzane, Lumezzane, Italy. mara.paneroni@fsm.it

Abstract

BACKGROUND: Treatment of bronchiectasis includes drugs, oxygen therapy, and bronchial-clearance maneuvers.

OBJECTIVE: To assess the safety and efficacy of intrapulmonary percussive ventilation (IPV) compared to traditional standard chest physical therapy in patients with bronchiectasis and productive cough.

METHODS: In a randomized crossover study, 22 patients underwent, on consecutive days, IPV and chest physical therapy. Before each treatment session, immediately after the session, 30 min after the session, and 4 hours after the session we measured S(pO(2)), heart rate, respiratory rate, and (with a visual analog scale) the patient's subjective sensation of phlegm encumbrance and dyspnea. Immediately after each treatment session we also measured (via visual analog scale) the patient's discomfort. We also measured the volume and wet and dry weight of collected sputum.

RESULTS: No adverse effects were so severe as to require discontinuation of treatment, and the incidence of adverse effects was similar in the groups (27%). Heart rate (P = .002) and respiratory rate (P = .047) decreased during treatment, and sensation of phlegm encumbrance improved (P = .03) with both treatments. Only IPV improved (P = .004) the sensation of dyspnea. The patients found IPV more comfortable than our traditional standard chest physical therapy (P = .03). Both treatments caused important phlegm production, but there were no differences in sputum volume, wet weight, or dry weight.

CONCLUSIONS: In patients with bronchiectasis and productive cough, short-term IPV was as safe and effective as traditional chest physical therapy, with less discomfort.

Effect of Intrapulmonary Percussive Ventilation on Mucus Clearance in Duchenne Muscular Dystrophy Patients: A Preliminary Report

Michel Toussaint PT, Harry De Win PT, Mark Steens PT, and Philippe Soudon MD

RESPIRATORY CARE • OCTOBER 2003 VOL 48 NO 10

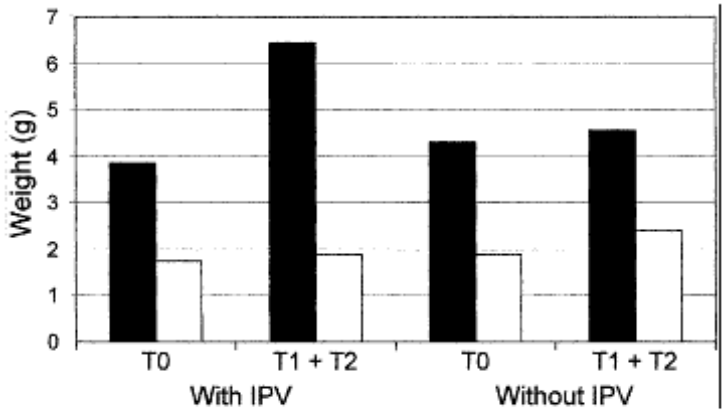


Fig. 2. Mean weight of collected secretions before (T0) and up to 45 min after treatment (T1 + T2) with and without intrapulmonary percussive ventilation (IPV). Black bars represent the hypersecretive patients. White bars represent the nonhypersecretive patients.

- Étude randomisée croisée incluant 8 patients avec maladie neuromusculaire
- Poids de sécrétions récoltées supérieur avec l'IPV
- Pas d'augmentation de sécrétions bronchiques pour les patients initialement peu sécrétants = s'oppose à l'hypothèse d'une augmentation de la production de sécrétions bronchiques sous l'effet d'une irritation des voies aériennes induite par l'IPV [Varekojis Respir Care 2003].

Intrapulmonary Percussive Ventilation vs Incentive Spirometry for Children With Neuromuscular Disease

Christine Campbell Reardon, MD; Demian Christiansen; Elizabeth D. Barnett; Howard J. Cabral, PhD

Arch Pediatr Adolesc Med 2005 ; 159 : 526-31.

- Étude prospective randomisée sur 7 mois incluant 18 patients avec pathologies NM
- diminution du nombre de jours d'antibiotiques utilisés, du nombre de jours d'hospitalisation et donc du nombre de jours d'absentéisme scolaire dans le groupe utilisant quotidiennement l'IPV

Table 3. Clinical Outcomes for 18 Patients With NMD Treated With IS or IPV

	IS (n = 9)	IS No./1000 Patient-Days	IPV (n = 9)	IPV No./1000 Patient-Days	IRR (95% CI)
Days on antibiotics*	44	24	0	0	43 (6-333)
No. of pulmonary infections*	3	1.7	0	0	3.9 (.43-35)
School days missed for respiratory illness	5	4.5	1	.95	4.8 (.5-37)
Days hospitalized for pulmonary function*	8	4.4	0	0	8.5 (1.1-67)

Abbreviations: CI, confidence interval; IPV, intrapulmonary percussive ventilation; IRR, incidence rate ratio; IS, incentive spirometry.
*One added to each cell in order to make comparison between control and IPV groups. Analysis completed using total person-time.

Études récentes : IPV et BPO

Physiological response to intrapulmonary percussive ventilation in stable COPD patients

Stefano Nava*,[1], Nicola Barbarito, Giancarlo Piaggi, Elisa De Mattia[1], Serena Cirio

Respir Med 2006

Étude randomisée incluant 10 patients BPCO

Étude prospective incluant 25 patients BPCO

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]

Journal of Critical Care (2008)

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]

Crit Care. 2005;

Étude randomisée incluant 33 patients BPCO

Étude randomisée incluant 40 patients BPCO

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

Crit Care Med 2006 Vol. 34, No. 12

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.

Étude prospective incluant 12 patients BPCO

Études récentes : IPV et BPO

Physiological response to intrapulmonary percussive ventilation in stable COPD patients

Stefano Nava*,[1], Nicola Barbarito, Giancarlo Piaggi, Elisa De Mattia[1], Serena Cirio

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

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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'adjonction de l'IPV au traitement conventionnel permet :
  - Une réduction du travail respiratoire (travail diaphragmatique) et une amélioration des échanges gazeux
  - De prévenir des épisodes infectieux bronchiques
  - De prévenir d'une aggravation clinique supplémentaire lors des épisodes infectieux

Études récentes : IPV et BPO

Physiological response to intrapulmonary percussive ventilation in stable COPD patients

Stefano Nava*,[1], Nicola Barbarito, Giancarlo Piaggi, Elisa De Mattia[1], 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 ne doit cependant pas être perçue comme une alternative à la VNI.
- En effet, 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.

IPV en pédiatrie

A Comparison of Intrapulmonary Percussive Ventilation and Conventional Chest Physiotherapy for the Treatment of Atelectasis in the Pediatric Patient

Kathleen Deakins RRT and Robert L Chatburn RRT FAARC

RESPIRATORY CARE • OCTOBER 2002 VOL 47 NO 10

Étude randomisée

Atelectatic children treated with intrapulmonary percussive ventilation via a face mask: Clinical trial and literature overview

THI KIM YEN HA,[1] THI DUNG BUI,[1] ANH TUAN TRAN,[2] PHILIPPE BADIN,[4] MICHEL TOUSSAINT[4,5] AND ANH TUAN NGUYEN[3]

Pediatrics International (2007) **49**, 502–507

Série de 6 patients

Nasal High Frequency Percussive Ventilation Versus Nasal Continuous Positive Airway Pressure In Transient Tachypnea of the Newborn:
A Pilot Randomized Controlled Trial (NCT00556738)

Eric Dumas De La Roque, MD, PhD,* Clotilde Bertrand, MD, Olivier Tandonnet, MD, Muriel Rebola, MD, Emilie Roquand, MD, Laurent Renesme, M.Sc., and Christophe Elleau, MD

Pediatric Pulmonology 00:1–6 (2010)

Étude randomisée incluant 46 patients

IPV en pédiatrie

Atelectatic children treated with intrapulmonary percussive ventilation via a face mask: Clinical trial and literature overview

THI KIM YEN HA,[1] THI DUNG BUI,[1] ANH TUAN TRAN,[2] PHILIPPE BADIN,[4] MICHEL TOUSSAINT[4,5] AND ANH TUAN NGUYEN[3]

A Comparison of Intrapulmonary Percussive Ventilation and Conventional Chest Physiotherapy for the Treatment of Atelectasis in the Pediatric Patient

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Nasal High Frequency Percussive Ventilation Versus Nasal Continuous Positive Airway Pressure In Transient Tachypnea of the Newborn: A Pilot Randomized Controlled Trial (NCT00556738)

Eric Dumas De La Roque, MD, PhD,* Clotilde Bertrand, MD, Olivier Tandonnet, MD, Muriel Rebola, MD, Emilie Roquand, MD, Laurent Renesme, MSc., and Christophe Elleau, MD

- L'emploi de l'IPV est possible en pédiatrie et n'a pas d'effet secondaire décrit.
- L'IPV peut s'avérer utile pour améliorer les atélectasies chez des enfants rebelles aux techniques classiques de kinésithérapie respiratoire ou lorsque la participation active de l'enfant n'est pas disponible.

Intensive Care Med
DOI 10.1007/s00134-006-0427-8

ORIGINAL

Enrico M. Clini
Francesca Degli Antoni
Michele Vitacca
Ernesto Crisafulli
Mara Paneroni
Sheila Chezzi-Silva
Maurizio Moretti
Ludovico Trianni
Leonardo M. Fabbri

Intrapulmonary percussive ventilation in tracheostomized patients: a randomized controlled trial

- Étude multicentrique, randomisée, incluant 46 patients trachéotomisés
- Chest Physiotherapy (CPT) versus CPT + 10 min d'IPV
- Groupe IPV :
  - meilleurs échanges gazeux (PaO2/FIO2)
  - meilleure performance des muscles expiratoires estimée par la pression maximale expiratoire
  - moindre incidence de pneumonie ($p < 0,05$)

Intensive Care Med
DOI 10.1007/s00134-010-1993-3

EXPERIMENTAL

Umberto Lucangelo
Agostino Accardo
Alessandro Bernardi
Massimo Ferluga
Massimo Borelli
Vittorio Antonaglia
Fabio Riscica
Walter A. Zin

Gas distribution in a two-compartment model ventilated in high-frequency percussive and pressure-controlled modes

Conclusions: HFPV accommodated volume distribution without overinflating compartments with low time constants, thus possibly presenting a potential protective behavior in mechanically heterogeneous lungs.

Indications de la ventilation à percussions intrapulmonaires (VPI) : revue de la littérature

Indications for intrapulmonary percussive ventilation (IPV):
A review of the literature

À paraître

Insufflation – Exsufflation mécanique

JIKRI 16 et 17/11/2000 Recommandations Lyon

Recommandations des Journées Internationales de Kinésithérapie Respiratoire Instrumentale (JIKRI)

The Use of Mechanical Insufflation-Exsufflation Via Artificial Airways

Michel Toussaint PhD

RESPIRATORY CARE • AUGUST 2011 VOL 56 NO 8

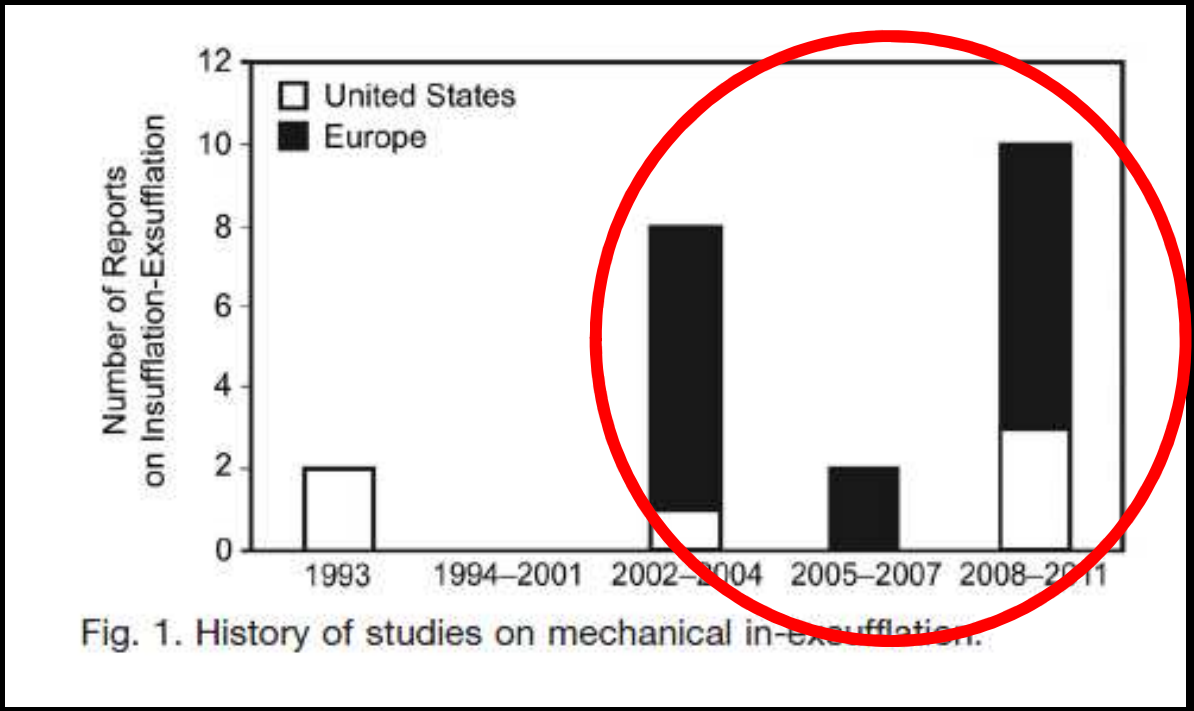


Fig. 1. History of studies on mechanical in-exsufflation.

21 articles publiés dans les 10 dernières années

The Use of Mechanical Insufflation-Exsufflation Via Artificial Airways

Michel Toussaint PhD

RESPIRATORY CARE • AUGUST 2011 VOL 56 NO 8

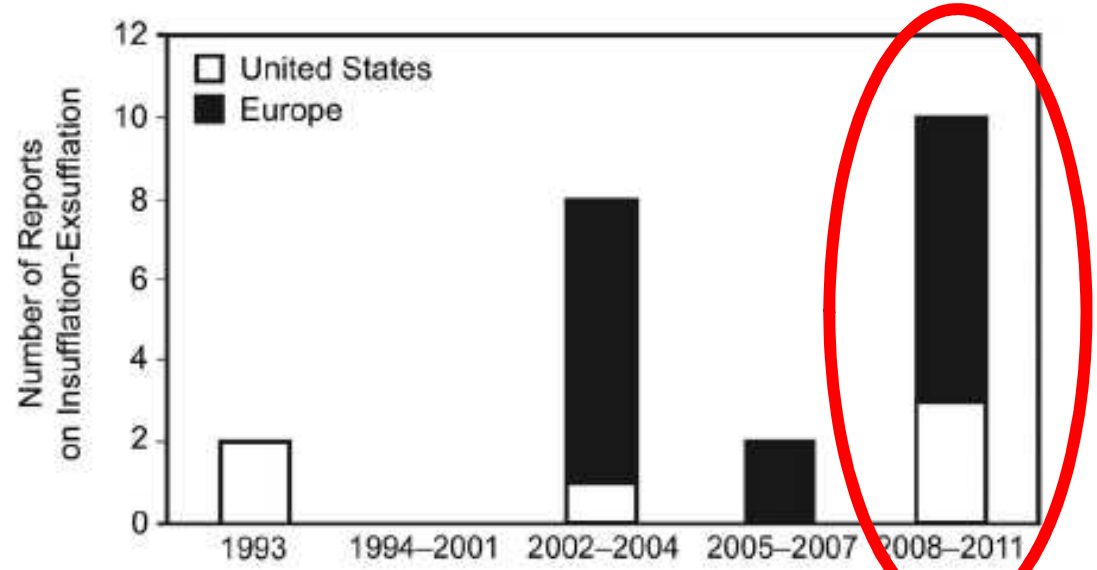


Fig. 1. History of studies on mechanical in-exsufflation.

dont 10 publiés dans les 4 dernières années

Insufflation-exsufflation mécanique

Voie non-invasive

Fig. 4. The CoughAssist In-Exsufflator used with a mask and manual cough assist (abdominal thrust). (Courtesy of the Ottawa Hospital Rehabilitation Centre. From Reference 34, with permission.)

Voie invasive

Fig. 3. The CoughAssist In-Exsufflator used with a tracheostomy. (Courtesy of Respironics, Murrysville, Pennsylvania.)

Photos : RESPIRATORY CARE • OCTOBER 2007 VOL 52 NO 10

Insufflation-exsufflation mécanique

Voie non-invasive

- Chez les patients très faibles avec syndromes respiratoires restrictifs et encombrement proximal, la capacité de la MI-E à produire les débits à la toux plus haut que n'importe quelle technique d'augmentation de toux manuelle ou instrumentale est bien documentée.

Bach JR, Smith WH, Michaels J, Saporito L, Alba AS, Dayal R, Pan J. Airway secretion clearance by mechanical exsufflation for post-poliomyelitis ventilator-assisted individuals. Arch Phys Med Rehabil 1993;74(2):170–177.

Bach JR. Mechanical insufflation-exsufflation. Comparison of peak expiratory flows with manually assisted and unassisted coughing techniques. Chest 1993;104(5):1553–1562.

Chatwin M, Ross E, Hart N, Nickol AH, Polkey MI, Simonds AK. Cough augmentation with mechanical insufflation/exsufflation in patients with neuromuscular weakness. Eur Respir J 2003;21(3):502–508.

Senent C, Golmard JL, Salachas F, Chiner E, Morelot-Panzini C, Meninger V, et al. A comparison of assisted cough techniques in stable patients with severe respiratory insufficiency due to amyotrophic lateral sclerosis. Amyotroph Lateral Scler 2011;12(1):26–32.

Insufflation-exsufflation mécanique

Voie non-invasive

Efficacy of Mechanical Insufflation-Exsufflation in Medically Stable Patients With Amyotrophic Lateral Sclerosis*

Jesús Sancho, MD; Emilio Servera, MD, FCCP; Juan Díaz, RN; and Julio Marín, MD, FCCP

(CHEST 2004; 125:1400–1405)

Amyotroph Lateral Scler. 2011 Jan;12(1):26-32. Epub 2010 Nov 24.

A comparison of assisted cough techniques in stable patients with severe respiratory insufficiency due to amyotrophic lateral sclerosis.

Senent C, Golmard JL, Salachas F, Chiner E, Morelot-Panzini C, Meninger V, Lamouroux C, Similowski T, Gonzalez-Bermejo J.

- MI-E peut significativement augmenter le débit expiratoire de pointe à la toux des patients, tant bulbaire que non bulbaire
- Exception faite des patients avec dysfonction glottique sévère

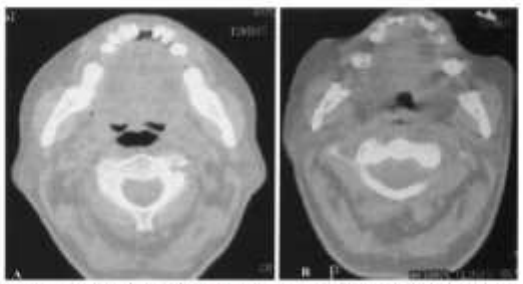


Fig. 7. Computed tomogram of the oropharynx in a patient with bulbar amyotrophic lateral sclerosis and a peak cough flow of < 2.7 L/s (see text). A: Baseline. B: Pharyngeal collapse during exsufflation. (From Reference 46, with permission.)

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/*Air Stacking* + 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 comparision of peak expiratory flows with manually assisted and unassisted coughing techniques. Chest 1993;104:1553-62.

Insufflation-exsufflation mécanique

Voie non-invasive

- MI-E peut limiter les hospitalisations et le recours à la trachéotomie et à l'intubation

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.

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.

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.

Insufflation-exsufflation mécanique

Voie non-invasive

- MI-E permet de diminuer la durée des séances de désencombrement, au prix d'un moindre effort : moins de baisse de SpO_2, moins de sensation de dyspnée

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.

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.

Insufflation-exsufflation mécanique

Voie non-invasive

- 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

			Neuromuscular weakness	
	Normal subjects (n=9)	*COPD (n=8)*	*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)	[illegible]	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)	[illegible]	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)	[illegible]	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

Insufflation-exsufflation mécanique

Voie invasive

- Dans ce cas, ni la toux spontanée du patient, ni le contrôle de glotte ne sont nécessaires et la MI-E peut produire une « toux artificielle », même chez des patients inconscients ou sédatés
- Malgré des résultats prometteur, l'utilisation de la MI-E dans des conditions n'est pas encore commune.

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.

Insufflation-exsufflation mécanique

Voie invasive

- Pourtant, dans ces conditions, les patients ont trouvé la MI-E plus efficace, moins irritante, moins douloureuse, moins fatigante et plus confortable que l'aspiration

Garstang SV, Kirshblum SC, Wood KE. Patient preference for in-exsufflation for secretion management with spinal cord injury. J Spinal Cord Med 2000;23(2):80–85.

Sancho J, Servera E, Vergara P, Marín J. Mechanical insufflation-exsufflation vs. tracheal suctioning via tracheostomy tubes for patients with amyotrophic lateral sclerosis: a pilot study. Am J Phys Med Rehabil 2003;82(10):750–753.

Insufflation-exsufflation mécanique

Voie invasive

Pediatr Pulmonol. 2010 Oct 20. [Epub ahead of print]

Use of a lung model to assess mechanical in-exsufflator therapy in infants with tracheostomy.

Striegl AM, Redding GJ, Diblasi R, Crotwell D, Salyer J, Carter ER.

- Durée de l'insufflation >1sec nécessaire pour équilibrer pression d'insufflation et pression alvéolaire
- L'augmentation des pressions d'insufflation et d'exsufflation augmentent toutes 2 le débit expiratoire maximum, mais l'augmentation du niveau de pression d'exsufflation a le plus grand impact

Insufflation-exsufflation mécanique

Voie invasive

Performance of the CoughAssist Insufflation-Exsufflation Device in the Presence of an Endotracheal Tube or Tracheostomy Tube: A Bench Study

Claude Guérin MD PhD, Gaël Bourdin MD, Véronique Leray MD, Bertrand Delannoy MD, Frédérique Bayle MD, Michèle Germain MD, and Jean-Christophe Richard MD PhD

RESPIRATORY CARE • AUGUST 2011 VOL 56 NO 8

Table 5. Expected Expiratory Pressure* to Reach Assisted Peak Expiratory Flow of 2.7 L/s Computed With the Constants in Tables 1 Through 4

	Compliance 30 mL/cm H_2O Resistance 0 cm H_2O/L/s	Compliance 30 mL/cm H_2O Resistance 5 cm H_2O/L/s	Compliance 60 mL/cm H_2O Resistance 0 cm H_2O/L/s	Compliance 60 mL/cm H_2O Resistance 5 cm H_2O/L/s
Control	20 (17–22)	30 (28–56)	15 (12–17)	28 (27–29)
Endotracheal Tube				
6.5 mm	55 (52–60)	61 (58–66)	40 (38–44)	46 (43–49)
7.0 mm	48 (47–50)	57 (54–61)	32 (31–33)	39 (38–41)
7.5 mm	42 (42–42)	49 (48–50)	NA†	32 (32–33)
8.0 mm	37 (36–38)	41 (41–41)	28 (17–35)	NA†
8.5 mm	32 (29–34)	41 (41–42)	31 (31–31)	NA†
Tracheostomy Tube				
6.0 mm	51 (49–54)	57 (54–60)	34 (31–43)	42 (40–45)
7.0 mm	35 (34–37)	44 (44–45)	35 (24–44)	NA†
8.0 mm	27 (24–29)	37 (36–37)	25 (22–27)	30 (27–31)

* Values are mean and 95% CI cm H_2O.

† Not applicable: not computed because of deviation from linearity.

- Quelles nouveautés depuis les JIKRI ?

La mobilisation précoce, l'exercice et le réentrainement à l'effort :

- L'exercice a montré son intérêt pour augmenter l'expectoration de mucus (Bradley 2002; Webb 1995)

Needham
JAMA 2008

Respiratory Medicine (2012) 106, 75–83

Diapo V. LERAY

Conclusion :

RESPIRATORY CARE
The Science Journal of the American Association for Respiratory Care

Editorials

July 2002 / Volume 47 / Number 7 / Page 757

Secretion Clearance Techniques: Absence of Proof or Proof of Absence?

Conclusion :

- Les techniques instrumentales nous incitent à nous intéresser à la phase inspiratoire lors des séances de désencombrement.

A short-term comparison of two methods of sputum expectoration in cystic fibrosis

K. Chatham, A.A. Ionescu, L.S. Nixon, D.J. Shale

Eur Respir J 2004; 23: 435–439

- 20 patients adultes (mucoviscidose)
- Étude randomisée, « postural drainage and actice cycle of breathing technique » *versus* résistance inspiratoire (80% du max)

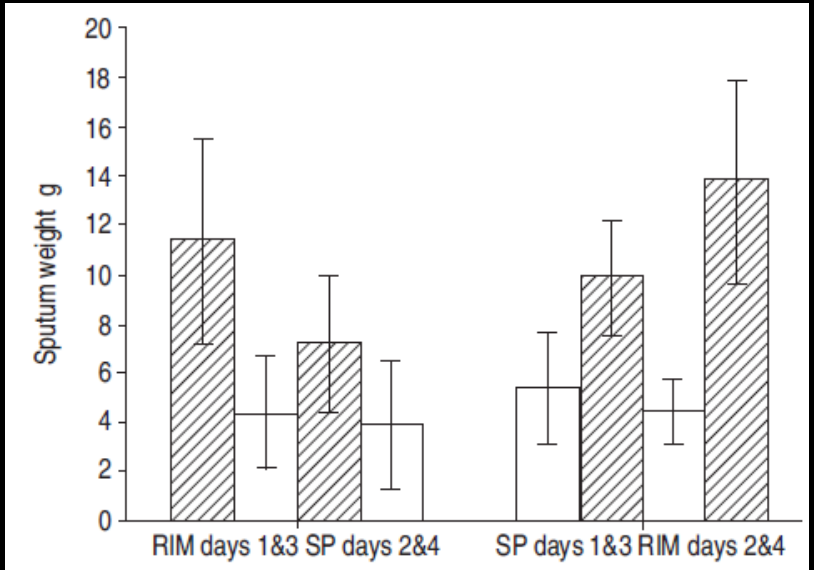


Fig. 2.–The mean weight of sputum expectorated during resistive inspiratory manoeuvres (RIM; ▨) treatment and standardised physiotherapy (SP; □).

Physiother Theory Pract. 2010 Aug;26(6):353-7.

A comparison of the Acapella and a threshold inspiratory muscle trainer for sputum clearance in bronchiectasis-A pilot study.

Naraparaju S, Vaishali K, Venkatesan P, Acharya V.
Department of Physiotherapy, Kasturba Medical College, Sanjeevreddy Nagar, Hyderabad, India. physio.kmc@gmail.com

- 30 patients, âge moyen 50 ans, expectorant plus de 30 ml de mucus par jour
- Acapella *versus* threshold

RESULTS: A statistically significant difference was found in the sputum volume expectorated after treatment with the Acapella (7.16+/-1.12 ml) compared with the threshold inspiratory muscle trainer (6.46+/-1.08 ml). Patients preferred Acapella in terms of usefulness of clearing secretions.

Et si l'effet des résistances expiratoires étaient en partie dû aux modifications de la reprise inspiratoire qui lui succède …

Conclusion :

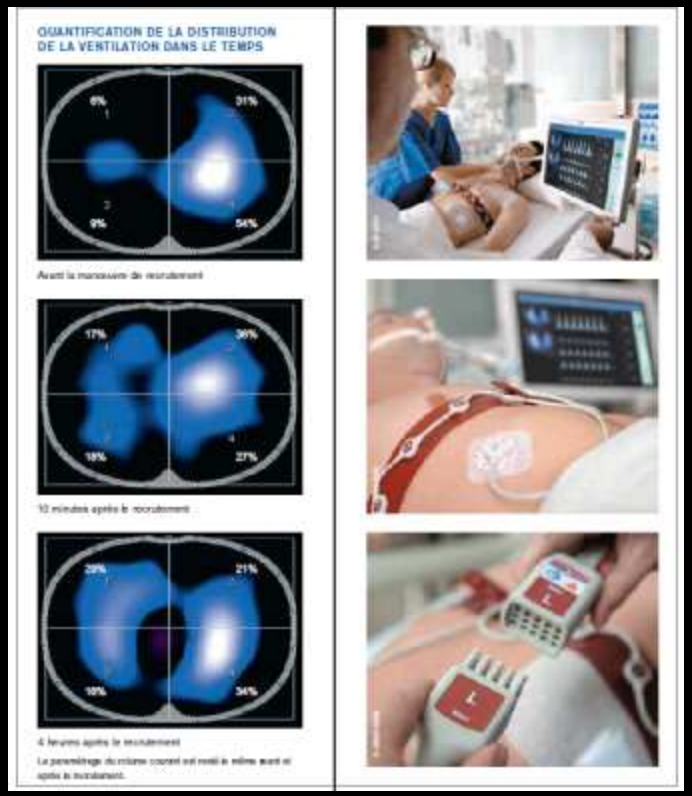
- Les techniques instrumentales nous incitent à nous intéresser à la phase inspiratoire lors des séances de désencombrement.
- Il ne suffit plus de s'intéresser au « sacro-saint » crachat…
- Mais il faut s'intéresser aux « zones tranquilles » du poumon (plus difficile à objectiver…)

Inspiré des commentaires de Guy Postiaux sur la liste kinérespi

L’avenir ?

- Continuons à ausculter !!
- De nouvelles techniques pour « objectiver » la ventilation

Diapo Paolo Pelosi



Maybe the secret to airway clearance comes from the literature a century ago; Booker commented:

I have had good results in these cases from pouring a small quantity of whiskey and water into the [child's] throat, some of which passed into the trachea and brought on coughing, which was soon followed by good breathing.

Positive Expiratory Pressure and
Oscillatory Positive Expiratory Pressure Therapies

Timothy R Myers RRT-NPS

RESPIRATORY CARE • OCTOBER 2007 VOL 52 NO 10

Liste kinerespi sur Yahoo

guillaume.riffard@orange.fr