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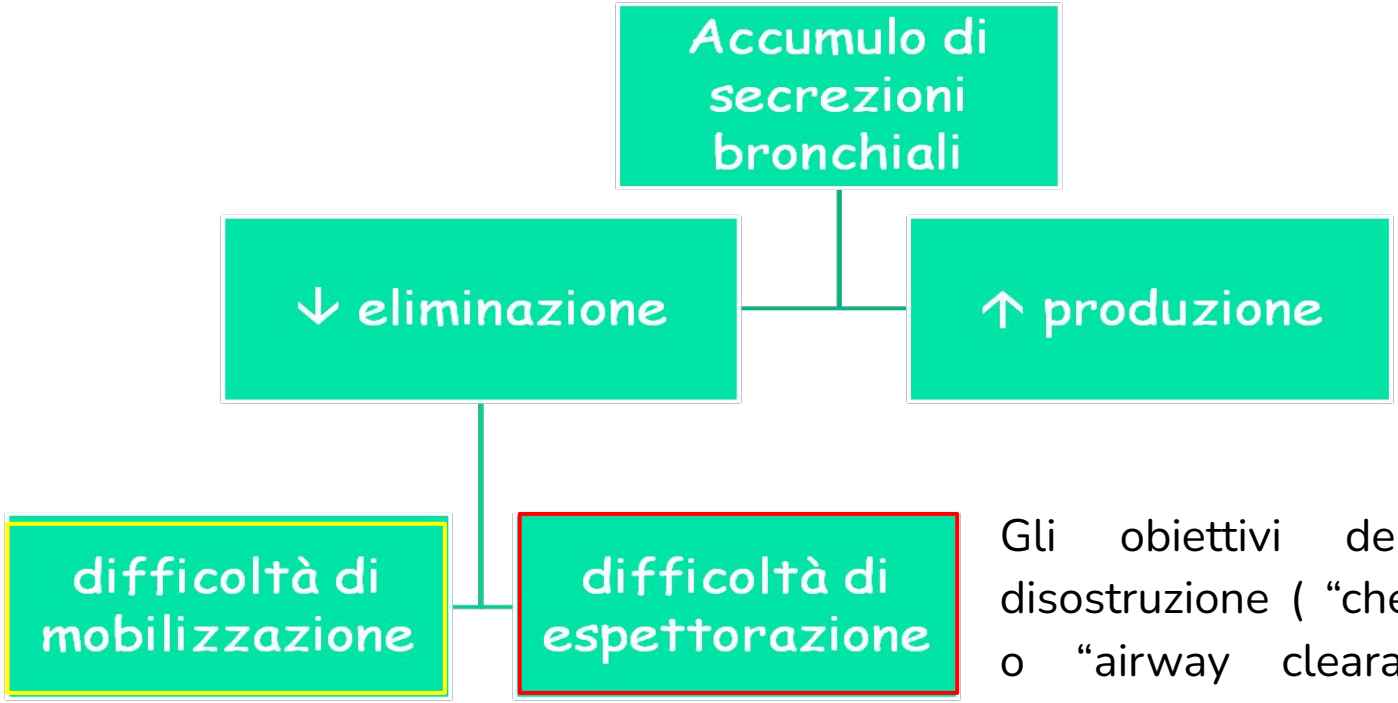
XXVIII Congresso Nazionale SIMRI
Torino, 10-12 ottobre 2024

# Disostruzione bronchiale nella riacutizzazione respiratoria del paziente con patologia neuromuscolare


Torino, 10 Ottobre 2024

Ft Matteo Masolini, AOU IRCCS Meyer

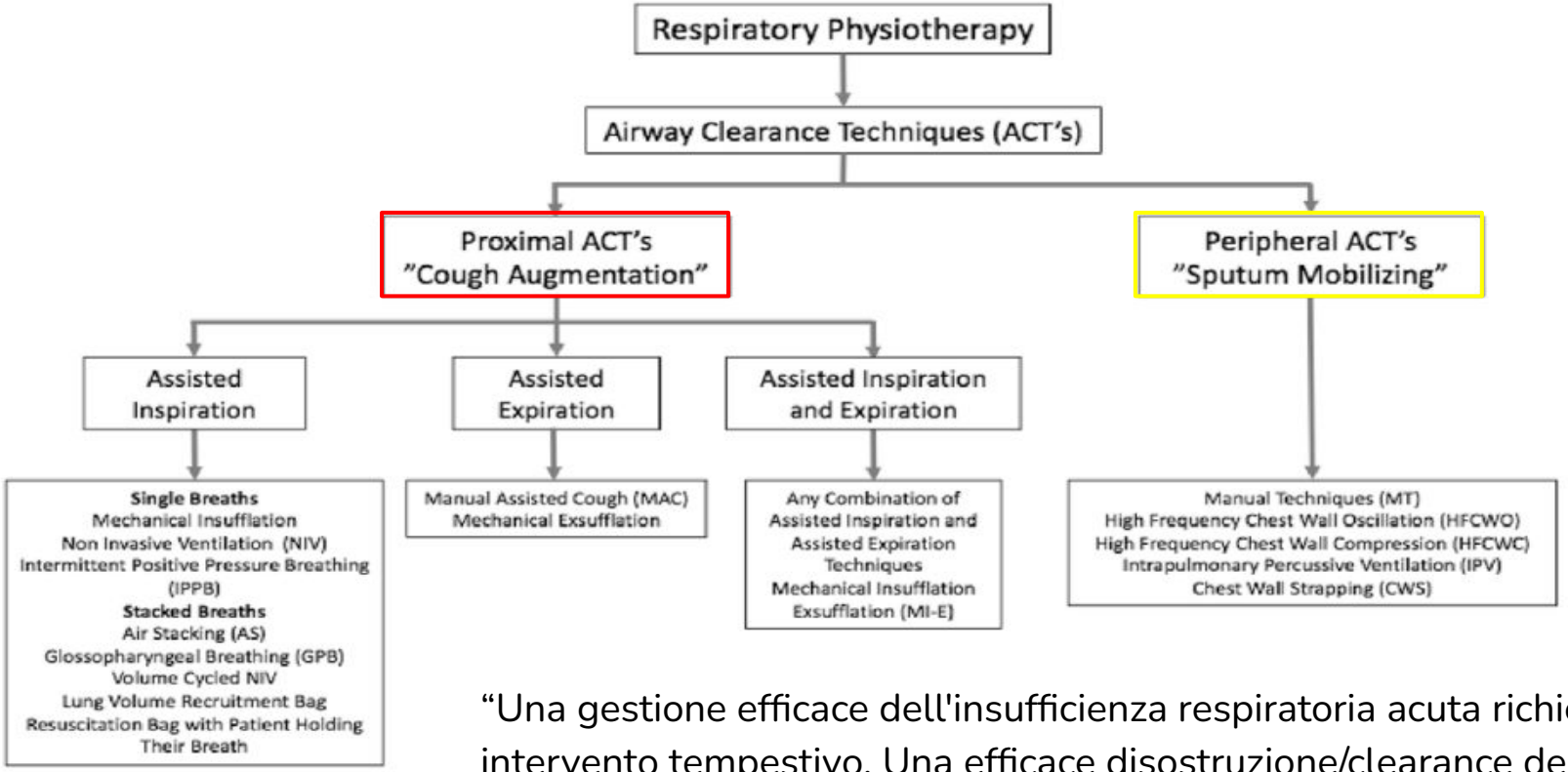
IRCCS Meyer
Azienda Ospedaliera Universitaria




Gli obiettivi delle tecniche di disostruzione ( “chest physiotherapy” o “airway clearance techniques”) sono prevenire o ridurre le conseguenze meccaniche dell'ostruzione delle secrezioni

Review article

# Airway clearance techniques in neuromuscular disorders: A state of the art review




"Una gestione efficace dell'insufficienza respiratoria acuta richiede un intervento tempestivo. Una efficace disostruzione/clearance delle vie aeree è essenziale." BTS Guidelines, Thorax 2014


1. Utilizzo in/exsufflator (MIE) anche dal TET per favorire weaning ventilatorio
2. MIE per evitare reintubazione
3. MIE per favorire weaning NIV
4. “**Oxymetry feedback protocol**”

- MI-E should be available in the acute setting in all hospitals that treat neuromuscular patients as an alternative method of airway clearance with the purpose of preventing deterioration and the need for intubation and mechanical ventilation. [D]

BTS Guideline Thorax 2012

CHEST Original Research
CRITICAL CARE MEDICINE

**Extubation of Patients With Neuromuscular Weakness**

**A New Management Paradigm**

*John Robert Bach, MD; Miguel R. Gonçalves, PT; Irram Hamdani, MD; and Joao Carlos Winck, MD, PhD*

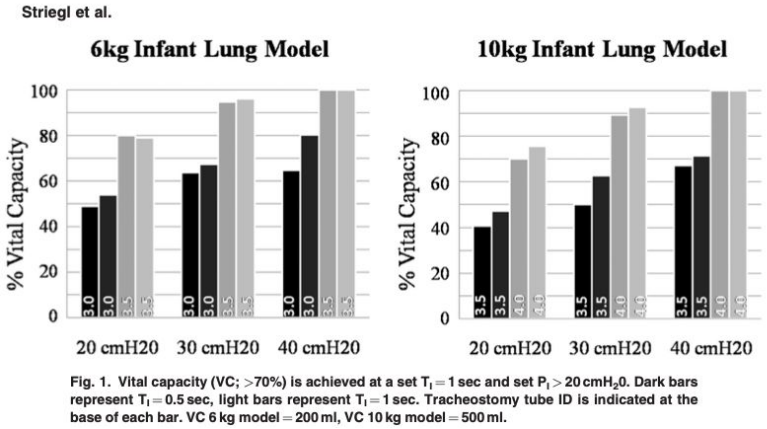
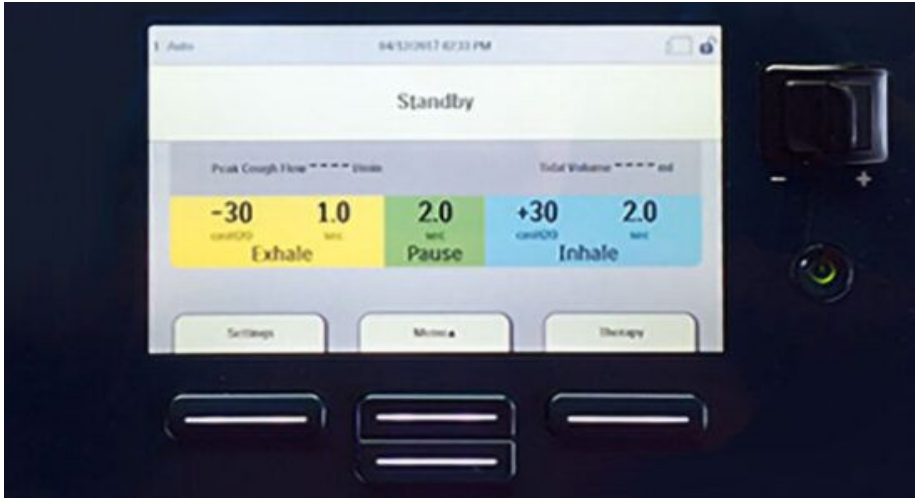



Fig. 1. Vital capacity (VC; >70%) is achieved at a set $T_I = 1$ sec and set $P_I > 20$ cm$H_20$. Dark bars represent $T_I = 0.5$ sec, light bars represent $T_I = 1$ sec. Tracheostomy tube ID is indicated at the base of each bar. VC 6 kg model = 200 ml, VC 10 kg model = 500 ml.



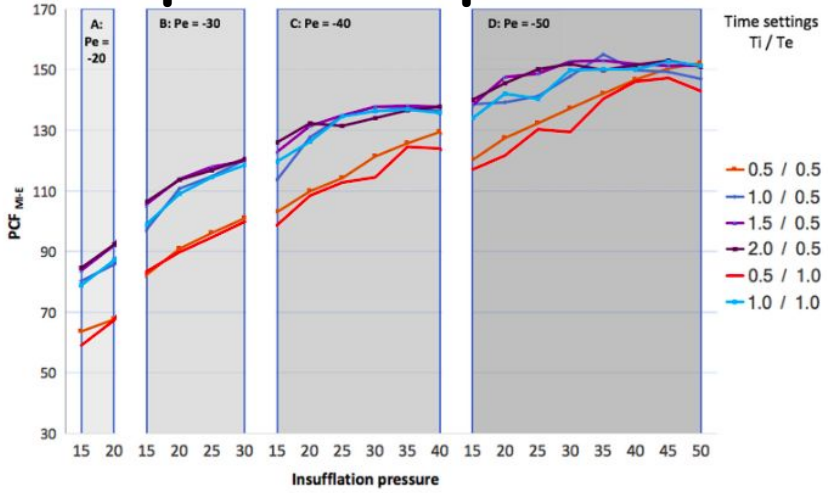

- **Utilizzo pressioni "asimmetriche" (**Pinsp 20–30 cmH2O e Pesp 30–40 cmH2O)
- un tempo di insufflazione >  1 sec
- **Tinsp > Tesp**
- ***Un Tesp più lungo non ha un impatto significativo sul volume o sulla velocità del flusso***

**Use of a Lung Model to Assess Mechanical In-Exsufflator Therapy in Infants With Tracheostomy**

Amanda M. Striegl, MD,[1]* Gregory J. Redding, MD,[1] Robert DiBlasi, RRT,[2] Dave Crotwell, RRT,[2] John Salyer, RRT and,[2] Edward R. Carter, MD[1]

# Peak CoughExpiratory Flow (PCEF)

- Pe quanto tollerato (-40 - 50 cmH20)
- Pinsp Bassa con Tinsp “lungo”
- Pinsp Alto e Tinsp breve



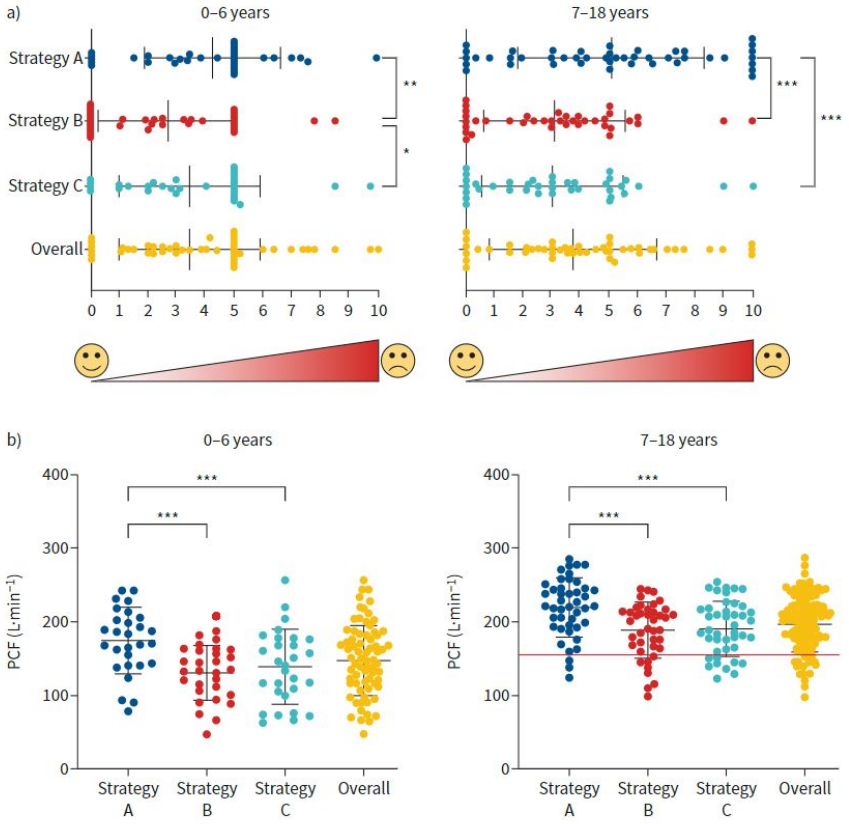

**Optimizing expiratory flows during mechanical cough in a pediatric neuromuscular lung model**

Brit Hov MSc[1,2] | Tiina Andersen PhD[3,4] | Michel Toussaint PhD[5] |

| | 0,5/0,5 | | 1/0,5 | | 1,5/0,5 | | 2/0,5 | |
|---|---|---|---|---|---|---|---|---|
| | Volume (ml) | Flow (l/min) | Volume (ml) | Flow (l/min) | Volume (ml) | Flow (l/min) | Volume (ml) | Flow (l/min) |
| 15/-20 | 212 | 64 | 314 | 80 | 344 | 84 | 352 | 85 |
| 20/-20 | 245 | 68 | 363 | 86 | 391 | 92 | 397 | 92 |
| 15/-30 | 214 | 82 | 323 | 97 | 359 | 105 | 368 | 106 |
| 20/-30 | 258 | 91 | 380 | 111 | 409 | 114 | 415 | 114 |
| 25/-30 | 294 | 96 | 424 | 115 | 442 | 118 | 445 | 117 |
| 30/-30 | 328 | 101 | 452 | 120 | 462 | 120 | 464 | 121 |
| 15/-40 | 218 | 103 | 336 | 114 | 370 | 123 | 376 | 126 |
| 20/-40 | 261 | 110 | 387 | 128 | 417 | 132 | 424 | 132 |
| 25/-40 | 298 | 114 | 431 | 135 | 451 | 135 | 455 | 132 |
| 30/-40 | 336 | 121 | 460 | 138 | 470 | 138 | 472 | 134 |
| 35/-40 | 371 | 126 | 475 | 137 | 481 | 138 | 483 | 137 |
| 40/-40 | 404 | 129 | 484 | 136 | 488 | 138 | 489 | 138 |
| 15/-50 | 216 | 120 | 339 | 139 | 372 | 138 | 380 | 140 |
| 20/-50 | 259 | 127 | 393 | 139 | 424 | 148 | 430 | 145 |
| 25/-50 | 298 | 132 | 436 | 141 | 457 | 149 | 460 | 150 |
| 30/-50 | 335 | 137 | 465 | 148 | 476 | 153 | 478 | 152 |
| 35/-50 | 372 | 142 | 481 | 155 | 487 | 153 | 488 | 150 |
| 40/-50 | 406 | 147 | 490 | 150 | 494 | 152 | 495 | 152 |
| 45/-50 | 439 | 150 | 496 | 149 | 498 | 151 | 499 | 153 |
| 50/-50 | 466 | 152 | 499 | 147 | 502 | 151 | 503 | 151 |

1. **P asimmetrici:** domicilio per comfort
2. **P simmetrici:** (Pinsp + alto Tinsp + basso) riacutizzazione per PCEF

| Strategy A<br>**Symmetric** | Strategy B<br>**Asymmetric**<br>by age | Strategy C<br>**Personalised** |
|---|---|---|
| Insufflation/exsufflation<br><br>Pressure: +50/−50 $cmH_2O$<br><br>Times (by age):<br><6 years - 1/1 s<br>6–12 years - 1.5/1.5 s<br>>12 years - 2/2 s<br><br>Analysed sequences =72 | Insufflation/exsufflation<br><6 years:<br>Pressure: +25/−40 $cmH_2O$<br>Times: 1.5/1 s<br>>6 years:<br>Pressure: +30/−40 $cmH_2O$<br>Times: 2/1.5 s<br><br>Analysed sequences =73 | Insufflation/exsufflation<br>mean±SD<br>Pressure: $cmH_2O$<br>33±5.08/−39.3±4.85<br><br>Times: seconds<br>1.7±0.26/1.4±0.32<br><br>Analysed sequences =73 |




## Mechanically assisted cough strategies: user perspectives and cough flows in children with neurodisability

Brit Hov [1,2], Tiina Andersen[3,4], Michel Toussaint[5], Ingvild B. Mikalsen[6,7], Maria Vollsæter[7,8],

- When using sputum mobilising techniques, appropriate emergency equipment (eg, resuscitation bag and suction) should be available in case of mobilising large mucus plugs into the central airways where they may result in airways obstruction. [√]
- Children who use regular night-time or diurnal NIV should use their ventilator to support deep breathing during airway clearance treatments. Use of NIV during airway clearance sessions can help prevent respiratory muscle fatigue. [√]
- Children who use MI-E for airway clearance should be given a long enough periods of rest during treatment sessions to prevent respiratory muscle fatigue due to coughing. [√]
- At the end of a treatment session with MI-E it is important to complete the session with an insufflation to leave the child with an appropriate functional residual capacity. [√]

BTS guidelines

British Thoracic Society guideline for respiratory management of children with neuromuscular weakness

- Presidi adeguati (aspiratore, pallone AMBU)
- **Utilizzo NIV a supporto della seduta di disostruzione**
- Prevedere periodi sufficienti di riposo (sedute brevi e ripetute)
- *Impostare insufflazione finale a fine ciclo MIE*

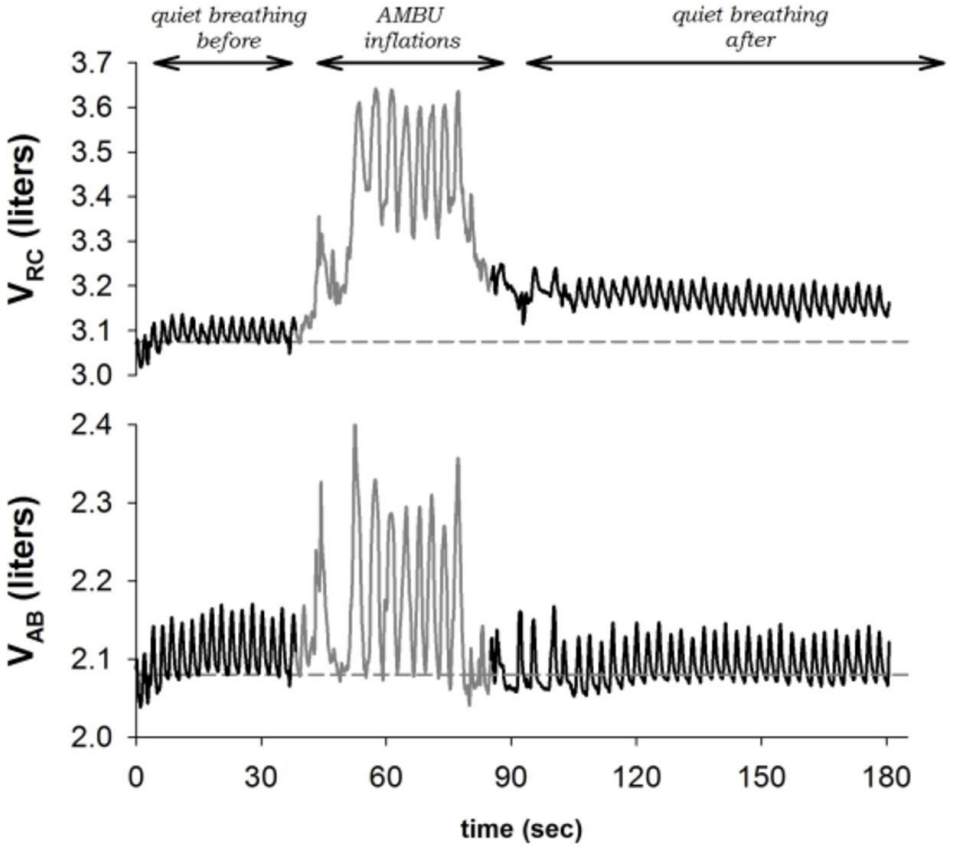



**Figure:** representative traces of ribcage ($V_{RC}$, top panel) and abdominal ($V_{AB}$, bottom panel) volumes during quiet breathing (black line) before and after AMBU inflations (grey line). The short-dashed grey line reprents end-expiratory volume before the AMBU inflations.

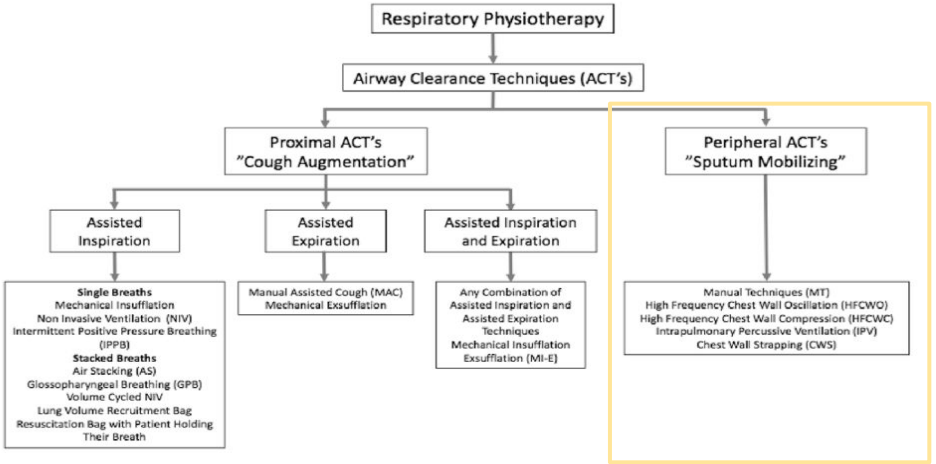
The effectiveness of AMBU-bag to recruit ribcage volume in spinal muscle atrophy
A Lo Mauro, European Respiratory Journal 2016

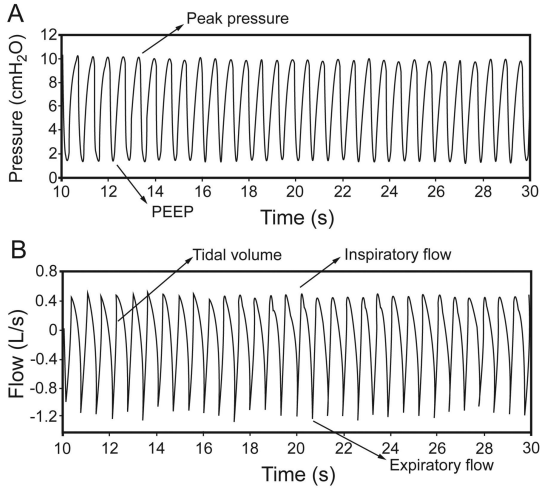
- Peripheral ACT should be commenced before and after clearing any secretions from the upper airway with proximal ACT's
- Peripheral ACT's do not require physical or intellectual patient co-operation
- Peripheral ACT's is possible in infants, children and adults, even in the presence of a tracheostomy and/or bulbar failure
- Deflation by CWS strapping, is promising and worth evaluating in a clinical trial
- MT should be considered as a treatment option
- In the ventilatory dependent patient, peripheral ACT should be used in combination with ventilator support

ACT: airway clearance technique; IPV: intrapulmonary percussive ventilation; HFCWO: high frequency chest wall oscillations; CWS: chest wall strapping; MT: manual techniques.

*"An expert report suggests that IPV and HFCWO/HFCWC may be recommended but lacks evidence, as for other ACT*

***The Paediatric BTS guidelines suggest that oscillatory techniques should be considered in children who have difficulty mobilizing secretions or who have persistent atelectasis , despite use of other airway clearance techniques"***

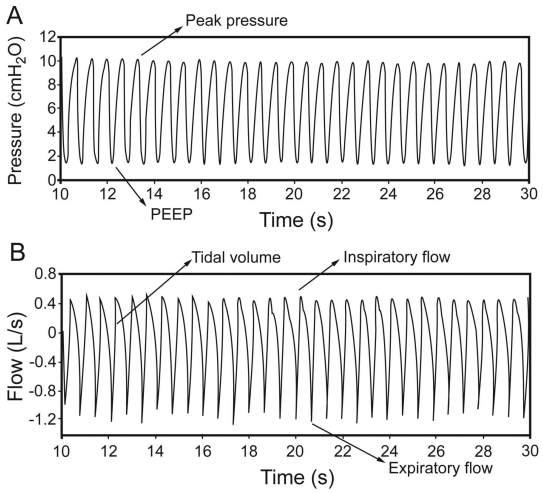





**L’ IPV è particolarmente utile nei pazienti con malattie neuromuscolari (NMD) e insufficienza respiratoria acuta.** Inoltre, può essere utilizzata in associazione con la ventilazione meccanica.

Respiratory Medicine 2018

L'IPV (Ventilazione Percussiva Intrapolmonare) sembra sicura, anche nei neonati che necessitano di assistenza per la pulizia delle vie aeree. Tuttavia, fino ad oggi, mancano criteri specifici per i bambini che permettano di determinare quando utilizzare queste modalità e quali siano le più efficaci.

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L'IPV abbinato alla ventilazione meccanica è stata studiato collegato ad un modello polmonare ed è stato osservato che **lo spostamento del muco era principalmente verso le zone distali del polmone, non favorendo quindi la pulizia delle vie aeree.**

*Fernandez-Restrepo et al "Effects of intrapulmonary percussive ventilation on airway mucus clearance: A bench model" World J Crit Care Med 2017*

Fig. 1. The RTX negative-pressure noninvasive ventilator. The pressures are transmitted externally, via the cuirass (right).

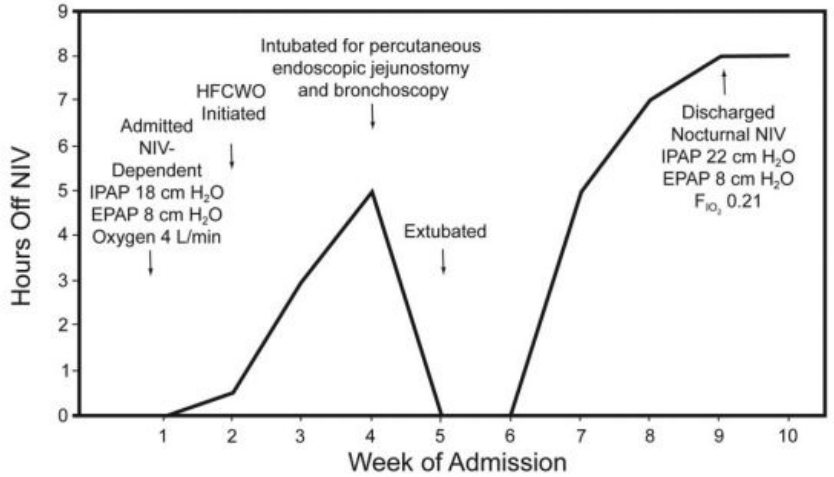


Fig. 2. Daily hours off of noninvasive ventilation (NIV) in our patient's clinical course. IPAP = inspiratory positive airway pressure. EPAP = expiratory positive airway pressure. HFCWO = high-frequency chest-wall oscillation.


# High-Frequency Chest-Wall Oscillation in a Noninvasive-Ventilation-Dependent Patient With Type 1 Spinal Muscular Atrophy

Joanna M Keating, Nicola Collins, Andrew Bush MD PhD, and Michelle Chatwin PhD

- MIE: impostare un programma “base” asimmetrico per favorire comfort e un programma simmetrico per le riacutizzazioni
- Sedute brevi e ripetute (feedback SpO2)
- Nei più piccoli (SMA) con NIV 24/24 utilizzare AMBU tra i cicli di MIE e/o aumentare RR NIV
- Tecniche di oscillazione ad alta frequenza  in caso di atelectasia persistente e/o mobilizzazione difficoltosa nonostante NIV/MIE