Secretion management in MND

26th March 2024

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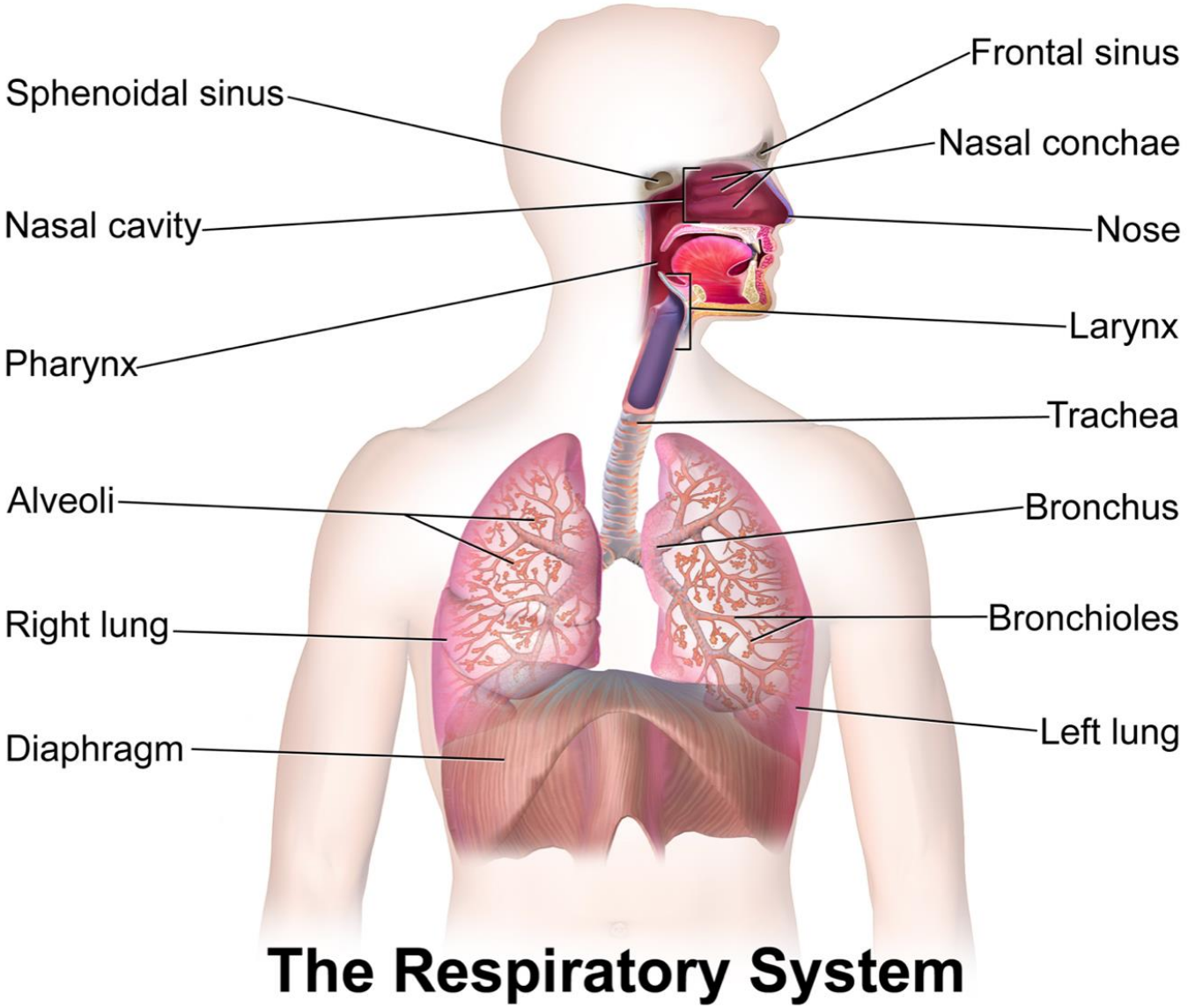
Anatomy review

Upper respiratory tract:

- Nasal Cavity
- Pharynx
- Larynx

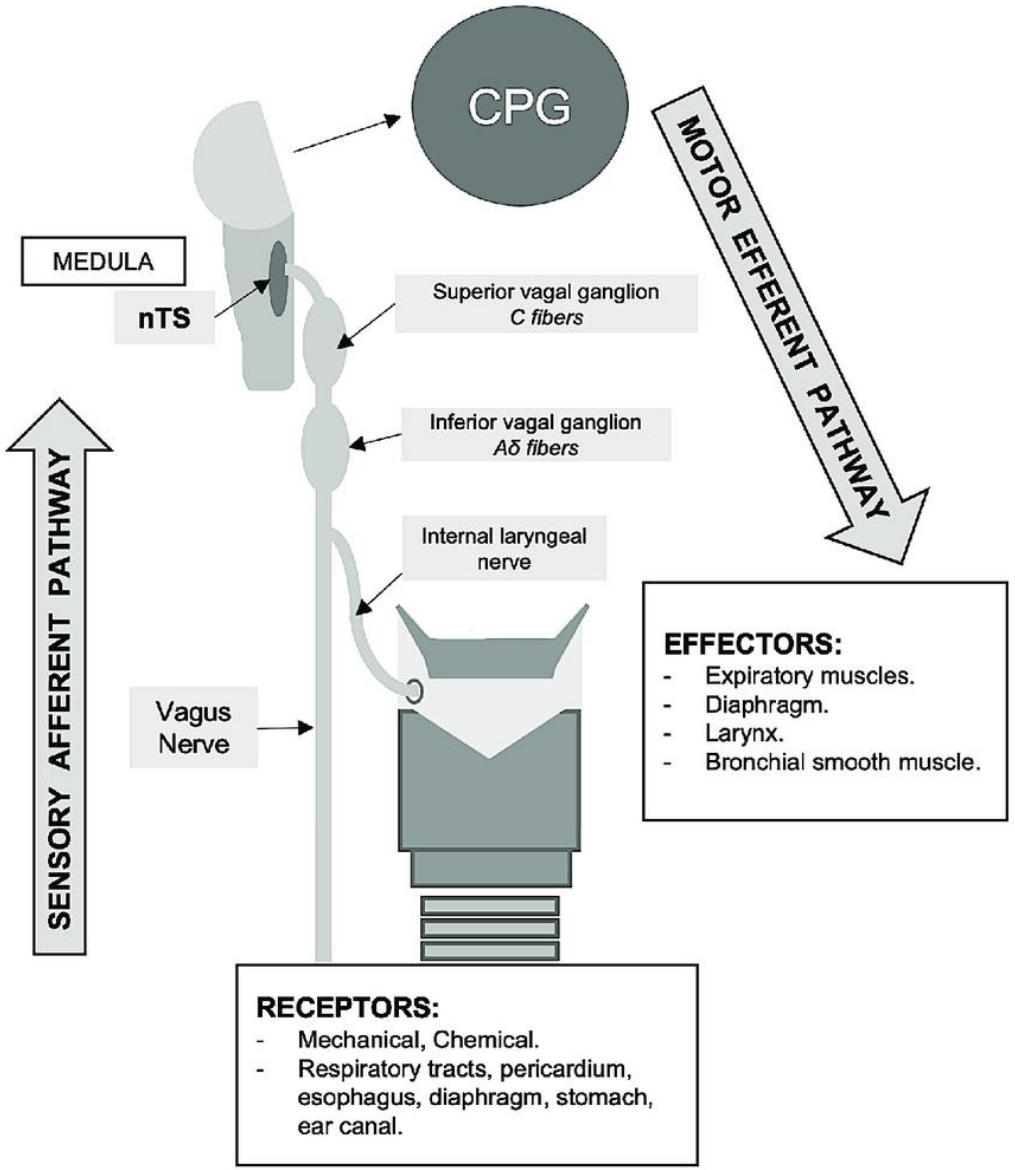
Lower Respiratory tract:

- Trachea
- Bronchus
- Bronchioles
- Alveoli



Chest secretion management

- Reduced cough function predispose to chest infection. Inability to clear chest secretions. Natural defence mechanism against aspiration of particles into the lung.

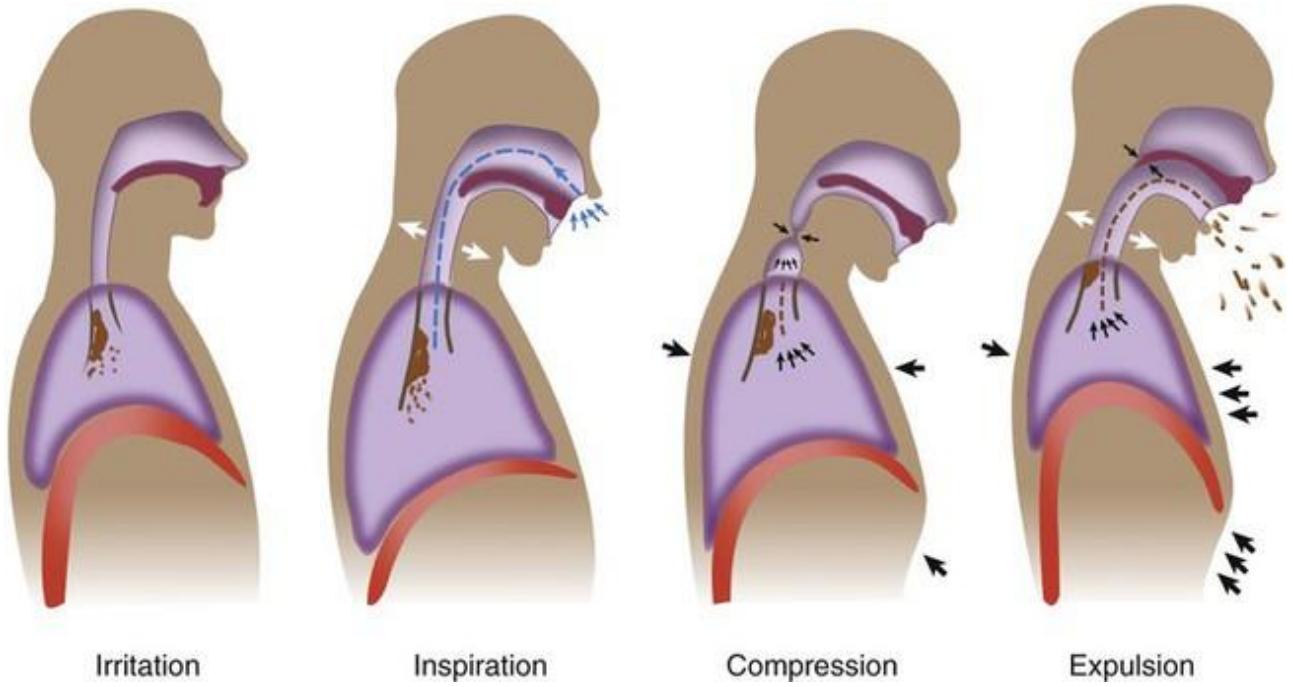

CPG
MOTOR EFFERENT PATHWAY
MEDULA
nTS
Superior vagal ganglion
C fibers
Inferior vagal ganglion
Aδ fibers
Internal laryngeal nerve
SENSORY AFFERENT PATHWAY
Vagus Nerve
EFFECTORS:
- Expiratory muscles.
- Diaphragm.
- Larynx.
- Bronchial smooth muscle.
RECEPTORS:
- Mechanical, Chemical.
- Respiratory tracts, pericardium, esophagus, diaphragm, stomach, ear canal.

Cough Mechanism

Insufflation phase

Build up of intra-thoracic pressures

Expulsion phase



Cough impairment in ALS

- Bulbar dysfunction

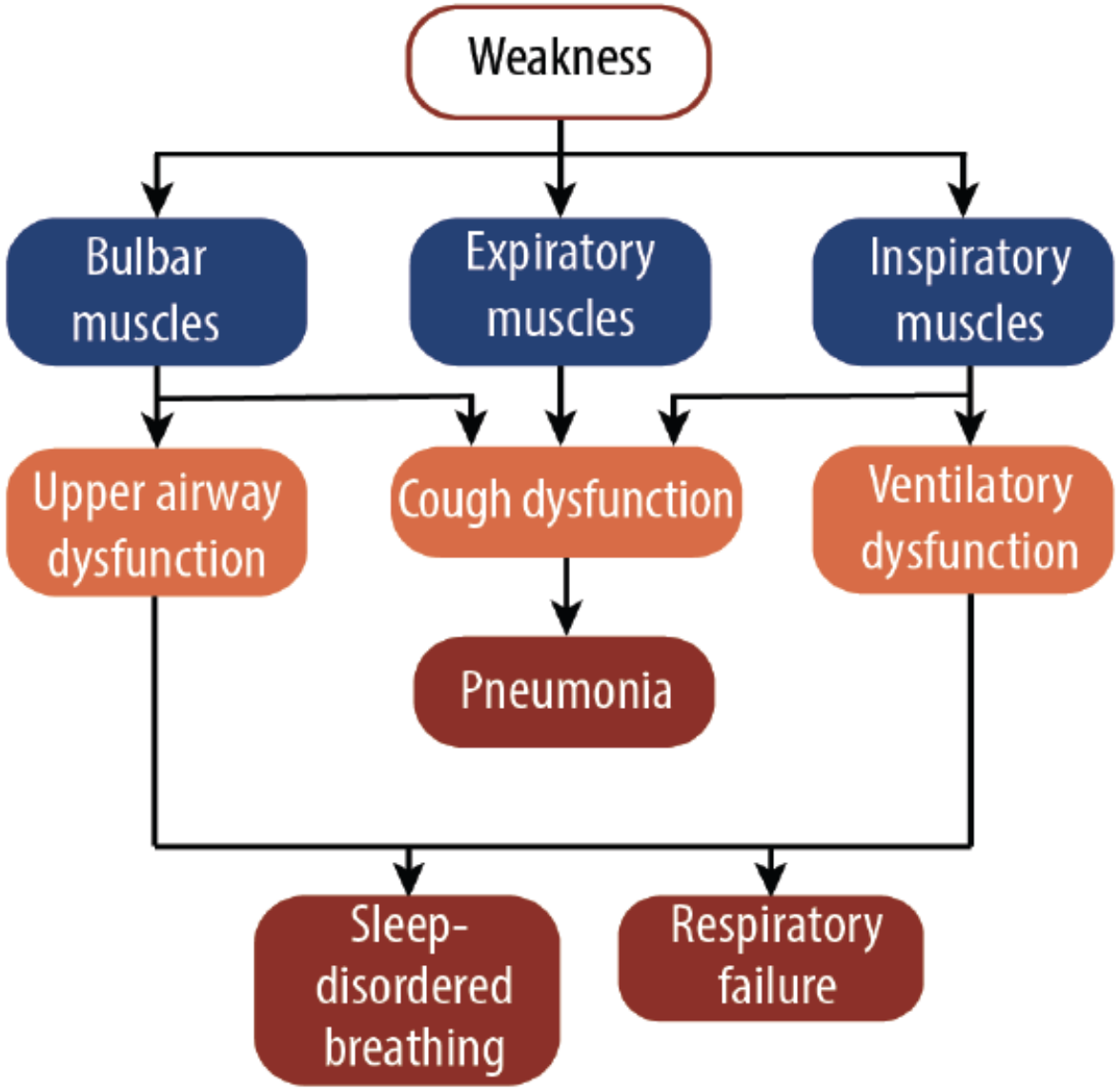
Reduces the rapid opening and closing of the glottis during coughing

- Inspiratory muscle weakness

Unable to reach maximal inspiratory capacity

- Abdominal/expiratory muscle weakness

Unable to generate adequate peak expiratory flow rates


Weakness
Bulbar muscles
Expiratory muscles
Inspiratory muscles
Upper airway dysfunction
Cough dysfunction
Ventilatory dysfunction
Pneumonia
Sleep-disordered breathing
Respiratory failure

Peak cough flow

360L/min

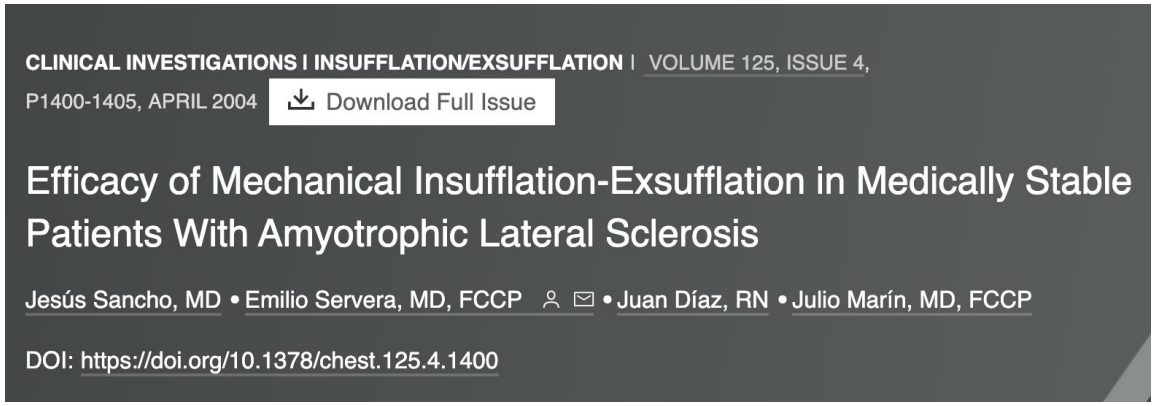
<360
>160L/min

160L/min

Cough augmentation strategies

Treatment modality	Phase of cough augmentation	Ease of delivery	Additional benefits
Lung volume recruitment bag (LVR, breath-stacking)	Insufflation phase (1)	Can be self administered if UL strength adequate Can teach caregiver to apply	• Helps to maintain chest wall compliance • Portable • Not battery operated
Manually assisted cough (MAC)	Expulsion phase (3)	Cannot be applied by individual	
Mechanical insufflation-exsufflation (MI:E, Cough assist)	Insufflation phase (1) Expulsion phase (3)	Can be self administered if UL strength adequate Can teach caregiver to apply	• Acutely enhanced forced vital capacity • Helps maintain chest wall compliance • May avoid need for emergency help

Evidence base



- N = 26 PwALS (15 with severe bulbar dysfunction
- Numerous lung capacity/volume outcome measures:
-
- Results:
- All pts had similar time from disease onset to diagnosis
- Statistical differences were found between the non-bulbar & bulbar patients in lung function and cough capacity parameters
- Four patients with bulbar dysfunction and MIC >1L had $PCF_{MI:E}$ < 2.7L/s

A preliminary randomized trial of the mechanica insufflator–exsufflator versus breath–stacking technique in patients with amyotrophic lateral sclerosis

Muhammad K Rafiq [1], Michael Bradburn [2], Alison R Proctor [1], Catherine G Billings [3], Stephen Bianchi [3], Christopher J McDermott [1], Pamela J Shaw [1]

- RCT
- 40 patients randomized to breath-stacking technique (n=21), MI:E (n=19)
- Patients followed up at 3-month intervals for at least 1yr or until death
- All patients diagnosed with respiratory failure and offered NIV

- Primary outcome measure:
- No. of days with symptoms of chest infection, treated with antibiotics, in the community or in hospital.

- Secondary outcome measures: Survival and QoL benefit

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

Cristina Senent, Jean-Louis Golmard, François Salachas, Eusebi Chiner, Capucine Morelot-Panzini, Vincent Meninger, ...

Pages 26-32 | Received 26 Apr 2010, Accepted 21 Oct 2010, Published online: 24 Nov 2010

- Unassisted PCF vs $PCF_{MI:E}$

- Bulbar group, these values were 42 (35–130) l/min versus 436 (244–630) l/min, respectively (p = 0.008), and 89 (40–106) l/min versus 491 (192–580) l/min, respectively, in the non-bulbar group (p = 0.019)

The effects of lung volume recruitment on coughing and pulmonary function in patients with ALS

Stuart Cleary, John E. Misiaszek, Sanjay Kalra, Sonya Wheeler & Wendy Johnston

Pages 111-115 | Received 10 May 2012, Accepted 05 Aug 2012, Published online: 12 Sep 2012

LVR had a significantly positive effect on FVC for up to 15 min following treatment but did not have a facilitative effect on SnP at any time-point.

LVR had a significantly positive effect on PCF during unassisted coughing at both 15 min and 30 min following treatment, and there was no significant decrease in flow rates from baseline to 30 min later.

Observational Study > Thorax. 2017 Mar;72(3):221-229. doi: 10.1136/thoraxjnl-2015-207555.
Epub 2016 May 12.

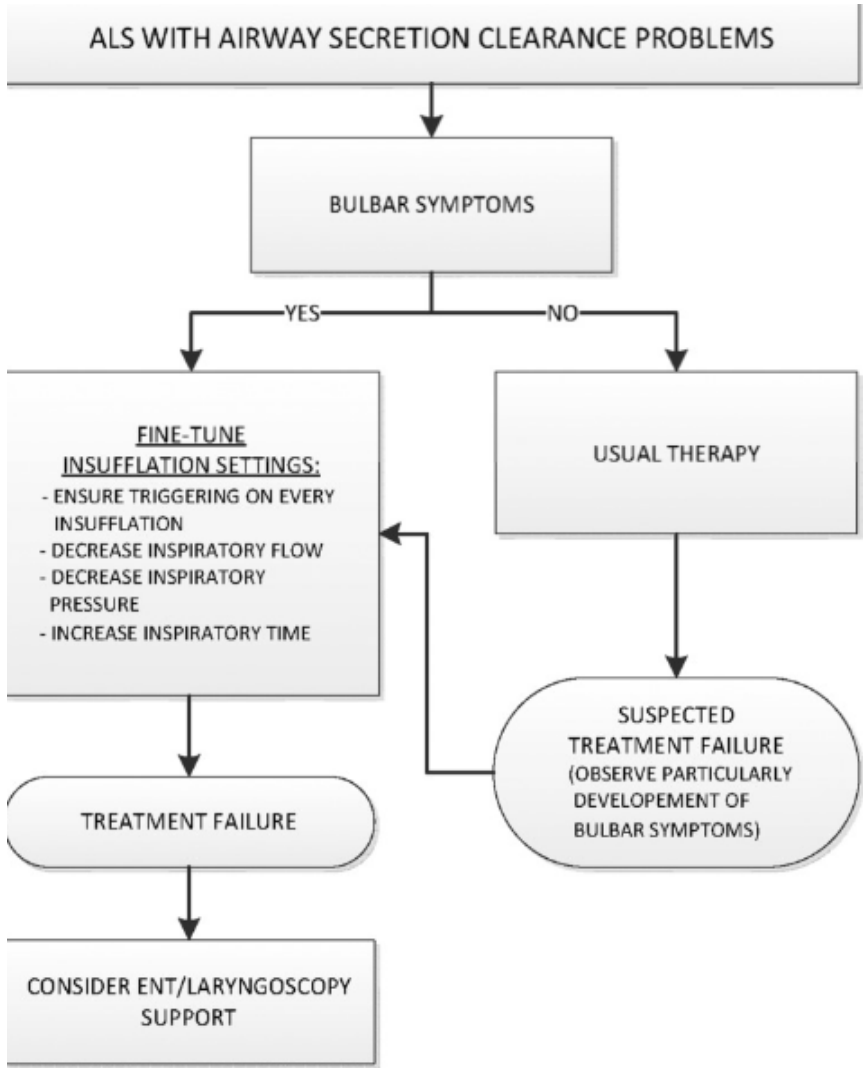
Laryngeal response patterns influence the efficacy of mechanical assisted cough in amyotrophic lateral sclerosis

Tiina Andersen [1 2 3], Astrid Sandnes [3], Anne Kristine Brekka [4], Magnus Hilland [5], Hege Clemm [3 6], Ove Fondenes [1], Ole-Bjørn Tysnes [7 8], John-Helge Heimdal [5 8], Thomas Halvorsen [3 6], Maria Vollsæter [1 3 6], Ola Drange Røksund [4 6]

- Cross-sectional study of 20 patients with ALS and 20 healthy age-matched and sex-matched volunteers
- Video-recorded flexible transnasal fibre-optic laryngoscopy
- Standardised protocol, applying pressures of ±20 to ±50 cm H_2O
- Laryngeal movements were assessed from video files

Results

- At the supraglottic level, all patients with ALS and bulbar symptoms (n=14) adducted their laryngeal structures during insufflation
- At the glottic level, initial abduction followed by subsequent adduction was observed in all patients with ALS during insufflation and exsufflation
- Hypopharyngeal constriction during exsufflation was observed in all subjects, most prominently in patients with ALS and bulbar symptoms
- Healthy subjects and patients with ALS and no bulbar symptoms (n=6) coordinated their cough well during MI-E



Andersen et al., 2017

The experiences and perceptions of mechanical insufflation-exsufflation in people with amyotrophic lateral sclerosis

Shauna Sheridan, Joerg Steier, Philip Marino, Shelley Srivastava, Eui-Sik Suh, Nicholas Hart, Patrick Murphy, Harriet Shannon, Leyla Osman, Georgios Kaltsakas, Michelle Ramsay

Lane Fox Respiratory Service, Guy's and St Thomas' NHS Foundation Trust, London.

Guy's and St Thomas' NHS

Introduction

- Amyotrophic lateral sclerosis (ALS) is an incurable progressive neuromuscular disease.
- Focus of treatments are to alleviate symptoms, thereby improving quality of life.
- Mechanical in-exsufflation (MI:E) is a respiratory adjunct used to improve cough function and enhance secretion clearance from the airways.
- Limited research is available on the experiences and perceptions of MI:E in people with ALS (pwALS).
- A service evaluation was carried out to investigate this.

Aims & Objectives

Aims:

- To explore pwALS experiences and perceptions of using MI:E in the home setting

Objectives:

To conduct semi-structured interviews to:

- To understand patients' experiences and perceptions of MI:E
- To understand the impact of MI:E on patients' quality of life
- To identify facilitators and barriers to MI:E usage

Figure 1. Flow diagram of the recruitment process

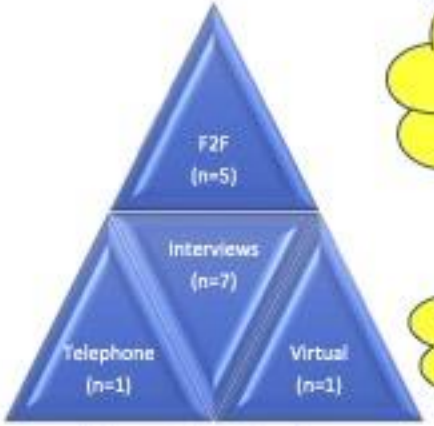


Figure 2. Interview types
F2F = Face to face

'Maybe checking in every month or something to see how it's going along. So, it makes you feel guilted into using it'

'I think it takes Ruth several minutes to set it all up and its really to eh, safeguard her as much as anything'

Methods

- PwALS meeting the inclusion criteria were invited to participate in semi structured interviews.
- Interviews were transcribed and analysed using thematic analysis.
- Coding was performed using qualitative data analysis software, Nvivo 12

Results

- Perception of MI:E is not fixed
- Factors that impact on MI:E efficacy
- The impact of MI:E is multi-faceted
- Facilitators to usage
- Barriers to usage

Figure 3. The five overarching themes

'I did not know what it was all about, erm and the first time I hated it because there was this big drawing power, and there was no escaping it erm and it frightened me half to death the second time'

'Yea they all have their own way of doing things as long as the end result is the same'

'Peace of mind that if you do have secretions, you will be able to do something about it independently, without medical assistance'

Conclusion

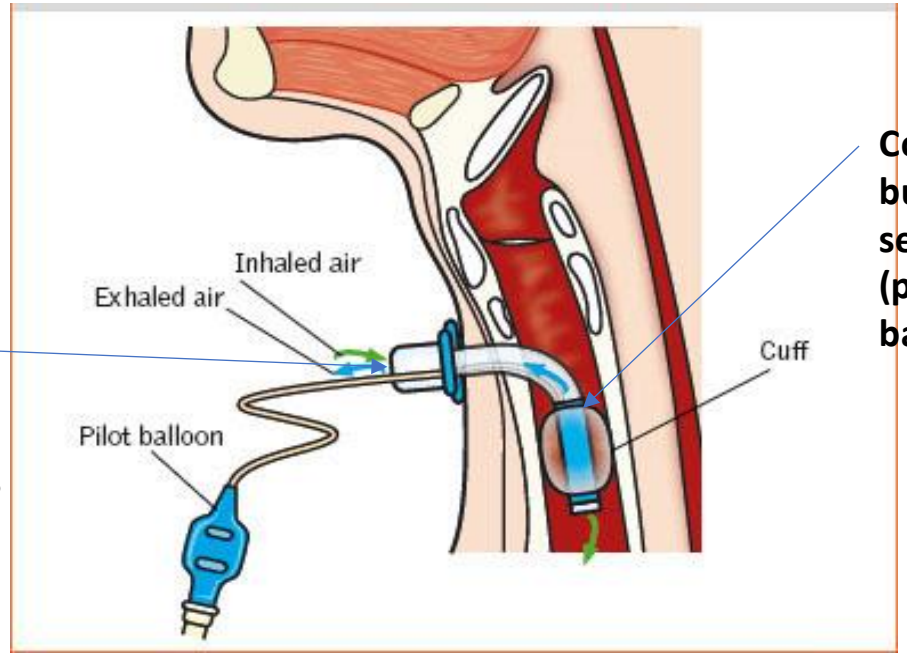
- Lived experience of pwALS using MI:E is not fixed, changing from fear and grief to physical relief and reassurance
- Ensuring adequate training of the operator is essential to enhance MI:E effectiveness and pwALS experience
- Regular review by the issuer to ensure that patient and their caregivers receive adequate support concerning MI:E usage

My personal view

- Holistic approach to cough assessment
- Peak cough flow measurement is only one part of the overall assessment
- Patients with severe bulbar dysfunction require careful consideration
- Does prophylactic treatment increase burden of care?

Tracheostomy

Direct access to suction chest secretions



Control of bulbar secretions (physical barrier)

Advantages	Disadvantages
May improve ventilation in appropriate patients	Risk of procedure and GA
Liberates face	Potential loss of voice/swallow
Enhanced secretion management	Increased support required
Case reports of improved survival	Carer burden
	Significant delays in discharge
	High associated costs (>250k/yr)
	May survive with increased levels of disability

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