Respiratory Physiotherapy and secretion clearance

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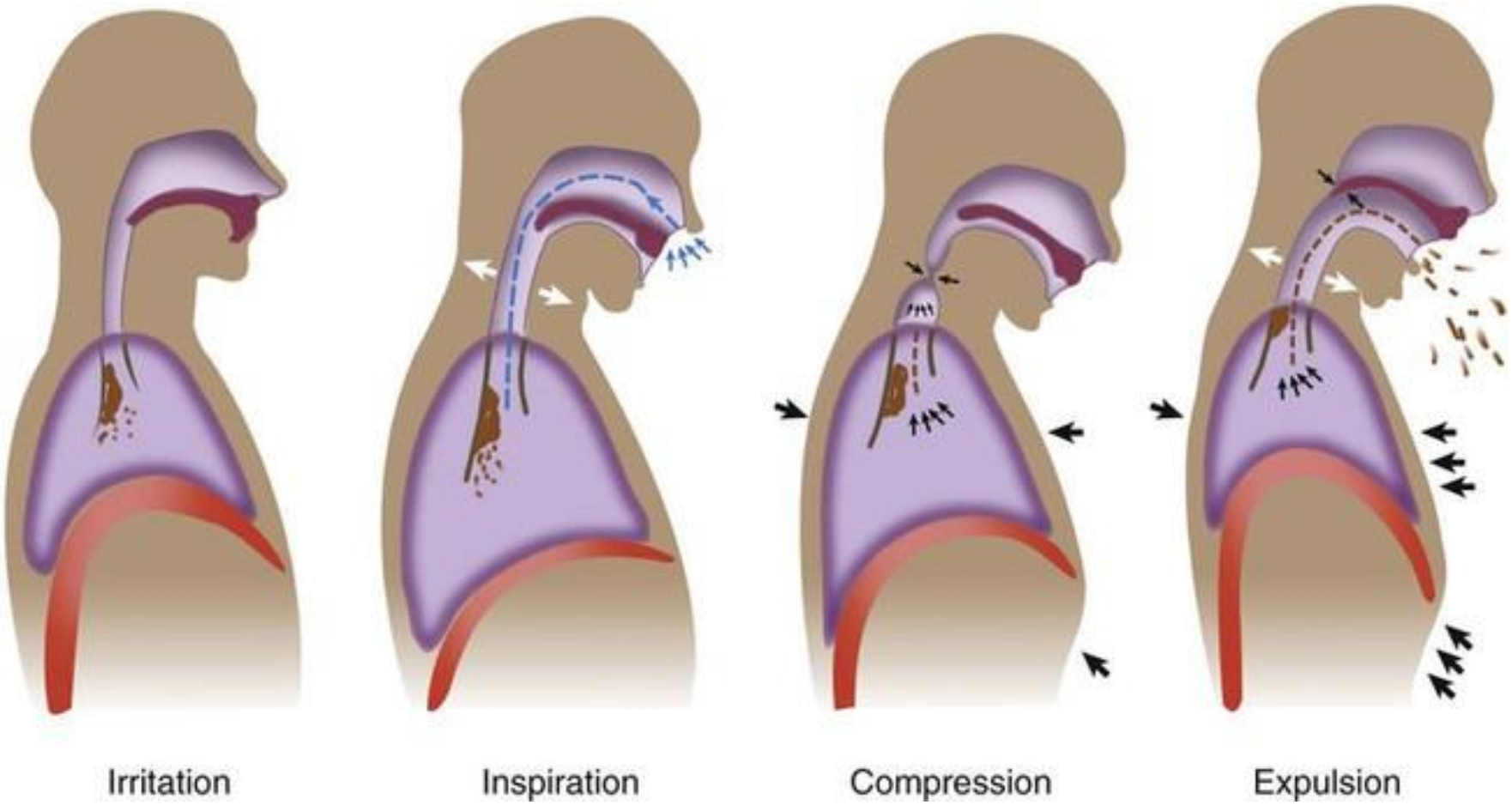
Objectives of session

- Understand mechanism of a normal cough
- What can effect cough in SMA
- Understand mechanics of MI:E and available devices
- Contraindications to use
- Case studies
    - Risk factors/adverse events
    - Device set up
    - Prophylactic programmes
- Challenges

Mechanism of a cough



SMA and cough

SMA causes muscle weakness including respiratory muscles.

-Effects deep inspiration

-Weak intercostals / abdominals

-Impaired bulbar function

SoC (2017)

3.3. Airway clearance

Manual chest physiotherapy combined with mechanical insufflation–exsufflation (e.g., Cough Assist® or VitalCough®) should be the primary mode of airway clearance therapy and should be made available to all non-sitters (Table 1). Because of the importance of aggressive management of respiratory illnesses [6], [8], [9], [10], [11], [12], airway clearance techniques should be introduced proactively in patients based on either clinical assessment of cough effectiveness or by measuring peak cough flow (not a routinely performed test in infants) [6]. When initiating cough assist devices, the insufflation and exsufflation pressures should be increased gradually to 30–40 cm H2O of positive or negative pressure, respectively [10], or instead increase them to the maximal tolerated pressure.

In the absence of significant parenchymal lung disease with small airway obstruction and air trapping there is no significant risk of pneumothorax in using the cough assist. While there is the potential of aerophagia and gastric distention in using the cough assist, this risk and the subsequent risk of aspiration can be mitigated in GTube venting to prevent gastric distention.

While there are case reports suggesting the use of mechanical insufflation or NIV to help prevent chest wall distortion [10], [13], [14], there was less consensus whether this is always a reasonable expectation and on the specifics of how to best accomplish this (supplementary Table S1).

Oral suctioning with a mechanical suction pump and catheter is a critical part of airway clearance in non-sitters and should be used with any patient with an ineffective cough.

What is the cough assist?

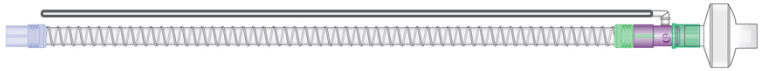
Mechanical Insufflation: Exsufflation

Phillips - E70

Breas - Clearway

Breas - Clearway 2

Consumables:



Circuit with filter

Appropriately sized mask

Inlet filter

Settings

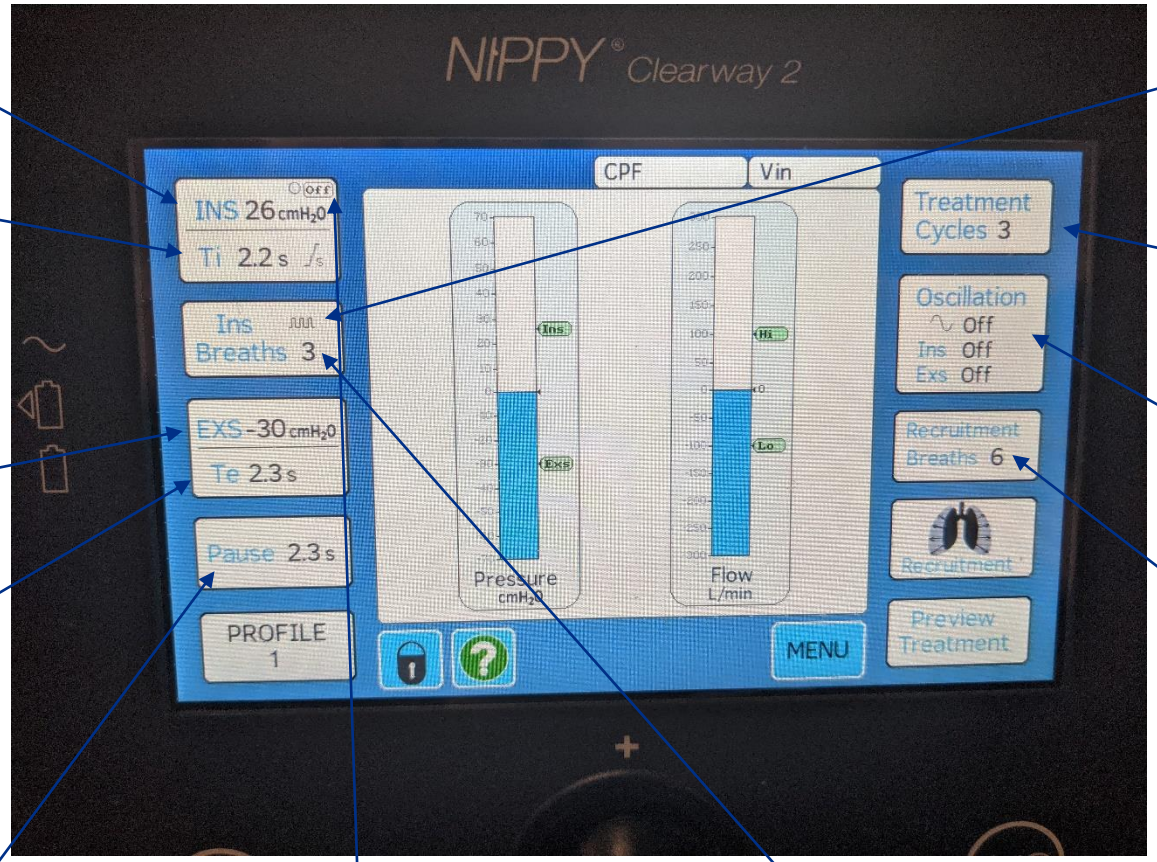
Insufflation

Insufflation time

Exsufflation

Exsufflation time

Pause



Trigger

Inspiratory repeats

Ramp

Treatment cycles

Oscillation

Recruitment breaths

Modes

Manual	Timed auto	Triggered
Breaths delivered using switch on device / remote	Breaths delivered at set intervals by device	Pt initiates each breath – or after max pause time device delivers if not triggered
Caregiver / pt controls number and length of each insufflation and exsufflation delivered	Pre-programmed cycle delivered by device	Pre-programmed cycle delivered by device
	Beeps when exsufflation pressure delivered	Beeps when exsufflation pressure delivered
	Double beep at end of cycle	Double beep at end of cycle
	Manual override can be used	Manual override can be used

Contraindications

- Undrained pneumothorax
- Foreign body
- Active pulmonary haemorrhage
- Pulmonary embolism
- Flail rib segment
- Main stem bronchus tumour

Cautions

- Cardiovascular instability
- Raised ICP
- Lung abscess
- Active untreated TB
- Surgical emphysema
- Bronchial tumour
- Recent facial, thoracic surgery or fractures
- Blood stained secretions
- PEEP dependence
- Bronchospasm
- Oxygen requirement
- Pain

Considerations

- Baseline ventilator settings (if on ventilation)
- Reliance on positive pressure / ventilation
- Patients lung compliance intrinsic/extrinsic
- Optimising time of treatment
    - Time treatment for before a feed/ meal or at least 45 minutes after.
    - Time treatment for at least 45 minutes after a large volumes of medications
    - Patient alertness/ state

Patient 1

- Referral for respiratory physio input on admission to PICU following respiratory arrest.
- Requiring 24hr / day BiPAP 8/4.
- Time off NIV not well tolerated and episodes of apnoeas and desaturations
- ? Cause ……Positional/airway patency/secretion related /Respiratory weakness/ poor respiratory drive when unsupported
- Discussion with MDT re: respiratory physio input

Patient 1 – Respiratory PT options

Treatment Options:

- Effective suction
    - Remove loose secretions
    - Stimulate cough
    - Ensure adequate suction around times off NIV
    - Risk of vomiting/ breath holding
    - Consider appropriateness of hyoscine

- Manual Techniques
    - Aim to mobilise secretions
    - Risk due to poor bone density

- Manual Insuflation: Exsuflation
    - Augment cough to remove secretions
    - +/- above techniques

Patient 1 – Effective suction

Introduced Airway clearance plan

Aim of airway clearance:

To effectively clear upper airway secretions and optimise xxxxx's comfort.

For my planned time off my Non-Invasive Ventilation

- When my mask is removed I need to an NP suction to .....cm completed to clear secretions.
- Also oral suction to clear pooling secretions in my mouth

How to recognise I am having difficulty clearing secretions:

- Audible secretions
- Palpable secretions on chest
- Raya attempts to cough and clear secretions, but unable to self-clear effectively without suction

If my secretions are causing me problems, please try:

- Re-position. Try moving me onto my side.
- NP suction to .... cm
- Oral suction to clear pooling secretions

If increased problems clearing retained secretions please speak to the nursing staff to request a respiratory physiotherapy review.

Parents completed oral and nasal suction competencies with nursing staff.

Patient 1 – MI:E consideration

- Careful consideration of indications and precautions

Benefits	Risk
Increase collateral ventilation	Derecruitment
Prophylactic secretion clearance due to ineffective cough	Mucus plugging
May allow a slight improvement in time off NIV	Need for increased respiratory support / intubation
Pt familiarity with device in case of increased secretions / respiratory infection	Patient distress

- Discussion with all professionals involved to reach team decision / plan
- Meeting with parents and MDT to discuss risks and benefits

Patient 1-1st trial with Nippy Clearway

- Insufflation pressure +9 cmH2O (to match vent)
- Pt unlikely to be able to activate trigger - manual mode used to attempt to synchronise with patients breathing pattern.
- x2 insufflation breaths delivered – ↓ SpO2, ↓HR, colour change. Required BVM ventilation. Medical team in attendance.
- Returned to NIV on previous settings.
- Increased BiPAP use following 24hours but no significant oxygen requirement

- ? Cause of desaturation – breath holding / different interface delivering pressure/ pt distress / positioning

Patient 1 – ongoing PT

- Further discussion with MDT and parents.
- Plan for very slow reintroduction of device
  - Mask familiarity – holding mask near face, progressing to mask on face with seal. Slowly built up over 2 weeks
  - Insufflation breaths with slowest rise time. Gradual increase of pressure
  - Introduce exsufflation breath 2:1 insuf:exsuf– initially at suboptimal pressure and then decreased
  - Increased to x3 insufflation breaths and then rise time reduced.
  - Afternoon Rx session introduced
  - Competencies completed with parents
  - Home prophylactic plan on discharge

Patient 1 – Prophylactic Rx plan

Clearway Prescription

Current clearway prescription as above on 9.09.22

Mode	Timed Auto	**Device Serial number**	2017- 29256
Insufflation pressure	12	**Time insufflation**	1.0
Exsufflation pressure	-8	**Time exsufflation**	0.8
Pause	1.0	**Trigger sensitivity**	N/A
Cycle repeat	1	**Ramp**	50%
Inspiratory repeat	3	**Oscillation**	no
Post treatment Insufflation breaths		2 insufflation breaths	
Device and mode locked	27.09.22		

Positions for treatment: 2 cycles in right side and left side lying

Frequency of treatment: twice daily when well at present, three times a day when unwell,

Suction: Suction prior to clearway treatment if secretions visible. Oral and nasal suction as between clearway cycles.

Additional treatment advice

Patient 1 – future plans

- Review at NM clinic appointments - adjustments to Nippy Clearway programme as indicated.

- If inpatient at RMCH:
    - settings adjusted for acute needs
    - reassessed for ongoing prophylactic plan on discharge.

Patient 2

- 14 year old with SMA type 2
- Seen in Joint Neuromuscular/Respiratory clinic
- Reports increased difficulty coughing with recurrent chest infections.
- x3 courses Ab in past 6 months.
- x1 hospital admission
- Recently established on overnight BiPAP: 12/5
- Lung Functions:
    - FVC – 2.21l/ 67% predicted
    - PCF – 220l/min
- Appointment offered for assessment with MI:E

Greater Manchester EUR Policy Statement on: Cough Assist (Mechanical Insufflation and Exsufflation (MI-E))

Cough Assist is commissioned for patients with weak cough which increases the risk of chest infection as a result of an underlying condition including, but not restricted to, the following:

- Neuromuscular diseases such as Amyotrophic lateral sclerosis (ALS); Spinal muscular atrophy; Muscular dystrophy; Myasthenia gravis; multiple sclerosis
- Guillain-Barré Syndrome
- Post polio syndromes
- Kypho-scoliosis
- Syringomyelia
- Spinal cord injuries

Patients should also have one of the following:

- PCF (Peak Cough Flow) less than 160 L/min OR
- PCF (Peak Cough Flow) of < 270 l/pm and have clinical symptoms / weak cough requiring an intervention in order to clear bronchial secretions or infection. (PCF can be measured by coughing into a peak flow meter attached to a mask MI-E Guidelines 2013 3) OR
- VC (vital capacity) below 1.1L in general respiratory muscle weakness.

Requests for Mechanical Insufflation and Exsufflation (MI-E) or 'cough assist therapy' for patients who do not meet the above criteria are considered low priority and will not be routinely funded.

For individuals who cannot undergo Peak Cough Flow testing the following criteria should be used instead:

- Recurrent hospital admissions, **OR**
- Effective use of equipment during inpatient admission, **OR**
- 2 courses of antibiotics prescribed for chest infections over 6 month period, **OR**
- evidence of retained secretions on auscultation with an inability to clear these

Funding Mechanism: Monitored Approval (MA) provided the patient meets the above criteria.

Cough Assist is not routinely commissioned for patients with:-

Absolute contraindications

Patient 2

- Seen for outpatient physiotherapy appointment
- Explanation about cough assist.
- Initial trial with adjustment of settings – good thoracic expansion, effective cough, pt comfort.

Mode	Triggered Auto
Insufflation Pressure	+20 cmH_2O
Exsufflation Pressure	-24 cmH_2O
Insufflation Time	1.2sec
Exsufflation Time	1.3sec
Pause Time	6 sec
Insufflation repeat	2
Cycle repeat	3
Post Treatment insufflation	2
Trigger level	5

- Well tolerated.
- Discussion with community nursing team – device ordered for patient

Patient 2

- When patients device delivered further OP physio apt.
- Competencies completed with parents –prophylactic use, potential adverse effects and management.

NHS
Manchester University
NHS Foundation Trust

Name: **ID number:**

NIPPY Clearway Cough Assistor Competency Assessment Tool

Task	Discussed	Observed	Assessors Initials	Parent/Carer Demonstrated (date and initial)		
Explain the indications for using the clearway device						
Navigate device, explaining buttons required						
Explain mode and settings used						
Identify cautions and the management of adverse effects						
Complete a safe and effective therapy session for patient to include recruitment breaths						
Explain and understand the frequency of treatment required for patient and when to allow patient to rest						
Discuss cleaning protocol for the device and circuit						
Understand maintenance and servicing requirements for the device						
Clearance of secretions from trachy/mouth/nose	Refer to RMCH suction competency booklet					

Declaration of Competence:

Name: _____(parent/carer)
I agree that I have received training in the supervision/application of chest physiotherapy for _____ as per the Physiotherapists prescription. I understand the teaching given to me and feel able to apply this chest physiotherapy effectively.

Signed: _____ (parent/carer)

Date: _____

Name: _____(Physiotherapist)

I agree that the above skills have been completed to a satisfactory standard and that competency has been achieved.

Signed and Initialled: _____

Title: _____

Date: _____

This declaration is to be copied and retained. One copy to be kept in patient's physiotherapy notes and one copy to be given to the parent/carer assessed.

Nippy Clearway 1 Cough Assistor Competency Assessment

RMCH Physiotherapy Team – Reviewed Jan 2022

Patient 2

- Prescription provided:
  - Family
  - Community Nursing Team
  - RMCH documentation.
  - Hospice / respite care on request.

- Follow up phone call and further offered review if needed
- Settings reviewed when indicated / on request.

Challenges

- Best time to initiate
- Access to devices – delay d/c
- Servicing and repair of faulty devices
- Differences in services across areas – outreach respiratory physio, service contracts
- Patient and family understanding and compliance

Summary

- Pts with SMA will have a weak cough secondary to weakness.
- Effective proactive airway clearance assists in maintaining good chest health
- Physiotherapists can assess for the most appropriate techniques
- Optimal time for introduction individual to each patient
- Involvement of parents/ family members vital for effective ongoing treatment