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Contents

Editorial 2

Acute

Supplementary Nasal Cannula Provision in Hypoxaemia Refractory to Non–Rebreathe Mask Treatment: A Case Study 3

Lung volume recruitment bags: An ACPRC technical standard 8

Geographical cohorting of ICU patients to support rehabilitation and weaning from mechanical ventilation 17

Paediatrics

Investigating the use of Mechanical Insufflation – Exsufflation in young people with Cystic Fibrosis during inpatient admission 21

Long–term

Commentary on Inspiratory Muscle Training with or without Pulmonary Rehabilitation for COPD: A Critical Appraisal of a Cochrane Review 30

The Nomenclature and Assessment of Breathing Pattern Disorder (BrPD): An Association of Chartered Physiotherapists in Respiratory Care (ACPRC) Position Statement 34

What next for Breathing Pattern Disorder (BrPD)? An Association of Chartered Physiotherapists in Respiratory Care (ACPRC) Commentary 39

Editorial

Editorial

Owen Gustafson, Elizabeth King

Journal of the Association of Chartered Physiotherapists in Respiratory Care

Vol. 57, Issue 1, 2025

We are delighted to bring you the first issue of the *Journal of the Association of Chartered Physiotherapists in Respiratory Care* for 2025. This issue has seven articles that encompasses a variety of manuscript styles and topics that highlight the breadth of work that is undertaken in respiratory physiotherapy.

It opens with a case study on providing additional supplementary oxygen during periods of respiratory failure by Nolan et al. It is followed by an ACPRC technical standard on using lung volume recruitment bags with consideration to assembly and governance by Mansell et al. The acute section ends with a commentary of geographical cohorting of patients in ICU by Dean et al. Lock et al., share the results of their investigation into the use of mechanical insufflation and exsufflation in young people with cystic fibrosis within the paediatric section. This is followed by a commentary on the effectiveness of inspiratory muscle training, both with and without pulmonary rehabilitation for patients with COPD. The long-term condition section concludes with an ACPRC position statement on the nomenclature and assessment of breathing pattern disorder, and an accompanying commentary.

We are delighted to welcome Stephanie Clarke who starts on an internship with the ACPRC Journal for four months from June 2025. This is hopefully the first of many such opportunities and we would encourage members to keep an eye on the newsletter for further details. We are keen to support members in developing both their projects for publication and their academic writing. We would like to encourage members to contact us to discuss at journal@acprc.org.uk if they would like support or guidance in developing their manuscript or potential ideas for publication. Additionally, if members would like the experience of peer reviewing articles, please get in touch and we will be able to support and guide you through that process.

Dr Owen Gustafson and Miss Elizabeth King Co-Editors

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Nolan A, Singer E. Supplementary Nasal Cannula Provision in Hypoxaemia Refractory to Non-Rebreathe Mask Treatment: A Case Study. *ACPRC Journal*. 2025;57(1):3-6.
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Long term conditions

Supplementary Nasal Cannula Provision in Hypoxaemia Refractory to Non-Rebreathe Mask Treatment: A Case Study.

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Keywords: Oxygen, Hypoxaemia, Nasal Cannula, Non-Rebreathe, Respiratory Failure.

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Journal of the Association of Chartered Physiotherapists in Respiratory Care

Vol. 57, Issue 1, 2025

INTRODUCTION

Hypoxaemia refers to a low level of oxygen in the blood and may occur in response to diffusion impairment, shunting, deadspace and alveolar hypoventilation.[1] Pulse oximetry can measure oxygen saturations (that is oxygen which is bound to the red blood cell) (SpO2).[2] When SpO2 is low (<94% or <88% in patients as risk of hypercapnic respiratory failure) supplemental oxygen can be used to treat hypoxaemia.[3]

Oxygen therapy on the 'ward' (level one care) is often limited to fifteen litres per minute (L/Min) via a non-rebreathe mask (NRB). In other clinical areas, hypoxaemia may be treated with the provision of high flow nasal oxygen (HFNO) (which is *not* limited to 15L/Min and can provide up to 100% fraction of inspired oxygen (FiO2)). In some cases, continuous positive airways pressure (CPAP) and invasive mechanical ventilation (MV) may be used.

As noted during the COVID-19 pandemic, the availability of oxygen has previously been scarse.

High flow oxygen therapy is not always available. This may be of detriment to the patient as profound hypoxaemia may not be responsive to 15L/Min NRB therapy in isolation. Indeed this was the situation we faced in the treatment of our patient which we have recounted here. In this case study we will discuss how the time from hypoxaemia to 'normoxaemia' can be reduced using a combination therapy: a 15L/Min NRB and 4L/Min nasal cannulae.

There has been some research into the combined use of nasal cannulae and NRB therapy however this has been confined to patients with COVID-19.[4,5] To date, there appears to limited data on the effect of this treatment in a non-COVID-19 population.

PRESENTING CASE

An 82-year-old male was admitted to Glenfield Hospital. Thoracic surgery was subsequently undertaken to remove the left lower lobe of the lung in view of potential lung malignancy. Further bronchoscopy and mini-tracheostomy insertion were required as the patient's sputum burden was not wholly amenable to chest physiotherapy, this was secondary to altered anatomy post procedure. Weeks after the procedure (while still an inpatient), the patient developed dyspnoea and hypoxaemia (likely secondary to mucus plugging compounded by altered anatomy post-surgery). Oxygen saturations (SpO2) were 66% on 4L/Min nasal cannula. This was immediately treated with a 15L/Min NRB; however, the patient's oxygen saturations failed to exceed 77%. Consequently, nasal cannula 4L/Min was applied beneath the 15L/Min NRB and SpO2 reached 88%. Once the SpO2 was stable at 88%, help was sought to supervise the patient on a one-to-one basis while a HFNO was sourced and set-up. The patient was commenced on HFNO therapy with an FiO2 of 1.0 and approximately 60L/Min flow rate. The patient's SpO2 at this time was 91%. An urgent chest x-way was requested which showed complete collapse of the left lung with an apical space. The patient was soon listed for a repeat bronchoscopy in the afternoon.

Variable Performance Devices	Fixed Performance Devices
Nasal Cannula	Venturi Mask
Simple Oxygen Facemask	Cold Humidified Oxygen (utilising Bernoulli Principle)
Non-Rebreathe Mask	

Figure 1. Examples of Variable and Fixed Performance Devices.

DISCUSSION

In the example mentioned above, it is likely many factors contributed to this patient's hypoxaemia. Firstly, the gas exchange membrane would have been reduced on account of the left lung collapse, this would have necessitated shunting. Alveolar hypoventilation is likely to have occurred also.

Oxygen therapy is broadly classified into 'variable performance devices' and 'fixed performance devices' wherein the former is posited to provide a variable fraction of inspired oxygen (FiO2) and the latter is posited to provide a fixed and constant FiO2. Examples of these devices are included in Figure 1.

Although this is a commonly cited classification, it may resemble a false dichotomy as all devices may become variable performance devices if the patient's inspiratory flow demand (IFD) greatly exceeds the flow rate of oxygen. This

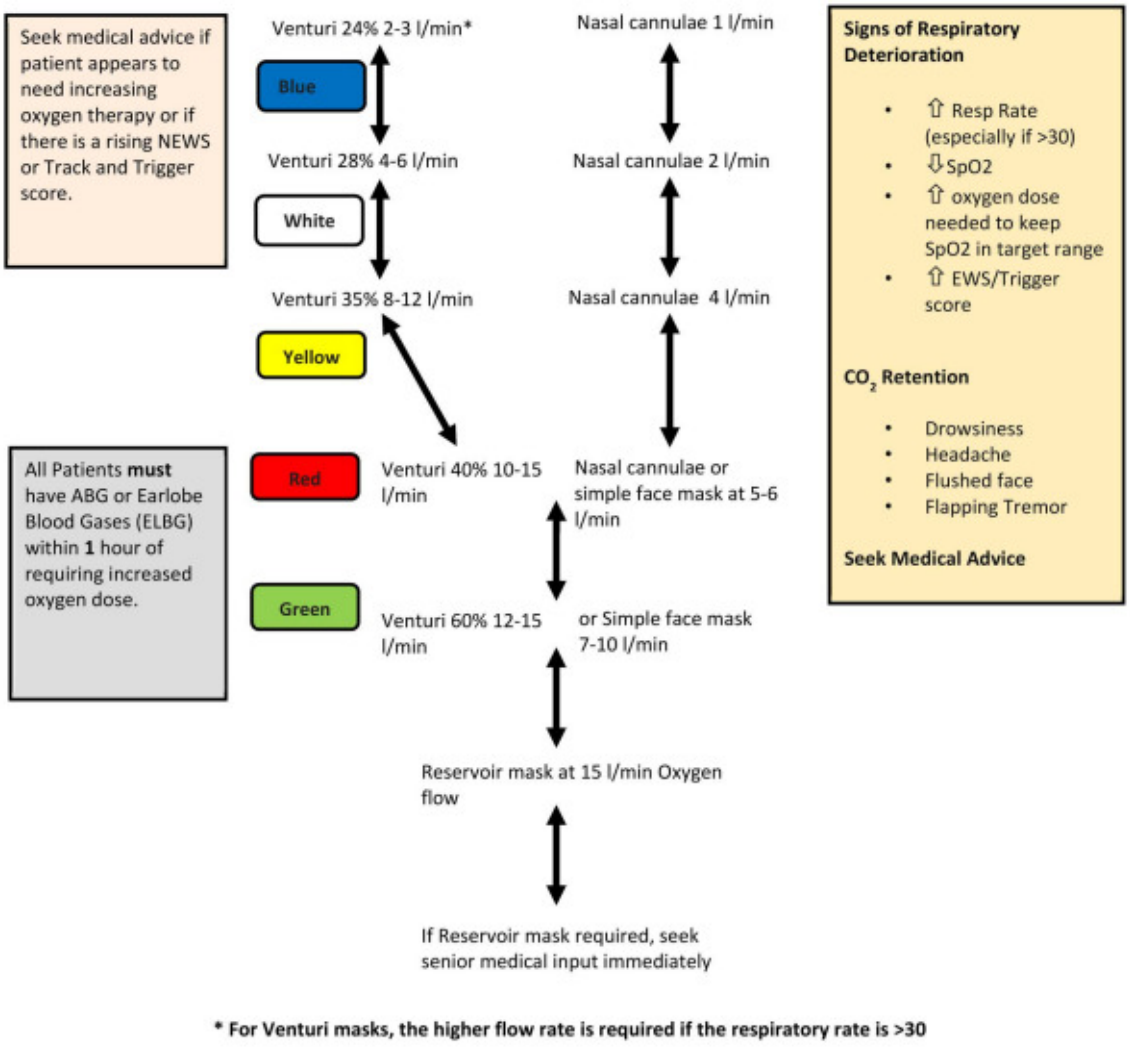

Figure 2. Illustration of Compatible Flow Rates for Venturi Valves.[3]

has been echoed by O'Driscoll et al.[3] who notes that although a Venturi valve may have a *suggested* flow rate (for instance 35% Venturi valve requires a suggested 8L/Min), clinicians can use up to 12L/Min provided the respiratory rate exceeds thirty. This has been illustrated in Figure 2.

At rest, a one's inspiratory flow demand (IFD) is roughly 30L/Min.[6] This means that on 15L/Min a patient is still diluting the FiO2 with 15L/Min of room air). As such, the FiO2 the patient receives (even with for instance a Venturi mask running at 15L/Min with a 60% valve) is not going to be exactly 60%.

Furthermore, during exercise, one's IFD can reach roughly 100L/Min.[6] Exercise mimics respiratory distress on account of the increased respiratory rate and tidal volume. If we apply this axiom to the example mentioned above, our gentleman may have been receiving only 15L/Min of FiO2 1.0 and 85L/Min of room air thus owing to his poor response to supplemental oxygen.

As described above, the provision of 4L/Min nasal cannula appeared to attenuate the hypoxaemia. This was the only treatment provided as examination findings were unremarkable; chest radiography had not yet been undertaken.

An additional 4L/Min of FiO2 1.0 may have been sufficient to meet the patient's IFD. There is research support for this idea from Kumar et al.[4] in the instance of COVID-19 induced hypoxaemia.[4] However, Kumar et al.[4] used 6L/Min and not 4L/Min which may suggest this method is only efficacious with higher flow rates.

Conversely, we concede that with the aforementioned IFD in mind, it is unlikely that an additional 4L/Min would be sufficient to meet a patient's IFD during respiratory distress. In this instance we would have to assume that 19L/Min of FiO2 1.0 was sufficient to treat the profound hypoxaemia. Unfortunately, in the absence of any real-time measurement of IFD, we are limited in our reasoning for this improvement.

CONCLUSION

In conclusion, supplemental nasal cannula use in hypoxaemia refractory to 15L/Min NRB therapy may be a useful as a 'holding therapy' while alternative forms of oxygen therapy are sourced. The mechanisms of additional nasal cannula therapy are unknown but may be related to the optimisation of IFD.

SUMMARY

Although there have been improvements in technology which have permitted the delivery of advanced respiratory support, this is often a timely endeavor. This case study has demonstrated a single method which can maintain a patient using novel application of existing older technology in order to address hypoxaemia, maintain safety and prevent deterioration while other treatments are set up.

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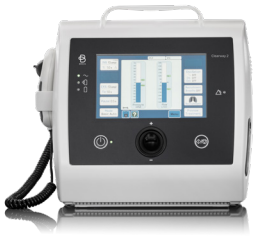

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Mansell SK, Tongo R, Mandal S, Armstrong A, Lewko A. Lung volume recruitment bags: An ACPRC technical standard. *ACPRC Journal*. 57(1):8-15. doi:10.56792/AOEZ5299

Guideline

Lung volume recruitment bags: An ACPRC technical standard

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Keywords: Cough augmentation, lung volume recruitment bag, technical document

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Abstract

Introduction

Lung volume recruitment (LVR) is a technique used to reach maximum inspiratory capacity (MIC). Within the United Kingdom, LVR self-inflating bags have been distributed historically by two manufacturers (Intersurgical and Breas). The LVR bags are currently unavailable for purchase as a complete kit, but competent clinicians can assemble the component parts.

Aims

The aim of this technical standard is to support clinicians using LVR bags and considers assembly, usage, governance and patient information.

Content

An overview of LVR is given. A list of component parts required and a step-by-step assembly guide with accompanying figures are provided. Quality control and governance are also considered. Usage instructions include: indications, contraindications, considerations and prescription. Maintenance is advised upon. Staff training, as well as patient and carer training, are discussed.

Conclusion

This technical standard is not meant to serve as a guideline, but rather as support for addressing a clinical problem. Clinicians are responsible for their own practice and should apply clinical reasoning when implementing LVR.

PURPOSE

This technical standard aims to provide a comprehensive solution to practice for clinicians, managers and medical electronics technicians on the purpose, assembly, use and governance of lung volume recruitment (LVR) bags. This technical standard has been produced in response to multiple ACPRC members' queries regarding LVR bags following the withdrawal from the market of the LVR kits by Intersurgical and Breas.

SCOPE

This document is intended for use by clinicians, managers and medical electronics technicians involved in the care and management of patients requiring LVR. The document covers:

- Assembly: Step-by-step instructions for assembling LVR bags, including necessary components and quality control measures.
- Usage: Guidelines for the safe and effective use of LVR bags, including: indications, contraindications and maintenance procedures.
- Governance: Policies and procedures for the governance of LVR bags, including compliance with MHRA regulations and staff training requirements.
- Patient Information: Information to be provided to patients, including usage instructions and safety information.

This document does not cover detailed clinical protocols for specific patient conditions. It is written for those working in the United Kingdom (UK), and thus, whilst aspects may be applicable to other countries, the regulatory and governance considerations are specific to the UK. Whilst the LVR bag can be used in combination with other treatments, these are not covered in detail within this docu-

ment. This document does not discuss the evidence-base for the application of LVR. Readers should refer to the recent narrative review from Sheers et al.[1] for a comprehensive presentation of the evidence-base.

DEFINITIONS

CE mark: Conformité Européenne, a European mark of conformity with European health, safety and environmental protections.

LVR: Lung Volume Recruitment Bag, a medical device used to augment maximal inspiratory capacity.

MHRA: Medicines and Healthcare Products Regulatory Authority. The UK body responsible for regulation of medicines and medical devices.

MIC: Maximum inspiratory capacity. The maximum amount of air in the lungs on full inspiration.

System pack: A combination of medical devices used for their intended purpose to achieve a specific medical intervention.

UK CA mark: UK Conformity Assessed. A UK mark indicating that applicable requirements have been met for the sale of the product in the UK. The UK CA mark replaced the CE mark following the UK's exit from the European Union.

INTRODUCTION

WHAT IS LUNG VOLUME RECRUITMENT

Lung volume recruitment (LVR) is a technique used to reach maximum inspiratory capacity (MIC).[2] A LVR bag is a modified resuscitation bag adapted with an extension tube and one-way valve.[2] The one-way valve allows patients to breath stack in order to achieve MIC.[2] LVR bags are NOT resuscitation bags; the one-way valve means the patient cannot exhale, and thus, if used in a closed circuit, where gas does not enter or exit the circuit, LVR bags could cause a tension pneumothorax.

LVR bags are beneficial for individuals with weak respiratory (inspiratory and expiratory) muscles due to neuromuscular conditions (such as motor neurone disease,[3,4] muscular dystrophy[5] and spinal cord injury[6]) and is used to augment an effective cough.[7,8] LVR bags can also aid in increasing lung volume, maintaining and increasing chest wall compliance, reducing atelectasis[9] and increasing speech volume. Without cough augmentation, patients with weak respiratory muscles often develop a weak and ineffective cough, which leads to sputum retention, risk of respiratory infection and respiratory failure.[1,4,7,8,10-12]

Within the UK, LVR bags have been distributed historically by two manufacturers, Intersurgical (United Kingdom) and Breas (Sweden). The LVR bags are currently unavailable for purchase as a complete kit, but competent clinicians can assemble the component parts.

The current (2025/2026) cost of the component parts is circa £10. The alternative to an LVR bags is a mechanical insufflation:exsufflation (MI:E) device. MI:E devices costing circa £5,000. As well as augmenting MIC through positive inspiratory pressure (insufflation), MI:E devices also augment expiratory flow through negative expiratory pressure (exsufflation). Currently, MI:E devices are not routinely available for all patients requiring MIC and cough augmentation, and the provision is dependent upon local commissioning and geographical provision.[13]

GOVERNANCE

All component parts of an LVR bag have a UK CA/CE mark, which are being used for their intended purpose. By combining these existing components to achieve a specific medical purpose, a LVR bag becomes a "systems pack" (The Medical Devices Regulations 2002 (SI 2002 No 618, as amended)). The assembly of the systems pack by healthcare professionals falls under the healthcare institution exemption.[14] Following the exit of the UK from the European Union, MHRA guidance is regularly updated. Readers take responsibility for ensuring this information is still valid. Please refer to the MHRA roadmap for "future implementation of the future regulations" for guidance on when intended updates will be published.[15] Certain regulations need to be adhered to when assembling the LVR systems pack:

1. Quality Management: a quality management system must be implemented locally to ensure the assembled packs meet safety and performance standards. A record should be kept of patients who have been issued with a LVR bag, including the date of issue, name of issuing clinician and batch numbers of component parts.
2. Documentation: Maintain detailed records of the assembly process, including components used, assembly instructions and quality checks. This technical standard could be included along with a local standard operating procedure.
3. Compatibility: Ensure that all components used in the system pack are compatible with each other and intended for their specific medical purposes.
4. Sterilisation: If sterilisation is required, it must be performed according to the manufacturer's instructions for each component.
5. Labelling and Instructions: Provide clear labelling and instructions for use to ensure safe and effective use of the system pack.

TECHNICAL SPECIFICATIONS

COMPONENT PARTS

Table 1. provides a list of the components needed to assemble a LVR bag in the UK. The product codes are for Intersurgical and are correct at the time of publication (May, 2025). Individuals assume responsibility for cross-checking the accuracy of product names and codes when operationalising this technical standard.

Table 1. List of component parts for the LVR bag

Product name	Intersurgical product code (Correct May 2025)
Bag valve mask OR bag valve mask with pressure relief valve	7152000 7152060
Low volume bacterial viral filter	1644007
22F-22F connector	1967000
22M-22M one way valve	1950000
Catheter mount with elbow	3506000
Anaesthetic Masks Soft Seal Size 3 Size 4 Size 5	1514111 1515111 1516111
Alternatives to Anaesthetic Masks soft seal are Anatomical Seal Size 3 Size 4 Size 5	7293001 7294001 7295001
Mouthpiece	1931000
Sponge nose clip	1435000

ASSEMBLY INSTRUCTIONS

STEP-BY-STEP INSTRUCTIONS

The LVR bag is assembled as follows and as per Figures 1 and 2.[2,7,10]

1. The self-inflating bag used within an LVR differs from those used for resuscitation as the oxygen reservoir and tubing should be removed; this is for simplicity and also prevents the LVR bag from being mistaken for a resuscitation bag in the event of an emergency.
2. A low-volume bacterial filter should be placed between the self-inflating bag and the rest of the circuit to prevent sputum and other secretions from entering the bag.
3. The 22F-22F connector is placed between the bag and the one-way valve; it acts solely as a connector.
4. The one-way valve must be placed in the correct orientation to allow air to flow towards the patient.
5. The catheter mount is used to increase the length of the circuit to make it easier for the user and allow different positions of use.
6. Interfaces (Figure 3): A mouthpiece with or without a nose clip (Figure 3.b) can be used. Often, users need to use the nose clip in the initial phase of using the LVR bag. Once they have control of the soft pallet, some users may find they are able to use the mouthpiece alone. An anaesthetic mask can be used, but requires two hands to ensure an adequate seal is achieved. Either a soft seal (Figure 3a) or anatomical anaesthetic mask (Figure 3c) can be used; this is dependent upon the user's preference.

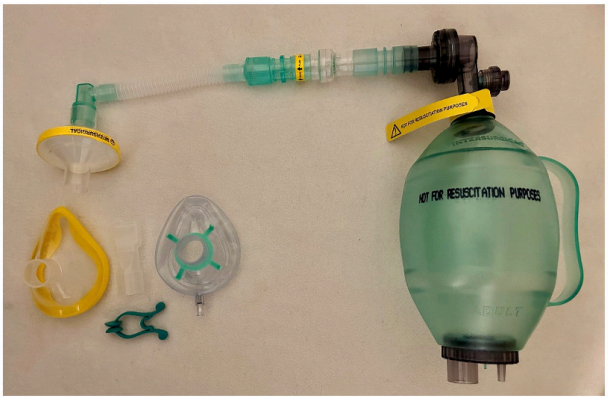

Figure 1. An overview of the LVR bag components

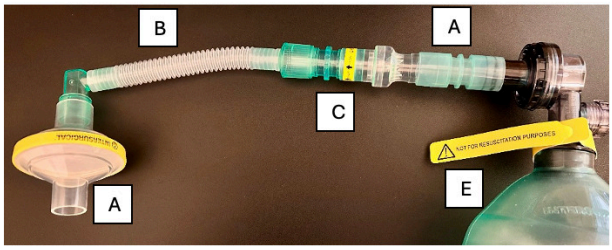

Figure 2. Close up of the LVR bag circuit.

A: Bacterial filter, B: Catheter mount,

C: 22M-22M one way valve, D: 22F-22F connector

E: Not for resuscitation purposes label

QUALITY CONTROL

- Check all component parts are within date
- Document the batch numbers of all component parts
- Check the one-way valve is correctly orientated; use a hand to ensure airflow can be felt going towards the user

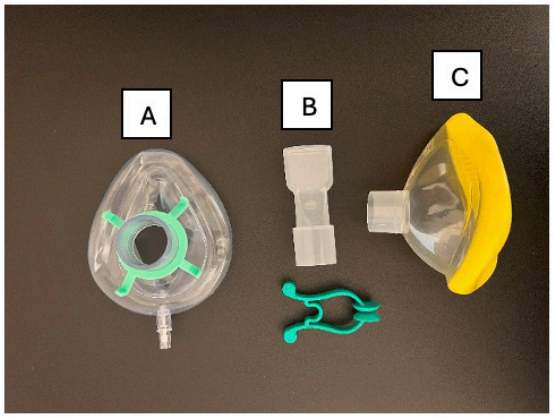

Figure 3. Interface options for use with the LVR bag.

A: Soft seal anaesthetic masks

B. Mouthpiece and nose clip

C. Anatomical seal mask

- Maintain a database of LVR bag users, date of LVR bag issue, LVR bag identifier number and date the next replacement LVR bag is due
- Report all patient safety incidents, including near misses on the national patient safety database
- Ensure the LVR bag is labelled as "not for resuscitation purposes"

USAGE INSTRUCTIONS

INDICATIONS

Clinicians are accountable for their own practice and should use clinical reasoning when applying LVR in the context of each individual clinical scenario.

Indications to LVR are listed below[2,7,8,10]

- Peak cough flow <270L/min
- Low vital capacity
- Risk of atelectasis
- Sputum retention
- Patients with a neuromuscular disease diagnosis

ABSOLUTE CONTRAINDICATIONS

An absolute contraindication refers to a situation or condition where a particular treatment, procedure, or medication must not be used under any circumstances, because it could result in life-threatening harm or severe adverse effects.

Absolute contraindications to LVR are[2,10]:

- Haemoptysis/blood-stained secretions
- Recent or current barotrauma
- Significant hypotension
- Active vomiting
- Via an endotracheal tube or tracheostomy tube with an inflated cuff (one-way valve will mean the patient cannot exhale and there is a risk of tension pneumothorax)

RELATIVE CONTRAINDICATIONS

A relative contraindication is a situation or condition that makes a treatment or procedure potentially risky, but not entirely ruled out. It means caution is needed, and the treatment may still be used if the potential benefits outweigh the risks.

Relative contraindications to LVR are[2,10]:

- Bullous emphysema
- Severe obstructive pulmonary diseases
- Patient reporting chest pain
- History of pneumothorax
- Raised intracranial pressure
- Patient unable to follow instructions
- Reduced consciousness

PERFORMING LVR

The following should be considered when performing LVR[2,10]:

- LVR should be avoided for a minimum of 60 minutes after a meal to avoid the risk of reflux and discomfort for the patient. For those on gastrostomy feeding, feed should be stopped 60 minutes before LVR.
- Consider the need for personal protective equipment.
- LVR is best performed in an upright sitting position. It can be performed in other positions, especially if other techniques (e.g., postural drainage, manually assisted cough) are combined.
- Agree with the patient a signal/hand gesture they will use to indicate they have reached MIC.
- Place the mouthpiece in their mouth using a nose clip or mask over their nose and mouth and form a tight seal to minimise any air leak.
- Instruct the patient to take a full breath in while gently squeezing the bag. Careful coordination of inspiratory effort and compression of the LVR bag is required.
- Instruct the patient to try to hold their breath for 1-2 seconds, then try to take another breath on top of the previous breath, again squeezing the bag. Repeat this until they have reached MIC. This may take two to five breaths.
- Once MIC is achieved, instruct the patient to hold their breath for 3-5 seconds and then breathe out gently.
- The patient should rest between MIC breaths.
- The patients should be instructed to cough instead of exhaling if they feel they have respiratory secretions to clear.
- The patient should rest/stop if they feel lightheaded or dizzy.

There are a number of positions that can be adapted to deliver LVR, both for patients to deliver the LVR indepen-

Figure 4a. Place the LVR bag between knees and use knees to compress LVR bag

Figure 4b. Use hands to compress LVR bag

Figure 4c. Place LVR bag under arm and squeeze like a bagpipe to compress the LVR bag

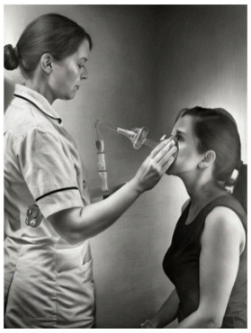

Figure 4d. If a carer assists, they should use two hands to hold the mask in place and place LVR bag under arm and squeeze like a bagpipe to compress the LVR bag

dently or with the assistance of a caregiver. See Figure 4 for examples of how to hold the LVR bag.

PRESCRIPTION

The prescription for LVR should be individualised to each patient.[1,10] The aim is to achieve MIC via breath stacking with multiple compressions of the LVR bag to augment inspiration. Usually, this takes three compressions of the bag, but this will vary between patients. One cycle usually consists of three-five breaths. A rest period is encouraged between cycles. A treatment session can comprise of two-three cycles. Patients should be encouraged to routinely perform LVR two to four times per day. At times of respiratory compromise, for example, a respiratory infection, they may need to undertake more frequent treatment sessions.[1, 10]

Other treatments can be used in combination with the LVR bag, for example manually assisted cough (MAC), positioning or suctioning.[1,10]

CONSIDERATIONS

- Some discomfort in the chest wall due to stretching of muscles and joints can occur during initial use.[10] It is appropriate to advise patients of this short-term side effect before commencing treatment.
- Some patients, especially those with spinal cord injury, may develop hypotension during MIC. The addition of an abdominal binder can assist with this hypotension response.[10]

MAINTENANCE

The LVR bag system pack should be replaced every three months. The low-volume bacteria filter prevents sputum and other fluid from entering the bag valve mask and one-way valve. If contaminated with fluid (e.g. respiratory secretions, saliva), the bacterial filter should be changed, and thus, the patient should be provided with spares and taught how to do this. Bacterial filters must not be washed as this will cause them to become blocked and air will not pass through. The interface (mouthpiece or mask) should be washed in warm soapy water daily. If the circuit is contaminated with sputum or other fluid, it should be rinsed with warm, soapy water and allowed to dry completely before use. Bacterial filters should be changed monthly. LVR bags should be changed if there are signs of damage.

STAFF COMPETENCE

Clinicians are responsible for practicing within their professional and individual scope of practice. Allied Health

professionals should refer to the Health and Social Care Professions Council's standards of conduct, performance and ethics and the standard of proficiency for their profession. Nurses should adhere to the Nursing and Midwifery Council's professional standards of practice and behaviour for nurses, midwives and nursing associates. Medics should adhere to the relevant General Medical Council's Professional Standards. Clinicians working in unregulated roles should refer to their local employer's standards. This technical standard is intended to assist in solving a clinical problem, not to act as a guideline. Clinicians are accountable for their own practice and should use clinical reasoning when applying LVR.

TRAINING REQUIREMENTS

Clinicians should undergo training and supervised practice to support the safe and effective assembly and use of LVR bags.

CAPABILITY ASSESSMENT FOR CLINICIANS

The following capabilities are suggested minimal standards for clinicians delivering LVR.

- Understand the physiology and pathophysiology of coughing and sufficient secretion clearance.
- Able to apply the LVR bag technique as described in this technical standard.
- Able to adapt the prescription and deliver LVR bag as described in this technical standard.
- Able to teach patients, their carers and other healthcare professionals how to apply LVR bag techniques.
- Able to adapt the prescription to individual patients.
- Able to assemble the LVR bag as described in this technical standard.
- Aware of the indications, absolute and relative contraindications for LVR bags.
- Aware of the quality control and governance procedures as described in this technical standard.

CARER TRAINING FRAMEWORK

- Understand the principles of lung volume recruitment and how the LVR assists in breathing.
- Understand that the LVR bag is not a resuscitation device and should not be used in emergencies.
- Able to apply the LVR bag technique as described in this technical standard.
- Able to assemble the LVR bag as described in this technical standard.
- Aware of the indications, absolute and relative contraindications for LVR bags.
- Knows when to stop the procedure and seek medical advice if the person experiences dizziness, chest discomfort, or pain.
- Ensure the LVR bag is kept clean and in good working order.

REVIEW AND APPROVAL

Reviewed by the MHRA for adherence to and information about their guidance in January 2025.

Endorsed by Specialists in Long-term Ventilation at Home (SiLVaH) network in February 2025.

Endorsed by Respiratory Information in Spinal Cord Injury (RISCI) group in February 2025

SAMPLE PATIENT INFORMATION SHEET

A sample patient information sheet is provided as a supplement to this technical standard. It is intended to act as a template for local adaptation.

Key points

- **Lung volume recruitment bags are designed to help increase the maximum amount of air a patient can inhale which, in turn, boosts cough strength and aids airway clearance in patients with neuromuscular diseases.**
- **Currently, these bags are available only as separate parts. This technical standard provides support for respiratory care professionals on how to assemble, use and manage lung volume recruitment bags.**

DECLARATION OF INTEREST

Nil to declare

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This work is unfunded

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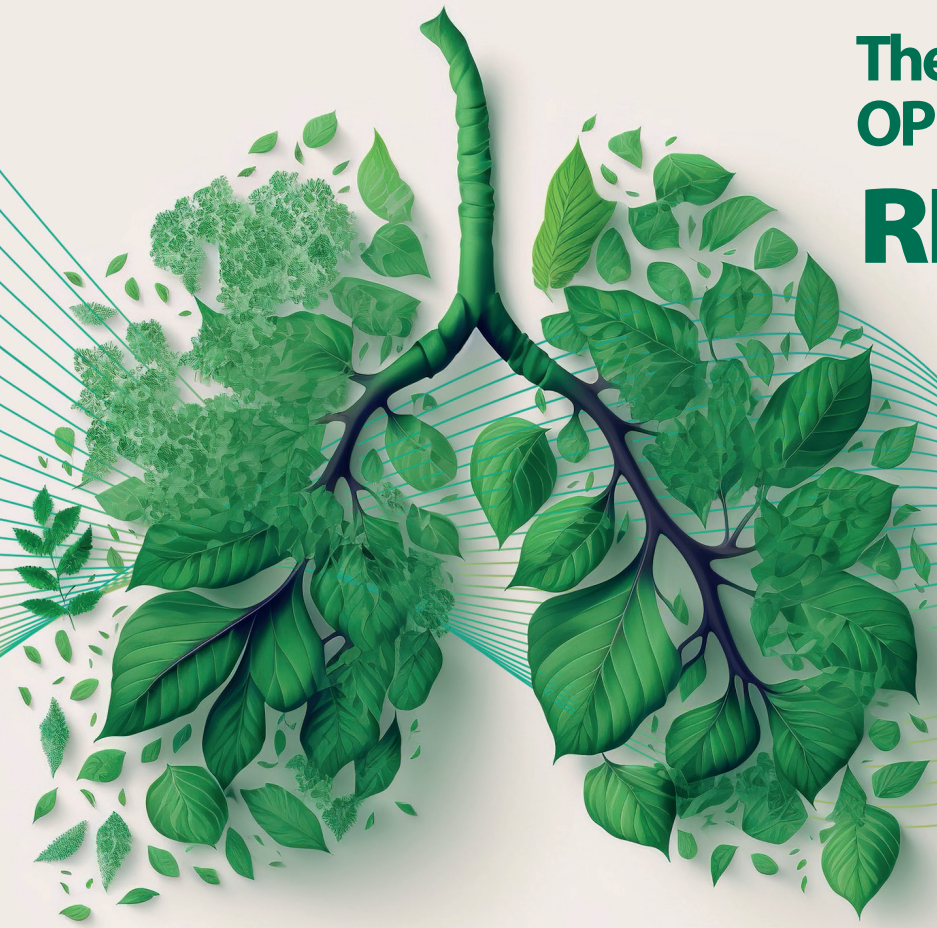
SUPPLEMENTARY MATERIALS

Sample Participant information Sheet

Download: https://acprcjournal.scholasticahq.com/article/137799-lung-volume-recruitment-bags-an-acprc-technical-standard/attachment/283388.docx?auth_token=KR1VGvOU3Ly8sfWTbO19

The #1 recommended OPEP device is NOW RECYCLABLE[1,‡]



Latest GOLD and BTS guidelines recommend **OPEP therapy** for mucus hypersecretion[2,3]

The most efficient and effective OPEP device[4]

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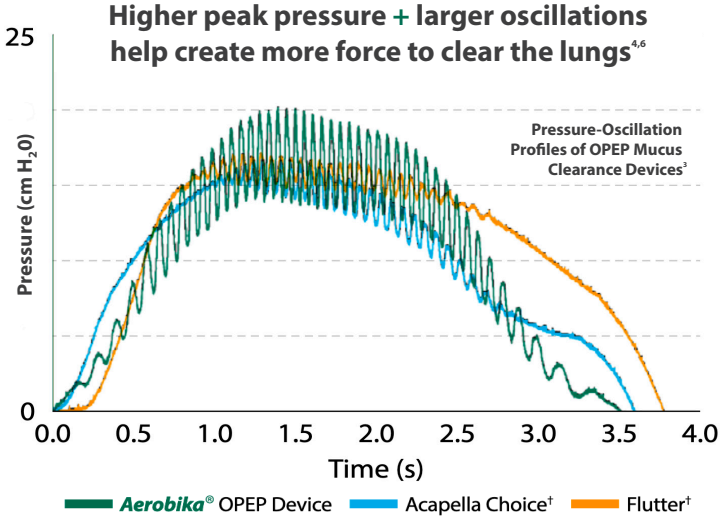

20-30% MORE EFFICIENT PER BREATH

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** Greater pressure amplitude is related to therapeutic effectiveness.

= Greater mucus clearance potential and optimal patient benefit.[4,5]

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† In vivo data, compared to Acapella and Flutter ‡ greater pressure amplitude is related to therapeutic effectiveness

1 GpRx Primary Care Data [Feb 2024]. **2** GOLD 2023 Report. **3** Hill AT *et al.*, British Thoracic Society Guideline for bronchiectasis. **4** Van Fleet H, *et al.* Respiratory Care 2017;62(4):451-458. **5** Suggett, J. *et al.* CHEST 2017.**6** Coppolo, *et al.* Pulmonary Therapy (2021)..

Dean S, Gustafson O. Geographical cohorting of ICU patients to support rehabilitation and weaning from mechanical ventilation. *ACPRC Journal*. 57(1):17-19.
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Commentary

Geographical cohorting of ICU patients to support rehabilitation and weaning from mechanical ventilation

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Journal of the Association of Chartered Physiotherapists in Respiratory Care

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INTRODUCTION

Among the many challenges faced by Intensive care unit (ICU) patients, prolonged mechanical ventilation (PMV) and ICU-acquired weakness (ICUAW) can complicate clinical management and extend recovery periods, necessitating specialised rehabilitation strategies. PMV refers to the need for mechanical ventilation for more than 21 days.[1] Despite only 5-10% of critically ill patients requiring PMV, they utilise approximately one-third of all available UK ICU bed days.[2]

ICUAW is characterised by significant muscle wasting and weakness that develops during an ICU stay with no other cause.[3] ICUAW worsens acute morbidity, increases healthcare related costs and 1-year mortality.[4] It is associated with PMV and is present in up to half of ICU patients.[1] Managing these patients is complex and resource-intensive, with a specialist structured approach to weaning from mechanical ventilation and rehabilitation required to improve outcomes.[5]

Rehabilitation and early mobilisation are potential therapeutic strategies to prevent the development of ICUAW.[6] The goal of rehabilitation is to mitigate the adverse effects of ICUAW and expedite recovery. However, implementing rehabilitation strategies in the ICU is challenging due to the heterogeneity of patient needs and the highly complex physical environment.

Geographical cohorting in the ICU for rehabilitation could be an innovative approach to address these challenges. Grouping patients with similar rehabilitation needs in specific areas of the ICU, can provide more focused and coordinated care. This model can potentially facilitate enhanced multidisciplinary team (MDT) collaboration, streamline care pathways, and use limited resources more efficiently. This commentary aims to explores the concept of geographical cohorting in the ICU for rehabilitation, examining its benefits, challenges, and implications for patient care.

POTENTIAL BENEFITS OF GEOGRAPHICAL COHORTING

Studies investigating geographical cohorting to date have been mainly undertaken in United states of America (USA) healthcare systems and not directly related to rehabilitation or weaning from mechanical ventilation.[7-10] The studies describe several aspects to how geographical cohorting can support healthcare systems including MDT collaboration, streamlined care pathways and improving patient outcomes.

The British Thoracic Society (BTS) and Intensive Care Society (ICS) paper on specialised weaning units (SWUs) provides valuable insights that support the concept of geographical cohorting for ICU patients undergoing rehabilitation. The model emphasises concentrated, specialised care, interdisciplinary collaboration, and continuous quality improvement. These elements are crucial for enhancing patient outcomes and operational efficiency in ICU rehabilitation settings.[2]

ENHANCED MULTIDISCIPLINARY COLLABORATION

Rehabilitation and weaning from PMV in the ICU is unpredictable and requires continual input from the MDT to tailor these processes.[11] Studies in the USA have found that geographical cohorting of patients improved time utilisation and care coordination.[10] Geographical cohorting has been associated with increased frequency of nurse-physician communication, and the proportion of time nurses spend on team rounds.[7]

IMPROVED CARE PATHWAYS

Concentrating patients with similar conditions in one area supports healthcare teams to streamline care pathways, allowing implementation of standardised protocols and rehabilitation plans. Kapoor et al.[10] demonstrated that geographical cohorting in patients reduced practice variation and enhanced team communication.

IMPROVED PATIENT OUTCOMES

Studies in the USA have shown that geographical cohorting can lead to improved patient outcomes, including reduced ICU length of stay (LOS) and lower rates of hospital-acquired infections.[7-10] Geographical cohorting in addition to MDT rounds and case management support, resulted in a 16-17% reduction in hospital LOS and a decrease in 30-day readmission rates.[8] Kapoor et al[10] evaluated geographical cohorting in a large ICU, with significant reductions in Hospital acquired infections and pressure ulcers.

EFFICIENT USE OF RESOURCES

Geographical cohorting allows for more efficient use of healthcare resources and improved workflow and reduced interruptions.[10] Through centralising care for patients with similar needs, ICU's can optimise staffing, equipment, reduce waste and improve overall efficiency. This is particularly important in the UK, where there is an emphasis on efficient use of ever decreasing resources.

CHALLENGES AND CONSIDERATIONS

IMPLEMENTATION BARRIERS

Implementing geographical cohorting in the ICU requires careful planning and organisation. Teams must consider the ICU's physical layout, including isolation rooms. Initial implementation can be resource-intensive and costly, posing challenges in the current UK healthcare system. Effective cohorting demands coordination across the MDT, which can be difficult in larger hospitals with complex structures. The system must be flexible and scalable to meet demands. Feedback mechanisms for staff and patients are essential for identifying improvements, and a culture of quality improvement is crucial for refining the system.

PATIENT SELECTION

Not all patients are suitable for geographical cohorting. Careful selection will be necessary to ensure that patients grouped together have similar rehabilitation needs. This requires robust criteria and regular assessment to avoid mismatches.[2] There is a risk that cohorting could lead to disparities in care if not managed properly. While cohorting focuses on grouping patients with similar needs, it is essential to maintain a patient-centred approach.

STAFF ADAPTATION

Healthcare providers need to adapt to new workflows and communication patterns. This requires ongoing training and support to ensure that staff are comfortable and effective within a new system. Staff should be adequately trained to work and support this new model, as there will be a shift in the care focus from acute ICU care to holistic rehabilitation, recovery and preparation for discharge. Staff may resist new systems, overcoming this resistance requires effective change management strategies.

CONCLUSION

Geographical cohorting in the ICU for rehabilitation presents a promising strategy for improving patient care and operational efficiency in the UK. While there are challenges to its implementation, the potential benefits in terms of enhanced collaboration, streamlined care pathways, and improved patient outcomes make it a worthwhile consideration for healthcare facilities aiming to optimise their ICU operations.

To the best of our knowledge this topic has not been considered in UK literature to support or refute the implementation of geographical cohorting in weaning from mechanical ventilation and rehabilitation in ICU. Although there are several studies showing the possible benefits of geographical cohorting on healthcare systems in the USA, it is difficult to generalise the findings. Healthcare systems, patient demographics, and resource availability can vary significantly, affecting the applicability of international studies to the UK context. At present, key stakeholders lack the evidence needed to make informed decisions about its implementation.

Although, the BTS/ICS paper on model for SWU's[2] in the UK is an interesting concept which could be useful to explore further on how this can support further research into geographical cohorting for rehabilitation and weaning from mechanical ventilation in the ICU.

The lack of existing research highlights an opportunity for funding bodies and researchers to explore this area. To address the gap in literature, there may be a need for small-scale single centre case studies within the UK. These initiatives could provide preliminary data and insights to inform a larger implementation study.

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Lock K, Hamilton C. Investigating the use of Mechanical Insufflation – Exsufflation in young people with Cystic Fibrosis during inpatient admission. *ACPRC Journal*. 2025;57(1):21-28. doi:10.56792/IJIH3243

Long term conditions

Investigating the use of Mechanical Insufflation – Exsufflation in young people with Cystic Fibrosis during inpatient admission

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Keywords: Children, Cystic Fibrosis, Physiotherapy

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Abstract

Background

People with Cystic Fibrosis (CF) are productive of sticky sputum which becomes a site for bronchial wall damage. During pulmonary exacerbations, People with CF often require increased airway clearance support. Mechanical Insufflation- Exsufflation (MI-E) has been suggested as a method of airway clearance in this group.

Aim

To describe the routine use and impact of MI-E devices in an inpatient acute population of children and young people with CF and to compare it to a historical cohort prior to the introduction of MI-E use.

Method

A retrospective medical notes review was conducted for all children with CF admitted during a pulmonary exacerbation over two, one-year periods: Feb 2019–Feb 2020 (18 admissions) and Feb 2020–Feb 2021 (26 admissions), at a single CF centre in the East of England. Outcomes including pulmonary function, length of stay, and the choice to include MI-E in airway clearance were all taken from electronic records.

Results

Between Feb 2019-Feb 2020 none of the 18 admissions utilised MI-E. In Feb 2020-Feb 2021 10 of 26 admissions incorporated MI-E. Settings varied based on patient tolerance and no adverse events were noted.

MI-E was employed in patients with a more significant drop in FEV1 Z score at admission, although no differences were observed in FEF2575. Length of stay trended longer for MI-E users (15.2 days) compared to non-users (13.3 days), likely reflecting greater initial illness severity.

Conclusion

MI-E shows promise in supporting airway clearance during pulmonary exacerbations in children with CF. Further research is needed before this becomes common practice.

INTRODUCTION

Cystic Fibrosis (CF) is a genetic condition affecting around 10,000 people in the UK and is the most common lethal genetic disease in the Caucasian population.[1] Patients with CF can have symptoms related to the digestive system, fertility, liver, pancreas, bones and importantly the lungs.[2] The damage to the lungs occurs from a build-up of sticky sputum, this sputum provides an environment for further bacteria colonisation and damage to surrounding tissues causing a bronchiectatic picture. This area of bronchiectasis can result in impaired mucociliary clearance of sputum and result in further microbial growth .[3] The trend is for this to begin in the small airways and gradually to effect larger airways.[4,5] To reduce this effect, a mixture of airway clearance techniques to facilitate sputum clearance, and nebulised antibiotics to eradicate or control bacterial sputum growths is seen as standard treatment.[6]

Airway clearance techniques can come in many forms with treatment regimes decided between patients, their families and clinicians.[7] Traditional options for airway clearance include exercise, oscillatory positive expiratory pressure (OPEP), positive expiratory pressure, autogenic drainage, manual techniques and/or postural drainage.[8]

Infective pulmonary exacerbations (IE) are when symptoms of infection become more severe.[9] Usually this entails one or more of the following symptoms: change in cough frequency and sound, chest pain, increased sputum production, change in sputum consistency/colour, dyspnoea, decreased energy level and appetite, weight loss, and decreases in pulmonary function results.[10] These IEs are a well-recognised as a part of the disease in people with CF and the associated with a need for increased treatment.[11] IEs can decrease the effectiveness of usual airway clearance techniques due to patient fatigue, dyspnoea or pain limiting treatment completion, or an increased sputum load reducing effective clearance through a reduction of lung function.[12] Approximately one in three people with CF will not recover their baseline Forced Expiratory Volume in 1 second (FEV1), following IE, with an ~3% sustained decrease.[13] There is no standardised measure for pulmonary exacerbations in CF, however, a decrease in pulmonary function (which includes FEV1 and FEF2575) are commonly cited as indicators.[14] CF transmembrane conductance regulator modulators, such as Kaftrio, Symkevi and Orambi have changed the landscape of CF care and physiotherapy involvement in IEs.[9]

Currently, there is no universal standardised airway clearance for people with CF. Instead, clinicians often recommend or implement personalised techniques that adapt to the individual's clinical presentation.[15,16] An adjunct, not routinely used, which may be useful in facilitating clearance is the Mechanical Insufflator-Exsufflator (MI-E). MI-E produces changes in the airflow inside the bronchial tree, through the provision of alternating positive and negative pressures.[17] To date, it has been mainly used in patients with an ineffective cough clearance, such as individuals with neuromuscular pathologies or respiratory muscle deficiency.[17,18] MI-E is recommended in use for children with neuromuscular weakness[19] but it's use outside of this population is poorly evidenced in paediatrics.

To the authors knowledge, only one abstract has been published on the use of MI-E in Children and Young People (CYP) with CF. Helper et al.,[20] found a 36% improvement in clearance of sputum in CYP using MI-E when compared to autogenic drainage ($P<0.0001$). However, the sample was small (n=22) and the project did not consider other treatments or outcomes, such as pulmonary function. Two small studies – one case study and one abstract - in adults with CF (combined n=7) concluded that when routine airway clearance is compromised due to fatigue or chest wall discomfort that MI-E could be considered and subjectively measured.[12,21]

Since the work by Helper et al,[20] the clinical team at a large tertiary teaching hospital has been using MI-E with CYP with CF.

AIMS

This paper aims to describe the routine use and impact of MI-E devices in an inpatient acute population of CYP with CF and to compare it to a historical cohort prior to the practice change.

METHOD

A retrospective review of routinely collected patient records was undertaken. All children with CF admitted to a tertiary hospital in the UK during two 12-month time windows with a pulmonary exacerbation who were able to do pulmonary function tests (PFT) were included. The first period was from Feb 2020-Feb 2021 (Period 1) and the second from Feb 2021-2022 (Period 2). A historical time window prior to the introduction of MI-E within this patient cohort (Period 1) was used to provide comparison to the main time window of (Period 2) illustrating current practice which included children who did and did not use MI-E. This project was approved by the hospital governance department as a service evaluation investigating routinely collected data and therefore ethical approval was not needed.

The following routinely documented variables were collected from the electronic records:

- Age at admission.
- Sex.
- Best FEV1 and FEF25/75 Z scores in the year- to describe the population.
- FEV1 and FEF2575 Z scores at the start and end of each admission- to describe the clinical picture.
- Length of admission.
- Use of MI-E or not.
- Other physiotherapy treatments used for sputum clearance.

Primary outcome:

- Change in FEV1 Z score throughout admission.

Secondary outcomes:

- Change in FEF 2575 Z score throughout admission,
- Change in length of admission.

Data was analysed using IBM SPSS Statistics version 28. Where data was parametric an two tailed independent T test was used to compare two groups and One-way ANOVA was used to compare the three groups (Period 1: Non MI-E historic cohort, Period 2: MI-E recent cohort, Period 2: non MI-E recent cohort). For non-parametric data Mann-Whitney U was used to compare two groups and Kruskal-Wallis ANOVA was used to compare the three groups.

RESULTS

PATIENT DEMOGRAPHICS

On review of medical records during Period 1, there had been 18 admissions of 10 CYP who had completed pulmonary function tests, six of which had multiple admissions, none had used MI-E. In Period 2 there had been 26 admissions of children with CF who had completed pulmonary function tests, from 11 patients, 6 of which had multiple admissions. MI-E was used in 10 admissions. Each admission was taken as a new data point. No participant was on Kaftrio during this data collection, though all were on either Orkambi or Symkevi. Comparisons were made be-

Table 1. Descriptive Statistics of Each Group.

	Period 1 (n=17)	Period 2 Using MI:E (n=10)	Period 2 Not Using MI:E (n=16)
Age	Mean=10.12 S.D=3.00	Mean= 9.58 S.D=0.98	Mean=9.74 S.D=1.92
Number Female	1	3	5
Best FEV1 Z Score in the year	Median= -0.417 IRQ= 3.47	Median=-0.57 IRQ =2.65	Median=-0.42 IRQ=4.22
Best FEF25/75 Z Score in the year	Median= -0.486 IRQ= 3.6565	Median=-1.00 IRQ=5.43	Median=-1.00 IRQ=5.34
FEV1 Z score on admission	Median= -2.59 IQR= 2.76	Median= -3.375 IQR= 4.02	Median= -2.23 IQR= 2.66
FEF25/75 Z Score on admission	Median= -2.97 IQR= 3.72	Median= -4.81 IQR= 4.07	Median= -2.92 IQR= 3.49
FEV1 Z score on discharge	Median= -1.13 IQR= 3.06	Median= -2.105 IQR= 4.5	Median= -1.97 IQR= 2.27
FEF25/75 Z Score on discharge	Median= -1.45 IQR= 3.77	Median= -3.44 IQR= 5.02	Median= - 2.45 IQR= 4.91
Length of Stay	Median=14 IQR=4	Median= 15 IQR=3	Median= 13.5 IQR=2
Number of treatments including OPEP	Median= 17 IRQ= 7 (14-21)	Median=20 IRQ= 17.5 (18.5-36)	Median=18 IRQ= 9 (12.5-21.5)
Number of treatments including Exercise	Median= 22 IRQ= 13 (12-25)	Median=20 IRQ= 4 (19-23)	Median=18 IRQ=11.25 (12-23.25)
Number of treatments including MI-E	0	Median=19 IRQ= 15.5 (15.5-31)	0

tween the 3 groups (Period 1 Cohort, Period 2 MI-E Cohort, Period 2 non MI-E Cohort). Descriptive statistics of patients can be seen in Table 1.

The baseline status of each group as measured by the highest achievedFEF25/75 and FEV1 Z score in the year (usually at routine annual review as an outpatient) were similar in all groups (Table 1).

At admission Z scores for both FEV1 and FEF25/75 were worse than "best in year" for all groups. This was pronounced in the Period 2 MI-E group who had worse median (IQR) scores -4.81(4.07) then either those in period 1 -2.97(3.72) or those in period 2 who did not use MI-E -2.23(2.66) indicating that this group was in general more unwell.

By discharge all groups had improved in both scores but remained worse than best scores of the year. The group in period 2 using MI-E remained the most impaired with median (IQR) FEV1 z scores -3.375(4.02) when compared to period 1 -1.13(3.77) and period 2s non MI-E comparison group -1.97(2.27)The Period 2 MI-E group had however had the biggest improvement.

Three patients who used MI-E had presented with atelectasis on admission X-ray as recorded in radiology report, two of these had resolved by the end of admission. No one outside of this group showed any acute radiological changes on chest X-ray. One patient continued to have atelectasis and had a one-month home trial of MI-E and on clinic review following this, atelectasis had resolved, and MI-E treatment was terminated. Across all groups two patients were on oxygen on admission, for both the physiotherapist used MI-E. This is in keeping with the MI-E group having the most impaired lung health at point of admission.

STANDARD TREATMENT

Amount and composition of physiotherapy sessions can be seen in table 1. OPEP devices varied but included Aerobika, Acapella and Bubble PEP. Exercise included active travel (including: walking/running/stair climbing) games (including: hide and seek, football, bulldog) and gym work (treadmill, exercise bike, body weight exercises).

USE OF MI-E

There was no formalised protocol for patients who started on the MI-E device. In all cases where MI-E was undertaken a NIPPY Clearway (Breas Medical LTD, Stratford-Upon-Avon, Warwickshire, UK) was used. In 9 patients, manual mode setting was used and in 1 triggered auto. All ratios of insufflation to exsufflation were 5:1 or less, notes indicate that this was dependent on how well this was tolerated and the child's clinical presentation. Both NIPPY Clearway 1 and 2 were used; where NIPPY clearway 2 was used the ramp was set to 10 during insufflation. Mouthpieces and face masks were used dependent on patient preference. In all cases, asymmetrical pressure settings were used. The largest pressure swing was 45cmH2O, with settings of +15cmH2O to -30cmH2O and this was also the most common pressure used in this group. Pressures were regularly changed and titrated for patient comfort and ef-

Table 2. Pulmonary Function Tests by Group.

Variable	Period 1: (n=17)	Period 2: MI:E (n=10)	Period 2 No MI:E (n=16)	Period 2: MI-E vs Non-MI-E	Period 2 MI-E vs Period 1	Period 2 Non MI-E vs Period 1	Comparison of all groups One Way Anova/ Kruskal-Wallis ANOVA
Change in FEV1 Z-score on admission in comparison to best score in year	Mean= -2.02 SD (1.23)	Mean= -2.56 SD (0.98)	Mean= -1.38 SD (1.19)	**T= 2.597 P=0.016***	T=-1.175 P=0.252	T=1.472 P=0.152	F(2,38)=3.210 P=0.052
Change in FEF25/75 Z-score on admission in comparison to best score in year	Median = -1.848 Q1=-5.11 Q3=-0.90 IQR (4.21)	Median = -1.96 Q1=-3.03 Q3=-1.24 IQR (1.79)	Median = -1.39 Q1=-2.1 Q3=-0.52 IQR (1.58)	U=41.00 P= 0.262	U=32.00 P=0.184	U=68.00 P=0.839	H=2.046 P=0.359
Change in FEV1 Z-score from admission to discharge	Median = 1.25 Q1=0.71 Q3=1.49 IQR (0.78)	Median = 1.55 Q1=0.88 Q3=2.74 IQR (3.62)	Median = 0.34 Q1=1.28 Q3=-0.90 IQR (2.18)	**U=39.00 P = 0.031***	U=57.00 P=0.466	U=67.00 P=0.064	**H=6.052 P=0.049***
Change in FEF25/75 Z-score from admission to discharge	Median = 1.29 Q1=0.54 Q3=1.95 IQR (1.41)	Median = 1.33 Q1=0.82 Q3=1.96 IQR (1.14)	Median = -0.04 Q1=-0.16 Q3=0.94 IQR (1.1)	**U= 23.00 P = 0.011***	U=57.50 P=0.729	**U=50.00 P=0.027***	**H=7.787 P=0.020***
Length of admission (days)	Mean= 14.7 SD (3.69)	Mean= 15.2 SD (2.82)	Mean= 13.3 SD (2.70)	T=-1.681 P=0.107	T=0.368 P=0.716	T=-1.151 P=0.260	F(2,37)=1.205 P=0.311

ficacy throughout stays in keeping with Morrison et al., (2015).

On review of the medical notes, there were no adverse events noted when using MI-E, though one patient did not tolerate this well only managing a ratio of 5 insufflations to 1 exsufflation for 2 sets, which was documented as being suboptimal. This poor tolerance was partially related to increased coughing and clearance of sputum and partially related to the behaviour of the patient.

CLINICAL OUTCOMES

In all groups FEV1 Z scores were worse on admission than their best in year scores. With Period 1 having a mean(S.D) drop from best in year scores of −2.02(1.23),Period 2 MI-E=-2.56(0.98) and Period 2 non MI-E −1.38(1.19). All groups also improved by the end of admission. With Period 1 having a median (IRQ) improvement in FEV1 Z scores between admission and discharge of +1.25(0.78), Period 2 MI-E = +1.33 (3.62), and Period 2 non-MI-E =+0.34(2.18). This was reflected in FEF25/75 Z scores as well apart from in the Period 2 non-MI-E group which showed a slight median(IRQ) drop in scores between admission and discharge of −0.04 (1.1).

DIFFERENCES IN OUTCOMES BY GROUPS

LUNG FUNCTION AT ADMISSION COMPARED TO BEST LUNG FUNCTION IN YEAR

A one-way ANOVA found no difference between groups in change in FEV1 Z Scores from best in year to admission F(2,38)=3.210,p=0.052. However, mean (S.D) scores for those in Period 2 who had MI-E had dropped more -2.56(0.98) z scores than those who clinicians didn't use MI-E -1.38(1.19). Indicating that clinicians selected to use MI-E with on average more unwell patients. This was significant using t(25)=2.597,p0.016. There was no significant difference in drop of FEF25/75 Z score on admission when compared to best of year scores between any of the groups.

IMPROVEMENT IN LUNG FUNCTION DURING ADMISSION

There was a difference found between the groups when a Kruskal- Wallis ANOVA was calculated for change in FEF25/75 Z score from admission to discharge (H=7.787,P=0.020). Post hoc analysis using a Mann-Whitney found those in period 2 who had had MI-E median(IRQ)= 1.33(1.14) had improved significantly more than those who hadn't -0.04(1.1) U=23.00, p=0.011. A difference was again found between the groups in FEV1 Z score from admission to discharge(H=6.052,P=0.049). Post hoc analysis again found that this was between those in period 2 who had used MI-E median (IQR)=1.55(3.62) had a significantly bigger

improvement then those who hadn't 0.34(2.18) U=39.00,P=0.031.

LENGTH OF STAY

A one-way ANOVA found no difference in length of stay between the three groups. However, the group using MI-E in period 2 had a higher mean(S.D) length of stay 15.2(2.70) then those who did not use it 13.3(2.70). While not statistically significant, 1.9 days difference may be considered clinically significant.

DISCUSSION

This paper has illustrated the use of MI-E in children with CF in an inpatient setting at one regional CF centre. Some interesting points can be found in the data.

CHOICE OF PATIENT

Clinicians were more likely to treat more unwell patients with MI-E. Previous work has highlighted the possible benefit of MI-E in patients suffering from Fatigue[21] which is often part of a person with CFs clinical presentation when presenting with an infective exacerbation. It may have been that clinicians see the use of MI-E as a treatment of choice when the patient is less able to participate in other techniques due to the severity of illness or that some aspect of their presentation indicated the use of MI-E such as a higher sputum load which is backed by a recent review.[22]

IMPACTS OF USING MI-E

While the aim of this project was not to explore the effects of MI-E some interesting results were seen. The use of MI-E was associated with improved FEV1 and FEF25 Z scores compared to those patients who were not selected to use MI-E which may warrant further investigation. It must be noted however that those children who were selected by clinicians to start MI-E had a significantly larger drop in FEV1 Z score on admission compared to their score at annual review than those receiving standard treatment. This may have meant that there was greater scope for improvement in this group. The lack of difference between groups in drop in FEF2575 may indicate that obstructions in the airway due to sputum were more related to central airways than peripheral. Previous work has highlighted that clinicians aim to return to baseline with treatment for IE,[23] the current project supports this and provides evidence that those who were the most unwell made the biggest recovery in FEV1. However, in keeping with Waters et al.,[13] patients are still off of their baseline lung function when discharged home.

Improvement in FEF25/75 has been found after effective airway clearance[24] and may indicate a higher level of clearance of the small airways in this population due to the use of MI-E.[25] This may partly explain the larger improvement in these scores seen in the MI-E group. While the volume of sputum is difficult to measure in children who often don't expectorate to command we can hypothesise that a larger volume of sputum may have been cleared by those using MI-E which may have impacted on this change in this measure. Small airways are the first affected in people with CF, therefore ensuring these remain as clear as possible is paramount in treating children with CF.[5]

LENGTH OF STAY

The increased length of admission (1.9 days), though not statistically significant, could arguably be described as clinically significant. This could be due to the use of MI-E and either a true negative effect or more likely that those that were selected for MI-E were a more unwell cohort and therefore less likely to be discharged quickly. FEV1 Z scores is an objective measure to help determine a patient's readiness for discharge.[26] The larger reduction of this on admission in the MI-E group, and the subsequent longer time to reach close to complete FEV1 recovery, may have been the cause for the increased length of stay. This project did not record the reason for the difference in admission length so it may be other factors such as other procedures or lack of weight gain. There is an expectation of weight gain so where this does not occur, length of admission can be lengthened.[27] However, this difference is likely to have a financial burden on the NHS,[28] as well as impacts on patients and families, and warrants further investigation in the future.

ADVERSE EVENTS

There were no adverse events reported throughout the medical notes and on the whole this was a well-tolerated adjunct in this population. This is in keeping with previous safety and efficacy reports in children with other respiratory conditions[29] and with adults.[30] It is important to note that this was not tolerated well by every patient though and this was managed by the treating therapist by reducing the number of sets and increasing the ratio of insufflation to exsufflation.

LIMITATIONS AND STRENGTHS

The retrospective nature of this project limits the conclusions we can draw. There was no attempt to standardise a protocol or power the project to enable us to understand if MI-E was the driver of the changes seen. The small sample and limitation to one team also restricts the generalisability of the results. The project was also limited by the level of documentation found. While MI-E use was found to be well documented other treatments such as "Exercise" were often less fully documented, with usually a time period or list of activities used documented without a fine detail which would allow for a more detailed description.

The reflection of real practice during a period of an introduction of a new treatment modality does illustrate current practice, however, and illustrates the need for more formal research in this area.

CONCLUSION

Clinicians routinely used MI-E in children with CF during inpatient admissions for infective exacerbations. It was generally well tolerated, and clinicians were more likely to use MI-E in patients who were more unwell. Among the children who used MI-E, a greater improvement in FEV1 and FEF25/75 Z-scores was observed. However, FEV1 had dropped significantly further from baseline in the MI-E group, providing a greater scope for improvement.

This is in area which would benefit from further research with prospective studies and a more robust review of adverse events to improve the generalisability of results, though does show promise in this population.

Key points

1. Physiotherapists working with children and young people with CF use a variety of treatment modalities during infective exacerbations. In the studied centre, manual Insufflation-Exsufflation tended to be used in more unwell patients.
2. Manual Insufflation-Exsufflation caused no adverse events in children and young people with CF.
3. Manual Insufflation-Exsufflation was well tolerated in children and young people with CF.
4. Further, more robust, research may provide greater detail into the mechanisms and effect of Manual Insufflation-Exsufflation in children and young people with CF.

DECLARATION OF INTEREST

The authors report no conflicts of interest.

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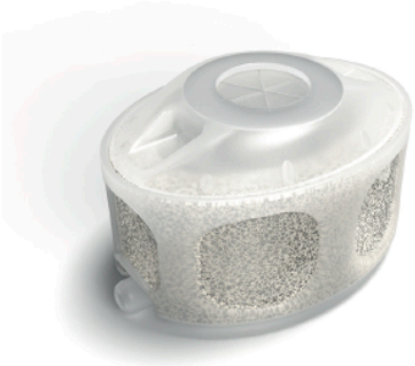

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Commentary

Commentary on: Inspiratory Muscle Training, with or without Pulmonary Rehabilitation, for COPD: A Critical Appraisal of a Cochrane Review

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INTRODUCTION

Approximately 300 million people worldwide have COPD[1] with a global prevalence of between approximately 10-12.2%.[2-4] COPD is a very common respiratory disease in the United Kingdom being the second most common lung disease with approximately 1.2 million people in the diagnosed with COPD.[5]

In COPD, oxidative stress and sarcomere injury lead to proteolysis and subsequent atrophy of the diaphragm, the main inspiratory muscle.[6] The reduction in capacity of the respiratory muscles lead to a reduction in the body's capacity to generate inspiratory pressures, thus reducing lung capacity and is thought to contribute to dyspnoea in adults with advanced COPD.[7]

Respiratory muscle weakness is a modifiable weakness and can be targeted with interventions including variations in frequency and duration of Inspiratory Muscle Training (IMT).[8] Inspiratory muscle training uses resistance to challenge inhalation, stimulating respiratory muscles and potentially enhancing contractile force through hypertrophy.[9] A previous Cochrane review examined the effectiveness of IMT, both with and without pulmonary rehabilitation, in increasing inspiratory muscle strength in individuals with COPD.[10]

AIM OF COMMENTARY

This commentary aims to critically appraise the methods used within the review by Ammous et al., (2023) and expand upon the findings in the context of clinical practice.

CRITICAL APPRAISAL AND METHODS OF AMMOUS ET AL., (2023)

Using the AMSTAR 2 tool this review achieved 16 out of 16 criteria. Therefore, the methods used in the review were appropriate in context to answering the question of interest.

RESULTS OF AMMOUS ET AL., (2023)

When comparing IMT to control or sham treatment in people with COPD there was a statistically significant improvement in:

- Dyspnoea scores
  - Borg scale and BDI-TDI (very low-certainty)
  - Modified Medical Research Council (mMRC) Scale (low-certainty: Clinically significant improvement)
- Functional exercise capacity (moderate-certainty: Clinically significant improvement)
- Inspiratory muscle strength (low-certainty)
- Health-related quality of life
  - COPD Assessment Test (CAT) scale (moderate-certainty: Clinically significant improvement)

However, there was no evidence of difference (very low certainty evidence) for health-related quality of life when using the St. George's Respiratory Questionnaire (SGRQ) total score.

There was no evidence of a difference between pulmonary rehabilitation combined with IMT compared to pulmonary rehabilitation alone in people with COPD for:

- Dyspnoea
  - Borg scale (moderate-certainty)
  - mMRC scale (very low-certainty)
- Functional exercise capacity (very low-certainty)
- Health-related quality of life
  - SGRQ total score (low-certainty)
  - CAT scale (very low-certainty)

There was moderate certainty evidence that pulmonary rehabilitation combined with IMT compared to pulmonary rehabilitation alone produced a small statistically significant increase in inspiratory muscle strength. The subgroup analyses showed no evidence of a difference regarding the duration of intervention variables or the severity of respiratory muscle weakness when comparing pulmonary rehabilitation plus IMT to pulmonary rehabilitation alone, or IMT to control or sham treatment.

COMMENTARY

The findings from this review suggest that there is low-certainty evidence indicating that IMT may lead to a slight increase in inspiratory muscle strength in patients with COPD compared to control or sham treatment. However, there seems to be low to moderate certainty evidence suggesting that IMT leads to a clinically significant improvement in dyspnoea (mMRC), functional exercise capacity, and health-related quality of life (CAT scale) compared to control or sham treatment. Previous systematic reviews in this area have found similar findings regarding the effects of IMT on inspiratory muscle strength, dyspnoea, functional exercise capacity, and health-related quality of life.[11] Furthermore, these findings are in line with recommendations within the gold standard for COPD.[2] It is recommended when designing a pulmonary rehabilitation programme that IMT should be considered as a possible approach used within the programme.[2] Furthermore, IMT should be considered for patients with hyperinflation as hyperinflation correlates closely with diffusion capacity, small airways obstruction and higher ventilatory response to exercise.[2] In terms of delivering IMT, the systematic review found no evidence of significant moderating factors regarding the duration of the intervention or whether individuals with greater inspiratory muscle weakness would particularly benefit from this approach. Guidance suggests that pulmonary rehabilitation should be offered for individuals with a minimum of a Medical Research Council [MRC] Grade 3 and above[12] and that programs should last from six to eight weeks.[2,12]

As highlighted in this review, when combined with pulmonary rehabilitation IMT does not appear to provide additional benefit outside a slight improvement in inspiratory muscle strength. These findings support historical recommendations from the American Thoracic Society/European Respiratory Society that IMT may not provide much benefit when delivered as an adjunct to standard pulmonary rehabilitation.[13] However, for those individuals who may not be able to attend exercise based pulmonary rehabilitation IMT may be considered as a possible alternative.

Most estimates in this review were downgraded due to methodological issues in the included RCTs. Future trials should clearly report randomisation sequencing and allocation concealment, as many studies were rated at a high risk of bias due to unclear methods. Adopting CONSORT checklist standards can help ensure transparent reporting of future studies.[14] It is worth noting that most studies in this review excluded participants who experienced exacerbations prior to the trial. This exclusion significantly limits the external validity of the findings for this population. Consequently, further investigation of IMT is needed specifically within this group. Given the uncertainty in the estimates, future RCTs should assess both dyspnoea and inspiratory muscle strength outcomes. Additionally, substantial heterogeneity in muscle strength gains when comparing IMT to control suggests the need to evaluate key moderating factors in future trials. Neither intervention duration nor baseline muscle weakness explained this heterogeneity. Future systematic reviews may also consider using multifactorial meta-regression to identify the sources of unexplained variation in effect.

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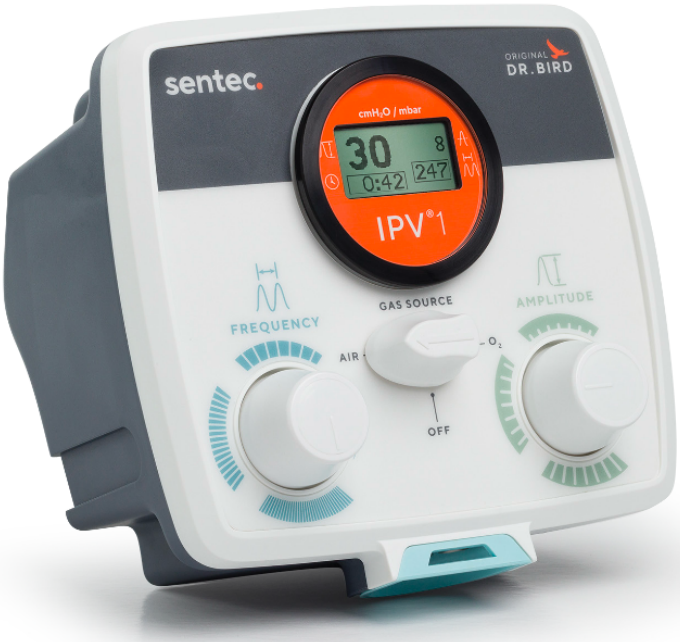

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Easton I, Schreuder F, Grillo L, Lewko A. The Nomenclature and Assessment of Breathing Pattern Disorder (BrPD): An Association of Chartered Physiotherapists in Respiratory Care (ACPRC) Position Statement. *ACPRC Journal*. 57(1):34-38. doi:10.56792/SUGT5265

Long term conditions

The Nomenclature and Assessment of Breathing Pattern Disorder (BrPD): An Association of Chartered Physiotherapists in Respiratory Care (ACPRC) Position Statement

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INTRODUCTION

This statement recognises the importance of assessing breathlessness when standard medical assessments incompletely explain symptoms and where often no pathophysiological cause of breathlessness can be attributed despite individuals experiencing unpleasant symptoms. It also acknowledges the vital role of physiotherapists in assessing and managing these patients. It aims to provide clear consensus on terminology and assessment, to support decision-making in various clinical settings, and to inform research and improve diagnosis. This consensus has significant clinical, policy, and research implications.

BACKGROUND

Breathlessness is caused when there is a loss of functional reserve, where alveolar ventilation is impaired, and/or gas exchange is compromised.[1] This complex symptom is known to be influenced by other functions, including emotion, hormones, musculoskeletal influences, and exertion.[2] When breathlessness remains unexplained by pathophysiology, it is often described by terms including dysfunctional breathing, unexplained breathlessness, functional breathlessness, hyperventilation and breathing pattern disorder (BrPD).[3,4] This type of breathing is typified by multi-dimensional characteristics that cause breathing to deviate from allostasis (respiratory requirements).[5-7] Such factors include a complex interplay of neural, biomechanical and biochemical cardiorespiratory mechanisms alongside psychological factors[5,6] and it can occur with and without pathological processes (Figure 1). Physiotherapists play an important role in non-pharmacological breathlessness and breathing pattern management.[8-10] Therefore, it is key to establish a unified terminology and consensus for the assessment of this clinical condition.

PREVALENCE AND MORBIDITY

The overall prevalence of BrPD in the general population is likely underestimated at 9.5%, increasing to over 30% for those with asthma and COPD.[7,11] Recently, there has been an increase in patients presenting with breathlessness in varied clinical settings, including long COVID,[12] back pain,[13] upper airway conditions,[7] as well as more traditional 'respiratory physiotherapy' services. It is a complex and burdensome condition; patients report worse physical functioning scores, are more anxious, with a poorer health-related quality of life.[14,15] Furthermore, this condition frequently exaggerates symptoms of respiratory conditions, increasing the likelihood of excess prescriptions and the misuse of the prescribing budget.[16]

Guidance is needed to support physiotherapists in various settings. Understanding the prevalence of this condition is hampered by the variety of ways it is recognised. In clinical practice, this is usually following an extensive physiotherapy assessment.[4,13] In research, the Nijmegen Questionnaire (NQ) is often utilised to record prevalence.[17] The NQ is a self-completed questionnaire of 16 items, initially developed to assess hyperventilation[18] and more recently suggested for 'functional respiratory symptoms'.[17] The true prevalence could be underestimated as the NQ may not capture all types of BrPD[19] and should not be used in isolation to assess for BrPD as scores may be increased in other presentations, due to pathophysiological and psychopathological processes. Consistent terminology and methods of assessment may help to improve recognition of these patients.[4]

TERMINOLOGY

There is significant variation in the terminology used by both clinicians and researchers to describe this issue. In 2023, physiotherapists working with people living with this condition felt that agreement on nomenclature was urgently needed and the interchangeable use of terms diminished the importance of the condition, delaying accurate diagnosis and treatment, and obstructing clinical and research progress.[4]

Recently, an expert panel of physiotherapists based in the United Kingdom (UK) reached a consensus on terminology through the use of the nominal group technique.[20] To achieve this agreement, focus groups were conducted

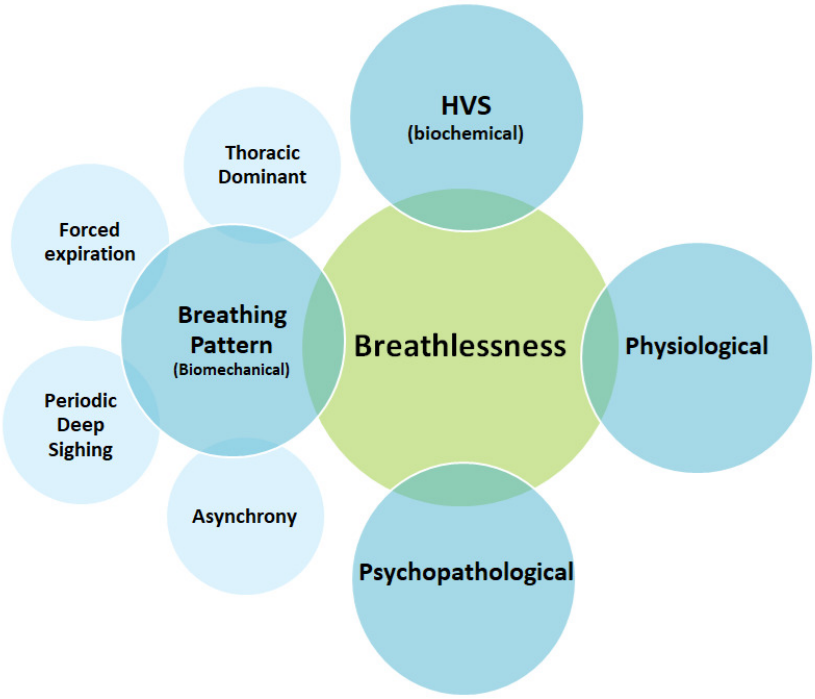

Figure 1. Factors influencing the presentation of BrPD adapted from[5,6]. HVS: Hyperventilation syndrome.

with physiotherapists, non-physiotherapy clinicians (doctors, nurses, and speech and language therapists), and, for the first time, patients. This approach aimed to gather a broad range of opinions on the terminology being used. Focus group findings were shared with the nominal group before consensus was concluded. Overall, 71% of the group agreed with the term breathing pattern disorder (BrPD). Discussions emphasised that both patients and clinicians dislike the term "dysfunction" because of the challenge it creates by separating the problem from the person when labelling this condition and an implication of blame, and how this subsequently impacts patients and their understanding and acceptance of such a label.

BrPD is not yet classified as a diagnosis within the UK Systematised Nomenclature of MEDicine clinical terms (SNOMED) and does not have a Health Resource Group (HRG) code to account for the growing number of physiotherapy interventions. HRG codes are used to group patient activities for payment purposes based on procedure and diagnosis codes. Terms available within the SNOMED system are 'ineffective breathing pattern', 'abnormal breathing patterns' and 'breathing pattern impairment'. The observation events, i.e., how many times this code is used are extremely low (fewer than 100 observations in total use). This lack of coding events may suggest insufficient recognition and missed opportunities for clinical care hindering the ability to understand the prevalence, outcome, and determinants of BrPD.

ASSESSMENT

Although various assessment tools and outcome measures exist for BrPD, they often address some aspects of how these patients present but may not cover all variations of the condition and additionally have inconsistencies in their measurement properties.[21,22] Inconsistency in the evidence of assessment and recognition may result in delayed diagnosis and access to services, and unnecessary investigations and healthcare resources.

A survey of 103 physiotherapists outlined the investigations that individuals commonly complete during a physiotherapy assessment, however, results will have been influenced by factors including level of experience, competency, and confidence of the physiotherapist completing the survey.[4] More recently, a consensus among experienced physiotherapists has developed a comprehensive assessment guide to support practitioners.[20] The development of assessment tools and outcome measures has been described as essential to developing higher-quality research and accurate diagnosis.[23]

POSITION STATEMENTS

The Association of Chartered Physiotherapists in Respiratory Care (ACPRC), therefore, supports the adoption of the term 'Breathing Pattern Disorder' to provide a consistent term for this condition. The acronym 'BrPD' was chosen to differentiate it from others including bipolar disorder and bronchial pulmonary dysplasia. Additionally, the ACPRC supports the use of the developed assessment guide to underpin the education and clinical delivery of a repeatable and effective assessment of BrPD (see supplementary material). Finally, it advocates that breathlessness services should consider including BrPD evaluation within their clinical pathway to optimise the delivery of breathlessness services where these patients may be referred.

DISCUSSION

CLINICAL IMPLICATIONS

The assessment guide will enhance clinical care by ensuring patients with BrPD receive structured, consistent specialist physiotherapy management, thereby promoting equality and inclusivity. The guide may be utilised for education and training at pre- and post-registration levels, as well as competency assessment and should be subject to review and validation in the future. It is important to emphasise that any guide should support, not replace, physiotherapists' decision-making and clinical reasoning.

POLICY

Consistency with nomenclature will enhance recognition of this condition. The future development of new SNOMED/HRG codes will build on this. Inequalities in care delivery, policy development, and workforce planning could be addressed with a uniform approach which can be built from the consistency described in this statement.

RESEARCH

Research designs should consistently use standardised terms and well-described assessments to ensure that BrPD research populations are representative. Furthermore, developing reliable assessment and outcome measures is crucial in research into effective BrPD management. Enhancing recognition of the condition has the potential for developing fellowships and funding for further research. Additionally, epidemiological interrogation of data may be possible in the future with the uptake of consistent coding.

FUTURE RECOMMENDATIONS

The ACPRC believes this position statement provides a platform to improve the quality of patient care. A definitive name and assessment method ensures consistency in clinical practice and research. It provides information to education providers to help them develop resources responsive to advancements in understanding breathlessness and in line with clinical skill expectations. The APCRC has created this position statement to encourage physiotherapists to promote consistent terminology and assessment practices and to share this information widely within their multidisciplinary communities.

Key points

1. Standardised Terminology

The ACPRC endorses 'Breathing Pattern Disorder' (BrPD) as the preferred term, replacing varied and inconsistent terminology to improve recognition, diagnosis, and research.

2. Comprehensive Assessment

A standardised assessment guide has been developed to support physiotherapists in their autonomous decision-making and clinical reasoning when diagnosing BrPD, ensuring consistent and effective evaluation across clinical settings.

3. Clinical and Policy Implications

The ACPRC advocates for integrating BrPD assessment into breathlessness services and promoting its recognition within healthcare coding systems (e.g., SNOMED and HRG codes) to support service planning and funding.

4. Future Research and Education

Calls for further research into BrPD mechanisms, treatment effectiveness, and outcome measures, while encouraging education and training at all levels to enhance physiotherapist expertise in managing the condition.

DECLARATION OF INTEREST

None to declare.

FUNDING

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Commentary

What next for Breathing Pattern Disorder (BrPD)? An Association of Chartered Physiotherapists in Respiratory Care (ACPRC) Commentary

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INTRODUCTION

The Association of Chartered Physiotherapists in Respiratory Care (ACPRC) position statement supports using the unified nomenclature for breathing pattern disorder (BrPD) according to the agreed consensus.[1] Additionally, the assessment for individuals suspected of having BrPD has been suggested based on the group of expert clinicians' recommendations.[1] Having a consensus on these aspects allows us to move forward and initiate important discussions about diagnosis, outcome measures and treatment for BrPD. It also marks an important starting point for facilitating discussions within the physiotherapy community, with patients and the wider multidisciplinary team on further developing the best ways to help with this important condition.

In June 2023, the ACPRC hosted an in-person conversation entitled 'What next for BrPD?' with a group of BrPD physiotherapy experts convened to participate in discussions on nomenclature and assessment,[1] and who agreed to continue the dialogue. This provided the opportunity for an open-ended discussion about the opportunities and challenges for BrPD in the future. This commentary aims to summarise (Figure 1) and reflect on these discussions aligned to the ACPRC's four pillars of practice.[2] So, what next for BrPD?

SHARING KNOWLEDGE AND SKILLS

Discussions recognised the importance of ensuring specific education for BrPD from pre-registration level upwards and includes providing courses that support education across all levels of experience. The European Respiratory Society (ERS) Harmonised Education in Respiratory Medicine for European Specialists (HERMES) Respiratory Physiotherapy post-graduate curriculum indicates assessment and management of breathing pattern abnormalities are within the knowledge and skills domains required for specialists in respiratory physiotherapy.[3] The assessment guide (see supplementary materials) developed by Grillo et al.[1] may support this by providing a baseline for developing such education with the development of competencies or minimum expected standards. Education about assessment of breathlessness, encompassing BrPD should start at pre-registration level and infiltrate all specialities within physiotherapy since this condition is relevant to respiratory physiotherapy as well as other specialities, including back/neck pain, fibromyalgia, pelvic floor problems and mental health conditions. Therefore, education at all levels should reflect this.

The group also discussed the role of the breathing pattern assessment within wider breathlessness services, and as an important component of a biopsychosocial assessment across many different fields, including (for example) chronic pain, exercise performance and long COVID. Education and awareness of this condition amongst the wider multidisciplinary team (MDT) was also felt to be essential to ensure prompt and effective referrals and accurate diagnosis. Increased knowledge and awareness could lead to preventative education and input in schoolchildren, primary care (for example, newly diagnosed asthmatics), and liaison with musculoskeletal services (e.g. patients with low back pain). Clinical experts in this area should also be supported to develop their specialist skills and continue to extend their knowledge.

CONNECTING PEOPLE

It is essential to provide opportunities to develop the patient voice within this field and support opportunities to include patients in the development of clinical services and research opportunities. Moreover, engaging with stakeholders within hospital trusts, community settings and academic institutions will ensure that this condition is recognised and included in service and policy development. Connecting with our international colleagues and experts in other professions will help us to develop our understanding of this condition and share good practice.

FACILITATING RESEARCH AND BEST PRACTICE

The proposal of a single name (BrPD), as well as assessment, will provide a clear baseline to support the devel-

Figure 1. A summary of the output from expert discussions "What next for BrPD?"

opment of research evidence to inform practice. Clarity of terminology will support recognition of the condition. However, a deeper understanding of the mechanisms underlying this condition is crucial, making further research in this area essential. It is also essential we understand more about how this condition presents across different groups (gender, age, culture, beliefs and socioeconomic groups) as well as hearing from the patient's voice through qualitative research. Furthermore, the evidence for effective treatment must be developed and supported by reliable and valid outcome measures. In parallel, it is essential we further estimate the workforce needs required to deliver effective services. It is, therefore, crucial to establish effective coding of the diagnosis of BrPD in the UK through both Systematized Nomenclature of MEDicine clinical terms (SNOMED codes)[4] and the development of a Health Resource Group (HRG) code[5] to ensure activity can be financially reimbursed. Clinical coding is an essential process for accurately capturing large volumes of data about diagnosis, treatment, and who delivers this activity. These data are vital to ensuring the true level of activity in respiratory departments is known for reimbursement of costs, for future planning, and information gathering about the nature of this condition. With more information, service provision can be more accurately planned. Within this, we need to increase professional opportunities through post-graduate education and the development of advanced specialist roles for clinicians working at an advanced level to help develop our workforce and the leaders within this area and to ensure each service can provide such expertise.

LEADERSHIP AND INNOVATION

There are leadership requirements across all the areas currently described. However, this may need to come from both individuals and the different professional groups with which the clinical experts are associated. There are many groups in the UK already at the forefront of promoting best practice for BrPD, including formal groups like the ACPRC, Physiotherapy for Breathing Pattern Disorders and the Buteyko Association, as well as some more informal groups, including singing for breathing groups and those interested in breathing and athletic performance. Additionally, there is the influence of social media and a range of experts with claims about the importance of breathlessness management, with varying expertise. Opportunities need to be created to enable these groups to come together to ensure this area of interest is moving forward collectively. By standardising the name, BrPD as well as assessment, the priorities outlined in this commentary should be more achievable. Service planning and evaluation will be easier, and career pathways can be shaped; collaboration between physiotherapists and other members of the MDT regarding education and research will be streamlined. Ultimately, patient outcomes will be improved.

WHAT NEXT FOR BRPD?

This commentary highlights many important next steps for BrPD from various perspectives. We hope that by discussing some of these issues, we have provided a clearer sense of direction for leaders, researchers and clinicians working with people living with BrPD.

DECLARATION OF INTEREST

None to declare.

FUNDING

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