Passy Muir Valve (PMV) in-line with a ventilator circuit - Use of - Clinical Guideline

Reference no.: CG-CLIN/4445/24

Contents

1. Introduction

Communication difficulties are one of the biggest challenges for mechanically ventilated patients (Tembo, Higgins and Parker, 2015). With a tracheostomy in situ, air bypasses the upper trachea and oropharynx which prevents speech occurring (Bier, 2004). Impaired communication can lead to:

- Safety concerns
- Violation of patient rights
- Reduced quality of life
- Frustration
- Anger
- Withdrawal from interaction
- Reduced participation in treatment
- Increased incidence of delirium
- Increased incidence of preventable reversible events

(Magnus & Turkington 2006, Kunduk et al 2010, Freeman-Sanderson et al 2018).

The Passy Muir Tracheostomy & Ventilator Swallowing and Speaking Valve (PMV) is a bias-closed position, no-leak valve. When a patient has a tracheostomy with the cuff inflated, airflow is directed in and out through the tracheostomy tube and bypasses the upper airway.

Using the Valve with the cuff deflated, allows a patient to breathe in through the tracheostomy tube and out through the upper airway (mouth and nose). The valve works by closing at the end of inspiration, which redirects airflow upwards through the vocal folds and upper airway, allowing phonation (Li et al 2021). Research has shown that this redirection of airflow offers patients numerous clinical benefits, including:

- Voice/speech production
- Improved swallowing
- Secretion management
- Improved oxygenation
- Restores subglottic pressure
- Restores positive airway pressure (PEEP)
- Facilitates weaning
- Reduce aspiration
- Facilitates decannulation
- Improves sense of smell
- Infection Control
- Improved quality of life

(O'Connor et al, 2019 and 2021, Li et al 2021).

The Passy Muir® Valve (PMV) should be used in conjunction with manufacturers guidelines published at: www.passymuir.com/sites/default/files/pdf/resource_guide.pdf.

The Passy Muir® Valve 007 is designed to be inserted into the ventilator circuit for patients with a tracheostomy, offering patients who are unable to tolerate a tracheostomy mask trial the above benefits. Studies have shown that the use of speaking valves does not result in any significant lung de-recruitment or adverse cardiovascular events (Sutt et al 2016, O'Connor 2019 and 2021, Sutt et al 2017).

For long term patients, the use of the PMV has been shown to enhance the weaning process by conditioning the patient to breathe past the oropharynx, thus increasing the strength of the diaphragm, intercostals and other accessory muscles (Sutt et al, 2016). Using PMV in the ventilator circuit allows earlier vocalisation and swallowing, which has a significant positive impact on their quality of life (Bier, 2004, Sutt and King, 2016, O'Connor et al 2019).

2. Aim and Purpose

This guideline aims to support the utilisation of the PMV within the ventilator circuit (in-line PMV ventilation) to improve speech, swallowing and quality of life for tracheostomy patients who are unable to progress to PMV trials via the tracheostomy mask.

It aims to improve the consistency, earlier implementation and standardisation of in-line PMV ventilation, by providing an evidence-based practice guideline.

This clinical document applies to:

Staff group

• Nurses

• Physiotherapists

• Doctors

• Speech and Language Therapists

3. Definitions and Key words

Physio: Physiotherapist

SLT : Speech and Language Therapist

ICU: Intensive Care Unit

Tracheostomy: Opening created at the front of the trachea so a tube can be inserted to help with breathing.

Cuff: Part of a tracheostomy that can inflated to help reduce the risk of aspiration and to aid ventilation.

Tracoe: Tracheostomy brand

Portex: Tracheostomy brand

Subglottic suction port: part of certain tracheostomies with the primary function to allow removal of secretions lying above the cuff to prevent the risk of ventilator acquired pneumonia (VAP).

ENT: Ear, nose and throat department

Passy Muir Valve (PMV): one way valve that fits in line with the ventilator circuit, is bias closed and directs airflow through the larynx on expiration.

FNE: fibreoptic nasendoscopy

HCRs: health care records

Drager, Mindray: models of ventilators

PEEP: Peak end expiratory Pressure

PS: Pressure Support

CCS: Closed Circuit Suction

NIV: Non-invasive ventilation

WOB: Work of breathing

FiO2: Fraction of inspired oxygen

ASB: Assisted Spontaneous Breathing

NG: Nasogastric

NJ: Nasojejunal

4. Main body of Guidelines

Patient selection criteria:

- At least 72 hours post tracheostomy insertion.
- Patient over the age of 18.
- Alert patient who attempts to communicate, able to follow simple instructions and consents/agrees to the procedure.
- Agreement gained from managing Consultant.
- Off sedation
- Manageable chest and oral secretions
- PEEP of 10 or less
- Peak inspiratory pressure (PIP) less than 40
- ASB / pressure support less than 15.
- Respiratory rate less than 30

Contraindications:

- Less than 72 hours post insertion of current tube.
- Patient declines/refuses to consent.
- Suspected or confirmed upper airway obstruction.
- Unmanageable chest or oral secretions
- Medically unstable or not alert
- Recent head and neck surgery/laryngectomy
- Tracheostomy tube displaced or not in optimal position
- Ventilator requirements outside the parameters above

- Unable to tolerate cuff deflation
- Large size tracheostomy tube which limits airflow past the tube even with the cuff deflated. This should be assessed on a patient-to patient basis, but considered with all patients with a tracheostomy above size 8 needs to be discussed with the MDT.
- Bulbar palsy
- Sedated, paralysed, sleeping or comatose patients
- Severely reduced lung elasticity that may cause air trapping.

Equipment:

- PMV – 007, aqua speaking valve
- Flexible catheter mount 22F-22M/15F
- 2 x 10ml syringe
- Cuff pressure gauge
- green straight connector size 22F/22F
- Closed suction circuit
- Yankauer suction tube

Staff required

- An ICU Consultant or a Senior Physiotherapist needs to be in attendance for the first attempt at using a PMV in line with the ventilator circuit. Ideally SLT to be present to assess voice quality and upper airway patency.
- Consultant or Senior Physiotherapist should review the ventilator parameters as indicated.
- A nurse competent in ventilator management, tracheostomies and suction (See separate competency) can complete follow-up PMV within the ventilator circuit trials as directed by a weaning plan, they also need to be present throughout the PMV trial if the Physiotherapist or Consultant is not present.
- A professional competent in yankauer and deep suction (See separate competency) should be available throughout.
- The nurse in charge should be aware when PMV within the ventilator circuit trials are taking place if a consultant or Senior Physiotherapist or not present.

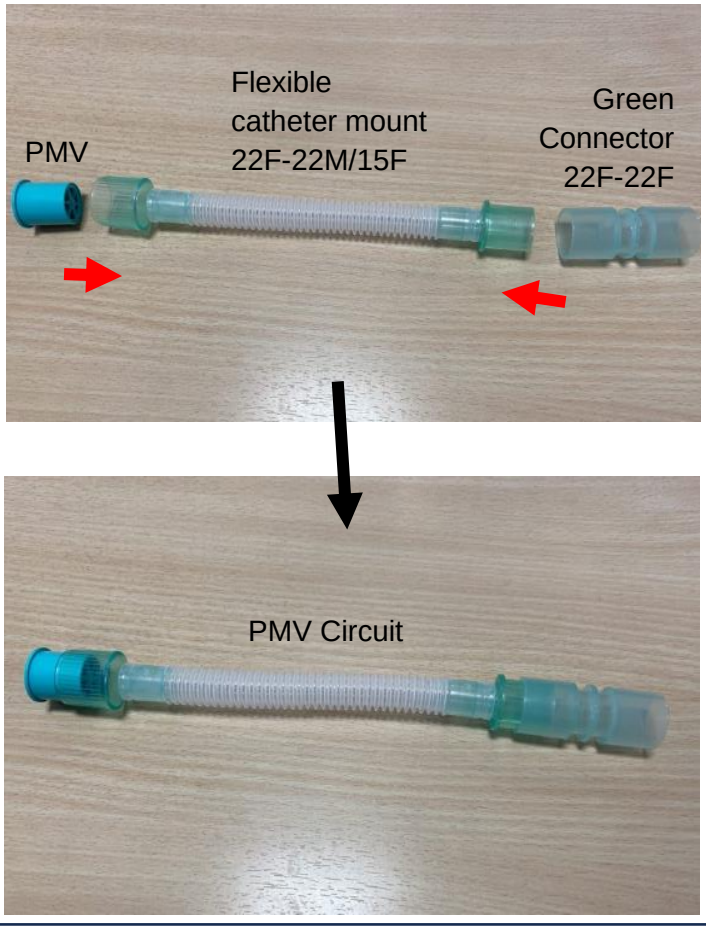
Procedure:

- Check patient meets inclusion criteria and there are no contraindications before proceeding.
- Gain agreement from Consultant Team.
- Collect required equipment.
- Ensure appropriate members of staff are present.
- Explain the procedure to patient and check they consent / agree if possible. Advise patient there may be changes to taste/sensation and movement of secretions in the oral cavity. Explain that PMV may not be successful in achieving voice.
- Ensure the patient is sat upright. General care should be taken to not dislodge any lines including NG or NJ tubes.
- Construct the PMV Circuit (FIG1) by attaching the PMV to the 22F end of the catheter mount and a 22F/22F straight connector to the 22M/15F end of the catheter mount
- Yankauer suction in oral cavity / carry out mouth care. If available, use the subglottic aspiration port to remove any secretions from above the cuff prior to cuff deflation. Tracheal suction if required. Pause any feeding pumps.
- With assistance, carry out concurrent tracheostomy suctioning and cuff deflation.
- Repeat oral or tracheostomy suctioning as required to clear any further secretions.
- Allow patient to settle, checking for any immediate changes to observations.
- Check for leak around the tracheostomy by asking the patient to talk or cough.
- Temporarily stop the ventilator, pre-oxygenating if required.
- As per FIG2, disconnect the flexible connector from the closed-circuit suction, remove the flexible connecter from the Y-connector and attach the PMV circuit to the 15mm end of the closed-circuit suction, and the straight connector end to the Y-Connector of the ventilator tubing
- Restart the ventilator.
- Check the patient is tolerating the PMV by observing patient work of breathing and observations. Further suctioning may be required.
- Consider increasing pressure support / Fio2 or reducing PEEP as required to optimise phonation, work of breathing, oxygenation and comfort.
- Adjust alarm settings or switch the ventilator to NIV mode. Pause Co2 monitoring.
- Continue trial as tolerated, observing patient for increased work of breathing or desaturation.

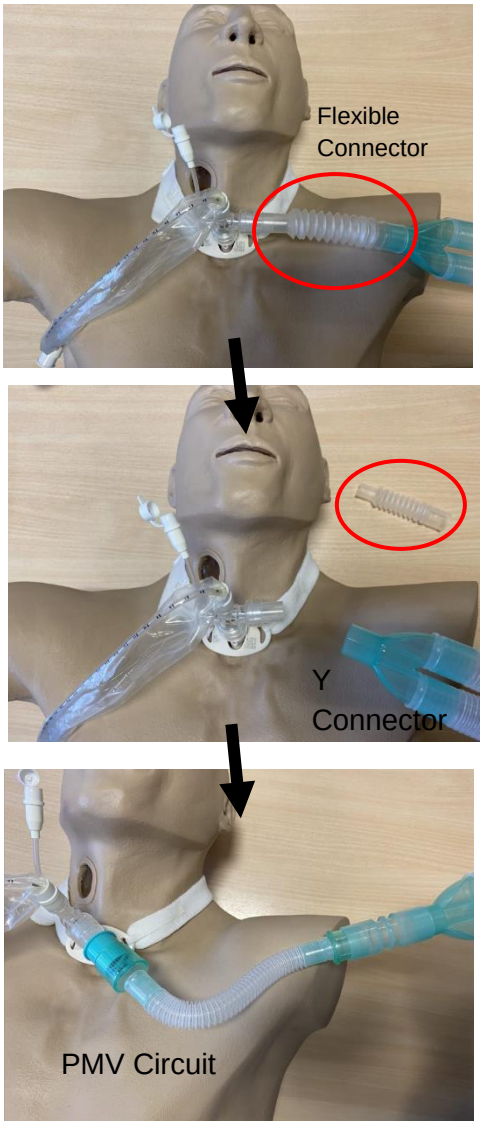
- To finish trial, return ventilator setting and alarms to pre-trial level, returning from NIV mode to invasive ventilation. Stop the ventilator, preoxygenating if required.
- Remove the PMV circuit to reverse FIG2. Replace the flexible connector between the Y-Connector and the 15mm end of the closed-circuit suction. Restart the ventilator.
- Only if PMV is removed, re-inflate the cuff.
- Check patient observations.
- Document outcome of trials in patients notes.

<u>Figures illustrating the construction of the PMV circuit and how it fits within the ventilator circuit</u>

Constructing the PMV Circuit (FIG.1)



Swapping the flexible connector for constructed PMV circuit (FIG.2)



PMV in line with ventilator flow chart

Are the required staff available for the duration of the trial? (if first attempt 1 must be a physiotherapist or consultant).

yes

Has an MDT decision re: cuff deflation safety & in-line PMV ventilation been agreed.

Yes

No

Create the PMV circuit (Fig 1) by attaching the PMV to the 22F end of the catheter mount and a 22F/22F straight connector to the 22M end of the catheter mount.

No / Unable

Patient not appropriate for in-line PMV ventilation. Discuss with MDT.

Pause any feed pumps. Perform tracheal & subglottic suction, **deflate cuff** with concurrent suction.

Is there leak around tracheostomy (indicated by vocal sounds/attempt to cough) & are observations stable.

No

Re-inflate cuff, Discuss with MDT

Yes

Stop Ventilator, remove flexible connector and connect PMV circuit to tracheostomy tube & Ventilator tubing (Fig 2). Restart Ventilator.

Is the patient tolerating the PMV? *Look for increased WOB and changes to observations. Further Suction as required.*

Consider increasing PS & FiO2 & reducing PEEP as indicated.

No Improvement

Remove PMV. Re-inflate cuff, Discuss with MDT

Yes

Improvement

Adjust ventilator alarm settings / pause Co2 monitoring / swap to NIV

Continue trials as tolerated.

At the end of the trial, return ventilator settings and alarms to pre-trial levels. Swap back from NIV mode if required. Pre-oxygenate if required. Stop the ventilator, remove PMV circuit & reconnect flexible connector to in-line suction and Y connector (Reversing FIG.2). Restart the ventilator.

Only **re-inflate the cuff once the PMV has been removed.** Check observations. Document trial.

5. Hazards and complications:

Hazard/complication	Action
Reduced oxygen saturations	Increase FiO2 and/or pressure support (PS) to counteract effect or cuff deflation up to the maximum level as stated on the weaning plan. Terminate trial if maximum parameters are exceeded
Excessive coughing Complete CCS, terminate if it does not settle	Ensure subglottic and tracheal suction are performed prior to cuff deflation to minimise secretion aspiration.
Patient intolerance	Provide adequate explanation of treatment to reassure patient. Increase FiO2 or PS if additional support is required to counteract cuff deflation.
Hyperinflation	Reduce ventilator PEEP to 5cmH2O
De-recruitment following cuff deflation	Increase PS to accommodate cuff leak during trial. Provide ventilator recruitment manoeuvres once trial has been completed. Obtain support from the physiotherapy or medical team if required for recruitment manoevres.
Dislodgment or accidental removal of lines including NG or NJ tube.	Medical team to be made aware for re-siting if appropriate.

6. Linked Documents

- Competency document for physiotherapists using a Passy Muir Valve within a ventilator circuit.
- Competency document for nurses using a Passy Muir Valve within a ventilator circuit.
- Nursing competency document for suction, ventilators and tracheostomies

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8. Documentation Controls (these go at the end of the document but before any appendices)

Reference Number CG-CLIN/4445/24	**Version: 1** **6.6.23**		**Status** Final	Final
Version / Amendment History	Version	Date	Author	Reason
	1	26/9/23	Dan Nolan Physiotherapist, Clare Larvin SLT and Nicola Hughes SLTs	No previous guideline in place
Intended Recipients: Speech and Language Therapists, Physiotherapists, Nurses, Doctors				
Is this guideline is for cross divisional use? **Y** ■ → Will require sign off at Trust Guideline Group once divisionally **N** □ → Suitable for divisional sign off				
Training and Dissemination: Disseminate to relevant staff				
Development of Guideline: **Daniel Nolan – Clinical Specialist Physiotherapist** **Nicola Hughes - Experienced Specialist SLT** **Clare Larvin - Specialist SLT**				
Consultation with: Respiratory and ICU teams **SLT tracheostomy group** **UHDB tracheostomy Group** Please confirm all relevant stakeholders/specialities have been consulted and list above eg all drugs must have pharmacy approval,,				
Linked Documents: State the name(s) of any other relevant documents None				
Keywords: **ACV, tracheostomy**				
Business Unit Sign Off			**Group: UHDB tracheostomy Group** **Date:**	
Divisional Sign Off			**Group:CDCS Governance** **Date:6/8/2024**	
Trust Guideline group sign off (if applicable)			**Trustwide CGG (30/8/2024)**	
Date of Upload			11/09/2024	
Review Date			August 2027	
Contact for Review			SLT Therapists	