

THE BENEFITS OF SPEAKING VALVES IN CHILDREN REQUIRING MECHANICAL VENTILATION

Francisca Mota, BSc (Hons), PGDip Children Nursing, RCN

Email: Francisca.Mota@UHBW.NHS.UK

Introduction

For children and young adults who communicate verbally, being unable to do so following a tracheostomy is known to cause them distress when awake and alert¹. Re-establishing communication should be a major goal for that child and the team around them, regardless of their ventilation status. This poster will look at patients who are mechanically ventilated via their tracheostomy, due to both long-term concerns as well as those weaning from it, and explore the multifaceted benefits using a speaking valve has for that child.

Natural Airway vs. Tracheostomy

The respiratory system is often divided into the upper and lower respiratory tract. The upper airway is made up of the nose, mouth and pharynx, while the lower airway is the larynx, trachea, bronchioles and lungs².

A tracheostomy is an artificial airway that by-passes the upper airway by creating a surgical opening in the anterior trachea. Long-term ventilation has become the most common indication for a tracheostomy in paediatrics³. The presence of a tracheostomy may alter some of the actions that happen in the upper airway, such as breathing, swallowing and voice production⁴.

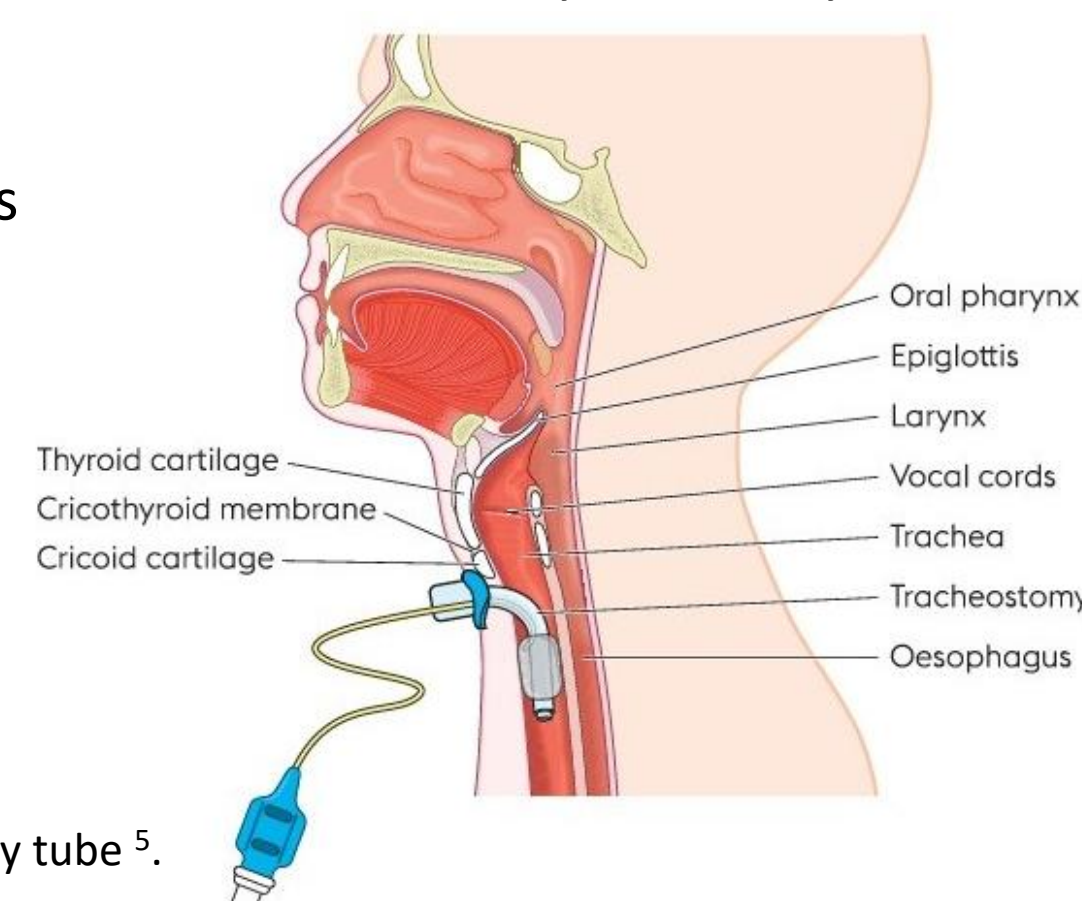


Image 1. Labelled paediatric airway anatomy with tracheostomy tube⁵.

The Speaking valve

The speaking valve is commonly referred to as a 'one-way' valve because of its bias-closed mechanism of action. The valve closes at the end of inspiration and remains closed throughout the expiratory cycle. Air follows through the path of least resistance and so is redirected through the upper airway. If a child has a cuffed tube, it is vital the cuff is deflated as this will prevent air from flowing. Failure to deflate the cuff may put the child at risk of aspiration, asphyxiation and may potentially lead to a respiratory arrest⁹.

A new name: 'One-way' valve

- Clinicians are moving away from calling it a 'speaking' valve as many non-verbal patients use the valve for reasons other than phonation.
- The Passy-Muir valve is the most popular valve used in practice and is largely referred to in the literature. Passy-Muir funds a lot of the research done using their valve, so there might be publication bias.

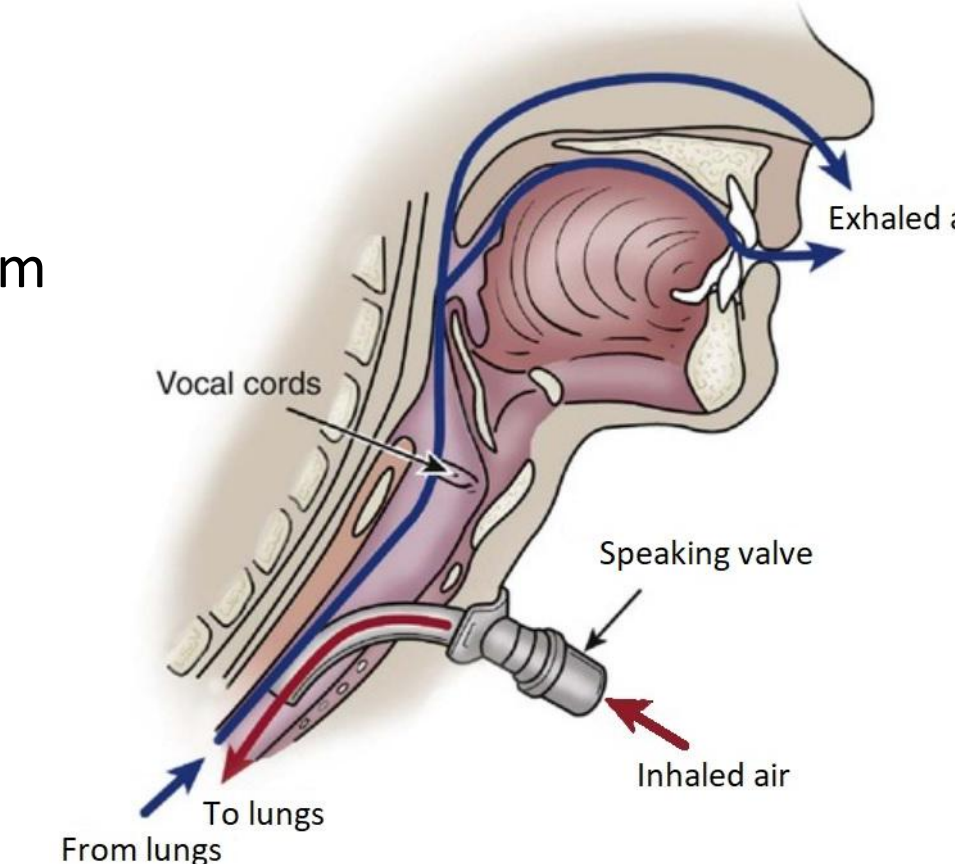


Image 2. Air flow with a speaking valve¹⁰.

Benefits of the speaking valve

Evidence-based rationale

👍 Voice and speech production

- The speaking valve restores normal physiology of phonation. The use of the valve has shown improvements in speech intelligibility, flow, and time in ventilator dependent patients, compared to those who use just a cuff-down technique¹¹.
- Several qualitative studies have reported that the return of the patient's voice was a priority following their tracheostomy¹².

👍 Nutrition

- The introduction of a speaking valve encourages airflow through the upper airway. This stimulates the sensory aspects needed to smell and taste, and consequently increases appetite^{4, 14}.
- The valve helps breathing and swallowing coordination which is usually disrupted while on mechanical ventilation⁷.

👍 Secretion management and reduced risk of aspiration

- Strong evidence has been produced that suggests the restoration of airflow to the upper airway increases subglottic pressure which improves coughing effort.
- A more productive cough allows for stronger bolus propulsion, and improved airway protection by reducing pooling of secretions in the pharynx and minimising the risk of aspiration^{7, 14}.

👍 Ventilator weaning and decannulation

- Several studies have repeatedly demonstrated improved lung recruitment, causing a positive impact on gas exchange, physiologic PEEP and increases expiratory tidal volumes, when using the a speaking valve on mechanically ventilated patients^{18, 19}.
- For patients who are able to tolerate the valve for long periods, capping is the next step toward decannulation, although this practice in the literature is mixed²⁰.

👍 Mental health

- Parallels can be drawn from studies on intubated patients who report that being unable to communicate evokes feelings of anxiety and fear. These feelings have been described as being closely related to the experience of agony and panic, making it difficult to sleep and rest¹².

Impact in nursing care

- Happ *et al.* (2011) study on nurse-patient interactions found that nurses initiate most of the communication exchanges in an ICU setting.
- The inability of patients to communicate effectively is concerning because those who cannot communicate experience more pain, which will be problematic for accessing pain relief¹³.

- Nurses play a crucial role in reintroducing an oral diet. This should be done following a speech and language assessment and under the advice of dieticians⁴.
- Nurses should remain vigilant during this period and follow safety protocols to reduce risk of aspiration when eating and drinking. This might involve suctioning prior to eating and optimising positioning^{4, 15}.

- The National Tracheostomy Safety Project has produced strong evidence-based recommendations that good oral hygiene should be maintained¹⁶.
- Two separate studies have demonstrated a reduction in the frequency and amount of oral secretions suctioned following speaking valve use^{16, 17}.

- In the presence of the valve the ventilator is no longer able to detect expiratory tidal volumes, expiratory minute volumes and end-tidal CO₂, causing it to alarm¹¹. In order to facilitate the use of speaking valves the nurse must have a good understanding of its effects on the ventilator, which may require adjusting settings.
- The bedside nurse may be involved in long-term planning if weaning ventilatory support or decannulation is feasible.

- Multiple studies report the use of the valve has a significant positive impact on patient's quality of life.
- Nurses' role is safeguarding patient wellbeing, which includes looking beyond physical disease and assessing signs of worsening mental health in the child receiving care^{1, 21}.

Recommendations for practice

Throughout an extensive search of the literature there has been little focus on the role of the bedside nurse, however their representation and contribution in supporting the multidisciplinary team will impact the care experienced by the child and their family.

Criteria for candidacy

Eligibility criteria for trials of speaking valves are inconsistent across the literature and included a combination of clinical assessment coupled with published indications²². The bedside nurse is able to make a real-time assessment regarding the child's clinical condition.

Establishing a tracheostomy team

It has been well documented across the literature that establishing a coordinated multidisciplinary team will improve the safety and quality of care for patients and their families²³. The bedside nurse will be able to recognise the need for specialist intervention, make the appropriate referral, and support these teams.

Assess valve tolerance during trials

The bedside nurse plays a vital role in continuously monitoring and assessing the patient's tolerance to the valve. Signs of intolerance will be specific to each child, and may not look like the commonly described symptoms, such as falling oxygen saturations, increase work of breathing or tachycardia²².

Using supplemental communication aids

Some studies have looked at the use of supplemental communication aids and they have all demonstrated statistically significant improvements in a patient's ability to communicate. Despite these encouraging findings, in Garry *et al.* (2016) study 50% of the patients reported frustration with the use of these aids, and the Maringelli *et al.* (2013) and Happ *et al.* (2014) studies required extensive communication skills training of doctors and nurses in order for them to communicate efficiently with patients using said aids^{13, 24, 25, 26}.

Influencing future practice

Addressing barriers in care

Common barriers often reported by bedside nurses include lack of nursing staff and time constraints. Having a family-centred approach and coordinating with the wider multidisciplinary team will ensure the patient receives specialist care and allows the nurse to share their task load²³.

Early patient and family engagement

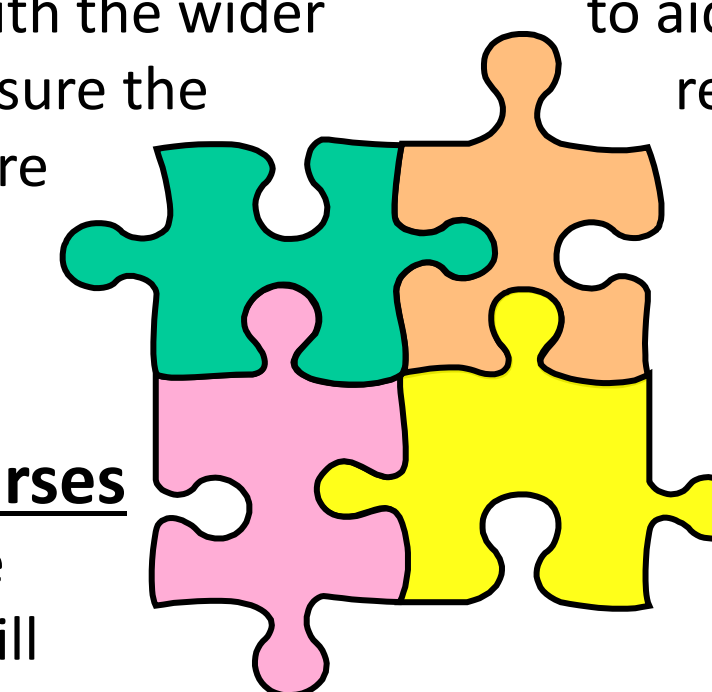
It is vital for patients and carers to engage with all members of the multidisciplinary team and to have access to appropriate tools to aid their education. In the USA resources such as the Passy-Muir's Toby Tracheasaurus Pediatric Program' is widely available^{9, 27}.

Education for bedside nurses

Educating nursing staff on the function of speaking valves will boost their confidence in caring for tracheostomy ventilated patients²³. This can be delivered in the classroom, online, at the bedside or through clinical simulation, which has become increasingly popular in medicine.

Revising local evidence-based guidance

Based on the evidence presented there may be scope for revising local guidance surrounding the use of speaking valves in mechanically ventilated children. Nevertheless, caution must be taken as there is limited strong evidence in paediatrics²².



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Conclusion

Using a speaking valve has not only physiological benefits, but also contribute to a better hospital experience, healthier mental state and overall better quality of life for ventilated children. It is vital for all members of the 'tracheostomy team' to work collaboratively to guarantee the best outcomes for the child. This includes the bedside nurse whose role is crucial in continuously monitoring and assessing the patient, advocating for the child and the family when they are not able to do so for themselves, and to encourage the safe use of the speaking valve.



Image 3. The Passy-Muir valves; 007 (aqua), 2000 (clear) and 2001 (purple)⁹.