Author: Dr. phil. Maria-Dorothea Heidler [a,b]

[a] Brandenburg Hospitals, Bernau, NRZ (Weaning Station) – heidler@brandenburgklinik.de
[b] University of Potsdam, Professor of Rehabilitation Sciences – mheidler@uni-potsdam.de

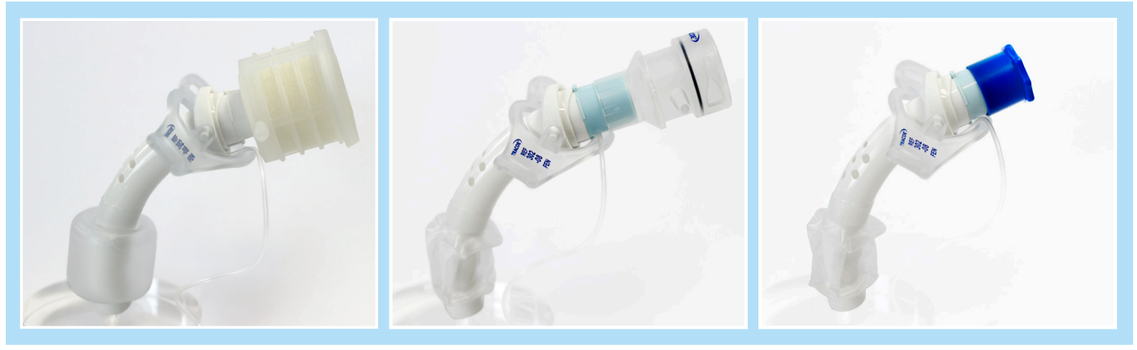

Figure 2: Example of a combination tube (TRACOE *twist*), which can be used for the entire three-step clinical pathway, without requiring a change to another model.

Step by step to decannulation using a speaking valve

An effective clinical pathway

Dr. phil. Maria-Dorothea Heidler

More and more often, speech and occupational therapists are being faced with patients who have cuffed tracheostomy (trach) tubes following long-term invasive mechanical ventilation. A tracheostomy tube has many advantages over an endotracheal tube but also has its disadvantages – especially with respect to swallowing. A cuffed trach tube remaining in situ for a prolonged period increases mucus production and hinders the natural laryngeal elevation during swallowing by fixing the trachea to the skin of the neck. The epiglottis does not close properly when the swallowing reflex is triggered, so that it is much easier to aspirate saliva and food (Heidler et al., 2015). Laryngeal elevation may be so greatly reduced that the upper oesophageal sphincter no longer opens, saliva accumulates and overflows into the trachea. In addition, the physiological flow of air through the larynx, pharynx, nose and mouth is an important stimulus for spontaneous swallowing; if this stimulus is absent because of a cuffed trach tube, swallowing frequency falls (Seidl et al., 2005). The absence of an airstream sometimes also leads to severe sensory impairment because chemoreceptors and pressure receptors in the laryngeal mucosa are not adequately stimulated, with a resultant deprivation of the swallowing and cough reflexes (De Lamimant et al., 1995). An inadequate build-up of intrathoracic pressure and the lack of an explosive passage of air through the larynx means that aspirated material cannot be coughed up effectively.

Summary

All patients who are undergoing invasive mechanical ventilation via a cuffed tracheostomy tube have a high risk of a swallowing disorder, usually associated with passive aspiration.

As a long-term inflation of a cuffed trach tube leads to an increase in aspiration, a vicious circle soon develops. On the one hand, patients need cuffed trach tubes when their sensory function is thus severely impaired and, on the other, the long-term presence of a cuffed tube in turn leads to sensory disorders because of the constant salivary irritation of the surrounding mucosa and the lack of a physiological laryngopharyngeal airstream. Therapists therefore find themselves in a dilemma: on the one hand, a patient cannot really have the cuff deflated because of passive aspiration and, on the other, sensory function will not improve significantly without the passage of a physiological flow of air (Heidler, 2007). This dilemma can only be solved if therapists take their courage in both hands and, with a certain (calculated) risk, rapidly start with short-term cuff deflation. In particular, a physiological flow of air channelled through the larynx has a beneficial effect on sensitivity and leads to an increase in the swallowing frequency (Seidl et al., 2005). The trach tube should be closed with a speaking valve in order to direct the air accordingly. This causes a sufficiently high subglottic pressure,

can pass upwards when the cuff is deflated and a speaking valve used (fenestrated inner cannula). The indirect route with a cuffless trach tube is not necessarily required with a combination trach tube, as this can also be capped when the cuff is deflated (see **Figure 2**).

Summary of clinical practice

A stimulating stream of air through the trachea, larynx and pharynx is crucial to restoring sensation and an adequate rate of spontaneous swallowing. The air can be particularly well channelled in the direction of the larynx by deflating the cuff and inserting a speaking valve. The procedure must not be undertaken lightly; however, the possible detrimental effects of too-rapid tracheostomy tube management (e.g. pneumonia) can be prevented by close monitoring in the clinical setting.

Unfortunately, decannulation is not possible in all patients. Weaning patients from the trach tube is particularly difficult if they have respiratory problems (e.g. COPD), progressive neurological diseases (e.g. ALS or myasthenia gravis) or neurological sensory disorders of the larynx and trachea (e.g. after brain stem injuries). On the other hand, patients who show “only” a trach-tube-induced sensory loss have a very good potential for tracheostomy tube removal.

De Larminant, V., Montravers, P., Dureil, B. et al. (1995): Alteration in swallowing reflex after extubation in intensive care patients. Crit Care Med 23: 486 – 490

Eibling, D.E. & Gross, R.D. (1996): Subglottic air pressure: a key component of swallowing efficiency. Ann Otol Rhinol Laryngol 105: 253 – 258

Heidler, M.-D. (2007): Rehabilitation schwerer pharyngo-laryngo-trachealer Sensibilitätsstörungen bei neurologischen Patienten mit geblockter Trachealkanüle. Neurol Rehabil 13: 3 – 14

Heidler, M.-D. (2011): Dekanülierungsmanagement in der Frührehabilitation. Ein Plädoyer für mehr Risikobereitschaft. Forum Logopädie 3: 22 – 25

Heidler, M.-D., Bidu, L., Friedrich, N. et al. (2015): Oralisierung langzeitbeatmeter Patienten mit Trachealkanüle. Med Klin Intensivmed Notfmed 1: 55 – 60

Neurogene Dysphagien. Leitlinie der Deutschen Gesellschaft für Neurologie und der Deutschen Gesellschaft für Neurotraumatologie und Klinische Neurorehabilitation (2004): http://www.bundesverband-klinische-linguistik.de/pdf/LL_Dysphagie.pdf

Schröter-Morasch, H. (2006): Klinische Untersuchung des Oropharynx und videoendoskopische Untersuchung der Schluckfunktion. In: Bartholome, G. & Schröter-Morasch, H. (Hrsg.): Schluckstörungen – Diagnostik und Rehabilitation (173 – 208). München: Elsevier

Seidl, R.O., Nusser-Müller-Busch, R. & Ernst, A. (2005): The influence of tracheotomy tubes on the swallowing frequency in neurogenic dysphagia. Otolaryngol Head Neck Surg 132: 484 – 486

Suiter, D.M., McCullough, G.H. & Powell, P.W. (2003): Effects of cuff deflation and one-way tracheostomy speaking valve placement on swallow physiology. Dysphagia 18: 284 – 292

Winklmaier, U., Wüst, K. & Wallner, F. (2005): Evaluation des Aspirationsschutzes blockbarer Trachealkanülen. HNO 53: 1057-1062

12. 2017/1.0

Step by step to decannulation using a speaking valve

An effective clinical pathway

Starting point:
cuffed tracheostomy tube

Tracheoscopy

Continuous passive aspiration of saliva

No → Short schedule of deflation and capping the tube; decannulation

yes

Step 1: Progressive increase in periods of cuff deflation (up to 24 hours)

Starting with 15-30 minutes daily and increasing stepwise up to 24 hours (with the use of a speaking valve and oxygen monitoring) if there is no infection, an adequate rate of spontaneous swallowing, and effective reflex or voluntary coughing

Tolerated: No → If not well tolerated, (because of infection, heavy secretions etc.), return to continuous cuff inflation; when there is no infection, repeat attempt with increasing periods of cuff deflation and a speaking valve

Tolerated: yes

Step 2: Progressive increase in capping the tube (up to 24 hours)

Complications (stenosis, tracheomalacia, granulation, etc.)

Tolerated: No → Check for complications, cuffless tube required to ensure breathing, not possible to extubate

Toleranz Ja

Step 3: Decannulation

Late complications
(stenosis, malacia, granulation)

Tolerated: No → In some circumstances, reinsertion of a trach tube required for late sequelae

Figure 1: Three-step clinical pathway to decannulation (Heidler, 2007).

which is the key component of effective swallowing. Numerous studies have shown that the use of a speaking valve has immediate positive effects on the biomechanics of swallowing and progressively reduces the risk of aspiration (Eibling et al, 1996; Suiter et al., 2003).

Summary

Even with passive aspiration and reduced coughing, the cuff should be deflated (even if only briefly at first), as spontaneous remission of the sensory disorder is not to be expected with the long-term inflation of a cuffed tracheostomy tube.

The following describes a three-step clinical pathway in which decannulation (tracheostomy tube removal) can be achieved through progressively longer periods of cuff deflation and the use of a speaking valve – irrespective of how alert and cooperative the patient is. At first glance, the general procedure for weaning the patient from the trach tube seems extremely simple: cuffed tracheostomy tube ➤ cuffless tracheostomy tube ➤ decannulation; but there are several interim steps that the patient should tolerate well (see **Figure 1**).

Step 1: Progressively increasing periods of cuff deflation and the use of a speaking valve: the first goal of treatment is that the patient tolerates increasing periods of cuff deflation (e.g. starting with 15 minutes a day for a week; if this is well tolerated, then progress to 30 minutes a day, then 2 hours, and so on). A speaking valve is used to channel a physiological stream of air. Contraindications to brief periods of cuff deflation are acute pulmonary infections, severe vomiting, and continuous passive aspiration without triggering reflex and/or voluntary coughing (grade IV endoscopic and radiological aspiration). Patients with grade III endoscopic aspiration onwards (Schröter-Morasch, 2006) should have the cuff deflated for short periods if, despite permanent aspiration without a cough reflex, effective coughing can at least be initiated voluntarily. Besides voluntary and/or reflex coughing, the prerequisite for increasing periods of cuff deflation is sufficiently effective swallowing of saliva (German society for neurotraumatology and clinical rehabilitation (DGNKN) guidelines on neurogenic dysphagia, 2004). The patient is, of course, at a higher risk of aspiration pneumonia during periods of cuff deflation – but this risk is present at all times: studies have shown that even trach tubes with a properly inflated cuff do not entirely protect the airway and prevent aspiration (Winklmaier et al., 2005). As there is always some danger of aspiration, there is little argument against short-term cuff deflation, particularly if this is the only way that the patient can cough effectively (it goes almost without saying that the patient's vital signs must always be closely monitored, with suction equipment at hand).

Step 2: Progressive increase in periods of capping (plugging) the tube: If no complications (infection, respiratory problems etc.) arise with cuff deflation for periods of up to 24 hours, a cuffless trach tube can be inserted, with subsequent increasing intervals of capping.

Step 3: Decannulation: if capping is also well tolerated without complications, the patient can be extubated. Follow-up after two to four weeks is important, to check for possible late sequelae (such as tracheomalacia, stenosis or granulation).

If no complications arise, management of the decannulation process lasts one or two months. One advantage is that even comatose patients and those with severely clouded levels of consciousness can be weaned from the trach tube – provided that they have a cough reflex, are not vomiting frequently, and the rate of spontaneous swallowing is sufficiently high (Heidler, 2011).

Summary

Cuff deflation and the use of a speaking valve to channel a physiological stream of air often improve the spontaneous swallowing rate and sensation within a few weeks, reducing aspiration and increasing natural processes to manage secretions (coughing and clearing the throat).

The use of a combination tube with a fenestrated and a closed inner cannula is to be recommended, so that no secretions can flow through the trach tube from above when the cuff is inflated (closed inner cannula), but a maximum volume of air