

# Possibilities And Opportunities For Subglottic Air Insufflation In Patients With Tracheostomies – More Than Just Above Cuff Vocalisation (ACV)

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## Abstract

For patients, in whom a deflation of the cuff and reconnection of the upper and lower airways is not justified or not possible, the retrograde flow of air with above cuff ventilation offers a low-risk therapeutic option, which, in addition to enabling patient participation, increases patient autonomy and improves the quality of life.

Tracheostomy counts as one of the most frequent procedures in intensive care. It is estimated that some 24% of patients on intensive care units have a tracheostomy (Mehta and Mehta 2017 in Schneider-Stickler and Kress, published 2018).<sup>6</sup>

This artificial airway has certain advantages, as mechanical ventilation is easier than with endotracheal intubation. Pulmonary hygiene for the management of secretions can be achieved more easily with the possibility of endotracheal suction. One considerable advantage over an endotracheal tube is that the patient can be awake and, in most cases, will not require any sedation.

Interdisciplinary, therapeutic patient care consists of ensuring that the inserted cannula not only meets the indication for a tracheostomy tube, but also maintains the patient's existing resources and unaffected abilities (eg in the management of secretions, breathing, speaking or swallowing) without hindering or even eliminating them.

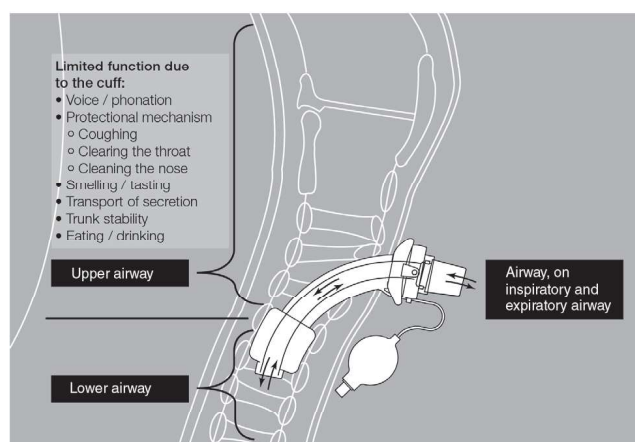


Figure 1. The restrictions of an inflated cuff

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One important therapeutic goal is to reconnect the upper and lower airways, in order to promote oropharyngeal sensitivity with the flow of air through the larynx and enable the patient to speak. The classic way is the successively prolonged deflating time of the cuff.

With some patients, it is not possible to deflate the tracheostomy tube cuff, especially in the early stages. For example, high pressure ventilation may be required to prevent atelectasis and this cannot be sufficiently achieved without an inflated cuff. The risk of aspiration is also increased with uncuffed tubes and deflated cuffs.

For aspiration prophylaxis, it is advisable to remove the above-accumulated secretion by means of a subglottic suction — even with an inflated cuff.

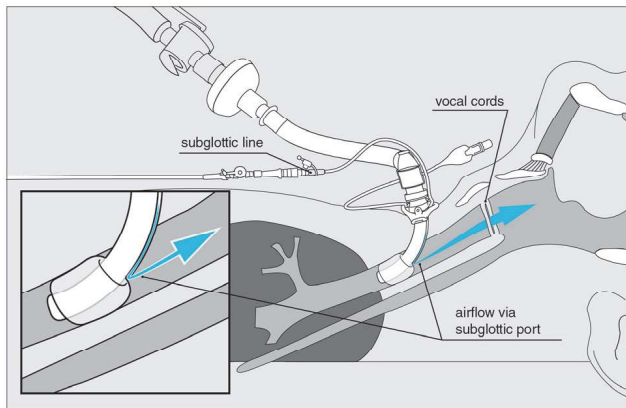
Various studies have provided evidence of the protective effects of regular subglottic suction on the lungs, especially in the prevention of nosocomial ventilation-associated pneumonia (VAP). The Robert Koch Institute (RKI), the German Commission for Hospital Hygiene and Infectious Disease Prevention in Berlin, recommends the suction of subglottic secretions, if the duration of mechanical ventilatory support is likely to be more than 72 hours. This is a category IA recommendation.<sup>10</sup>

Tracheostomy tubes made for subglottic suctioning have an additional lumen that ends in a hole immediately above the cuff and allows secretions to be removed through the subglottic port.

Besides the possibility of removing secretions, the subglottic line ending in the subglottal region also provides the option for air insufflation by offering the patient an air flow for vocalisation. **It is a close imitation of cuff deflation.** The patient is able to produce an audible voice using the *above cuff vocalisation* (ACV) technique.<sup>2,3</sup> Air insufflation may also have a positive impact on laryngeal function and early or long-term rehabilitation.

The term *above cuff vocalisation* (ACV) coined for this procedure by McGrath et al<sup>2,3</sup> puts the focus firmly on vocalisation (phonation), which can be achieved in many cases by means of this airflow. Restoring the voice is a great motivation for the patient and also strengthens their autonomy.

However, there are essential, far-reaching and complex prerequisites for vocalisation:



**Figure 2.** Air insufflation via the subglottic port

- intact laryngeal function, in particular, of the vocal cords (vocalis muscle and recurrent laryngeal nerves)
- the intent and drive to speak (with the required degrees of wakefulness and strength)
- the necessary speech motor function (no serious dysarthrophonia)
- the necessary systematic language (no serious aphasia)
- the necessary speech coordination (no serious apraxia)

But even without achieving phonation, laryngeal flow provides valuable therapeutic and physiological support. Laryngeal flow has a higher-order role in the therapeutic setting, also for the support of passive or even comatose patients. The flow of air almost automatically restores or regenerates sensitivity, with far-reaching effects.

In practice, it has been shown time and again that a flow of air (via the subglottic line) leads to increased spontaneous activity of the swallowing reflex and the patients start to make an effort to control the supraglottic space by trying to clear the throat and swallowing.

#### Laryngeal flow accounts for more than 'just phonation', as it:

- exploits sensorimotor possibilities with dysphagia (swallowing reflex and clearing of secretions)
- prevents complications (reduces pooling of secretions above the cuff)
- activates the patient (wakefulness, motor activation) through stimulation by the air (contact with and reaction to the flow)
- prepares the patient for a later deflation of the cuff, improves the situation with respect to secretions and increases sensitivity
- improves the quality of life by enabling or optimising communication

Accurate observation of the patient's reactions to the flow of air is crucial. Positive reactions such as swallowing activity and the start of efforts to clear the throat are of high therapeutic benefit and should not be overlooked. The stimulation of swallowing, appropriate changes in posture and supportive measures such as the jaw control grip give the patient further encouragement.

#### Social aspects

Impact on quality of life during treatment — less stress, frustration and anxiety with:

- increased patient autonomy

- involvement in their own treatment, expression or verbal manifestation of the patient's will
- opportunities for communication
- motivation to participate in rehabilitation
- improved compliance during the weaning process

Even though, as mentioned previously, a large number of the patient clientele could benefit from this option, there are still a number of prerequisites and contraindications to take into consideration.

#### Prerequisites

- Tracheostomy tube with subglottic line in situ
- A metered compressed air or oxygen supply must be available
- Clear upper respiratory tract
- Sufficiently stabilised tracheostomy and the possibility to remove the secretion via subglottic line
- Possible contraindications
- Upper airway obstruction
- Recent tracheostomy (do not attempt until at least five days old)
- A vulnerable, severely inflamed stoma
- Severe air leak between stoma and tracheostomy tube, with or without secretion
- A heavily sedated patient

#### ACV procedure

After the **patient has been fully informed** about the procedure, a **subglottic suction** is performed to remove the secretions.

The patient's **posture or position** is then optimised.

The **compressed air is connected** through a line that should have the option for **fingertip occlusion**. Once the initial trial phase is over and the appropriate flow rate has been determined, this accessory will allow the patient to regulate vocalisation as required.

**The air supply starts at a rate of 1 litre/minute for the patient to become accustomed to the flow and is gradually increased up to 3-6 litres/minute.**

The irritation experienced at the beginning (as a result of hypersensitivity following the possibly long absence of flow) can be alleviated by initially introducing the air insufflation **only during expiration**.

It must be remembered that subglottic pressure regulation by the abdominal muscles, which is important for phonation, cannot occur with an inflated cuff. The patient only has laryngeal (and articulatory) control options.

By altering the air supply to vary the flow, the subglottic pressure that causes the vocal cords to vibrate can be determined — this may take several attempts. Depending on the conditions, considerably higher flow rates may be required to restore the voice.

Once phonation has been achieved, the flow should be reduced as much as possible to prevent mucosal irritation and lower the noise level.

If vocalisation is not possible, the oropharyngeal flow of air will at least ensure the articulation of non-vocal sounds. This would allow to better understand the patient than it is possible

## Troubleshooting

Problem	Cause / Possible solution
Subglottic suction not successful	<ul style="list-style-type: none"> <li>Suction line blocked by viscous secretions</li> <li>The opening of the subglottic line is blocked by its proximity to the tracheal wall: smaller tracheal cannula or more flexible tracheal cannula</li> </ul>
No oral / nasal flow can be produced	<ul style="list-style-type: none"> <li>Change the patient's position, paying particular attention to symmetry/alignment</li> <li>Try briefly increasing the flow</li> <li>If necessary, seal a parastomal leak</li> <li><b>Stop the air insufflation</b></li> </ul>
Irritation due to the flow, with persistent cough	<ul style="list-style-type: none"> <li>Reduce the flow</li> <li>Flow introduced only during expiration at first</li> <li>Inform the patient that irritation usually only occurs at the beginning</li> <li>The opening of the subglottic line lies directly on the tracheal wall: <ul style="list-style-type: none"> <li>Change the position of the head and/or trunk; tube with smaller outer diameter, more flexible tracheal cannula, variation in length or angle</li> </ul> </li> <li>Irritation due to dry air: humidify air with a booster</li> <li>Diagnostic imaging</li> </ul>
No phonation	<ul style="list-style-type: none"> <li>Try briefly increasing the flow</li> <li>Voice therapy with phonation aids</li> <li>Change the patient's posture/position</li> <li>Diagnostic imaging: endoscopy / radiology</li> </ul>



**Figure 3.** Subglottic air supply with fingertip occlusion for self-regulation

with lipreading alone. The use of the ACV technique is therefore worthwhile even without achieving phonation.

### Summary and Outlook

Even though the subglottic air insufflation technique

- is easy to perform
- may contribute to better verbal communication
- has positive effects on the ability to swallow and the management of secretions
- and helps to prepare for weaning and decannulation
- it is rarely used in routine clinical practice

Irrespective of the patient's communicative performance, this method allows a very early initiation of therapy to alleviate, for example, disorders of swallowing.

The acronym **ACV** should therefore stand for *above cuff ventilation* instead of *above cuff vocalisation*, in order to reflect the holistic aspects of this therapeutic option more accurately and not restrict it solely to phonation.

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