Rehabilitation Practice and Science

Volume 2024 | Issue 1 Article 1

6-1-2024

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Recommended Citation

Liu, Chih-en; Yang, Shu-Mei; and Hsiao, Ming-Yen (2024) "Management of Dysphagia in Tracheostomized Patients: A Narrative Review," *Rehabilitation Practice and Science*: Vol. 2024: Iss. 1, Article 1.
DOI: https://doi.org/10.6315/3005-3846.2229
Available at: https://rps.researchcommons.org/journal/vol2024/iss1/1

REVIEW ARTICLE

Management of Dysphagia in Tracheostomized Patients: A Narrative Review

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Abstract

Swallowing disorders are prevalent in tracheostomized patients and are associated with a high incidence of aspiration. This narrative review discusses the primary causes and subsequent management strategies for dysphagia in this population. Factors such as reduced laryngeal elevation, compromised hypopharyngeal and laryngeal sensations, impaired vocal cord function, loss of glottic airflow and subglottic pressure, weakened cough reflex, increased respiratory secretions, and disuse muscle atrophy have been identified as major contributors. These challenges can lead to severe complications, including aspiration pneumonia and respiratory failure. Comprehensive evaluations that combine clinical assessments with a thorough review of a patient's medical history are crucial. The integration of objective tests, such as the blue dye test, along with instrumental examinations like videofluoroscopic swallow study and flexible endoscopic evaluation of swallowing, offers a holistic perspective on the swallowing function. Once identified, personalized treatment plans are imperative. Initially, the focus should be on preventing muscle atrophy, especially in patients requiring respiratory support. As patients achieve respiratory stability, interventions such as cuff deflation and the use of a one-way speaking valve become essential. The use of a one-way speaking valve aids in reconstructing a closed respiratory system, which can restore normal subglottic pressure, improve laryngeal sensations, reduce the accumulation of respiratory secretions, and enhance swallowing functions. By incorporating these interventions with a combination of direct and indirect swallowing exercises, the duration until oral intake can be safely resumed may be shortened.

Keywords: Tracheostomy, Deglutition disorders, Rehabilitation, Respiration

1. Introduction

Tracheostomy is a surgical intervention used for patients with complex respiratory conditions.[1,2] This procedure involves creating an opening in the front of the neck that leads directly into the trachea. A tube is then inserted through this opening to aid breathing.[1] Compared with endotracheal intubation, tracheostomy can reduce a patient's respiratory effort, decrease pharyngeal injury, improve patient comfort, and provide an opportunity for oral feeding.[3] However, the physiological changes in swallowing caused by tracheostomy may lead to the occurrence of dysphagia.

Dysphagia is prevalent in 50 %−83 % of tracheostomized patients, with a high incidence of aspiration.[4−6] Dysphagia, frequently observed in these patients, is largely attributed to the influence of the tracheostomy tube on airway protection during swallowing.[7] In

Received 28 September 2023; revised 16 November 2023; accepted 16 November 2023.
Available online 1 June 2024

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https://doi.org/10.6315/TJPMR.2229

tracheostomized patients, airflow enters and exits through the tracheostomy opening rather than the oral, nasal, and pharyngeal airways. This results in diminished glottic airflow and reduced subglottic pressure.[8] Such changes can precipitate a range of physiological issues including voice disorders, compromised olfaction and taste, increased viscosity of respiratory secretions, decreased cough strength, and loss of natural positive end-expiratory pressure, leading to an increased risk of lung collapse.[9–12] Collectively, these factors can significantly hamper swallowing functions.

Swallowing and breathing are intricately connected physiological processes, and their precise coordination is essential to prevent aspiration.[13,14] During deglutition, respiration usually continues until just before laryngeal elevation begins. At this juncture, the respiratory cycle pauses, and apnea—a temporary cessation of breathing—is observed in most healthy adults throughout the swallowing sequence. This apneic period is typically followed by expiration, which serves to clear foreign materials from the upper airway and expel any residual substances in the pharynx, reducing the risk of penetration or aspiration.[13] However, for patients with respiratory disorders, this natural mechanism can become disrupted and pose significant challenges.[15–17] An elevated respiratory rate and compromised respiratory muscle strength can shorten the apneic duration during swallowing. Additionally, an uncoordinated swallowing pattern, particularly if followed by inspiration rather than the typical expiration, can lead to the retention of residual material in the pharynx or subglottic areas. This increases the risk of aspiration pneumonia.[16] Given these complexities, the accurate assessment and tailoring of interventions for individuals with respiratory disorders is crucial for reducing the likelihood of aspiration pneumonia.

Most swallowing difficulties in tracheostomized patients improve over time and show further progress with the intervention of appropriate swallowing training.[18] Understanding the impact of tracheostomy on a patient's swallowing physiology, potential dysphagia, and how to assess swallowing functions in tracheostomized patients to choose appropriate treatment strategies for early intervention are important clinical issues. This article provides clinicians with a comprehensive understanding of this issue through a literature review.

2. Methods

We used PubMed databases to search English papers, spanning from their earliest records to August 2023. We also reviewed the references of key relevant articles.

Our search targeted terms pertinent to our study objectives including “tracheostomy”, “tracheotomy”, “trach*“, in conjunction with “dysphagia”, “deglutition”, “swallow*“, “swallowing management”, and “swallowing disorders”.

We restricted our search to studies focused on human subjects. Our inclusion criteria encompassed case series with more than 10 participants, prospective and retrospective observational studies, as well as randomized controlled trials. We excluded conference abstracts and studies centered on pediatric populations and coronavirus disease 2019.

Our primary interest was papers that addressed oropharyngeal dysphagia in patients (aged 13 years and older) diagnosed using specific tools and who had undergone a tracheostomy. Two reviewers independently evaluated potential articles based on their titles and abstracts. Subsequently, the full text of these articles was scrutinized to ascertain their alignment with the inclusion criteria. Discrepancies between the reviewers were discussed, and if unresolved, the final decision was made by the corresponding author.

3. Results and discussion

Fig. 1 demonstrates our selection process and the identification of eligible studies. For this narrative review's qualitative assessment, we included 23 full-text articles.[5,6,10,11,18–36] Of these, 9 studies compared the swallowing impairment and outcomes based on tracheostomy modifications (Table 1).[6,19–26] Additionally, 2 studies compared the fiberoptic endoscopic evaluation of swallowing (FEES) or videofluoroscopic swallow study (VFSS) with the blue dye test, aiming to evaluate their sensitivity and specificity in detecting aspiration among tracheostomized patients (Table 2).[27,28]

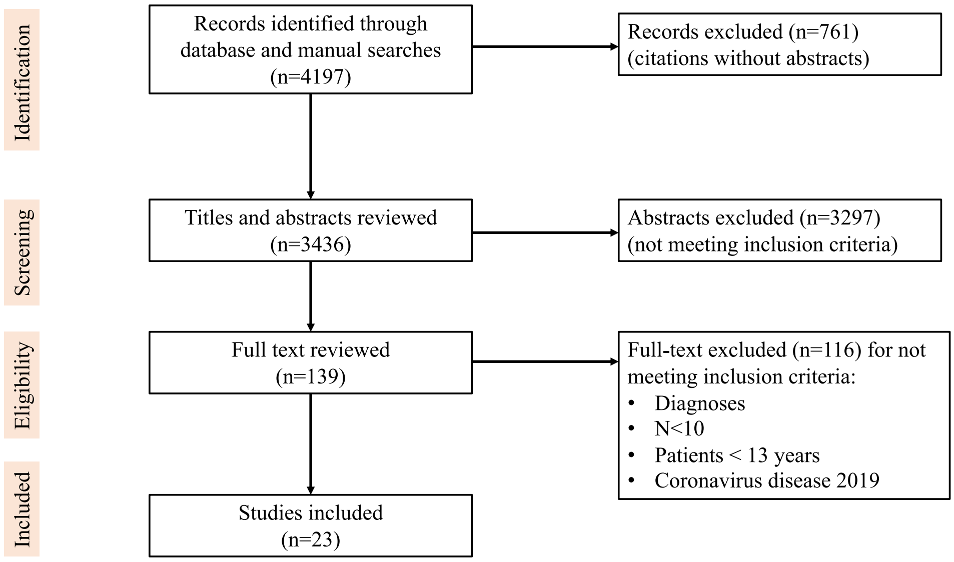

Fig. 1. The selection process and the identification of eligible studies.

3.1. Manifestations of dysphagia in tracheostomized patients

The occurrence of dysphagia in tracheostomized patients is multifactorial, with the direct cause arising from the influence of the tracheostomy tube itself on swallowing function. This includes reduced laryngeal elevation, compromised hypopharyngeal and laryngeal sensations, impaired vocal cord functions, loss of glottic airflow and subglottic pressure, weakened cough reflex, and increased respiratory secretions. Collectively, these factors impede the process of normal swallowing.[5,10,11,18,25,30,37]

Most patients with a tracheostomy have previously undergone endotracheal intubation. In situations involving emergency intubation, repeated intubations and extubations, or extended intubation durations, there is a heightened risk of vocal cord damage, laryngeal ulceration, granulation tissue formation, and temporary or permanent recurrent laryngeal nerve (RLN) paralysis.[4] The RLN is critical as it provides motor and sensory innervations to the larynx, governing the opening and closing of the vocal folds and supplying sensations to the vocal cords and the subglottic region.[38] Specifically, the RLN innervates the intrinsic muscles of the larynx (with the exception of the cricothyroid) and is susceptible to compression by the tube cuff. This vulnerability is especially pronounced if the cuff is positioned too high or if the cuff pressures surpass capillary perfusion pressure.[39] RLN dysfunction can hinder vocal fold movement and diminish sensory sensitivity, leading to impaired airway protection and inefficient secretion management.[11] This can result in the loss of the cough reflex, which in turn elevates the risk of penetration or aspiration, significantly augmenting the patient's likelihood of developing aspiration pneumonia.[40] Furthermore, patients with prolonged intubation often have longer exposure to sedatives, which can lead to uncoordinated respiration and swallowing, impaired pharyngeal muscle function, and a prolonged swallowing reflex.[41,42]

Patients requiring tracheostomy often have underlying conditions that could lead to dysphagia including neuromuscular diseases such as stroke, amyotrophic lateral sclerosis, Parkinson's disease, and multiple sclerosis, as well as obstructive airway disease, post-operative or post-radiation treatments for head and neck cancers, and adult respiratory distress syndrome. For patients with the aforementioned diseases and concurrent respiratory disorders, the incoordination between respiration and swallowing, combined with atrophy due to the disuse of laryngeal structures, significantly exacerbates dysphagia.[7,10,43]

Tracheostomy most commonly affects swallowing functions during the pharyngeal

Table 1. Overview of studies on swallowing outcomes and tracheostomy tube modifications.

Author, Year, Country	Study design	N	Tracheostomy modifications	Assessment tool	Swallowing outcomes
Davis et al., 2002, USA[19]	Case series	12	Cuff Status (Inflated/Deflated)	VFSS	Aspiration rate was 2.7 times higher with the cuff inflated (17.8 % vs. 6.5 %)
Suiter et al., 2003, USA[6]	Case series	22	Cuff Status (Inflated/Deflated) Speaking valve	VFSS	No significant effect on the PAS by cuff status. One-way valve placement significantly reduced scores for liquid bolus
Elpern et al., 2000, USA[21]	Case series	15	Passy-Muir Speaking valve	VFSS	Significantly lower aspiration rate with the valve on
Ohmae et al., 2006, Japan[22]	Case series	16	Speaking valve	VFSS	Improved laryngeal clearance; Prevented laryngeal penetration
Leder, 1999, USA[20]	Case series	20	Speaking Valve	FEES	No significant differences in aspiration rates
Ledl and Ullrich, 2017, Germany[26]	Case series	20	Tracheotomy Tube Occlusion	FEES and manometry	Lower penetration-aspiration values
Leder et al., 1996, USA[23]	Case series	19	Tracheotomy Tube Occlusion	VFSS	No significant differences in aspiration rates
Leder et al., 2001, USA[24]	Case series	11	Tracheotomy Tube Occlusion	Manometry	No significant change in UES and pharyngeal manometric pressure measurements
Donzelli et al., 2006, USA[25]	Case series	40	Tracheotomy Tube Occlusion	FEES	No significant differences in aspiration rates

Abbreviation: VFSS, videofluoroscopic swallow study; FEES, fiberoptic endoscopic evaluation of swallowing; PAS, penetration-aspiration scale; UES: upper esophageal sphincter.

phase. A study in 2015 enrolled 187 tracheostomized patients with identified dysphagia, which was further categorized based on the primary diagnosis into neurological and pulmonary disease groups.[18] There were 106 patients in the neurological group (main diagnoses being ischemic stroke, hemorrhagic stroke, or head trauma) and 81 patients in the pulmonary disease group (main diagnoses being chronic obstructive pulmonary disease or restrictive lung disease). All patients underwent a VFSS, revealing that pharyngeal dysphagia was the most common manifestation in tracheostomized patients, including incomplete epiglottic inversion and food residuals in the valleculae and pyriform sinus. Obvious laryngeal penetration occurred in 33.7 % of patients and 28.9 % experienced evident aspiration, i.e., bolus entering the airway. All 187 patients received systematic swallowing training, and 81 patients underwent a second VFSS after four weeks. The results showed that all patients exhibited improved dysphagia, with the neurological disease group making more significant progress than the pulmonary disease group. Consequently, dysphagia in most tracheostomized patients improves over time and shows more notable progress after swallowing rehabilitation intervention, with dysphagia in patients with neurological diseases (average age of 61.3) showing better reversibility compared to those with chronic lung disease (average age of 70.5).[18]

3.2. Assessment of swallowing disorders in tracheostomized patients

The swallowing process is generally categorized into three phases: oral, pharyngeal, and esophageal stages.[44] Tracheostomized patients predominantly encounter challenges during the pharyngeal phase,[18] and occasionally in the oral phase due to disuse atrophy of laryngeal structures.[11] When assessing the oral phase, the range of movement and strength of the jaw, lips, and tongue are examined. During the pharyngeal stage evaluation, clinicians focus on several indicators including the onset time of the swallowing reflex, anterior movement of the hyoid, elevation of the larynx, the presence of a wet voice, the ability to clear

Table 2. Comparative assessment of FEES and VFSS versus MEBDT in evaluating dysphagia and aspiration detection.

Author, Year, Country	Study design	N	Assessment tool	Swallowing outcomes
Muñoz-Garach et al., 2023, Spain[27]	Case series	41	FEES vs. MEBDT	Dysphagia prevalence with FEES: 70.7 % (29 of 41) MEBDT sensitivity: 0.79, specificity: 0.91, positive predictive value: 0.95, negative predictive value: 0.64
Brady et al., 1999, USA[28]	Case series	20	VFSS vs. MEBDT	VFSS documented aspiration in 40 % (8 of 20) MEBDT identified 100 % aspiration (more than trace), 0 % (trace). 50 % false-negative rate

Abbreviation: FEES, fiberoptic endoscopic evaluation of swallowing; VFSS, videofluoroscopic swallow study; MEBDT, modified Evan's blue dye test.

the throat, as well as instances of aspiration.[45] In direct swallowing assessments, examiners utilize varying volumes of materials, typically ranging from 1 cc to 10 cc per intake, in different textures like liquid, puree, and solid. Parameters observed include the capacity for oral holding, drooling, coughing occurrence at various swallowing stages (before, during, and after), changes in voice after swallowing, and the presence of a wet voice.[45,46]

In addition to these clinical swallowing assessments, both FEES and VFSS provide detailed assessments of swallowing dynamics and enable the detection of aspiration. Integrating instrumental swallowing assessment with clinical observations is essential for achieving a comprehensive understanding of a patient's swallowing problems.

3.2.1. FEES

The FEES uses a flexible endoscope, inserted through the nose, to obtain a superior view of the pharynx and larynx during the swallowing process. During the examination, patients swallow foods with variable textures and adjust positions while executing specific swallowing maneuvers, which assists in establishing treatment plans to manage swallowing difficulties.[47,48] Dyed food is suggested for those at greater aspiration risk to enhance swallowing observation and detect aspiration.[49] The method captures clear images of residues in regions such as the vallecula, pyriform sinus, and below the vocal cords, assisting in detecting aspiration events.[47,48]

FEES has multiple advantages. It provides a sensory evaluation of the pharynx and larynx, favors real food over barium preparations for tests, eliminates radiation exposure, and is adaptable for bedside or clinical settings. By adjusting the patient's position during the examination, clinicians can instantly review swallowing results and give immediate feedback, which is invaluable for dysphagia biofeedback training.[49,50] However, FEES possesses inherent limitations. The evaluation predominantly focuses on the pharyngeal stage, frequently experiences a "white-out" during swallowing, and cannot quantify the volume of an inhaled bolus. The origins of dysphagia or particular moments of aspiration can only be deduced from the state observed pre- and post-swallowing.[49,50] Because FEES fails to capture the entire swallowing process, VFSS should be used to confirm if there is any aspiration missed during FEES, and when instrumental assessment of the oral phase or esophageal phase is indicated.[50]

3.2.2. VFSS

VFSS, also known as the modified barium swallow study, is the gold standard for assessing swallowing functions.[51] The test uses foods mixed with barium of different textures to identify swallowing disorders across the pre-oral, oral, and pharyngeal phases. Conducted in an upright position due to equipment configuration, patients consume barium-impregnated food, ranging from liquid to solid forms. Initial tests typically use 5 ml of the substance, but smaller amounts are utilized if the aspiration risk is high. The evaluation starts with a lateral view, highlighting landmarks including the cervical rachis, tongue base, and larynx. It tracks the bolus's passage from the oral cavity to the esophagus. The oral phase examines mandible, tongue, and labial movements, chewing capacity, bolus control, and transition. The pharyngeal phase assesses nasopharyngeal regurgitation, swallowing reflex initiation, laryngeal elevation, and residue presence in areas like the vallecula. Aspiration events, including silent aspirations with minimal traces, are carefully observed. The anteroposterior view facilitates the identification of any asymmetry in the retention of the bolus in the oral and pharyngeal regions.[52]

VFSS offers the distinct advantage of capturing dynamic images across all swallowing stages, delivering invaluable insights. Nonetheless, it does have some limitations including potential resistance from patients due to the barium content and radiation exposure concerns, making it unsuitable for frequent monitoring, and the need for specialized radiology rooms, restricting its accessibility.[50] Helliwell K, et al. reported that FEES serves as an advantageous first-line diagnostic tool because it is minimally invasive and highly adaptable to patient needs, while also avoiding the use of ionizing radiation. The subsequent employment of VFSS can ensure a thorough visualization that helps in confirming the absence of any aspiration events that FEES might have missed.[50]

3.2.3. *Blue dye test*

The blue dye test can be utilized to assess whether patients with tracheostomy tubes are experiencing aspiration. The most frequently administered clinical test is the modified Evan's blue dye test (MEBDT). This process involves deflating the cuff of the tracheostomy tube, letting the patient consume food or liquid containing a blue dye, and then observing the presence of blue dye in the tracheostomy during the suction process within 24 h.[4] Despite its simplicity and availability, the accuracy of this test in detecting aspiration remains uncertain. A systematic review in 2016 of the diagnostic accuracy of the MEBDT to detect aspiration in tracheostomized patients reported the modified Evan's blue dye test had good specificity (79–100 %) but poor sensitivity (38–95 %).[53]

In a case series in 2023, Muñoz-Garach et al. conducted a comparative study of the diagnostic accuracy of MEBDT and FEES. The study recruited 41 tracheostomized patients from the intensive care unit (ICU) and evaluated them with two diagnostic methods: MEBDT and FEES, the latter serving as the reference standard. Utilizing FEES, the study identified a 70.7 % prevalence of dysphagia, which equates to 29 patients. In contrast, the MEBDT diagnosed 24 patients, or 80.7 %, with dysphagia. The diagnostic performance of the MEBDT was notable, exhibiting a sensitivity of 0.79 and a specificity of 0.91. Additionally, it yielded positive and negative predictive values of 0.95 and 0.64, respectively.[27]

In a study in 1999, Brady et al. examined aspiration events in 20 tracheostomized patients at an acute rehabilitation hospital using MEBDT and VFSS. Their findings highlighted a significant limitation of the blue dye test: a 50 % false-negative rate. Although the MEBDT successfully identified aspiration in every patient who aspirated more than trace amounts (100 %), it completely missed detecting those who aspirated only trace amounts (0 %). This underscores the test's limitation in accurately detecting silent aspirations that involve minimal amounts of bolus.[28]

Given the inconsistent findings on the accuracy of the blue dye test, it is predominantly viewed as a preliminary screening tool rather than a definitive diagnostic method. For a more comprehensive and objective evaluation of swallowing function, clinicians predominantly turn to instrumental examinations like VFSS and FEES. Both are gold-standard methods for evaluating swallowing functions and offer comparable precision in diagnosing swallowing disorders in tracheostomized patients.

3.3. *Management of dysphagia in tracheostomized patients*

Early intervention by swallowing therapy is an effective strategy to enhance swallowing functions, potentially reducing the time required to resume oral intake.

Based on existing literature, several management strategies aiming to ameliorate swallowing physiology have been proposed. These include cuff pressure reduction (deflation), partial or total occlusion of the artificial airway, and the utilization of speaking valves. The implementation of these techniques has often resulted in observed enhancements in swallowing physiology, particularly secretion clearance, cough reflex, and airway protection.[6,19–26] Additionally, it is worth highlighting that according to past research, the persistence of low swallowing functional levels has been negatively correlated with the success in decannulation. Early swallowing assessment and rehabilitation not only enhance the swallowing functional level during hospitalization but are also associated with a favorable decannulation outcome.[54]

3.3.1. Direct and indirect swallowing treatment in tracheostomized patients

Patients with tracheostomies commonly experience difficulties such as incoordinated respiration and swallowing, reduced subglottic pressure, insufficient glottic closure, diminished laryngeal sensation, impaired cough strength, and muscle atrophy resulting from disuse.[4,5,10,18,29] Ensuring a stable respiratory status is of utmost importance, with the early therapeutic objective being the prevention of disuse muscle atrophy in both respiratory and swallowing-related muscles.[29,55,56] The use of clinical and instrumental evaluations of swallowing is essential to accurately determine the nature of the swallowing dysfunction. This in-depth understanding is crucial when formulating a targeted and effective swallowing management plan.

Indirect swallowing treatments, such as oral motor exercises, tongue base exercises, pharyngeal exercises (e.g., the Masako maneuver), laryngeal elevation, and closure exercises, and thermal tactile stimulation, have the potential to effectively prevent disuse atrophy of swallowing muscles.[31] However, direct swallowing treatments for tracheostomized patients usually focus on compensatory strategies, including modifying food consistencies, changes in posture (e.g. head turn, head tilt) and the implementations of other facilitating techniques (e.g. effortful swallow, Mendelsohn maneuver, glottic-glottic swallow).[31] Among these strategies, the supra-glottic swallow has emerged as an effective method for preventing aspiration. In this procedure, the patient inhales before and exhales after swallowing, and the expiratory flow following each swallow helps clear the airway.[32] Furthermore, non-invasive peripheral stimulation techniques, such as functional electrical stimulation and deep pressure neuromuscular stimulation, hold promise in enhancing pharyngeal swallowing and the swallowing reflex.[31]

Direct and indirect swallowing interventions are effective for dysphagia in tracheostomized patients. A study in 2015 involved 14 ICU patients with swallowing disorders dependent on tube feeding. They underwent conventional swallowing therapy. Eligible participants had been mechanical ventilated for at least 48 h post-tracheostomy and were conscious. Those with prior surgeries in the oral to esophageal region, degenerative diseases, or a history of dysphagia were excluded. The swallowing rehabilitation program combined both indirect and direct approaches. The therapy regimen included oral motor strengthening, thermal-tactile stimulation and various swallowing maneuvers. The average therapy duration was 12.4 ± 9.4 days. Assessments revealed improved swallowing functional scores in all patients, with 11 resuming oral feeding within 4 days (range 2–13) in the ICU.[33]

Nonetheless, it is important to note that not all compensatory strategies are universally recommended for all patients. For instance, drinking through a straw is not advised for every tracheostomized patient. A study in 1994 examined 13 young adults aged 17–32 years. These individuals were asked to swallow varying quantities (3 ml, 10 ml, 20 ml, and 100 ml) of bolus using a straw, and the study revealed that consuming a large volume (100 ml) via a straw elevated the risk of aspiration. This increased risk was attributed to the prolonged breath-holding required during straw drinking, which interfered with the usual breathing rhythm and altered the respiratory sequence. Such a disruption can be especially challenging for those with weakened respiratory support, particularly when they need to hold their breath during the laryngeal elevation and vocal fold closure.[13]

3.3.2. The impact of inflated or deflated cuff on swallowing function in tracheostomized patients

Tracheostomy tubes can be cuff-inflated or deflated based on the patient's condition. Recent studies reported that the past belief that inflating the cuff of a tracheostomy tube can prevent mucus or secretions above the cuff from falling into the respiratory tract, thus preventing aspiration pneumonia, is a misconception. Firstly, from a definitional perspective, when food or liquids are above the cuff of the tracheostomy tube, they have already entered the airway below the vocal cords, which is clinically considered aspiration. Therefore, regardless of whether the cuff is inflated or deflated, neither can reduce the occurrence of aspiration. Furthermore, even if the cuff is inflated, it cannot fully adhere to the tracheal wall, and some of the mucus or secretions above the cuff will still fall into the lower respiratory tract.[6,32,34] Moreover, increased cuff pressure can also impede swallowing by decreasing the subglottic air pressure, reducing laryngeal sensitivity, suppressing the activity of swallowing muscles, and possibly restricting larynx elevation. Consequently, higher cuff pressure tends to further impair swallowing functions.[35]

In a retrospective study conducted in 2005, the swallowing performance of 623 tracheostomized patients was analyzed using VFSS. One group was assessed under cuff-inflated conditions and the other group under cuff-deflated conditions. The study revealed a 64.8 % incidence of aspiration. Notably, the silent aspiration rate was 22.6 % in patients with an inflated cuff compared to just 7.2 % in those with a deflated cuff.[34]

In a study in 2013, Hernandez et al. recruited 181 patients with tracheostomies in the ICU who were randomly divided into two groups: 94 patients with deflated cuffs and 87 with inflated cuffs. The research investigated the timeframe for the definitive withdrawal of mechanical ventilation, the occurrence of respiratory infections, and the status of swallowing function. Findings indicated that patients in the cuff-deflated group had a shorter weaning time from mechanical ventilation, a lower rate of respiratory infections (20 % versus 36 %), and potentially improved swallowing functions. The study concluded that a cuff-deflated condition allowed for higher airflow through the upper airway and facilitated better drainage of secretions, effectively improving swallowing functions.[35]

Another retrospective study in 2002 included 12 tracheostomized patients and observed their swallowing performance with different food textures under the states of inflated and deflated cuffs using VFSS. The study results showed that the rate of aspiration occurring when patients ate with the cuff inflated was 2.7 times that when the cuff was deflated.[19]

Maintaining the inflation of the cuff for prolonged periods can result in desensitization, accumulation of secretions, a lack of coordination in glottic closure, weakened cough strength, and a heightened risk of aspiration, all culminating in a negative impact on swallowing.[6,19,32,34] Thus, transitioning to a cuff-deflated state at an early stage is crucial.

3.3.3. The impact of speaking valve usage on swallowing function

When patients can breathe smoothly with the cuff deflated in a tracheostomy tube, or with a cuffless tracheostomy tube, they can try to block the tracheostomy tube mouth (capping), i.e., using a sterile stopper that seals the opening of the tracheostomy tube or covering the tracheostomy tube mouth with a finger, allowing the respiratory system to return to a closed system. During exhalation, air can flow out through the normal pathway (pharyngeal cavity, nasal cavity, oral cavity) instead of through the tracheostomy tube.[30] The use of a tracheostomy speaking valve can achieve a similar effect. A speaking valve is a one-way device placed on the hub of the tracheostomy tube that allows airflow into the upper airway during inspiration and closes during expiration. This mechanism directs air to pass directly through the vocal folds, facilitating phonation. Utilizing one-way speaking valves aids in restoring normal respiratory and laryngeal physiology, enhancing laryngeal sensation, and reestablishing subglottic pressure, all of which positively influence swallowing functions.[6,21,36]

Several studies have evaluated the efficacy of one-way valve placement in improving airway protection and reducing aspiration. A study conducted in 2003 compared the swallowing physiology of 14 patients under three specific conditions: (1) cuff inflation, (2) cuff deflation, and (3) speaking valve placement.[6] The results revealed that 8 of the 10 participants who aspirated while consuming a liquid bolus under cuff inflation and deflation conditions did not aspirate when the one-way valve was in place. Moreover, there was a decrease in scores on the penetration-aspiration scale during the usage of the one-way valve.[6]

The Passy-Muir Valve, a tracheostomy speaking valve, is a one-way air valve that opens during inhalation and closes during exhalation. This allows tracheostomized patients to inhale through the tracheostomy tube and exhale through the upper airway. A study in 2000 explored the effects of the Passy-Muir tracheostomy speaking valve on instances of aspiration. Of 15 subjects, 7 experienced aspiration when consuming thin liquids. Specifically, five aspirated only without the speaking valve, while two aspirated with and without the valve. Notably, no subject experienced aspiration while the valve was on exclusively. Aspiration occurred less frequently with the Passy-Muir tracheostomy speaking valve on compared to when it was off, highlighting that an expiratory occlusive valve can effectively reduce instances of aspiration.[21]

In summary, the use of a one-way speaking valve has been proven effective at reconstructing a closed respiratory system, which provides several benefits to swallowing functions. These include restoring normal subglottic pressure (approximately 8–10 cm H_2O), naturally forming positive end-expiratory pressure to promote lung expansion, improving laryngeal sensation when airflow passes through the upper airway, helping to cough up sputum, reducing the accumulation of respiratory secretions, and reducing the occurrence of aspiration pneumonia.[6,21,30]

4. Conclusions

Swallowing difficulties are a common problem for tracheostomy patients. The primary causes of dysphagia in tracheostomized patients typically include disuse muscle atrophy, limited laryngeal movement, reduced sensation, and inadequate vocal fold protection. These issues significantly elevate the risk of complications like aspiration pneumonia and respiratory failure. When assessing tracheostomy patients' swallowing functions, it is crucial to conduct a comprehensive evaluation, including clinical assessments and a thorough medical history review. By combining these clinical assessments with objective tests such as blue dye tests and instrumental examinations like VFSS or FEES, a more accurate and detailed assessment of swallowing can be achieved. Based on the findings from this comprehensive evaluation, individualized treatment recommendations can then be formulated to address the patient's specific swallowing needs.

During the initial stages, especially for patients with unstable respiratory support, the primary treatment objective is to prevent disuse muscle atrophy. Once respiratory stability is achieved, deflating the cuff and implementing a one-way speaking valve can enhance laryngeal sensation, subglottic pressure, and potentially improve swallowing functions. Early cuff deflation, the placement of one-way valves, and a combination of direct and indirect swallowing training exercises may effectively reduce the time required for oral intake to resume.

Funding

No financial support was received by the authors for the research, authorship, and/or publication of this article.

Conflicts of interest

The authors stated that there are no conflicts of interest related to the research, authorship, and/or publication of this article.

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