**Research Article**

**Characteristics Associated with COVID-19 Related Dysphagia: A Retrospective Study**

**Catherine Crowley, PhD, CCC-SLP1#, Kristin Beadle, M.S., CCC-SLP, CLT1, Husneara Rahman, PhD1**

1#Department of Otolaryngology, Long Island Jewish Medical Center, New York, USA

2Feinstein Institute for Medical Research, Biostatistics Unit, New York, USA

**#Corresponding author:** Catherine Crowley, PhD, CCC-SLP, Department of Otolaryngology, Long Island Jewish Medical Center, 430 Lakeville Road, New Hyde Park, New York 11040 USA

**How to cite this article:** Crowley C, Beadle K, Rahman H (2021) Characteristics Associated with COVID-19 Related Dysphagia: A Retrospective Study. Int J Nurs & Healt Car Scie 01(15): 2021-89.

**Submission Date:** 29 September, 2021; **Accepted Date:** 08 October, 2021; **Published Online:** 14 October, 2021

­­­­­­­­­­­

**Abstract**

**Purpose:** The purpose of this study is to investigate the underlying characteristics of the presenting oropharyngeal dysphagia in patients treated for the COVID-19 virus.

**Method:** This is a retrospective study. 39 patients who were sent for a dysphagia clinical evaluation among the admitted patients for COVID-19 related complications were considered for the study. A chart review was conducted to analyze the characteristics of patients with dysphagia. Patient’s age, duration of intubation, presence of dysphagia, and diet recommendation were analyzed.

**Background:** Case-load analyses by speech-language pathologists revealed that not all of these recent COVID-19 patients were intubated, suggesting a separate etiology for their presenting dysphagia. To date there have been limited analysis of COVID-19 patients who later present with dysphagia

**Result:** Findings of this study revealed that endotracheal intubation and aging were characteristics among individuals with resultant COVID-19 dysphagia. We also observed that a higher proportion of intubated patients required nothing per oral as compared to the non-intubated patients. Patients who required nothing per oral status had higher median age as compared to the patients with diet per oral. Further the median duration of intubation was higher for patients recommended to be nothing per oral as compared to patients placed on a per oral diet. We also observe smaller duration of intubation for recommended diet category ‘Thin’ and ‘Thick’ than that of patients with nothing per oral status, which indicates that there can be positive association between duration of intubation and the severity of patients’ condition for dysphagia.

**Conclusion:** Endotracheal intubation was found to be a characteristic in those individuals presenting with an oral and pharyngeal dysphagia. However, almost half of the individuals analyzed in this study did not require intubation but nevertheless presented with a dysphagia. Future research, should consider investigating sarcopenia as characteristic for COVID related dysphagia.

**Keywords:** COVID-19; Dysphagia; Endotracheal intubation

**Introduction**

The novel COVID-19 virus has impacted the medical world and has left many suffering in the wake of its passing. Patients with a more severe clinical course experience acute respiratory distress, requiring hospitalization, with about 5% of patients experiencing respiratory failure requiring intensive care treatments and mechanical ventilation via endotracheal intubation [1-3]. The occurrence of dysphagia post intubation is a well-established finding [4], which is more recently clinically supported by the large increase of COVID-19 patients being consulted by speech-language pathologists for swallowing evaluations. Interestingly, case-load analyses by speech-language pathologists revealed that not all of these recent COVID-19 patients were intubated, suggesting a separate etiology for their presenting dysphagia.

To date there have been limited analysis of COVID-19 patients who later present with dysphagia. We aim to investigate the underlying characteristics of the presenting oropharyngeal dysphagia in patients treated for COVID-19. This study will consider the risk factors of endotracheal intervention and aging on the presence of both oral and pharyngeal dysphagia and required diet modification. The ultimate goal is to determine if a dysphagia assessment should be standard of care for all patients in the setting of COVID-19, regardless of history of intubation. The information obtained from this study will significantly improve patient-care practices because without a comprehensive understanding of the characteristics associated with COVID-19 dysphagia, we risk dysphagia being under diagnosed and increase risk of additional medical complications such as aspiration pneumonia, malnutrition, and dehydration. These in turn may result in an increased hospital length of stay.

Endotracheal intubation is a known risk factor for resulting oropharyngeal dysphagia in hospitalized patients. A systemic review reported a 3% to 62% occurrence of post-extubation dysphagia in the critical care setting, with most studies identifying an incidence of greater than 20% [5]. Kim and colleagues [6] found that 59% of non-neurologic critically ill patients presented with supraglottic and infraglottic aspiration post-extubation.

The pharyngeal stage of the swallow plays the primary role in airway protection, however, the oral stage of swallowing provides crucial steps for safety as well. Both oral and pharyngeal stages of the swallow are susceptible to the effects of intubation. Within the pharyngeal stage, weak vocal fold adduction during the swallow and reduced pharyngeal sensation can be implicated in the pharyngeal dysphagia identified in these individuals. Laryngeal sensory deficits have also been identified post extubation and associated with aspiration [7]. Impaired glottal closure is associated with arytenoid dislocation and subluxation from the endotracheal tube [6]. Adequate vocal fold closure is imperative for airway protection during the swallow, an absence or reduction of that function places the patient at risk for aspiration and by extension aspiration pneumonia.

Within the oral stage, the functions of the labial and lingual movements ensure adequate bolus collection, formation and containment, and anterior-posterior propulsion into the pharyngeal cavity. Specific deficits reported post intubation include lingual motor weakness associated with sarcopenia and compromised lingual somatosensory function [8]; reduced lingual muscle mass and lingual strength. Su and colleagues [9] reported reduced lingual strength and impairment of sensory function that was independent of age, gender, and comorbidities. These authors also found that lingual weakness persisted past a 14-day period, where as sensory disturbance was noted to clear within 14 days. A contributing factor to reduced lingual sensorimotor function is the immobility and reduced range of motion that is a consequence of prolonged intubation.

Studies have also found compromised labial function as a result of intubation. For example, reduced labial compression strength was found post extubation [8]. Endotracheal intubation has also resulted in reduce oral aperture due to masticatory muscle weakness for jaw movement [10]. Adequate mouth opening is imperative for the collection of the bolus and adequate mechanical breakdown of the bolus for tolerance of a regular consistency diet. In addition to sensorimotor etiologies of oral dysphagia, reduced salivary flow is also implicated. In a study by Wu and colleagues [11], over 37% of participants presented with hyposalivation 2 days post extubation. Reduced labial and lingual sensorimotor skills, compromised oral aperture, and reduced salivary flow are all side effects of endotracheal intubation that result in an oral dysphagia that in turn may place the patient at risk for aspiration and require the patient to be placed on a modified diet.

Further, there is a positive correlation between duration of intubation and severity of the dysphagia [4,8,12,13], which in turn may result in a greater risk for aspiration pneumonia [6]. Prolonged intubation places patients at risk for oropharyngeal dysphagia with noted penetration and/or aspiration [14]. Skoretz and colleagues [5] reported that studies that identified the higher rates of occurrence of dysphagia following extubation (62%, 56%, and 51%) were positively associated with prolonged periods of intubation. Critical patients who present with a moderate to severe dysphagia are more likely to have had prolonged intubation as compared to those patients who present with a mild or no dysphagia [15]. Risk for post-extubation aspiration has been found to be 1.82 times greater following 7 days of intubation; the risk continues to increase with increased days of intubation [6]. However, research on the correlation is conflicting. Several studies have found no relationship between duration and dysphagia [16-18]. Park and colleagues [8] found that the number of days intubated had no affect on lingual function, in particular for lingual endurance.

Another risk factor to be considered for oropharyngeal dysphagia in the setting of COVID is aging. Age has been found to be a factor for aspiration and silent aspiration in those patients post-extubation, secondary to the impact of the primary critical illness or the effects of the endotracheal tube on the pharynx and/or larynx [16]. Studies have shown that elderly patients in the absence of illness demonstrate changes to the swallowing mechanism. Pharyngoglottic closure for airway protection is present however compromised in healthy elderly individuals [19]. Atrophy of the intrinsic laryngeal muscles, dehydration of the laryngeal mucosa, reduced laryngeal excursion, and bowing of the vocal folds have been associated with the aging process [20]. Additionally, the older population has been found to have atrophy of the tongue and geniohyoid muscles and thinning of the pharyngeal wall [21] and reduced tongue pressure and mastication [22]. In contrast, Solh and colleagues [18] found that elderly patients do not have a greater risk for dysphagia post-extubation than younger individuals.

In an effort to ward off the consequences of dysphagia, including aspiration pneumonia, a modified diet may be recommended. Research has found that 30-45% of elderly patients in acute and rehabilitations settings receive a modified diet [13]. There is a paucity of research related to the epidemiology of modified diet recommendations in those individuals post-extubation.

It is imperative for the development of protocol for both intervention and treatment of those recovering from the COVID-19 that we have a comprehensive understanding of the characteristics of the presenting oropharyngeal dysphagia. At this time, little is known of the sequelae of this novel virus. The speech-language pathologist is currently being asked to assess for swallow function with little empirical evidence of the most efficacious approach. Although much is known about dysphagia, it is unknown if this knowledge is applicable to patients recovering from the COVID-19 virus. Findings from this study may aid in the development of standard of care for these individuals that are suffering from the side effects of this virus.

**Objective**

This is a retrospective study whose objective is to investigate the underlying characteristics of the presenting oropharyngeal dysphagia in patients treated for the COVID-19 virus. This study will consider the effects of endotracheal intervention and aging in both oral and pharyngeal dysphagia. The ultimate goal is to determine if a dysphagia assessment should be standard of care for all patients in the setting of COVID-19, regardless of history of intubation.

**Hypothesis**

Patients diagnosed with COVID-19 requiring endotracheal intubation will present with a greater occurrence of a dysphagia than those that do not require intubation for the treatment of this virus.

Presence of oropharyngeal deficits requiring a modified diet are positively correlated with incidence of endotracheal intubation.

Aging is also a characteristic for oropharyngeal dysphagia secondary to COVID-19

**Methods**

This study was reviewed and accepted by the Northwell Health Feinstein Institute for Medical Research Institutional Review Board (IRB #: 20-0569).

**Participants**

A chart review of 39 patients referred to the Long Island Jewish Medical Center’s Speech-Language Pathology department was conducted. All patients had been admitted for the treatment of complications related to the COVID-19 virus. Charts were reviewed from all adult units within the hospital with no exclusion of any particular unit. All patients had been referred for a dysphagia clinical evaluation. For those patient that were intubated and later extubated, the lapse of time between extubation and the clinical swallowing evaluation averaged 2.7 days (range 1-6 days). A modified barium study, although considered to be the gold standard of assessment was not performed due to hospital restrictions related to risk for aerosol transmission of the COVID-19 virus, therefore a clinical swallowing evaluation was completed. Both female and male participants were included. It was anticipated that participants would represent diverse ethnicities and varying levels of socio-economic status. Patients with prior history of neurological deficits or dysphagia were excluded. Past history of neurological deficits and dysphagia were determined based on the chart review and/or patient report. Previously treated patients for any speech or swallowing dysfunction were also excluded. None of the patients had a tracheostomy at the time of the clinical swallowing evaluation nor had they received swallowing therapy during this hospitalization prior to the clinical swallowing evaluation. Additionally, none of the patients received a laryngoscopic evaluation by an otolaryngologist prior to the swallowing evaluation. However, otolaryngologic evaluations were recommended following the swallowing evaluation as deemed necessary by the clinical Speech-Language Pathologist. Patients with previous history of head and neck cancer were also ineligible for this study.

**Data Acquisition and Analysis**

This is a retrospective study. All patients who were sent for a dysphagia clinical evaluation among the admitted patients for COVID-19 related complication from March - April of 2020, were considered for the study. A chart review was conducted to analyze the characteristics of patients with dysphagia. Patient’s age, duration of intubation, presence of dysphagia, and diet recommendation were analyzed. The presence of dysphagia and diet recommendations were based on findings from the clinical swallowing evaluation conducted by a certified Speech-Language Pathologist. During the clinical swallowing evaluation PO trials were administered and information regarding the patients’ oral and pharyngeal stages of deglutition were assessed. Signs and symptoms of aspiration were monitored. Recommendations for a PO diet were determined based on the patients’ level of function, aspiration risk, and overall presentation for all trials administered. Swallowing techniques were not tried at that point due to the Speech Language Pathologist’s inability to objectively assess their effectiveness at that time.

Median (IQR) or frequency count (%) were reported for the patients’ characteristics as appropriate. For continuous data, Wilcoxon two sample test or Kruskal-Wallis test was used to compare two or more groups. For categorical data, chi-square test or Fisher’s exact test were used to observe statistical significance. Results were considered as statistically significant if corresponding p-value <0.05. All analysis was performed using statistical software SAS v 9.4 (SAS Institute, Inc., NC, USA).

**Results**

There were 40 patients who were referred for dysphagia evaluation during March to April of 2020, among them one patient was not diagnosed to have dysphagia and was excluded from the analysis. 38 (97%) patients had oral dysphagia and 35 (90%) patients had pharyngeal dysphagia. Among all the COVID-19 patients with dysphagia, 23 (59%) were intubated. This proportion of intubated patients were higher compared to overall COVID-19 patients (proportion of intubation 19%) admitted during the same time period. We observed 16 (41%) non-intubated COVID-19 patients who were diagnosed with dysphagia (Table 1).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Characteristics** | **Overall** | **Intubated** | **Non-intubated** | **P-value** |
| All patients | Total, n (%) | 39 | 23 (59.0) | 16 (41.0) |  |
| Age, median (IQR) | 72.0 (61.0- 79.0) | 66.0 (61.0-75.0) | 79.0 (74.0 - 84.0) | 0.002 |
| Intubation duration, median (IQR) |  | 12.0 (5.0 - 16.0) |  |  |
| Oral dysphagia patients | Total, n (%) | 38 (97.4) | 23 | 15 |  |
| Age, median (IQR) |  | 66 (61.0 - 75.0) | 79.0 (73.0 - 84.0) | 0.004 |
| Intubation duration, median (IQR) |  | **12.0 (5.0 - 16.0)** |  |  |
| Pharyngeal dysphagia patients | Total, n (%) | 35 (89.7) | 20 | 15 |  |

**Table 1:** Patients baseline characteristics by intubation status.

Median age of the patients was 72.0 (IQR 61.0-79.0). Non-intubated patients had a higher median age (median 79, IQR 74.0-84.0) as compared to intubated patients (median 66, IQR 61.0-75.0). The difference in age among the two groups were statistically significant (p< 0.002). We observed similar results on age differences for intubated and non-intubated patients by oral or pharyngeal dysphagia.

Among all the patients with dysphagia, 18 (46.2%) patients were recommended to be NPO. We observed that a higher proportion of intubated patients required NPO as compared to the non-intubated patients. Among the intubated patients 12 (52.2%) were recommended to be NPO, and among the non-intubated patients 6 (37.5%) were recommended to be NPO. We failed to observe statistically significant difference (p<0.37). Similar results are observed by the two types of dysphagia. We also observed that patients who required NPO status had a higher median age (median 74, IQR 67-83) as compared to the patients with PO (median 66, IQR 61-79). We failed to observe statistical significance (p<0.38) (Table 2).

|  |  |  |  |
| --- | --- | --- | --- |
| **Characteristics** | **NPO** | **PO** | **p-value** |
| Total patients, n (%) | 18 (46.2) | 21 (53.8) |   |
| Age, median (IQR) | 74.0 (67.0 - 83.0) | 66.0 (61.0 - 79.0) | 0.382 |
| Intubated, n (%) | 12 (52.2) | 11 (47.8) | 0.366 |
| Not-intubated, n (%) | 6 (37.5) | 10 (62.5) |   |
| Duration of intubation, median (IQR) | 14.5 (5.0 - 18.0)  | 11.0 (3.0 - 14.0) | 0.309 |

**Table 2:** Patients characteristics for diet recommendations.

The intubated patients with dysphagia had a median duration of intubation of 12 days (IQR 5-16). The median duration of intubation was higher for patients recommended to be NPO (median 14.5, IQR 5-18) as compared to patients placed on a PO diet (median 11, IQR 3-14) (Figure 1). We failed to observe statistical significance. We also observed smaller duration of intubation for recommended diet category ‘Thin’ and ‘Thick’ than that of patients with NPO. Observed median duration of intubation for patients with recommended diet ‘Thick’ was 11 days (IQR 9-14) and for patients with recommended diet ‘Thin’ was 7 days (IQR 1.5-14.5), which indicates that there can be positive association between duration of intubation and the severity of patients’ condition for dysphagia. For the difference in duration of intubation among patients with NPO, with ‘Thick’ and with ‘Thin’ diet recommendations, we failed to observe statistical significance (p<0.523).



**Figure 1:** Box plot for intubation days by NPO or PO diet recommendation.

**Discussion**

The relationship between dysphagia and endotracheal intubation has been well determined, however current understanding of dysphagia secondary to COVID-19 in patients requiring intubation is limited. Further, caseload analyses revealed the presence of dysphagia in patients diagnosed with this virus in the absence of intubation. In order to gain a better understanding of the virus and in return provide best practice for the patients afflicted by the virus, the swallowing function of those individuals not requiring intubation was investigated. This retrospective study sought to investigate the characteristics associated with COVID-19 related dysphagia.

Endotracheal intubation was found to be a characteristic in those individuals presenting with an oral and pharyngeal dysphagia. Most individuals that required intubation presented with a dysphagia. This finding of a 97% occurrence rate for oral dysphagia and a 90% occurrence rate for pharyngeal dysphagia is higher than a prior systemic review that reported a 3% to 62% occurrence of post-extubation dysphagia in the critical care setting [5]. Of interest is the greater number of individuals that presented with an oral dysphagia as compared to a pharyngeal dysphagia. These results suggest that reduced labial and lingual function may have a greater impact on overall swallow than reduced pharyngeal function. Despite the greater number of dysphagia patients requiring intubation, which was overall higher compared to overall COVID-19 patients admitted during the same time period, this study found that 41% of the individuals presenting with a dysphagia were not intubation. This finding now raises the question, what then is the cause of the dysphagia in these individuals diagnosed with COVID-19.

During acute hospitalization often there is a decline in overall function, referred to as hospital-associated deconditioning. This deconditioning occurs in approximately one-third of patients older than 70 years of age [23]. One possible commonality found in these patients is this deconditioning or better defined as activity related sarcopenia. This sarcopenia is a result of bed rest, sedentary lifestyle, deconditioning, and zero gravity conditions [24]. Sarcopenia is a clinical syndrome secondary to muscle atrophy due to aging, immobilization, and malnutrition. Although it is most often seen in older adults, this condition can also develop in younger adults [25]. Future research should consider investigating sarcopenia as an etiology for COVID related dysphagia as compared to endotracheal intubation.

Consistent with prior findings that dysphagia may occur in the elderly in the absence of illness, this study found age was a risk factor for dysphagia in those individuals diagnosed with COVID-19 sans the need for intubation. The average age was significantly higher in the non-intubated group as compared to the intubated group for both oral and pharyngeal dysphagia. The lower average age in the intubated patients of this study is in contrast with Marvin and colleagues [16] study that found age to be a factor for aspiration and silent aspiration in those patients post-extubation.

Among all the patients with dysphagia, almost half of the patients were recommended to be NPO. As a recommendation of NPO would imply a greater severity on deficits, this finding is suggestive that COVID has a severely adverse affect on oral and pharyngeal swallow function. Further, a higher proportion of those requiring NPO status were the intubated patients, indicative of greater impact on those individuals that are status post extubation. Further, age was found to be a contributing factor for severity of dysphagia as this study found that patients who required NPO status had a higher median age as compared to those patients that were recommended to be on a diet following the swallowing evaluation. Our findings are consistent with prior research that found that 30-45% of elderly patients in acute and rehabilitations settings receive a modified diet [13].

Although not statistically significant, this study found that duration of intubation was correlated with the severity of the presenting dysphagia. We found that the median duration of intubation was higher for patients recommended to be NPO relative to those placed on a PO solid diet. We also observed a shorter period of intubation for those individuals recommended to be on thin or thick fluids than that of patients requiring NPO. Further, those individuals requiring thick fluids had a longer period of intubation that those recommended for thin fluids. These findings indicate that there can be positive association between duration of intubation and the severity of patients’ condition for dysphagia. Consistent with other research that found that prolonged intubation places patients at risk for oropharyngeal dysphagia [6,5,14,15].

Based on findings from this study, it is suggested that all patients diagnosed with the COVID-19 virus have a dysphagia evaluation or at minimum a screening as part of standard of care. Endotracheal intubation should not be the only factor considered when recommending a swallowing evaluation for these individuals.

Since we have a small sample of 39 patients, the statistical tests of significance for the difference between two groups can be of small power (may fail to detect significance for smaller difference). Future studies with larger sample can provide more information about statistical significance. Additionally, future research should consider the analysis of sarcopenia as a possible etiology for dysphagia in individuals diagnosed with COVID-19.

**Funding**

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

**Declarations of Interest**

None.

**References**

1. [Guan W, Ni Z, Hu Y, et al. (2020) Clinical characteristics of coronavirus disease 2019 in China. The New England Journal of Medicine 382: 1708-1720.](https://www.nejm.org/doi/full/10.1056/nejmoa2002032)
2. [Wang D, Hu B, Hu C, et al. (2020) Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus-infected pneumonia in Wuhan, China. JAMA. 323: 1061-1069.](https://jamanetwork.com/journals/jama/fullarticle/2761044)
3. [Zhou F, Yu T, Du R, et al. (2020) Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: A retrospective cohort study. Lancet 395: 1014-1015.](https://pubmed.ncbi.nlm.nih.gov/32171076/)
4. [Schefold J, Berger D, Zurcher P, et al. (2017) Dysphagia in mechanically ventilated ICU patients (Dynamics): A prospective observational trial. Critical Care Medicine 45: 20161-2069.](https://pubmed.ncbi.nlm.nih.gov/29023260/)
5. [Skoretz S, Flowers H, Martino R (2010) The incidence of dysphagia following endotracheal intubation: A systemic review. Chest 137: 665-673.](https://pubmed.ncbi.nlm.nih.gov/20202948/)
6. [Kim M, Park Y, Park Y, et al. (2015) Associations between prolonged intubation and developing post-extubation dysphagia and aspiration pneumonia in non-neurologic critically ill patients. Annals of Rehabilitation Medicine 39: 763-771.](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4654083/#:~:text=Conclusion,a%20swallowing%20evaluation%20after%20extubation.)
7. [Borders J, Fink D, Levitt J, et al. (2019) Relationship between laryngeal sensations, length of intubation, and aspiration in patients with acute respiratory failure. Dysphagia 34: 521-528.](https://pubmed.ncbi.nlm.nih.gov/30694412/#:~:text=Altered%20laryngeal%20sensation%20was%20significantly,(p%20%3D%200.001)%20diets.)
8. [Park H, Koo J, Song S (2017) Association of post-extubation dysphagia with tongue weakness and somatosensory disturbance in non-neurologic critically ill patients. Annals of Rehabilitation Medicine 41: 961-968.](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5773439/)
9. [Su H, Hsiao T, Ku S, et al. (2015) Tongue weakness and somatosensory disturbance following oral endotracheal extubation. Dysphagia 30: 188-195.](https://pubmed.ncbi.nlm.nih.gov/25663416/)
10. [Chen C, Wu K, Ku S, et al. (2018) Bedside screen for oral cavity structure, salivary flow, and vocal production over the 14 days following endotracheal extubation. Journal of Critical Care 45: 1-6.](https://pubmed.ncbi.nlm.nih.gov/29257983/)
11. [Wu C, Xu Y, Wang T, et al. (2019) Effects of swallowing and oral care intervention for patients following endotracheal extubation: A pre- and post- intervention study. Critical Care 23: 1-8.](https://pubmed.ncbi.nlm.nih.gov/31706360/#:~:text=The%20SOC%20group%20also%20had,14%20days%20following%20endotracheal%20extubation.)
12. [Barker J, Martino R, Reichardt B, et al. (2009) Incidence and impact of dysphagia in patients receiving prolonged endotracheal intubation after cardiac surgery. Cardiac Journal of Surgery 52: 119-124.](https://pubmed.ncbi.nlm.nih.gov/19399206/)
13. [Zuercher, P, Moret C, Dziewes R, et al. (2019) Dysphagia in the intensive care unit: Epidemiology, mechanisms, and clinical management. Critical Care 23: 1-11.](https://www.researchgate.net/publication/332060084_Dysphagia_in_the_intensive_care_unit_Epidemiology_mechanisms_and_clinical_management)
14. [Vergara J, Skoretz S, Brodsky M, et al. (2020) Assessment, diagnosis, and treatment of dysphagia in patients infected with SARS-CoV-2: A review of the literature and international guidelines. American Journal of Speech-Language Pathology 29: 2242-2253.](https://pubmed.ncbi.nlm.nih.gov/32960646/)
15. [Malandraki G, Markaki V, Georgopoulos V, et al. (2016) Postextubation dysphagia in critical patients: A first report from the largest step-down intensive care unit in Greece. American Journal of Speech-Language Pathology 25: 15-156.](https://pubmed.ncbi.nlm.nih.gov/27115679/)
16. [Marvin S, Thibeault S, Ehlenbach W (2019) Post-extubation dysphagia: Does timing of evaluation matter? Dysphagia 34: 210-219.](https://pubmed.ncbi.nlm.nih.gov/30043081/)
17. [Scheel R, Pisegna J, McNally E, et al. (2016) Endoscopic assessment of swallowing after prolonged intubation in the ICU setting. Annals of Otology, Rhinology & Laryngology 125: 43-52.](https://pubmed.ncbi.nlm.nih.gov/26215724/)
18. [Solh A, Okeda M, Bhat A, et al. (2003) Swallowing disorders post orotracheal intubation in the elderly. Intensive Care Med 29: 1451-1455.](https://pubmed.ncbi.nlm.nih.gov/12904855/)
19. [Shaker R, Ren J, Bardan E, et al. (2003) Pharyngoglottal closure reflex: Characterization in healthy young, elderly an dysphagic with predeglutitive aspiration. Gerontology 49: 12-20.](https://pubmed.ncbi.nlm.nih.gov/12457045/)
20. [Cichero J (2018) Age-related changes to eating and swallowing impact frailty: Aspiration, choking risk, modified food texture and autonomy of choice. Geriatrics 3: 69.](https://pubmed.ncbi.nlm.nih.gov/31011104/)
21. [Fujishima I, Fujiu-Kurachi M, Arai H, et al. (2019) Sarcopenia and dysphagia: Position paper of four professional organizations. Geriatrics and Gerontology International 19: 91-97.](https://onlinelibrary.wiley.com/doi/10.1111/ggi.13591)
22. [Dellis S, Papadopoulou S, Krikonis K, et al. (2018) Sarcopenic Dysphagia. A Narrative review. Journal of Frailty, Sarcopenia & Falls 3: 1-7.](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7155347/)
23. [Wakabayashi H, Sakuma K (2014) Rehabilitation nutrition for sarcopenia with disability: A combination of both rehabilitation and nutrition care management. Journal of Cachexia, Sarcopenia and Muscle 5: 269-277.](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4248414/)
24. [Shiozu H, Higashijima M, Koga T (2015) Association of sarcopenia with swallowing problems, related to nutrition and activities of daily living of elderly individuals. Journal of Physical Therapy Science 27: 393-396.](https://pubmed.ncbi.nlm.nih.gov/25729176/)
25. [Cruz-Jentoft A, Baeyens J, Bauer J, et al. (2010) Sarcopenia: European consensus on definition and diagnosis: Report of the European Working Group on Sarcopenia in Older People. Age and Ageing 39: 412-423.](https://pubmed.ncbi.nlm.nih.gov/20392703/)