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Post-extubation Dysphagia and COVID-2019

Post-ekstübasyon Disfajisi ve COVID-19

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Abstract

Objective: Coronavirus disease-2019 (COVID-19) is a global pandemic that affects worldwide. Most patients who need intensive care due to COVID-19 develop acute respiratory distress syndrome and patients need long-term mechanical ventilation. This situation increases the risk of dysphagia, aspiration, and aspiration pneumonia in patients. Information about COVID-19-associated dysphagia is still limited. Thus, this study aimed to evaluate the frequency of postextubation dysphagia (PED) and its effect on clinical outcomes.

Materials and Methods: Patients with COVID-19 in the adult intensive care unit (ICU) who were left on a mechanical ventilator for at least 24 h and are extubated were retrospectively screened. Gugging swallowing screen (GUSS) test was performed 24 h after extubation to evaluate swallowing function. Patients were examined in two groups as with and without dysphagia.

Results: This study included 40 patients who were followed up on a mechanical ventilator and extubated due to COVID-19. According to the bedside GUSS test results, patients were divided into two groups as dysphagia group (n=24) and the non-dysphagia group (n=16). The mean age was higher in the dysphagia group ($p<0.001$). Re-intubation rate and ICU, and in-hospital mortality were higher in the dysphagia group ($p<0.001$ for all), whereas the length of stay in the ICU and mechanical ventilation time were longer ($p=0.005$ and $p=0.001$). ICU mortality was higher in patients with severe dysphagia ($p=0.026$).

Conclusion: Our study revealed that the risk of PED increased with the age of patients with COVID-19 and PED increased the incidence of re-intubation, which was an important prognostic parameter that indicates mortality. Recognizing dysphagia with the early evaluation of swallowing in extubated patients with COVID-19 diagnosis is important to minimize the risk of aspiration pneumonia with proper nutrition, reduce the increased health cost, and prevent poor clinical outcomes.

Keywords: Dysphagia, COVID-19, postextubation

Öz

Amaç: Koronavirüs hastalığı-2019 (COVID-19) tüm dünyayı etkisi altına alan küresel bir salgındır. COVID-19'a bağlı yoğun bakıma ihtiyaç duyulan hastaların birçoğunda akut solunum sıkıntısı sendromu gelişmekte ve hastalar uzun süreli mekanik ventilasyona ihtiyaç duymaktadır. Bu durum hastalarda disfaji, aspirasyon ve aspirasyon pnömonisi riskini artırır. COVID-19 ilişkili disfaji ile ilgili henüz sınırlı sayıda bilgi mevcuttur. Bu çalışmanın amacı, post-ekstübasyon disfajinin (PED) sıklığını ve klinik sonlanım üzerine etkisini değerlendirmektir.

Gereç ve Yöntem: Erişkin yoğun bakım ünitesinde (YBÜ) COVID-19 tanısıyla en az 24 saat mekanik ventilatörde kalıp ekstübe edilen hastalar retrospektif olarak tarandı. Yutma fonksiyonunu değerlendirmek için ekstübasyondan 24 saat sonra yatak başı Gugging swallowing screen (GUSS) testi yapılan hastalar çalışmaya dahil edildi. Hastalar disfaji olan grup ve disfaji olmayan grup olmak üzere iki grupta incelendi.

Bulgular: COVID-19 nedeniyle mekanik ventilatörde takip edilip ekstübe edilen 40 hasta çalışmaya dahil edildi. Yatak başı GUSS testi sonuçlarına göre hastalar disfaji gelişen (n=24) ve disfaji gelişmeyen (n=16) olarak iki gruba ayrıldı. Disfaji grubunda yaş ortalaması yüksekti ($p<0,001$). Disfaji grubunda re-entübasyon oranı, yoğun bakım ve hastane içi mortalite daha yüksek saptanırken (hepsi için $p<0,001$) YBÜ'de kalış süresi ve mekanik ventilasyon süresi daha uzun idi ($p=0,005$ ve $p=0,001$). Şiddetli disfajisi olanlarda yoğun bakım mortalitesi yüksekti ($p=0,026$).

Sonuç: Çalışmamızda COVID-19'lu hastalarda ekstübasyon sonrası disfaji riskinin yaşla birlikte arttığını, PED gelişmesinin re-entübasyon görülme sıklığını artırdığını ve PED'nin mortaliteyi gösteren önemli bir prognostik parametre olduğunu gösterdik. COVID-19'lu ekstübe edilmiş hastalarda yutmayı erken dönemde değerlendirerek disfajiyi tanımak; doğru beslenmeyi sağlayarak aspirasyon pnömonisi riskini en aza indirebilmek, artmış sağlık maliyetini düşürmek ve kötü klinik sonlanımın önüne geçebilmek için önemlidir.

Anahtar Kelimeler: Disfaji, COVID-19, post-ekstübasyon

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Introduction

The disease named coronavirus disease-2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) first appeared in Wuhan, China in December 2019, which affected the whole world and was declared a pandemic (1). COVID-19 manifests itself in a wide spectrum ranging from mild upper respiratory tract involvement to severe respiratory failure, resulting in the need for intensive care, endotracheal intubation, and mechanical ventilation (2,3).

The literature review on tracheal intubation revealed its history in the 2000s BC. Endotracheal intubation and positive pressure mechanical ventilation have been used for >50 years. However, data on postextubation swallowing disorders [e.g., post-extubation dysphagia (PED)] have begun to draw attention in recent years (4). PED is defined as a swallowing disorder that develops after extubation (5).

PED is common in patients with critical illness who are followed up in the intensive care unit (ICU). PED is associated with increased risk of aspiration and related pneumonia, inadequate oral intake and nutrition, decreased quality of life, long hospital stay, re-intubation, and increased mortality and morbidity (2).

This study aimed to evaluate the frequency of PED and its effect on clinical outcomes.

Materials and Methods

Study Design

Patients who were followed up on a mechanical ventilator for at least 24 h with COVID-19 diagnosis in adult ICUs between March 2020 and February 2021 and were extubated during their follow-up were evaluated, as well as patients who underwent bedside Gugging swallowing screen (GUSS) test 24 h after extubation to evaluate swallowing function. Exclusion criteria are dysphagia before intubation, re-intubation in the first 24 h, and tracheostomy due to respiratory failure. Swallow test results after the first extubation of patients were recorded, whereas the swallow test results of patients who were extubated after repeated intubations were not evaluated in this study. The study was conducted following the Research and Publication Ethics. Ethics committee approval of the study was obtained from the scientific research platform of the Ministry of Health and the Ethics Committee of Nigde Omer Halisdemir University (decision no: 2021/04-06).

Our database records and hospital automation system information of patients who were intubated due to COVID-19 and extubated during the ICU follow-ups were retrospectively evaluated. Age, gender, comorbidities (diabetes mellitus, hypertension, atrial fibrillation, coronary artery disease, heart failure, chronic kidney disease, chronic obstructive pulmonary disease/asthma, and neurologic comorbidity), date of ICU admission, serological methods for COVID-19 diagnosis, length of ICU stay, length of hospital stay, in-hospital mortality, and ICU mortality was recorded in the data collection form, as well as routine bedside GUSS results.

According to the bedside GUSS results, patients were divided into two groups: Dysphagia and non-dysphagia groups.

Swallowing Test Evaluation

Swallowing function is routinely evaluated with bedside GUSS in our hospital. In patients followed up with COVID-19 diagnosis, GUSS was applied at the bedside 24 h after extubation. This test consists of two parts that evaluate indirect and direct swallowing. Indirect swallowing evaluates the state of consciousness, throat clearing, saliva swallowing, drooling, and voice change, whereas the second part examines direct swallowing. Ingestion of semi-solid, then liquid, and finally, solid foods are evaluated. Voice changes, drooling, piecemeal deglutition, and involuntary coughing before and 3 min after swallowing are observed at each test stage. Successful swallowing is scored 2 points, delayed swallowing 1 point, and pathological swallowing 0 points. A maximum of 5 points can be reached in each subgroup. The test is continued with successful swallowing, whereas terminated if it is not reached. The patient can get a maximum of 20 points from the test and is considered as having normal swallowing, 15-19 points as mild dysphagia and low aspiration risk, 10-14 points as moderate dysphagia, 0-9 points as severe dysphagia, and high aspiration risk (6,7).

Statistical Analysis

The conformity of the numerical variables to the normal distribution was tested with the Shapiro-Wilk test. Numerical variables were described using the mean and standard deviation or median values, whereas categorical variables used frequency and percentage values. The relationship between two categorical variables was investigated using the chi-square test (Fisher's Precision test/Precision test). The Student's t-test was used to compare two independent means. Two independent median values were compared using the Mann-Whitney U test. The study was performed at a 95% confidence interval (a statistically significant difference was accepted when $p<0.05$).

Results

This study evaluated 47 patients who were followed up on mechanical ventilator due to COVID-19 in the ICU and were extubated during their follow-up, wherein seven patients were re-intubated in the first 24 h after extubation and swallowing test was not performed, thus these seven patients were excluded from the study. The study includes the remaining 40 patients with COVID-19, of whom 3 had radiological and clinical findings of COVID-19 that revealed negative the SARS-CoV-2 reverse transcription-polymerase chain reaction (RT-PCR) test but positive anti-SARS-CoV-2 IgM and 37 were positive for SARS-CoV-2 RT-PCR.

Patients were divided into two groups as dysphagia (n=24) and non-dysphagia based on the bedside GUSS test results (n=16). The mean age was 73.3±12.4 years in the dysphagia group and 56.8±12.4 years in the non-dysphagia group. This difference was statistically significant ($p<0.001$). The dysphagia group included 16 (66.7%) male patients and 8 (33.3%) females, whereas 10 (62.5%) males and 6 (32.5%) females in the non-dysphagia group. No significant difference was found between the groups in terms of gender ($p=0.787$). Both groups were evaluated in terms of additional diseases, such as coronary artery disease, diabetes mellitus, hypertension, heart failure, chronic kidney disease, atrial fibrillation, asthma, and chronic obstructive pulmonary disease, which revealed no significant difference between the groups ($p>0.05$ for all) (Table 1). Additionally, patients were evaluated in terms of neurological comorbidities with a higher rate in the dysphagia group, but without significant difference ($p=0.210$).

The swallow test results after the first extubation of patients in the study were recorded. The first intubation time was longer in the dysphagia group the non-dysphagia group (5.5 days vs. 5 days), but without statistically significant difference (p=0.311) (Table 2).

The groups with and without dysphagia were evaluated for clinical outcome parameters including re-intubation rate, mechanical ventilation time, ICU mortality, in-hospital mortality, length of ICU stay, and length of hospital stay (Table 3). The clinical outcome parameters of the dysphagia group were worse those of the non-dysphagia group. The re-intubation rate and ICU and in-hospital mortality were higher (p<0.001 for all) and the length of stay in the ICU and mechanical ventilation were longer in the dysphagia group (p=0.005 and p=0.001, respectively). Hospital stay duration was also longer in the dysphagia group, but without statistically significant difference (p=0.092).

The ICU mortality was higher in patients with severe dysphagia (p=0.026), but the difference between dysphagia severity and in-hospital mortality was not statistically significant (p=0.253) (Table 4).

Discussion

Our study revealed a higher re-intubation rate, ICU mortality, and in-hospital mortality and longer duration of mechanical ventilation and ICU stay in the dysphagia group (p<0.05 for all). These results supported that the presence of PED was an indicator of poor clinical outcome prognosis.

Swallowing is a complex activity that involves multiple cranial nerves and muscles as well as cortical and subcortical structures and brain stem (5). Dysphagia can occur with various mechanisms. The neurological damage that is independent of acute respiratory failure in patients with COVID-19 may be the primary cause of PED. Other possible causes in the dysphagia development include underlying critical illness, direct laryngeal and pharyngeal damage due to endotracheal tube, newly developed dysfunction of motor and sensory nerves, impaired swallowing and respiratory synchronization, muscle atrophy and critical illness myopathy due to disuse, agents causing neuromuscular blockade, sedative drugs, and delirium in the ICU (8,9).

Screening tests can be used to evaluate swallowing in patients who are followed up in the ICU. Trapl et al. (7) developed the GUSS test in 2007 to screen dysphagia, which progressively evaluated the severity of dysphagia with semi-solid, liquid, and solid substances to minimize the risk of aspiration during the test. This study used the GUSS test, which was easy to use at the bedside, non-invasive, and low-cost, with the opportunity to determine the severity of dysphagia and aspiration after the evaluation to screen dysphagia in patients with COVID-19. After the screening test, advanced diagnostic tests, such as videofluoroscopy and fiberoptic endoscopic evaluation, were started. Objective results were obtained with these tests; however, applying this in clinical practice is difficult because they are unavailable in every center and are invasive (10). Our study was conducted on the patient population with COVID-19; thus, videofluoroscopy and fiberoptic endoscopic evaluation could not be performed as advanced tests due to the risk of SARS-CoV-2 transmission. Trapl et al. (7) showed that the bedside GUSS test detected dysphagia similar to videofluoroscopy and fiberoptic endoscopic evaluation.

Table 1. Comorbid diseases

	Without dysphagia (n=16)	With dysphagia (n=24)	p value
History of neurological disease (n, %)	1 (6.2)	6 (25)	0.210
Coronary artery disease (n, %)	4 (25)	12 (50)	0.14
Diabetes mellitus (n, %)	9 (56.2)	9 (37.5)	0.43
Hypertension (n, %)	13 (81.2)	21 (87.7)	0.668
Heart failure (n, %)	0 (0)	3 (12.5)	0.262
Chronic renal disease (n, %)	1 (6.2)	4 (16.7)	0.631
Atrial fibrillation (n, %)	1 (6.2)	4 (16.7)	0.631
COPD/asthma (n, %)	6 (37,5)	3 (12,5)	0,120

KOAH: Kronik obstrüktif akciğer hastalığı

Table 2. Intubation

	Without dysphagia (n=16)	With dysphagia (n=24)	p value
First intubation (day, median)	5 (5.5)	5.5 (8)	0.311
Re-intubation (n, %)	2 (12.5)	18 (75)	<0.001
Total intubation time (day, median)	5.5 (5)	14.5 (15)	0.001

Table 3. Clinical outcome parameters

	Without dysphagia (n=16)	With dysphagia (n=24)	p value
Re-intubation (n, %)	2 (12.5)	18 (75)	<0.001
Intensive care unit mortality (n, %)	3 (18.8)	18 (75)	<0.001
In-hospital mortality (n, %)	3 (18.8)	21 (87.7)	<0.001
Length of stay in intensive care unit (day, median)	13 (9.8)	24 (16.8)	0.005
Length of hospital stay (day, median)	20 (14.8)	29 (9.8)	0.092
First intubation time (day, median)	5 (5.5)	5.5 (8)	0.311
Total intubation time (day, median)	5.5 (5)	14.5 (15)	0.001

The incidence of PED in patients with critical illness, who are followed up in the ICU, is highly variable, ranging from 3% to 62% (11,12,13). Data on the incidence of COVID-19-associated dysphagia are insufficient. The study of Luisa and Laguna (5) revealed that 167 (72%) of 232 patients with COVID-19 were intubated, of whom PED was detected in 26.9%. Our study

Table 4. The relationship between dysphagia severity and mortality

	Dysphagia severity			
	Mild (n=4)	Moderate (n=8)	Severe (n=12)	p value
Intensive care mortality (n, %)	2 (50)	4 (50)	12 (100)	0,026
Hospital mortality (n, %)	3 (75)	6 (75)	12 (100)	0,253

in patients with COVID-19 revealed dysphagia in 60% of extubated patients. This was a very high rate. Early detection of PED is important for early recognition of complications, such as pneumonia and malnutrition, that may develop due to swallowing disorders (9,12,14).

Studies that evaluate the risk factors for PED revealed that age, intubation time, repetitive intubations, sedation duration, use of neuromuscular blocking agents, and corticosteroid use were associated with the development of dysphagia (4,13,14,15). With prolonged intubation time, the risk of developing dysphagia increases with mechanical trauma, prolonged sedation period, and muscle weakness due to the use of neuromuscular blocking agents. The intubation period is not long; however, dysphagia may develop with corticosteroid treatment and repetitive intubations (9). A metaanalysis by Skoretz et al. (15) revealed that the frequency of dysphagia increased with the prolonged intubation time. The study of Malandraki et al. (16) revealed that the severity of dysphagia increased as the intubation time increased. Our study revealed a longer duration of mechanical ventilation before extubation in the dysphagia group but without a statistically significant difference between the groups ($p>0.05$). Our study performed dysphagia screening after all patients were extubated after the first intubation. Swallowing disorders are observed more frequently in elderly patients due to muscle atrophy, connective tissue weakening, and sensorimotor changes (17). The evaluations on patients who developed PED revealed a direct correlation between age and dysphagia incidence (9). Our study revealed a significantly higher mean age of the dysphagia group (73.3±12.4) the non-dysphagia group (56.8±12.4) ($p<0.05$), which was consistent with the literature.

PED has been associated with poor clinical outcome parameters, such as re-intubation and increased mortality and morbidity (18,19,20). Macht et al. (21) revealed that the frequency of re-intubation significantly increased in parallel with the severity of dysphagia in patients who developed PED. Our study revealed that 18 (75%) patients in the dysphagia group needed re-intubation ($p<0.05$). Of the 24 patients with dysphagia, 12 had severe dysphagia, and all patients with severe dysphagia died in the ICU. Our study revealed that ICU mortality was increased in patients with severe dysphagia ($p=0.026$). Most studies that examine the relationship between PED and hospital stay in patients with critical illness who are followed up in the ICU revealed a prolonged length of hospital stay in patients with dysphagia (18,22). The study by Regala et al. (19) revealed no significant relationship between dysphagia and hospital stay duration. Our study revealed a statistically significantly longer ICU stay duration in patients who developed dysphagia ($p<0.05$). The hospital stay was longer in the dysphagia group but without significant difference between the groups ($p>0.05$). Studies that evaluate PED in patients with COVID-19 are limited (5). Luisa and Laguna (5) showed that PED was associated with prolonged mechanical ventilation and disease severity in patients with COVID-19. The presence of PED is an important indicator of poor outcomes in studies (12,18,21). An increased ICU and hospital mortality were observed in patients with dysphagia (18,23). Our study revealed a significantly higher ICU and hospital mortality in the dysphagia group than the non-dysphagia group ($p<0.05$).

Study Limitations

Our study had several limitations. First, no further testing was performed for dysphagia after the screening test. Second, parameters such as corticosteroid use, sedation duration, and use of neuromuscular blocking agents that might contribute to the development of dysphagia, were not evaluated.

Conclusion

Therefore, our study revealed that the risk of PED increased with age in patients with COVID-19 and the development of PED increased the incidence of re-intubation and was an important prognostic parameter that indicates mortality. Recognizing dysphagia with the early evaluation of swallowing in extubated patients with COVID-19 is important to minimize the risk of aspiration pneumonia by providing proper nutrition to reduce the increased health cost and prevent poor clinical outcomes.

Ethics

Ethics Committee Approval: Ethics committee approval of the study was obtained from the scientific research platform of the Ministry of Health and the Ethics Committee of Nigde Omer Halisdemir University (decision no: 2021/04-06).

Informed Consent: Since the data in our study were obtained retrospectively by scanning the records kept in the hospital database, informed consent was not obtained from the patients.

Peer-review: Externally and internally peer-reviewed.

Authorship Contributions

Concept: D.Y., T.M., S.S., Design: D.Y., T.M., S.S., Data Collection or Processing: D.Y., T.M., S.S., Analysis or Interpretation: D.Y., T.M., Literature Search: D.Y., T.M., Writing: D.Y.

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