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ORIGINAL ARTICLE

Screening Oropharyngeal Dysphagia in Older Adults

A Risk Factor for in-Hospital Mortality With COVID-19 Infection?

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This study investigated the use of the Eating Assessment Tool 10 (EAT-10) in predicting clinical outcomes in older adults hospitalized with COVID-19 infections between February and June 2021. The EAT-10 was performed for all patients. Thirty one percent and 23% of the 153 patients had oropharyngeal dysphagia risk and in-hospital mortality, respectively. Older age (hazard ratio: 1.08; 95% confidence interval, 1.03-1.13; $P = .003$) and higher EAT-10 score (hazard ratio: 1.02; 95% confidence interval, 1.01-1.04; $P = .043$) were associated with in-hospital mortality. Older age and having increased risk of oropharyngeal dysphagia were independently associated with a higher risk of in-hospital mortality in older patients with COVID-19. **Key words:** *COVID-19, dysphagia, EAT-10, in-hospital mortality, older adults*

THE CORONAVIRUS DISEASE 2019 (COVID-19) was first identified in China in December 2019 and spread all over the world.[1] In 2023, there were 773 million cases and a staggering 7 010 568 deaths cumulatively from COVID-19 worldwide.[2] COVID-19 predisposes to malnutrition, oropharyngeal dysphagia, and mortality in older adults.[3-7] Oropharyngeal dysphagia in patients with COVID-19 has been determined as a key predictor of hospital duration, delirium, confusion, history of intubation, longer duration of mechanical ventilation, neuromuscular complications, sarcopenia, and malnutrition.[8-11] Very few articles have reported that patients with COVID-19 had oropharyngeal dysphagia without a history of intubation.[4,10,12] The details of the association of COVID-19, oropharyngeal dysphagia, and their effect on mortality are still unclear.

Oropharyngeal dysphagia is described as the inability and/or difficulty to form or transmit a food mixture composition safely and/or effectively from the oral cavity to the esophagus.[11] Recently, it has been accepted as a geriatric syndrome; the prevalence of oropharyngeal dysphagia increases with older age, along with some clinical conditions such as dementia, Parkinson's disease, stroke, and amyotrophic lateral sclerosis.[11,13] Oropharyngeal dysphagia is a marker of functional dependency and frailty.[11] Untreated

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oropharyngeal dysphagia may lead to dehydration, psychological problems, aspiration pneumonia, malnutrition, sarcopenia, weight loss, disability, institutionalization, increased readmissions and length of hospitalization, and even mortality.[8,11]

Some screening tests (eg, water swallowing tests, repetitive saliva swallowing tests) and questionnaires, such as Eating Assessment Tool 10 (EAT-10)[14] and Sydney Swallowing Questionnaire,[15] are recommended for standard screening of oropharyngeal dysphagia. After initial evaluations, the next step is instrumental evaluation.[8,11] Given that most procedures (the Gugging Swallowing Screen [GUSS],[16] cough testing [voluntary cough], reflexive cough, flexible endoscopic evaluation of swallowing [FEES], and videofluoroscopic swallow study [VFSS]) for the diagnosis of oropharyngeal dysphagia are aerosol-generating procedures (AGPs),[9] the risk of transmission of COVID-19 increases during these procedures. These AGPs are recommended for a few indications in patients with COVID-19, such as insufficient clinical evaluation, history of aspiration pneumonia, dehydration and malnutrition risk, suspicion of silent aspiration, or life-threatening conditions.[8,17] In addition, procedures such as FEES and VFSS are performed by expert individuals and instrumentation may not be easily accessible and has not been validated for COVID-19. Therefore, it is essential to identify dysphagia with an easier, simpler method that does not increase health care workers' risk. By conducting recommended oropharyngeal dysphagia screening questionnaires such as the EAT-10,[8,11,14] the risk of infection of health care workers may be minimized, the oropharyngeal dysphagia status and the nutrition plan of the patients may be determined, and prevention against aspiration may be provided.

This study aimed to evaluate the in-hospital mortality risk factors of patients with COVID-19, who had not been treated with invasive ventilation and had oropharyngeal dysphagia risk determined using the EAT-10 screening test, and the prevalence and risk factors of oropharyngeal dysphagia in these patients.

METHODS

Study design

A single-center cross-sectional study was designed at Marmara University Medical School Hospital, a tertiary referral center/COVID-19 pandemic hospital, which included patients who were admitted between February and June 2021. Written informed consent was obtained from patients or proxies. Those who did not provide consent were excluded. This research was conducted in accordance with the Helsinki World Medical Association Declaration. The study was approved by the Local Ethics Committee of Marmara University (Marmara University Clinical Research Ethics Committee/Decision no.: 09.2021/68).

Inclusion and exclusion criteria

All individuals who were aged 65 years and older with a positive real-time reverse transcriptase-polymerase chain reaction and/or whose radiologic imaging was compatible with COVID-19 were included in the study. Exclusion criteria included admission to intensive care unit (ICU) at the time of hospitalization, age younger than 65 years, dental problems, and stroke. In-hospital mortality was the primary outcome of this study.

Sample size calculation

A sample size calculation was performed on the basis of the reported oropharyngeal dysphagia prevalence.[13,18] Using a power of 80%, a confidence level of 95%, and an error probability of 20%, a goal sample size of 149 participants was determined and 153 patients were enrolled.

Data collection

Assay samples collected with nasopharyngeal swabs were used for detecting COVID-19. Based on the World Health Organization, the severity of COVID-19 was

categorized as mild, moderate, severe, and critical.[19,20]

Demographic variables (age, sex), anthropometric measurements (height [cm], weight [kg], and body mass index [BMI]), comorbidities (coronary artery disease [CAD], congestive heart failure [CHF], chronic kidney disease, chronic obstructive pulmonary disease, cerebrovascular disease [CVD], diabetes mellitus [DM], and hypertension [HT]), the number of medications, admission to the ICU, ICU length of stay (LOS) (days), and presence of in-hospital mortality were recorded. The time until in-hospital mortality or hospital LOS was used as the follow-up time.

Geriatric assessments

The definition of polypharmacy for the current study was accepted as the regular use of 5 or more medications.[21] The Nutritional Risk Screening 2002 (NRS-2002) screening tool was used for determining the nutritional status of individuals. Participants who had 3 points and greater were described as at increased nutritional risk and those with less than 3 points were described as at low nutritional risk. The nutritional intervention was recommended for individuals at risk for malnutrition. The Geriatric 8 (G8) screening tool includes 8 questions (food intake, self-perception of, loss of weight, BMI, neuropsychological status, number of medications, health, age, and motor skills).[22] The G8 score has a threshold value of 14 (0-17) and lower. Further assessment is recommended for scores of 14 and lower.[22]

Dysphagia evaluation

During the COVID-19 pandemic, multiple factors such as the limitations of transporting patients to other parts of the hospital, and increased viral transmission risk through AGP, strongly restricted using the FEES or the VFSS, which are the criterion standard for the diagnosis of dysphagia. Therefore, in this study, the EAT-10 was used for screening for swallowing function and detecting the risk of oropharyngeal dysphagia.[14] Scores of 3 and greater were classified as oropharyngeal dysphagia risk positive. All participants were questioned for oropharyngeal dysphagia by the same geriatrician within the first 2 days of hospitalization.

Laboratory sample collection

At the time of hospital admission, laboratory variables such as complete blood cell count, creatinine, C-reactive protein (reference values <5 mg/L), prothrombin time, international normalized ratio, activated partial thromboplastin time, lactate dehydrogenase, ferritin, procalcitonin, glucose, and D-dimer were measured. For renal function evaluation, glomerular filtration rate (GFR), as calculated using the Cockroft and Gault formula (140-Age) × Mass (kg) × [0.85 if female]/72 × (Serum Cr [mg/dL]), was used.[23] Participants who had hypoxia (oxygen saturation level ≤92) and/or polypnea (30 cycles per minute with 90% of blood oxygen saturation on room air) were evaluated using thorax computed tomography and aAll individuals were treated with the same therapy protocol (favipiravir [first day 1600 mg twice per day, 600 mg twice daily for 4 days], proton pump inhibitors, and prophylactic enoxaparin [1 mg/kg]). Oxygen support and dexamethasone were started if the patients had hypoxia

Statistical analysis

The normality of the variables was determined using visual (histograms and probability plots) and the Kolomgorov-Smirnov test. Frequencies and descriptive statistics were calculated. Numbers and percentages were used for categorical variables. The Fisher exact test or the χ^2 test was used for the comparison of data. Normally distributed continuous variables are reported as mean and standard deviation; group comparisons were performed using the independent sample *t* test. If the continuous factors demonstrated nonnormality, the data were reported as median (minimum-maximum) and compared using the Mann-Whitney *U* test. Significantly associated

factors ($P < .05$) were analyzed in multivariate models. The Stepwise method was used to assess independent factors. Significant variables in the univariate analysis were involved in a multivariate Cox regression model to identify independent risk factors for mortality. Multicollinearity was checked among independent variables. Results are shown as 95% confidence intervals (CIs) and hazard ratios (HR) or odds ratios (OR). Statistical significance was considered as P value of less than .05. The data were analyzed using the SPSS version 22.0 software (SPSS, IBM, Armonk, New York).

RESULTS

Participants' characteristics

A total of 153 patients were hospitalized during the evaluation period. Eighty-three (54.2%) of the participants were female and the mean age of all participants was 76.7 ± 7.9 years. Ninety-five percent of patients had at least 1 comorbidity and the 3 most common comorbidities were HT (69.3%) and DM (41.2%), followed by CAD (26.1%). Most participants (70.6%) had a severe-critical COVID-19 disease status. None of the patients was vaccinated. Eighty-nine percent of the patients had a G8 score of 14 and lower. Polypharmacy, increased nutritional risk, and oropharyngeal dysphagia were determined at rates of 39.9% (n = 61), 74.5% (n = 114), and 31.4% (n = 48), respectively. Most of the patients were fed orally (79.7%, n = 122). Only 1 patient is fed via percutaneous endoscopic gastrostomy. All other enteral and mixed feeding routes were established by using a nasogastric tube. The mean of the hospital LOS of the patients was 14.0 (minimum: 4, maximum: 68) days. In-hospital mortality occurred in 38 (23.5%) patients. Table 1 shows the demographic and laboratory characteristics of the participants.

Oropharyngeal dysphagia risk

Based on EAT-10, 31.4% (n = 48) of patients had a risk of oropharyngeal dysphagia. Participants with increased oropharyngeal dysphagia risk were older (74.0 vs 81.0 years, $P < .001$), had a lower BMI ($P = .004$), had more severe-critical COVID-19 disease status ($P = .019$), increased nutritional risk ($P < .001$), longer ICU ($P = .014$) and hospital LOS ($P = .006$), mostly fed by the parenteral route ($P = .023$), and had lower G8 scores ($P < .001$). Analytical parameters showed lower mean glucose ($P = .019$), albumin ($P = .025$), and GFR ($P = .029$) levels for patients with oropharyngeal dysphagia (Table 2).

Mortality

The in-hospital mortality rate was 23.5% (n = 38). Nonsurvivors were older (74.0 vs 81.5 years, $P < .001$), and more were diagnosed as having CHF ($P < .001$). In addition, longer hospital LOS ($P = .050$) and more frequent ICU admissions ($P < .001$) were associated with mortality. Most of the nonsurvivors were at an increased nutritional risk ($P < .001$), had higher EAT-10 scores ($P = .005$), increased dysphagia risk ($P = .006$), and were mostly fed by the parenteral route ($P = .012$). Baseline glucose ($P = .041$), platelet levels ($P = .050$), and GFR ($P = .001$) were significantly lower in nonsurvivors. Table 3 presents the characteristics and laboratory parameters of survivors and nonsurvivors.

Multivariate analysis

In multivariate Cox regression analysis, older age (HR: 1.08; 95% CI, 1.03-1.13; $P = .003$), CHF (HR: 0.42; 95% CI, 0.19-0.93; $P = .031$), and higher EAT-10 scores (HR: 1.02; 95% CI, 1.01-1.04; $P = .043$) were associated with in-hospital mortality (Table 4). Every 1-year increase in age increased the odds of severe oropharyngeal dysphagia risk by 9% (OR: 1.09; 95% CI, 1.03-1.15; $P = .001$). As shown in Table 4, the risk of oropharyngeal dysphagia was 3 times higher in patients with severe COVID-19 (OR: 3.04; CI, 1.21-7.63; $P = .018$).

Table 1. Demographic and Laboratory Characteristics

Variable	n (%), n =153
Sex, n (%)	
Female	83 (54.2)
Male	70 (45.8)
Age, y[a]	76.7 ± 7.9 (65-96)
COVID diagnosis, n (%)	
Positive PCR test only	7 (4.6)
Positive radiologic findings only	8 (5.2)
Both	138 (90.2)
BMI[a]	27.1 ± 4.4 (16.3-40.0)
Smoking, n (%)	38 (24.8)
Number of chronic diseases[a]	3.0 (1-7)
HT, n (%)	106 (69.3)
DM, n (%)	63 (41.2)
CAD, n (%)	40 (26.1)
COPD, n (%)	24 (15.7)
Dementia, n (%)	21 (13.7)
CKD, n (%)	21 (13.7)
Malignancy, n (%)	20 (13.1)
CHF, n (%)	17 (11.1)
CVD, n (%)	15 (9.8)
COVID severity, n (%)	
Mild ± Moderate	45 (29.4)
Severe ± Critical	108 (70.6)
Number of medications[a]	4.0 (1-10)
Polypharmacy, n (%)	61 (39.9)
Hospital stay, d[a]	14.0 (4-68)
ICU admission, n (%)	38 (24.8)
ICU stay, d[a]	5.0 (1-28)
In-hospital mortality, n (%)	36 (23.5)
G8 score, n (%)	
G8 > 14	16 (10.5)
G8 < 14	137 (89.5)
The score of NRS-2002[a]	4.0 (0-7)
NRS-2002, n (%)	
At low nutritional risk	39 (25.5)
At increased nutritional risk	114 (74.5)
EAT-10 score[a]	0.0 (0-40)
EAT-10, n (%)	
Normal	105 (68.6)
Oropharyngeal dysphagia risk	48 (31.4)
Route of nutrition, n (%)	
Oral + Enteral	130 (85.0)
Parenteral	8 (5.2)
Mixed	15 (9.8)
White blood cell, $\times 10^3/\mu L$[a]	7.0 (1.6-16.0)
Lymphocyte, $\times 10^3/\mu L$[a]	1.0 (0.1-3.9)
Neutrophil, $\times 10^3/\mu L$[a]	5.3 (0.9-14.5)
Hemoglobin, g/dL	12.3 (4.1-16.9)
Thrombocyte, $\times 10^3/\mu L$[a]	198 (27-432)

(*continued*)

Table 1. Demographic and Laboratory Characteristics (*Continued*)

Variable	n (%), n =153
Glucose, mg/dL[a]	125 (59-500)
GFR, mL/m[a]	59.34 (4.2-147.6)
Albumin, g/L	3.5 (2.1-4.5)
LDH, U/L[a]	374 (105-1329)
C-reactive protein, mg/L[a]	81.4 (0.6-333)
Prothrombin time, s[a]	14.8 (10.6-85.2)
INR[a]	1.1 (0.9-6.9)
aPTT, s[a]	30.9 (21.5-75.1)
Fibrinogen, mg/dL[a]	526 (198-999)
D-dimer, mg/dL[a]	0.99 (0.05-20)
Ferritin, µg/L[a]	400 (14-2992)
Procalcitonin, µg/L[a]	0.14 (0.02-31.4)
25-OH vitamin D, µg/L[a]	15.9 (3.4-73.8)
Vitamin B_{12}, ng/mL	327 (43-2450)

Abbreviations: aPTT, activated partial thromboplastin time; BMI, body mass index; CAD, coronary artery disease; CHF, congestive heart failure; CKD, chronic kidney disease; COPD, chronic obstructive pulmonary disease; CVD, cerebrovascular disease; DM, diabetes mellitus; Eat-10, Eating Assessment Tool 10; G8, Geriatric 8; GFR, glomerular filtration rate; HT, hypertension; ICU, intensive care unit; INR, international normalized ratio; LDH, lactate dehydrogenase; NRS-2002, Nutritional Risk Screening 2002; PCR, polymerase chain reaction.
[a]Numeric variables are presented as median (minimum-maximum), mean ± SD.

DISCUSSION

In the current study, one-third of the participants had an increased risk of oropharyngeal dysphagia according to EAT-10 scores. COVID-19 severity and older age increased the risk of oropharyngeal dysphagia. The in-hospital mortality rate was 23.5%. Higher EAT-10 scores, the presence of CHF, and older age were associated with in-hospital mortality.

COVID-19 may increase the risk of oropharyngeal dysphagia due to cerebrovascular accidents, neuronal involvement, anosmia, ageusia, oropharyngeal sensory dysfunction, COVID-19 treatment protocols (steroids, prone position, intubation, use of tracheostomy, and mechanical ventilation), sarcopenic dysphagia, myositis, frailty, and malnutrition.[4,8,10,24-26] In studies with patients with COVID-19, the rate of oropharyngeal dysphagia has been reported as 20% to 80%.[10,12,18,24,25,27] The reasons for the reported differences may be due to the age range distribution of the individuals, the methods of diagnosing oropharyngeal dysphagia and risk (EAT-10, GUSS, Swallowing Disturbance Questionnaire, and the Volume-Viscosity Swallow Test, VFSS, and FEES), the status of the participants (inpatient, nursing home, ICU, rehabilitation centers), and history of intubation.[4,11,12,25,26] Lee et al[25] investigated oropharyngeal dysphagia in patients with COVID-19 and reported that the prevalence of oropharyngeal dysphagia was 35%. Rouhani et al[27] found an element of oropharyngeal dysphagia based on EAT-10 scoring in one-third of patients diagnosed with COVID-19. However, all of the patients included in that study had a history of intubation. In our study, no patient had a history of intubation when EAT-10 scoring was used. According to recent reports, without intubation and/or tracheostomy insertion, patients with COVID-19 suffered oropharyngeal dysphagia due to sarcopenic dysphagia, myositis, or malnutrition.[4,10,24] In a study in Turkey,[18] the oropharyngeal dysphagia rate was 20.6% but the participants were younger (57 years). Shadi and Farahat[12] found that the

Table 2. Univariate Analysis of Patients Based on the Presence or Absence of the Oropharyngeal Dysphagia

	Normal, n (%) n = 105	**Oropharyngeal Dysphagia Risk, n (%) n = 48**	***P***
Sex, n (%)			
Female	57 (54.3)	26 (54.2)	.989
Male	48 (45.7)	22 (45.8)	
Age, y[a]	**74.0 (65.0-96.0)**	**81.0 (65.0-95.0)**	**<.001**
BMI[a]	**28.1 (16.3-40.0)**	**25.4 (18.4-37.5)**	**.004**
Smoking, n (%)	25 (23.8)	13 (27.1)	.664
Number of chronic diseases[a]	3.0 (1-7)	3.0 (1-7)	.195
HT, n (%)	75 (71.4)	31 (64.6)	.394
DM, n (%)	41 (39.0)	22 (45.8)	.429
CVD, n (%)	8 (7.6)	7 (14.6)	.192
CAD, n (%)	28 (26.7)	12 (25.0)	.828
CKD, n (%)	13 (12.4)	8 (16.7)	.481
CHF, n (%)	10 (9.5)	7 (14.6)	.365
Dementia, n (%)	**6 (5.7)**	**15 (31.3)**	**<.001**
Malignancy, n (%)	13 (12.4)	7 (14.6)	.710
COVID severity, n (%)			
Mild ± Moderate	**37 (35.2)**	**8 (16.7)**	**.019**
Severe ± Critical	**68 (64.8)**	**40 (83.3)**	
NRS-2002, n (%)			
At low nutritional risk	**36 (34.3)**	**3 (6.3)**	**<.001**
At increased nutritional risk	**69 (65.7)**	**45 (93.8)**	
Number of medications[a]	4.0 (1.0-10.0)	4.0 (1.0-9.0)	.853
Polypharmacy, n (%)	41 (39.0)	20 (41.7)	.759
Hospital stay, d[a]	12.0 (4.0-68.0)	16.0 (5.0-60.0)	.133
ICU admission, n (%)	**20 (19.0)**	**18 (37.5)**	**.014**
ICU stay, d[a]	5.5 (1.0-28.0)	4.5 (1.0-20.0)	.918
In-hospital mortality, n (%)	**18 (17.1)**	**18 (37.5)**	**.006**
Route of nutrition, n (%)			
Oral ± Enteral	**92 (87.6)**	**38 (79.2)**	**.023**
Parenteral	**2 (1.9)**	**6 (12.5)**	
Mixed	**11 (10.5)**	**4 (8.3)**	
Classification of G8, n (%)			
G8 score >14	**16 (15.2)**	**0 (0.0)**	**<.001**
G8 score ≤14	**89 (84.8)**	**48 (100.0)**	
White blood cell, $\times 10^3/\mu L$[a]	6.9 (2.7- 16.0)	7.6 (3.5-14.3)	.114
Lymphocyte, $\times 10^3/\mu L$[a]	1.0 (0.1-3.9)	1.1 (0.2-3.8)	.433
Neutrophil, $\times 10^3/\mu L$[a]	5.2 (1.1-14.5)	5.8 (2.6-13.2)	.091
Hemoglobin, g/dL	12.5 (4.1-16.9)	12.1 (6.5-16.6)	.517
Thrombocyte, $\times 10^3/\mu L$[a]	196 (35-432)	209 (55-432)	.362
Glucose, mg/dL[a]	**130 (35-432)**	**108 (74-269)**	**.019**
GFR, mL/m[a]	**64.8 (4.2-147.6)**	**53.5 (4.2-147.6)**	**.029**
Albumin, g/L	**3.6 (2.1-4.5)**	**3.4 (2.1-4.4)**	**.025**
LDH, U/L[a]	375 (149-1192)	359 (147-1329)	.911
C-reactive protein, mg/L[a]	83.2 (0.6-333.0)	80.7 (0.6-303.0)	.734

(*continued*)

Table 2. Univariate Analysis of Patients Based on the Presence or Absence of the Oropharyngeal Dysphagia (*Continued*)

	Normal, n (%) n = 105	Oropharyngeal Dysphagia Risk, n (%) n = 48	*P*
Procalcitonin, µg/L[a]	0.1 (0.1-29.9)	0.2 (0.1-23.7)	.957
Ferritin, µg/L[a]	370 (29-2992)	469 (29-1759)	.326
Prothrombin time, s[a]	14.6 (10.6-47.1)	16.9 (11.6-47.1)	.531
INR[a]	1.1 (0.9-1.4)	1.2 (0.9-3.7)	.546
aPTT, s[a]	31.1 (21.5-75.1)	30.6 (22.3-75.1)	.821
Fibrinogen, mg/dL[a]	538 (202-999)	506 (198-928)	.370
D-dimer, mg/dL[a]	0.9 (0.1-20.0)	1.5 (0.1-20.0)	.182
25-OH vitamin D, µg/L[a]	17.7 (3.4-73.8)	14.2 (3.4-56.4)	.245
Vitamin B_{12}, ng/mL	374 (43-2450)	297 (157-2000)	.611

Abbreviations: aPTT, activated partial thromboplastin time; BMI, body mass index; CAD, coronary artery disease; CHF, congestive heart failure; CKD, chronic kidney disease; CVD, cerebrovascular disease; DM, diabetes mellitus; G8, Geriatric 8; GFR, glomerular filtration rate; HT, hypertension; ICU, intensive care unit; INR, international normalized ratio; LDH, lactate dehydrogenase; NRS-2002, Nutritional Risk Screening 2002.
Bold values indicates significant values.
[a]Numeric variables are presented as median (minimum-maximum), mean ± SD.

prevalence of self-perceived oropharyngeal dysphagia as diagnosed using EAT-10 was 64.6% (232 of 359 participants) in nongeriatric, nonintubated patients. A possible explanation for this might be that the frequency of self-perceived oropharyngeal dysphagia was reported in that study in the first week after the participants were diagnosed as having COVID-19. In our study, the patients were hospitalized in the second week after the COVID-19 diagnosis and dysphagia was screened. When the previous study was reviewed, the frequency of increased oropharyngeal dysphagia risk was found to be 16.2% after the first week.

The prevalence of in-hospital mortality has been reported to be 20% to 40% in older adults with COVID-19.[3,5,6,10,28] The possible explanation of the differences in the mortality rate in patients with COVID-19 was the patients' age distribution, comorbidities, presence of geriatric syndromes, ICU admission, intubation history, and mechanical ventilation.[3,5,6,9] The mortality rate in the present study is 23.5%, which is in line with studies with a similar design (including older adults).[3,5,6] In our study, like others,[3,5,6,29] the mortality was related to older age. Older people were more prone to death. Wolff et al[30] documented that older age was the most common risk factor for COVID-19–related mortality. Older age increased in-hospital mortality risk by approximately 8% in patients with COVID-19 in this study (HR: 1.08; 95% CI, 1.03-1.13).

Several factors are known to increase the risk of mortality in patients with COVID-19. In a previous study,[29] male sex was predisposed to mortality with COVID-19. In the current study, although lower glucose, thrombocyte, and GFR values were associated with increased in-hospital mortality in univariate analysis, laboratory values were not significantly related to in-hospital mortality in multivariate analysis (data not shown). The decreased statistical power may be explained by the small sample size. Comorbidities (eg, HT, DM, CVD, CHF, arrhythmia, dementia, cancer, obesity) were related to COVID-19 severity and mortality in previous studies.[29,31] Murat et al[32] reported that patients with CAD and COVID-19 were more likely to experience longer ICU LOS, shock, kidney failure, and in-hospital mortality. In their study, 7 in 10 patients with mortality had a diagnosis of CHF. In the current study, a significant relationship between the presence of CHF

Table 3. Univariate Analysis of Survivors and Nonsurvivors

	Survivors n (%) n = 117	**Nonsurvivors n (%) n = 36**	***P***
Sex, n (%)			
Female	67 (57.3)	16 (44.4)	.177
Male	50 (42.7)	20 (55.6)	
Age, y[a]	**74.0 (65.0-95.0)**	**81.5 (66.0-96.0)**	**<.001**
BMI[a]	27.1 (16.3-39.6)	26.9 (18.4-40)	.279
Smoking, n (%)	29 (24.8)	9 (25.0)	.979
Number of chronic diseases[a]	3.0 (1-7)	3.0 (1-7)	.143
HT, n (%)	82 (70.1)	24 (66.7)	.697
DM, n (%)	49 (41.9)	14 (38.9)	.750
CVD, n (%)	10 (8.5)	5 (13.9)	.363
CAD, n (%)	30 (25.6)	10 (27.8)	.799
COPD, n (%)	16 (13.7)	8 (22.2)	.233
CKD, n (%)	14 (12.0)	7 (19.4)	.270
CHF, n (%)	**6 (5.1)**	**11 (30.6)**	**<.001**
Dementia, n (%)	13 (11.1)	8 (22.2)	.106
Malignancy, n (%)	18 (15.4)	2 (5.6)	.098
COVID severity, n (%)			
Mild ± Moderate	36 (30.8)	9 (25.0)	.506
Severe ± Critical	81 (69.2)	27 (75.0)	
Number of medications[a]	4.0 (1.0-10.0)	4.0 (1.0-10.0)	.858
Polypharmacy, n (%)	46 (39.3)	15 (41.7)	.801
Hospital stay, d[a]	**12.0 (4.0-68.0)**	**23.0 (4.0-67.0)**	**.050**
ICU admission, n (%)	**12 (10.3)**	**26 (72.2)**	**<.001**
ICU stay, d[a]	4.5 (2.0-20.0)	6.0 (1.0-28.0)	.925
NRS-2002, n (%)			
At low nutritional risk	**37 (31.6)**	**2 (5.6)**	**<.001**
At increased nutritional risk	**80 (68.4)**	**34 (94.4)**	
EAT-10 score[a]	**0.0 (0.0-40.0)**	**4.5 (0.0-40.0)**	**.005**
EAT-10, n (%)			
Normal	**87 (74.4)**	**18 (50.0)**	**.006**
Oropharyngeal dysphagia risk	**30 (25.6)**	**18 (50.0)**	
Route of nutrition, n (%)			
Oral ± Enteral	**105 (89.7)**	**25 (69.4)**	**.012**
Parenteral	**3 (2.6)**	**5 (13.9)**	
Mixed	**9 (7.7)**	**6 (16.7)**	
Classification of G8, n (%)			
G8 score >14	15 (12.8)	1 (2.8)	.052
G8 score ≤14	102 (87.2)	35 (97.2)	
White blood cell, $\times 10^3/\mu L$[a]	6.9 (2.7-16.0)	7.3 (1.6-14.3)	.658
Lymphocyte, $\times 10^3/\mu L$[a]	1.0 (0.1-3.9)	1.0 (0.2-2.7)	.492
Neutrophil, $\times 10^3/\mu L$[a]	5.2 (1.1-14.5)	5.8 (0.9-13.2)	.573
Hemoglobin, g/dL	12.4 (4.1-16.9)	11.8 (8.0-16.6)	.909
Thrombocyte, $\times 10^3/\mu L$[a]	**204 (35-432)**	**163 (27-144)**	**.041**
Glucose, mg/dL[a]	**128 (35-432)**	**108 (76-303)**	**.050**
GFR, mL/m[a]	**64.8 (4.2-147.6)**	**47.0 (11.7-112.0)**	**.001**
Albumin, g/L	3.6 (2.1-4.5)	3.3 (2.6-4.3)	.073
LDH, U/L[a]	367 (149-1192)	402 (105-1329)	.327

(*continued*)

Table 3. Univariate Analysis of Survivors and Nonsurvivors (*Continued*)

	Survivors n (%) n = 117	Nonsurvivors n (%) n = 36	*P*
C-reactive protein, mg/L[a]	80 (0.6-333)	95 (3.3-300)	.161
Procalcitonin, µg/L[a]	0.1 (0.1-29.9)	0.3 (0.1-31.4)	.273
Ferritin, µg/L[a]	397 (29-2992)	404 (14-1656)	.850
Prothrombin time, s[a]	14.6 (10.6-47.1)	14.5 (11.6-85.2)	.149
INR[a]	1.1 (0.9-1.4)	1.2 (0.9-6.9)	.166
aPTT, s[a]	30.4 (21.5-75.1)	31.8 (21.8-74.1)	.106
Fibrinogen, mg/dL[a]	533 (202-999)	515 (198-877)	.689
D-dimer, mg/dL[a]	0.9 (0.1-20.0)	1.6 (0.1-5.3)	.324
25-OH vitamin D, µg/L[a]	16.2 (3.4-73.8)	14.8 (6.8-36.0)	.818
Vitamin B_{12}, ng/mL[a]	327 (43-2450)	320 (103-2000)	.980

Abbreviations: aPTT, activated partial thromboplastin time; BMI, body mass index; CAD, coronary artery disease; CHF, congestive heart failure; CKD, chronic kidney disease; COPD, chronic obstructive pulmonary disease; CVD, cerebrovascular disease; DM, diabetes mellitus; Eat-10, Eating Assessment Tool 10; G8, Geriatric 8; GFR, glomerular filtration rate; HT, hypertension; ICU, intensive care unit; INR, international normalized ratio; LDH, lactate dehydrogenase; NRS-2002, Nutritional Risk Screening 2002.
Bold values indicates significant values.
[a]Numeric variables are presented as median (minimum-maximum), mean ± SD.

and mortality was found after adjusting by age, sex, and EAT scores.

Viñas et al[26] and Zayed et al[33] reported in different studies that the presence of oropharyngeal dysphagia increased mortality risk approximately 5 times. Oropharyngeal dysphagia can contribute to poor outcomes such as malnutrition, sarcopenia, and frailty, and increased morbidity and mortality in older individuals.In the study by Zayed et al,[33] oropharyngeal dysphagia was observed in 50% of the participants who died. In our

Table 4. Multivariate Logistic Regression Analysis of Risk Factors Associated With Mortality and Oropharyngeal Dysphagia Risk[a]

Mortality	***P***	**HR (95% CI)**
Age	**.003**	1.08 (1.03-1.13)
Sex: male	.317	1.41 (0.72-2.77)
EAT-10 score	**.043**	1.02 (1.01-1.04)
CHF	**.017**	0.40 (0.19 -0.85)
NRS-2002 score	.224	1.14 (0.92-1.44)
Oropharyngeal Dysphagia Risk	***P***	**OR (95% CI)**
Age	**.001**	1.09 (1.03-1.15)
Sex: male	.986	0.99 (0.46-2.12)
In-hospital mortality	.167	1.83 (0.77-4.32)
Severity of COVID-19	**.018**	3.04 (1.21-7.63)

Abbreviations: CHF, congestive heart failure; CI, confidence interval; EAT-10, Eating Assessment Tool 10; HR, hazard ratio; NRS-2002, Nutritional Risk Screening 2002; OR, odds ratio.
Bold values indicates significant values.
[a]Variables included in the model for mortality are age, sex, EAT-10 score, CHF, NRS-2002, severity of COVID-19, glucose, and glomerular filtration rate (GFR). Variables included in the model for oropharyngeal dysphagia risk are age, sex, in-hospital mortality, severity of COVID-19, body mass index, glucose, and GFR.

study, an increase in EAT-score was found to be associated with mortality in a Cox regression analysis (HR: 1.02; $P = .043$).

As in our study, COVID-19 severity was associated with increased oropharyngeal dysphagia risk, similar other research.[12] In our study, an association between increased oropharyngeal dysphagia risk and COVID-19 severity was found likely related to the severity of the infection, like all serious infections, contributing to exacerbation of complications. As expected and found in other studies,[10,11,26] older age is a risk factor for dysphagia risk. Older age is a well-described risk factor for dysphagia due to the presence of comorbidities such as dementia, CVD, malnutrition, polypharmacy, and malignancy.[10,11] Viñas et al[26] reported that older age and increased nutrition risk (identified using NRS-2002) were related to dysphagia. In our study, older age and increased nutrition risk were associated with increased oropharyngeal dysphagia risk in univariate analysis but increased nutrition risk was not related to increased oropharyngeal dysphagia risk in multivariate analysis (data not shown), which may be due to the sample size.

It is known that oropharyngeal dysphagia is a risk factor for older individuals with long COVID.[4,8] Can et al[4] reported that an 85-year-old male patient was hospitalized for aspiration pneumonia 6 weeks after having COVID-19 and due to sarcopenic dysphagia caused by COVID-19. A study about oropharyngeal dysphagia after hospital discharge showed that 7% of patients had EAT-10 scores of 3 and greater 73 days after discharge.[34]Long COVID is both a hospitalization issue and a follow-up concern. For this reason, screening during hospitalization, diagnosing, and treating oropharyngeal dysphagia is necessary both for the patient's quality of life and for the prevention of complications due to dysphagia. Patients with COVID-19 should be screened for long-COVID oropharyngeal dysphagia risk at follow-up visits. The fast and simple EAT-10 questionnaire is suitable for screening. Individuals with long-COVID oropharyngeal dysphagia risk based on EAT-10 may be referred for instrument evaluation (eg, FEES, VFSS). Early recognition and treatment of oropharyngeal dysphagia may prevent many complications such as dehydration, aspiration pneumonia, weight loss, malnutrition, sarcopenia, frailty, disability, rehospitalization, institutionalization, and even mortality.

This study has limitations. First, the study sample was small, which decreased statistical power. Second, to minimize aerosol exposure, we did not obtain data on instrumental evaluations of oropharyngeal dysphagia such as FEES or VFSS. In our study, we preferred the EAT-10 screening test, which has been previously proven to be reliable and applicable in older individuals, does not increase the contamination and the infection risk of health care providers, and is recommended for use in patients with COVID-19.[8,11,35] However, as recommended in many guidelines,[8,9,35] because it is a priority to protect health care workers during the pandemic, oropharyngeal dysphagia assessments should be based primarily on clinical evaluations. Notwithstanding these limitations, to the best of our knowledge, this is the first study to support the predictive role of EAT-10 in older patients with COVID-19.

CONCLUSION

The EAT-10 tool, which incorporates the identification of oropharyngeal dysphagia risk with disease severity, provides rapid assessment for risk stratification in hospitalized older patients with COVID-19. Our findings underline the significance of early oropharyngeal dysphagia risk screening in the setting of COVID-19. Nutrition and oropharyngeal dysphagia interventions may be lifesaving and should be part of standard inpatient COVID-19 treatment for older adults.

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