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Coronavirus disease 2019 status and related anxiety levels in cases undergoing total laryngectomy

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Main Article

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Abstract

Objective. This study aimed to evaluate rate of the COVID-19 disease, its severity, mortality rate and anxiety levels in subjects who underwent total laryngectomy.
Methods. The subjects who underwent total laryngectomy were included in the study. The data were first obtained retrospectively and then a telephone survey was applied. Anxiety levels was evaluated by the Coronavirus Anxiety Scale (CAS).
Results. A total of 54 subjects were included in the study. Nine (16.7%) males were reported to be infected with SARS-CoV-2. Five (55 %) of them were hospitalized; 2 of them (22 %) were taken to intensive care units, and one subject (11 %) died. Although a tendency to increase risk of COVID-19 disease in the tracheoesophageal voice prosthesis users (23.1% vs 14.63%) was observed, statistically difference was not significant. The average total CAS score was significantly higher in those who had COVID-19.
Conclusion. The data documented that people who underwent total laryngectomy developed more frequent and more severe COVID-19 disease and had a higher mortality rate. Although no obvious variable was found, our data suggest that using a tracheoesophageal voice prosthesis may be somewhat effective. Besides, our subjects presented very low anxiety about COVID-19.

Introduction

A new type of severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) was first reported in China and caused a global crisis all over the world. Coronavirus disease 2019 (Covid-19), caused by SARS-CoV-2, is an upper respiratory tract infection, and in some subjects it can cause severe respiratory failure that requires hospitalisation.[1–5] It is known that Covid-19 can spread via aerosol droplets and contact.[6] The health of the upper airway, particularly the nose, has been reported as the first important barrier to the prevention of colonisation of the virus in the body.[7]

Laryngeal cancer is very common in men and total laryngectomy is a mandatory choice for advanced-stage patients.[8–10] In people undergoing total laryngectomy, because the trachea and lower airways are directly open to the outside, the functions of the nose and nasopharynx to warm and humidify the air for respiration and nasal and nasopharyngeal mucociliary activity to prevent incubation of the droplets into the respiratory tract are disabled.[11–13] It therefore could be said that those who have had a total laryngectomy for a longer period of time face a greater risk of Covid-19. In addition, many total laryngectomy patients use voice rehabilitation devices, and their use causes a tracheoesophageal leak and further frequent hand contact with the stoma.[14,15] It is logical to consider that both these examples could be new routes for virus transmission to the lungs.

A tracheoesophageal puncture surgically created for voice restoration can be enlarged, which increases the risk of pneumonia and respiratory complications due to frequent aspiration around the voice prosthesis.[16] It can therefore be hypothesised that droplets containing SARS-CoV-2 more easily reach and cause Covid-19 in those with tracheoesophageal voice prostheses. Moreover, the majority of total laryngectomy patients are known to be smokers, and further co-morbidities have been cited as risk factors for Covid-19, especially more severe disease.[17,18] It is also worth noting that total laryngectomy patients would have visited hospitals regularly during the pandemic period.

It can be assumed that the above-mentioned factors related to total laryngectomy may increase the risk of Covid-19 and even predispose these patients to more severe disease and high mortality. In this study, we aimed to find the rate of Covid-19 and its mortality rate in relation to sex, age, clinical stage, time after surgery, further co-morbidities and speaking method during the pandemic period. Another issue we examined was the subjects' anxiety about Covid-19, considering that high levels of anxiety may lead to increased compliance with protective measures. Hence, we also questioned the levels of the Coronavirus Anxiety Scale in these cases.

Materials and methods

Study design

The study was designed as a retrospective and case–control study. Ethical approval was obtained from the institutional review board of the University Clinical Research Ethics Committee (Decision number: 580). Special approval related to the Covid-19 pandemic was obtained from the Ministry of Health. The study was conducted in compliance with the Helsinki Declaration.

Subjects

Patients who underwent total laryngectomy in a single centre between January 2012 and 11 March 2020, the date of the first Covid-19 case in Türkiye, were included in the study. The exclusion criteria were as follows: those still under chemo- and/or radiotherapy, or suffering from relapse, a secondary malignancy or any local complication of laryngectomy, those with extended laryngectomy to the oesophagus, and subjects who were operated on as a result of non-laryngeal tumours such as thyroid, oesophagus, etc.

Data collection

The subjects' data were obtained from the computer-based hospital data system between June and July 2021. The demographics of the subjects (sex and age), time after surgery, co-morbidities (hypertension, diabetes mellitus, coronary artery disease, cerebrovascular disease, etc.) during the pandemic and the method that they used for speech were noted.

The survey was performed via phone by the same researcher. The subjects who were alive at the study time and the relatives of those who were not alive during the study period were questioned. Help was also received from the relatives of those who could not make phone calls during the survey. They were first informed about the research and the exclusion criteria of the study were established. The researcher asked whether the patients had Covid-19 confirmed by a polymerase chain reaction test. If the answer was positive, the severity of the disease (staged from 1 to 5, as shown in Table 1), additional co-morbidities and duration of hospital stay (if applicable) were obtained. Meanwhile, if the patient or his or her relatives shared medical data regarding the Covid-19 period with the researcher, these data were also used. The anxiety status of the subjects was evaluated using the Coronavirus Anxiety Scale. This is a questionnaire designed by Lee, validated in Turkish, that consists of five items rated on a five-point scale (Table 2).[19–21]

Table 1. Coronavirus disease 2019 status and severity of disease

Status	Description
0	Not infected
1	Mild (asymptomatic, minor symptoms)
2	Mild–moderate (pneumonia, no hospitalisation)
3	Moderate (pneumonia, hospitalisation*)
4	Moderate–severe (pneumonia, hospitalisation**)
5	Severe (follow up in the intensive care unit)

*Hospitalisation for less than two weeks; **hospitalisation for longer than two weeks

Statistical analysis

All data were analysed with SPSS software version 26. The descriptive statistics for the data, frequency and percentage in categorical variables and mean, standard deviation, and minimum and maximum statistics in numerical variables were obtained. The Mann–Whitney U test was used to compare the quantitative data for the independent groups, and the chi-square test and Fisher's exact test were used to compare the qualitative data. A p value less than or equal to 0.05 was considered statistically significant. For measuring internal consistency, the Cronbach alpha test was used. Spearman correlation analysis was performed to determine the correlations between hospital stays and measured data.

Results

A total of 54 subjects were included in the study, 51 males and 3 females. The mean age was 65.02 ± 9.25 years (range, 40–87 years). The mean time since laryngectomy was 61.85 ± 27.07 months (range, 20–117 months) for the whole study group (Figure 1).

It was found that 9 of the 54 subjects (16.67 per cent) had Covid-19 during the pandemic, all of whom were male (17.65 per cent). The mean age of those with Covid-19 was 62.56 ± 6.93 years (range, 52–77 years) and the mean age of those in the Covid-19 negative group was 65.51 ± 9.64 years (range, 40–87 years) (Figure 1). The mean times since total laryngectomy were 58.89 ± 27.52 months (range, 30–114 months) and 62.44 ±27.26 months (range, 20–117 months) in Covid-19 positive and negative subjects, respectively (Figure 1). The statistical analysis revealed that age and time since laryngectomy were not significantly associated with being infected with Covid-19 (Mann–Whitney U test, $p > 0.05$).

The severity of Covid-19, co-morbidities and the voice rehabilitation methods used by patients are summarised in Table 3. Of the 9 cases suffering from Covid-19, 4 (44.44 per cent) with severity stages 1 or 2 were monitored at home. The remaining 5 cases (55.56 per cent) were hospitalised because their disease was more severe (stage 3 or worse). Two of these cases (22.22 per cent) were connected to mechanical ventilation in intensive care and 1 of these 2 cases (aged 58 years) died. The mortality rate of Covid-19 was found to be 11.11 per cent for the entire total laryngectomy group and 20 per cent for the hospitalised patients. The

Table 2. Coronavirus Anxiety Scale

I felt dizzy, lightheaded or faint when I read or listened to news about the coronavirus 0 1 2 3 4
I had trouble falling or staying asleep because I was thinking about the coronavirus 0 1 2 3 4
I felt paralysed or frozen when I thought about or was exposed to information about the coronavirus 0 1 2 3 4
I lost interest in eating when I thought about or was exposed to information about the coronavirus 0 1 2 3 4
I felt nauseous or had stomach problems when I thought about or was exposed to information about the coronavirus 0 1 2 3 4
Score: 0 = not at all; 1 = rare, less than a day or two; 2 = several days; 3 = more than 7 days; 4 = nearly every day over the last two weeks

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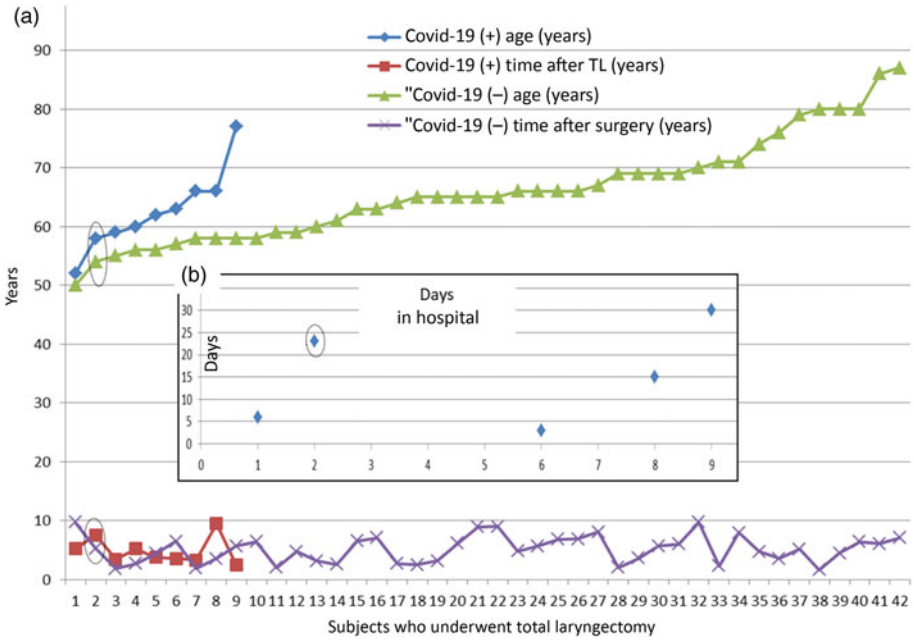

Figure 1. (a) Age (years) and time since laryngectomy (years) for subjects with (Covid-19 (+)) or without (Covid-19 (–)) Covid-19. (b) Number of the days in hospital for patients in the Covid (+) subgroup. The dashed circle indicates the dead subject. Covid-19 = coronavirus disease 2019

average hospital stay was 15.4 days (range, 3–30 days) (Figure 1). The average hospital stay was not correlated with age and time since total laryngectomy (Spearman test, $p > 0.05$), but was correlated with the severity of Covid-19 (Spearman test $r = 0.95$, $p < 0.05$)

Co-morbidities (hypertension, diabetes mellitus, coronary artery disease, cerebrovascular disease, etc.) were detected in 44.44 per cent of the total laryngectomy patients (Table 3). There was no significant difference in the frequency of co-morbidities in the subjects infected with Covid-19 (Fisher's exact test, $p > 0.05$). The subject who died as a result of Covid-19 had no co-morbidity.

As seen in Table 3, 13 subjects (24.07 per cent) used tracheoesophageal voice prosthesis, and the rate of SARS-CoV-2 infection appeared to be higher in tracheoesophageal voice prosthesis users (23.08 per cent) but lower in the other patients (electrolarynx users and oesophageal speakers; 14.63 per cent), although the difference was not statistically significant (x^2 test, $p > 0.05$). One of the patients with tracheoesophageal voice prosthesis was a woman (7.69 per cent), and 4 of 13 cases had co-morbidities (30.77 per cent).

It was found that the Coronavirus Anxiety Scale items were compatible with each other in the Cronbach alpha test, which was used to measure the internal consistency of the Coronavirus Anxiety Scale applied to the subjects ($\alpha = 0.795$). The Coronavirus Anxiety Scale scores were reported as 0 in 37 (69.81 per cent) of 53 total laryngectomy patients (2 of 8, (25 per cent) in the Covid-19 group and 35 of 45 patients (77.78 per cent) in those without Covid-19 (x^2 test, $p = 0.007$)). As seen in Table 4, except for one case with a Coronavirus Anxiety Scale score of 10, none of those without Covid-19 disclosed a higher Coronavirus Anxiety Scale score than 5, while only 2 subjects (3.77 per cent) reported Coronavirus Anxiety Scale scores of 5 or 6 in the Covid-19 group. The mean Coronavirus Anxiety Scale scores were 0.69 ± 1.77 and 2.87 ± 2.17 in those with and without Covid-19, respectively (Mann–Whitney U test, $p = 0.001$) (Table 4).

Table 3. Characteristics of the subjects with total laryngectomy

Characteristic	Total (*n*)	Covid-19 positive						
		Stage 1 (*n*)	Stage 2 (*n*)	Stage 3 (*n*)	Stage 4 (*n*)	Stage 5 (*n*)	Total (*n* (%))	Covid-19 negative (*n* (%))
Gender								
– Male	51	3	1	3	0	2*	9 (17.65)	42 (82.4)
– Female	3	0	0	0	0	0	0	3 (100)
Co-morbidity								
– Yes	24	1	0	2	0	1	4 (16.67)	20 (83.33)
– No	30	2	1	1	0	1*	5 (16.67)	25 (83.33)
Voice rehabilitation method								
– Oesophageal speech	30	2	0	2	0	1	5 (16.67)	25 (83.33)
– Tracheo-oesophageal voice prosthesis	13	1	1	0	0	1*	3 (23.08)	10 (76.92)
– Electrolarynx	11	0	0	1	0	0	1 (9.09)	10 (90.91)

*The subject who died as a result of Covid-19 was in this subgroup. Covid-19 = coronavirus disease 2019

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Table 4. Coronavirus Anxiety Scale scores of subjects who underwent total laryngectomy

Total score	Covid-19 positive ($N = 8$*)** (n)	Covid-19 negative ($N = 45$) (n)	Total ($N = 53$) (n (%))
0	2 (Stage 3)	35	37 (69.81)
1	0	2	2 (3.77)
2	1 (Stage 1)	4	5 (9.43)
3	2 (Stage 3, Stage 5)	1	3 (5.66)
4	1 (Stage 1)	2	3 (5.66)
5	1 (Stage 2)	0	1 (1.89)
6	1 (Stage 1)	0	1 (1.89)
10	0	1	1 (1.89)

*One subject died as a result of Covid-19. **In the subjects infected by SARS-CoV-2, the clinical stage of Covid-19 is shown in parentheses. Covid-19 = coronavirus disease 2019

Discussion

Our data supported the study hypothesis. It was found that those who underwent total laryngectomy were more prone to becoming infected with SARS-CoV-2, and they were predisposed to more severe disease and high mortality. However, age, time after total laryngectomy and the presence of co-morbidities did not reveal any association with the risk and severity of the disease. However, it was clear that all infected total laryngectomy patients with SARS-CoV-2 were males.

The rate of Covid-19 infection for total laryngectomy patients was found to be 16.67 per cent for all groups (17.65 per cent in males) in this study, although Govender *et al.* reported this rate as 2 per cent.[14] However, in accordance with our data, Patel *et al.* declared the rate to be about 19 per cent in those with laryngeal and hypopharyngeal cancer, while the overall Covid-19 incidence was 10.8 per cent compared with 18.8 per cent.[22] The reason why the rate of Covid-19 infection was higher in our study group compared with Govender *et al.*'s data could be related to the date of their study, which was carried out between March 2020 and September 2020, during the first wave of the pandemic. At that time, Covid-19 precautions were stricter, there were quarantine periods and hence the spread of the disease could not be higher. Our study was retrospectively conducted when the Covid-19 epidemic was mostly over. (The Turkish government completely lifted Covid-19-related measures and our phone survey was done later.)

Hence, based on the results of our study, which provides data covering the entire epidemic period, we can say that total laryngectomy can be added to the list of co-morbidities that increase the risk of SARS-CoV-2 infection. (Incidentally, as discussed below, our data revealed that Turkish total laryngectomy patients did not have much anxiety about Covid-19, which could be another reason for the increasing spreading of the disease in the study population; lower anxiety levels might be an indicator of decreased compliance with protective measures.) It is clear that data from a larger series are needed to determine whether total laryngectomy could be included in the list of co-morbid diseases increasing the risk of being infected by SARS-CoV-2. As pointed out before, separation of the upper respiratory tract from the lungs, breathing without nasal protection and opening the trachea to the skin increase the possibility of contracting Covid-19.[13,15]

Our data also indicate that the voice rehabilitation method could be a factor in increasing the risk of transmission of SARS-CoV-2 (14.63 per cent *vs* 23.08 per cent). Heat moisture exchange devices placed in the stoma reduce the risk of both exposure and spread of viruses, especially with virus and bacteria filters.[12,23–25] However, these were not used by the subjects in our study; all of them used their fingers to close the stoma, and frequent hand–neck and/or stoma contact may have increased the possibility of pathogen transmission. As stated by Searl *et al.*, a large percentage of people with a total laryngectomy did not use a heat moisture exchange device, and they could have a greater risk of pathogen contamination.[25]

According to current literature, the mortality rate due to Covid-19 was around 2 per cent,[26–28] but the rate was 11.1 per cent in our series. In a study in which 72 314 patients were analysed in China, the Covid-19 mortality rate was 2.3 per cent and increased to 10.5–7.3 per cent in the presence of a co-morbid disease.[29] This may be due to the relatively small number of subjects in our study. Still, considering the other conditions in the subjects in our study (smokers, alcohol users, co-morbidities, lack of protective barriers in the upper airway, etc.), this higher rate is not surprising. Govender *et al.* found the mortality rate to be 50 per cent in Covid-19 patients[14] and reported that 65 per cent of the infected subjects were hospitalised for Covid-19. According to the literature, approximately 20 per cent of Covid-19 patients are hospitalised and approximately 6 per cent of them require follow up in an intensive care unit.[30–32] In our series, the rate of hospitalisation was 55.56 per cent and the rate for patients being treated in intensive care was 22.2 per cent.

The reason for more severe disease and high mortality in total laryngectomy patients could be related to the fact that the virus is inoculated directly into the lower respiratory tract without passing through any filter. The study carried out by Patel *et al.* supports this hypothesis. In Patel *et al.*'s study, subjects with laryngeal and hypopharyngeal cancer who underwent total laryngectomy had higher pulmonary complication rates due to Covid-19 than cancer patients who did not undergo total laryngectomy.[22] The study also confirmed the relationship between the severity of Covid-19, co-morbidities and age, but our data did not show this.

Covid-19 has posed a serious threat to people's physical health and lives. This situation affected everyone psychosocially and caused psychological destruction.[33] However, according to the data obtained from our study, it is seen that the anxiety state of individuals who had undergone laryngectomy was not very high. This may be due to the timing of our study. This study was conducted when the epidemic was almost over. It is possible to say that the severe shock experienced in the first period of the epidemic disappeared over time. Furthermore, it is possible that the physiological, psychological and social changes that occurred in patients' lives after total laryngectomy masked the burden of the epidemic.[34]

Limits of the study

The subjects we recruited in this study were obtained retrospectively from the hospital data pool after the Covid-19 epidemic was mostly over, and only 54 subjects were evaluated in this study. The retrospective manner, timing and size of the sample are the limits of our study. It is clear that suddenly occurring events, such as the burden of the pandemic, make prospective study designs for special groups almost impossible. Conducting this study at a time when the epidemic was almost

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over was both a limitation and an advantage in terms of seeing the total picture. The timing changed not only the perception of the subjects about the pandemic but also the diagnosis and treatment options of the subjects with Covid-19.

Over time, as diagnosis and interventions for Covid-19 became easier and more successful, the disease was increasingly transmitted to a wider population. However, our data are taken from 54 subjects operated on in a single centre after the pandemic retrospectively presented not only a high risk of being infected with SARS-CoV-2 in those who underwent total laryngectomy but also a severe clinical picture and high mortality for those with total laryngectomy.

The other two technical limitations in our study concerned information about how often the patients visited the hospital during the pandemic and the care patients took to comply with general protective measures during the pandemic. We did not manage to get appropriate information about the former from the subjects and/or their relatives, and the latter point was not addressed in this study.

Conclusion

Compared with general literature information on Covid-19, the data in this study documented that people who underwent total laryngectomy developed more frequent (16.67 per cent) and more severe Covid-19 (hospitalisation rate, 55.56 per cent; stay in intensive care units, 22.22 per cent) and had a higher mortality rate (11.11 per cent). However, they presented very low anxiety about Covid-19 (Coronavirus Anxiety Scale, 1.02), although having Covid-19 increased this score slightly (from 0.69 ± 1.77 to 2.87 ± 2.17). Even those who suffered from Covid-19 disclosed only mild anxiety about the disease. In addition, the data from this study indicate that the risk of Covid-19 may increase in tracheoesophageal voice prosthesis users.

Since laryngeal cancer is one of the most common malignancies, especially in men,[8,10] whether total laryngectomy could be added to the list of co-morbid diseases increases the risk of being infected by SARS-CoV-2, particularly the risk of severe Covid-19, which is important regarding future pandemics. Future studies presenting multicentric data are necessary.

- In people undergoing total laryngectomy, because the trachea and lower airways are directly open to the outside, the functions of the nose and nasopharynx are disabled
- A total laryngectomy can increase the risk of coronavirus disease 2019 (Covid-19) and potentially predispose individuals to more severe disease and higher mortality
- This retrospective study tried to find the rate of Covid-19 and its mortality rate in relation to sex, age, clinical stage, time after surgery, further co-morbidities and speaking method during the pandemic period
- More frequent and more severe Covid-19 with higher mortality rate was found in the our total laryngectomy series
- Some evidence for an increased risk of Covid-19 in total laryngectomy patients with tracheoesophageal voice prosthesis was found

Competing interests. None declared

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