Covid-19 tracheostomized patients in a tertiary hospital: Long-term voice, swallowing and airway outcomes

Original Article

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Abstract

COVID-19 has led to an increase number of tracheotomized patients requiring prolonged mechanical ventilation, whose consequences on voice, swallowing and high airway are poorly known in these patients. The objective of this project was to study them. The 37 COVID-19 patients, hospitalized in an Intensive Care Unit, who had undergone tracheotomy and were subsequently decannulated, between March 2020 and November 2021, were considered. 14 of these patients were included and submitted to an interview, answering questionnaires. 8 of them underwent to endoscopic examination, too. The mean age was 49 years and the male:female ratio was 11:3. The mean time from intubation to tracheotomy was 24 days and 51 days to decannulation. 29% reported swallowing disorders, 14% voice disorders and 29% symptoms indicative of pharyngolaryngeal reflux. 62% of the endoscopies presented alterations. Preliminary results show a high incidence of laryngeal injury but long-term studies are needed, including in non-tracheotomized COVID-19 patients.
Keywords: COVID-19; tracheotomy; voice; swallowing; mechanical ventilation; complications

Introduction

The COVID-19 pandemic is a highly contagious zoonosis caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which is an RNA virus. In most patients, the manifestations of the disease are mild to moderate, with symptoms of fever, cough, nausea, vomiting, and diarrhea. However, it can also significantly affect the lower airways, causing interstitial pneumonia that often requires intensive care.[1] The number of patients admitted to intensive care units (ICU) who need prolonged ventilation has increased exponentially during the COVID-19 pandemic.[2,3] During the pandemic, there

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was a frequent lack of materials and human resources in sufficient numbers to meet the increased needs. Therefore, the normal protocol, which recommends performing tracheotomy approximately 7–10 days after orotracheal intubation to avoid complications and reduce morbimortality, was not followed, leading to a higher number of patients with prolonged intubation.[4-7] In the UK, a study showed that orotracheal intubation was continued for 0–35 days until tracheotomy was performed, while a second study reported a period of 10–40 days.[8] The effects of prolonged intubation on the larynx in tracheotomized patients with COVID-19 include dysfunctions of the voice, swallowing, and the airway. Additionally, vocal cord paralysis may occur, as well as dysphagia, laryngotracheal stenosis, or other lesions such as granulomas of the vocal cords.[9,10] Nevertheless, these effects are still not well known in patients with severe forms of COVID-19.

Thus, this study aimed to study the consequences of prolonged intubation in tracheotomized patients with severe COVID-19 in terms of the impact on the voice, swallowing, and permeability of the upper airway.

Material and Methods

The clinical records of all patients with COVID-19 who were admitted to the ICU of a Portuguese tertiary hospital and underwent tracheotomy (surgical or percutaneous approach) between March 2020 and November 2021 were identified and reviewed.

Of an initial population of 37 patients, 11 were excluded due to death, and four were excluded because although they were positive for SARS-CoV-2, they underwent tracheotomy for another medical condition (polytrauma, stroke, or coma due to other causes).

Of the remaining 22 patients, eight were excluded because they were not reachable by telephone. Six patients out of the remaining study sample (N=14) refused to go to the hospital because they lived far away or wanted to avoid another hospital appointment; therefore, they were only administered a telephone interview. The remaining eight patients underwent face-to-face interviews and consented to undergo flexible endoscopy to assess the upper airway. The patients were followed-up for at least two months after hospital discharge in an outpatient setting. Four questionnaires that have been validated in Portuguese were administered. The Voice Handicap Index-10 (VHI-10)[11,12] and Reflux Symptom Index (RSI) were used to evaluate the patients' perception about their voice/changes in the voice and signs of reflux, respectively.[13,14] To assess the perception about swallowing, the Eat Assessment Tool (EAT-10)[15,16] was administered, while the Functional Oral Intake Scale (FOIS)[16,17] was used by the otorhinolaryngologist who assessed the patient. The eight patients who underwent face-to-face interviews were also administered a test involving swallowing 100 mL of water as fast and as comfortably as possible (Water Swallow Test - WST)[7,18]. The test was timed, and the swallowing speed (ml/s) was calculated as the amount of water swallowed divided by the elapsed time.

Results

The mean age of the 14 analyzed patients was 49 years (range: 27–69 years). Eleven patients were men, and three were women.

Four patients had a history of tobacco use, and none had a history of gastroesophageal reflux disease. Five tracheotomies were performed using the percutaneous technique, and nine were performed by surgical technique, of which eight were performed by an otorhinolaryngologist and one by a cardiothoracic surgeon. The mean number of days under invasive mechanical ventilation (IMV) until tracheotomy (TCT) was 24, and the minimum and maximum days were 6 and 42, respectively. The mean number of days with TCT until decannulation was 51 (minimum of 23 and maximum of 109).

Voice and Laryngopharyngeal reflux

Two patients (14%) reported voice changes in the VHI-10 questionnaire, with a score higher

than 11 (between 12 and 35 points), which is deemed abnormal. Four patients (29%) reported scores higher than 13 points in the RSI questionnaire, indicating the presence of symptoms suggestive of laryngopharyngeal reflux.

Swallowing

Four patients (29%) reported changes in swallowing in the EAT-10 questionnaire, with scores higher than 2, indicating potentially abnormal swallowing. All patients in the study (N=14) had a maximum score of 7 in the FOIS, which indicates a lack of restriction in the total oral intake. The eight patients who underwent a face-to-face interview completed the WST and showed no signs of aspiration. Values of swallowing capacity lower than 10 ml/s[23] were considered abnormal, and five patients had abnormal scores. Two of these five patients also had an abnormal EAT-10 score.

Upper airway

Flexible endoscopy was performed in all patients during consultation (8), and five patients (62%) showed alterations—unilateral paralysis (two patients), thickening (one patient), and granulomas (two patients) of the vocal cords. Table 1 shows the questionnaire results of patients with changes observed in endoscopy.

Discussion

This unique study evaluated the development and progression of laryngeal changes resulting from intubation and tracheotomy procedures performed during the COVID-19 pandemic.

As mentioned above, during the COVID-19 pandemic, the recommended protocol of 7–10 days for orotracheal intubation until tracheostomy was performed was often not followed. This study confirmed this fact, with the mean number of days until tracheostomy was performed being 24 and the maximum being 42. Additionally, decannulation was delayed in these patients, with a mean time of 51 days and a maximum time of 109 days until the cannula was removed. This fact may reflect the severity of the disease, which was associated with difficult decannulation in these patients.

In terms of the effects on the voice and vocal quality, only 14% of the included patients subjectively considered their voice as being abnormal, with a score higher than 11 in the VHI-10 questionnaire, contrary to what would be expected. This may be explained by the fact that the patients themselves minimize the importance of their voice and prioritize other problems that appear as a consequence of severe SARS-CoV-2 infection, such as fatigue, dyspnea, weakness, or exacerbation of pre-existing comorbidities.[19]

Moreover, it would be expected that a substantial number of patients had symptoms related to laryngopharyngeal reflux, given that many were placed in the prone position in the ICU, and laryngopharyngeal reflux has been correlated with worse clinical outcomes in COVID-19.[20] However, only 29% of the patients had a score >13 in the RSI scale (indicative of laryngopharyngeal reflux symptoms).[13] We can assume that the reflux had already resolved at the time of consultation. However, it is essential to evaluate laryngopharyngeal reflux in this population because evidence suggests

Table 1
Questionnaire results of patients with endoscopy changes

Patient	Change on NFLC	WST (ml/s)	EAT-10	RSI	VHI-10
Patient 1	Unilateral paralysis VC	Normal	Normal	Normal	Normal
Patient 2	Unilateral paralysis VC	Decreased	Normal	Altered	Normal
Patient 3	Granuloma VC	Normal	Altered	Normal	Normal
Patient 4	Thickening VC	Decreased	Altered	Altered	Normal
Patient 5	Granuloma VC	Decreased	Normal	Altered	Normal

that it may exacerbate laryngeal lesions.[21]

In this study, four patients (29%) reported dysphagia in the EAT-10 questionnaire, with a score > 2; however, they were already on a normal unrestricted diet (100% with FOIS of 7). This finding is in line with the known discrepancy among the different scales of dysphagia classification.[22] Although their diet was normal, five of the eight patients had abnormal swallowing capacity values in the WST, which are indicative of a physiological anomaly in swallowing. This finding suggests that there is an increased incidence of dysphagia in patients with severe COVID-19 infection. However, as no test results were available from before the patients became infected with COVID-19, it is difficult to draw accurate conclusions. A useful test would be to compare the results of each patient before and after (tracheostomy and prolonged ventilation) COVID-19 infection and prove that the swallowing capacity decreased after COVID-19, after excluding pre-existing conditions. Additionally, age and some comorbidities may interfere with swallowing. Therefore, this test should only be considered in patients without any previous swallowing problems, with the same age, and with no associated comorbidities; however, this was not possible. We subsequently compared our endoscopic results with those in the literature. Brodsky *et al*.[10] conducted a systematic review in 2017 and observed that the incidence of unilateral vocal cord paralysis was 21%, which is in line with the incidence of 25% (two patients) obtained in our study, while the incidence of bilateral paralysis was 2.7%, unlike the 0% obtained in our study. However, all patients included in the systematic review were evaluated within two weeks after extubation, earlier than in this study, and vocal fold mobility probably improved spontaneously with time in some patients. Nevertheless, in the abovementioned study with a sample of 775 patients, the mean duration of intubation was 8.2 days, which differed significantly from the 24 days observed in this study.

One of the limitations of our study is the fact that the time to assess the patients after hospital discharge was not standardized. In other words, although all patients were evaluated for more than two months after discharge, the time between discharge and assessment was not the same for all of them, which may have interfered with the results of the questionnaires and findings of the endoscopic evaluation. Another weakness was the small sample size, which was due to the exhaustion of patients who had been admitted for long periods, and our hospital is a tertiary hospital that offers care to people from a broad area of the country. Therefore, patients who live farther away were reluctant to participate.

Conclusion

The preliminary results of the study show a high incidence of laryngeal lesions among tracheotomized patients who underwent IMV during the COVID-19 pandemic. However, further studies with larger samples and longer follow-up periods are necessary, including in non-tracheotomized COVID-19 patients and control groups (patients without COVID-19) to allow drawing more accurate conclusions.

Conflicts of Interest

The authors declare that there is no conflict of interests regarding the publication of this paper.

Data Confidentiality

The authors declare having followed the protocols in use at their working center regarding patients' data publication.

Protection of humans and animals

The authors declare that the procedures were followed according to the regulations established by the Clinical Research and Ethics Committee and to the 2013 Helsinki Declaration of the World Medical Association.

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Availability of scientific data

There are no datasets available, publicly related to this work.

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