

SARS-CoV-2 tracheitis in laryngectomized patients: a consecutive case-series study.

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Abstract

Key points * SARS-CoV-2 is a possible cause of acute severe tracheitis in laryngectomees. * In our series, the clinical picture was characterized by a hemorrhagic tracheitis with a slow resolution pattern. * We observed a histological pattern of erosive inflammation of the respiratory epithelium. * Planned tracheo-bronchoscopy and tracheal toilettes are recommended to prevent critical obstruction of the airway, which can be fatal in patients with associated impairment of lung function caused by SARS-CoV-2 infection. * The present cases highlight the need for close interdisciplinary working and communication in the management of airway complications of COVID-19 infection.

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- We observed a histological pattern of erosive inflammation of the respiratory epithelium.
- Planned tracheo-bronchoscopy and tracheal toilettes are recommended to prevent critical obstruction of the airway, which can be fatal in patients with associated impairment of lung function caused by SARS-CoV-2 infection.
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Keywords: SARS-CoV-2, total laryngectomy, tracheitis, tracheo-bronchitis, airway obstruction, case series.

Introduction

After total laryngectomy, the changes in the physiology of the tracheal epithelium due to the direct passage of air through the stoma, the loss of nasal warming and humidification and the impairment of the mucociliary clearance may increase the risk of lower respiratory tract infections¹. In retrospective studies, the incidence of lower respiratory tract infections in laryngectomees was, in fact, considerably higher compared to that of adults of the same age². Among these, tracheitis represents a challenging condition, commonly requiring

urgent management and hospitalization, as it can be complicated by significant crusting and recurrent occlusion of the airway.

Total laryngectomy patients represent a unique challenge during the SARS-CoV-2 pandemic. On one hand, they have a potential higher exposure to the contagious nature of SARS-CoV-2 through respiratory droplets and aerosols and a high risk of mortality due to the elderly age, respiratory comorbidities and immunodepression³. On the other hand, they carry a high risk of transmitting viral particles to health care staff through the tracheostoma.

Herein we describe the clinical features of a series of patients, previously subjected to total laryngectomy, who contracted SARS-CoV2 and developed severe tracheitis, focusing on its management, clinical course and histologic features.

Methods

This is a retrospective study performed on patients subjected to total laryngectomy, who were hospitalized at the University Hospital of Modena between September 2020 and January 2021 for acute tracheitis and tested positive for SARS-CoV-2.

Inclusion criteria were the following: patients previously subjected to total laryngectomy; patients who underwent SARS-CoV-2 status assessment by means of a combined nasal and tracheal swab (by reverse transcriptase-polymerase chain reaction [RT-PCR]) and tested positive; patients who required hospitalization; patients whose diagnosis of tracheitis was confirmed by means of an otolaryngologist's evaluation, including fiberoptic tracheoscopy or tracheo-bronchoscopy; patients whose full clinical data were available. Were excluded from the study total laryngectomy patients requiring hospitalization, who developed SARS-CoV-2 infection during their hospital stay (tested negative at admission).

Patients' demographic, clinical and surgical information were retrospectively reviewed from clinical charts. Local Ethics Committee approval for this retrospective study was obtained on December 2020 (576/2020/OSS/AOUMO). Written informed consent to collect deidentified data was obtained from all patients. The study was conducted following the CARE guidelines.

Results

Six patients were hospitalized for tracheitis after total laryngectomy and tested positive for Covid-19 during the reporting period. Five cases were considered eligible and a retrospective analysis of their clinical charts was performed. One patient was excluded for missing clinical data. Detailed clinical and laboratory data regarding the patients is reported in Table 1.

Mean age of patients was 75.2 years (SD=±7.3; range=64-82 years). Total laryngectomy was performed on average 4 years (SD=±3.7; range=1-9 years) before the present hospitalization. None of the patients had a speech prosthesis. All patients were referred to the Emergency Room (ER) of our Institution. The diagnosis of SARS-CoV-2 infection was in all cases concomitant with the ER access. All patients presented with significant Oxygen desaturation at the admission (considered as O₂level < 90%), three patients had fever and cough, one had thoracic pain and one had bleeding from the tracheostoma. In all cases a prompt ENT assessment, including flexible fiberoptic evaluation through the stoma was performed, allowing a diagnosis of tracheitis and aspiration/removal of secretions or crusts. In all patients, a tracheal cannula was positioned at admission. Five patients were hospitalized at the Infectious Disease unit and one at the Pneumology unit. No patient involved in the study needed recovery at the Intensive Care Unit (ICU), except for patient #3 who had a brief ICU stay, concomitant with the rapid deterioration of his conditions.

In four cases a pulmonary involvement was detected whereas in one case, no signs or symptoms of pulmonary involvement were collected during the hospital stay. Bubble-humidified oxygen was provided via mask over the tracheostoma in all cases as well as aerosols administration of mucolytics and hyaluronic acid solutions. In all cases intravenous pharmacological therapy, including wide spectrum antibiotics and high dose steroids, was administered. In 4 out of 5 cases anticoagulants were also indicated.

In three patients, data of microbiologic analysis of the tracheobronchial aspiration material was available, resulting in two cases in a multiagent bacterial superinfection and no infection detected in one case. In four patients, a serological assessment for testing other respiratory viruses (Influenza A virus, Respiratory Syncytial virus, Rhinoviruses, Parainfluenza viruses, Adenoviruses, Bocaviruses and Metapneumovirus) was performed, with negative results.

All patients were evaluated daily by an otolaryngologist to assess the degree of obstruction of the airway and possibly to remove secretions, crusts and tracheobronchial plugs. Four patients showed variable degree of haemorrhagic component of the tracheitis. In three cases a rigid bronchoscopy was required for the management of the airway occlusion and removal of distal bronchial plugs and blood clots (Figure 1). A tracheal tissue sampling was collected in two cases and resulted in an erosive inflammatory pattern at the histopathological analysis (Figure 2).

Four patients progressively improved their general conditions and were discharged after a mean duration of the hospital stay of 32 days. One patient died, 6 days after hospitalization, due to SARS-CoV-2 respiratory complications.

Discussion

As the Covid-19 pandemic progresses, an increasing number of clinical implications of the disease emerge. SARS-CoV-2 infection can severely affect laryngectomees and although this population is rather small, experiences need to be collected regarding their management and clinical course. In the present paper, we described a series of five laryngectomees presenting with tracheitis characterized by a more severe pattern compared to the usual cases of seasonal tracheitis, in terms of both disease duration and management challenges.

Several criticalities were noticed in those patients: the hemorrhagic component, the detrimental role of oxygen therapy on the tracheal mucosa and crusting, the difficulty in ventilating patients with concomitant pulmonary involvement due to the tracheal obstruction and finally the management of tracheo-bronchial obstruction. The latter aspect needs special attention: due to the increased aerosolizing risk, in fact, laryngectomees have the potential to become “super spreaders” and transmitting viral particles to health care staff⁴. When urgent procedures related to bulky obstructing clots are required, the time for disposing proper personal protective equipment may lack. Therefore, we suggest planning a daily precautionary flexible tracheoscopy, to avoid acute airway obstruction, which in the setting of SARS-Cov-2 associated pneumonia can induce a rapid worsening of the respiratory failure in these patients, eventually creating an emergency situation. Moreover, when possible, the avoidance of tracheal intubation permits to reduce further tracheal complications.

Human angiotensin-converting enzyme II (ACE2) has been identified as a functional receptor for SARS-CoV-2. The tracheal epithelium expresses high levels of ACE2 receptors in humans and sustained viral replication in the tracheal epithelium have been showed in ACE2-humanized animal models⁵. Indeed, SARS-CoV-2 RNA and antigens have been identified in ciliated epithelial cells of the trachea and bronchi of infected patients⁶. Also, evidences of acute and chronic tracheitis due to Sars-CoV2-involvement of the tracheal mucosa have been showed in post-mortem histopathologic examination of Covid-19 cases⁷. A previous study by Verger et al.⁸ demonstrated signs of a tracheobronchitis in a COVID-19+ patient, detected by lung scintigraphy. A report by Paderno et al.⁹ described two cases of COVID-19+ laryngectomized patients who presented with respiratory distress due to a concomitant severe pulmonary involvement and tracheal inflammation, who required repeated tracheal toilettes. Similar to our series, one patient had a fatal outcome and the paper focused on the potential higher risk for a worse outcome of this patient’s population; evidences from the present cases allowed us to support these considerations.

Histological samples, collected in two patients, demonstrated a diffuse inflammation along with epithelial erosion. The erosive pattern of Covid-19-related tissue damage has already been described¹⁰: two cases of ulcerative lesions of the epiglottis, subglottis and upper trachea were described in patients with a resolution of clinical, radiological and bronchoscopic characteristics of COVID-19 respiratory disease. This histopatho-

logical aspect, along with the hemorrhagic component, could be partially responsible for the longest mean duration of the disease in these patients, compared to usual post-laryngectomy tracheitis. In the light of the histological features of tracheitis found in our patients, we can hypothesize two mechanisms which can play a role in the hemorrhagic phenotype of tracheitis. Indeed, the erosive mucosal damage associated with the endothelial dysfunction caused by SARS-CoV-2 may explain the airway bleeding in these patients, which can be exacerbated by the use of anticoagulants.

The present cases highlight the need for close interdisciplinary working and communication in the management of airway complications of COVID-19 infection. Careful joint planning between anesthesiologist, pneumologist and ENT surgeons is critical and despite it, this category of patients have a high risk for poor outcome.

The main limitations of the present study are the retrospective design and the small study population, which is related to the rarity of the clinical condition. Nonetheless, in the authors' opinion, the clinical experience in this frail population can be important for improving the management and avoiding critical obstruction of the airway.

Data availability

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions

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Patient N	#1	#2	#3	#4	#5
Age	77	72	82	81	64

Patient N	#1	#2	#3	#4	#5
Years from TL	1	2	7	9	1
OD (<90%)	Yes	Yes	Yes	Yes	Yes
Other symptoms	Fever	None	Fever	Thoracic pain	Fever, active bleeding from trachea
Hospital Ward	Infectious disease	Infectious disease	Infectious disease, ICU	Infectious disease	Pneumology
Pulmonary Hemorrhagic tracheitis	Yes	No	Yes	Yes	Yes
LMWH	Yes	Yes	No	Yes	Yes
Oxygen therapy	Yes	Yes	Yes	Yes	Yes
Microbiology	MSSA + E. Coli	MSSA	-	Negative	Negative
Viral co-infection	Negative	Negative	-	Negative	Negative
Need for invasive procedure in OR	No	Yes (Bronchoscopy)	No	Yes (Bronchoscopy)	Yes (Bronchoscopy)
Tissue Sampling	No	Yes	No	Yes	No
Hospital Stay	5 weeks	5 weeks	6 days	7 weeks	12 days
Outcome	Recovered	Recovered	Dead	Recovered	Recovered

Table 1. Description of the clinical features of patients affected by SARS-CoV-2 tracheobronchitis after total laryngectomy.

N: patient number; TL: total laryngectomy; OD: oxygen desaturation; Other symptoms: other symptoms or signs on admission; Hosp. ward: hospital ward. Pulmonary: SARS-CoV-2 Pneumonia on admission; LWMH: treatment with low molecular-weight Heparin. Microbiology: bacterial cultural test from trachea and bronchi. Viral co-infection: serology and antigenic tests (see text) for associated respiratory viruses. OR: operating room; MSSA: methicillin-susceptible *Staphylococcus Aureus*, E. Coli: *Escherichia Coli*.

Figure Legends

Figure 1. Tracheal plug

Bulky tracheal plug removed from patient #5, the procedure was performed by urgent rigid bronchoscopy.

Figure 2. Photomicrographs of tracheal biopsy

Tracheal biopsy, 10x magnification, hematoxylin-eosin stain. Superficial fragments of squamous epithelium with acute inflammation, neutrophilic granulocyte infiltrate and erosive aspects.

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Tables_25Feb.pdf available at <https://authorea.com/users/401173/articles/513366-sars-cov-2-tracheitis-in-laryngectomized-patients-a-consecutive-case-series-study>



