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COVID-19 survivorship: How otolaryngologist-head and neck surgeons can restore quality of life after critical illness

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ABSTRACT

Mortality from COVID-19 has obscured a subtler crisis – the swelling ranks of COVID-19 survivors. After critical illness, patients often suffer post-intensive care syndrome (PICS), which encompasses physical, cognitive, and/or mental health impairments that are often long-lasting barriers to resuming a meaningful life. Some deficits after COVID-19 critical illness will require otolaryngologic expertise for years after hospital discharge. There are roles for all subspecialties in preventing, diagnosing, or treating sequelae of COVID-19. Otolaryngologist leadership in multidisciplinary efforts ensures coordinated care. Timely tracheostomy, when indicated, may shorten the course of intensive care unit stay and thereby potentially reduce the impairments associated with PICS. Otolaryngologists can provide expertise in olfactory disorders; thrombotic sequelae of hearing loss and vertigo; and laryngotracheal injuries that impair speech, voice, swallowing, communication, and breathing. In the aftermath of severe COVID-19, otolaryngologists are poised to lead efforts in early identification and intervention for impairments affecting patients’ quality of life.

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1. Introduction

December 7, 1941, “A day that will live in infamy” marked the attack on Pearl Harbor – a day of massive, catastrophic loss of life. December 2020 witnessed similar loss of life with each day of the coronavirus disease-2019 (COVID-19) pandemic. This mortality represents the tip of the larger iceberg of COVID-19 survivorship. Even with the promise of widespread vaccination, the aftermath of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection can be crippling, particularly for those who have a severe course of illness requiring mechanical ventilation in an intensive care unit (ICU) [1]. Otolaryngologists play important roles in COVID-19 survivor care and have engaged with the pandemic response from investigating early symptoms of olfactory and gustatory loss to decisions around tracheostomy, airway interventions, and rehabilitation [2].

2. Post-intensive care syndrome (PICS)

To provide optimal care for patients, Otolaryngologists need to understand COVID-19 survivorship after critical illness. PICS encompasses a spectrum of physical, cognitive, and/or mental health impairments experienced by patients after ICU stay that can be long-lasting barriers to resuming a meaningful life [3]. For some post-ICU impairments, a longer duration of critical illness is associated with greater impairment [4]. Timing of tracheostomy is therefore a key consideration [5]. Over 80% of patients requiring mechanical ventilation manifest residual impairments (Fig. 1), many directly relevant to otolaryngology and potentially lingering for years after hospital discharge (Fig. 2) [6].

Patients who survive ICU stays often face profound debilitation—with muscle weakness, memory loss, anxiety, depression, and post-traumatic stress disorder (PTSD). Specifically, prolonged ventilation promotes patient frailty, which can require a very long period of rehabilitation. Laryngotracheal injury impairs voice, swallowing, and breathing. A year after ICU discharge, 34% of patients over age 50 have cognitive impairments similar to a moderate traumatic brain injury; a quarter demonstrate cognitive decline similar to mild Alzheimer’s disease [7]. The joy that families experience when their loved ones survive is often replaced by grim realization that the road to recovery is long and arduous. Otolaryngologists are capable of providing timely diagnosis, education to patients and families, and specialized interventions (Tables 1 & 2).

3. Airway injury

There is growing awareness of device-related pressure injuries and trauma that may arise in COVID-19 patients, resulting in lasting functional impairment. Laryngotracheal injuries include posterior glottic stenosis with resultant vocal cord immobility, vocal fold edema, or posterior glottic ulcerations. More distally, cuff injury may cause subglottic and/or tracheal stenosis. In one study of COVID-19 patients intubated more than 14 days, 14 of 30 (47%) patients had transmural tracheal erosion resulting in pneumomediastinum, pneumothorax, and tracheoesophageal fistulas [8]. Laryngeal injury is linked to duration of intubation [9], size of endotracheal tube, and difficulties with endotracheal tube insertion. Intubation can be more challenging due to reduced visualization or personal protective equipment that impedes communication. Otolaryngologist input into optimal tracheostomy timing and multidisciplinary care may decrease laryngeal injuries and expedite both early diagnosis and intervention [5].

Abbreviations: PICS, post-intensive care syndrome; ICU, intensive care unit.

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Fig. 2. Role of Otolaryngologist-Head and Neck Surgeons in COVID-19 survivorship. Abbreviations: PTSD, post-traumatic stress disorder.

Table 1
Delineation of otolaryngology domains related to COVID-19 survivorship.

| Subspecialty Area                  | Impairments                                      | Management                                      |
|------------------------------------|--------------------------------------------------|-------------------------------------------------|
| Comprehensive Otolaryngology       | Prolonged ventilator dependence                  | • Proactive tracheostomy timing (avoid delays)   |
|                                    |                                                  | • Post-tracheostomy care, suctioning             |
|                                    |                                                  | • Decannulation protocols                       |
|                                    |                                                  | • Multidisciplinary airway leadership           |
| Laryngology                        | Laryngotracheal injury                           | • Laryngeal and vocal fold repair/reconstruction|
|                                    |                                                  | • Voice and swallowing rehabilitation           |
|                                    |                                                  | • Surgical management of posterior glottic and  |
|                                    |                                                  | subglottic/tracheal stenosis                     |
| Rhinology, Skull Base, and Allergy | Loss of taste and olfaction                      | • Objective testing of taste and olfaction      |
|                                    |                                                  | • Olfactory training                            |
|                                    |                                                  | • Topical corticosteroids sprays and rinses     |
| Otology and Neurotology            | Vertigo, hearing loss                            | • Audiometry                                    |
|                                    |                                                  | • Vestibular testing                            |
|                                    |                                                  | • Amplification, cochlear implantation          |
| Facial Plastic & Reconstructive    | Iatrogenic pressure injuries and facial palsies | • Alar necrosis from feeding tubes              |
|                                    |                                                  | • Perioral/comissure injury                      |
|                                    |                                                  | • Tracheostomy scar revision                    |
|                                    |                                                  | • Facial nerve rehabilitation                   |
| Head & Neck Oncology               | New and deferred cancers, double survivorship   | • Reconditioning of patients for surgery        |
|                                    |                                                  | • Catch-up surveillance for cancer survivors    |
|                                    |                                                  | • Managing surgical, chemoradiation and ICU-related morbidity |
| Cross-functional considerations    | Mental health, quality of life, and preventing relapse| • Mitigate stigma and psychological sequelae |
|                                    |                                                  | • Consultation of mental health professionals  |
|                                    |                                                  | • Addressing sleep, hallucinations, and PTSD    |
|                                    |                                                  | • Education on vaccination, risk of recurrence  |
|                                    |                                                  | • Engage family, acknowledge caregiver burden    |

Abbreviations: ICU, intensive care unit; PTSD, post-traumatic stress disorder.
4. Voice and swallowing

Dysphonia and dysphagia are common impairments associated with weakness and deconditioning of aerodigestive muscles; acute laryngotracheal insults might exacerbate such impairments [2]. Dysphagia is much more common than dysphonia in COVID-19 patients; it may be associated with otolaryngologic symptoms—dyspnea, ear pain, facial pain, throat pain, or nasal obstruction. Aspiration pneumonia, a complication of dysphagia, is among the main reasons for hospital readmissions and mortality post-ICU, highlighting the importance of laryngeal and dysphagia evaluation (e.g., using flexible endoscopic evaluation swallowing).

5. Hearing loss and vertigo

Neurologic involvement is common in COVID-19. Although literature is limited, neurotological manifestations including ataxia, dizziness, imbalance, tinnitus, and sensorineural hearing loss have been observed [10–13]. Intralabyrinthine hemorrhage—similar to pulmonary and cerebrovascular microhemorrhages attributed to COVID-19 associated coagulopathy—may be responsible for persistent hearing and balance disturbances [14]. Awareness of inner ear symptoms is paramount to prompt screening and timely management with oral and intratympanic steroids. Patients with persistent balance disturbances in addition to cognitive impairment are at significant risks for falls and might benefit from vestibular therapy.

6. Taste and smell

New-onset taste and smell disorders are well-recognized symptoms of COVID-19, affecting over 60% of patients [15,16]. SARS-CoV-2 entry is mediated via Angiotensin Converting Enzyme 2 (ACE-2) and Transmembrane serine protease 2 (TMPRSS-2) receptors present throughout the olfactory cleft, with associated inflammatory disruption of the nervous system via nasal olfactory fibers [17]. Symptoms often persist for 4–6 weeks, affecting patients’ overall quality of life [18–20]. While early studies demonstrate a high rate of spontaneous resolution, the residual 10% with persistent olfactory dysfunction underscore the tremendous need for improved treatment options [21]. Rhinology expertise in post-viral olfactory disorders is critical for the continued development of objective screening measures and treatments for these debilitating sequelae [22].
Multidisciplinary Approach to COVID-19 Survivorship

Fig. 4. Multidisciplinary engagement in care of patients with COVID-19 during and after intensive care unit stay.

7. Multidisciplinary care

In the acute phase of illness, preventative measures to minimize risk of airway injuries, such as endotracheal tube cuff pressure monitoring, airway assessment, and proactive identification of underlying causes of dysphagia or dysphonia, may reduce long-term complications (Fig. 3) [23,24]. Otolaryngologists can partner with the multidisciplinary critical care team, including speech-language pathologists, nurses, respiratory therapists, and intensivists, to guide timely diagnosis and treatment of airway injuries (Fig. 4) [25].

8. Implications for the future

Data science, machine learning, and biosensor technology will play increasingly prominent roles in patient care, ranging from early detection of physiological indicators of disease to timing for tracheostomy and other interventions to diagnosis and treatment of laryngotracheal injury or other manifestations of PICS. Prospective data registries, such as RegENT (www.entnet.org/content/reg-ent-1) and Global Tracheotomy Collaborative (www.globaltrach.org), provide platforms for data collection and analysis, risk adjustment, or future clinical prediction [1,26]. Otolaryngologists play a critical role in multidisciplinary efforts to facilitate high-quality recovery care and to improve COVID-19 patients’ quality of life.

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CRediT authorship contribution statement

| Author name                  | Contribution                                                                 |
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| Martin B. Brodsky, PhD, ScM, CCC-SLP | Conceptualization; Data curation; Writing - original draft; review & editing. |
| Emily P. Brigham, MD         | Conceptualization; Data curation; Methodology; Writing - review & editing.   |
| Ann M. Parker, MD, PhD       | Conceptualization; Data curation; Writing - review & editing.                |
| Alexander T. Hillel, MD      | Data curation; Formal analysis; Methodology; Writing - original draft; review & editing. |
| Joshua M. Levy, MD, MPH      | Data curation; Formal analysis; Methodology; Writing - original draft; review & editing. |
| Christopher H. Rassekh, MD, FACS | Conceptualization; Writing - original draft; review & editing.              |
| Anil K. Lalwani, MD          | Conceptualization; Writing - original draft; review & editing.               |
| Dale M. Needham, MD, PhD, FCPA | Conceptualization; Data curation; Formal analysis; Methodology; Writing - review & editing. |
| Michael J. Brenner, MD, FACS | Conceptualization; Data curation; Formal analysis; Methodology; Writing – review & editing; supervision; review & editing. |

Declaration of competing interest

The authors discern no conflicts of interest; however to ensure to uncomprensive disclosure, we list the relationships above.

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