Speech-language and swallowing management of COVID-19 patients: A Narrative Synthesis

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Abstract

The virus COVID-19 was defined on 11th February 2020 by the International Committee on Taxonomy of Viruses as "Acute Respiratory Syndrome from Coronavirus 2 (SARS-CoV-2)" (WHO 2020). The COVID-19 pandemic was declared by the WHO on 11th March 2020. At the beginning of 2020, the first cases were tracked in Italy, however the spread of the virus increased from February 2020 (ISS 2019). The clinical symptoms of SARS-CoV-2 range from flu symptoms to severe respiratory disorders associated with a fatal outcome (WHO 2019, Zhang Y 2020, Zhu N 2020). The management of the virus requires hospital network, including local and hub hospitals as well as health care professions. Speech therapists contributed to the management of patients with COVID-19 from acute to rehabilitative setting. This document aims to share the experience of the Italian speech therapists directly involved in the emergency, describing clinical features, diagnostic and therapeutic procedures relating to the management of dysphagia in patients with Covid-19.

Keywords: Covid-19, dysphagia, post extubation dysphagia, assessment, rehabilitation

Description of Covid - 19:

The virus was discovered analyzing genome sequencing, polymerase chain reaction (PCR), and culture of bronchoalveolar lavage fluid obtained from sick patients. This virus, the 7Th coronavirus which infects humans, presents 75-80% genomic similarity with the severe acute respiratory syndrome coronavirus (SARS-CoV), 50% with the Middle East respiratory syndrome coronavirus (MERS- CoV) and 96% with a bat coronavirus. The cell receptors, the angiotensin-converting enzyme II ACE2, are the same of SARS-CoV (Arabi et al., 2020).

The virus is transmitted in a multimodal way; direct (air transmission from aerosols: "droplets nuclei"), and indirect (through contaminated objects or surfaces).

Droplets are particles consisting of water, large enough to quickly settle on a surface, showing a diameter> 5μm. Droplets remain in the air for shorter periods of time than aerosols (Pasnick et al., 2020). Transmission via droplets usually occurs when a person is in close contact (within 1 meter) of an infected person with respiratory symptoms (such as coughing or sneezing). In these circumstances, the droplets can reach the mouth, nose or eyes of a sensitive person causing them to become infected.

Aerosol particles are smaller (usually <5μm) than droplets, they could last in the air hours, they can disperse over long distances and spread through ventilation systems (WHO 2020).

COVID - 19 pneumonia

The clinical spectrum of COVID-19 pneumonia ranges from asymptomatic to mild and critical cases. Patients with mild disease could

present fever, dysgeusia, anosmia, and dry cough, followed by respiratory secretions and fatigue. Anosmia and ageusia are common and could occur in the absence of other clinical features (Ellul, 2020). Sepsis, respiratory failure, acute respiratory distress syndrome, heart failure and septic shock are commonly seen in critically ill patients.

The risk factors include advanced age, neutrophilia, organ dysfunction, coagulopathy, and elevated D-dimer levels. (Liang et al., 2020). Severe disease progression is often associated with the development of acute respiratory distress syndrome (ARDS). Acute respiratory distress syndrome is characterized by diffuse damage of the alveolar capillary membrane, resulting in protein-rich non-cardiogenic pulmonary edema (accumulation of fluid in the lung), accompanied by evidence of pulmonary fibrosis including interstitial thickening, coarse reticular patterns, parenchymal bands and acute respiratory failure (ARF). For this reason pneumonia in Covid-19 is defined as interstitial pneumonia (Raghu & Wilson, 2020). Radiological examination showed bilateral pulmonary infiltrates caused by the increased permeability of the alveolar-capillary membranes.

The definition of severity in compliance with the WHO directive (interim Guidance January 20, 2020) adopted by the National Institute for Infectious Diseases Spallanzani

MILD FORM: patient with pneumonia (clinical and radiological diagnosis) but without signs of a severe picture

SEVERE FORM: fever and suspected respiratory infection, plus one of RF> 30 apm, dyspnea, Spo2 <90% in ambient area

VERY SEVERE FORM ARDS: radiological picture of bilateral interstitial engagement and PaO2 / FiO2 <300

Neurological symptoms associated with COVID-19

A recent article outlines that although the most common and important symptoms of the disease are respiratory, reports of neurological manifestations in COVID 19 disease are growing. Their neuropathogenesis seems to be caused by both nonspecific disorders of systemic disease and direct effects of viral infection and inflammation of the nervous and vascular systems. Therefore, the neurological diseases associated with COVID-19 includes nonspecific impairments such as hypoxic encephalopathy and critical care neuropathy as well as para-infectious and post-infectious encephalitis, states of hypercoagulability leading to stroke and acute neuropathies such as Guillain-Barré syndrome (Ellul, 2020; Varatharaj et al., 2020).

One way of SARS-CoV-2 to access the brain is through the olfactory bulb, which is the only part of the central nervous system not protected by the dura madre. This is recognized one of the causes of the anosmia in COVID-19 (Ellul, 2020; Li et al., 2020; Varatharaj et al., 2020). Alternative access routes include transport across the blood-brain barrier, following viraemia, or through infected leukocytes (Desforges et al., 2020).

Post-Extubation Dysphagia

In literature, it is well recognized that endotracheal intubation, associated with the duration of mechanical ventilation, can lead to dysphagia. Intensive care patients (ICU) are particularly exposed to this risk after extubation, also due to the possible residual effects of drug sedation (de Larminat et al., 1995). The prevalence of dysphagia increases by 56% for patients intubated longer than 48 hours and 25% of dysphagic patients present silent aspiration (Ajemian et al., 2001). The etiopathogenetic mechanisms in the dysphagia of patients undergoing oro-tracheal intubation are: oro-pharyngeal-laryngeal trauma, neuromuscular deficits, reduction of laryngeal sensitivity, reduction of the sensitivity of the oropharyngeal tract, gastroesophageal reflux disease (GERD), breathing and swallowing incoordination (Frajkova et al., 2020).

Oropharyngeal trauma is due to several causes releted to methods of intubation and extubation, the endotracheal tube characteristics and duration of intubation (Ajemian et al., 2001). There is a broad evidence that intubation could cause inflammations, hematomas and ulcerations from oral cavity to pharyngeal-laryngeal structures (Macht et al., 2013), (Kim et al., 2019) (Christensen & Trapl, 2018). In addition, it is well recognised that it may causes granulations, paresis of the vo-

cal cords (Brodsky et al., 2018). Accordingly, the European Laryngological Society recently warned about the possibility of increased stenosis and granulations due to prolonged intubation times in patients with COVID-19 (Piazza et al. 2020).

The side effects of the endotracheal tube and sedation and long-term use of neuromuscular blocking agents are reported to impede the movements of the laryngeal and pharyngeal muscles (Rassameehiran et al., 2015; Zuercher, Moret, Dziewas, et al., 2019). Neuromuscular weakness leads to incoordination of muscle complexes during the act of swallowing (Brodsky et al., 2018; Brodsky & Gilbert, 2020; Dziewas et al., 2020).

The symptoms of impaired swallowing function include pain and/or cough during swallowing, the proprioception of food and gurgling voice after swallowing or the sensation of regurgitation (Zuercher, Moret, & Schefold, 2019). The lack of stimulation of the oro-pharynx during swallowing and breathing causes a deficit in the sensitivity of chemoreceptors and mechanoreceptors located in the mucous membranes of the pharynx and larynx (Braz et al., 2018). The receptors are involved during swallowing and coughing.

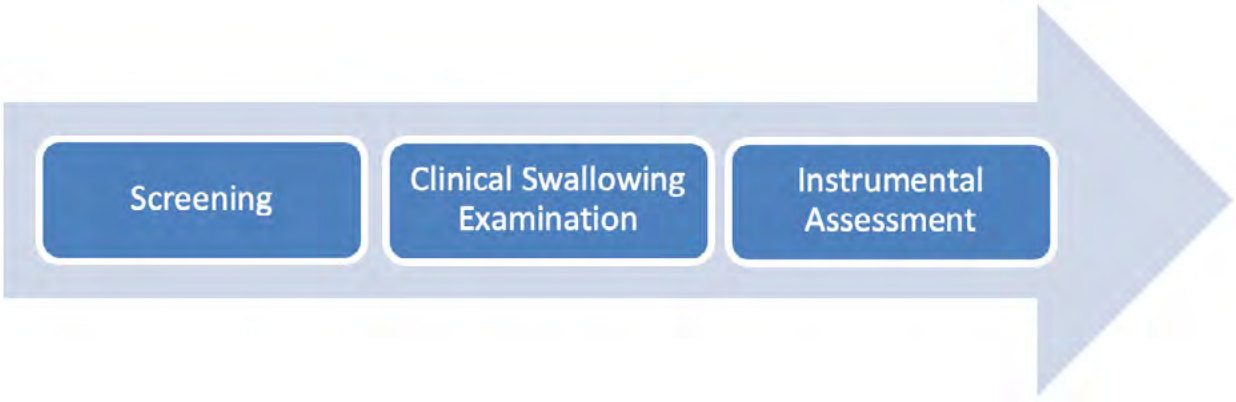
Furthermore, the occurrence of nasogastric tube (SNG), supine/pronation position could cause GERD reflux. It is defined as a reverse flow of gastric contents through the esophagus, and it can occasionally reach the pharynx (Mendell & Logemann, 2002). It determines an irritation of the pharyngeal laryngeal mucous membranes which results in laryngitis, ulcers from contact, granulations, strictures, laryngeal carcinoma (Macht et al., 2013) further exposing them to dysphagia risk.

The speech and language management of COVID-19 patients

The speech therapist played a fundamental role in weaning process enteral and / or parenteral nutrition (Amitrano, 2003). To date, it is not clear if the swallowing problems in patients with Covid19 are the direct expression of the viral infection or the consequence of the damage that the virus causes to the organs involved in swallowing. Nevertheless, it is largely documented that patients undergoing oral intubation and mechanical breathing are at high risk of developing swallowing disorders. Moderate and severe dysphagia after extubation is associated with the risk of re-intubation, aspiration pneumonia and death. (Zuercher, Moret, & Schefold, 2019).

Swallowing Assessment

The evaluation of swallowing is normally divided into three distinct phases: the Screening, the Clinical Swallow Examination (CSE) and the instrumental evaluation.



These swallowing assessments in Covid 19 patients are recognized as aerosol generating procedure associated with high risk of contagiousness (Canelli et al., 2020, Bolton et al., 2020). Therefore, using specific and validated scale for assessing dysphagia is fundamental in this population. Recent studies show the evidence of the implementation of specific screening tests for the assessment of swallowing in patient post-intubated. In the

following sections, the scale for assessments are described.

Screening tests are designed to be rapid (approximately 15 minutes), relatively non-invasive, and low risk to the patient. (Donovan et al., 2013; Logemann et al., 1999). They aim to identify population at risk of dysphagia which requires further evaluation. The screening tests must have a sensitivity of 80% or more, in order to identify the patient at risk of dysphagia. The specificity, on the other hand, can be about 50% or more, in order not to detect false positives (Donovan et al., 2013). The literature recognizes that the nurse is the heal-care professional designed to perform the swallowing screening, who must be properly trained (Daniels et al., 2015). The main screening tests for critically ill post intubated patients are the following:

1. Gugging Swallowing Screen-ICU (GuSS-ICU) is an adaptation of the original Gugging Swallowing Screen (GuSS). The GuSS-ICU contains specific evaluation elements for the patient admitted to the ICU, (for example Richmond Agitation and Sedation Scale and Confusion Assessment Method for ICU) (Christensen & Trapl, 2018).
2. Nurse-Performed Screening (NPS)(See et al., 2016) derives from the adaptation of "The Massey Bedside Swallowing Screen" (Massey R., et al., 2002). The NPS is administered as early as 1 hour after extubation when the patient is alert, cooperating and his peripheral basal saturation is maintained at least at 90% (SpO2> 90%). It consists in the administration of 5 mL of water with a teaspoon, observing signs of dysphagia (cough or wet voice) and it continues with the administration of 60 ml of water (See et al., 2016).
3. Post Extubation Dysphagia screening (PEDs) has 5 sections: "Assessment", "Alert level", "Assessment of respiratory status", "Symptoms and devices". The oral intake test consisted of the 90 mL water swallow test (WST). Patients who do not pass the screening are not allowed anything per os until the speech therapy evaluation (Johnson et al., 2018).
4. Yale Swallow Protocol (YSP). screening is divided into 3 steps. The first step requires that the patient is alert, has control of the head, no tracheostomy. If these parameters are met, step 2 investigates orientation and the ability to execute simple commands through simple questions. Step 3 consists of the administration of 30 mL of water from a cup or straw without interruptions (Ward et al., 2020).
5. Bernese ICU Dysphagia Algorithm is a pragmatic diagnostic algorithm, not yet validated. This algorithm is structured in 2 phases: a) Safety check, in which the state of alertness, collaboration, attention, posture, motility of the structures, respiratory state, airway protection maneuvers, saliva management and voice quality are investigated. b) If the above criteria are met, specialized nurses then perform the Water Swallow Test (Zuercher et al., 2020)

Positive patients at screening test are referred to Clinical Swallowing Examination (CSE) which is usually carried out by the speech and language therapist. The value of CSE has been recently described by Garand et al. 2020. They highlighted the role of CSE in depicting the whole picture of swallowing impairments (Garand et al., 2020). The CSE, indeed, allows to assess the primary constructs of the International Classification Function and Disability (WHO, 2001) which includes: (a) body structure and function, (b) activity and participation and (c) personal and environmental factors (WHO, 2001).

In patients with covid-19, the clinical assessment of motility, sensitivity and function of the oral- laryngeal- pharyngeal structures should be performed using validated protocols whereas the instrumental swallowing examination should not be carried out. The cranial nerve assessment is mandatory in this population, which could be assessed using the I&I test. This test is a validated tool which investigated the sensitivity and motility of the cranial nerves involved in the swallowing (Koch et al., 2015). Several systematic reviews and guideline suggested to undertake FEES or VFS only for life-threading events caused

the proximity and aerosol generating risk are higher than in CSE (Schindler et al. 2020).

The most recent guideline recognized the instrumental swallowing assessments such as video-fluoroscopic swallow study (VFSS) and flexible endoscopic evaluation of swallowing (FEES) should be performed only if a potential life-threatening event, although they are the gold standard for swallowing (Bolton et al., 2020; Brodsky & Gilbert, 2020; Mattei et al., 2020; Mohan & Mohapatra, 2020; Namasivayam-MacDonald & Riquelme; Schindler et al., 2020). The main reason is that they are higher aerosol generating procedures than screening and clinical swallowing assessments (Brodsky & Gilbert, 2020; Schindler et al., 2020).

Hence, the examiner should adopt the appropriate PPE (Bolton et al., 2020) as the CSE is included among the aerosol generating procedures (AGPs) (ASHA 2020). During the CSE there are two main risks: 1) the patients do not use the mask and the examiner is closed by; 2) patients could cough. In particular, the clinicians should pay attention on the presence/absence of cough as prolonged intubation could cause the inhibition of the cough receptions and so increase the risk of silent aspirations.

Speech and Language Treatment

The swallowing treatment should be tailored based on the results of the assessment and also on personal and emotional factors. There is no evidence of specific treatment for dysphagia in people with post-extubation syndrome and covid-19. Nevertheless, the speech and language therapist management should adopt compensatory maneuvers such as changes consistency of the food and modify posture (Langmore et al. 2017) in order to prevent worsening of the pulmonary infections. When the patient is negative, the speech and language therapist should plan a specific rehabilitation protocol in order to increase the recovery of swallowing impairments.

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