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Case Report

Post-COVID-19 paradoxical vocal cord movement and dysfunctional dysphonia: A clinical case

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ABSTRACT

Introduction: Post-COVID persistent dyspnea linked to a paradoxical vocal fold movement has rarely been described, and it has never been described as associated with dysfunctional dysphonia.

Case study: We present a case of a 46-year-old patient with severe COVID-19 history who presented to our hospital for persistent cough, dysphonia, and **intermittent episodes of dyspnea, getting worse when speaking**. A chest **computed tomography (CT)** scan done was normal. The patient was treated by empiric bronchodilators with inhaled corticosteroids but without any improvement. A bronchoscopy was done and revealed spontaneous paradoxical vocal fold movement and dysfunctional dysphonia. The patient was referred to a speech therapist, and her problem was resolved.

Conclusion: Resistant dyspnea to empiric treatment, after COVID-19, should suggest the diagnosis of paradoxical vocal fold movement. Laryngoscopy should be done to confirm the diagnosis, and the patient should be referred to a speech therapist.

1. Introduction

In the era of COVID-19, physicians noticed variable neurological morbidity. Post-Coronavirus disease-19 (COVID-19) paradoxical vocal fold movement has rarely been described in the literature [1,2]. To the best of our knowledge, it has never been reported in association with dysfunctional dysphonia.

Here we present a case of a post-COVID-19 patient with both paradoxical vocal fold movement and dysfunctional dysphonia.

2. Case presentation

A 46-year-old jobless patient presented with a persistent cough, dysphonia, and intermittent dyspnea to our university hospital. She does not have any previous respiratory disease in her medical history, a nonsmoker, with a history of type 2 diabetes and arterial hypertension. She was diagnosed with a severe COVID-19 infection three months ago. She required hospitalization for one month and was intubated for severe hypoxia for only three days. The patient was treated with corticosteroids during hospitalization and for ten days after discharge. She did not need Oxygen at home and had a negative control **polymerase chain reaction (PCR)** after two months.

The dysphonia appeared one week after extubation; her dyspnea appeared two weeks after, **dysphonia occurred during dyspnea**

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episodes. The patient's dyspnea was inspiratory, intermittent, lasting less than an hour, occurring several times during the day, and sometimes triggered by strong odors. On physical examination, she had diffuse inspiratory and expiratory wheezing, without any physical sign of acute respiratory distress, neither intercostal retraction nor polypnea. The patient's dysphonia was severe: his voice was inaudible, low, and monotonous, and she had difficulty pronouncing all the words. The Voice Handicap Index 10 (VHI-10) score was used to measure the functional impact of dysphonia and was 31/38. The patient had a persistent cough. A chest **computed tomography (CT)** scan was done, then repeated two weeks after, with tracheal reconstruction, and was found to be normal. The patient was treated with empirical bronchodilators and inhaled corticosteroids without improvement.

Bronchoscopy was performed and revealed adduction of the vocal cords on inspiration, spontaneously, without provocative maneuver, (**Figure 1**), concomitantly with inspiratory dyspnea. When the patient spoke, the anteroposterior diameter of the vestibule decreased, and the ventricular bands got closer, so the vocal cords were impossible to see. **Figure 2** There were no indirect signs of gastric reflux: no laryngeal or tracheal mucosa hyperemia. The bronchoscopy was otherwise normal, and it allowed us to eliminate tracheal stenosis and post-intubation laryngeal granuloma. Finally, the patient was diagnosed with paradoxical vocal fold movement and type 4 dysfunctional dysphonia of the Koufman's classification. The patient was then referred to an otolaryngology specialist who performed a laryngoscopy and confirmed the diagnosis. She was referred for speech therapy, and her symptoms completely disappeared after 3 months of follow-up.

3. Discussion

Laryngeal complications of the post-COVID-19 syndrome, **are common and have already been described in the literature: unilateral vocal cord paralysis (the most frequent especially after intubation), vocal cord congestion and ventricular hypertrophy**, glottic stenosis, subglottic stenosis, subglottic granulation tissue, laryngopharyngeal reflux, muscle tension dysphonia were the most reported abnormalities [3,4]. The occurrence of paradoxical vocal fold movement disorder (PVFMD) after acute COVID-19 is rare, **Leriche et al. and Aviv et al. have described PVFMD in non-hospitalized COVID-19 patients, highlighting it through direct visualization of the vocal cords (by videolaryngostroboscopy or flexible laryngoscopy).** [1,2] **Note that the dyspnea or shortness of breath described in patients in the articles already mentioned was persistent, which contrasts with the case of our patient who noted intermittent dyspnea.** To the best of our knowledge, PVFMD association with dysfunctional dysphonia has never been described before.

Paradoxical vocal fold movement is adduction of the vocal cords during inspiration or, less frequently, expiration [5–7]. The patient may present with dyspnea, cough, inspiratory stridor, husky voice, or even aphonia [5–7]. A misdiagnosis can lead to unnecessary urgent intubation or tracheostomy [5,7]. The diagnosis is made on flexible laryngoscopy, which eliminates bilateral paralysis of the vocal cords and allows visualization of their adduction during inspiration [5,7]. When respiratory function testing is done, the peak inspiratory flow is low spontaneously during an attack or after provocation with physiological saline serum [6–8].

Common causes may be laryngopharyngeal reflux, asthma, sinusitis, post-nasal drip, various irritants (tobacco, dust, pollutants), post-extubation, and general anesthesia [1,5–9]. Treatment of an acute attack lies in the administration of anxiolytic or heliox [5,8]. A panting maneuver can be used, ending the crisis by activating the posterior cricoarytenoid muscle, an abductor of the vocal cords [5,8]. Corticosteroids and bronchodilators give minimal improvement [8]. Speech therapy is the best treatment [5,8]. Biofeedback, psychotherapy, and self-hypnosis are also described as alternative treatments [5,8].

Few cases of post-COVID-19 paradoxical vocal fold movement are published in the literature [1,2]. This association can be explained by a viral neuropathy of the vagus nerve and its recurrent laryngeal branch [1,2]. Indeed, there are few cases in the literature describing viral neuropathy of the vagus nerve, especially following infection with human metapneumovirus, influenza, and

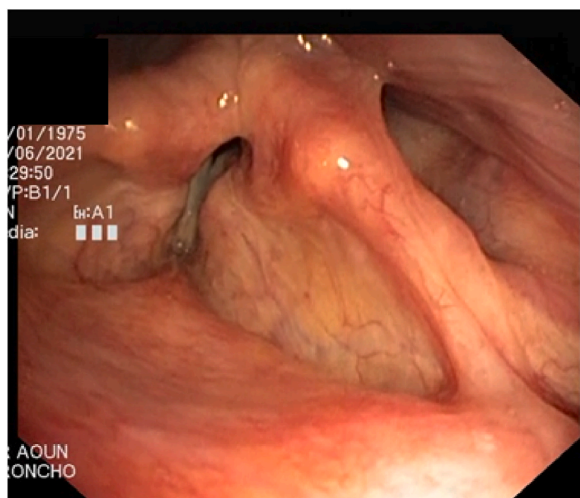


Fig. 1. Paradoxical Vocal Fold Movement, closure of the vocal folds during inspiration.

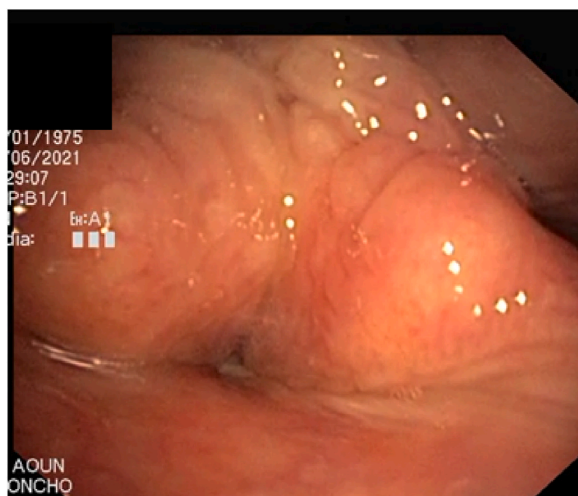


Fig. 2. Dysfunctional Dysphonia, adduction of the vocal cord on inspiration.

picornavirus [5,6,10]. On one hand, the coronavirus has a neuro-invasive power since several cases of mononeuritis have already been described [11–13]. On the other hand, we know that Angiotensin-converting enzyme 2 (ACE2) receptors in the vocal cords are a potential gateway for this virus [8,13,14]. Therefore, the existence of viral vagus neuropathy secondary to coronavirus seems plausible [1,2,14]. In our patient's case, there are no potential known causes explaining a paradoxical vocal fold movement such as laryngopharyngeal reflux or asthma, thus reinforcing the hypothesis of a viral vagus neuropathy to coronavirus.

Dysfunctional dysphonia is an alteration of the vocal function of the larynx without any anatomical or organic cause [15,16]. It is classified either according to the presence (complicated dysfunctional dysphonia) or absence (simple dysfunctional dysphonia) of a secondary lesion of the larynx, or either hyperkinetic or hypokinetic aspect the larynx [15,16]. Hyperkinetic dysfunction dysphonia is the most common and named by Morrison muscle tension dysphonia [16]. Koufman described four possible aspects of hyperkinetic dysfunctional dysphonia on laryngoscopy [16].

The vicious cycle of vocal forcing (vocal abuse or misuse) is the only theory that explains dysfunctional dysphonia [15,16]. Several triggering factors led to this vicious cycle. First, organic factors: excessive voice use with vocal fatigue, frequent yelling, tonsillitis, acute laryngitis, excessive cough, and intubation [15]. Then, psychological factors: professional, family, or some professions in which speaking is a must are risk factors for dysfunctional dysphonia [15]. Treatment lies in speech therapy [15].

Dysfunctional dysphonia seems frequent after acute COVID-19. [3] Few authors have explained this association, inflammation of the upper airways, cough by laryngeal irritation, and intubation [14]. These are all the entry points in the vicious cycle of vocal forcing. The psychological factors that are so important in the long COVID-19 should not be underestimated.

There is an additional explanation. The surgical mask reduces the voice intensity by 3–4 dB and the N95 mask by 12 dB [17]. This could be an additional entry point into the vicious cycle of vocal forcing caused by the constant use of a higher voice to make oneself understood [14]. It has been shown that healthcare workers have more voice disorders when wearing a permanent mask during the COVID-19 pandemic [18].

Our patient had all these risk factors potentially explaining the occurrence of dysfunctional dysphonia.

Our case's originality lies in the association between paradoxical vocal fold movement and dysfunctional dysphonia in a post-COVID-19 patient. To the best of our knowledge, this association has never been reported in the literature before.

The VHI-10 score can assess the burden of dysfunctional dysphonia on daily life [19]. This impact could be important in the post-COVID-19 era. A threshold of 11 has been described in the literature [19]. Our patient presented a score of 31, underlining the significant impact on her daily life. The impact of such diseases on the rehabilitation of post-COVID-19 patients is still unknown. Therefore, new studies must confirm the association between paradoxical vocal fold movement and long COVID-19.

4. Conclusion

We reported the case of a patient who had a paradoxical vocal fold movement and dysfunctional dysphonia after recovering from COVID-19 pneumonia. Non-resolution of dyspnea despite empiric treatment and a normal chest CT scan should suggest a paradoxical vocal fold movement diagnosis, and lead to laryngoscopy to confirm the diagnosis [2]. This will enable an early and appropriate treatment by referring the patient to a speech therapist [5,8].

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Declaration of competing interest

The authors declare that there are no conflicts of interest.

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