IRRITANT VOCAL CORD DYSFUNCTION AND OCCUPATIONAL BRONCHIAL ASTHMA: DIFFERENTIAL DIAGNOSIS IN A HEALTH CARE WORKER

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Abstract
Objectives: Vocal cord dysfunction (VCD) is an uncommon respiratory disease characterized by the paradoxical adduction of vocal cords during inspiration, that may mimic bronchial asthma. The pathogenesis of VCD has not been clearly defined but it is possible to recognize non-psychologic and psychologic causes. The majority of patients are female but, interestingly, a high incidence of VCD has been documented in health care workers. A misdiagnosis with asthma leads to hospitalisation, unnecessary use of systemic steroids with related adverse effects, and sometimes tracheostomy and intubation. In a subset of VCD patients, the disease can be attributed to occupational or environmental exposure to inhaled irritants.

Materials and Methods: We report the case of a 45-year-old woman, working as a nurse, who complained of wheezing, cough, dyspnoea related to inhalation of irritating agents (isopropylic alcohol, formaldehyde, peracetic acid). She underwent chest radiography, pulmonary function assessment both in the presence and in the absence of symptoms, bronchial provocation with methacholine and bronchodilation test with salbutamol to recognize asthma's features, allergy evaluation by skin prick tests and patch tests and video-laryngoscopy.

Results: VCD diagnosis was made on the basis of video-laryngoscopy, that visualized the paradoxical motion of the vocal cords during symptoms, in the absence of other pathologic processes.

Conclusions: This case fulfills the proposed criteria for the diagnosis of irritant VCD (IVCD). This is the first report of VCD onset following exposure to several irritants: formaldehyde, glutaraldehyde, isopropylic alcohol, peracetic acid-hydrogen peroxide mixture. These substances are used as cleaning and antiseptic agents in healthcare settings and some ones can also be found in many indoor environments. A correct diagnosis is important both to give the appropriate treatment and for medical legal implications.

Key words: Vocal cord, Asthma, Irritant

INTRODUCTION

Vocal cord dysfunction (VCD) syndrome, which is due to inappropriate movement of vocal cords during inspiration with resultant airflow limitation [1,2], is an uncommon disorder of the larynx that may mimic or coexist with bronchial asthma [3]. Wheezing, dysphonia, choking feeling, throat tightness, stridor, dyspnoea, suprasternal and neck muscle retraction, anxiety and cough are typical symptoms of VCD [4–6]. Wheezing, in particular, is typically monophasic, in contrast to asthma wheezing, which is polyphasic. The pathogenesis of VCD has not been clearly defined but it is possible to recognize non-psychologic and psychologic
cases. Among the first ones are neurologic disorders [7], gastroesophageal reflux (GER) [5,8] and post-nasal drip syndrome [9], whereas the other ones include depression, anxiety and subconscious conversion reaction [7,10]. The majority of patients are female between the second and fourth decade of life, but the syndrome is also common among children and adolescents. Interestingly, a high incidence of VCD has been documented in health care workers [11,12]. Fast and appropriate diagnosis of VCD is very important because a misdiagnosis with asthma leads to hospitalisation, unnecessary use of systemic steroids with related adverse effects, and sometimes tracheostomy and intubation as a result of severe dyspnoeic crisis [13]. The diagnosis is essentially based on the careful collection of the clinical history elements, the exclusion of alternative/similar disorders, and the close collaboration with pneumologists and otorhinolaryngology (ORL) specialists. Patient education, speech therapy to decrease laryngeal muscle tone and psychologic counselling are the therapeutic tools for treatment [1,4,14]. In some patients, during acute attacks, the administration of helium and oxygen seems to relieve the symptoms [15].

In a subset of VCD patients, the disease can be attributed to occupational or environmental exposure to inhaled irritants [16]. The pathogenesis of VCD, and of irritant-induced VCD (IVCD) in particular, has not yet been defined.

MATERIALS AND METHODS

We report the case of a 45-year-old woman, working as a nurse in a general hospital, who was hospitalised with a history of dyspnoea, cough and stridor that lasted for several months. In particular, the patient reported her symptoms began approximately one week after moving to a gastroenterology unit, where she was in charge of cleaning endoscopy instruments with products containing irritants, such as peracetic acid, sodium hypochlorite, formaldehyde, glutaraldehyde and isopropyl alcohol (40/50 washes a day). The cleaning cycle consists of the following steps: a) washing with cleansing agents (isopropyl alcohol), b) rinsing, c) disinfection of the lumen of the endoscopes with products containing formaldehyde or glutaraldehyde and then with peracetic acid-hydrogen peroxide mixture, d) rinsing, e) cold chemical sterilization by isopropyl alcohol and hydrogen peroxide. All these activities were carried out for 8 hours a day, Monday to Friday every week, in the absence of environmental air aspirators. The first episode, which included headache and throat tightness, quickly evolved into cough with cyanosis, inspiratory stridor and dyspnoea. These symptoms also occurred at home when using house-cleaning products, and even when the patient was permanently relocated to another hospital unit. An antiasthmatic therapy with inhaled budesonide (80 μg bid) was started, following a spirometry suggesting a minimal upper airway obstruction.

Due to the persistence of symptoms, the patient was admitted to our clinical setting with a suspicion of occupational asthma [17], in order to undergo a complete diagnostic procedure. On admission day, routine blood and urine tests, as well as the levels of total IgE (79.6 kU/l), were in the normal range. The patient had no history of chronic rhinitis, angioedema or sinus infection. A concurrent pulmonary flogistic process, hyperinflation or peribronchial thickening were ruled out by chest radiography. A complete spirometric test, including the evaluation of alveolo/capillary diffusion capacity (DLCO) and emogas analysis, was carried out. Although spirometric manoeuvres were often hampered by closing glottis episodes, in association with cough (Fig. 1), static lung volumes (VC, RV, TLC)
aspecific inflammatory process. Sputum examination was performed at a time when the patient was currently symptomatic and in the presence of ongoing exposure, at least to some of the chemicals that were able to trigger symptoms. Chest physical examination performed in the presence of symptoms did not detect the typical asthmatic wheezing. On the other hand, a stridor was detected by auscultation on the trachea. Based on our instrumental results, a diagnosis of bronchial asthma could not be confirmed and a VCD syndrome was suspected. We did not perform a specific inhalation challenge with glutaraldehyde, or with the other chemicals to which the patient was exposed, because she did not show any of the functional and inflammatory features of bronchial asthma.

ORL examination, excluded alterations of nasal mucosa, nasal polyps, submucosal oedema and nasal discharge. A papilloma on the soft palate was found.

RESULTS

Video-laryngoscopy examination (after provocation by appropriate respiratory manoeuvres) revealed an adduction motion of the vocal cords during the inspiratory cycle, with a typical posterior chinking of the glottis (Fig. 3), as usually observed in the VCD syndrome. Considering the
initial suspicion of asthma and the psychologic component often described for VCD, the patient underwent CBA (Cognitive Behavioural Assessment) psychological test, that gave normal results. Thus, an important psychogenic component of the dysfunction seemed unlikely.

Based on video-laryngoscopic findings and on clinical and occupational history, a diagnosis of occupational irritant-induced VCD (IVCD) was made. The patient was advised to avoid irritant exposure both in the working and non-working environment. Furthermore, she was addressed to speech therapy rehabilitation sessions for laryngeal relaxation and psychological counselling.

DISCUSSION

VCD is an under-recognized disorder, initially described by Dunglison in the first half of XIX century [18], affecting more people than previously thought.

This is the first report of VCD onset following exposure to several well-known irritants, namely formaldehyde, glutaraldehyde, isopropyl alcohol, peracetic acid/hydrogen peroxide mixture, sodium hypochlorite vapour. These substances are widely used as cleaning and antiseptic agents in healthcare settings and some ones (e.g. formaldehyde and isopropyl alcohol) can also be found in many indoor environments. These irritants are recognized as a possible cause of asthma [19–21]. Very few cases of IVCD have been described so far [16,22]. In 1996 Perkner et al. [16] reviewed eleven cases of VCD attributable to occupational irritant exposure and prepared a list of clinical criteria for IVCD: 1) absence of prior VCD or laryngeal disease, 2) onset of symptoms after a single specific exposure or accident, 3) exposure to an irritant gas, smoke, fume, vapour, mist or dust, 4) onset of symptoms within 24 hours after exposure, 5) symptoms of wheezing, stridor, dyspnoea, cough, or throat tightness, 6) abnormal direct laryngoscopy for VCD and 7) exclusion of other vocal cord diseases. Our case meets all diagnostic criteria proposed in that study.

Since in VCD patients clinical history may often mimic bronchial asthma, pulmonary function tests are usually performed in the diagnostic assessment of these patients. Technical evaluation of spirometry must be particularly careful, in order to avoid misinterpretation of functional data. A strict compliance with the ATS criteria for spirometry standardization [23], together with flow-volume curve morphologic analysis may help to avoid misleading conclusions.

Some IVCD causing agents can be encountered both in the working and domestic environment. In our case, the patient did not show a clearly positive stop-resume work test because of irritant exposure at home, mainly related to the presence of bleach and isopropyl alcohol in home cleansing products, stain removers and deodorants. Besides hindering the identification of the occupational cause of the disease, the widespread diffusion of some irritants can also complicate the management of the diagnosed cases. The patients should be given detailed directions on how to avoid unexpected or even inadvertent exposure to substances that can trigger their symptoms.

Although the pathogenesis of VCD is not elucidated, the temporal association between the onset of symptoms and irritant exposure in IVCD suggests a direct inflammatory effect on the vocal cords. The paradoxical adduction of the vocal cords during inspiration has been found to be associated with reddening, oedema, when histamine was used as a provoking agent [24]. By analogy, the irritants involved in our IVCD case may cause local laryngeal inflammation. For example, formaldehyde and glutaraldehyde are highly water-soluble irritants of the mucous membranes in the upper respiratory tract.

The biological plausibility of irritant exposures as a cause of VCD is further supported by evidence in the medical literature that irritants cause other diseases of the upper airways. Occupational laryngitis has been reported after exposure to certain chemicals. Many irritants in the workplace are known to cause occupational rhinitis, and the lower airways can become hyperreactive after irritant exposure, leading to occupational asthma without latency period [25].

The involvement of immunologic mechanisms, that has been explored and finally excluded in the case of VCD induced by Eucalyptus exposure [22] seems unlikely in our case as well. In fact, some chemicals to which our patient was exposed can act both as irritants and sensitisers, but
the triggering of VCD by anyone of them suggests a non-specific mechanism.
Although asthmatic patients can have normal spirometry between symptomatic episodes, normal airflow in a dyspneic and wheezing patient should raise the index of suspicion for VCD masquerading as asthma. The flow-volume loop may provide additional clues to the diagnosis of VCD, although, in our case, the classic truncation of the inspiratory portion was not much evident. Further studies are needed to elucidate the mechanisms leading to IVCD and its similarities and differences with irritant-induced asthma and rhinitis.

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REFERENCES
