



Differential diagnosis in paradoxical vocal fold movement (PVFM): An interdisciplinary task[☆]



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ABSTRACT

Objectives: The objective of this study was to contribute to the discussion of differential diagnosis in paradoxical vocal fold movement (PVFM), a disorder frequently associated with episodes of breathing difficulty and stridor. Because of analogous respiratory symptoms, PVFM is often misdiagnosed as asthma. Additional evidence suggests the association of factors such as respiratory struggle during physical exertion, digestive reflux, and respiratory allergies with PVFM, particularly in athletes and young females. Interdisciplinary attention is warranted to avoid unnecessary utilization of medical resources and potential delay in the application of proper treatment.

Methods: A description of critical points in PVFM differential diagnosis is proposed, featuring the assessment of a seven-year-old female with a history of behaviors considered to exacerbate voice fatigue symptoms. Noticeably, the child has consistently demonstrated tiredness and respiratory difficulties during physical education classes. Past use of oral steroids to reduce respiratory problems was applied with no improvement; short-acting beta 2-agonists have been also tried with mild improvement. Indications of instability and effort associated with respiratory–phonatory functions were demonstrated.

Furthermore, there was evidence of GERD and seasonal allergies.

Results: The literature suggests an association of factors such as respiratory struggle during physical exertion, unwanted vocal effort, GERD, and respiratory allergies in individuals with PVFM, particularly in young females. A diagnosis of PVFM was suggested, in association with paradoxical vocal folds motion caused by respiratory difficulties verified by laryngeal examination.

Conclusions: In PVFM, the vocal folds adduct during inhalation, thereby restricting the airway opening. Inconsistent vocal folds movement during phonation may also lead to PVFM symptoms. Acute bronchospasm/asthma-like symptoms, as well as additional morbidity may impact accuracy of diagnosis, leading to unnecessary use of asthma medications and office/emergency room consultations.

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1. Introduction

Voice production requires a synchronized action of complex respiratory and phonatory functions that culminates in the voice sound perceived by the listener [1]. An abnormal respiratory–phonatory movement may lead to a puzzlingly disorder associated with episodes of breathing difficulty and stridor [2]. In paradoxical vocal fold movement (PVFM), also called vocal cord dysfunction (VCD), the vocal folds adduct during inhalation, thereby restricting the airway opening [3,4].

PVFM is a complex disorder of the larynx that has been increasingly identified in the pediatric population, particularly in association with athletic activities [2]. Signs, symptoms, and comorbidity associated with varied etiologies pose a challenging mission in pursue of an accurate diagnosis leading to an efficient recovery [3].

1.1. PVFM and asthma

Respiratory difficulties related to asthma are relatively common in medical practice [5]. Narrowing and mucus presence in the airways can make breathing difficult, triggering symptoms such as shortness of breath and wheezing [3,6–8]. Although PVFM involves airway obstruction at the laryngeal level associated with inspiratory stridor, its characteristics are often misperceived as asthma symptoms, which involves bronchoconstriction of the

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lower airway associated with expiratory stridor [4,5]. Comorbidity of PVFM and asthma has also been reported, representing an additional diagnostic challenge. Differential diagnostic procedures should be applied in such cases, particularly when conventional asthma treatment does not produce expected respiratory relief [3,4].

1.2. PVFM and GERD/LPR

Reflux-related episodes may act as PVFM precipitators [2,3,8]. While in gastroesophageal reflux disease (GERD) the contents of the digestive tract reflux to the esophagus, laryngopharyngeal reflux (LPR) involves acid reflux traveling beyond the upper esophageal tract reaching the larynx or pharynx [2].

There are indications of a high incidence of GERD and LPR comorbidity in PVFM [7]. Acid reflux has been identified as triggering reactive laryngeal symptoms such as vocal folds adduction and apnea, which can also lead to bronchial constriction [2,8,9]. It is believed that the effect gastric fluids on supraglottic chemoreceptors leads to stimulation of reflexes mediated by the Vagus nerve causing respiratory obstruction [10,11].

Accordingly, gastroenterological conditions that may contribute to PVFM should be verified with application of meticulous assessment such as pH monitoring, combined with thorough examination of medical history. Self-reported aspects are commonly considered in GERD and LPR, and may be assessed by examination of medical reports and with the application of systematic instruments such as the reflux symptom index [12]. LPR has been pointed out as a commonly related trigger of PVFM [13]. While it is important to consider reports of symptoms, reflux occurrences termed silent may lack typical patterns such as episodes of heartburn [3]. Additional diagnostic confirmation may involve a course trial of aggressive antireflux therapy [3]. Associated complaints including hoarseness, swallowing difficulties, chronic cough, and throat clearing indicate a need for extended investigation using laryngeal imaging and ph documentation [9].

Successful pharmaceutical approaches to treat LPR reported in the literature indicate that a course of proton pump inhibitors every 12 h in low dosage for approximately four weeks should be effective. A long-term high-dose treatment may be needed in some cases [10,14,15].

1.3. PVFM and psychogenic factors

Non-organic factors, such as emotional stress and other psychological aspects have been associated with PVFM [9]. Somatoform underlying causes including emotional responses to anxiety, social strain, and previous psychiatric diagnoses were reportedly linked to PVFM episodes [2,15,16]. Additionally, pressed exercising and competition stresses involved in athletic activities have also been connected with PVFM [6,17,18]. Conversely, recurrent symptoms of dyspnea and choking sensation augments stressful feelings [19].

It has been pointed out that, because PVFM involves aspects related to function of the autonomic nervous system, a diagnosis involving psychogenic factors should be approached with caution [19]. Hence, while comorbidity involving somatoform disorders such as anxiety, panic, and depression may occur in PVFM, it is also possible that they are consequences rather than causes of persistent respiratory problems [20].

1.4. PVFM and allergies/upper airway sensitivity

Inflammation and exudation sometimes present in allergy conditions such as sinusitis have been linked with PVFM [21]. Reported evidence of triggers of PVFM in the literature

includes respiratory tract irritants such as airborne pollutants, dust, smoke, and odors [20–22].

1.5. Differential diagnosis

Despite past efforts, etiology of PVFM is still somehow poorly understood [4]. Appropriate and timely treatment of PVFM requires accurate diagnosis. Episodic restricted airflow, unwanted respiratory sounds, and anxiety feelings may be confused with respiratory and psychological conditions [4]. Furthermore, comorbidity of various underlying conditions adds to the challenge.

Consequences of treating unrecognized PVFM as other disorders such as asthma and anxiety disorders are reported in the literature, ranging from mild recurrent inconvenient symptoms to threatening emergency situations involving hospitalization and tracheostomy [8]. Furthermore, individuals with PVFM may be exposed to overmedication, with no effective results [6–8].

Although behavioral approaches involving respiratory and phonation techniques may be applied in controlling attacks in general [19,22], successful treatment recommendations and referrals should be based on comprehensive etiological diagnosis. Treating underlying causes and coexistent conditions is critical for an optimal prognosis. The variety of techniques and duration of therapy should be individualized according to underlying causes, identified through careful evaluation.

1.6. Evaluation of PVFM

Delivering effective services are contingent on careful examination of all aspects involved, which includes characteristics demonstrated as well as background history [19]. Therefore, PVFM evaluation should encompass a detailed clinical description of the patient involving all aspects that could contribute to the airway disturbances such as evidence of allergies and psychogenic factors, pulmonary tests, and laryngoscopic observation, as well as functional voice assessment [23].

The primary method in PVFM assessment involves visualization of laryngeal activity through transnasal flexible laryngoscopy (TFL). PVFM signs and symptoms may be provoked through effortful behavior such as fast breathing, alternating vowel emission and sniffing, coughing, throat clearing, and loud phonation as well as physical exertion using for example a treadmill or a stationary bike [3]. Standard results reveal adduction of the vocal folds during breathing, frequently accompanied by a posterior glottal chink [19]. These typical laryngoscopic findings have been consistently described in association with PVFM episodes, although negative results throughout examination in absence of signs and symptoms of PVFM have also been reported [3,5]. Moreover, individuals who have LPR-induced PVFM may present normal laryngeal movement during some examinations [3]. Hence, normal laryngeal exam in the absence of symptoms does not exclude PVFM diagnosis [24]. Furthermore, while asymptomatic periods are associated with normal laryngeal function, abnormal vocal folds movement between PVFM attacks may indicate exacerbation of the disorder.

Although laryngoscopic methods are well established as fundamental in PVFM diagnosis, attempts to pinpoint voice quality impairments associated with the disorder have been pursued, using perceptual and objective methods [25,26]. Evidence of abnormalities associated with PVFM include reduced maximum phonation time (MPT), phonation range, and maximum phonation time (MPTs) as well as elevated perturbation measures (i.e., jitter and shimmer) in comparison with healthy controls [26–28]. Deterioration in voice quality in association with PVFM can be detected even between acute episodes [25,29]. Past research demonstrating differences in voice performance among asymptomatic patients

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