

Use of videography in the diagnosis of exercise-induced vocal cord dysfunction: A case report with video clips

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Key words: Vocal cord dysfunction, videography, exercise-induced asthma, exercise-induced vocal cord dysfunction

A picture is worth a thousand words...but a video can be priceless.

—Anonymous

Allergists and pulmonologists frequently encounter patients with exercise-induced asthma (EIA). The majority of these patients are successfully treated without the time or expense of a formal exercise challenge test. However, a subset of these patients will not respond to usual therapy and may therefore create a diagnostic challenge.

One of the conditions that may mimic EIA is vocal cord dysfunction (VCD). VCD is defined as a paradoxical adduction of the true vocal cords primarily during inspiration. This leads to varied clinical presentations including acute wheezing, stridor, dyspnea, throat or chest tightness, and cough. Although VCD was first described in the 19th century and has been associated with hysteria and psychiatric conditions, Christopher et al¹ were the first to present a series of patients treated for severe asthma who were documented to have VCD instead. Newman et al² showed that VCD occurred in a high percentage of patients with refractory asthma admitted to a tertiary center. Many patients had developed iatrogenic complications because of an incorrect diagnosis and the use of asthma medications for prolonged periods. Many of these patients also had multiple emergency department visits and hospitalizations requiring intensive care admissions. Although some patients clearly have only VCD or asthma, both conditions may coexist in the same patient.² Patients with suspected EIA who do not respond to traditional asthma therapy

Abbreviations used

EIA: Exercise-induced asthma

EIVCD: Exercise-induced vocal cord dysfunction

VCD: Vocal cord dysfunction

can present a diagnostic dilemma, leading physicians to consider a diagnosis of exercise-induced vocal cord dysfunction (EIVCD). EIVCD is defined as a type of VCD in which competitive exercise induces paradoxical closure of the true vocal cords, causing similar symptoms to EIA. This syndrome has been reported in elite athletes, especially early in a competitive event, leading to more respiratory difficulty during inspiration than expiration.^{3,4} In contrast, EIA usually occurs after more sustained exercise and causes primarily expiratory wheezing. In evaluating for EIVCD, an exercise challenge with flow-volume loops may show the characteristic pattern of a flattening or clipping of the inspiratory loop when the patient is symptomatic (Fig 1). However, a negative challenge test does not rule it out. The gold standard for the diagnosis of VCD is visualization of the vocal cords in the symptomatic patient (see this article's [Video Clip E1](#) in the Online Repository at www.jacionline.org) performed by a clinician skilled in rhinolaryngoscopy.¹⁻⁸ Laryngoscopy reveals paradoxical vocal cord movement, especially during inspiration (see this article's [Video Clip E2](#) in the Online Repository at www.jacionline.org). However, arranging a challenge such as this may not always be easily coordinated logistically with an exercise laboratory and may not be readily available in some hospitals. Moreover, not every patient with EIVCD can be provoked into symptoms by treadmill running or bicycle ergometry. Studying these patients during actual competition would be ideal and has been attempted in rare instances.^{3,5}

Videography has been successfully used in the homes of patients with suspected obstructive sleep apnea.⁹ This is less expensive than a formal overnight sleep study and may aid in the diagnosis of obstructive sleep apnea while saving considerable healthcare costs. However, no studies to date have reported the use of videography outside the hospital to aid in the diagnosis of EIVCD.

The following case report focuses on an elite athlete who presented with the diagnostic dilemma of suspected

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Disclosure of potential conflict of interest: The authors have declared that they have no conflict of interest.

Received for publication March 2, 2007; revised April 4, 2007; accepted for publication April 6, 2007.

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J Allergy Clin Immunol 2007;119:1329-31.

0091-6749/\$32.00

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doi:10.1016/j.jaci.2007.04.007

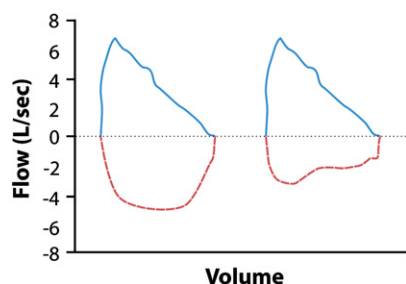


FIG 1. Two flow-volume loops demonstrate the types of changes that may be seen in a subject with symptomatic vocal cord dysfunction. The loop on the *left* displays a normal contour for both the expiratory (*blue continuous line*) and inspiratory (*red dashed line*) portions of the loop, whereas the effort on the *right* reveals blunting or flattening of the inspiratory portion of the loop. This blunting is not seen when subjects are asymptomatic (flow-volume loop on *left*).

EIA, unresponsive to traditional asthma therapy. All commonly used diagnostic evaluations failed to prove that she had EIVCD. Only after her father provided her physician with a videotape (with audio) of her swimming competitively was the diagnosis established. Parental videography (see this article's [Video Clip E3](#) in the Online Repository at www.jacionline.org) of their daughter's competitive sport proved to be an inexpensive and convenient tool that helped to establish a diagnosis. This is the first report in the literature in which videography in the setting of competition has helped document symptoms and aided in establishing a diagnosis.

CASE REPORT

A 15-year-old white female competitive swimmer presented to the allergist's office with a 2-week history of "difficulty breathing and wheezing" occurring only during swimming. She had no previous history of any chronic or recurrent respiratory symptoms. Use of albuterol and sodium cromoglycate via metered dose inhalers alone and in combination did not help when used before swimming. Her review of systems was entirely negative, and her physical examination was only significant for mild nasal congestion. Spirometry showed supernormal flows with a normal flow-volume loop. She also had a normal chest x-ray.

Because the patient was scheduled for competition to qualify for junior nationals within a few days of her initial evaluation, she was placed on a trial of fluticasone propionate (44 μ g) and salmeterol xinafoate, both delivered by metered-dose inhalers. Two puffs of each were given every 12 hours through a valved holding chamber. She continued to have difficulty breathing when swimming despite this therapy. Subsequent evaluation included a normal sinus computed tomography scan and echocardiogram. She also had a negative methacholine challenge. An exercise challenge (treadmill) monitored by tests of lung function and followed by rhinolaryngoscopy showed

no change in flows, normal flow-volume loops, and normal vocal cord anatomy and motion.

After discussing her normal test results with her parents, the patient's father suggested review of a videotape demonstrating her respiratory symptoms that developed within minutes of commencing swimming might be helpful. The videotape revealed what appeared to be EIVCD with inspiratory stridor (see this article's [Video Clip E3](#) in the Online Repository at www.jacionline.org). The patient underwent a speech therapy evaluation with therapy provided by the Speech Department, completely resolving her problem after 2 visits. Follow-up years later revealed that she never had subsequent problems with EIVCD while swimming competitively throughout high school or college.

DISCUSSION

Differentiation between EIA and EIVCD may present clinicians with a difficult diagnostic dilemma, especially when elite athletes are being evaluated.^{3,5,10} The standard to prove the diagnosis of EIVCD is a formal exercise challenge test with pulmonary function tests and flow-volume loops followed by rhinolaryngoscopy.^{1-8,10} The patient is generally challenged on a treadmill or with bicycle ergometry in a pulmonary function laboratory. However, in some patients, especially elite athletes, neither form of challenge may adequately simulate their exact stimulus to reproduce symptoms. It may be that the conditions required to induce symptoms include the competitive environment of their actual sporting event.³

Although it has been suggested in previous studies that actual exercise challenge of patients in the field should be attempted, this has not commonly been used.^{3,5} Making the diagnosis in 2 of the patients reported by McFadden and Zawadski,³ 1 ice skater and 1 boxer required being studied in the field competing in their sport. However, there are obvious logistic and cost limitations that preclude trained staff from challenging a patient under the conditions of the athlete's competition.

For the patient reported in this case report, all standard tests that were used to establish a diagnosis of EIA and/or EIVCD failed until the patient's father provided the videotape documenting his daughter's symptoms while actually swimming laps. This inexpensive yet informative visual display of her inspiratory stridor within a few minutes after she had begun to swim was reassuring of the correct diagnosis and led to therapy that appeared highly effective. She was subsequently evaluated and treated by a speech therapist with the results outlined. After the correct diagnosis of EIVCD was made and speech therapy was initiated, she stopped all asthma medications and never had any subsequent respiratory problems while swimming.

Use of videography in the field for patients with suspected EIVCD may lead to a more timely diagnosis. If there is a high index of suspicion of EIVCD on the basis of videotaped evidence, this may lead to earlier therapy and temporize the need for more expensive diagnostic

studies. Thus, videography should be considered an important ancillary tool for use with more traditional diagnostic approaches¹⁰ when evaluating patients with exercise-induced respiratory symptoms.

We thank Mr Brian Camp from the Media Services Department of St Louis Children's Hospital and Mr Boyd Jacobson of the Illustrations and Photography Department at National Jewish Medical and Research Center for their valuable technical assistance with the video clips. We also thank those shown in the video clips for granting permission to use them for this educational purpose.

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