

# Update

## Vocal Cord Dysfunction

by Susan M. Brugman, M.D. and Kenneth Newman, M.D.

### Introduction

A number of clinical syndromes can mimic asthma and lead to inaccurate diagnosis and inappropriate, potentially harmful treatment. Of these syndromes, vocal cord dysfunction (VCD) stands out because of the increased frequency with which it is reported and because of its complex etiology. The condition is characterized by vocal cord closure, usually on inspiration, leading to airflow obstruction, wheezing, and occasionally, stridor.

A number of different terms have been used to describe VCD, compounding diagnostic difficulty. Further, VCD and asthma are not mutually exclusive diagnoses and in fact can occur co-existently.

VCD has been reported in patients from ages 3 to 82, though the condition occurs most often between the second and fourth decades. Among adult patients, women predominate. For as-yet-unidentified reasons, VCD also occurs with increased frequency among health care workers, as compared to other segments of the adult population.

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Among children and teenage patients, VCD has a strong link to participation in competitive sports activities and to personal and family orientations toward high achievement. Prevalence by sex is unknown, but may not be as heavily weighted toward females, as it is in adults. Boys and girls of all ages have been evaluated for VCD at National Jewish.

Community prevalence among adults or children remains unknown. The medical literature on VCD consists almost exclusively of case reports, making estimates of prevalence tenuous at best. However, in a recent study at the National Jewish Center for Immunology and Respiratory Medicine, five of 52 consecutive adult inpatients (9.6%)

referred for refractory asthma had a VCD diagnosis. An additional 17 (32.6%) had VCD accompanying asthma.

Over the past five years, 225 National Jewish patients ages 18 and under have been diagnosed as having some type of vocal cord dysfunction.

The underlying mechanisms of VCD remain unknown. No biochemical, physiologic, or structural abnormalities have been associated with the disorder. Psychogenic factors clearly contribute to many cases of VCD, especially in adults. Stress often plays a role in children with VCD, but they usually do not exhibit psychopathology on evaluation.

### Presentation

Most VCD patients carry a diagnosis of asthma unresponsive to therapy, including bronchodilators and steroids. Episodic or recurrent wheezing and dyspnea, usually with sudden onset and cessation, are the most common clinical features and complaints. Difficulty with inspiration prompts many patients to say

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they felt they were going to die.

Presentation in the emergency department, especially among children, is not uncommon. In extreme cases, VCD patients have been tracheotomized or intubated. Many patients have been hospitalized on a number of occasions, and they typically are maintained on bronchodilators, steroids, or both.

Obesity is a common feature among adult patients. On average, adult VCD patients seen at National Jewish are 40% above ideal weight, at least a portion of which undoubtedly is due to steroid use.

### ***History***

As is the case with most diagnostic challenges, a careful history can produce valuable clues that will lead toward an accurate diagnosis of VCD and away from inappropriate treatment.

Patients tend to identify the throat as the major site of obstruction during attacks. They often report hoarseness and dysphonia, tightness in the throat or upper chest, and sometimes, difficulty swallowing. Adult patients' attacks may be precipitated by irritants, such as dust, smoke, chemicals, and certain odors. Unlike asthmatics, VCD patients rarely are awakened from sleep by attacks.

In children and teenagers, attacks often occur during sports competition or strenuous physical activity. Occasionally, some transference exists, and attacks occur in other contexts, such as school exams or other potentially stressful situations. An orientation toward high achievement seems to be a pervasive factor in younger VCD patients.

Physical examination of the VCD patient typically produces few remarkable findings with respect to differentiating the disorder from asthma. Because the large airways are excellent conductors of distal airway sounds, asthmatics may have laryngeal wheezing. Patients suspected of having stridor can have normal vocal cord movement and normal upper airway examinations.

All in all, the physical exam is an unreliable indicator of vocal cord dysfunction.

### ***Laboratory Assessment***

Laboratory results can provide clues that point clearly toward a VCD diagnosis. However, the most important clues are derived during a symptomatic attack.

A crucial indicator of VCD is the absence, during an acute attack, of an increase in P(A-a)O<sub>2</sub> gradient. Additionally, eosinophilia is not present. Both findings are positive in more than 90% of asthmatic attacks.

Physiologically, asymptomatic VCD patients usually have normal expiratory flows and spiromgrams. Flow volume loops are usually normal in the asymptomatic state.

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However, during an acute attack, blunting of the inspiratory loop occurs, resulting in an MEF<sub>50</sub>/MIF<sub>50</sub> ratio exceeding 1.5. Asthmatics, on the other hand, tend to have blunting of expiratory loops.

A definitive VCD diagnosis requires visualization of the vocal cords via laryngoscopy. With the vocal cords under direct observation, the patient should sequentially pant, breathe deeply, and phonate. Classically, VCD appears as adduction of the anterior two-thirds of the vocal cords with posterior chinking that creates a diamond shape. Typically this appearance

presents during inspiration but may persist into expiration. Vocal cord closure also may occur during expiration.

In asthmatics, the vocal cords tend to adduct during expiration, especially after exercise and during asthmatic attacks. As a result, a VCD diagnosis based solely on expiratory changes should be pursued cautiously.

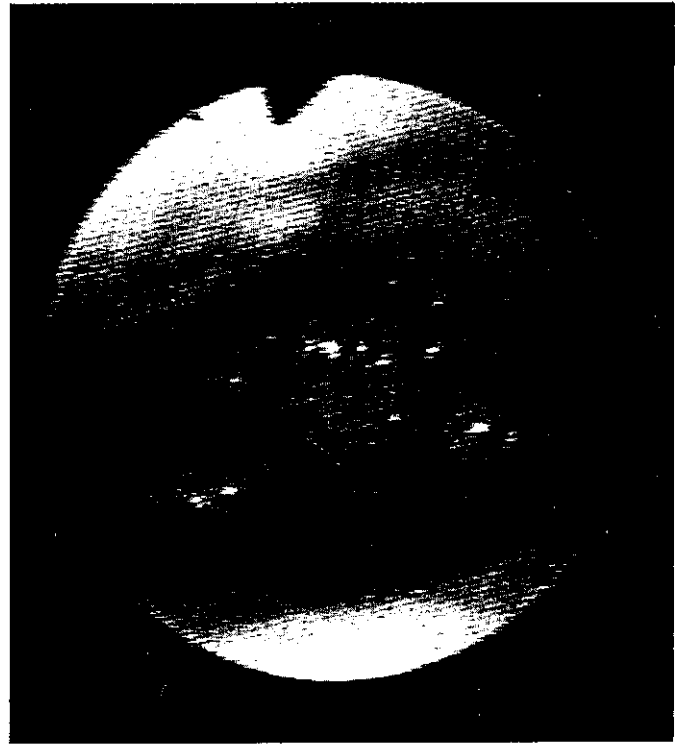
Asymptomatic patients may have normal vocal cord appearance on laryngoscopy. The current gold standard for diagnosis is laryngoscopy at the time of an acute attack. Either exercise or bronchial challenge can induce symptoms. Why methacholine or histamine challenge induces VCD remains unclear. Abduction typifies normal vocal cord function during inspiration. Symptomatic patients who have normal vocal cord abduction on laryngoscopy probably do not have VCD.

### ***Psychological Factors***

VCD patients, particularly adults, appear to have an increased incidence of psychiatric disorders. No uniformity has been observed, as associated psychiatric diagnoses have included depression, personality disorders, adjustment disorders, and post-traumatic stress syndrome. Some evidence suggests an association between sexual abuse and VCD. However, that association must be viewed as somewhat tenuous given the uncertain prevalence of sexual abuse in the general population; some estimates range as high as 30%. In general, psychiatric disorders and sexual abuse are less common in children and teenagers than in adults referred to National Jewish for evaluation of vocal cord disorders.

Mental stress can induce paradoxical vocal cord motion, but no evidence points to a voluntary component to VCD.

The links to psychiatric disorders and sexual abuse lend support to the concept that VCD is a conversion disorder triggered by trauma. That concept remains to be proven by



*Fiberoptic laryngoscopy while the patient is experiencing symptoms in order to correlate symptoms with vocal cord movement.*

additional investigation of larger numbers of patients.

### **Differential Diagnosis**

Other causes of upper-airway obstruction can produce symptoms that resemble VCD. Those causes must be carefully differentiated from VCD to arrive at an appropriate diagnosis.

Among the diagnoses to rule out, bilateral vocal cord paralysis, usually from surgery, is probably the most common. The condition may cause recurrent episodes of wheezing and dyspnea, but the diagnosis can be made easily by direct visual examination.

Reflex laryngospasm is particularly common among children. The etiology is unclear, but the condition appears to be associated with glottic stimulation.

Laryngeal edema resulting from anaphylaxis can cause stridor, but systemic findings, such as hypotension or urticaria, typically accompany the disorder.

Potential sources of upper-airway obstruction also include neoplasms;

tuberculosis, sarcoidosis and other granulomatous diseases; foreign body aspiration; trauma-associated stenotic lesions; hypertrophic tonsils; and extrinsic airway compression (such as caused by goiter or mediastinal infections).

Careful airway examination should exclude other diagnostic possibilities of upper-airway obstruction.

### **Therapy**

For many VCD patients, the first order of therapy is to identify and stop unnecessary treatment. Use of oral steroids should be tapered as rapidly as possible. Since steroids are not effective in VCD unless needed to treat underlying asthma, the drugs should be carefully discontinued to avoid the morbidity associated with their use. Children in particular can experience severe long-term consequences from steroid use, including growth retardation.

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were adapted from speech therapy used in functional voice disorders. The techniques emphasize decreasing laryngeal muscle tone, largely by helping patients focus on expiration, rather than inspiration.

VCD patients learn abdominal breathing and inhalation through a relaxed throat. To accomplish this objective, the patient places the tongue on the floor of the mouth behind the lower front teeth and inhales with gently closed lips as the abdomen expands. The patient exhales with a gentle "s" sound as the abdomen contracts. The technique is practiced during asymptomatic periods to facilitate use during acute attacks.

Patients also receive instruction in relaxation techniques for the neck, shoulder, chest and oropharyngeal muscles.

## ***Psychogenic factors clearly contribute to many cases of VCD, especially in adults.***

Occasionally, speech therapy techniques are not adequate to stop VCD attacks. For those patients, breathing a mixture of 70% helium and 30% oxygen may relieve symptoms by promoting less turbulent flow past partially obstructed vocal cords. The low-density gas can alleviate dyspnea and interrupt VCD attacks when used with the relaxed-throat breathing.

Psychologic intervention has some value in the treatment of VCD, but long-term intervention should be reserved for patients in whom specific underlying disorders have been identified by appropriate evaluation. At National Jewish, a combined approach of psychotherapy and speech therapy can be highly effective in more difficult cases.

As a rule, psychotropic medications, such as anxiolytics and antidepressants, are not used in the treatment of VCD, except as a therapeutic aid for specific patients in whom underlying psychiatric disorders have been identified.

Biofeedback training has proven useful in some VCD patients but is not employed routinely.

### ***Conclusion***

Vocal cord dysfunction remains a widely unrecognized and untreated disorder, despite indications (primarily reports in the medical literature) that physician awareness of the condition is increasing. Clinical suspicion of VCD should arise any time a patient with asthma-like symptoms fails to respond to conventional asthma therapy. The possibility that VCD is the reason for a patient's unresponsiveness to bronchodilators should help make a case for more cautious use of oral steroids in the absence of an evaluation that clearly excludes VCD.

Direct visualization of the vocal cords via laryngoscopy is the only definitive means of diagnosing

VCD. To be truly diagnostic, a laryngoscopic evaluation should take place during an acute attack. Even then, VCD patients may present with variations of the classic picture of anterior vocal cord adduction with posterior chinking.

Vocal cord dysfunction can occur in association with asthma, further complicating diagnosis and treatment. In such patients, the therapeutic approach must address both disorders.

The presentation of VCD may differ between adults and pediatric patients. While psychogenic factors play more of a role in adults, athletic competition and an achievement-oriented environment seem most prominent among young patients.

Regardless of the etiology, VCD poses a very real, potentially debilitating health problem to patients. The symptoms are not imagined or voluntarily induced. In some cases, the condition can be life-threatening:

VCD has led to several near-drownings among competitive swimmers.

The natural history of vocal cord dysfunction is unknown. However, it seems unlikely that the condition would completely resolve without some form of clinical intervention. It is uncertain whether pediatric patients "outgrow" this disorder. This may be particularly true of children whose VCD is accompanied by psychological disorders. Following on the conversion disorder theory, one could speculate that failure to deal with the psychogenic input at an early age could lead to a worsening of symptoms in adulthood and development of other symptoms, such as irritable bowel.

Accurate diagnosis and appropriate treatment of VCD not only avoids inappropriate and potentially harmful therapy, but also provides important reassurance to patients. By giving a name to the condition, physicians relieve patients of the

### ***Travel Schedule***

National Jewish faculty members frequently travel to national and international conferences and to other institutions to talk about their clinical and research findings. Guest speakers can be requested through the Office of Continuing Medical Education.

1993 International Conference of the American Thoracic Society  
May 16 -19, 1993, San Francisco, CA

|                    |   |
|--------------------|---|
| Leland Fan, MD     | Clinical Pediatric Rounds/Symposium   |
| Michael Iseman, MD | Treatment of Multi-Drug Resistant TB in Normal and Immuno-compromised Hosts |
| Talmadge King, MD  | Bronchoalveolar Lavage in Non-infectious ILD                                |
| Barry Make, MD     | New Trends in Pharmacology Management in COPD                               |
| Richard Martin, MD | Asthma: Clinical Year in Review   |
| Robert Mason, MD   | Alveolar Type II Cells and Chronic Lung Disease                             |
| Lee Newman, MD     | Controversies in Occupational/Environmental Lung Disease                    |
| Cecile Rose, MD    | Hypersensitivity Pneumonitis: Buildings, Bioaerosols and Biopsies           |
| Carl White, MD     | Effects of Cytokines and Endotoxin on Lung Manganese Superoxide Dismutase   |

## ***“Physical Illness, Psychologic Development and How the Twain Shall Meet”***

Cosponsored by National Jewish, the Children's Hospital and The American Academy of Child and Adolescent Psychiatry's Committee on the Physically Ill Child  
Keystone, Colorado  
June 24-27, 1993

This conference will focus on increasing a critical understanding of the interplay between physical illness and psychological factors, both individual and familial.

### ***Meeting Faculty Includes***

Stuart Hauser, MD, PhD      Robert Harmon, MD      Anne Kazak, PhD  
James Griffith, MD & Melissa Griffith, MSN  
Junius Gonzales, MD      Thomas Roesler, MD      Marianne Wamboldt, MD

## ***“Clinical Update on Asthma”***

The Omni Sagamore Resort  
Bolton Landing on Lake George, NY  
July 16 - 18, 1993

This program is designed for general practitioners, internists, pediatricians and others who are involved in the diagnosis and clinical management of patients with asthma. Participants in this program will learn about:

- guidelines for the treatment of asthma
- the impact sleep has on asthma
- the diseases that masquerade as asthma
- new concepts in asthma
- increased prevalence and severity of asthma
- pharmacotherapy

### ***Meeting Faculty:***

Gary L. Larsen, MD; Head, Division of Pediatric Pulmonary Medicine  
Richard J. Martin, MD; Director, Sleep Research  
Robert J. Mason, MD; Chairman, Department of Medicine  
Harold S. Nelson, MD; Senior Faculty Member,  
Division of Allergy and Clinical Immunology  
Lanny J. Rosenwasser, MD, Head; Division of Allergy and Clinical Immunology  
Stanley J. Szefer, MD; Director of Clinical Pharmacology

## ***“A Comprehensive Review in Adult & Pediatric Allergy/Immunology”***

The Radisson Hotel, Denver  
August 25-29, 1993

This course is designed for practitioners and allergy trainees who will benefit from a review of diagnosis, pathogenesis, treatment and future trends in allergy and clinical immunology. It will provide a review of:

- Basic and Clinical Immunology
- Allergic and immunologically-mediated disorders
- Asthma pathophysiology and management
- Immunology laboratory tests and interpretation

Includes talks by National Jewish and University of Colorado School of Medicine faculty Donald Leung, Harold Nelson, Erwin Gelfand, Daniel Hamilos, Talmadge King, Gary Cott, Charles Irvin, Henry Claman, George Eisenbarth, and guest speakers Thomas Casale, Robertson Parkman, and William Henderson.

burden of thinking that the condition is “all in their head.” An accurate VCD diagnosis provides patients with a clinical focal point, and appropriate intervention with speech therapy helps involve patients directly in overcoming the disorder. Patients have a sense of greater

control over their symptoms and therefore might be more motivated to follow clinical instructions and assume more responsibility for mastering their condition. With proper patient motivation and frame of mind, the chances of successful treatment improve immeasurably.

## ***National Jewish Faculty for Diagnosis and Treatment of VCD:***

Susan M. Brugman, M.D. Assistant Faculty Member, Department of Pediatrics, National Jewish; Assistant Professor of Pediatrics, UCHSC. Specialty Interests: VCD; Chronic Cough

Kenneth Newman, M.D. Assistant Faculty Member, Department of Medicine, National Jewish; Assistant Professor of Medicine UCHSC. Specialty Interests: VCD; Asthma.

Florence Blager, Ph.D. Chief of Speech Pathology and Audiology Services, National Jewish; Associate Professor of Otolaryngology and Psychiatry, UCHSC. Specialty Interests: Professional Voice problems; VCD and Cough.

Thomas Corbridge, M.D. Assistant Faculty Member, Department of Medicine; Assistant Professor of Medicine, UCHSC. Specialty Interests: Status Asthmaticus; COPD; VCD

Gary Cott, M.D. Clinical Director, Department of Medicine, National Jewish; Associate Professor of Medicine, UCHSC. Specialty Interests: VCD; Asthma

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## **Upcoming CME Programs**

### **"Clinical Update on Asthma"**

The Omni Sagamore Resort,  
Bolton Landing on Lake George, NY  
July 16 - 18, 1993

### **"36th Annual Pediatric Conference"**

sponsored by the Children's Hospital and  
National Jewish Center for Immunology  
and Respiratory Medicine  
Aspen, Colorado  
August 8 - 12, 1993

### **"1993 Comprehensive Review in Adult & Pediatric Allergy/Immunology"**

co-sponsored by National Jewish  
and the American Academy of  
Allergy & Immunology  
Radisson Hotel Denver  
August 25 - 29, 1993

### **"1994 Update on Allergy and Clinical Immunology"**

Keystone, CO  
February 2 - 6, 1994

*For further information on any of these  
meetings, call 303-398-1000*

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MD, Kenneth Newman, MD, and Uwe  
Staerz, PhD

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#### **Monday:**

Immunology Course

#### **Tuesday:**

Research in Progress

#### **Wednesday:**

Denver Allergy Rounds  
(1 hour Category 1 CME credit)

#### **Thursday:**

Pediatric Grand Rounds

#### **Friday:**

Pulmonary Research in Progress

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