Identification and Treatment of Vocal Cord Dysfunction: Best Practices

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VCD Historical Perspective

- Osler (1902) described patients with “laryngeal muscle spasms during inspiration and at times of great distress” and discussed these cases as Paradoxical Vocal Fold Motion (PVFM)
- Patterson, et al., (1974) diagnosed a young woman with inhalation stridor as having Munchausen’s Stridor and considered this a purely psychogenic disorder
- Christopher, et al., (1983) described five patients with asthma like symptoms and diagnosed them as exhibiting Vocal Cord Dysfunction (VCD)

Vocal Fold Respiratory Physiology

Figure 2. The appearance of the vocal cords during (A) inspiration in a healthy patient and (B) during inspiration in a patient with VCD, showing the adduction of the vocal cords with the characteristic posterior “chink” opening.

Adapted from Perkner, et al. (1998).

During VCD the anterior portion of VF are ADDucted with a small chink (posterior aspect) of VF being ABDucted resulting in dyspnea. Respiratory stridor may be evident on either inhalation or exhalation (or both).

Vocal Cord Dysfunction (VCD) also known as:

- Paradoxical Vocal Fold Motion (PVFM)
- Vocal Cord Malfunction
- Laryngeal Dyskinesia
- Inspiratory Adduction
- Paroxysmal Laryngospasm
- Functional Airway Obstruction
- Adductor Laryngeal Breathing
- Munchausen's Stridor
- Emotional Laryngeal Wheezing
- Pseudo-asthma
- Fictitious Asthma
- Episodic Laryngeal Dyskinesia

A common characteristic of this condition (under any of these terms) is Dyspnea.

- Dyspnea refers to the sensation of difficult or uncomfortable breathing.
- It is a subjective experience perceived and reported by an affected patient.
- Dyspnea on exertion (DOE) may occur normally, but is considered indicative of a disease/condition when it occurs at a level of activity that is usually well tolerated.
The Problem

Vocal cord dysfunction is commonly confused with exercise-induced asthma, leading to misdiagnosis and unnecessary treatment in athletes (Yelken, 2009).

Similar to exercise-induced asthma, vocal cord dysfunction may not be symptomatic unless provoked with physical activity (Rich, et. al, 2010).

VCD symptoms typically include episodes of subjective respiratory distress (dyspnea) that are associated with inspiratory stridor, cough, choking sensations, & throat tightness.

The inspiratory stridor is frequently mistakenly described as wheezing.... This appears to be one of the main reasons for misdiagnosis (Deckert, 2010).

It is important that a differential diagnosis is made between exercise-induced asthma and vocal cord dysfunction because of the difference in treatment for each. (Hoelh & McGuire, 2011).

VCD: Athlete Perspective

Case 1 – High School Football Player

- Symptoms: Dyspnea associated with exertion
- Inspiratory Stridor
- General respiratory incoordination
- Diagnosis: Exertion Asthma
- Initial Dx made by coach
- Confirmed by family physician
- Perpetuated by Collegiate Athletic Training Staff & Team Physician
- Treatment: Bronchial Inhaler & supplemental oxygen during pronounced dyspnea
- Treatment was ineffective
- Impact: Talented & highly recruited athlete negatively impacted by loss of interest by Division I collegiate recruiters when EIA diagnosis became known.

Case 2 – Successful Middle-School Runner

- Symptoms: Dyspnea associated with exertion
- Inspiratory Stridor
- Sensitive young lady with high self-expectations
- Diagnosis: Exercise Induced Asthma (EIA)
- Initial Dx made by family physician
- Treatment: Bronchial Inhaler
- Treatment was ineffective
- Impact: Talented runner gave competitive running and took up a “less demanding breathing sport”
- Postscript: Returned to “competitive” running as a young adult following receiving a VCD Dx and subsequent treatment

Whose Problem?

Beyond the athlete, the “Problem” or the correct assessment & intervention of VCD and necessary education of the community belongs to:

- Athletic Trainers
- Speech-Language Pathologists
- Pulmonologists
- Otolaryngologists
- Psychiatrists
- Coaches
- Parents

Frequently, the Athletic Trainer (AT) is the initial point of contact in cases of Dyspnea during athletic participation and are the liaison between the athlete/coach and health professionals.

The knowledgeable SLP is a key player in the treatment of VCD and should assume a lead role in educating the professional and lay community of this condition, its assessment & intervention.
Profile of Athletic Trainers (ATs)

“ATs are health care professionals who collaborate physicians. The services provided by ATs comprise prevention, emergency care, clinical diagnosis, therapeutic intervention, and rehabilitation of injuries and medical conditions. ATs work under the direction of physicians, as prescribed by state licensure statutes” (NATA, 2014).

ATs are recognized & qualified allied health professionals and are licensed in 49 states and work under different job titles including wellness/occupational health manager, physician extender, rehabilitation specialist, etc.

ATs complete an academic curriculum & clinical training following the medical model and must graduate from an accredited program; 70% of ATs have a master’s degree.

ATs improve patient functional and physical outcomes; various institutions/employers recognize the ATs’ versatile wellness services and injury/illness prevention; ATs focus on far more than just musculoskeletal conditions, including working with patients with diabetes, heart disease, asthma, VCD and other health conditions.

Where do ATs Practice?

The title “Athletic Trainer” is a misnomer based on its professional roots, ATs provide medical services to all types of people in a host of different settings and not just athletes participating in sports.

That said, 51% of secondary schools in Missouri have access to ATs; 20% have ATs at their school full-time & 29% have part-time AT services (Prior, et al., 2015).

ATs are uniquely positioned to bridge care between healthcare professionals (including SLPs) due to their frequent interaction with athletes at practices and competitions. ATs interact with athletes regularly, not only when an injury/condition occurs.

Concerned SLPs should reach out to ATs and work collaboratively as they work to identify, assess and treat patients/athletes exhibiting dyspnea and suspected of having VCD.

SLP Role in Reaching out to ATs

Survey Results - (continued)

73% of survey respondents feel uncomfortable in distinguishing the symptoms of VCD and exercise induced asthma.

The most common treatments used for athletes that experience breathing problems are bronchodilator inhalers, decongestants, and antihistamines.

67% are unaware of general approaches that are used to address VCD; 100% of survey respondents felt they would benefit from additional resources, training, and information involving athletes with VCD.

Concerned SLPs have a role in reaching out to ATs to support them and benefit from their “front-line” position in patients exhibiting dyspnea and to work on the effective screening, assessment and intervention of those athletes who have VCD.

This is based on the assumption that SLPs are knowledgeable and comfortable in the clinical assessment and management of VCD – which may be a false assumption.
**Facts related to VCD Athletes**

Overall incidence of VCD ranges from 3-10%

- Affects mostly children and young adults, onset is typically between 11 – 18 years of age
- 2:1 Female to male ratio
- Tend to be high achieving individuals, type “A” personalities with high personal standards, & intolerance to personal failure
- Can relate to social pressure, desire to please others (peers, coaches, parents)

Onset can be associated with transitions to a higher level of competition within their sport (rec team to select/travel team, JV to Varsity, HS to College)

**Pathophysiology**

VCD seems to be caused by laryngeal hyper-responsiveness initiated by an initial inflammatory insult and subsequent stimuli appear to induce local reflexes causing airway narrowing at the glottic level (Ayers & Gabbott, 2002).

Glottic narrowing increased inspiratory airflow resistance resulting in increased inspiratory effort.

Cycle perpetuates itself – cyclical

Results in dyspnea & distress

**Precipitating Factors Related to VCD**

- Airway irritants
- GERD
- Allergies
- Infection
- Physical exercise
- Emotional stressors
- Psychological factors
- Extreme temperatures

**VCD Symptoms**

- Shortness of breath (dyspnea)
- Chest or throat tightness
- Chronic cough
- Frequent throat clearing
- Intermittent hoarseness
- Wheezing/stridor
- Difficulty with inhalation and/or exhalation

**Co-occurring Conditions and/or Associated Symptoms**

- Postnasal drip
- Gastroesophageal reflux (GERD)
- Laryngopharyngeal reflux
- Asthma
- Chronic cough
- Increased body tension during exercise/exertion
- Physical exercise
- Emotional stressors
- Psychological factors
- Anxiety
- Extreme temperatures
- Dysphagia
VCD Assessment
(as outlined by National Jewish Health)

• **Laryngoscopy** – Video-endoscope used to visualize movements of the vocal folds during inspiration & expiration

• **Pulmonary Testing** -- Primarily Spirometry with a focus on inspiratory/expiratory flow loops

• **Clinical Evaluation** – Patient interview focusing on symptoms of dyspnea, VCD symptoms & triggers

*It is noted that asthma & VCD can co-exist.*

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**Laryngoscopic Examination**

Laryngoscopy enables observation of laryngeal structures, glottal abduction and adduction, laryngeal instability, & signs of reflux (irritation)

Laryngoscopy enables examination of supraglottic hyperfunction

Laryngoscopy is expensive, invasive and difficult to do during physical exertion as needed to capture VCD in situ.

May not be necessary in all cases to clinically diagnose VCD.

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**Pulmonary Testing - Spirometry**

Typical findings:

VCD - Symptomatic:
- Flattened inspiratory curve
- Varied inspiratory curves
- Expiratory portion my be “normal” of blunted
- Ratio of forced expiratory to inspiratory flow at 50% VC can be greater than 1.0

VCD – Asymptomatic:
Flow volume loops are normal.
Three-minute Test as a Diagnostic Challenge for Exercise-induced Dyspnea: A Pilot Study
Newsham, Freese, McGuire, Fuller, & Noyes (2014)

**Purpose** – To establish a clinically appropriate, valid and reliable high-intensity challenge that would benefit professionals evaluating exercise-induced dyspnea (EID) and reliably distinguish between exercise-induced bronchoconstriction (EIB) (asthma) & exercise-induced laryngeal obstruction (EILO) (VCD).

**Study** – Examined 16 collegiate athletes (4 male, 12 female) who reported prior episodes of exercise-induced dyspnea (EID). Each performed resting spirometry to obtain flow-volume loops (FVL), mannitol challenge (MCT), and three-minute all-out cycle ergometer test (3MT) within a week of the MCT.

**Measures** -
- Forced expiratory volume in 1 second (FEV$_1$) used to identify exercise induced bronchoconstriction (EIB)
- FVL used to identify exercise-induced laryngeal obstruction (EILO)
- 3MT has high ventilatory requirements and was investigated as an exercise challenge for EIB and EILO.

**Criteria** – Each measure was judged as “positive” or “negative”; **positive** judgment criteria included:
- For EIB – a 15% fall in FEV$_1$ from baseline during the MCT and/or a 10% fall after the 3MT
- For EILO – a forced expiratory flow (FEF) – forced inspiratory flow (FIF) ratio of 50% of vital capacity (FEF$_{50}$/FIF$_{50}$) > 1.30
  - The (FEF$_{50}$/FIF$_{50}$) measure demonstrated 87% sensitivity for extra-thoracic obstruction.

**Results** - All participants exhibited EID associated with the 3MT
- 31% were positive for EIB; 60% of these were confirmed via MCT
- 68% were positive for EILO; 36% of these had concomitant EIB/EILO

**Conclusions** – The 3MT is a sufficient challenge to elicit EID in trained athletes & exacerbates EILO. Additional study is warranted to assess efficacy of 3MT in identification of EIB.

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**Clinical Evaluation**

Clinical Interview questions:
- Do you have more trouble breathing in than out?
- Do you experience throat tightness?
- Do you have a sensation of choking or suffocation?
- Do you have hoarseness?
- Do you make a breathing-in noise (stridor) when you are having symptoms?
- How soon after exercise starts do your symptoms begin?
- How quickly do symptoms subside?
- Do symptoms recur to the same degree when you resume exercise?
- Do inhaled bronchodilators prevent or abort attacks?
- Do you experience numbness and/or tingling in your hands or feet or around your mouth with attacks?
- Do symptoms ever occur during sleep?
- Do you routinely experience nasal symptoms (postnasal drip, nasal congestion, runny nose, sneezing)?
- Do you experience reflux symptoms?
- Have you been diagnosed with asthma or exercise-induced asthma? If yes, has your asthma been treated? Was the treatment effective?

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**Differential Diagnosis of VCD & EIA**

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<thead>
<tr>
<th>Feature</th>
<th>VCD</th>
<th>EIA</th>
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<tbody>
<tr>
<td>Female Preponderance</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Chest Tightness</td>
<td>+/-</td>
<td>-</td>
</tr>
<tr>
<td>Throat Tightness</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Stridor</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Usual onset of symptoms after beginning exercise (min)</td>
<td>&lt;5</td>
<td>&gt;5-10</td>
</tr>
<tr>
<td>Refractory period</td>
<td>5-10</td>
<td>15-60</td>
</tr>
<tr>
<td>Late-phase response</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Response to beta-agonist</td>
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When asked where the location of the distress is, VCD patients will likely indicate the neck or throat while EID report “the chest.”

VCD has stridor on inspiration, EID has wheezing on exhalation.
**Acute VCD Management**

Patients do not consciously manipulate or control their upper airway obstruction.

The is generally a feeling of helplessness during an dyspnea episode (may be terrified at first)

Implying that it is “in their head” is incorrect and counterproductive to their recovery

Be calming, positive, coach the patient; implying that it is “in their head” is counterproductive

Offer reassurance and prompt for EASY breathing; elicit controlled panting with a relaxed shoulders, mandible, & tongue with the tongue in a low position behind lower teeth

Have patient stand with an open chest, hands on hips, or bent over with hands on knees (the position that produces the best result); visualize a wide open respiratory system (easy in and out)

**Sniff Technique**
- Have patient sniff then blow
- Sniff in with focal emphasis at the tip of the nose; sniffing should result in glottal ABDuction
- Then have patient blow (exhale) with airflow resistance by producing a sustained voiceless fricative (e.g., /s/, /f/, /w/)
- The object it to build up pressure in the vocal tract to facilitate its opening.

In severe cases, medical/pharmacological treatment might include: (may require hospitalization in some cases)
- Heliox
  - Administered by Paramedics or ER MDs
- Sedatives and psychotropic medications
  - Last resort
  - Calming effect
  - Eliminates tension/ constriction

**Speech Therapy Intervention**
- Patient counseling, education
- Whole body and focal relaxation techniques
- Respiratory retraining (breathing resistance activities/tools can be effective)
- Phonatory retraining (relaxed easy phonation)
- Monitor anxiety and other potential triggers (e.g., reflux, coughing, allergies, toxins)
- Develop an action plan for when VCD occurs; practice when asymptomatic to enable effective implementation at the onset of dyspnea
- Psychological intervention/hypnosis may be useful

**Goal**
- Ability to overcome fear and helplessness
- Reduced tension in extrinsic laryngeal muscles
- Diversion of attention from larynx
- Reduced tension in neck, shoulders and chest
- Ability to use techniques to reduce severity and frequency of attacks

**Method**
- Mastery of breathing techniques
- Open throat breathing; resonant voice technique
- Diaphragmatic breathing and active exhalation
- Movement, stretching, progressive relaxation
- Increase awareness of early warning symptoms; Rehearse action plan
Medication alone will not help alleviate VCD, so active participation with behavioral techniques (speech therapy) is the best practice for controlling VCD.

**Acute Management** (during VCD episode) is likely to be administered by AT; effective interactions with AT is best way to support the patient; AT should be informed of and involved in behavioral techniques established in Speech Therapy.

**Behavioral techniques** and Individualized exercises help patient:
- Increase awareness of breathing & remediation of maladaptive breathing patterns
- Increase awareness of body posture & encourage relaxation of laryngeal & throat muscles
- Learn and employ VCD release breathing techniques to control VCD while exercising
- Utilize chronic cough suppression & throat clearing elimination techniques
- Maximize vocal hygiene

**Counseling** — Counseling can help identify & deal positively with stress that may be an underlying factor in VCD.

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**References**


