Symptoms & Treatment of Vocal Cord Dysfunction / Paradoxical Vocal Fold Motion

Florence B. Blager, Ph.D., CCC-SLP
Professor Emeritus
Department of Otolaryngology
University of Colorado Denver
and
Department of Medicine
National Jewish Health
Denver, Colorado

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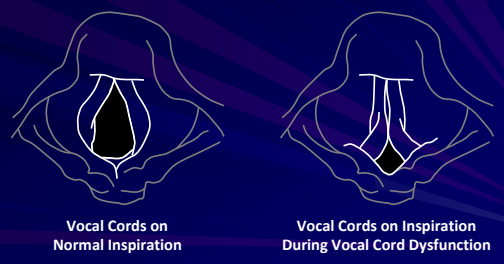
Description of VCD / PVFM

- Nonorganic disorder of upper airway that can involve closure of vocal cords and/or supraglottic structures during inspiration, expiration or both
- Result is significant respiratory distress, which can include stridor, wheezing and dyspnea
- Identified and described as Vocal Cord Dysfunction in 1983 by multi-disciplinary clinical research team at National Jewish Health, led by Kent Christopher, M.D.

Vocal Cord Dysfunction with Posterior Opening



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- Some terms used include:
  - Vocal Cord Dysfunction (VCD)
  - Paradoxical Vocal Fold Motion (PVFM)
  - Paradoxical Vocal Fold Dysfunction (PVFD)
  - Paradoxical Vocal Fold Disorder (PVFD)
- Most significant concern is misdiagnosis as asthma resulting in treatment with damaging medications, or invasive procedures of intubation or tracheostomy in Emergency Room admissions.

Diagnostic Differentiation for VCD/PVFM

- Rapid onset and rapid release of constriction
- Normal lung volume
- Normal arterial-blood-gas analysis
- No bronchial hyperreactivity

- Some decreased inspiratory lung volume
- Flattened inspiratory flow rate
- Rhinolaryngoscopy shows adduction of true vocal cords
- May include supraglottic structures, including false vocal cords and epiglottis

Some Suggested Causes of VCD / PVFM

- Irritable Larynx Syndrome
- Underlying pulmonary disorders
- Childhood sexual abuse
- Hyperventilation
- Emotional conflicts
- Panic disorders
- Overlapping asthma, panic and VCD/PVFM

Suggested Causes of VCD/PVFM

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Conceptual Model for Vocal Cord Dysfunction / Paradoxical Vocal Fold Motion is A Vulnerable System

Clinical Presentations of Vocal Cord Dysfunction

- Established by laryngoscopic evaluation:
- Narrow vocal cord opening visualized when symptomatic on inspiration, expiration or both
- Glottis and Supraglottic closure may be involved producing stridor
- "Twitching larynx" leading to intermittent closure

Symptomatic Presentations of Vocal Cord Dysfunction

- Cough – to open sensation of closure in airway
- Throat clearing to open sensation of closure in airway
- Laryngeal or upper chest tightness when lower airway disease is not active

- Laryngeal or upper chest tightness with lower airway disease
- Symptomatic with exertion
- Symptomatic from inhaled irritants
- Randomly symptomatic
- Symptoms described, but unable to be provoked under controlled conditions

Vocal Cord Dysfunction Subgroups

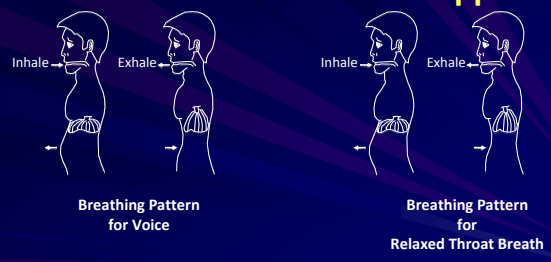
- Vocal Cord Dysfunction
- Asthma Evolving into Vocal Cord Dysfunction
- Hyper – Hyposensitive Gag
- Exercise – Induced Bronchoconstriction
- Functional Constriction

- Classic Laryngospasm from Reflux, occurring mostly at night
- Environmental Insult – Inhalation of chemicals or other irritants
- Panic Disorder
- Central Neurological / Physiological Systems Impacting on Breathing Patterns
- Conversion Reaction

- Intractable Vocal Cord Dysfunction – Not Responsive to Functional control – may Require Intervention of Tracheostomy, Resection of Recurrent Laryngeal Nerve or Other Procedures
- Other Underlying Pulmonary Conditions, such as Cystic Fibrosis, Chronic Obstruction Pulmonary Disease, or Interstitial Lung Disease

Conceptual Model for Speech Pathology Therapy is Cognitive-Behavioral

Relaxed Throat Breath Based on Breath for Voice Support



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Relaxed Throat Breath With Abdominal Support

- Relaxed Throat Breath
  - Inhale with relaxed throat.
    - Tongue on floor of mouth.
    - Lips gently closed.
    - Jaw gently released.

- Exhale on gentle /s/ with abdominal support, or /SH/ or /F/ in public
  - Hand on abdomen (above the belt, below the belt, or both)
  - Inhale into abdomen – abdomen comes in
  - Exhale from abdomen – abdomen comes in
  - As you pull in abdomen, exhale on gentle /s/

- If more comfortable, use gentle sip of inhale and gentle blow for exhale, feeling the air on the lips
- Do five of these breaths __x__
  - In the morning
  - At noon
  - Before bedtime
  - Before medications
  - As it fits into your schedule

- Use this breathing pattern at any sign of tightness or stridor
  - If this occurs during activity, stop activity, do exercises until it stops, and then resume activity gradually

- Remember –
  - Tightness or stridor can be released by breathing exercises
  - Do exercises easily –
    - Don't push or pull on shoulders, chest or neck
    - Concentrate on "letting" air in and out
    - Go into new activities and sports gradually, using the breath as a basic part of your activity

Use of Heliox in the Treatment of Paradoxical Vocal Cord Dysfunction

- During an acute attack of Paradoxical Vocal Cord Dysfunction, give a patient mixture of Heliox (70% Helium, 30% Oxygen)

- Patients with compromised breathing, like the patients at National Jewish Health, are administered this combination, rather than the frequently used 80% Helium and 20% Oxygen

- While using the Heliox mask, start the Relaxed Throat Breath pattern
  - Inhale with Relaxed Throat
    - Lips gently closed
    - Tongue on floor of mouth behind lower front teeth
    - Jaw gently released

- Exhale on gentle /s/ or /sh/
- Use abdominal support if patient is able to do this easily. If not, concentrate on the Relaxed Throat Breath

- Remove Heliox mask briefly, while maintaining the Relaxed Throat Breath
- Continue with the Heliox mask for five minutes, maintaining the gentle Relaxed Throat Breath

- Remove Heliox mask for a longer period, maintaining the Relaxed Throat Breath
- Gradually <u>increase</u> time <u>without</u> Heliox mask and <u>decrease</u> time <u>with</u> Heliox mask, until patient is breathing independently

Variations of Treatment

for

Vocal Cord Dysfunction

VCD With Asthma

- May evolve from years of having asthma, or may evolve into asthma from working to move air during VCD attacks
- Use Relaxed Throat Breath for five minutes

- If still tight, use inhaler with only mouthpiece, but without medication
- Repeat breath and inhaler mouthpiece
- If still tight after fifteen minutes, us inhaler with medication

Upper Chest Tightness Without Lower Airway Disease

- If no medical basis, explain to patient probably muscle tightness
  - Have patient place hand on tight area
  - Intentionally tighten and release
  - Practice

- Increase focus on abdomen and front of mouth when using Relaxed Throat Breath and interrupt using upper chest to help move breath

Functional Constriction

- Occurs without laryngeal closure
  - May have audible stridor
  - Usually emotional or habituated
  - Use Relaxed Throat Breath and approach for audible stridor
  - May not respond to breathing techniques if large psychogenic component is present

Audible Stridor

- Have patient inhale and exhale, and if exhale is unconstricted, have patient focus on where air is moving and exhale
- Place inhale at that place
- If unsuccessful, use gentle sip on inhale and gentle blow on exhale with lips gently pursed

Laryngospasm from Reflux

- Occurs at night
- Not functional VCD, as larynx is closing tightly to protect airway from aspiration
- Breathing techniques not appropriate for this

- Refer for evaluation of reflux
- Pursue closely in taking history
- Help patient differentiate between types of attack, and use Breathing Techniques when appropriate

Environmental Insult

- Patient can become sensitive to benign environmental situations and inhaled irritants
  - Interpreted as threatening airway
  - Can lead to Vocal Cord Dysfunction

- Need to be led gradually
  - Use Relaxed Throat Breath with increased focus on audible and tactile feedback
  - Gradually increase use of Breath
  - Gradually integrate into activity
  - Use desensitization techniques as needed for inhaled irritants

Desensitization to Inhaled Irritants

- Establish Irritant
  - Get into Relaxed Throat Breath
  - Go to place where irritant is located
  - Walk past quickly, maintaining Relaxed Throat Breath
  - Recover if necessary
  - Repeat and extend exposure gradually

Panic Disorder

- Teach Breathing Techniques when not symptomatic
- Have patient practice when not symptomatic
- Help patient recognize beginning body cues and/or external situations that generate breathing constriction
- Goal is to interrupt sequence of behaviors

Conversion Reaction

- Emotional conflict converted into bodily symptom
- Current thinking is if original conflict defended successfully, can work on behavioral control of symptom

- If original conflict has affected rest of personality, will not respond successfully to behavioral control
- If patient does not show expected progress, refer for psychosocial counseling

Hypersensitive Gag Reflex

- Tongue Walking
  - Have patient use his/her finger
  - Touch on tongue, inside of cheeks and hard palate
  - Go only as far as can be tolerated without provoking gag
  - Gradually increase distance toward back of mouth

VCD with Underlying Pulmonary Conditions

- May have other problems, such as Cystic Fibrosis, Chronic Obstructive Pulmonary Disease, or Interstitial Lung Disease
- VCD may result from maximal effort to move air through lungs

- Prognosis similar to VCD with additional limitations on using Relaxed Throat Breathing techniques because of:
  - Physical condition
  - Energy level

Relaxed Throat Breath with Active Movement

- Avoid predictions of performance levels that will be achieved
- Focus on ribcage
  - Start with patient's hand on their ribcage
  - With inhale, ribcage expands and with exhale, ribcage contracts

- Develop awareness of breath going into and out of ribcage
- Goal is to let the breath support the pace, not to force the breath to match the pace
  - Explain that this pattern responds more quickly than lower abdomen during physical activities when rapid breathing is required, particularly with athletes

- Develop awareness of breath moving behind nose when lips are gently closed, or in front of mouth when using gentle sip and blow
- Use same diagnostic and intervention pattern for each sport – basketball, skiing, swimming, and tennis
  - Evaluate the body pattern of the sport
  - Evaluate the breathing demands

- Start slowly and gradually to integrate the new breathing pattern into the sport
- Gradually increase pace while maintaining the breathing

- Alert client that inhale and exhale will become more rapid as the pace of the activity increases
- Feel ribcage expand with inhale, and contract with exhale
- Practice this pattern standing in place

- Walk across the floor slowly, maintaining breathing into ribcage
- Keep hands on ribcage if helpful
- Remove hands from ribcage when breathing pattern can be maintained

- Increase pace of walking, maintaining focus on ribcage
- If pattern is maintained, increase pace of walking again
- Go into slow jog briefly, and return to rapid walk
- Go into slow jog for longer period, and return to rapid walk

- Increase pace of jog for longer period, while maintaining ribcage breath
- If pattern cannot be maintained at increased pace, or sensation of constriction occurs
  - Slow pace
  - Slow pace until ribcage breathing can be maintained, then start pattern of gradually increasing pace again

- Goal is to aim for maximum performance with new breathing program

- Evaluate body movement and breathing pattern of sport or activity client is involved with.
- Integrate breathing pattern into movements into this activity at slow pace.

- For example:
  - Tennis requires fast movement and then waiting for opponent's return – or preparing for serve with inhale and strong exhale

  - Basketball, hockey and soccer require constant movement and inhale for impact on ball or puck while moving
  - Track, swimming and cycling require sustained endurance

- Start slowly and gradually to integrate the new breathing pattern into the sport
- Gradually increase pace while maintaining the breathing pattern

- Slow pace when breathing pattern not maintained, regain pattern, and increase pace again
- Goal is to aim for maximum performance with new breathing

Interval Training

Activity-Based Breathing similar to

Interval Training

From *Sports Medicine Newsletter*, reviewed by Quinn, E. of Medical Review Board, May 2008

"Early training used short intervals alternating two minutes slow and two minutes fast of activity.

More currently precisely measure intervals are established to match the sport and level of conditioning of the athlete."

From *J. Appl Physiol* 100:2041-2047, 2006

"Burgomaster, K.A., et al, reported six sessions of Sprint Interval Training improved aerobic exercise performance during a laboratory time trial that simulated the way athletes typically compete and dramatically improved cycle endurance capacity increased from 25 to 51 minutes."

Denver Post, November 19, 2007

Reported studies on Interval Training:

- Exercise Metabolism Research Group showed recreational cyclists able to cycle longer by adding fast periods alternating with slower periods.

Denver Post, continued –

- Male and female college student sprinters improved endurance in two weeks by adding intense sprints with two days of rest between at McMaster University in Canada

Denver Post, November 19, 2007

- University of Strathclyde, Scotland, reported healthy women 75 to 85 years old alternated three minutes of fast walking on a treadmill with two minutes of slower walking for twenty minutes, increased walking speed by 13 percent, and amount of walking before tiring by 65 percent after twelve weeks

Research with Pediatric Patients Diagnosed with Vocal Cord Dysfunction

Retrospective Study

- Goal
  - To explore impact of breathing techniques on inpatient pediatric population

Method

- Reviewed charts of 40 children diagnosed with Vocal Cord Dysfunction seen at National Jewish Health over a 4-year period

Results

- Highly significant response of improvement reported by patients seen by Speech Pathology for two or more sessions

Results of Speech Therapy With Pediatric Patients

	Patient Reports					
	Number of Sessions	Number of Pt Treated	Better	Same	Worse	P value
Fewer than 2 sessions	0	2	0	0	0	
	1	8	0	8	0	
More than 2 sessions	2	13	11	2*+	0	P = 0.00001**
	3	4	4	0	0	
	4	2	2	0	0	
	5	4	4	0	0	**Chi Square: Highly significant difference in patients receiving 2 or more sessions unless emotional issues are present
	6	0	0	0	0	
	7	1	1	0	0	
	8	3	3	0	0	
	9	1	1	0	0	
	10	0	0	0	0	
	11	0	0	0	0	
*Significant Emotional Issues	12	1	1	0	0	
+No occurrence of VCD	13	0	0	0	0	
	14	1	0	1*	0	
		40	27	11	0	

Prospective Study

- Goal
  - To explore characteristics that might distinguish adolescent patients diagnosed with Vocal Cord Dysfunction from patients diagnosed with asthma

Responses to Speech Pathology Vocal Cord Dysfunction Questionnaire

Response	Subject Group	Number/ Percent	p value
Constriction in throat	VCD VCD + Asthma Asthma Controls	4 (80%) 8 (88.89%) 2 (22.22%)	p = .016**
Constriction in Throat * Fisher's Exact Test (2-tail) ** Chi Square	VCD, VCD+Asthma Asthma Controls	12 (85.71%) 2 (22.22%)	p = .007*

Responses to Speech Pathology Vocal Cord Dysfunction Questionnaire

Response	Subject Group	Number/ Percent	p value
Constriction in Upper Chest	VCD VCD+Asthma Asthma Controls	4 (80%) 8 (88.89%) 4 (44.44%)	p = .131* NS
Constriction in Upper Chest * Fisher's Exact Test (2-tail) ** Chi Square	VCD, VCD+Asthma Asthma Controls	12 (85.71%) 4 (44.44%)	p = .036

Results

- Speech Pathology questionnaire revealed highly significant differences
  - Between VCD and Asthma patients in feeling constriction in upper airway during attack

- Between VCD and VCD with Asthma compared to Asthma Controls in feeling constriction in upper chest during attack

Summary of Research

- Highly significant improvement of symptoms after two or more sessions learning Breathing Techniques
- >58% continue to use Breathing Techniques as primary method to control VCD
- Sensation of place of constriction during attack highly significant predictor of Vocal Cord Dysfunction

Summary Thoughts

- VCD/PVFM is a complicated disorder, as so many disorders impact on respiratory system
- These disorders need to be diagnosed and treated
- However, the respiratory system remains a habituated system, and even if causal factors are controlled, the respiratory system needs to be retrained to an adaptive, life-supporting system

- Treat each patient/client as if they are an "N" of "1" with unique history and response to intervention
- The patient's response will help clarify contributing factors
- Allow the picture of the patient to include all discrepant data
- Don't try to simplify the symptomatic picture into a single cause
- Allow it to be as complicated as it may be

- Incorporate these factors into your treatment plan:
  - When patient practices breathing pattern
  - How and when to use breathing pattern to prevent and/or constriction
- Help patient see exploring the disorder as an opportunity to use breath as supporting life activities, not interfering with these activities

- If something does not fit into a classification category, allow it to remain outside the category, and include the extra factors
- These may evolve into another cluster of symptoms or responses to treatment

- Keep in mind – treatment for VCD/PVFM is classically not a longterm therapy program
- If patient does not respond within three sessions, accept that there are other factors impacting on the patient – psychosocial, undiagnosed underlying pulmonary problems, impact of medications that may need re-evaluation

- If you don't work in a clinical or medical center, try to set up your own "clinic team" of individual physicians in your community you can work with comfortably – ENT, laryngologist, primary physician, pediatrician, allergist, possibly physical therapist, and pulmonologist