

Vocal Cord Dysfunction The Great Masquerader



Dr. Mary Noseworthy MD FRCPC
Pediatric Respirologist Alberta Health Service
Clinical Assistant Professor
University of Calgary
Asthma and Home Oxygen Clinical Director
Alberta Children's Hospital Calgary, AB

Learning Objectives:

- ▶ Describe Vocal Cord Dysfunction(VCD) as a differential diagnosis
- ▶ Feel confident with VCD diagnostic criteria and treatment modalities
- ▶ Integrate VCD educational tools into their practices

Vocal Cord Dysfunction

Paradoxical vocal cord dysfunction

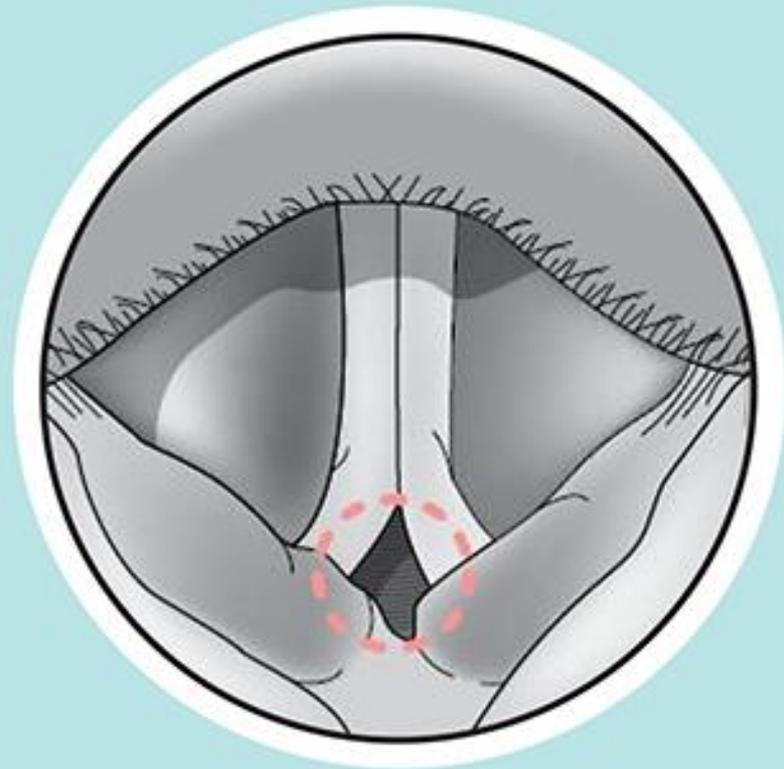
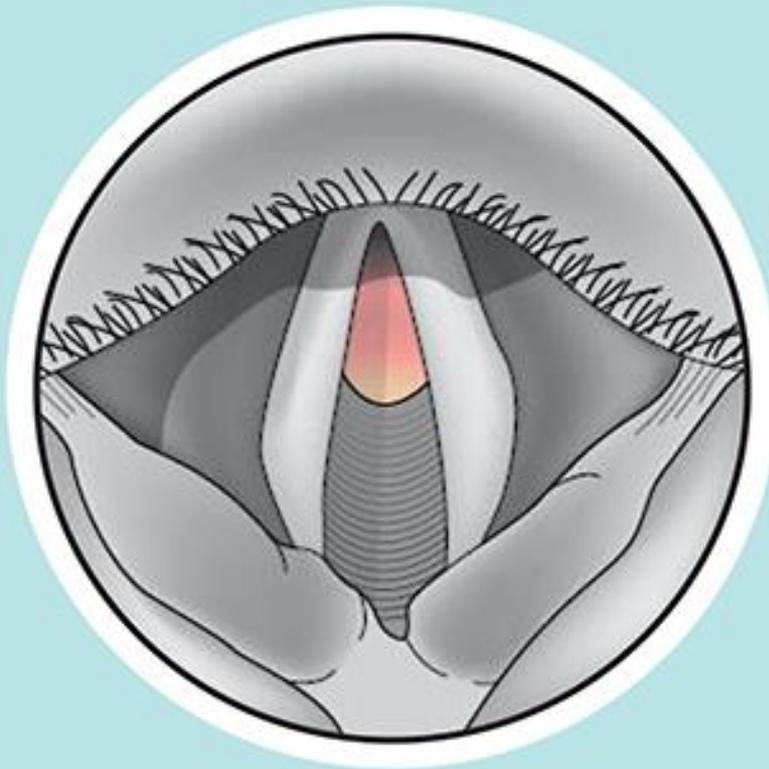
Paradoxical vocal fold motion

70 other names

Has a history - Year 1842 mentioned in literature

A name by any other name...

- ▶ Hysterical croup
- ▶ Munchausen's Stridor
- ▶ Poor performance stridor
- ▶ Factitious asthma
- ▶ Psychogenic stridor
- ▶ Malingering



A Normal vocal cords at mid-inspiration

B Vocal cord dysfunction

Normal – vocal cords open during inspiration

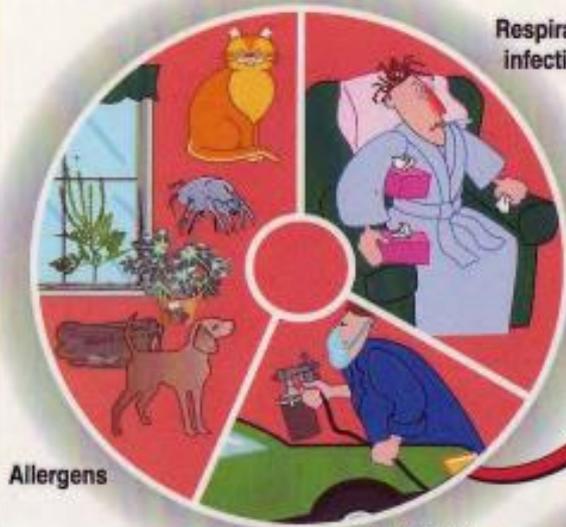
VCD - vocal cords move towards during inspiration, creating varying degrees of obstruction

Symptoms

- ▶ Subjective reoccurring respiratory distress
- ▶ Shortness of breath
- ▶ Coughing
- ▶ Cannot get a full breath of air
- ▶ Difficulty getting air in or out of the lungs
(more typical in)
- ▶ Tightness in the throat or chest
(more typical throat)
- ▶ Stridor, wheezing, raspy breathing
- ▶ Hoarse voice
- ▶ Apparent upper airway obstruction +/- asthma

TRIGGERING FACTORS

Inflammation



Constriction



Others



Reproduced with permission: Dr. Louis-Philippe Boulet, Hôpital Laval. Understanding and Controlling Asthma, CEA-R, Hôpital Laval, Audiovisual Department 149-06 A. Copyright, 1993, Revised June 2006

What can Trigger VCD

- ▶ Strenuous exercise (outdoor > indoor)
- ▶ Psychogenic: anxiety/stress/strong emotions
- ▶ Inflammation: post nasal drip/ allergies/ rhinitis sinusitis
- ▶ Viral: colds/URTI's
- ▶ Irritants: strong smells/pollutants/envir allergens/smoke
- ▶ Acid reflux (GERD)/laryngopharyngeal reflux
- ▶ Laryngeal hyper responsiveness
- ▶ Rarely neurological diseases, brain stem compression, neuronal injury

***Similar triggers as asthma*

Physiology

- ▶ 4 distinct sensory nerve fibers
 - 1) Cold (Thermoreceptors)
 - 2) Pressure (Mechanoreceptors)
 - 3) “Drive” (resp to tracheal movement)
 - 4) Irritant (mechanical and chemical)

DDX of Laryngeal movement disorders

VCD	Somatoform disorder, conversion disorder, abuse, anxiety disorder, depression, Munchausen syndrome, malingering
Psychogenic	
Exercise	Exercise
Irritant	Extrinsic (chemical irritants, olfactory stimuli) Intrinsic (GERD, laryngopharyngeal reflux rhinitis/post nasal drip, sinusitis)
Laryngospasm	Intubation, airway manipulation, IgE mediated, nocturnal aspiration
Vocal Cord Paresis/Paralysis	Prolonged intubation, recurrent laryngeal or vagus nerve damage during chest or thyroid surgery, idiopathic
Infectious	Epiglottitis, bronchiolitis, laryngotracheobronchitis (croup), laryngitis, pharyngeal abscess, diphtheria, pertussis, laryngeal papillomatosis Head and neck malignancy, cystic hygroma, hemangioma,

Differential Diagnosis VCD

- ▶ **Asthma**
 - ▶ Foreign body
 - ▶ Tracheal stenosis
 - ▶ Vocal cord paralysis
 - ▶ Croup
 - ▶ Vocal Cord polyps/tumors
 - ▶ Exercise Induced Asthma
 - ▶ Dysfunctional Breathing (DB)
- Angioedema
 - Anaphylaxis
 - Epiglottitis
 - Hypoparathyroidism
 - Laryngomalacia

**Laryngoscopy needed to rule out structural problems –
especially adults

“Typical Patient”

- ▶ More girls than boys 2:1 or 3:1 ratio
- ▶ >20 times more females than men
- ▶ Females generally 20-40 years age
- ▶ High achieving personality (Type A)
- ▶ Elite Athletes (outdoor 8.3%> indoor 2.5% sports)
- ▶ Military Recruits
- ▶ A high incidence of health care workers*
- ▶ Presentation widely variable
- ▶ Often have a “diagnosis” of asthma
- ▶ Inhalers not working and symptoms worsening

*cleaning and antiseptic agents

Case 1

- ▶ 14 year old female with asthma long standing
- ▶ Diagnosis at 2 years of age Fm Dr
- ▶ Peanut allergy carries EPIPEN
- ▶ Several visits to ER over the years

Case 1

- ▶ Grade 9 honours student
- ▶ Involved in all Gr 9 varsity sports
- ▶ Voice training (classical)
- ▶ Sings in English, German, French, and Italian
- ▶ Private school in SW of city
- ▶ Both parents are highly successful lawyers

Case 1

- ▶ She recently **failed** the cross country track component of her high school gym program
 - ▶ Mom says the **school** doesn't **understand** her **exercise limitations** with asthma and how her SOB affects her performance in gym
 - ▶ Mom and teen now in **big conflict** with the **school** over all extracurricular events involving exercise or gym or outdoor special events
 - ▶ Teen afraid and **anxious** of next years Gr 10 Gym Class Marathon
 - ▶ GP unsure how to handle this conflict refers to asthma clinic
-
- ▶ ****PEARL** Kids with asthma well controlled can exercise without limitations

Case 2

- ▶ Boy in his bed at night
- ▶ Wakes up with croup like noise
- ▶ Given Salbutamol puffer to take
- ▶ PFT normal in past

All test results should be evaluated by a qualified physician.

Smoking-Pack Years: 0

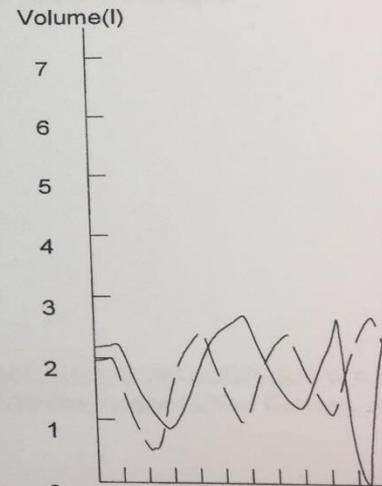
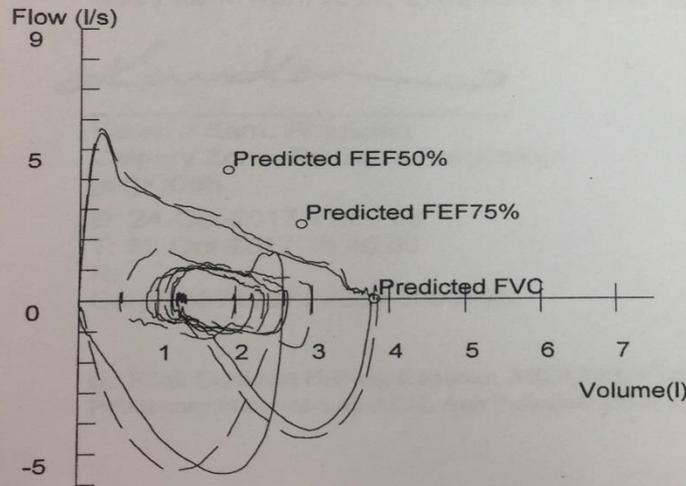
Test Sequence	Pred. (LLN)	Best Pre	% Pred.	Best Post	% Pred.	% Change
FVC (L)	3.81 Kn (2.99)	#3 3.75	98.4%	#2 3.81	99.9%	1.5%
FEV1 (L)	3.35 Kn (2.66)	2.66	79.4%	2.79	83.2%	4.8%
FEV1/FVC	0.86 Kn (0.73)	0.71	82.6%	0.73	85.1%	3.1%
PEFR (L/s)		5.55		5.70		2.8%
PEFT (s)		0.10		0.09		-16.3%
FEF25-75% (L/s)	3.87 Kn (2.45)	2.10	54.3%	2.28	58.9%	8.5%
FIVC (L)		2.54		2.60		2.2%
PIFR (L/s)		4.29		4.54		5.9%
Ext. Vol. (L)		0.06		0.05		-1.8%
FET (s)		3.39		3.48		2.6%
EOTV (L)		0.00		0.00		0.0%
Time		10:06		10:07		
Mouthpiece #		5676-7289		5676-7289		
Physician/Tech		as		as		

Best Pre-FVC: 3.75 (L), Best Pre-FEV1: 2.66 (L), Best Post-FVC: 3.81 (L), Best Post-FEV1: 2.79

Best Pre-FVC interpretation: Mild obstruction.

Best Post-FVC interpretation: Normal spirometry.

Comments: ATS criteria met Pt did not have any inhalers this AM Suymbicort taken as BD 1 puff 2
Noseworthy BMI 23.2



Case 3

- ▶ 15 year old female
- ▶ Wheeze, cough, dyspnea at school
- ▶ Outdoor track athlete
- ▶ A+ student who is a “Perfectionist”
- ▶ Student in music (violin), dance, basket ball
- ▶ Parents deny anxiety or social discord
- ▶ Collapses on basket ball court with inspiratory wheeze during game “frightening noise”
- ▶ CARDIO has said there’s nothing wrong with her heart
EKG & ECHO is normal



Investigations:

- ▶ CXR
- ▶ PFT in presence and absence of symptoms
- ▶ Bronchial provocation with Methacholine
- ▶ Bronchodilator test with Salbutamol
- ▶ Allergy evaluation with skin prick testing
- ▶ Video -laryngoscopy

Diagnostic Aids

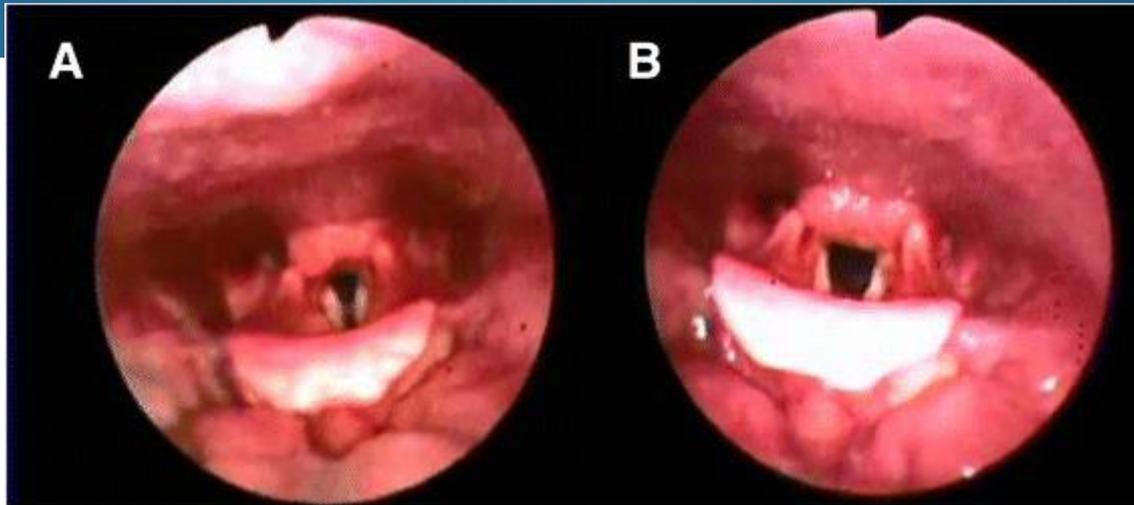
- ▶ Clinical History/Symptoms
 - ▶ Difficulty breathing in
 - ▶ throat/upper chest
 - ▶ voice change
- ▶ Pulmonary function test
 - ▶ *Some patients have Asthma/EIA and VCD*
- ▶ Exercise Testing
- ▶ Flexible Laryngoscopy **GOLD STANDARD

Pertinent questions for evaluation of VCD

1. Do you feel like your symptoms are confined to your throat or upper chest?
2. Do you feel like there is a restriction in your throat or upper chest preventing you from getting air past a certain point?
3. Do you have shortness of breath when breathing in?
4. Do you have a sudden onset of your attacks?
5. Do you have a sensation of something in your throat you are unable to clear?
6. Does your voice change when you have an attack?
7. Do you feel your breathing is loud or noisy during attacks?
8. Do specific triggers cause your attacks?
9. Do you feel your symptoms have not been understood correctly?
10. Do you have difficulty with light pressure, such as tight clothes or bending your neck?
11. Are your attacks impacting your social life?
12. Do asthma medications help?
13. Do use of your asthma inhalers sometimes make symptoms worse?
14. Do you ever feel lightheaded or dizzy during attacks?
15. Do you have numbness or tingling in your hands, feet or lips with attacks?
16. When your symptoms start, do you generally cough?

Flexible Fiberoptic Laryngoscopy

- ▶ Diagnostic Standard
- ▶ Patients may demonstrate abnormal movement during scope **if not** can try stimulating VCD
- ▶ Limited to Specialists who are proficient in technique and availability of the scope



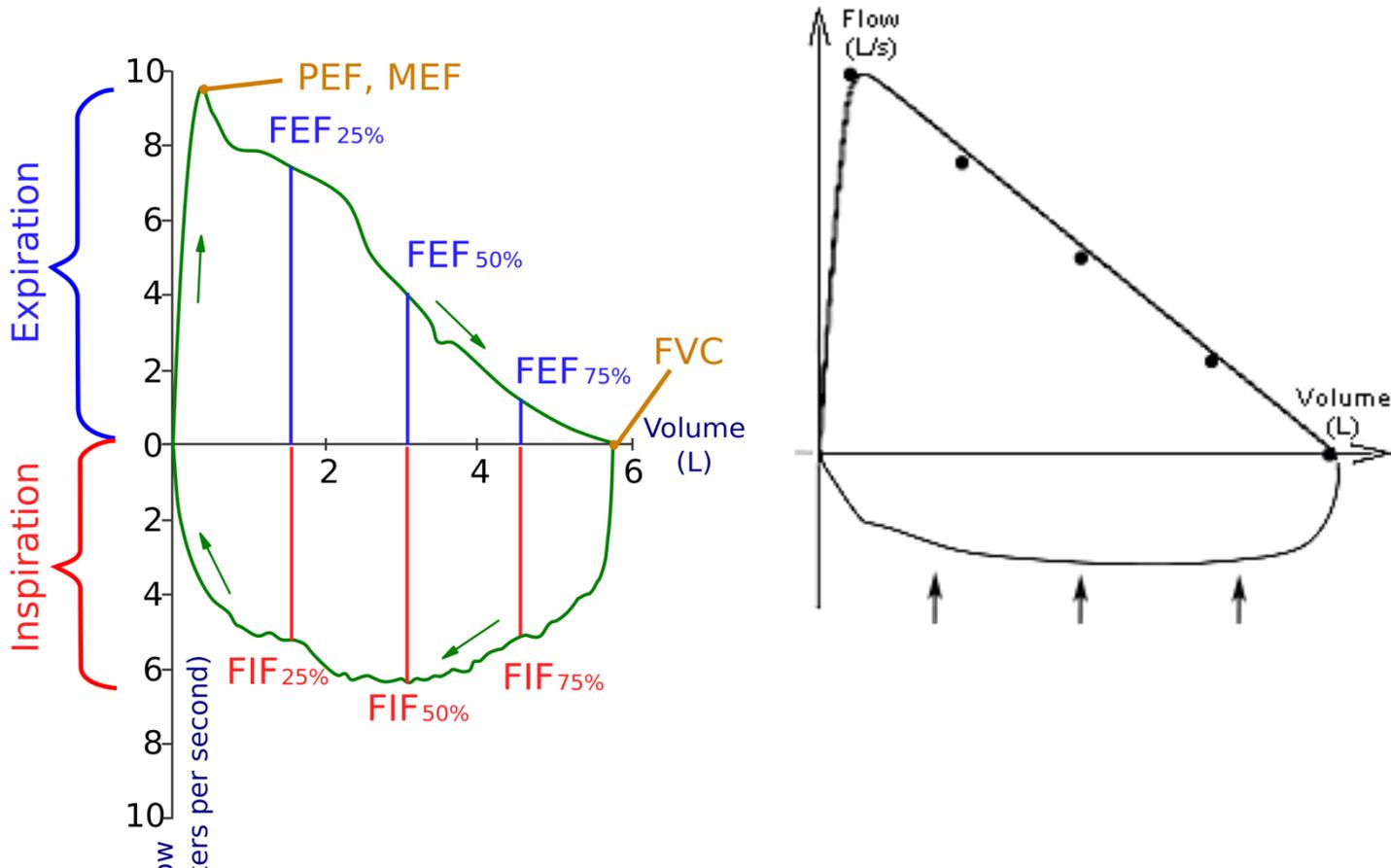
A: Images taken during laryngoscopy showing paradoxical adduction detected during mid-inspiration in a patient with vocal cord dysfunction

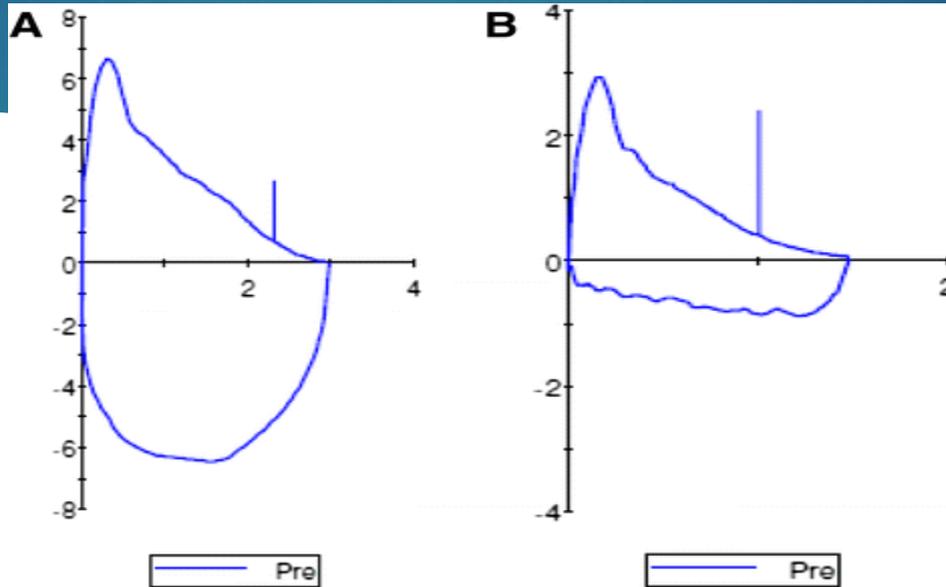
B: Appropriate movement of the vocal cords during mid-inspiration in the same patient following speech therapy

FVL showing inspiratory obstruction

Flattened inspiratory loop

Broad rule $FEF_{50\%} = FIF_{50\%}$





a Normal flow volume loop in asymptomatic patient **b** Example of flattening, early truncation and saw-tooth pattern of inspiratory limb of flow volume loop in a patient with vocal cord dysfunction

Barriers to diagnosis

Poorly understood and diagnosed

Not sure how many people are affected

Some studies show up to 50 % of people dx with asthma

Not many Health Care Professionals have heard of it

*Studies show as low as 20 % of family physicians are aware of
VCD*

< 5% of nurses

Laryngoscopy gold standard for diagnosis requires Specialist skill and knowledge

May not be widely available

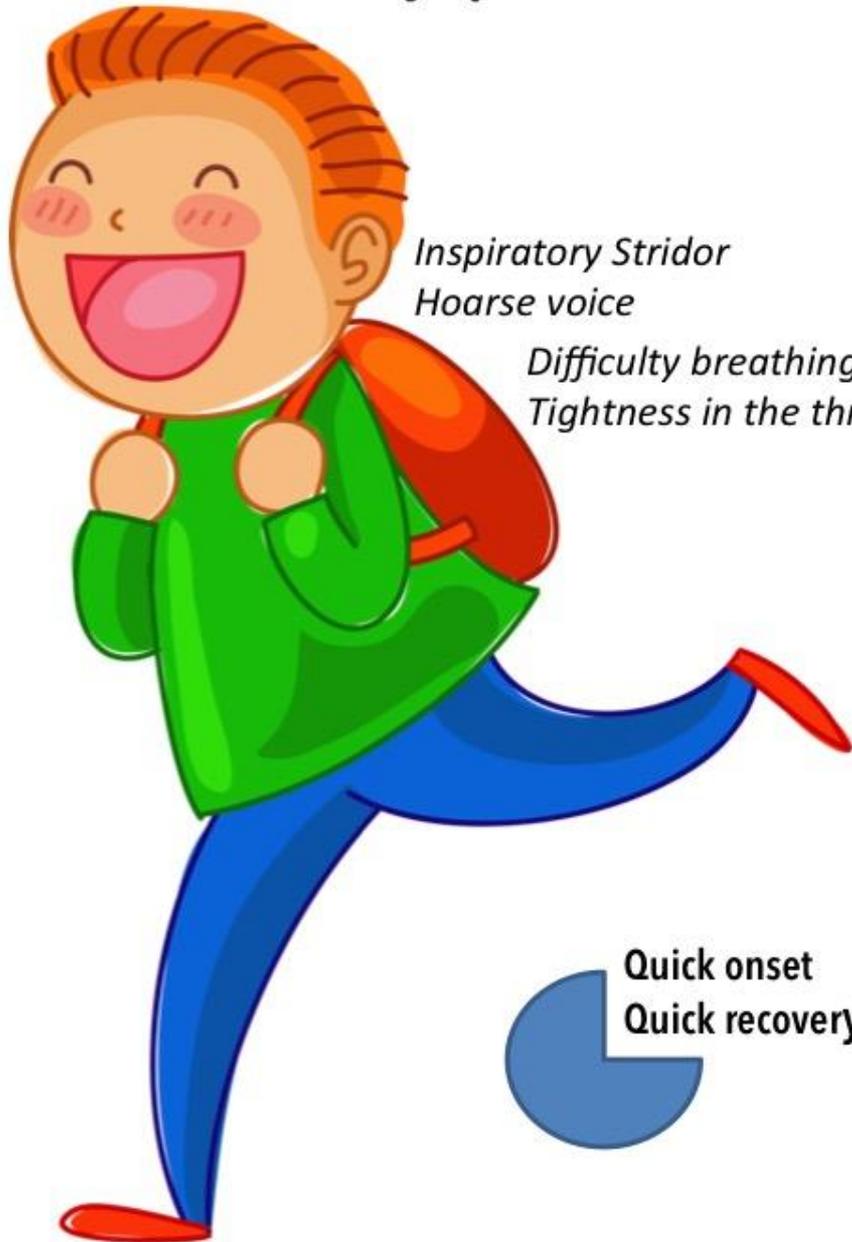
Impact and Cost of Misdiagnosis

- ▶ Patients quality of life physically and psychologically
Often quit their sports because of having refractory asthma
- ▶ Increased cost on health care system
Asthma medications, emergency department, primary care visits



Why do people get VCD

VCD symptoms



Inspiratory Stridor
Hoarse voice

Difficulty breathing In
Tightness in the throat

Quick onset
Quick recovery

Exercise Induced Asthma



Cough, Wheeze
Difficulty breathing out

Slower onset
Slower recovery

VCD vs Exercise Induced Asthma

VCD

- ▶ Difficulty breathing in
- ▶ Stridor
- ▶ Tightness in the throat/upper chest
- ▶ Rapid onset/Rapid recovery
- ▶ Puffers may or may not help

Asthma symptoms

- ▶ Breathless/ cough/wheeze
- ▶ Harder to breath out
- ▶ Tightness in the chest
- ▶ Gradual onset, gradual recovery
- ▶ Puffers always help

**Note : Some patients have VCD and Asthma
Making diagnosis tricky**

Multidisciplinary approach to Treatment

- ▶ Reassure patient
- ▶ Avoid and treat triggers
- ▶ Breathing exercises
- ▶ Speech therapist (*1996 survey only 2/15 had good knowledge and tx*)
- ▶ Psychologist
- ▶ Physiotherapist
- ▶ RT/CRE
- ▶ Physician
- ▶ Specialists - ER Physicians, Respirologist, Otolaryngologist, Gastroenterologist, Allergist, Neurologist, Psychiatrist or Psychologist, Speech pathologist, and Athletic trainer

Treatment

- *DIAPHRAGMATIC BREATHING AND SNIFF TECHNIQUE*
- *EASY TO LEARN*
- *MUST PRACTICE*

Throat breathing exercises

Relaxed Throat Breathing Exercises

1. Sip water before and after doing these exercises.
2. Exercises:
 - a. Shoulders Down
 1. This is the cue for you to relax.
 - b. Hand on abdomen
 1. This helps you focus on easy abdominal breath support – the best and the most relaxed way to breathe.
 - c. Gentle, quick “sip” of air IN (pursed lip “sip, sip, sip”)
 1. Breathe in through your mouth (using a straw cut to 3” is helpful, but just pursing your lips can work also).
 2. Pursed lips around the straw.
 3. About 1 second for the INHALE.
 - d. Gentle, blow of air OUT (“blow, blow, blow”)
 1. Through the slightly tight lips around the straw.
 2. About 2-3 seconds for the EXHALE
 3. Breathing both IN and OUT should be easy and relaxed.
3. Practice 10 breaths, 5-7 times per day when you are NOT having symptoms. For example: in the car, when reading, watching television, or before medications. Regular practice when you are feeling well is important.
4. Be patient when completing the breathing, it may take several minutes to start feeling relief.
5. Make it automatic and use it at the first sense of throat tightness to prevent or suppress the VCD. You may start with the INHALE or the EXHALE.
6. If asthma is also a concern, follow your physician’s instructions regarding taking an inhaler after completing the breathing exercises.
7. Use it to “pre-treat” yourself before known trigger for VCD. Possible triggers could be: change in air temperature, strong odors or perfumes, and exercise.
8. This technique can be a “stress-buster” too!

- 
- ▶ While the use of medications can be attempted, effective long-term therapy requires psychosocial support, speech therapy and even biofeedback.

Treatment during acute episodes

- ▶ Heliox (80% helium/20% oxygen)
- ▶ Topical Lidocaine
- ▶ Anxiolytics
- ▶ Superior laryngeal blocks with Clostridium botulinum toxin

Pittsburgh Vocal Cord Dysfunction Index



2014, researchers developed a scoring index to help distinguish VCD from asthma

Throat tightness and dysphonia, the absence of wheezing, and the presence of odors as a symptom trigger as key features of VCD that distinguish it from asthma.

The index showed good sensitivity (83%) and specificity (95%), and accurately diagnosed VCD in 77.8% of patients with laryngoscopy-proven VCD.^[25]

VCDQ Questionnaire

Developed in England



Table 2. The 12-item Vocal Cord Dysfunction Questionnaire (VCDQ)

Question	Disagree strongly	Disagree	Neither agree nor disagree	Agree	Agree strongly	Score
	1	2	3	4	5	
1. My symptoms are confined to my throat/upper chest						
2. I feel like I can't get breath past a certain point in my throat/upper chest because of restriction						
3. My breathlessness is usually worse when breathing in						
4. My attacks typically come on very suddenly						
5. I feel that there is something in my throat that I can't clear						
6. My attacks are associated with changes in my voice						
7. My breathing can be noisy during attacks						
8. I'm aware of other specific triggers that cause attacks						
9. My symptoms are associated with an ache or itch in my throat						
10. I am frustrated that my symptoms have not been understood correctly						
11. I am unable to tolerate any light pressure around the neck, e.g. tight clothes or bending the neck						
12. The attacks impact on my social life						
Total						(12–60)



What Is Vocal Cord Dysfunction (VCD)?

Vocal Cord Dysfunction means that your vocal cords do not act normally. With VCD, instead of your vocal cords opening when you breathe in and out, your vocal cords close. When your vocal cords close, it makes it harder to get air into or out of your lungs.



Where are the vocal cords and what do they do?

Your vocal cords are deep in your throat in your voice box (larynx). Normally, when you breathe in (inhale), your vocal cords open. This allows air to go into your windpipe (trachea) and lungs. When you breathe out (exhale), your vocal cords open and let the air out of your lungs. Breathing out can cause your vocal cords to vibrate and lets you produce sounds for speaking.

Common signs and symptoms of VCD

- Shortness of breath or difficulty getting air into or out of your lungs.
- Tightness in the throat or chest.
- Frequent cough or throat clearing.
- A feeling of choking or suffocation
- Noisy breathing (stridor, gasping, raspy sounds or wheezing)
- Hoarse voice

VCD can come on suddenly and may be mild or sometimes severe. Without treatment, a severe attack may require emergency room treatment. Even if an attack is severe, the oxygen level in your blood is usually normal. VCD symptoms do not usually occur during sleep.

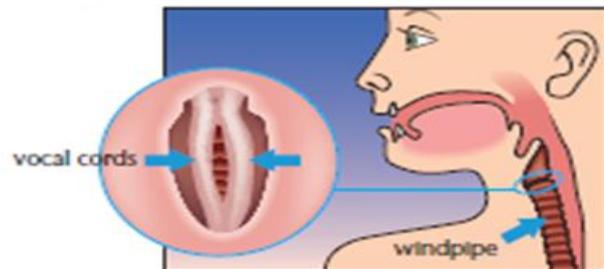
What can trigger VCD?

There are many different possible triggers of VCD. Often no trigger can be found. VCD may be triggered by:

- Acid reflux (GERD)
- Post-nasal drip
- Upper respiratory infection (cold)
- Exercise
- Strong odors or fumes
- Tobacco smoke
- Strong emotions and stress

VCD is often confused with asthma

Often people with VCD are thought to have asthma because the symptoms and triggers for VCD and asthma can be similar. However, symptoms from VCD are not relieved by taking asthma medicines that open your breathing tubes (bronchodilators like albuterol). A confusing fact is that some people have both VCD and asthma. When a person with both VCD and asthma starts to cough, wheeze or have trouble breathing, it can be difficult to tell if the symptoms are from asthma, VCD, or both at the same time.



Exercises for Vocal Cord Dysfunction

Diaphragmatic Breathing

Many people who experience difficulty breathing will benefit from lower, relaxed breathing that fills the part of the lungs below the shoulders, armpits, and upper chest – not just the upper lung area near the shoulders. Many people tighten the neck and shoulder muscles in response to air hunger, thereby increasing the experience of throat tightness. The goal of this exercise is to become comfortable with low, deep diaphragmatic breathing.

How:

1. Sit or lie quietly with one hand on your chest and one hand on your belly, below your ribcage.
2. Without changing anything, notice the movement when you inhale and exhale.
3. Try to make your belly rise or expand outward when you inhale deeply. When you exhale, let your belly deflate or move in as the air leaves your body.
4. Do this deep breathing without moving your shoulders.
5. Deep, relaxed breathing is rhythmic, with equal intervals of inhalation and exhalation.

Sniff-Breath Technique

This is the actual breathing manoeuvre that will be used when the first trigger of a VCD episode is identified. Being able to breathe through the nose is important for this step. Blow your nose if necessary before beginning.

How:

1. Practice sniffing deeply through your nose.
2. Practice sniffing in deeply and quickly. 3 quick sniffs that rapidly follow one another allows air into your lungs by forcing your vocal folds open.
3. After you take 3 quick, deep sniffs into your body, exhale through pursed lips or while making any of the following sounds for a count of 8-10: "s, sh, f".
 - This step is important to keep your throat open when you exhale.
 - You must exhale as completely as possible to avoid hyperventilation.
4. Do 5 consecutive sniff-breath exercises at five times throughout the day. It helps to pair the exercise with a routine activity such as mealtime, tooth brushing, and bedtime. Do the exercise before starting the activities that tend to trigger the Vocal Cord Dysfunction episode, and at the first sign of onset of a VCD episode.

The Goal is to ward off the episodes, recover breathing more quickly and easily, reduce the frequency of episodes, and eventually, keep them from happening at all.

Belly Breathing

Diaphragmatic Breathing

will benefit from lower, relaxed breathing that fills the upper chest – not just the upper lung area near the diaphragm. In response to air hunger, the diaphragm contracts and moves down. The goal of this exercise is to become comfortable with

stand and one hand on your belly, below your ribcage. When you inhale and exhale, feel the movement when you inhale and exhale. When you inhale deeply, let your chest expand and your shoulders relax. When you exhale, let your chest contract and your shoulders relax. Repeat for equal intervals of inhalation and exhalation.

used when the first trigger of a VCD episode is identified. It is important for this step. Blow your nose if necessary

quick sniffs that rapidly follow one another allows air to enter the lungs. When you exhale, let your chest contract and your shoulders relax. When you exhale, let your chest contract and your shoulders relax. Repeat for equal intervals of inhalation and exhalation.

times throughout the day. It helps to pair the exercise with brushing, and bedtime. Do the exercise before a VCD episode, and at the first sign of onset

breathing more quickly and easily, reduce the frequency of VCD episodes, and prevent them from happening at all.

revised February 8, 2006 from <http://www.mjc.org>

Disorders in Children and Adults. Language, speech, and hearing.

stand, sit or lie down comfortably in a quiet room.



2. Close your eyes and loosen any tense muscles. Make sure to relax your shoulders.



3. Place one hand on your upper chest and another on your belly button.



4. Breathe in slowly through your nose for *three seconds*. Feel your chest expand. Your chest should still.



5. Breathe out slowly through your mouth for *three seconds*. Feel your stomach move back.



6. Repeat steps 4 and 5. Gradually increase the time you take to breathe in and out.

Four seconds in and four seconds out, five seconds in and five seconds out.....