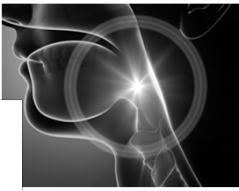
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## ADULT PARADOXICAL VOCAL FOLD MOTION: EVALUATION & TREATMENT

JOANNA SLOGGY, MA, CCC-SLP  
UK VOICE & SWALLOW CLINIC

## RELEVANT FINANCIAL RELATIONSHIPS


- JoAnna is receiving an honorarium for this presentation, conference registration, and receives a salary from the University of Kentucky Voice & Swallow Clinic.




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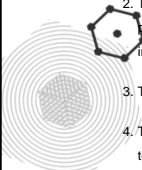
### ABSTRACT


- This presentation focuses on understanding and treating paradoxical vocal fold motion (PVFM) in adults.
- Patients often see multiple providers prior to receiving a diagnosis of PVFM and recent literature suggests that otolaryngologists and SLPs should provide the definitive and long-term management of patients with PVFM. The prevalence is currently unknown; however, it is more common in females than males (2:1).
- Participants will learn to identify Irritable Larynx Syndrome and PVFM symptoms and how to perform a non-instrumental evaluation for PVFM. The clinical diagnosis process performed by SLP using instrumental assessment in conjunction with ENT will be introduced and laryngeal exams will be used to further understanding of PVFM as well as differential diagnosis of Asthma vs. PVFM.
- Therapy demonstrations will include rescue breathing for PVFM as well as the use of an inspiratory muscle strength training protocol and physiologic voice therapy.

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### LEARNER OUTCOMES


1. The participant will be able to demonstrate an understanding of Paradoxical Vocal Fold Dysfunction and the epidemiology of PVFM in the adult population
2. The participant will be able to recognize symptoms of PVFM in adults and perform a non-instrumental assessment of PVFM for referral to ENT/SLP for instrumental assessment.
3. The participant will be able to perform rescue breathing for PVFM.
4. The participant will be able to identify and practice appropriate voice therapy technique for treating adults with PVFM.



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### PARADOXICAL VOCAL FOLD MOTION

“Paradoxical vocal fold motion is a disorder of respiration that most commonly presents with acute respiratory distress from abnormal adduction of the vocal fold during inspiration.”  
(Denipah et. al, 2017)

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### IRRITABLE LARYNX SYNDROME

- Chronic Cough
- Laryngopharyngeal Reflux
- Paradoxical Vocal Fold Motion

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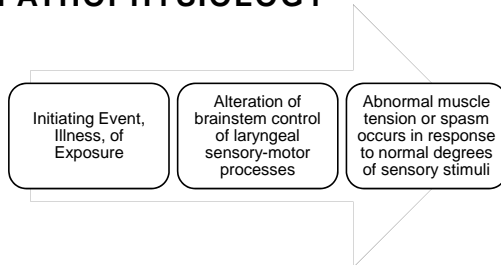
## IRRITABLE LARYNX SYNDROME: DEFINITIONS

- Laryngeal Hypersensitivity
  - "Hyperkinetic laryngeal dysfunction resulting from a variety of specific causes in response to a definitive triggering stimulus" (Stemple & Fry, 2010, p. 247)
  - "ILS" term est. 1999 (Morrison, Rammage, & Emami, 1999)
  - Associated with a collection of symptoms

## IRRITABLE LARYNX SYNDROME: DIAGNOSTIC CRITERIA

- Original Criteria: (Morrison, Rammage, & Emami, 1999)
  1. Symptoms of laryngeal tension
    - Combinations of dysphonia, laryngospasm, globus pharyngeus, and/or chronic cough
  2. Evidence of tension
    - Laryngoscopy: Mediolateral, AP compression
    - Neck, shoulders
  3. Trigger(s)
    - e.g., airborne substance, esophageal irritant, odor

## IRRITABLE LARYNX SYNDROME: PATHOPHYSIOLOGY



(Stemple & Fry, 2010, p. 247)

## IRRITABLE LARYNX SYNDROME: PATH TO DIAGNOSIS

- Indirect path is common
- GI
- Pulmonary
- Family Medicine
- Rheumatology
- Allergy
- Cardiology
- ENT
- SLP

## IRRITABLE LARYNX SYNDROME: ASSESSMENT

- Perceptual Assessment, Case History
  - Does voice quality deteriorate with extensive talking?
  - Has pt developed adaptive or compensatory behaviors?
  - Patient self-ratings
- Videostroboscopy
  - May present with generalized hypersensitivity **during actual examination** (gag, difficulty sustaining phonation, excessive coughing)
  - Integrity of tissue; reflux irritation
  - Muscular imbalance? Abnormal closure pattern?
  - May look normal
- **Therapeutic Probes, Strategies** (Morrison, Rammage, & Emami (1999))

## IRRITABLE LARYNX SYNDROME: DIAGNOSIS

- Symptom-based
- Commonly preferred:
  - ENT Evaluation
  - SLP Evaluation with videostroboscopy

## IRRITABLE LARYNX SYNDROME: SLP TREATMENT

1. Patient education
2. Reduction of sensory stimuli
3. Reprogram maladaptive response
  - Tension reduction, posture
  - Pursed lips breathing technique
  - Physiologic voice therapy


Goal: rebalance laryngeal mechanism and musculature to reduce laryngeal hypersensitivity

Morrison, Rammage, & Emami (1999)



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## CHRONIC LARYNGITIS

- Sore throat, irritation for > 3 wks
  - Thick, sticky mucus
  - Mild to severe dysphonia
  - Vocal fatigue
  - Unproductive cough, throat clearing
- 
- Image: UK Voice & Swallow Clinic
- Possible causes: repeated acute laryngitis, vocal misuse and abuse, smoking (anything), poor hydration, air pollutants, airborne allergies, dehydrating medications, GERD, repeated vomiting (e.g., bulimia)
  - **Treatment:** *identify and eliminate causes*
    - *Voice therapy: rebalance laryngeal mechanism, reduce dysphonia*



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## CHRONIC COUGH: DEFINITION


- Cough persisting > 8 weeks
  - Pulmonary cause ruled out
- Names:
  - Refractory chronic cough
  - Idiopathic chronic cough
  - Cough hypersensitivity
  - Psychogenic cough
  - Habit cough
  - Recalcitrant cough
  - Upper airway cough syndrome

Koufman (2014a)  
Iyer & Lim (2013)



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## CHRONIC COUGH vs. ACUTE COUGH

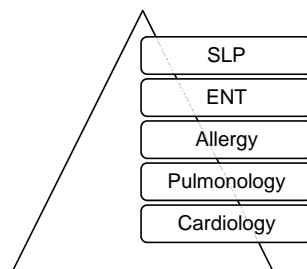
- Cough: defensive reflex to clear airway
    - Inspiration + compression + expulsion
    - Larynx high in tussigenic nerve endings
    - *Can be desensitized and suppressed*
  - Acute cough: beneficial to airway
  - Chronic cough: no benefit to airway
  - Phonotraumatic
- 

Iyer & Lim (2013)



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## CHRONIC COUGH: PATH TO DIAGNOSIS



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## CHRONIC COUGH: PATIENT PRESENTATION

- Prevalence: 9-33% in all age groups; females > males
- 5-35% of patients using ACE-inhibitors (Lisinopril common)
- Triggers similar to ILS: *airborne irritants, temperature changes, reflux, perfumes, odors*
- May result in:
  - Vomiting, chest pain, voice changes/injury, sleep deprivation, incontinence, embarrassment, interference with work/relationships/social activity
- 40% also dx with dysphonia

Chamberlain, Birring, & Garrod (2014); Iyer & Lim (2013); Vertigan, Theodoros, Gibson, & Winkworth (2007); Koufman (2014a)



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## CHRONIC COUGH: PATIENT INTERVIEW

- Patterns/timing/frequency
- Improvement? With what and for how long?
- Associated illnesses/events with onset
- Allergies/PND
- Other disciplines
- Quality of Life/Psychosocial concerns
- ACE-Inhibitors
- **Therapeutic Probes, Strategies**

## CHRONIC COUGH: INSTRUMENTAL ASSESSMENT

- Videostroboscopy *may* reveal:
  - Bilateral midmembranous swelling, erythema of true vocal folds
  - Impaired glottic closure (anterior gap, larger than normal posterior gap)
  - Supraglottic hyperfunction

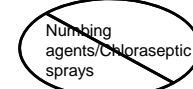
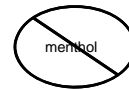
## CHRONIC COUGH: DIAGNOSIS

- Symptom-based
- Rule out pulmonary cause
  - Chest X-Ray
  - Asthma
  - COPD
- Common Causes:
  - GERD
  - Rhinitis/PND

Iyer & Lim (2013)  
Chamberlain, Birring, & Garrod (2014)

## CHRONIC COUGH: TREATMENT

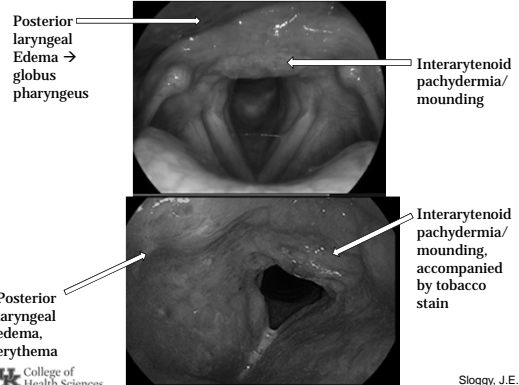
- Underlying causes
  - Asthma
  - LPR/GERD
  - Rhinitis/PND
- Ask pt: Cough suppressants?

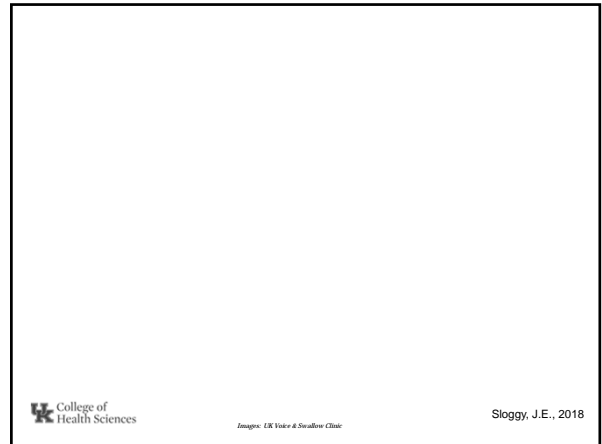
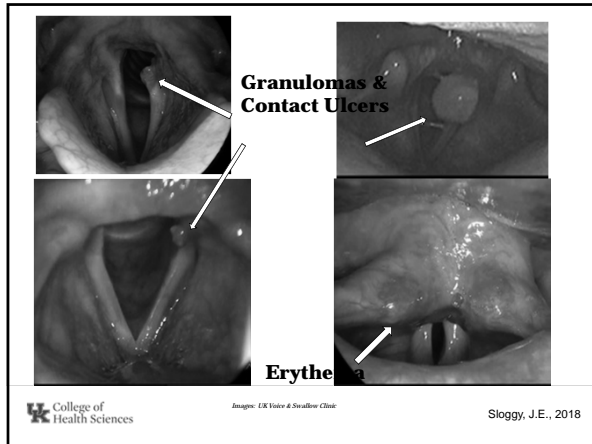


## CHRONIC COUGH: TREATMENT

- Behavioral: Voice Therapy for dysphonia
  - Cough Suppression (swallow), Elimination of triggers
  - Breathing
    - Gentle, steady breathing; pursed lips
    - May worsen with typical "rescue breathing"
  - Physiologic voice therapy: rebalance laryngeal musculature and manage laryngeal hypersensitivity
  - Decrease compensatory behaviors, muscle tension
- Pharmacologic treatment: limited efficacy
  - Gabapentin: 2012 study

Gibson & Vertigan (2015)  
Koufman (2014a) Chamberlain,  
Birring, & Garrod (2014)





## PARADOXICAL VOCAL FOLD MOTION (PVFM)

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## CONFUSING TERMINOLOGY “PSUEDO-ASTHMA”?

This was first described as a clinical entity in 1983. Since then, many terms have been used with descriptions of the same condition.

- Adductor laryngeal breathing dystonia
- Episodic laryngeal dyskinesia
- Munchausen's stridor/Psychosomatic stridor/Factitious asthma stridor
- Emotional laryngeal asthma/Emotional laryngeal wheeze
- Episodic paroxysmal laryngospasm
- Hysterical croup
- Functional (non-organic) upper airway obstruction
- Laryngeal hyper-responsiveness
- Vocal cord dysfunction (VCD)
- Paradoxical vocal fold motion/movement (PVFM)

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## MOST RECENT TERMS - VOCAL CORD DYSFUNCTION

“The term **vocal cord dysfunction** is commonly used to describe paradoxical vocal fold motion but actually encompasses the broader category of laryngeal disturbances without acute upper airway obstruction.” (Denipah et. al, 2017)

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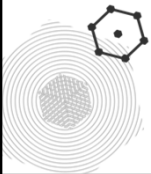
## PARADOXICAL VOCAL FOLD MOTION

“Disorders of the upper airway when vocal folds and/or supraglottic structures constrict during respiration, resulting in significant respiratory distress.” (Blager, 2000).

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PARADOXICAL VOCAL FOLD MOTION

## CURRENT CLINICAL DEFINITION



"Inappropriate adduction or closure of the true vocal folds during inspiration and/or expiration, may result in upper airway obstruction and stridor."

(Andrianopolous, Gallivan, & Gallivan. 2000; Maschka et al., 1997; Mathers-Schmidt, 2001; Sandage & Zelanzy, 2004.)

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## PARADOXICAL VOCAL FOLD MOTION

"Paradoxical vocal fold motion is a disorder of respiration that most commonly presents with acute respiratory distress from abnormal adduction of the vocal fold during inspiration."

(Denipah et. al, 2017)

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## IMPORTANT TO KNOW...

- "Because is this often perceived as life-threatening by the patient will often breathe faster, which may exacerbate a Bernoulli phenomenon between the already adducted VFs during inspiration, leading to worsening or prolonging of symptoms or ( in severe cases) temporary complete glottic occlusion with a resultant syncope.
- If this happens, the respiratory center in the brainstem will take over and normal breathing will soon resume with out any significant risk for anoxic brain injury." (Palla & Friedman, 2016).
- This may be perceived as a life-threatening ER presentation, leading to unnecessary intubation and even tracheostomy even though these patients will have normal pulse oximetry, chest X-ray, and blood gas levels.
- **However... timely diagnosis and treatment can significantly reduce this.**

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## PVFM BEDSIDE ADVICE

- It's important to remember that the patient truly feels like they can't breathe.  
*It's not "just in their head".*
- The PVFM patient is typically highly anxious and very scared in the middle of a PVFM attack.

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## [ The PVFM Journey ]

The average time from symptom onset and diagnosis is **over four years**.  
(Patel et al., 2004)

Speech-Language Pathologist

Otolaryngologist/ENT

Pulmonologist

Gastroenterologist

Psychiatrist/Psychologist

Neurologist

Cardiologist

Allergist

Multiple ER visits

PCP

Athletic Coach/Athletic Trainer

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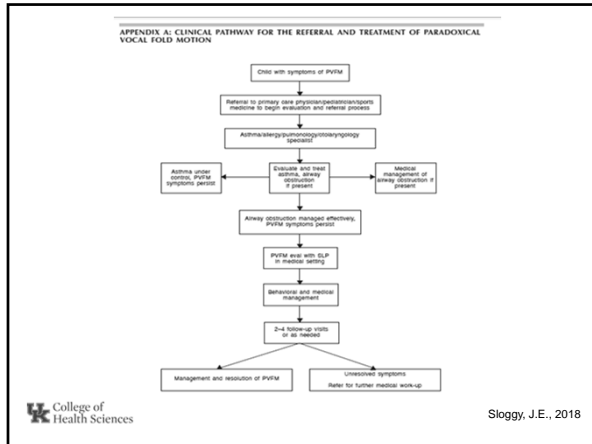
## WHICH SPECIALTY IS THE BEST FIT?

Recent literature is suggesting that otolaryngologists and speech-language pathologists should provide the definitive and long-term management of patients who have these disorders

(Murry & Sapienza, 2010)



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## EPIDEMIOLOGY OF PVFM

- Prevalence:**
  - Unknown due to limited awareness and challenges associated with diagnosis
  - Relatively Uncommon
- Average Age of Diagnosis**
  - 14.5 years for adolescents
  - 33 years for adults
- Typical Patient**
  - More common in females, 2:1
  - With adolescents, the typical profile is the **young elite athlete**
- Co-occurs with asthma 50% of the time
- Often misdiagnosed as asthma or exercise induced bronchospasms

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## PATHOPHYSIOLOGY

ADDITIONAL HYPOTHESES

### Unclear; Multiple Causes

- Organic –**
  - Non-competitive exercise
  - Postoperative neurologic injury
- Non-organic –**
  - Psychiatric disorders, including: conversion disorder, major depression, obsessive-compulsive disorder, and anxiety
  - Prior history of sexual abuse
  - Stress – especially stress related to competitive sports

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## PATHOPHYSIOLOGY

ADDITIONAL HYPOTHESES

“Inflammatory or irritant insult causes laryngeal hyper-responsiveness, resulting in airway narrowing at the glottic level. This results in an altered autonomic balance, which can become persistent with repeated stimuli”  
(Ibrahim et al., 2007; Gurevich-Uvena et al., 2011).

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## PATHOPHYSIOLOGY

ADDITIONAL HYPOTHESES

“Persistent stimulation of laryngeal sensory afferent nerves by inhaled chemicals may result in hyper intense laryngeal adduction reflex that may be inappropriately activated during inspiration”  
(Guss & Mirza, 2006).

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## PARADOXICAL VOCAL FOLD MOTION: SYMPTOMS

### “Difficulty Breathing”

- Episodic events characterized by **dyspnea on inspiration**
- Stridor sounds are loudest at the level of the throat and less audible throughout the chest wall
- Tightness of throat, potentially also of the chest
- Sense of panic and anxiety
- Asthma inhalers and other treatment do not seem to help their symptoms
- Typically does not respond to methacholine and/or histamine challenges
- Often experiences dysphonia during or after episodes

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## NON-INSTRUMENTAL ASSESSMENT

- Onset
- Triggers
- Frequency/duration of attacks
- Description of attacks
- Dietary habits
- Changes in voice quality/swallowing

## NON-INSTRUMENTAL ASSESSMENT

- Physical activities
- Other medical intervention
  - (chest x-rays, pulmonology results)
- Observation of breathing during speech and resting breathing
- Introduce PVFM Rescue Breathing

## INSTRUMENTAL ASSESSMENT

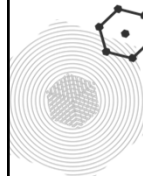
- Flexible Nasoendoscopy – *“The Gold Standard”*
- Aerodynamic Assessment
- Acoustic Assessment
- Spirometry (Pulmonology)

## FLEXIBLE NASOENDOSCOPY

It is important to rule out other laryngeal or central airway pathologies that may cause similar symptoms

such as:

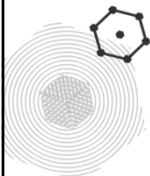
- laryngomalacia
- tracheobronchomalacia
- excessive dynamic airway collapse
- bilateral VF paralysis/paresis
- masses (benign or malignant)
- stenosis



## FLEXIBLE NASOENDOSCOPY

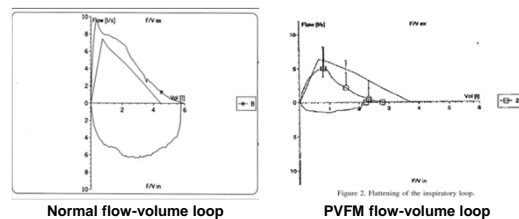
“Most patients who present in a medical clinic with concerns about VCD **do not demonstrate symptoms** during the clinical assessment” (Sandage & Zelazny, 2004).

Include rescue breathing techniques during the endoscopy with the purpose of providing the patient with biofeedback regarding the patency of the airway when using these techniques.



## SPIROMETRY

Acutely symptomatic patients may have a flattening or truncation of the inspiratory flow loop on the full flow-volume loop.





## DIFFERENTIAL DIAGNOSIS – ASTHMA VS. PVFM

- PVFM co-occurs with asthma as much as **50%** of the time  
(Newman, Mason, & Schmaling, 1995)
- The clinical features of PVFM apply to patients who **are free of** organic obstructive laryngeal conditions and pulmonary diseases other than asthma

## ASTHMA VS. PVFM

Most patients over the age of 8 who have asthma can be taught to differentiate between an asthma attack and a VCD attack based on location of the tightness.

- Throat
- Chest

## DIFFERENTIAL DIAGNOSIS PVFM VS. ASTHMA

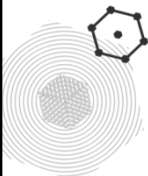
Diagnostic Feature	PVFM	Asthma
Chest tightness	Yes/No	Yes
Throat tightness	Yes	No
Stridor with inhalation	Yes	No
Wheezing with expiration	No	Yes
Types of Triggers	Exercise, extreme temperature (hot or cold), airway irritants (GERD/LPR and/or postnasal drip, emotional stressors)	Exercise, extreme temperature (hot or cold), airway irritants, allergens, emotional stressors
Number of triggers	Usually one	Usually multiple
Usual onset of symptoms after beginning exercise (in min)	< 5; however, can be variable	> 5-10 min
Recovery period (in min)	5-10	15-60
Response to bronchodilators and/or systemic corticosteroids	No response	Good response
Nocturnal awakening with symptoms	Rarely	Almost always
Female preponderance	Yes	No

## DIFFERENTIAL DIAGNOSIS- PVFM VS. EXERCISE-INDUCED BRONCHOSPASM

	PVFM	EIB
<b>Symptoms</b>	Highly variable and often difficult to reproduce	Reproducible under similar conditions
	Throat tightness	Chest tightness
	Occurs during exercise and spontaneously resolves within 5 mins after exercise	Typically peaks 5-10 mins after exercise begins and often spontaneously resolves within 30-60 mins with continuous exercise
	Symptoms may be interrupted by distraction or panting	Unable to catch their breath or pant effectively
	No circadian pattern	May have nighttime symptoms
	Poor therapeutic and prophylactic responses to anti-asthma meds	Good therapeutic and prophylactic response to anti-asthma meds
<b>Signs</b>	Inspiratory stridor	Expiratory wheezing
	May have normal provocation response to exercise or methacholine	Usually has abnormal provocation response to exercise or methacholine

## DE LA HOZ ET AL., 2008

### Irritant exposure and psychological factors resulting in VCD



- Patients were workers and volunteers who participated in the rescue, recovery, and cleanup of the World Trade Center disaster site
- Exposed to cement dust and psychological stressors
- VCD was determined to be a consequence of their exposure to the disaster site

## MEDICAL MANAGEMENT

GERD

Asthma

## BEHAVIORAL TREATMENT

Rescue Breathing

Inspiratory Muscle Strength Training

Abdominal Breathing

"The goal of treatment is not simply to promote relaxation, but also to cultivate awareness of the subtle physiological feedback that the body provides to the patient signaling that a VCD event is about to occur. This training is key to the successful implementation of the breathing exercises" (Sandage & Zelazny, 2004).

## THERAPEUTIC INTERVENTION

(Smith et al., 2017)

- Establish abdominal breathing control.
- Eliminate or decrease muscle tension in torso associated with high ventilatory output tasks
- Establish forceful activation of the inspiratory muscles, while relaxing throat and laryngeal muscles using graduated breathing exercises including rescue breathing, pursed lip inhalation and exhalation, which induces inspiratory resistance, and increases inspiratory muscle strength

## THERAPEUTIC INTERVENTION

(Smith et al., 2017)

- Respiratory practices introduced initially in static postures than gradually progressing into dynamic practice. Focus on coordinating breathing rhythms with physical activity.

walking      light jogging      running

- Adaptions are then made to incorporate breathing control practices in the patient's sport.

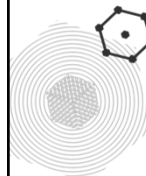
### • Rescue breathing technique

- Start with breathing **OUT** on "*shhhh*" or "*ffffff*". Maintain a steady flow of air - pause
- **Fast inhalation in with a pursed lip posture** (fast nasal inhalation may work as well – can use three quick breaths instead of one longer one) - **Pause**
- Repeat

## RESCUE BREATHING TECHNIQUE

- Patients report that it typically takes a small number (3-6) cycles to re-establish the patency of the airway during an attack.
- Have patients practice when they aren't having any difficulty breathing to learn their rhythm.

## RESCUE BREATHING TECHNIQUE



- The rate of inspiratory vs. expiratory cycles will be different for each patient
- It is important to take the time to establish the ideal rate for the patient before they leave the clinic.

## Rescue Breathing Techniques

## THERAPEUTIC BREATHING MANEUVERS

(Denipah et al., 2017)

- **Jaw Thrust**
  - Protrude the lower jaw forward while breathing normally
- **Pursed Lip Breathing through an endotracheal tube or straw**
  - Use a drinking straw or a 6.0 endotracheal tube cut to approximately 13 cm
  - Close lips around the tube or straw
  - Inhale through the tube or straw and exhale through the mouth
- **Nose to Mouth Breathing**
  - Inhale through the nose over 3 seconds
  - Exhale through semi-pursed lips (open pucker) over 3 seconds

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## THERAPEUTIC BREATHING MANEUVERS

(Denipah et al., 2017)

- **Panting**
  - Breathing in a rhythmic pattern and motion ("pant like a dog")
  - Make sure the mouth is open and the tongue is protruded forward
- **3 Sniff**
  - Take 2 quick then 1 slow inhalation sniffs through the nose
  - Exhale slowly through the mouth

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## INSPIRATORY MUSCLE STRENGTH TRAINING



- Structured inspiratory muscle strength training program completed over 4-6 weeks.
- Use of a pressure threshold load respiratory muscle trainer allowing for adjustments on the inspiratory side to rebalance and strengthen inspiratory muscles through various exercises.

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## INSPIRATORY MUSCLE STRENGTH TRAINING

This is a crucial part of successful treatment because the cessation of VCD attacks is believed to be related to the principle of neural adaptation and crossover effects that accompany physical training

(Baker et al., 2003).

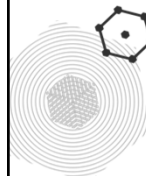


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## FURTHER MEDICAL MANAGEMENT

- Referral to additional specialties for a more comprehensive workup



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PVFM

PVFM

PVFM

Laryngospasm

Case Study

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