Asthma?
or
Vocal Cord Dysfunction
Hyperventilation Syndrome
Panic Disorder?

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Case 1: Female receptionist, 27y

- Childhood asthma
- 1y history of recurrent breathlessness
  - Sensation of being unable to catch breathe, or feeling lungs only ¾ full & need to breathe in more air
  - No increase in breathlessness with activity
  - Maybe associated dizziness, shaking, yawning, sweating, palpitations, tiredness, parathesiae, panic
  - No benefit with asthma medication
  - Improvement with sitting down & breathing slowly
- History of panic attacks
- FEV1 2.42 (76%), FVC 3.28 (88%)

Case 2: Retired Engineer 62 y Male

- Never smoked & no asthma
- Intermittent cough 1y, worse with cold air
- Symptoms of postnasal drip; inflammed larynx on review by ENT ? GORD
- Admitted with SOB 6 weeks
  - Feels like wheezing from throat, or breathing through a straw
  - Better when relaxes throat
  - Intermittently limited making bed & showering
- OE wheeze confined to larynx

Case 3: Invalid 23y Female

- Asthma from childhood

- Very severe symptoms
  - Recurrent admissions
  - Maintained on high dose prednisone 40mg/d (upto 120mg/d) and iv immunoglobulins, fluticasone 500mcg 4x daily, salmeterol
  - Aseptic necrosis, cataracts, obesity
  - Invalids benefit, requiring crutches
  - Tramadol, paradex, codeine, ativan

Case 3 continued

- Symptoms
  - Variable breathlessness, could mobilise despite breathlessness occurring at rest
  - Sensation of blockage in upper part of her chest with more difficulty breathing in than out
  - At times associated wheeze, fatigue, frustration, chest soreness, racing heart
- FEV1 0.71 (22%) FVC 0.89 (24%) SaO_2 98%
- OE variability in tachypnea, intermittent upper airway wheeze

Is it Asthma?

Difficult to Control Asthma

- Poor adherence
- Unusual asthma triggers
- Associated or aggravating conditions
- Diseases that mimic asthma

Holgate S. Lancet 2006; 368: 780-93

Difficult to Control Asthma

Associated Conditions

- Chronic rhinosinusitis
- GORD
- Anxiety, panic, fear, depression
- Hyperventilation syndrome
- Vocal cord dysfunction
- Obesity
- Obstructive sleep apnea

Difficult to Control Asthma

Diseases that mimic asthma

- Bronchiectasis
- Constrictive bronchiolitis
- COPD
- Congestive heart failure
- Hyperventilation syndrome
- Upper airway obstruction
- Allergic bronchopulmonary aspergillosis
- Churg-Strauss syndrome
- Eosinophilic pneumonia
- Thyrotoxicosis

Hyperventilation Syndrome

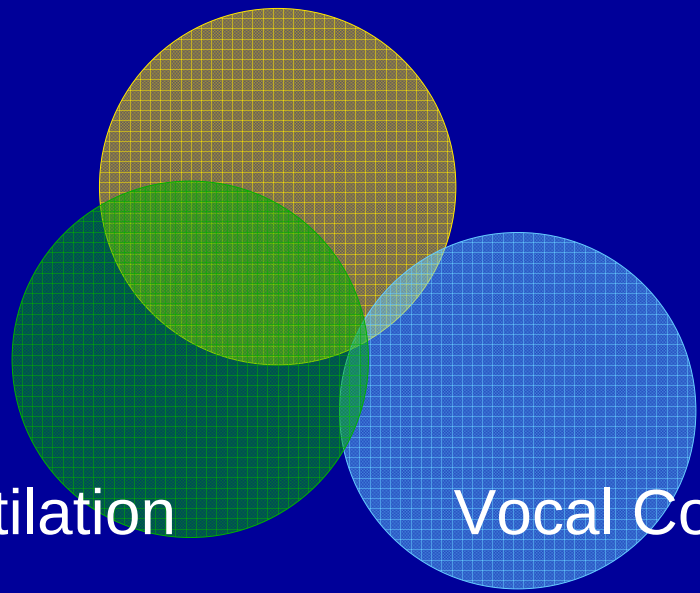
"Behavioural Dyspnea"

Panic Disorder

Vocal Cord Dysfunction

"paradoxical vocal cord fold motion dysfunction", "paradoxical vocal cord motion", "laryngeal instability", "laryngeal hyper-responsiveness", "irritable larynx syndrome"

Panic Disorder



Chronic Hyperventilation

Vocal Cord Dysfunction

Background

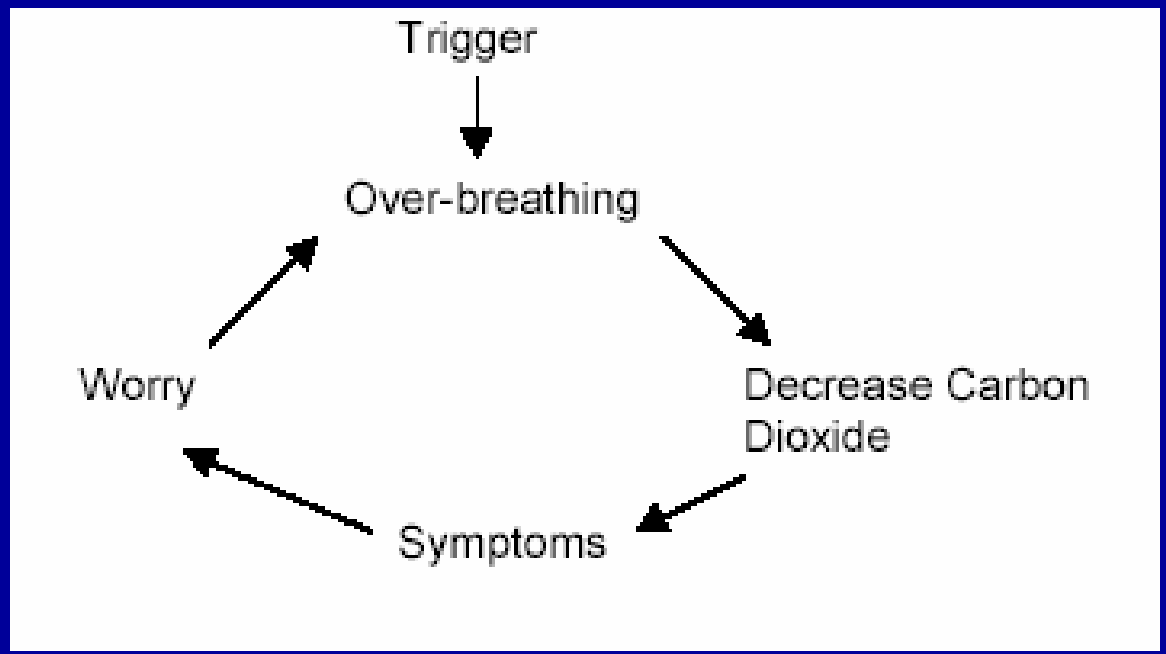
- Experience genuine discomfort
- Maybe disabled psychologically by:
  - unexplained symptoms
  - false diagnoses
  - complications of treatments & investigations
  - medical system not understanding them & their problem
- May suffer physical harm from unneeded investigations or treatment
  - Withholding therapy is difficult in a patient with crushing chest pain, dyspnea, &/or suggestive ECG changes
- Considerable expense

Pathophysiology

- Mechanism for development unknown
- Certain stressors provoke an exaggerated response
- The initiating stimulus & the abnormal stress response may be identical for hyperventilation syndrome & panic disorder but are expressed differently

Hyperventilation Syndrome

Behavioural or psychogenic breathlessness with hyperventilation as a consequence



Hyperventilation Syndrome

Symptoms due to:

- Dysfunctional breathing
- Hypocarbia
  - Reduced coronary blood flow
  - Reduced cerebral blood flow (decreases 2-3% for every 1 mm Hg decrease in pCO_2)
  - Reduced ionised calcium & phosphate levels
  - Bronchospasm
- Associated anxiety & panic

HVS: Metabolic changes

Result from intracellular shifts & increased protein binding of various electrolytes during respiratory alkalosis

- Acute **hypocalcemia**: carpopedal spasm, muscle twitching, positive Chvostek & Trousseau signs, prolonged QT interval.
- **Hypokalemia:** generalized weakness.
- Acute **hypophosphatemia** may contribute to paresthesias & generalized weakness.
- A leftward shift in the HbO_2 dissociation curve & vasospasm related to **low pCO_2** may cause myocardial ischemia in patients with coronary artery disease

Panic Disorder

Chronic condition with recurrent panic attacks in association with (one of):

- Worry about future attacks
- Phobic avoidance of situations that could trigger an attack
- Other change in behaviour due to attacks (frequent medical or ED attendance)

Panic attacks characterised by sudden onset of episodes of intense fear and/or physical symptoms that peaks in 10min and lasts about 20min

Panic Disorder

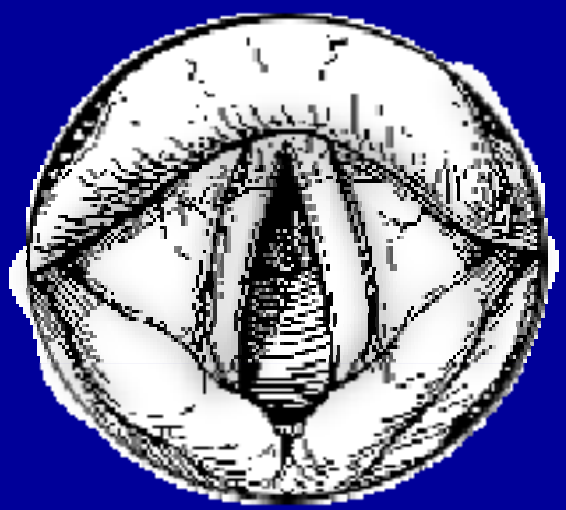
- Genetically inherited neurochemical dysfunction
- Errors in perception of stimuli lead to increased levels of anxiety, arousal & somatic complaints
- Sustained or intermittent high levels of anxiety & panic which are not aroused by realistic danger & does not dissipate when stimulus goes away

Vocal Cord Dysfunction

Inappropriate movement of the vocal cords which results in functional airways obstruction, & inspiratory & expiratory stridorous breathing

Episodes of severe dyspnea with sudden onset, lasting several hours to days, with symptom free periods

?related to increased laryngeal tone mediated by vagus nerve



Pathophysiology

Hyperventilation Syndrome	Panic Disorder	Vocal Cord Dysfunction
Hightened sensitivity to •Lactate infusion •Increased CO_2 •Caffeine • Isoproterenol •Cholecystokinin •Emotional distress •Provoke exaggerated respiratory response	Heightened sensitivity to •Lactate infusion •Increased CO_2 •Stimulants (caffeine, cocaine etc, decongestants) •Yohimbine •Injury/Illness/Conflict or loss/Situational (public spaces, public transport-agoraphobia) •Produce flight or fight response	Lowered threshold to •GORD •Sinusitis •Postnasal drip •Strenuous Exercise •Irritant fumes/intubation •Psychosocial •Provoke vocal spasm or abnormal adduction

Epidemiology

Hyperventilation Syndrome	Panic Disorder	Vocal Cord Dysfunction
•Prevalence upto 10% of patients in a general IM practice •Peak age of incidence from 15-55 years, but all age groups except infancy. •Female-to-male ratio ? 7:1	•Prevalence up to 4-7% in primary care setting •Average age of onset is usually 18-45 years age, can also come later in life •Female-to-male ratio ? 2:1 •Modest concordance identical twins	•Prevalence ?2% •Peak age of incidence from 20-40 years, but can occur from 6-83 years •Female-to-male ratio ? 3:1

Associated Conditions

Hyperventilation Syndrome	Panic Disorder	Vocal Cord Dysfunction
Occurs: •approx 50% of patients with panic disorder •60% of patients with agoraphobia Associated with: •panic disorder (25%)	Occurs: •6-39% asthma •24% COPD •30% chest pain & normal angiogram •15% headache Associated with: •generalised anxiety (most) •agoraphobia (30%) •episode major depression (60-90%) •suicide rate 18x •substance abuse 4-14x	Occurs: •20% asthma? Associated with: •anxiety disorders & depression

Presentation of HVS

- Acute: sudden onset of symptoms following an acute event
- Chronic: associated with a myriad of symptoms with numerous presentations
  - Hyperventilation is usually not clinically apparent
  - Respiratory alkalosis can be maintained with occasional deep sighing respirations, which are often observed
  - Symptoms can mimic virtually any serious organic disorder, but usually have atypical features of these diseases, & without much supporting physical evidence of disease

HVS Respiratory symptoms

- Increased breath volume and rate
- Chest pain
- Sensation of breathlessness
- The patient often complains of a sense of suffocation, an inability to breathe in, or the feeling that there is not enough air

HVS: Cardiac symptoms

- Chest pain:
  - may closely resemble angina
  - tends to last hours rather than minutes
  - often relieved rather than provoked by exercise
  - usually unrelieved by GTN spray
- ECG changes common
- Vasospasm induced by low CO_2 may be sufficient to provoke myocardial injury in patients with coronary artery stenosis
- Prinzmetal angina (coronary angiospasm) can be triggered (would be expected to respond to nitrates or calcium channel blockers)

HVS: Central nervous system

- Dizziness, weakness, confusion & agitation (common)
- Feelings of depersonalization & visual hallucinations
- Syncope or seizure (rare)
- Paresthesiae:
  - Usually in both upper limbs
  - When unilateral left-sided in 80% cases
  - Perioral numbness very common.

HVS: Other symptoms

- GI symptoms
  - aerophagia causes bloating, belching, flatus, epigastric pressure
- Dry mouth
  - occurs with mouth breathing & anxiety

Symptoms

Hyperventilation Syndrome	Panic Disorder	Vocal Cord Dysfunction
•Dyspnea, wheezing •Sense of suffocation or inability to breathe in, "not enough air" •wheeze •Atypical chest pain, palpitations •Dizziness, weakness, confusion, agitation, depersonalisation, convulsions •Paresthesia, carpopedal spasm, generalized weakness	•SOB, smothering •Palpitations, trembling, shaking •Chest pain, tachycardia •Dizziness, light headedness, derealisation, depersonalisation •Abdominal discomfort, nausea, distress •Fear of dying/losing control •Paresthesia •Chills or hot flashes	•Difficulty breathing •Inspiratory stridor •Choking •Wheeze •Cough •Hoarseness & voice change

Diagnosis

- The diagnosis depends on
  - Recognizing the typical constellation of signs & symptoms
  - Ruling out serious conditions
- Based on careful history
  - Symptoms will be subtly different from those of coexisting asthma
  - Nature, timing & location of symptoms
  - Relationship of symptoms to exercise
  - Presence of anxiety, depression & agarophobia

Differential Diagnosis

Hyperventilation Syndrome	Panic Disorder	Vocal Cord Dysfunction
•Panic •Asthma •Pulmonary embolus •Pneumothorax, pneumonia etc •Angina/AMI •Cardiac dysrrhythmias •Cardiac Failure •Diabetic ketoacidosis •Hypoglycaemia •Hypoparathyroidism •TIA's •Seizures	•Asthma •COPD •Hyperventilation syndrome •Pulmonary embolus •Angina/AMI •Cardiac dysrhythmias •Mitral Valve prolapse •Hyperthyroidism •Hypoglycaemia •Pheochromocytoma •Hypoparathyroidism •TIA's •Seizures	•Asthma •Hyperventilation syndrome •Laryngeal polyp, neoplasm, cyst •Recurrent laryngeal or vagal nerve palsy •Arthritis cricopharyngeal joint •Brain stem compression •Upper/lower motor neuron disorder •GORD •Foreign body •Anaphylaxis

Investigations

Hyperventilation Syndrome	Panic Disorder	Vocal Cord Dysfunction
•PFR's •Lung function tests •Pulse oximetry •ABG •CXR •ECG (Prolonged QT interval ,IST depression, elevationT-wave inversion) •Calcium, Magnesium, Phosphate •Toxicology screen •D Dimer (PE) •V/Q scan/spiral CT •FENO	•PFR's •Lung function tests •Pulse oximetry •ABG •CXR •ECG, cardiac enzymes •Calcium, Magnesium, Phosphate, glucose •Thyroid function •Toxicology screen •D Dimer (PE) •V/Q scan/spiral CT •FENO	•Laryngoscopy •Spirometry (reduced inspiratory flow) •Methacholine provocation (increased insp flow limitation) •PFR's (maybe reduced) •Lung function tests •Pulse oximetry •ABG •CXR •ECG •FENO

Hyperventilation Syndrome

Provoking the symptoms by having the patient voluntarily hyperventilate for 3-4 minutes may help educate the patient but is time-consuming & may be ineffective

Management

- Reassurance & counselling
  - Patient will be convinced that they have a serious condition that requires medication
  - Need to convince the patient about what is happening & remove the anxiety & panic
- Explanation that you understand what is happening & patient is not alone
  - “I see & manage the condition repeatedly”
  - “I understand the mental & physical effects of living with undiagnosed or wrongly diagnosed conditions”

Management

- Explanation in layman's terms of how the body's exaggerated physical response is leading to very real symptoms
  - Not factitious or malingering disorder, or due to mental weakness
  - Emphasise the mind-body interaction
  - Need to change the affective response to the sensations i.e. desensitisation & reduce fear

Management

- Teach patient how to differentiate between asthma & other symptoms
  - May need to stop PEF monitoring
- Confirm asthma & cardiac treatment not helpful except for placebo effect by reducing coexisting anxiety
- When patient ready commence gradual mobilisation & reduction of asthma medication
- Referral for counseling, psychotherapy

Management

Hyperventilation Syndrome	Panic Disorder	Vocal Cord Dysfunction
•Acutely; reduce hyperinflation etc •Counseling –Frequent reassurance –Psychotherapy –Support groups •Behavioural therapy –Relaxation –Breathing retraining –Change thoughts relating to symptoms –Exercise •No specific medications	•Acutely; i.n midazolam •Counseling –Frequent reassurance –Psychotherapy –Support groups •Behavioural therapy –Relaxation –Breathing retraining –Change thoughts relating to symptoms –Exercise •Medications Antidepressants	•Acutely; reassurance, panting, heliox, CPAP •Treat underlying disorders (sinusitis, GORD triggers etc) •Counseling –Frequent reassurance •Behavioural therapy –Relaxation –Change thoughts relating to symptoms –Speech therapy •No specific medications Ipratropium pre exercise, ?Botulinum toxin

Treatment HVS

- Rebreathing using a paper bag is not recommended
  - If hyperventilating for organic reasons increasing pCO_2 and decreasing O_2 may be disastrous.
  - Often unsuccessful because patients have difficulty complying with the technique & because CO_2 itself may be a chemical trigger for anxiety

- Reduce hyperinflation
  - Physically compress the upper thorax & have the patient exhale maximally decreases hyperinflation of the lungs.
  - Instructing the patient to breathe abdominally, using the diaphragm more than the chest wall.

Conclusion

- Need to consider these disorders in all patients who are not responding as expected to treatment
- Unrecognised these conditions may persist for many years & lead to immense psychological distress & effects of incorrect investigations & treatments
- Physical conditions which are due to an exaggerated physiological response

Conclusion

- Diagnosis is based on taking a careful history
- Need to get patient's trust & change the way the patients is relating to their symptoms
- Patients over time can learn to differentiate symptoms from those of coexisting asthma
- As the anxiety diminishes & trust is established begin reducing the asthma medications & start rehabilitation

Physical Examination

- Acute hyperventilation
  - Obvious tachypnea and hyperpnea
  - chest wall tenderness is common
  - Carpopedal spasm (acute hypocarbia causes reduced ionized calcium and phosphate levels)
  - Chvostek or Trousseau signs (hypocalcemia).
  - Wheezing may be heard (bronchospasm from hypocarbia).
  - Tremor, mydriasis, pallor, tachycardia, and other manifestations of anxiety can occur.
  - Evidence of depersonalization or hallucination may be noted.
- Chronic HVS
  - Hyperventilation usually not readily apparent
  - Frequent sighing respirations, 2-3 per minute
  - Chest wall tenderness, numbness, tingling

Chvostek and Trousseau signs

- The Chvostek sign is a facial twitch elicited by tapping the jaw with a reflex hammer. This sign is not specific for hypocalcemia and may be present in healthy adults.
- Trousseau sign is carpal spasm after 3 minutes of inflation of a pressure cuff 20 mm Hg above the patient's systolic pressure. This measure assesses nerve irritability and is more specific for tetany.