Pulmonary Curbside
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Disclosures and Conflict Of interest

• None
Objectives

• Identification of common pulmonary symptoms in clinic
• Approach to differential diagnosis
• Diagnostic testing: when and why?
Symptoms Of Pulmonary Disease

• **Dyspnea**

• **Cough**
  • Wheeze
  • Hemoptysis

• Chest pain not really .....
Dyspnea
Definition

• "Dyspnea is a term used to characterize a subjective experience of breathing discomfort that is comprised of qualitatively distinct sensations that vary in intensity. The experience derives from interactions among multiple physiological, psychological, social, and environmental factors, and may induce secondary physiological and behavioral responses."

• Acute dyspnea over hours to days usually less than 3 weeks

• Chronic 4-8 weeks at least
Case 1

- 83 year old man with past medical history of hypertension comes with shortness of breath for 2 week duration
  - He has noticed sudden onset leg swelling both legs, Chest tightness, Orthopnea
  - He has also noticed black tarry stools
  - Appears very confused

- PMH: HTN on one medication “it’s a small white pill”
- PSH: none
- Allergies: none
Case 2

• 32 year old Caucasian woman presented with a 2 year history of dyspnea which is progressively worsening.
• 3 years back she could scale Kilimanjaro, now she was having difficulty walking 8 miles on level ground
• No fever chills, no h/o long distance travels, no oral contraceptive pills, no weight loss supplements.
• NO asthma in childhood, never smoker, no illicit drugs.
• No orthopnea, palpitations, leg swelling
Case 3

- 37 year old white woman with WHO class I Pulmonary arterial hypertension with functional class III symptoms, chronic hypoxemia requiring 3 lit of oxygen seen in clinic for worsening dyspnea
- Onset after respiratory failure and prolonged intubation in 2013
- She denies asthma as a child.
- She smoked off/on throughout her 20s for 9 years; mostly socially. Has not smoked over the past 6 years per her report. Has never smoked anything else.
- 2DECHO RV dilation stable, no new LV dysfunction
- Repeat right heart catheterization numbers unchanged from 2013
Pathophysiology

Dyspnea results when a stimulus activates a respiratory center beyond a certain threshold

- Hypoxemia
- Acidosis or Hypercarbia
- Decreased Compliance
- Airway Resistance
  - Carotid Body
  - Medullary Chemoreceptors
  - Lung or Muscle Mechanoreceptors
  - Airway Receptors

Dyspnea
Decreased Compliance

- Compliance = dV/dP
- Mechanoreceptors in diaphragm, chest wall and airways
- Examples:
  - CHF
  - Obesity
  - Airway restriction
  - Surfactant loss
  - Chest wall tightness
Airway Resistance

- Decreased flow through narrowed airways
- Airway Receptors
- Increased work of breathing
- Examples
  - Reversible
    - Asthma
    - Allergic Bronchospasm
    - Toxic
  - Some Non-Reversible
    - Emphysema
    - Chronic Bronchitis
Factors affecting FRC

- Functional Residual Capacity =
  - Volume left at bottom of tidal volume breath
  - Our natural $O_2$ reservoir
- Mechanoreceptors in diaphragm, chest wall and airways
- Symptom:
  - “Fullness”
  - “Inability to take a deep breath”
- Examples:
  - Emphysema
  - Blebs
  - Pregnancy
  - Abdominal Distention

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**FIGURE 1.** Static lung volumes and capacities based on a volume-time spirogram of an inspiratory vital capacity (IVC). IRV: inspiratory reserve volume; $V_t$: tidal volume (TV); ERV: expiratory reserve volume; RV: residual volume; IC: inspiratory capacity; FRC: functional residual capacity; TLC: total lung capacity.
Other

- **Volume Loss / External Compression**
  - Pleural Effusions
  - Pneumothorax
  - Malignancy
- **Decreased Oxygen Delivery to Tissues**
  - Anemia
  - Toxic Exposure
  - Sepsis
  - Metabolic Acidosis
- **Decreased Diaphragm/Chest Wall Strength**
  - Neuromuscular
    - CNS or Spinal Cord Disorder
    - Myopathy/Neuropathy
  - Chest Wall Injury
- **Constitutional or Psychiatric Factors**
  - Deconditioning
  - Psychogenic
### Association of Qualitative Descriptors, Clinical Characteristics, and Pathophysiologic Mechanisms of Shortness of Breath

<table>
<thead>
<tr>
<th>Descriptor</th>
<th>Clinical Examples</th>
<th>Pathophysiology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chest tightness or constriction</td>
<td>Asthma, CHF</td>
<td>Bronchoconstriction, interstitial edema</td>
</tr>
<tr>
<td>Increased work or effort of breathing</td>
<td>COPD, asthma, neuromuscular disease, chest wall restriction</td>
<td>Airway obstruction, neuromuscular disease</td>
</tr>
<tr>
<td>“Air hunger,” need to breathe, urge to breathe</td>
<td>CHF, PE, COPD, asthma, pulmonary fibrosis</td>
<td>Increased drive to breathe</td>
</tr>
<tr>
<td>Inability to get a deep breath, unsatisfying breath</td>
<td>Moderate to severe asthma and COPD, pulmonary fibrosis, chest wall disease</td>
<td>Hyperinflation and restricted tidal volume</td>
</tr>
<tr>
<td>Heavy breathing, rapid breathing, breathing more</td>
<td>Sedentary status in healthy individual or patient with cardiopulmonary disease</td>
<td>Deconditioning</td>
</tr>
</tbody>
</table>

**Abbreviations:** CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease; PE, pulmonary embolism.
## Differential diagnosis

- Asthma
- Primary lung cancer
- Metastatic cancer
- Chronic bronchitis
- Bronchiolitis
- Laryngeal disease
- Tracheal stenosis
- Tracheomalacia
- Alveolitis
- Drug toxicity
- Anaphylaxis
- Emphysema
- Chronic Bronchitis
- Pneumonitis
- Pulmonary edema
- Pulmonary fibrosis
- Abdominal distention
- Chest wall trauma
- Pulmonary effusion
- Pericardial effusion
- Pulmonary hypertension
- Pulmonary embolism
- Vasculitis
- Myocardial Infarction
- Arrhythmia
- Myocardial ischemia
- Congestive heart failure
- Intracardiac shunt
- Left ventricular hypertrophy
- Atrial myxoma
- Pericarditis
- Myocarditis
- Valvular disease
- Myopathy
- Neuropathy
- Phrenic nerve dysfunction
- Spinal cord injury
- Anemia
- Deconditioning
- Gastroesophageal reflux disease
- Hyperthyroidism
- Metabolic Acidosis
- ARDS
- Sepsis
- Psychogenic dyspnea
- Acute bronchitis
- High altitude pulmonary edema
- **PLUS HUNDREDS MORE**
Common Associations

• Wheezing
  • Asthma
  • COPD
  • Heart failure
  • Allergies
  • Upper airway resistance syndrome

• Fever
  • Pneumonia
  • Acute bronchitis

• Cough
  • COPD/Asthma
  • Heart Failure
  • Fibrotic lung disease
  • PE

• Leg edema
  • PE
  • Anemia
  • Heart Failure
  • Pulmonary hypertension

• Tachycardia
  • PE
  • Heart failure
  • Anemia
  • Pneumonia/bronchitis

• Dizziness
  • Pulmonary Hypertension
  • Hypoxia

• Chest pain
  • MI
  • Heart failure
  • PE
  • Pleural disorders
Case 1

• 83 yr. old man with past medical history of hypertension comes with shortness of breath for 2 week duration
  • He has noticed sudden onset leg swelling both legs, Chest tightness, Orthopnea
  • He has also noticed black tarry stools
  • Appears very confused

• PMH : HTN on one medication “it’s a small white pill”
• PSH: none
• Allergies: none
Physical exam

• T:98.1, P:112 bpm, BP: 100/65 mmHg, RR:23, O2 saturation : 93% on room air.
• Appears confused, sitting in chair in mild distress, conjunctival pallor
• + JVD, Heart sounds tachycardia, regular rhythm, systolic murmur 2/6,
• Lungs clear to auscultation except for crackles at lung bases
• Abdomen minimal epigastric tenderness
• Bilateral pitting edema up to the thighs
Facts to concentrate on

- Acute dyspnea
- Leg swelling
- Tachycardia
- Pallor on exam
- Black tarry stools
- Orthopnea

• Now what?
Tests

- **PFT’s always**
- **2D ECHO nearly always**
- **CT Chest mostly without contrast, except if you are worried about malignancy or CT PE protocol if pulmonary embolism is suspected**

**Blood work**
- **CBC with differential**
- Ig E if asthma is suspected
- Basic or complete metabolic profile (if intention is to start on high risk meds)

- Lower extremity duplex if PE is in the DD
- Respiratory muscle forces
- ABG
- VQ scan to rule out shunt or if chronic thromboembolic pulmonary hypertension (CTEPH) is suspected
Case 1

• Found to have Hb 3.9
• EGD unrevealing
• Colonoscopy showed a few diverticula
• Capsule endoscopy showed AVM’s
• Lower extremity duplex negative
• CT PE negative for pulmonary embolus
• PFT’s mild obstruction, moderate defect in gas transfer
Case 2

• 32 year old Caucasian woman presented with a 2 year history of dyspnea which is progressively worsening.

• 3 years back she could scale Kilimanjaro, now she was having difficulty walking 8 miles on level ground.

• No fever chills, no h/o long distance travels, no oral contraceptive pills, no weight loss supplements.

• NO asthma in childhood, never smoker, no illicit drugs.

• No orthopnea, palpitations, leg swelling.
Case 2 cont.

• Well built well nourished woman sitting in chair in no acute distress
• BMI 27.89, T: 36.7, P: 90, BP: 110/70, RR : 18, O2 sat: 98% on ambient air
• Pertinent positive on physical exam is increased dyspnea when supine
• Heart sounds normal
• No leg swelling/clubbing or cyanosis

• What tests?
Case 2 cont.

• RHC : RA 5, RV 15/2, PA 20/10 mean 14, PCWP: 8,
• PFT’s: FEV1 was 2.9 liters (107% predicted), FVC was 3.35 liters (97% predicted), DLCO 72%. Her mouth pressures were very low with an MIP of 46% predicted and an MEP of approximately 16% predicted.
• CT chest normal lung parenchyma. Pulmonary artery normal caliber
Case 3

• 37 year old white woman with WHO class I Pulmonary arterial hypertension with functional class III symptoms, chronic hypoxemia requiring 3 lit of oxygen seen in clinic for worsening dyspnea
• Onset after respiratory failure and prolonged intubation in 2013
• She denies asthma as a child.
• She smoked off/on throughout her 20s for 9 years; mostly socially. Has not smoked over the past 6 years per her report. Has never smoked anything else.
• 2DECHO RV dilation stable, no new LV dysfunction
• Repeat right heart catheterization numbers unchanged from 2013
<table>
<thead>
<tr>
<th>Spirometry</th>
<th>Ref</th>
<th>Pre</th>
<th>% Ref</th>
<th>Post</th>
<th>% Ref</th>
<th>%Chg</th>
</tr>
</thead>
<tbody>
<tr>
<td>FVC Liters</td>
<td>3.32</td>
<td>1.65</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>FEV1 Liters</td>
<td>2.61</td>
<td>0.82</td>
<td>32</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FEV1/FVC %</td>
<td>78</td>
<td>50</td>
<td>64</td>
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<tr>
<td>FEV3 Liters</td>
<td>1.19</td>
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<td>FEV6 Liters</td>
<td>1.46</td>
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<td>FEF25-75% L/sec</td>
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<td>8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IsoFEF25-75% L/sec</td>
<td>3.13</td>
<td>0.26</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PEF L/sec</td>
<td>5.98</td>
<td>2.93</td>
<td>49</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Lung Volumes      |     |     |       |      |       |      |
| TLC Liters        | 4.67| 4.21| 90    |      |       |      |
| VC Liters         | 3.32| 1.65| 50    |      |       |      |
| IC Liters         | 1.1|    | 10    |      |       |      |
| FRC PL Liters     | 2.55| 3.07| 121   |      |       |      |
| ERV Liters        | 0.52|     |       |      |       |      |
| RV Liters         | 1.40| 2.56| 183   |      |       |      |
| RV/TLC %          | 30  | 61  | 204   |      |       |      |
| Vtg Liters        | 3.15|     |       |      |       |      |

| Diffusing Capacity |     |     |       |      |       |      |
| DLCO mL/mmHg/min  | 23.1| 13.9| 60    |      |       |      |
| DL Adj mL/mmHg/min| 23.1| 13.9| 60    |      |       |      |
| DLCO/VA mL/mmHg/min/L | 4.92| 4.19| 85    |      |       |      |
| Krogh K 1/min     | 3.62|     |       |      |       |      |
| VA Liters         | 3.31|     |       |      |       |      |
| IVC Liters        | 1.65| 1.60| 97    |      |       |      |
| BHT Sec           | 12.39|    |       |      |       |      |
Wheezing

Wheezes are "musical" adventitious lung sounds produced by airflow through the central and distal airways. Wheezes are heard predominantly during expiration.
Cough

• From a physiological perspective, coughing represents an important pulmonary defense mechanism, in as much as it serves to clear the airways of inhaled or aspirated substances and excessive secretions, which can compromise airway patency and/or promote pulmonary damage and infection.

• Acute cough < 3 weeks in duration

• Subacute between 3-8 weeks duration

• Chronic > 8 weeks in duration
Representative Punum ladders to assess (A) cough severity or (B) overall quality of life.

J Clin Epidemiol, 63 (10) (2010), pp. 1123-1131
CHEST 2015; 147(3):804-814
person saying: "COUGH! COUGH! COUGH! COUGH!"

doctors thinking:
- "hmm...
- "???
- "huh?"
Acute Cough

Life-threatening diagnosis
- Pneumonia, severe exacerbation of asthma or COPD, PE, heart failure, other serious disease
  - Evaluate and treat first

History and physical examination, ask about environmental and occupational factors and travel exposures
- Investigations
- Infectious
  - LRTI
  - URTI
  - Acute Bronchitis
  - Pertussis
  - Consider TB in endemic areas or high risk

Non-life-threatening diagnosis
- Exacerbation of pre-existing condition
  - Asthma
  - Bronchiectasis
  - UACS
  - COPD
  - Other

Reminders
1. Check for red flags - see adjacent box
2. Routinely assess cough quality of life or cough severity with validated tool
3. Routinely follow up with patient in 4-6 weeks

Red Flags
- Hemoptysis
- Smoker > 45 years of age with a new cough, change in cough, or coexisting voice disturbance
- Adults aged 65-80 years who have a 30 pack-year smoking history and currently smoke or who have quit within the past 18 years
- Prominent dyspnea, especially at rest or at night
- Hoarseness
- Systemic symptoms
  - Fever
  - Weight loss
  - Peripheral Edema with weight gain
  - Trouble swallowing when eating or drinking
  - Vomiting
  - Recurrent pneumonia
  - Abnormal respiratory exam and/or abnormal chest radiograph coinciding with duration of cough
Case 1

- A 41 yr. old woman who works in the Library of Congress, presented with cough of more than 6 weeks duration
- Initially started when she had a head cold, however persisted
- Cough productive of clear phlegm then more of a dry cough
- Cough worse at night
- She admits to late nights and eating at midnight regularly
- In addition she wakes up with a barking cough in the morning and hoarseness, along with a sour taste in the mouth
Next steps

- Is it Gastro esophageal reflux disease (GERD) or Laryngopharyngeal reflux (LPR)

<table>
<thead>
<tr>
<th>Laryngopharyngeal reflux</th>
<th>Gastro-oesophageal reflux disease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breach upper oesophageal sphincter</td>
<td>Breach lower oesophageal sphincter</td>
</tr>
<tr>
<td>Hoarseness, globus, cough, ‘thick mucus/postnasal drip’, throat pain</td>
<td>Acid reflux, heartburn, chest pain</td>
</tr>
<tr>
<td>Symptoms worse while upright</td>
<td>Symptoms worse while recumbent</td>
</tr>
<tr>
<td>No association with obesity/high body mass index (BMI)</td>
<td>Associated with obesity/high BMI</td>
</tr>
<tr>
<td>Patients usually deny heartburn, reflux</td>
<td>Patients report heartburn and reflux</td>
</tr>
</tbody>
</table>
Reflux symptom index

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hoarseness or a problem with your voice</td>
<td>0 – 1 – 2 – 3 – 4 – 5</td>
</tr>
<tr>
<td>Clearing your throat</td>
<td>0 – 1 – 2 – 3 – 4 – 5</td>
</tr>
<tr>
<td>Excess throat mucus or post-nasal drip</td>
<td>0 – 1 – 2 – 3 – 4 – 5</td>
</tr>
<tr>
<td>Difficulty swallowing food, liquids or pills</td>
<td>0 – 1 – 2 – 3 – 4 – 5</td>
</tr>
<tr>
<td>Coughing after you ate or after lying down</td>
<td>0 – 1 – 2 – 3 – 4 – 5</td>
</tr>
<tr>
<td>Breathing difficulties or choking episodes</td>
<td>0 – 1 – 2 – 3 – 4 – 5</td>
</tr>
<tr>
<td>Troublesome or annoying cough</td>
<td>0 – 1 – 2 – 3 – 4 – 5</td>
</tr>
<tr>
<td>Sensation of something sticking in your throat or a lump in your throat</td>
<td>0 – 1 – 2 – 3 – 4 – 5</td>
</tr>
<tr>
<td>Heartburn, chest pain, indigestion, or stomach acid coming up</td>
<td>0 – 1 – 2 – 3 – 4 – 5</td>
</tr>
</tbody>
</table>

Total

J Voice 2002;16(2):274–77, with permission from Elsevier
Case 1 cont.

- Patient initially responded with resolution of cough with PPI
- However she noticed recurrence of cough in spring
- Trees and pollen
- Nasal congestion
- Post nasal drip
- Itchy eyes
Upper Airway Cough Syndrome

• Upper airway cough syndrome (UACS), previously referred to as postnasal drip syndrome, is one of the most common causes of chronic cough

• Airway inflammation with remodeling

• Laryngeal and pharyngeal hypersensitivity

• Cough hypersensitivity/ increased sensory neural activity
Next steps

- Antihistamine
- Nasal Steroids
Cough @#$%^!!

"...Chronic Cursitus Cough"?

Apparently I picked it up here, at Cough Fatigue Work.
Important Reminders

- Check for red flags and address them – see Red Flags box
- Optimize therapy for each diagnosis
- Check compliance during regularly scheduled and frequent follow-ups (assess for patient barriers to enactment or receipt of instructions)
- Due to the possibility of multiple causes, maintain all partially effective treatment
- Routinely assess for environmental and occupational factors
- Routinely assess cough severity & quality of life with validated tools
- Routinely follow up with patient in 4-6 weeks
- Consider a referral to a Cough Clinic for refractory cough

Red Flags

- Hemoptysis
- Smoker > 45 years of age with a new cough, change in cough, or coexisting voice disturbance
- Adults aged 55-80 years who have a 30 pack-year smoking history and currently smoke or who have quit within the past 15 years
- Prominent dyspnea, especially at rest or at night
- Hoarseness
- Systemic symptoms
  - Fever
  - Weight loss
  - Peripheral Edema with weight gain
- Trouble swallowing when eating or drinking
- Vomiting
- Recurrent pneumonia
- Abnormal respiratory exam and/or abnormal chest radiograph coinciding with duration of cough
Case 2

• 56 year old with stage I breast cancer, s/p lumpectomy comes for chronic cough
• Associated with hoarseness of voice, tickling sensation in back of throat and wheezing.
• She reports this occurs every year during change of season from fall to winter.
• Constant coughing spells worse at night and in supine position interfering with sleep.
• As a child denied asthma but had seasonal allergies, odor sensitivity
• She was treated with tessalon pearls, hydrocodone, prednisone 5 mg per day, amoxicillin for 10 days and robitussin.
• Only hydrocodone helped her cough but she had to discontinue opioid due to nausea.
Exposures

• 20 years ago she developed anosmia, unknown etiology
• 4 years back there was renovation at her workplace resulted in chronic cough which resolved with albuterol and steroid inhaler for few weeks
• Recent commercial cleaning of her carpets, comforter and rugs, new deodorant use by husband
• Her husband reports that she sometimes uses cleaning agents with strong odor. Since she has anosmia she has to be warned about the strength of odor.
• She usually has Sneezing spells with commercial soap
### Spirometry

<table>
<thead>
<tr>
<th></th>
<th>Ref</th>
<th>Pre Meas</th>
<th>Pre %</th>
<th>Post Meas</th>
<th>Post %</th>
<th>Post % Chg</th>
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<tbody>
<tr>
<td>FVC</td>
<td>Liters</td>
<td>3.18</td>
<td>3.35</td>
<td>105</td>
<td>3.36</td>
<td>106</td>
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<tr>
<td>FEV1</td>
<td>Liters</td>
<td>2.32</td>
<td>2.63</td>
<td>113</td>
<td>2.74</td>
<td>118</td>
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<tr>
<td>FEV1/FVC</td>
<td>%</td>
<td>72</td>
<td>78</td>
<td>108</td>
<td>82</td>
<td>113</td>
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<tr>
<td>FEV6</td>
<td>Liters</td>
<td>3.23</td>
<td>3.31</td>
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<tr>
<td>FEF25-75% L/sec</td>
<td>2.56</td>
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<td>114</td>
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<td>IsoFEF25-75L/sec</td>
<td>2.56</td>
<td>2.34</td>
<td>91</td>
<td>3.06</td>
<td>120</td>
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<tr>
<td>FEF50%</td>
<td>L/sec</td>
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<td>3.73</td>
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<td>3.88</td>
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<tr>
<td>PEF</td>
<td>L/sec</td>
<td>5.85</td>
<td>5.91</td>
<td>101</td>
<td>4.94</td>
<td>84</td>
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<tr>
<td>MVV</td>
<td>L/min</td>
<td>88</td>
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### Lung Volumes

<table>
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<tr>
<th></th>
<th>Ref</th>
<th>Pre Meas</th>
<th>Pre %</th>
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</thead>
<tbody>
<tr>
<td>TLC</td>
<td>Liters</td>
<td>5.37</td>
<td>5.03</td>
</tr>
<tr>
<td>VC</td>
<td>Liters</td>
<td>3.18</td>
<td>3.35</td>
</tr>
<tr>
<td>IC</td>
<td>Liters</td>
<td>2.51</td>
<td></td>
</tr>
<tr>
<td>FRC Plus</td>
<td>Liters</td>
<td>3.07</td>
<td>2.32</td>
</tr>
<tr>
<td>ERV</td>
<td>Liters</td>
<td>0.65</td>
<td></td>
</tr>
<tr>
<td>RV</td>
<td>Liters</td>
<td>2.20</td>
<td>1.67</td>
</tr>
<tr>
<td>RV/TLC%</td>
<td></td>
<td>41</td>
<td>33</td>
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Raw cmH2O/L/sec <3.06
Gaw L/sec/cmH2O 0.605

### Diffusion Capacity

<table>
<thead>
<tr>
<th></th>
<th>Ref</th>
<th>Pre Meas</th>
<th>Pre %</th>
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<tr>
<td>DLCO</td>
<td>mL/mmHg/min</td>
<td>21.9</td>
<td>23.3</td>
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<tr>
<td>DL Adj</td>
<td>mL/mmHg/min</td>
<td>21.9</td>
<td>23.3</td>
</tr>
<tr>
<td>DLCO/V/A mL/m/MHg/min/L</td>
<td>4.27</td>
<td>4.65</td>
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<td>VA</td>
<td>Liters</td>
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<tr>
<td>IVC</td>
<td>Liters</td>
<td>3.35</td>
<td>3.50</td>
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</table>
Now what

• CBC showed eosinophilia
• IgE slightly elevated at 120

• Stressed avoidance of triggers
• Used Loratidine, Singulair and Flonase
• Lifestyle modifications, PPI
• Resolution of cough
Hemoptysis

• *Hemoptysis*, the expectoration of blood from the respiratory tract, can arise at any location from the alveoli to the glottis.

• Bleeding in hemoptysis most commonly arises from the small- to medium-sized airways. Irritation and injury of the bronchial mucosa can lead to small-volume bleeding.

• Most common cause: viral or bacterial bronchitis

• TB

• Cancer

• Alveolar causes like diffuse alveolar hemorrhage
Questions, concerns?

This is going really well. I did a great job organizing this lecture.