Dyspnea: Work up and management

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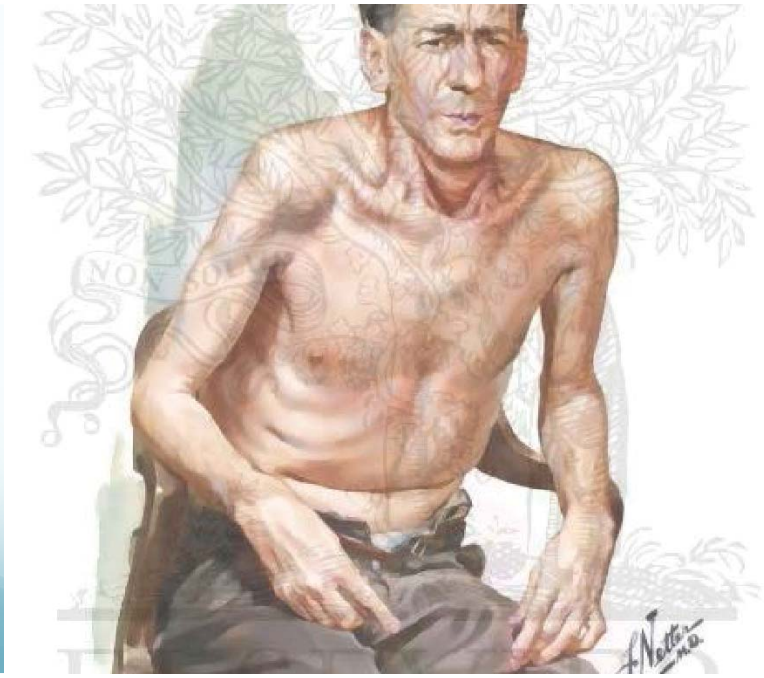
Disclosures

- I have no conflicts of interest to disclose

Objectives

- At the end of this lecture, you should be able to...
  - Name top 5 causes of chronic dyspnea
  - Understand what causes dyspnea
  - Use the history of patient's dyspnea to gain clues as to the origin of patient's dyspnea
  - Better understand the work up of dyspnea (eg what tests to order and when)
    - Indications for HRCT, bronchoscopy and lung biopsy



Question

- Which of the following is not one of the top 5 causes of chronic dyspnea?
  - A. Asthma
  - B. Chronic obstructive pulmonary disease (COPD)
  - C. Interstitial Lung Disease
  - D. Pulmonary Embolism
  - E. Myocardial dysfunction
  - F. Obesity/Deconditioning

Top 5 causes of chronic dyspnea

- Asthma
- Chronic obstructive pulmonary disease (COPD)
- Interstitial Lung Disease
- Myocardial dysfunction
- Obesity/Deconditioning

Introduction-Dyspnea

- Definition
  - A SUBJECTIVE experience of breathing discomfort that consists of qualitatively distinct sensations that vary in intensity
- Dyspnea is a common SYMPTOM that affects up to 50% of patients admitted to acute, tertiary care hospitals and a quarter of patients seeking health in the ambulatory setting
- It is a predictor of hospitalization and mortality in patients with chronic lung disease
- More closely associated with cardiac mortality than angina
- To help you categorize dyspnea, you can think of it in one of two ways...
  - Acute vs chronic
  - Organ system etiology

Pathophysiology

- Respiratory system dyspnea
  - Central controller
  - Ventilatory pump
  - Gas exchanger
- Cardiovascular system dyspnea
  - Heart Failure
  - Anemia
  - Deconditioning

Table 29-2 Diseases That Cause Dyspnea Grouped by Physiologic Mechanism of Action*

VENTILATORY CONTROLLER AND GAS EXCHANGE—INCREASED RESPIRATORY DRIVE
Simulation of Chemoreceptors
Conditions leading to acute hypoxemia
Impaired gas exchange (e.g., asthma, pulmonary embolism, pneumonia, congestive heart failure†)
Environmental hypoxia (e.g., altitude, contained space with fire)
Conditions leading to increased dead space and/or acute hypercapnia
Impaired gas exchange (e.g., acute, severe asthma, exacerbations of COPD, severe pulmonary edema)
Impaired ventilatory pump (see below) (e.g., muscle weakness, airflow obstruction)
Metabolic acidosis
Renal disease (renal failure, renal tubular acidosis)
Decreased oxygen-carrying capacity (e.g., anemia)
Decreased release of oxygen to tissues (e.g., hemoglobinopathy)
Decreased cardiac output
Stimulation of Pulmonary Receptors (Irritant, Mechanical, Vascular)†
Interstitial lung disease
Pleural effusion (atelectasis)
Pulmonary vascular disease (e.g., thromboembolism, idiopathic pulmonary hypertension)
Congestive heart failure
Mild asthma
Inhalation of toxic gases
Behavioral Factors
Hyperventilation syndrome, anxiety disorders, panic attacks
VENTILATORY PUMP—INCREASED EFFORT OR WORK OF BREATHING
Muscle Weakness
Myasthenia gravis, Guillain-Barré syndrome, spinal cord injury, myopathy, postpoliomyelitis syndrome
Decreased Compliance of the Chest Wall
Severe kyphoscoliosis, obesity, pleural effusion
Airflow Obstruction (Includes Increased Resistive Load from Narrowing of Airways and Increased Elastic Load from Hyperinflation)
Asthma, COPD, laryngospasm, aspiration of foreign body, bronchitis

Table 1: Common Causes of Dyspnea by Organ System

Organ System	Acute	Chronic
Cardiovascular	Pulmonary edema Acute valvular disease Myocardial infarction Cardiac tamponade	Heart failure Angina Constrictive pericarditis
Respiratory	Acute exacerbations of obstructive lung diseases Pulmonary embolism Pneumothorax Pneumonia ARDS Anaphylaxis	COPD Asthma Interstitial lung diseases Pulmonary hypertension Malignancy (tumor related obstructive lesions and lymphangitic spread) Pleural effusions Sleep apnea
Gastrointestinal/Hepatic	Acute liver failure (metabolic acidosis)	Ascites Pleural effusions Portopulmonary hypertension Hepatopulmonary syndrome
Renal	Acute renal failure (metabolic acidosis)	Pleural effusions Pericardial effusions
Hematological	Hemorrhage	Anemia
Neuromuscular	High cervical cord lesions Trauma to phrenic nerves	Central apneas Myasthenia gravis Deconditioning Myopathies Amyotrophic lateral sclerosis

History and physical

Your clues.... not your diagnosis!

Temporal pattern and triggers

- Can provide important clues
- Acute vs Chronic
- Mechanism of dyspnea
- Dyspnea that occurs over minutes to hours are only caused by a certain number of conditions
  - Cardiovascular system
    - Acute myocardial ischemia
    - Heart Failure
    - Cardiac Tamponade
  - Respiratory system
    - Bronchospasm
    - Pulmonary embolism
    - Pulmonary infection- bronchitis, pneumonia
    - Upper airway obstruction- Aspiration, anaphylaxis

Some clues..

- Chronic exertional dyspnea and paroxysmal nocturnal dyspnea
  - Heart failure (although nocturnal dyspnea is more specific to heart failure)
  - Asthma (although does not improve with sitting or standing)
- Intermittent dyspnea-association with cold air or animal exposure
  - Suggest Asthma, COPD
  - Heart failure, PE can be intermittent but usually have a baseline dysfunction

Qualities of dyspnea and associated disease states

Descriptor	Pathophysiologic mechanism	Disease state
Chest tightness or constriction	Bronchochonstriction, interstitial edema	Asthma
		Myocardial ischemia
Increased work or effort of breathing	Airways obstruction, neuromuscular disease, reduced chest wall or pulmonary compliance	COPD, moderate to severe asthma, myopathy, pulmonary fibrosis
Air hunger, need to breathe, urge to breathe	Increased drive to breathe	HF, pulmonary embolism, moderate to severe asthma or COPD
Rapid, shallow breathing	Reduced chest wall or pulmonary compliance	Interstitial fibrosis
Suffocating, smothering	Alveolar edema	Pulmonary edema
Heavy breathing, breathing more	Inadequate oxygen delivery to the muscles	Deconditioning

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Social history

- Smoking!
  - COPD is uncommon among patients who have never smoked or who have smoked less than 10 pack years
- Occupational history may lead to a diagnosis of asbestosis, chronic beryllium disease, silicosis or other pneumoconiosis
- Pets
  - Birds and hypersensitivity
  - Cats/Dogs and asthma

Physical exam clues

- Heart- Arrhythmia, tachycardia?
  - Distant heart sounds may suggest pericardial effusion or obesity, maybe hyperinflation from emphysema
- Lungs- Wheezing? Stridor?, crackles?
  - Not all that wheezes is asthma
- Extremities- Peripheral edema, clubbing?
  - Clubbing is associated with bronchiectasis, pulmonary fibrosis, lung cancer, cyanotic heart disease BUT NOT asthma or COPD

The correct diagnostic test will give you the correct diagnosis (...usually)

- "Initial tests"
  - CBC
    - Exclude anemia
  - Glucose, BUN, creatinine, electrolytes
  - TSH
  - Spirometry pre and post OR full pulmonary function tests (PFTs) if the clinical evaluation does not suggest asthma or COPD
    - Can identify the presence and severity of airflow obstruction, and when both FEV1 and FVC are reduced proportionately (ie the FEV1/FVC ratio is normal or high), restrictive disease is suggested
    - Reversibility suggestive of asthma

What to do if the clinical evaluation doesn't allow narrowing of the differential?

- Pulse ox during ambulation at a normal pace over approximately 200 meters
- Chest X-ray
- EKG
- Plasma BNP or pro-BNP

Case 1

- A 40 year old female with a past medical history of depression, seasonal allergies and IBS presents to your office with shortness of breath that has worsened over the last 5 or 6 months.
- She has a history of post nasal drip cough but otherwise has no other pulmonary complaints. Other review of systems is negative as well
- Patient takes Claritin (Loratadine), Zoloft (Sertraline) and Miralax (polyethylene glycol) as needed
- Patient has never been a smoker and has no family history of pulmonary diseases.
- Vitals in your office are within normal limits and physical exam is unremarkable.

What would you do next?

- A. Treat post nasal drip with saline spray
- B. CT high resolution
- C. Limited Spirometry
- D. EKG

Work up

- Limited Spiro got lucky and turned into a cPFT...
  - Good effort (patient was able to exhale >6 seconds)
  - Normal curve
  - FEV1/FVC ratio of 89 pre and post bronchodilator
  - FVC of 80
  - TLC is normal at 79
  - DLCO is borderline at 50
- Chest X-ray read...
  - No acute cardiopulmonary disease, possible hyperinflation
- CBC/TSH/BMP
  - Within normal limits

So what do we do next?

While there is more than one way to go about what we do next, what would you do?

- A. Methacholine challenge test
- B. High resolution CT scan
- C. CTA chest rule out PE
- D. 6 minute walk test (MWT)

Results and follow up

- She was started on Advair empirically for possible Asthma which did little to help her shortness of breath.
- Patient went for methacholine challenge test, which was negative for significant reversibility.
- She then presented to you for follow up. It has been about a month and she continues to feel short of breath. While a year ago she will run 5Ks every other weekend, she is now having to walk/run while trying to exercise. She uses her albuterol inhaler as needed before but it doesn't seem to make a difference.

What would you do next?

- A. Send to pulmonology for further work up
- B. Increase her Zoloft
- C. Do an echo
- D. Do a stress test/EKG
- What clues did we have from before?!

Further studies

- Patient went for a high resolution CT scan and echocardiogram
- CT high resolution was negative
- Echocardiogram showed normal EF with an RVSP of 59 consistent with pulmonary hypertension.
- Patient went for right heart cath and had positive reactivity to adenosine challenge
- She was started on Revatio (sildenafil) and sent to U of M for advanced pulmonary hypertension evaluation.

Case 2

- A 69 year old male presents with worsening shortness of breath over the last couple of months. He normally is active with his grandchildren and will take them to the park about ½ mile away. Now, however, he will get winded on the way there and has stopped. He also complains of a dry cough that has been getting worse over the same period of time. Otherwise, he denies any chest pain, wheezing, lower extremity swelling or fevers/chills.

Case 2

- Past medical history: Significant for hypertension, hyperlipidemia, Type II DM and “arthritis”
- Past social history: Never smoker, no history of drug or alcohol abuse
- Past surgical history: Right knee replacement
- Family history: Mother died of early CAD and he never knew his father
- Allergies: None
- Initial vitals and physical exam were all unremarkable, other than some crackles heard in the bases of the lungs.

Which of the following should NOT be at the top of your differential?

- A. CAD/CHF
- B. Interstitial lung disease
- C. COPD
- D. Asthma

Work up

- Chest X-ray- Negative
- Echo- EF 55% without significant valvular abnormalities and RVSP of 40
- cPFT-
  - FVC 60
  - FEV1/FVC 75 pre and post bronchodilator
  - TLC 50
  - DLCO 65

How would you read the patient's PFT?

- cPFT-
  - FVC 60
  - FEV1/FVC 75 pre and post bronchodilator
  - TLC 50
  - DLCO 65
- A. Within normal limits
- B. Obstructive lung disease
- C. Restrictive lung disease
- D. Reversible airway disease

What do you want to do next?

- A. CTA chest r/o PE
- B. High resolution CT chest
- C. CT chest with and without contrast
- D. Treadmill Stress test

A quick note about HRCT

- Provides more detail than either chest radiograph or conventional CT
- Can accurately assess the pattern and distribution of diffuse lung disease
- Some major diseases that can be characterized by HCRT include...
  - Emphysema/Bullous lung disease
  - Bronchiectasis
  - Lymphangitic carcinomatosis
  - Sarcoidosis
  - ILDs
  - Hypersensitivity pneumonitis

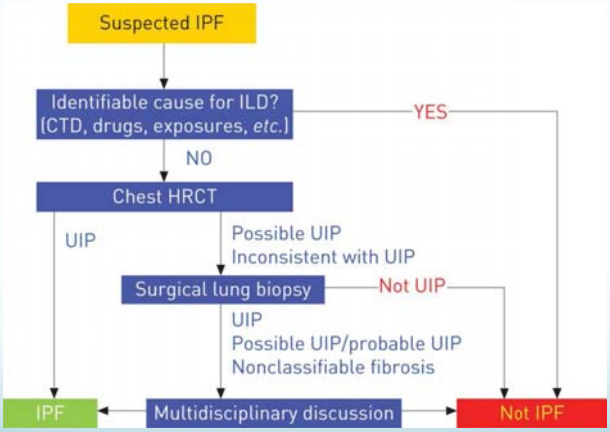
The patient went to the ER before we could stop him..

- And he had a CTA chest r/o PE performed.
- His CTA chest showed “pulmonary fibrosis” at which point, his primary sent him to see pulmonary

Follow up

- High resolution CT scan showed possible usual interstitial pneumonia (UIP).
- There are two ways you can diagnose UIP
  - By high resolution CT scan which will show features of "typical UIP" at which time you have made your diagnosis
  - Or by lung biopsy
  - Other things you can consider would be serology for hypersensitivity, ACE level, rheumatologic work up
- As this patient had "possible UIP" and the diagnosis was uncertain, he went for lung biopsy which confirmed UIP.

Diagnosis of IPF/UIP



Case 3

- A 45 year old male known to your office for years presents with dyspnea and a cough that has been going on for about a month. He first presented to urgent care (unknown to you) and they treated him with a z-pak and prednisone taper. He felt initially better but then the cough came back. It is occasionally productive of yellow sputum and while he doesn't take his temperature at home he occasionally will feel chills. No sick contacts, no history of pulmonary issues.
- Past medical history: Hyperlipidemia
- Past social history: Never smoker, no history of drug or alcohol abuse
- Family history: Unknown
- Medications: Atorvastatin
- Physical exam: Vitals are WNL, some crackles in the right lower lobe, no other significant findings

Clinical course

- You order a chest x-ray which shows a right lower lobe infiltrate. You diagnose your patient with community acquired pneumonia
- You treat your patient with Levaquin and follow up with him in another 2 weeks.
- 2 weeks later he said he initially felt a little better but then started to feel worse again...physical exam reveals worsening wheezes in the right lower lobe and patient is running a low-grade fever at 99.9.

What would you do next?

- A. Sputum culture
- B. Treat with doxycycline for MRSA coverage
- C. CT high resolution
- D. Prednisone taper with doxycycline

CT high resolution

Now what?

- A. Pulmonary referral for bronchoscopy
- B. Sputum culture
- C. CT guided biopsy
- D. CTS consult for VATS with biopsy

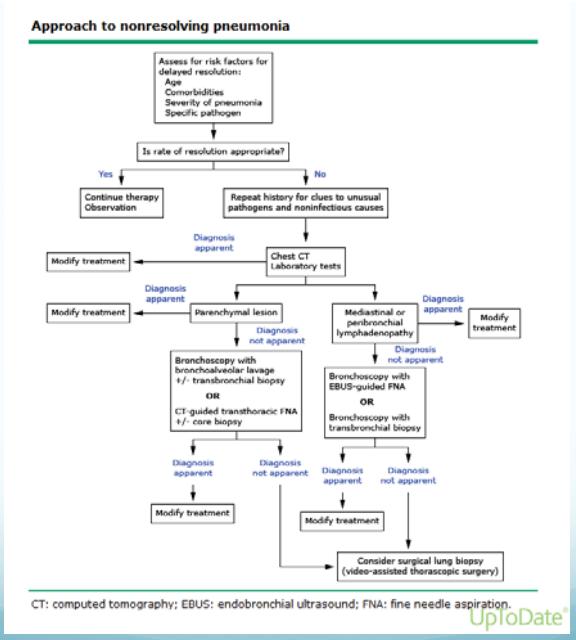


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Table 3 Indications of bronchoscopy

Exploration of airways
Persistent stridor
Persistent wheezing
Hemoptysis
Suspicion of foreign body
Persistent of recurrent atelectasis
Persistent of recurrent pneumonia
Localized pulmonary hyperlucency
Problems with tracheostomy or other artificial tubes
Obtaining biological samples (BAL, bronchial biopsy, brushing
Pneumonia in immunosuppressed patients
Chronic interstitial pneumonia (hemosiderosis, eosinophilic pneumonia, etc.)
Obstruction in bronchial lumen
Aspiration to lungs
Therapeutic procedures
Aspiration of endobronchial secretions
Difficult intubations
Selective intubations
Management of foreign bodies combined with RB

Follow up

- This patient went for bronchoscopy which grew out MRSA in 2 washes
- The patient was started on oral Zyvox (Linezolid) and the follow up CT scan in a month showed a nearly resolved infiltrate

To summarize

- Dyspnea is not as easy as one would like to think
  - Can be caused by MANY things
- History will give you clues to your diagnosis
  - Acute vs chronic
  - Description of the dyspnea
  - Social history
- The right test will give you the right diagnosis... usually

Questions?

References

- Ashton, Rendell. “Dyspnea”. Cleveland Clinic, Center for Continuing Education. July 2015.
- Berliner et al. “The Differential Diagnosis of Dyspnea” Dtsch Arztebl Int. 2016 Dec; 113(49): 834–845. Published online 2016 Dec 9. doi: 10.3238/arztebl.2016.0834
- Cottin, Vincent et al. “diagnosis and management of pulmonary fibrosis: French practical guidelines.” Eur Respir Rev 2014; 23: 193–214 | DOI: 10.1183/09059180.00001814
- Ost, David et al. “Nonresolving pneumonia”. UpToDate. https://www.uptodate.com/contents/nonresolving-pneumonia/print?topicRef=7032&source=see_link
- Parshall et al. “An Official American Thoracic Society Statement: Update on the Mechanisms, Assessment and Management of Dyspnea” Am J Respir Crit Care Med Vol 185, Iss. 4, pp 435–452, Feb 15, 2012 Copyright a 2012 by the American Thoracic Society. DOI: 10.1164/rccm.201111-2042ST
- Soyer, Tutku. “The role of bronchoscopy in the diagnosis of airway disease in children”. *J Thorac Dis* 2016;8(11):3420-3426
- Schwartzstein et. al. “Approach to the patient with dyspnea”. UptoDate. https://www.uptodate.com/contents/approach-to-the-patient-with-dyspnea/print
- Swartzstein, Richard and Adams, Lewis. Dyspena, chapter 29. Murray and Nadel’s textbook of respiratory medicine. Copyright 2016.