

Dyspnea

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REFERENCES

- **WALTER C. MORGAN, M.D., HEIDI L. HODGE, M.D., Diagnostic Evaluation of Dyspnea**
- **John B. Bass, JR. Dyspnea**
- **Murray & Nadel's Textbook of Respiratory Medicine, 4th ed., Copyright © 2005 Saunders, An Imprint of Elsevier**
- **James L. Hallenbeck, M.D. Palliative Care Perspectives Copyright © 2003 by Oxford University Press, Inc.**
- **Nishimura K, Izumi T, Tsukino M, Oga T. Dyspnea is a better predictor of 5-year survival than airway obstruction in patients with COPD. *Chest.* 2002;121:1434-1440.**

Definition

- **Dyspnea is defined as abnormal or uncomfortable awareness of breathing in the context of what is normal for a person according to his or her level of fitness and exertional threshold for breathlessness.**
- **Dyspnea is a common symptom and can be caused by many different conditions. It often has multiple etiologies. Although other causes may contribute, the cardiac and pulmonary organ systems are most frequently involved in the etiology of dyspnea.**

Pathophysiology of Dyspnea

- **Dyspnea results when there is an imbalance between the perceived need to breathe and the perceived ability to breathe.**
- **CO₂ build-up and oxygen deprivation were the critical factors that result in dyspnea.**

- **oxygen saturation is insensitive in identifying patients with dyspnea.**
- **oxygen saturation also lacks specificity as a predictor of dyspnea**
- **Elevations in carbon dioxide levels appear to stimulate dyspnea more than do low oxygen levels.**

Stretch receptors in and about the lungs signal expansion and contraction of the lungs. Thoracic muscles and ribs signal that they are moving, a good sign breathing is occurring normally. These nerves tell the brain "all is well" and allow respirations to continue automatically and largely unconsciously in the non-dyspneic person. The brain senses no imbalance between the ability to breathe and the need to breathe. If there is a sudden cessation of airflow or respiratory muscle movement, as measured by these nerves, the brain quickly goes into alarm mode - before any measurable change in blood gases occurs.

Physiologic mechanisms of Diseases Causing Dyspnea

■ Mechanical Interference with Ventilation

Obstruction to airflow (central or peripheral)

Asthma, emphysema, bronchitis

Endobronchial tumor, Tracheal or laryngeal stenosis

Resistance to expansion of the lungs ("stiff lungs")

Interstitial fibrosis of any cause

Left ventricular failure

Lymphangitic tumor

Resistance to expansion of the chest wall or diaphragm

Pleural thickening or "peel" (from prior empyema)

Kyphoscoliosis, Obesity

Abdominal mass (e.g., tumor, pregnancy)

Physiologic mechanisms of Diseases Causing Dyspnea: Cont.

■ Weakness of the Respiratory Pump

Absolute

Poliomyelitis

Neuromuscular disease (e.g., Guillain-Barré syndrome, muscular dystrophy, systemic lupus erythematosus, hyperthyroidism)

Relative (i.e., muscles at a mechanical disadvantage)

Hyperinflation (e.g., asthma, emphysema)

Pleural effusion Pneumothorax

Physiologic mechanisms of Diseases Causing Dyspnea: Cont.

■ Increased Respiratory Drive

Hypoxemia of any cause

Metabolic acidosis

Renal disease (failure or tubular acidosis)

Decreased effective hemoglobin (e.g., anemia, hemoglobinopathy)

Decreased cardiac output

Stimulation of intrapulmonary receptors (e.g., infiltrative lung disease, pulmonary hypertension, pulmonary edema)

Physiologic mechanisms of Diseases Causing Dyspnea: Cont.

- Increased Wasted Ventilation

Capillary destruction (e.g., emphysema, interstitial lung disease)

Large-vessel obstruction (e.g., pulmonary emboli, pulmonary vasculitis)

- Psychological Dysfunction

Anxiety (e.g., hyperventilation syndrome)

Depression

Etiology

- **The broad differential diagnosis of dyspnea contains four general categories: cardiac, pulmonary, mixed cardiac or pulmonary, and noncardiac or nonpulmonary**

1. Cardiac

- **Congestive heart failure (right, left or biventricular)**
- **Coronary artery disease Myocardial infarction (recent or past history)**
- **Cardiomyopathy**
- **Valvular dysfunction**
- **Left ventricular hypertrophy**
- **Asymmetric septal hypertrophy**
- **Pericarditis**
- **Arrhythmias**

1. Pulmonary

- **COPD**
- **Asthma**
- **Restrictive lung disorders**
- **Hereditary lung disorders**
- **Pneumothorax**

1. **Mixed cardiac or pulmonary**
 - **COPD with pulmonary hypertension and cor pulmonale**
 - **Chronic pulmonary emboli**
 - **Trauma**

1. Noncardiac or nonpulmonary

- **Metabolic conditions (e.g., acidosis) anemia, diabetic ketoacidosis and others**
- **Pain in the chest wall or elsewhere in the body**
- **Neuromuscular disorders such as multiple sclerosis and muscular dystrophy.**

- **Otorhinolaryngeal disorders include nasal obstruction due to polyps or septal deviation, enlarged tonsils and supraglottic or subglottic airway stricture.**
- **Functional**
 - **Anxiety**
 - **Panic disorders**
 - **Hyperventilation**

Causes of Dyspnea according to its onset:

Acute onset (within minutes)

Pulmonary: Pneumothorax, Pulmonary embolism, Bronchospasm, Asthma (with previous history), Reactive airway disease (with previous exposure), Foreign body, Toxic inhalation (eg, chlorine, hydrogen sulfide)

Acute onset: cont.

**Cardiac, Acute myocardial ischemia
or infarction, Papillary muscle
dysfunction or rupture,
Ventricular dysfunction ,
Cardiogenic pulmonary edema,
Others.**

**Diaphragmatic paralysis, Anxiety
disorders, hyperventilation**

Subacute onset (within hours or days)

Same as acute onset, with addition of:

**Pneumonia, Acute bronchitis,
Poisoning with Salicylate or
Ethylene glycol**

Nonacute onset (hours–years)

- Pulmonary

Obstructive lung disease

Restrictive lung disease

Interstitial lung disease

Pleural effusion

Cardiac

**Ventricular dysfunction, Pericardial effusion
and tamponade**

Others: Anemia and Physical.

Modified Borg Category Scale for Rating Dyspnea

Rating	Intensity of Sensation
0	Nothing at all
0.5	Very, very slight (just noticeable)
1	Very slight
2	slight
3	Moderate
4	Somewhat severe
5	severe
6	
7	Very severe
8	
9	Very, very severe (almost maximal)
10	maximal

Diagnostic Evaluation of Dyspnea

■ History

Dyspnea on exertion-----Cardiac or pulmonary disease,

Orthopnea, paroxysmal nocturnal dyspnea, edema-----Congestive heart failure, chronic obstructive pulmonary disease

**Medications as Beta blockers may exacerbate bronchospasm or limit exercise tolerance.
Pulmonary fibrosis is a rare side effect of some medications**

History

- **Smoking -----Emphysema, chronic bronchitis, asthma**
- **Allergies, wheezing, family history of asthma-----Asthma**
- **Coronary artery disease-----Dyspnea as anginal equivalent**
- **High blood pressure -----Left ventricular hypertrophy, congestive heart failure**
- **Anxiety ---Hyperventilation, panic attack**

History

- **Recent trauma-----
Pneumothorax, chest-wall
pain limiting respiration**
- **Occupational exposure to
dust, asbestos or volatile
chemicals -----Interstitial
lung disease**

Physical examination

- **Anxiety -----Anxiety disorder**
- **Nasal polyp, septal deviation----Dyspnea due to nasal obstruction**
- **Postnasal discharge-----Allergies/asthma**
- **Jugular vein distention ---Congestive heart failure**
- **Decreased pulse or bruits -----Peripheral vascular disease with concomitant coronary artery disease**
- **Cyanosis, clubbing-----Chronic severe hypoxemia**

Physical examination

- **Increased anteroposterior chest diameter ----Emphysema**
- **Wheezing-----Asthma, pulmonary edema**
- **Rales-----Alveolar fluid (edema, infection, etc.)**
- **Tachycardia----Anemia, hypoxia, heart failure, hyperthyroidism**
- **S3-----Congestive heart failure**
- **Murmur-----Valvular dysfunction**

Grading Scale for Dyspnea

- **Grade 0:** “Are you ever troubled by breathlessness, other than on strenuous exertion?”
- **Grade I:** “Are you short of breath when hurrying on level ground or walking up a slight hill?”
- **Grade II:** “Do you have to walk slower than most people on level ground? Do you have to stop after a mile or so (or after 15 minutes) when you walk on level ground at your own pace?”
- **Grade III :** “Do you have to stop for breath after walking about 100 yards (or after a few minutes) on level ground?”
- **Grade IV:** “Are you too breathless to leave the house or breathless after undressing?”

Types of Dyspnea

- 1. *Nocturnal Dyspnea:*** Dyspnea, which occurs only at night and may be paroxysmal as in patients with heart failure.
- 2. *Orthopnea:*** Here dyspnea occurs when a patient lies down as in cases with heart failure, asthma and chronic obstructive disease of the lungs.

Types of Dyspnea:Cont.

- 3. *Trepopnea*:** This is used to describe the appearance of breathlessness only in the left or right lateral lying position. This does not occur when a patient is in the supine position. This occurs in patients with heart disease.
- 4. *Platypnea*:** Is breathlessness, which occurs only in the upright position.

Investigation

- **The most useful methods of evaluating dyspnea are the electrocardiogram and chest radiographs. These initial modalities are inexpensive, safe and easily accomplished. They can help confirm or exclude many common diagnoses.**
- **The electrocardiogram can show abnormalities of the heart rate and rhythm, or evidence of ischemia, injury or infarction. Voltage abnormality suggests left or right ventricular hypertrophy if the voltage is excessive, or pericardial effusion or obstructive lung disease with increased chest diameter if the voltage is diminished.**

Investigation

- **A chest radiograph can identify skeletal abnormalities, such as scoliosis, osteoporosis or fractures, or parenchymal abnormalities, such as hyperinflation, mass lesions, infiltrates, atelectasis, pleural effusion or pneumothorax. An increased cardiac silhouette can be caused by increased pericardial size or increased chamber size.**
- **A finger-stick hemoglobin determination or a complete blood count can quantify the severity of suspected anemia. Thyroid abnormalities rarely present with dyspnea and can be assessed by measurement of the serum thyroid-stimulating hormone level.**

Investigation

- **Spirometry**

Spirometry can help differentiate obstructive lung disease from restrictive lung disease

- **Pulse Oximetry**

Pulse oximetry uses an infrared light source to determine the hemoglobin oxygen saturation. It is valuable as a rapid, widely available and noninvasive means of assessment and is accurate in most clinical situations.

Investigation

- **Arterial Blood Gases**

Arterial blood gas measurement can provide information about altered pH, hypercapnia, hypocapnia or hypoxemia. This measurement is more commonly used for the evaluation of acute dyspnea but it can also be used in the evaluation of patients who have gradually become dyspneic or who are chronically dyspneic.

- **Complete Pulmonary Function Testing**
Complete pulmonary function testing can be obtained if screening office spirometry is inconclusive. Measurement of all types of lung volume, such as total lung capacity and residual volume, can show combinations of obstructive and restrictive disease. The diffusing capacity of the lung for carbon monoxide (DLCO) is often included in complete pulmonary function testing. The DLCO is used to indirectly measure the gas exchange of oxygen and carbon dioxide across the alveolar surface. Reduced diffusing capacity can occur in a variety of alveolar or interstitial abnormalities, such as edema, inflammation, infection, infiltration and malignancy. Reduced oxygen diffusion can markedly contribute to dyspnea; however, it usually occurs with some spirometric abnormality

■ Exercise Treadmill Testing

Exercise treadmill testing can target ischemia as a cause of dyspnea. This test can be performed when symptoms are atypical for exertional angina or when silent ischemia is suspected as a cause of dyspnea on exertion. A patient's ability to perform a treadmill test can be limited by poor aerobic conditioning, by lower extremity pathology such as arthritis, claudication or edema, or by coincidental pulmonary disease. Exercise treadmill testing is relatively safe and has few risks: only one in 10,000 patients dies of malignant arrhythmia or acute myocardial infarction, and only two in 10,000 have serious but nonfatal arrhythmia or another complication.¹¹

Echocardiography

- **Echocardiography can detect a valvular abnormality and may be diagnostically helpful in patients with questionable murmurs in the context of dyspnea. Chamber size, hypertrophy and left ventricular ejection fraction can also be assessed. A multigated cardiac acquisition (MUGA) scan or radionuclide ventriculography can also be used to quantify the ejection fraction.**

Cardiopulmonary Exercise Testing

- **Cardiopulmonary exercise testing quantifies cardiac function, pulmonary gas exchange, ventilation and physical fitness. Cardiopulmonary exercise testing may be used in selected cases when the diagnosis is still unclear after the initial examination. It can be particularly useful in cases where obesity, anxiety, exercise-induced asthma or other problems preclude standard exercise treadmill testing.**

Treatment-General Measures

- Treatment of dyspnea is directed at the cause.
- Positioning (sitting up), increasing air movement via a fan or open window, and use of bedside relaxation techniques are all helpful; decrease or discontinue use of IV fluids.
- Quit smoking immediately.

Treatment with Opioids

- It is the drug of choice for dyspnea. Low doses of oral (10-15 mg) or parenteral morphine (2-5 mg), will provide relief for most patients; higher doses will be needed for patients on chronic opioids (50% over baseline). When dyspnea is acute and severe, parenteral is the route of choice: 2-5 mg IV every 5-10 minutes until relief. Nebulized morphine can be used, but its relative benefit compared to po/IV in controlled trials has not been proven.
- The exact mechanism is not understood but may be through inhibition of respiratory drive or decrease work of breathing

Treatment w/Oxygen

- **Nasal cannula is better tolerated than a mask, especially in the terminal setting; Oxygen is not always helpful; a therapeutic trial, based on symptom relief, not pulse oximetry, is indicated. There is little reason to go beyond 4-6 L/min of oxygen via nasal cannula in the actively dying patient. Request a face-tent for patients who are claustrophobic from a mask.**

Treatment w/Other Drugs

- **Anti-tussives can help with cough, anti-cholinergics (e.g. Scopolamine) will help reduce secretions and anxiolytics (e.g. lorazepam) can reduce the anxiety component of dyspnea.**

Thank you