Respiratory Block

2019 CSIE: ACE –Dyspnea

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Overview of the ACE live session and instructions to Facilitators

Introductions (Start at 8:30 am: 5-10 minutes)
● Start the live session by introducing yourself
● Meet the students and let them introduce themselves
● If you are familiar with the students, take a few minutes to check in on them and how they are doing
● Let the pre-designated student/students connect the computer/laptop to the AV system to log on and bring up the google doc forms to be used in the session

Clinical Approach Questions (Start no later than 8:40 am: 15 minutes)
● Start with the Clinical Approach Questions document on the screen:
  o Ask each clinical approach question and elicit a response from the students (as a large group)
  o If students are not volunteering or speaking up, go around the room and call on them or use the student roster provided in your folder
  o If students are not giving the expected/correct answers, guide them further
  o Ensure that you fill in gaps, if students are missing important points, or necessary information relating to the learning objectives

ACE Table (Start no later than 9:00 am: 40 minutes)
● Next direct the students to bring up the ACE Table document on the screen:
  o Students will need to work together to fill in the table (via google docs)
  o They can access the electronic “Resources folder” at any time
  o Divide your large group into smaller subgroups of 2-3 students
  o Assign each smaller subgroup of 2-3 students, a diagnosis and let them fill in the missing information-allow about 10-15 minutes
  o Circulate or check on them periodically and guide them as needed
After the table is filled, let each subgroup present what they worked on - allow about 25-30 minutes
Let each student present if possible
Discuss or challenge them if you see gaps in the information provided or if there are erroneous information
Once completed, the students are allowed to keep this table for their educational purposes

Practice Clinical Cases (Start no later than 9:40 am: 20-25 minutes)
- Next, direct the students to the Practice Clinical Cases document on the screen:
  - As a large group, work to discuss the practice clinical cases
  - Rotate through the students to elicit responses to the questions in each practice clinical case and direct the discussion as needed
  - Reveal the “working diagnosis” for each clinical case after all the questions have been answered
  - Alternatively if you have ample time, divide your large group into smaller subgroups and give each subgroup a clinical case to work on (10 minutes) and let each subgroup present (15-20 minutes)

Quiz and feedback (Start no later than 10:00 am: 15-20 minutes)
- Ensure that all students log into eCampus and access the Quiz under the course/CSIE ACE folder/Quiz
- Access the brown envelope in your maroon folder and read out loud the quiz password
- If a student experiences technical issues, access the brown folder for a backup copy
- The quiz will take 10 minutes to complete
  - During the quiz, please access the one page student evaluation form (in the brown envelope) and evaluate each student using the given grading rubric
  - When all students are done with the quiz, briefly go over the quiz questions/answers (5-10 minutes)
- Conclude the session and release the students by 10:20 am
- Leave the completed student evaluation form in the brown envelope within the maroon folder

PLEASE ENSURE THAT ALL FILLED-IN STUDENT EVALUATIONS ARE IN THE BROWN ENVELOPE BEFORE YOU LEAVE THE ROOM

Quick Overview of Student Expectations and Assessment:
Student Expectations
- Students are expected to arrive on time, in professional dress, white coat and badge.
- Students are expected to actively participate, show professional behavior such as appropriate listening skills and refraining from disrupting the session (please see the student evaluation rubric for more details).
- Students are expected to have prepared for the live session by reading the preparation guide and assigned reading material to prepare them for the live session.

ACE Assessment
- This CSIE ACE comprises of 3% of the overall block grade in the following way:
  - 1.5% for the individual quiz given at the end of the session
  - 1.5% for the student evaluation form (provided by you as the facilitator

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ACE Dyspnea Learning Objectives:

1. Develop a clinical approach to the chief complaint of dyspnea.
2. Name the organ systems commonly associated with dyspnea.
3. Develop a differential diagnosis for dyspnea based on history, physical exam findings, and diagnostic tests.
4. List common causes of dyspnea.
5. List major life threatening causes of dyspnea.
6. Identify important signs of the unstable patient presenting with dyspnea.
7. Identify acute and chronic causes of dyspnea.
8. Differentiate between different causes of dyspnea (e.g. congestive heart failure, pulmonary embolism, pneumonia, foreign body aspiration, anxiety etc.) given key clinical features.
9. Identify appropriate diagnostic testing to further evaluate dyspnea.
10. Identify most likely causes of dyspnea in a younger versus an older patient.
11. Identify the need to assess a patient’s airway, breathing, and circulation (ABCs) in the setting of dyspnea.

CC: Dyspnea (shortness of breath)

Clinical Approach & Questions for Dyspnea:

Approach to the Patient with Dyspnea

Definitions:

Dyspnea - breathlessness or shortness of breath; labored or difficult breathing. It is a sign of a variety of disorders and is primarily an indication of inadequate ventilation or of insufficient amounts of oxygen in the circulating blood. adj., adj dyspneic.

Tachypnea – a respiratory rate greater than normal. Normal rates vary with age.

Hypopnea - overly shallow or abnormally low respiratory rate.

Orthopnea – dyspnea in a recumbent position. Usually measured in number of pillows patient used to lie in bed.

Paroxysmal nocturnal dyspnea – sudden onset of dyspnea while reclining at night, usually related to the presence of congestive heart failure.

Common chief complaints:

“can’t breathe”, “trouble breathing”, “can’t catch my breath”, “fast breathing”, “working hard to breathe”, “noisy breathing”, “air hungry”
Note: In a patient with dyspnea, begin by assessing the patient’s airway, breathing, and circulation (ABCs). If the patient is unable to complete a full sentence without pausing for a deep breath, or there are other signs of instability (see Q5 below), move quickly to stabilize the patient.

1. What organ systems are commonly associated with dyspnea?
   - Pulmonary, cardiac, head & neck, immune system, neuro, psych, hematology, musculoskeletal, other-toxins

2. Within these systems, what is your differential diagnosis for each?
   - Pulmonary
     - Asthma exacerbation, chronic obstructive pulmonary disease (COPD) exacerbation, cystic fibrosis, bronchiectasis, bronchiolitis, interstitial lung disease, bronchitis, pneumonia, pneumothorax, pulmonary embolism, foreign body aspiration, atelectasis, pleural effusion, acute respiratory distress syndrome (ARDS), tumors/malignancies
   - Cardiac
     - MI, congestive heart failure, cardiac tamponade, aortic stenosis, supraventricular tachycardia (SVT), ventricular tachycardia, constrictive pericarditis, aortic stenosis, mitral regurgitation, ruptured chordae tendineae
   - Head & Neck
     - Peritonsillar abscess, retropharyngeal abscess, croup, epiglottitis, angioedema, congenital airway anomalies (laryngomalacia, vocal cord paralysis, subglottic stenosis, tracheomalacia), upper respiratory infection (Note: URI in the young infant may cause significant dyspnea since they are obligate nasal breathers)
   - Immune System
     - Anaphylaxis
   - Neuro
     - Myasthenia gravis, amyotrophic lateral sclerosis (ALS), Guillain Barre, muscular dystrophy, CNS injury, CNS infection, post polio syndrome and diaphragmatic paralysis that can be seen post trauma or post surgery
   - Psych
     - Anxiety
   - Hematology
     - Anemia- (acute/severe), acute chest syndrome from sickle cell disease
   - Musculoskeletal
     - Kyphoscoliosis, obesity, deconditioning
   - Toxins
     - Methanol, carbon monoxide poisoning, ethylene glycol, salicylates, metabolic acidosis- e.g. diabetic ketoacidosis (DKA), renal tubular acidosis (RTA)

3. What are common conditions that cause dyspnea?
   Asthma, COPD, congestive heart failure, obesity/deconditioning, interstitial lung disease.
4. What are life-threatening causes of dyspnea?

Acute coronary syndrome (ACS), congestive heart failure exacerbation, arrhythmia, pericardial tamponade, pulmonary embolism, pneumonia, COPD exacerbation, asthma exacerbation, angioedema, anaphylaxis, carbon monoxide poisoning, trauma (i.e. pneumothorax, hemothorax, neck trauma), epiglottitis, bacterial tracheitis, retropharyngeal abscess, foreign body, burns (thermal or caustic).

5. What are important signs of the unstable patient presenting with dyspnea?

Signs of severe respiratory distress include:

- The use of accessory muscles and chest retraction
- Incomplete sentences or fragmented speech
- Altered mental status (agitation or somnolence)
- Inability to lie flat (supine)
- Diaphoresis (sweating profusely) and ashen skin
- Stridor

Signs of imminent respiratory arrest:

- Inability to maintain respiratory effort
- Depressed mental status
- Cyanosis

Other features of an unstable patient include abnormal vital signs such as hypotension, tachypnea, hypoxemia, tachycardia (hypoxemia with bradycardia is an ominous sign of impending cardiac arrest).

For additional info on HPI questions/exam findings/labs and procedures etc., see “Further information for the ACE Table and its discussion” below. This document will only be discussed with students in context of the ACE Table discussion.

Further information for the ACE table and its discussion

What HPI questions would you ask the patient? (Pain, Onset, Duration, Timing, Location, Quality, Severity, Modifiers, Associated symptoms, Context)

- Onset, duration and timing:
  - **Acute onset** over minutes to hours: consider pulmonary embolism, acute asthma, COPD exacerbation, bronchospasm, pneumothorax, pneumonia, foreign body aspiration, MI, CHF exacerbation, cardiac tamponade, diabetic ketoacidosis, hyperventilation, anaphylaxis, or angioedema.
    - In children, consider aspirated foreign body with sudden onset of gagging or choking. Children can have an acute onset of epiglottitis and bacterial tracheitis.
  - **Chronic onset** with exertional dyspnea: CHF, asthma, interstitial lung disease, obesity/deconditioning, anemia, hyperthyroidism, neuromuscular causes
  - **Intermittent/recurrent**: asthma (worsened by cold air or animal dander)
● Modifying factors:
  o Worse with exertion and at night time: heart failure and asthma. *Difference is that in CHF they have paroxysmal nocturnal dyspnea (PND), which improves with sitting up, where asthma does not improve with sitting up.*
  o Worse with cold air or exercise should prompt consideration of asthma.

● Associated signs and symptoms:
  o Substernal chest pain: MI, PE, aortic stenosis
  o Pleuritic chest pain: PE, pneumothorax, or pneumonia
  o Palpitations: SVT and V-tach
  o Urticaria: consider anaphylaxis. Will have swelling of upper airway, tongue, hives and flushing. May progress to wheezing, stridor, tachycardia and hypotension. May have diarrhea.
  o Swelling of lips and tongue: angioedema
  o Wheezing: asthma, COPD, cystic fibrosis, anaphylaxis, foreign body aspiration
  o Cough: obstructive lung disease (asthma, COPD, cystic fibrosis in kids, bronchiectasis) or pneumonia.
    ▪ Asthma: dry cough with wheezing
    ▪ COPD and CF: productive cough with wheezing
    ▪ Bronchiectasis and pneumonia: productive cough with crackles/rhonchi
    ▪ Croup (laryngotracheitis): barking cough
  o Fever: consider pulmonary infection with/without sepsis
    ▪ *In children:* fever alone can increase respiratory rate (3-7 breaths for every degree centigrade above normal, and 7-11 for those <12 months)
  o Orthopnea or paroxysmal nocturnal dyspnea (PND): CHF
    ▪ *In children:* congenital heart disease and viral myocarditis
  o Polyuria, polydipsia, and polyphagia: diabetic ketoacidosis causing dyspnea
  o Hemoptysis: PE, TB, and malignancy

● Context:
  o Trauma - larynx fracture, pneumothorax, pulmonary contusion, flail chest, open pneumothorax, cardiac tamponade, intra abdominal and/or CNS injury
  o Home fire - smoke inhalation
  o Near drowning - can progress from non-cardiogenic edema to ARDS
  o Recent subclavian catheter insertion – consider pneumothorax
  o Non-compliance to medicines and diet – CHF exacerbation
  o Exposure to cold or an allergen – Asthma exacerbation

*What other pertinent element of the patient’s history would you focus on?*

**Past Medical History**

● Diabetes – diabetic ketoacidosis will produce dyspnea
● Sickle cell disease – acute chest syndrome can cause dyspnea
- Cystic fibrosis/Asthma/COPD – can cause spontaneous pneumothorax
- History of DVT, active cancer, recent surgery, immobility due to stroke, currently pregnant, on birth control – consider PE
- History of Stroke/intoxicated – aspiration pneumonia
- Atopy and eczema - in those who are wheezing, may support diagnosis of asthma

**Social History**

- Smoking history is predictive of COPD when present with symptoms of dyspnea
- Absence of cigarette smoking (ie, < 10 ppy), is predictive of not having COPD
- Occupation history (asbestosis, chronic beryllium disease, silicosis, Pneumoconiosis "Coal Worker's Pneumoconiosis")

**What pertinent exam findings would you look for? (Vitals, General, HEENT, Lungs, Cardiac, Abdomen, Musculoskeletal, Neuro-Psych)**

<table>
<thead>
<tr>
<th>Sign</th>
<th>Physical Finding</th>
<th>Diagnoses to Consider</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Vital Signs</strong></td>
<td></td>
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<tr>
<td>Fever</td>
<td></td>
<td>Pneumonia, PE</td>
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<tr>
<td>Tachypnea</td>
<td></td>
<td>Respiratory disease, response to metabolic acidosis</td>
</tr>
<tr>
<td>Hypopnea</td>
<td></td>
<td>Intracranial insult, drug or toxin ingestion</td>
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<tr>
<td>Tachycardia</td>
<td></td>
<td>PE, Traumatic chest injury, acute blood loss</td>
</tr>
<tr>
<td>Hypotension</td>
<td></td>
<td>Shock, tension pneumothorax, cardiac tamponade</td>
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<tr>
<td>Pulsus paradoxus (&gt;10 mmHg Hg drop of BP with inspiration)</td>
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<td>Cardiac tamponade, severe asthma exacerbation</td>
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<tr>
<td>Oxygen saturation (Pulse oximetry)</td>
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<td>Hypoxemia</td>
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<tr>
<td><strong>General appearance</strong></td>
<td>Restlessness, anxiety, and combativeness</td>
<td>Early signs of air hunger/hypoxia</td>
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<tr>
<td>Somnolence and lethargy</td>
<td></td>
<td>Indicate severe hypoxia, hypercarbia, and respiratory fatigue</td>
</tr>
<tr>
<td>Sniffing or Tripod positioning with a refusal to lay down</td>
<td>Upper Airway Obstruction (Croup, Epiglottitis, retropharyngeal abscess) or COPD or asthma with severe distress</td>
<td></td>
</tr>
<tr>
<td>Traumatic injury</td>
<td></td>
<td>Pneumothorax, rib fractures, flail chest, hemothorax, pulmonary contusion</td>
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<tr>
<td>Pallor, ashen color, and cyanosis</td>
<td></td>
<td>Concern for hypoxia and shock</td>
</tr>
<tr>
<td>Pregnant</td>
<td></td>
<td>PE</td>
</tr>
<tr>
<td>Obesity</td>
<td></td>
<td>Hypoventilation, sleep apnea, PE</td>
</tr>
<tr>
<td>Hives</td>
<td></td>
<td>Allergic reaction</td>
</tr>
<tr>
<td><strong>HEENT and Neck</strong></td>
<td>Dysphonia</td>
<td>Upper airway obstruction</td>
</tr>
<tr>
<td>Drooling and dysphagia</td>
<td>Inability to handle oral secretions suggest oropharyngeal or laryngotracheal obstructions.</td>
<td></td>
</tr>
<tr>
<td>Deviation of the uvula with trismus and tonsillar exudate</td>
<td>Peritonsillar abscess</td>
<td></td>
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</tbody>
</table>

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<table>
<thead>
<tr>
<th>Tracheal deviation</th>
<th>Tension pneumothorax</th>
</tr>
</thead>
<tbody>
<tr>
<td>JVD</td>
<td>CHF or Cardiac tamponade</td>
</tr>
<tr>
<td>Stridor</td>
<td>Inspiratory stridor suggests obstruction above the vocal cords or upper airway obstruction (e.g. foreign body, epiglottitis, angioedema) Expiratory stridor or mixed inspiratory and expiratory stridor suggests obstruction below the vocal cords (e.g. croup, bacterial tracheitis, foreign body)</td>
</tr>
</tbody>
</table>

**Thorax/Lungs**

<table>
<thead>
<tr>
<th>Barrel chest</th>
<th>COPD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crepitance or pain on palpation</td>
<td>Rib or sternal fractures</td>
</tr>
<tr>
<td>Subcutaneous emphysema</td>
<td>Pneumothorax, tracheobronchial rupture</td>
</tr>
<tr>
<td>Thoracoabdominal desynchrony</td>
<td>Diaphragmatic injury with herniation, cervical spinal cord trauma</td>
</tr>
<tr>
<td>Flail segment</td>
<td>Flail chest, pulmonary contusion</td>
</tr>
<tr>
<td>Wheezes</td>
<td>Bronchospasm, CHF, anaphylaxis</td>
</tr>
<tr>
<td>Grunting</td>
<td>In children suggest moderate to severe lower airway disease</td>
</tr>
<tr>
<td>Rales</td>
<td>CHF, pneumonia, PE</td>
</tr>
<tr>
<td>Unilateral decrease</td>
<td>Consolidation, pneumothorax, pleural effusion, pulmonary contusion</td>
</tr>
<tr>
<td>Hemoptysis</td>
<td>Infection, Malignancy, bleeding disorder, CHF</td>
</tr>
<tr>
<td>Sputum production</td>
<td>Infection</td>
</tr>
<tr>
<td>Friction rub</td>
<td>Pleurisy</td>
</tr>
<tr>
<td>Abnormal pattern</td>
<td>Kussmaul respirations (deep, regular, fast sighing breaths): metabolic acidosis (e.g. DKA, toxic ingestion of methanol, ethylene glycol, salicylates etc). Cheyne-Stokes respirations (increasing and decreasing rate and depth with periods of apnea: CNS immaturity in neonates, brain injury, increase intracranial pressure (ICP), central narcotic depression, CHF</td>
</tr>
</tbody>
</table>

**Cardiac**

<table>
<thead>
<tr>
<th>Decreased heart sounds</th>
<th>Pericardial effusion or cardiac tamponade (may also have JVD and hypotension in cardiac tamponade), hyperinflation from COPD, or obesity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pericardial rub</td>
<td>Pericarditis</td>
</tr>
<tr>
<td>Murmur</td>
<td>Aortic stenosis, mitral regurgitation, or ruptured chordae tendinae.</td>
</tr>
<tr>
<td>S3 or S4</td>
<td>S3 suggests systolic heart dysfunction, S4 suggests ventricular hypertrophy with possible diastolic dysfunction</td>
</tr>
</tbody>
</table>

**Abdomen**

| Hepatomegaly | Venous congestion from CHF |

**Vascular**

| Edema | CHF |
Calf tenderness or Homans’ sign (pain behind knee with forced dorsiflexion of the foot) | DVT causing PE

| Musculoskeletal | Clubbing | Chronic pulmonary disease |
| Neurologic | Symmetrical deficits | Neuromuscular disease |
| | Diffuse weakness | Metabolic or electrolyte disorders |
| | Hypo-reflexia and ascending weakness | Guillain-Barre syndrome |

Note: In general, healthy individuals demonstrate an oxygen saturation (SpO2) of 95 percent or greater. Elders and patients who are obese or smoke heavily often maintain levels between 92 and 95 percent, while patients with severe chronic lung disease may have baseline levels below 92 percent. In the setting of acute dyspnea, oxygenation levels lower than expected, or below a patient’s known baseline, should be investigated and explained.

What laboratory values and/or studies would you order to narrow your differential diagnosis? (depending on the clinical data, not all will be ordered on each patient)

<table>
<thead>
<tr>
<th>Category</th>
<th>Test</th>
<th>Findings and Potential Diagnoses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laboratory</td>
<td>Pulse oximetry</td>
<td>Evaluate a-A gradient and severity. Low resting O2 Sat (&lt;95%) or exertional drop (&gt;5%) may suggest a-A derangement</td>
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<tr>
<td></td>
<td>VBG, ABG</td>
<td>Severity of respiratory compromise</td>
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<td></td>
<td>CBC</td>
<td>Infection anemia</td>
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<td></td>
<td>Chemistry</td>
<td>Metabolic acidosis, diabetes</td>
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<tr>
<td></td>
<td>D- dimer</td>
<td>PE</td>
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<tr>
<td></td>
<td>Brain natriuretic peptide (BNP) or N-terminal pro-BNP</td>
<td>CHF</td>
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<tr>
<td></td>
<td>Cardiac troponin</td>
<td>Cardiac ischemia or infarct</td>
</tr>
<tr>
<td>Cardiac</td>
<td>ECG</td>
<td>Ischemia, dysrhythmia, S1Q3T3 with PE</td>
</tr>
<tr>
<td></td>
<td>Echocardiogram</td>
<td>Pericardial effusions/cardiac tamponade, pulmonary HTN, intracardiac shunts</td>
</tr>
<tr>
<td>Lung</td>
<td>Pulmonary function tests/Peak Flows</td>
<td>Asthma and COPD</td>
</tr>
<tr>
<td>Fiberoptic</td>
<td>Laryngoscopy</td>
<td>Mass lesion, airway edema, FB,</td>
</tr>
<tr>
<td></td>
<td>Bronchoscopy</td>
<td>Mass lesion, FB, Interventions (stenting biopsy)</td>
</tr>
<tr>
<td>Radiologic</td>
<td>CXR/CT chest</td>
<td>Pneumonia, pleural effusion (lateral decubitus), air trapping from obstructive lung disease, atelectasis pneumothorax, cardiomegaly, and pericardial fluid</td>
</tr>
<tr>
<td></td>
<td>Inspiratory and expiratory CXR</td>
<td>foreign body aspiration</td>
</tr>
<tr>
<td>Soft tissue plain film/neck CT</td>
<td>Retropharyngeal abscess, peritonsillar abscess, tracheitis, epiglottitis, croup, or foreign body</td>
<td></td>
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<tr>
<td>--------------------------------</td>
<td>-----------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>CT chest angiogram (if normal renal function), V/Q scan</td>
<td>PE</td>
<td></td>
</tr>
<tr>
<td>High resolution CT (HRCT)</td>
<td>Interstitial lung disease</td>
<td></td>
</tr>
</tbody>
</table>

### ACE Table

**Chief Complaint – Dyspnea (Students will fill in 8 diagnoses below; see yellow highlights)**

<table>
<thead>
<tr>
<th>Diagnosis/Category</th>
<th>System</th>
<th>History</th>
<th>Physical Exam Finding</th>
<th>Labs</th>
<th>Radiology/Procedure</th>
</tr>
</thead>
</table>
| Croup/Epiglottis, Foreign Body aspiration | Head & Neck | SOB. “Noisy breathing” with FB/Croup/Epiglottis | Stridor - inspiratory characteristic of obstruction at or above vocal cords, both inspiratory and expiratory think subglottic, expiratory think tracheal. Tripoding and drooling with Epiglottis  
**Note: Be careful not to agitate kids with acute airway obstruction** | None indicated | Lateral necks films and CXR. FB may not be visible (RADIOLUCENT) and will need bronchoscopy |
<p>| Anaphylaxis (note: recognize that treat - delay could mean loss of airway) | Immune     | SOB. Exposure history with allergic reaction | Urticaria or angioedema with allergic reaction | None indicated | None |
| 1. Asthma                      | Pulmonary  | Cough, SOB, chest pain/tightness. Fever with infectious etiologies. No fever with allergic triggers | Diffuse lung sounds - wheezing or rhonchi, pulsus paradoxus (if severe dz), accessory muscle use | Most often not needed. Blood gas if severe | CXR - hyperinflation (asthma/COPD). PFTs - reduced FEV1/FVC |
| 2. COPD                        | Pulmonary  | Productive cough, SOB, chest pain/tightness. | Wheezes or rhonchi. Barrel chest and clubbing with chronic disease. Accessory muscle use | Most often not needed. Blood gas if severe | CXR - hyperinflation (asthma/COPD). PFTs - reduced FEV1/FVC |</p>
<table>
<thead>
<tr>
<th>3. Bronchiolitis</th>
<th>Pulmonary</th>
<th>Infant with dry cough and shortness of breath. Hemoptysis at times.</th>
<th>Wheezes/rales</th>
<th>None indicated</th>
<th>CXR - Hyperinflation and atelectasis</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Pneumonia</td>
<td>Pulmonary</td>
<td>Productive cough, SOB, fever</td>
<td>Localized crackles/fremitus or decreased BS</td>
<td>CBC - increased WBC</td>
<td>CXR</td>
</tr>
<tr>
<td>5. Interstitial lung disease</td>
<td>Pulmonary</td>
<td>Gradual onset of dyspnea with a non-productive cough, also environmental or tobacco smoke exposure</td>
<td>Fine dry crackles at bases with interstitial, clubbing</td>
<td>Test for collagen vascular disease with ILD</td>
<td>CXR may be normal in early stages of ILD. CT of chest, lung biopsy</td>
</tr>
<tr>
<td>7. Pneumothorax</td>
<td>Pulmonary</td>
<td>acute SOB and chest pain, trauma or procedure</td>
<td>Spontaneous -usually young, thin, and tall, absent breath sounds, hyperresonance, Tracheal shift if large Hypotension with tension pneumothorax Look for Marfanoid features - arachnodactyly, arm span &gt; body height. a long and narrow face, crowded teeth, scoliosis or kyphosis, pectus excavatum or pectus carinatum</td>
<td>none, normal</td>
<td>CXR</td>
</tr>
<tr>
<td>Condition</td>
<td>Location</td>
<td>Symptoms</td>
<td>Tests</td>
<td>Imaging/Procedure</td>
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<td>---------------------------------------------------------------------------</td>
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<tr>
<td>CHF</td>
<td>Cardiac</td>
<td>LV - exertional dyspnea, fatigue, PND；RV - ankle swelling and fatigue</td>
<td>Edema, JVD, S3, S4, hepatojugular reflux, murmurs, rales, hypertension, wheezing</td>
<td>CBC, CMP, Cardiac enzymes, BNP；CXR - pulmonary edema；Echo；ECG；Coronary Angio with concern for CAD</td>
<td></td>
</tr>
<tr>
<td>Ischemic Heart Disease</td>
<td>Cardiac</td>
<td>Pale, cool, diaphoretic, shock, 4th heart sound, blowing apical murmur (papillary muscle rupture), JVD RV infarct</td>
<td>Cardiac markers, CBC, CMP, Lipid profile；ECG；Coronary angiography with STEMI</td>
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<tr>
<td>8. Pulmonary Embolism</td>
<td>Pulmonary/Vascular</td>
<td>Acute exertional SOB, Pleuritic chest pain, cough, hemoptysis (uncommon), syncope；Look for risk for DVT</td>
<td>Tachycardia, tachypnea, hypoxia, shock or cardiac arrest with massive PE；Look for signs of DVT (pain, swelling, erythema of extremity)</td>
<td>ABG；Elevated d-dimer；Cardiac marker testing, Thrombophilia work up；CXR - nonspecific, often normal；ECG with new RBBB or S1Q3T3；CT angio；VQ scan；Duplex US；Echocardiogram；US for DVT</td>
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<tr>
<td>Disordered control of breathing: Neuromuscular disease, Toxin</td>
<td>Neuro/Toxic</td>
<td>Difficult to detect until compromised, care giver may notice first, recent seizure, known neuromuscular disease, recent sedative medication</td>
<td>Altered mental status, Irregular respiratory pattern, inadequate depth or effort of breathing, decreased air movement</td>
<td>ABG, Toxicologic screen；CXR – under-ventilated with atelectasis</td>
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<tr>
<td>Hyperventilation (DKA or other metabolic or toxicologic process)</td>
<td>Metabolic or Toxic</td>
<td>Any condition causing acute metabolic acidosis (MUD PILES) may cause；Tachypnea without distress, fruity breath with DKA</td>
<td>ABG, CMP (HCO3, AG, Glucose), UDS, NH4；CXR - normal</td>
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</tbody>
</table>
### Anxiety

<table>
<thead>
<tr>
<th>Behavioral/Psych</th>
<th>Chronic - sigh deeply and frequently</th>
<th>Acute - Severe dyspnea out of proportion to physical findings, terror, chest pain, paresthesia</th>
<th>ABG (rule out metabolic acidosis), cardiac enzymes, d-dimer</th>
<th>Diagnosis of exclusion: Pulse oximetry, CXR, ECG (hyperventilation can cause ST and T wave abn), may need to rule out PE (see above)</th>
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### ACE- Dyspnea PRACTICE CLINICAL CASES

**Case 1: CC: “I’m working hard to breathe”**

During the winter, a 60-year-old man with known history of congestive heart failure presented to the ER with a 3 day history of constant, progressively worsening, exertional dyspnea that he describes as suffocating.

Questions:

1. What is your differential diagnosis?
   
   See ACE approach and Table

2. What is common in this age group?
   
   CHF, MI, PE, COPD, Lung infection (pneumonia, bronchitis)

3. What pertinent HPI questions would you ask the patient?
   
   • Normally he can walk from the front door to the mailbox without problems.
   • Three days ago, while at home he had developed moderate exertional dyspnea that slowly progressed to severe dyspnea with minimal exertion.
   • He does state that the dyspnea is relieved modestly with sitting up.
   • His home health nurse came to visit him at home and had noticed that he was in respiratory distress and called EMS.
   • Upon arrival, EMS noted an oxygen saturation of 80% and also performed an EKG that was normal.
   • The home health nurse did state that his weight had increased by 15 lbs over three days.
   • PMHX - congestive heart failure (CHF), CAD, diabetes mellitus, hypertension, and 30-pack-year of smoking
   • Medications - Used to feel this way “all the time” years ago but that this has not happened much since he began using his “water pill.” He cannot remember the names of his medications. He has not missed any doses.
   • Diet - He has been eating more hot soup since the weather has gotten colder.

4. What pertinent ROS questions would you ask the patient?
   
   • Denies fever or chills, productive cough, chest pain, or palpitations.

5. What pertinent exam findings would you look for or expect for this patient?
• Vitals - Temperature is 37.5°C (99.5°F), blood pressure is 135/90 mm Hg, heart rate is 90/min, respiratory rate is 18/min, and oxygen saturation is 92% on 4L O2.
• Neck - mild jugular venous distention.
• Lungs - loud crackles throughout the lung fields bilaterally.
• Heart - a laterally displaced point of maximum impulse with no murmurs, rubs, or gallops.
• Extremities - Mild clubbing of the extremities, as well as pitting edema of the lower extremities to the knee, bilaterally.

6. What studies would you order?
• Plasma brain natriuretic peptide level on rapid bedside assay is 500 pg/mL
• X-ray of the chest reveals perivascular haziness, interstitial edema, and an enlarged cardiac silhouette.

7. Would the patient need close observation in the hospital?
Yes. He is in acute distress with hypoxia.

**Diagnosis: CHF exacerbation**

- The patient reported increasing intake of soup, a particularly salty food, which can significantly increase water retention, thereby worsening CHF.
- Mnemonic for the causes of recurrent CHF is FAILURE: Forgot medication, Arrhythmia/anemia, Ischemia/infarct/infection, Lifestyle (increased sodium intake, decreased exercise), Upregulation (increased cardiac output due to pregnancy, hyperthyroidism, etc.), Renal failure, Embolus (pulmonary)

**Case 2: “It’s getting harder to breathe”**

A 9-year-old girl presents to the clinic with her mom with a 5 day history of increased fatigue and mild exertional dyspnea that was associated with fever and chills.

Questions:

1. What is your differential diagnosis?
   See ACE approach and table
2. What is common in this age group?
   Asthma and Infection (URI with cough, pneumonia)
3. What pertinent HPI questions would you ask the patient?
   • She does complain of an associated mild productive cough.
   • She and her mother state that the symptoms were insidious in onset and slowly progressing as well as constant.
   • On day two of illness she was diagnosed as having an upper respiratory infection (URI) and was sent home with a cough syrup.
   • Two days later her symptoms have progressed to moderate exertional dyspnea, several spikes of fever around 103 to 104, and a worsening productive cough with an associated pleuritic chest pain.
   • PMHx - previously healthy, no prior asthma
• Medications - cough syrup, none prior to illness
• Immunizations - up to date
• Sick contacts - several children at school with URI sym

4. What pertinent ROS questions would you ask the patient?
• Drinking poorly with decreased UOP (dehydration common reason for admission in children)
• Growing well (makes chronic disease less likely)
• Not recent choking or near drowning events (FB or aspiration)
• No previous use of inhaler/nebulizer (family may not associate with asthma)

5. What pertinent exam findings would you look for or expect for this patient?
• Vitals show a temperature of 103.2°F, heart rate is 115 BMP, respiratory rate is 22/min, oxygen sat is 98% on room air.
• Exam show a tired appearing child with nasal congestion, dry mucous membranes, and decreased breath sounds to right lung base posteriorly.

6. What studies would you order?
• CXR shows RLL consolidation small pleural effusion.

7. Would the patient need close observation in the hospital?
The concern for dehydration and findings of a pleural effusion warrant close observation on IV antibiotics.

Admission criteria (Pedi ID society):
• Children and infants who have moderate to severe CAP, as defined by several factors, including respiratory distress and hypoxemia, severe dehydration, or concern for sepsis.
• Infants less than 3–6 months of age with suspected bacterial CAP.
• Children and infants with suspected or documented CAP caused by a pathogen with increased virulence, such as community-associated methicillin-resistant Staphylococcus aureus (Consider with pleural effusion or failed outpatient Rx)
• Children and infants for whom there is concern about careful observation at home or who are unable to comply with therapy or unable to be followed up should be hospitalized.

Diagnosis: Community-acquired pneumonia

Case 3: CC: “I can’t catch my breath”

A 75-year-old male with a history of COPD and active small cell cancer presented to his pulmonologist with a sudden onset of moderate exertional dyspnea that was worse than his baseline and associated pleuritic chest pain.

Questions:
1. What is your differential diagnosis?
   See ACE approach and table
2. What is common in this age group?
   COPD, MI, PE, Infection (Pneumonia, Bronchitis)
3. What pertinent HPI questions would you ask the patient?
• He states that he had difficulty going from the bedroom to the bathroom and describes his dyspnea as air hunger.
• Patient normally will sat at 95% with 2L home O2, but in the clinic was sating at 89% on 2L.
• He had wheezes on exam and was diagnosed by his pulmonologist with a COPD exacerbation and was treated with nebulizers, prednisone, and doxycycline with a close follow up.
• The following day his symptoms worsened and he developed dizziness with standing and worsening pleuritic chest pain.
• He had received chemotherapy with stable disease after 2 courses, his symptoms developed after 3rd dose of therapy.
• He did have an indwelling central line.
• He was compliant with medications.

4. What pertinent ROS questions would you ask the patient?
• No fever or palpitations.
• No swelling or pain to extremities.

5. What pertinent exam findings would you look for or expect for this patient?
• Vitals - Blood pressure of 100/70 mmHg, a heart rate of 90/min, oxygen saturation 90% on room air
• Lungs - decreased left respiratory sounds on auscultation.
• Neck - No swelling of his neck
• Central line site mildly tender, no swelling, or erythema.
• Extremities - No swelling to lower extremities

6. What studies would you order?
• Chest X-ray revealed left pleural effusion (malignant pleural effusion).
• Arterial blood gas analysis at room air showed pH 7.459, PaCO2 33.9 mmHg, and PaO2 69.5 mmHg.
• CBC showed white blood cells 5,600/mm3, hemoglobin, 9.6 g/dl, and platelets increased to 434,000/mm3.
• Serum D-dimer value was increased to 4.7 lg/ml.
• Chest contrast computed tomography (CT) revealed right internal jugular vein thrombosis and PE.

7. Would the patient need close observation in the hospital?
Admit for emergent anticoagulant therapy.

**Diagnosis: pulmonary embolism**

Case 4: CC: “my boy is wheezing and sounds short winded”

A 1-year-old boy who had presented with a 4 day history of rhinorrhea, a productive cough, and a fever of 101 at home. His symptoms were then followed by wheezing and shortness of breath noticed by the mother.

Questions:
1. What is your differential diagnosis?
See ACE approach and table

2. What is common in this age group?
   Viral induced airway obstructions (URI, Croup, Viral bronchiolitis)

3. What other pertinent HPI questions would you ask the patient?
   • The mother noted that his vocal utterances were shorter due to his dyspnea but that he did not appear to be that sick.
   • He is still playful at home and, although his appetite has lessened, he is still able to tolerate fluids and table foods.
   • No history of prematurity (Preemies may have chronic lung dz due to bronchopulmonary dysplasia)
   • No previous noisy breathing or wheezing
   • Up-to-date immunizations
   • He does attend daycare (infectious source)
   • Mother is a smoker.

4. What pertinent ROS questions would you ask the patient?
   • Growth and development normal (makes chronic disease less likely)
   • No recent choking or gagging spells (make FB less likely)
   • No barky cough or stridor (makes Croup/Epiglottis less likely)

5. What pertinent exam findings would you look for or expect for this patient?
   • He is alert and smiling
   • Vitals Temperature of 97.9°, heart rate of 120 bpm, respiratory rate 20, and pulse oximetry of 98% on room air.
   • Nares are congested
   • Lungs show diffuse wheeze with mild substernal retractions. No accessory muscle use.
   • Moist mucous membranes and brisk capillary refill.

6. What studies would you order?
   None. Classic viral URI progressing to Viral Bronchiolitis on day 3-5 of illness.

7. Would the patient need close observation in the hospital?
   Infant is currently a “happy wheezer”. He is previously healthy, immunized, non-toxic, and well hydrated. He has mild respiratory distress without hypoxia. Care for bronchiolitis is supportive (nasal suctioning, oxygen if hypoxic, IVF if dehydrated). Avoidance of tobacco smoke exposure is essential. If parents are comfortable and reliable he can be monitored closely as home with clear instructions about when to return.

Diagnosis: Viral Bronchiolitis

ACE Dyspnea Quiz Questions:

1) Beyond the respiratory and cardiac causes of dyspnea what other organ system/category is commonly associated with dyspnea?
   a. Gastrointestinal
   b. Renal
c. Genitourinary 
d. Head and Neck 
e. Integument 

2) Which of the following entities would be considered a life threatening cause of dyspnea?  
   a. Sinusitis 
   b. Tension pneumothorax 
   c. Kyphoscoliosis 
   d. Deconditioning 
   e. Anxiety 

3) All of the following are common causes of dyspnea EXCEPT?  
   a. COPD 
   b. Congenital laryngomalacia 
   c. Congestive heart failure 
   d. Obesity 
   e. Asthma 

4) An otherwise healthy toddler experiences acute onset of dyspnea with gagging and drooling, while playing on the floor. His exam shows localized right-sided wheezing. What is his most likely diagnosis?  
   a. Pneumonia 
   b. Asthma exacerbation 
   c. Congestive heart failure 
   d. Foreign body aspiration 
   e. Pulmonary embolism 

5) The following are acute causes of dyspnea except which of the following?  
   a. Pneumonia 
   b. Asthma exacerbation 
   c. Congestive heart failure 
   d. Foreign body aspiration 
   e. Obesity or deconditioning 

6) True or False. In children the most common causes of dyspnea are asthma, respiratory infections, and upper airway obstructions.  
   a. True 
   b. False 

7) Which of the following is an important sign of the unstable patient presenting with dyspnea?
a. Altered mental status
b. Hypotension
c. Use of accessory muscles of respirations
d. Cyanosis
e. All of the above

8) Exertional dyspnea with lower extremity swelling, JVD, bilateral rales, and elevated serum BNP best describes:
   a. Pneumothorax
   b. Congestive heart failure
   c. Pneumonia
   d. COPD exacerbation
   e. Bronchitis

9) A 38-year-old man presents to the emergency department with shortness of breath for 1 hour. He states that while hiking in a nearby park, he got stung by a bee. He states that he feels that his lips and tongue are starting to swell up. Which of the following would be the most appropriate immediate step in this patient?
   a. Obtain a chest x-ray
   b. Assess the patient’s airway, breathing and circulation
   c. Perform spirometry
   d. Obtain an electrocardiogram (ECG)
   e. Obtain a CT angiogram
   f. Perform a thorough and complete history and physical

10) A 61-year-old business man develops chest pain and dyspnea after a flight from China to Los Angeles. He is a heavy smoker. On physical exam he is tachycardic and tachypneic. CXR is normal. ECG shows sinus tachycardia. Troponin is normal. Which of the following test/s would confirm your suspected diagnosis?
   a. Serum BNP or N-terminal pro-BNP
   b. Spirometry
   c. CT pulmonary angiogram
   d. CBC and CMP
   e. Lung biopsy

Answers:
1. D (Objective 1,2)
2. B (Objective 5)
3. B (Objective 4)
4. D (Objective 3,8)
5. E (Objective 7)
6. A (Objective 10)
ACE Dyspnea Learning Objectives:

1. Develop a clinical approach to the chief complaint of dyspnea.
2. Name the organ systems commonly associated with dyspnea.
3. Develop a differential diagnosis for dyspnea based on history, physical exam findings, and diagnostic tests.
4. List common causes of dyspnea.
5. List major life threatening causes of dyspnea.
6. Identify important signs of the unstable patient presenting with dyspnea.
7. Identify acute and chronic causes of dyspnea.
8. Differentiate between different causes of dyspnea (e.g. congestive heart failure, pulmonary embolism, pneumonia, foreign body aspiration, anxiety etc.) given key clinical features.
9. Identify appropriate diagnostic testing to further evaluate dyspnea.
10. Identify most likely causes of dyspnea in a younger versus an older patient.
11. Identify the need to assess a patient's airway, breathing, and circulation (ABCs) in the setting of dyspnea.