EMS Subspecialty Certification Review Course

Respiratory
1.3.1 Respiratory
1.3.1.1 Shortness of breath
1.3.1.2 Use of portable non-invasive ventilation devices
1.3.1.2.1 Field identification of COPD
1.3.1.2.2 Assisted Ventilation
1.3.1.4 Use of Capnography and Capnometry Waveforms in Diagnosis
1.3.1.2 Pneumothorax
1.3.1.2.1 Identifying Pneumothorax without ancillary testing
1.3.1.2.2 Management of Pneumothorax with occlusive dressing and alternative devices

Prepared by: Frank Guyette, MD, MPH
Version Date: 2/11/13

EMS Subspecialty Certification Review Course

1.3.2.2 Acute exacerbation of CHF
1.3.2.2.2 Field identification of CHF

Prepared by: Paul R. Hinchey, MD, MBA
Version Date: 2.10.13

EMS Subspecialty Certification Review Course

Use of oxygen
1.3.2.1.2 Use of oxygen

Prepared by: Paul R. Hinchey, MD, MBA, FACEP
Version Date: 2.10.13
EMS Subspecialty Certification Review Course

• 1.3.2.2.1 Use of portable non-invasive ventilation devices

Prepared by: Paul R. Hinchey, MD
Version Date: 2.10.13
Respiratory

Conflict of Interest Disclosure

Authors Conflicts of Interest;
A. Guyette, No Conflict of Interest

A conflict of interest is a particular financial or non-financial circumstance that might compromise, or appear to compromise, professional judgment. Anything that fits this should be included. Examples are owning stock in a company whose product is being evaluated, being a consultant or employee of a company whose product is being evaluated, etc. Taken in part from “On Being a Scientist: Responsible Conduct in Research.” National Academies Press, 1995.

Learning Objectives

Upon the completion of this program participants will be able to:
• Identify common causes of Shortness of Breath and general principles of management
• Discuss the prehospital identification and treatment of COPD and Asthma
• Describe the recognition and management of Pneumothorax

Respiratory
Learning Objectives

Upon the completion of this program participants will be able to:

• Describe the pathophysiology of CHF
• Describe the history and physical in suspected CHF
• Identify the challenges of this diagnosis by EMS
• Describe the treatment of CHF including:
  – Role of nitrates
  – Alternative therapies

Introduction: Shortness of Breath (SOB)

• 2nd Most common complaint
• 13% of EMS call volume
• Evidence based benefit of ALS care
• Treatment of SOB must balance disease severity, diagnostic uncertainty, likelihood of harm
• Differentiating COPD from CHF in the field is very difficult

Learning Objectives

Upon the completion of this program participants will be able to:

• Describe indications for supplemental oxygen
• Identify oxygen delivery devices and their associated oxygen delivery
Indications for Supplemental Oxygen

- Ventilation/perfusion mismatch or shunting
- Decreased oxygen carrying capacity
- Tissue hypoxia
- Diffusion problems

Use of Supplemental Oxygen

- Historical EMS use of O2 on anyone with potential for hypoxia
- Greater emphasis on titration based on clinical need
  - Titration with pulse oximetry
- COPD is no longer absolute contraindication to O2 administration

Pathophysiology

- **Upper Airway Obstruction** - Foreign Body, Anaphylaxis, or Angioedema
- **Small Airways Obstruction** - COPD, Asthma
- **Cardiogenic** - Pulmonary Edema
- **Infectious conditions** - Pneumonia, Abscess
- **Mechanical** - pneumothorax, mucous plug
Respiratory Assessment:

**History**

- **Upper Airway Obstruction**: Sore throat, neck stiffness, fever, exposure to insect stings, medications, or other allergens
- **Small Airways Obstruction**: History of COPD or Asthma. Exposure to allergens, smoking.
- **Cardiogenic**: HTN, MI, Diuretic use, Weight gain
- **Infectious conditions**: Fever, productive cough, aspiration

Respiratory Assessment:

**Physical Exam**

- Evaluate VS, Mental Status, Oxygenation and Ventilation
- **Upper Airway Obstruction**: Stridor
- **Small Airways Obstruction**: Diminished Breath Sounds, Wheezing, Prolonged expiration
- **Cardiogenic**: Bilateral crackles, wheezing
- **Infectious conditions**: Unilateral decrease, focal crackles or wheezing

Other disease presenting as SOB

- MI: Chest pain obtain and ECG
- Dysrhythmia- palpitations monitor
- Sepsis-Presence of fever, elevated lactate
- Pulmonary Embolism- pleuritic chest pain, tachycardia
- Toxic Exposure- ASA, CO, CN
- Metabolic acidosis- DKA, AKA
Obstructive Pulmonary Diseases

Treatment of SOB in Asthma/COPD
- Monitor VS
- Obtain IV Access
- Place on O₂ to maintain SpO₂ (92-94%)
- Bronchodilators
- Adjunctive Medications
- Non Invasive Positive Pressure Ventilation
- Endotracheal Intubation

Treatment of Asthma
- Oxygen
- Beta agonists- mainstay of therapy
- Corticosteroids- may decrease admissions
- Epinephrine (when inhaled Beta agonists are not effective)
- Heliox- improves laminar flow to the distal airways
- NIPPV
- Ketamine- induction agent that bronchodilates
Chronic Obstructive Pulmonary Disease

- Chronic lung disease precipitated by an inflammatory response to noxious particles
- Results in destruction of alveoli and is only partially reversible
- Presents with:
  - Cough
  - Increased mucous production
  - Dyspnea
  - Wheezing

Treatment of COPD

- O₂ to maintain SpO₂ (92-94%)
- Administration of Beta agonists and Anticholinergics
- Corticosteroids
- Antibiotics reduce mortality
- NIPPV- may prevent intubation
- Intubation only as a last resort

Bronchodilators

- Beta Agonists- rapid onset of smooth muscle relaxation in bronchioles
- Some absorption into systemic circulation
  - Rarely precipitate MI
  - May drive potassium intracellular = hypokalemia
- May result in hypoxemia due to shunting and V/Q mismatch
Adjunctive Medications

- Anticholinergics - smooth muscle relaxation, synergistic with Beta agonists, no systemic absorption
- Magnesium - smooth muscle relaxation, may be beneficial in severe bronchospasm
- Steroids - reduces inflammation in the airways, peak effect may take hours

Use of Non Invasive Devices for Ventilation

- Continuous Positive Airway Pressure (CPAP)
  - Reduces the work of breathing
  - Improves oxygenation through the recruitment of alveoli
  - Displaces fluid in the airway
- Bilevel Positive Airway Pressure (BiPAP) - further reduces the work of breathing
- Beneficial in both COPD and CHF
- Contraindicated in patients with immediate need for intubation

Use of NIPPV

- Improves cardiopulmonary mechanics:
  - Redistributes extravascular pulmonary fluid
  - Increases FRC and recruitment
  - Improves oxygenation
  - Decreased work of breathing
  - Increases intrathoracic pressure
  - Reduces venous return
Indications for NIPPV

- Traditional use in CHF in conjunction with traditional therapies
- Reported success in:
  - Pneumonia
  - Asthma/COPD
- Requires patient cooperation and:
  - Intact resp drive and airway reflexes
  - Intact mental status

Asthma

- Chronic inflammatory lung disorder characterized by airway hyper reactivity and reversible obstruction
- May be precipitated by allergens and pollution
- Presents with:
  - Dyspnea
  - Cough
  - Wheezing
  - Chest Tightness

CHF Pathophysiology

- Volume overload
  - Due to neurohumoral activation
  - Increased afterload
  - Acute volume overload
  - Hypertensive state
- Inadequate cardiac output
  - Hypotensive state
  - Discussed in shock
- Capillary Leak
History and Physical

- Difficult to diagnose in prehospital setting
- Poor sensitivity/specificity to each finding
- Must use combination of history and exam
- Cumulative picture to create suspicion
- ETCO2 waveform analysis may be beneficial
  – Distinguishes from obstructive process

Findings

<table>
<thead>
<tr>
<th>History</th>
<th>Physical</th>
</tr>
</thead>
<tbody>
<tr>
<td>HPI</td>
<td>Crackles</td>
</tr>
<tr>
<td>Cough (character/volume)</td>
<td>Peripheral edema</td>
</tr>
<tr>
<td>Orthopnea/PND</td>
<td>JVD*</td>
</tr>
<tr>
<td>DOE</td>
<td>Hepatojugular reflux</td>
</tr>
<tr>
<td>Prior history of same</td>
<td>S3 /S4</td>
</tr>
<tr>
<td></td>
<td>– Specific</td>
</tr>
<tr>
<td></td>
<td>– Difficult to assess</td>
</tr>
</tbody>
</table>

CHF Primary Management

- Supplemental oxygen
- Essential Preload/Afterload reduction
  – Aggressive use of SL nitrates
  – IV NOT required prior to administration
  – Used as tolerated by BP
  – Remember ED drugs
- Positioning
Primary Management

- Non-invasive Positive Pressure Ventilation
  - Reduces preload
  - Increases alveolar recruitment
  - Redistributes pulmonary fluid
- Reduced need for ETI and ICU admission
- Low cost and increasingly common
- Must be tolerated by patient

Supplemental Management

- ACE Inhibitors
  - Proven ED therapy but little in EMS
  - May be used as SL or IV
- Diuretics
  - 20 mg or match daily PO dose with IV
  - Falling out of favor in EMS environment
- Morphine
  - No longer recommended

Pneumothorax
Pneumothorax

- Air present between the lung and the pleural cavity
- Spontaneous Pneumothorax - leakage of air from the lung into the pleural space. Usually in tall slim men
- Open Pneumothorax - Wound between the skin and the pleural space allowing air to communicate
- Tension Pneumothorax - Air in the pleural space under positive pressure forcing collapse of the lung and compression of the thoracic structures

Field Identification of Pneumothorax

- **Simple Pneumothorax** - acute onset of dyspnea or decreased exercise tolerance.
- **Open Pneumothorax** - Thoracic wound, dyspnea, decreased breath sounds, subcutaneous emphysema
- **Tension Pneumothorax** - Tracheal deviation, Dyspnea, Absent unilateral breath sounds, Jugular venous distension, tachycardia, and tachypnea

Management of Pneumothorax

- **Spontaneous Pneumothorax** - w/o tension physiology - Oxygen and monitoring
- **Open Pneumothorax** - 3 sided occlusive dressing to allow escape of gas from the pleural space
- **Tension Pneumothorax** - Needle decompression. A Heimlich valve should be placed on the catheter to allow gas to escape.
Management of PTX with Occlusive Dressings or other devices

- **Occlusive Dressing**: can be fashioned from plastic placed over an open PTX and taped on three sides to allow gas to escape.
- **Needle Decompression**: A large bore (12-16g) catheter should be inserted in the second intercostal space midclavicular line.
- **Heimlich Valve**: devices are plastic tubes with rubber sleeves that connect to the catheter and allow escape of gas. An improvised device can be constructed with a glove finger.

Capnography

Use of Capnometry for Diagnosis

- Abrupt loss of Capnometric waveform indicates dislodgement of the endotracheal tube or cardiovascular collapse
- Shark fin appearance of capnographic waveform denotes impaired exhalation and is associated with obstructive or bronchospastic (COPD and Asthma) disease
Take-Home Points

• Brief review of indications/methods of oxygen delivery
  • Clinical aspects of EMS medicine (40%)
• Oxygen therapy should be used based on clinical presentation and titrated as needed
• Be familiar with delivery devices and estimated range of oxygen delivery

Take-Home Points

• Clinical Aspects of EMS = 40% of tests items
• Take home points:
  • Changes in NIPPV delivery devices have made them more affordable and more common
  • NIPPV augment cardiopulmonary function and improve oxygenation
  • Use is no longer limited to CHF
  • Proper patient selection is required

Take-Home Points

• Treat all SOB with oxygen to maintain normoxia
• Bronchodilators are generally safe for patients with SOB.
• NIPPV will prevent intubation in many patients presenting with severe SOB
• Needle decompression of tension pneumothorax is live saving but may not be necessary in simple pneumothorax.