Non-Cardiac Chest

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The In-training Exam is a comprehensive examination covering the breadth of Emergency Medicine. The exam contains 225 multiple choice questions and takes about 4.5 hours to complete.

Acuity Frames: Target (15%)
- Critical: 35%
- Urgent: 40%
- Non-urgent: 25%
- Non-erviceable: 0%

Physician Tasks
For the examination, the board has assigned the following specific percentage weight to the identifying factor of age:
- Pediatric: 5% minimum
- Geriatric: 5% maximum

1 2 3 4 5 6
A 82 year old female awoke with lip swelling 1 hour ago. On arrival to the ED, she is awake, alert, able to speak and complains of a slight pressure in her throat.

BP: 220/110, HR 55, RR 22, T 36 C and SPO2 is 98% on room air.

On physical examination, the patient is sitting upright, slightly anxious, with lip swelling, neck edema, and tongue slightly protruding.

Which part of the body can be affected by angioedema?

A. Lips
B. Extremities
C. Genitalia
D. Tongue
E. All of the Above

Angioedema Clinical Presentation

The lips, face, tongue, neck, extremities and/or genitalia can all be affected by angioedema.
True or False: Angioedema is always an IgE mediated allergic reaction to a stimulus

Angioedema Pathophysiology

Angioedema is not always an IgE mediated allergic reaction to a stimulus

This patient's presentation is consistent with which of these conditions?
A. Hereditary Angioedema (HAE)
B. Acquired C1 Esterase Deficiency (ACID)
C. Allergic Reaction
D. ACE Inhibitor-associated angioedema
E. All of the above

Angioedema Clinical Presentation

The etiologies of angioedema (a symptom), include:
✓ Hereditary Angioedema (HAE)
✓ Acquired C1 Esterase Deficiency (ACID)
✓ Allergic Reaction
✓ ACE Inhibitor-associated angioedema

Additional patient history and physical examination will help narrow the differential dx
Which of the following findings is not consistent with the presentation of Hereditary Angioedema (HAE)?

A. Abdominal pain
B. Nausea, vomiting and diarrhea
C. Family history of HAE
D. Urticaria

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The presence of itching and urticaria would suggest which diagnosis?

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B. Acquired C1 Esterase Deficiency (ACID)
C. Allergic Reaction
D. ACE Inhibitor-associated angioedema
E. All of the above

Angioedema Clinical Presentation

Patients with Hereditary Angioedema (HAE) present with angioedema and often a family history (but 25% are de novo mutations). Some typical findings of an IgE mediated response (especially urticaria) are typically absent.

The presence of itching and urticaria suggest an allergic reaction.

The presence of itching and urticaria would suggest which diagnosis?

A. Hereditary Angioedema (HAE)
B. Acquired C1 Esterase Deficiency (ACID)
C. Allergic Reaction
D. ACE Inhibitor-associated angioedema
E. All of the above
The patient provides additional history. She has hypertension, diabetes mellitus, 3 prior coronary stents and no personal or family history of angioedema. Medications include glucophage, ramipril and a multivitamin.

Which of the following is the most appropriate next step in management?

A. Administer Epi 1:1000 0.3mg IM
B. Administer Epi 1:1000 0.5mg IM
C. Order 2 units of fresh frozen plasma
D. Perform immediate cricothyroidotomy

Angioedema Management

Fresh frozen plasma may be helpful in ACE Inhibitor associated angioedema.

Epinephrine may precipitate an acute coronary syndrome in this elderly, severely hypertensive patient with known coronary artery disease.

Given the additional history, which medication is least likely to be effective in relieving this patient’s symptoms?

A. 2 units of fresh frozen plasma
B. Diphenhydramine 50mg IV
C. Famotidine 20mg IV
D. C1 esterase inhibitor [human]
The patient just remembers that she actually ran out of her ramipril two years ago. Her husband tells you that her cousin Joyce and daughter Cynthia had the "same thing happen to them last year." Appropriate laboratory tests might include

A. CBC
B. C2, C4, C1q, C1-inhibitor
C. Troponin
D. Liver transaminases

Angioedema Management

Given the absence of an ACE inhibitor, ACEI associated angioedema is impossible.

Her family history suggests Hereditary Angioedema. C4 and C1 esterase inhibitors are useful in this diagnosis. In the US, the C1 esterase inhibitor function is insensitive (C4 will be low at baseline and during an attack).

1 week later, one of your attending physicians is reviewing lab results that returned after patient discharge. She notices that one of your patients had a C1 inhibitor and C4 that were "low" and wants to know what to do with this result. You tell her:

A. This rules out Hereditary Angioedema in your patient from last week. Please notify the patient.
B. This is suggestive of Hereditary Angioedema in your patient from last week. Please notify the patient.
C. I don’t really know why I drew that test. Just check physician aware.

References:


Asthma:

1.8 million ED visits (2011)
3,630 deaths (2013)
219 deaths of children (2013)

A 15 year old female with history of asthma developed shortness of breath 1 hour ago. On arrival to the ED, she is awake, alert, and appears mildly anxious.

BP: 140/80, HR 110, RR 34, T 36 C and SPO2 is 89% on room air.

On physical examination, the patient is sitting upright, slightly anxious, with tachypnea. Lung sounds are diminished with faint wheezing.

Appropriate initial stabilization includes all of the following except:

A. Nebulized albuterol solution 1.25 mg every 20-30 minute x 3 doses
B. Nebulized ipratropium 0.5mg every 20-30 minutes x 3 doses, mixed with albuterol solution
C. Oxygen therapy
D. Prednisone 40-60mg
E. Theophylline 5mg/kg PO

While all of the below conditions limit airflow in asthma, _______ may decrease the response to therapy by causing permanent structural changes.

A. Bronchial constriction
B. Bronchial edema
C. Mucous plugging
D. Airway remodeling
E. All of the above
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- B. Bronchial edema
- C. Mucous plugging
- D. Airway remodeling
- E. All of the above

Asthma Pathophysiology

Early Response
- Bronchospasm
- Edema
- Airflow Obstruction

Late Response
- Airway inflammation
- Airflow obstruction
- Airway Hyper response

Asthma is a chronic inflammatory condition associated with bronchial hyper responsiveness and some reversibility.

True or False:
- IV steroids are more effective than PO steroids

Asthma Management

✓ IV steroids are not more effective than PO steroids ... unless the patient cannot tolerate oral intake
✓ Give steroids promptly in severe attacks
✓ Effects begin within hours (peak at 24 hours)
True or False:
The absence of wheezing is reassuring

Asthma Clinical Presentation

Wheezing does not correlate with disease severity and may be absent in a patient in extremis

You have actively managed the patient for 1 hour. Her breath sounds are more diminished and pulse oximetry is 90%. Your primary nurse is asking if you want any "tests" ordered. You then order:

A. No additional testing at this time
B. Chest x-ray
C. Arterial blood gas
D. EKG
E. Peak Expiratory Flow Rate
F. B and E
G. C and D

Asthma Management

✓ When possible, PEFR or FEV1 should be measured in acute exacerbations. % Patient's personal best is most helpful
✓ ABGs are rarely clinically useful in this setting
✓ Patients who do not respond to usual therapy have 15% incidence of radiographically identifiable pulmonary complications (pneumothorax, pneumomediastinum)
✓ ECG is not routinely indicated unless the patient is older or cardiovascular disease suspected

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A. No additional testing at this time
B. Chest x-ray
C. Arterial blood gas
D. EKG
E. Peak Expiratory Flow Rate
F. B and E
G. C and D

You have actively managed the patient for 1 hour. Her PEFR remains <40% predicted. She can still converse and is sipping on Rockstar. You should:

A. Order magnesium sulfate 2 gram IVPB over 20 minutes
B. Prepare to intubate
C. Administer montelukast 10mg PO
D. Order salmeterol 1 puff inhaled
E. Administer Epi 1:000 0.3mg subcutaneous
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Asthma Management

You should order magnesium sulfate 2 gram IVPB over 20 minutes to relax bronchial smooth muscle and dilate the airways.

✓ Subcutaneous adrenergics (epinephrine and terbutaline) do not have an advantage over aerosol but may be considered.
✓ There is no role for salmeterol or leukotriene inhibitors in the acute setting.

Your attending physician asks which of the following is not a risk factor for death from asthma?

A. Cocaine use
B. Severe psychiatric disease
C. Two or more hospitalizations for asthma in the past 1 year
D. Use of >2 MDI short-acting β2 agonist canisters per month
E. Younger age at time of diagnosis

Asthma Clinical Presentation

Risk factors for death from asthma:

- Prior severe exacerbation
- >2 MDI albuterol canisters per month
- Inner-city residence
- Cardiovascular disease
- 2+ hospitalizations in year
- Difficulty determining asthma severity
- Severe psychosocial problems
- Chronic lung disease
- 3+ ED visits in year
- Low socioeconomic status
- Cocaine and/or heroin use
- Psychiatric disease

The patient made minimal improvement with magnesium sulfate. Additional measures might include:

A. Administer ketamine
B. Place patient on CPAP or BIPAP
C. Request heliox
D. Administer high flow oxygen
E. All of the above
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D. Administer high-flow oxygen
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**Asthma Management**

- Ketamine has bronchodilator effects (watch for increased secretions and emergency reactions)
- CPAP or BIPAP may improve oxygenation and reduce fatigue
- Heliox reduces airway resistance

The patient's urine pregnancy test is positive. Her mother wants to know if any of the medications you gave her is going to seriously harm the baby. You tell her:

A. No, all of the medications were Category C or lower and the risks of uncontrolled asthma to both mother and fetus are high
B. Oops. I wish I hadn't given the steroids!

On your way to see another patient, you walk by the patient with asthma's room. The patient is lying back in the bed and her mother reports that she seems very sweaty. You have difficulty arousing the patient. Next step in management should include:

A. Reassurance to the parent and initiate plans for discharge home
B. Order an ABG
C. Prepare for intubation
D. Request one more nebulized albuterol treatment
E. Call the patient's pediatrician to arrange for 24-hour observation

Asthma Management

- Acute asthma should be aggressively treated to avoid hypoxia (maternal and fetal)
- Maternal and fetal risk of uncontrolled asthma = high
- If systemic corticosteroids used, continuous fetal monitoring is recommended at delivery
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E. Call the patient’s pediatrician to arrange for 24 hour observation

Beware the now “calm” and “relaxed” patient with a severe asthma exacerbation

Beware the normal ABG in a severe asthma exacerbation

Asthma Management

Coma and apnea are absolute indications for intubation in asthma

Exhaustion, hypoxemia, altered mental status are indications for intubation

You are preparing to intubate. Which of the following agents will not only provide sedation but also bronchodilation?

A. Ketamine
B. Etomidate
C. Propofol
D. Versed
Asthma Management

Ketamine is the preferred RSI induction agent for asthma and may be used with muscle paralysis (rocuronium 1mg/kg or succinylcholine 1.5mg/kg).

You have successfully intubated the patient. Which is important in ventilator management for this patient?

A. Provide adequate oxygenation
B. Use a low tidal volume 6-8ml/kg
C. Use a low ventilation rate (<10 breaths/min)
D. Use high inspiratory flow rates
E. All of the above

Asthma Management

Adequate oxygenation and ventilation should be provided while minimizing elevated airway pressures, barotrauma and hypotension.

✓ low tidal volume 6-8ml/kg
✓ low ventilation rate (<10 breaths/min)
✓ high inspiratory flow rates

Permissive Hypercapnia

You had just started charting and are called to the patient’s room for cardiac arrest. You note PEA on the cardiac monitor. Next steps in management include all of the following except:

A. Disconnect patient from vent
B. Compress chest
C. Place bilateral tube thoracostomies
D. Give a fluid bolus
E. Administer terbutaline

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B. Compress chest
C. Place bilateral tube thoracostomies
D. Give a fluid bolus
E. Administer terbutaline
Asthma Management

Squeezing of the lateral chest may relieve breath stacking. In the setting of abruptly high airway pressures followed by cardiac arrest, the patient may have tension pneumothorax requiring tube thoracostomy.

The patient’s sister also has asthma and thinks you’re an amazing doctor so asks you how to use her Metered-Dose inhaler properly. You tell her:

- Remove the cap from the MDI container
- Assemble the MDI and hold upright
- Shake the canister
- Place the mouthpiece loosely between the teeth
- Exhale fully
- Activate the inhaler at the beginning of a slow inhalation lasting 5-6 seconds
- Hold breath 10 seconds
- Wait 1 minute before reuse

References:
http://www.cdc.gov/asthma/most_recent_data.htm, Accessed on: 12/19/15

COPD/Emphysema

A 60 year old male presents with shortness of breath, cough productive of brown phlegm for the past 7 days. He complains of an increase in sputum production. He has smoked 1 pack of cigarettes daily for 20 years.

BP: 180/90, HR 110, RR 34, T 37 C and SPO2 is 86% on room air.

On examination, he is thin and anxious. You note pursed lip breathing and use of accessory muscles.

Does this patient meet criteria for an acute COPD exacerbation? Y/N
COPD Management

Characteristics of a COPD exacerbation:
- change in the patient’s baseline dyspnea, cough, or sputum
- beyond day to day variations
- abrupt in onset
- may require change in medications

Does this patient meet criteria for an acute COPD exacerbation? Y/N

COPD Pathophysiology

Cigarette smoking is the most significant risk factor for the development of COPD. However, only a minority of smokers develop COPD.

- airway obstruction + obliteration of pulmonary vasculature
- poor gas exchange

What is the most significant risk factor for the development of COPD?

COPD Pathophysiology

Cigarette smoking is the most significant risk factor for the development of COPD. However, only a minority of smokers develop COPD.

While the terms “blue bloater” and “pink puffer” are outdated, these phenotypes can be useful to describe the predominant pathophysiology.

What is the most significant risk factor for the development of COPD?

Which typical COPD phenotype does this patient fit?

A. “Blue Bloater”
B. “Pink Puffer”
Which of the statements regarding pulse oximetry in COPD is most accurate?

A. The change in pulse oximetry from patient's baseline is more important than absolute levels
B. Any pulse oximetry reading less than 88% requires admission
C. Patients with COPD should not be discharged unless pulse oximetry is greater than 94%

COPD Management

The change in pulse oximetry from patient's baseline is more important than absolute levels.

Indications for admission for COPD are:
✓ significant worsening from baseline
✓ inadequate response to ED therapies
✓ significant comorbidities
✓ worsening hypoxia or hypercarbia from baseline
✓ insufficient home resources

Initial ED management for this patient should include:
A. Nebulized albuterol solution 1.25 mg every 20-30 minute x 3 doses
B. Nebulized ipratropium 0.5mg every 20-30 minutes x 3 doses, mixed with albuterol solution
C. Solumedrol 125mg IV or Prednisone 60mg PO
D. Consideration for antibiotic therapy due to increase in sputum
E. All of the above

Beta agonists and anticholinergics are first line therapy for COPD exacerbation

Corticosteroids lead to a decrease in relapse and dyspnea

Antibiotics are recommended for:
✓ increase in sputum purulence and increased dyspnea or sputum volume
✓ for any COPD patient requiring ventilation (including non-invasive)
Routine Initial ED testing for this patient should include:
A. Arterial Blood Gas
B. CBC
C. Chest radiograph
D. Peak Expiratory Flow Measurement
E. Sputum for gram stain

COPD Management

Initial ED testing for this patient should include:
✓ chest radiograph to rule out pneumothorax and coexisting cardiac pathology
✓ sputum cultures have limited value unless you expect a superinfection
✓ ABGs are of limited value, especially if you do not know the patient's baseline

The patient would like to know why his symptoms worsen. You educate him that possible causes of an acute COPD exacerbation include his ongoing smoking and:
A. Infection (Viral or Bacterial)
B. Pneumothorax
C. Pulmonary Embolism
D. CHF
E. All of the above

Despite oxygen therapy, beta agonists, corticosteroids, the patient has ongoing dyspnea with increased work of breathing. He is able to speak in short phrases and is not diaphoretic. The next most appropriate step in management includes:
A. Non-invasive ventilation
B. Non-rebreather at 15 LPM
C. Venti Mask at 50% FIO2
D. Order an ABG
E. Prepare for immediate rapid sequence intubation
Despite oxygen therapy, beta agonists, corticosteroids, the patient has ongoing dyspnea with increased work of breathing. He is alert, able to speak in short phrases and is not diaphoretic. The next most appropriate step in management includes:

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C. Ventil Mask at 50% FiO2
D. Order an ABG
E. Prepare for immediate rapid sequence intubation

**COPD Management**

Non-invasive ventilation can be very effective in avoiding intubation, increasing pH and lowering PCO2.

**Contraindications for non-invasive ventilation include:**
- Respiratory arrest
- Cardiovascular instability
- Uncooperative patient
- Upper airway obstruction
- High risk for aspiration
- Recent facial or gastrointestinal surgery
- Facial trauma
- Non fitting mask

**COPD Pathophysiology**

Additional possible etiologies of a COPD exacerbation include:
- Atelectasis
- Pneumonia
- Pulmonary compression (obesity, ascites, pleural effusion, gastric distension)
- Trauma
- Neuromuscular disorders
- Other chronic pulmonary diseases
- Noncompliance

**COPD Clinical Presentation**

You have access to the patient’s most recent PFT in the electronic health record. You notice that the patient’s FEV1/FVC 60% predicted and the FEV1 was 25% predicted. You inform the patient that he has/is:

A. At risk for COPD
B. Mild COPD
C. Moderate COPD
D. Severe COPD
The patient wants to know what he can do to avoid meeting you again. The 2 interventions that alter the progression of COPD and reduce mortality are: smoking cessation and oxygen therapy.

References
A 59 year old female presents with cough and congestion. She was seen earlier at the local health clinic, complained of chest discomfort and was sent to your ED for evaluation. History includes a “mental disorder.” She takes no current medications. She has no recent travel or surgery.

BP: 140/30, HR 90, RR 20, T 36 C and SPO2 is 96% on room air.

On examination, she is thin and anxious, wearing a sparkly pink tiara. Lung sounds are clear and there is no peripheral edema or calf tenderness.

True or False: Applying the PERC Rule to this patient, pulmonary embolism can be ruled out.

PE Clinical Presentation
✓ The PERC Rule risk stratifies (<2%) but does not “rule out” PE
✓ Clinician must have a low suspicion for PE and the patient must fulfill all of the 8 criteria
  1) Age <50
  2) Pulse ox > 94% on room air
  3) HR <100 bpm
  4) No prior venous thromboembolism
  5) No recent major surgery or trauma
  6) No hemoptysis
  7) No estrogen use
  8) No unilateral leg swelling

The overall 30 day mortality rate for ED patients with PE is:
A. 5%
B. 10%
C. 15%
D. 20%
E. 25%
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A. 5%
B. 10%
C. 15%
D. 20%
E. 25%

The overall 30 day mortality rate for ED patients with PE is approximately 10%.

The most common symptom of PE is:
A. dyspnea
B. chest pain
C. palpitations

PE Clinical Presentation

The most common symptom of PE is:

A. dyspnea
B. chest pain
C. palpitations

~90% of patients with PE have some sensation of dyspnea
~70% of patients with PE have chest pain
~50% of patients with PE have tachycardia

Initial ED testing for this patient should include:
A. EKG
B. Chest radiograph
C. D-dimer
D. CT Angiogram of the chest
E. A, B and C
F. A, B and D
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PE Management

EKG findings associated with PE include:
✓ S1 Q3 T3
✓ Tachycardia
✓ RBBB pattern
✓ Inverted T waves in V1-V4
✓ P pulmonale

Chest radiograph findings associated with PE include:
✓ Hampton's Hump and Westermark Sign

PE Clinical Presentation

EKG findings associated with PE include:
✓ S1 Q3 T3
✓ Tachycardia
✓ RBBB pattern
✓ Inverted T waves in V1-V4
✓ P pulmonale

Chest radiograph findings associated with PE include:
✓ Hampton's Hump and Westermark Sign

PE Clinical Presentation

Well's PE Criteria

<table>
<thead>
<tr>
<th>Clinical Factor</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical DVT</td>
<td>3</td>
</tr>
<tr>
<td>PE as likely or more likely</td>
<td>3</td>
</tr>
<tr>
<td>Immobilization &gt; 7 days or surgery in past 4 wk</td>
<td>1.5</td>
</tr>
<tr>
<td>Previous DVT or PE</td>
<td>1.5</td>
</tr>
<tr>
<td>Heart rate &gt; 100 bpm</td>
<td>1</td>
</tr>
<tr>
<td>Active malignancy</td>
<td>1</td>
</tr>
<tr>
<td>Hemoptysis</td>
<td>1</td>
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</tbody>
</table>

< 2 = low risk / 2-6 = moderate risk / > 6 = high risk

The patient's d-dimer is 521 ng/ml. Creatinine is 1. Based on the prior algorithm, you decide to order:
A. CT Angiogram of the chest
B. No additional testing required
C. V/Q Scan
The patient's d-dimer is 521 ng/ml. Creatinine is 1. Based on the prior algorithm, you decide to order:

A. CT Angiogram of the chest  
B. No additional testing required  
C. V/Q Scan

PE Management

In the non-pregnant patient with normal renal function, CT angiogram is currently the test of choice for PE.

The CTA of the chest reveals extensive bilateral PE. Next step in management includes:

A. Heparin 20 u/kg IV bolus then 12 u/kg/hr infusion  
B. Heparin 40 u/kg IV bolus then 20 u/kg/hr infusion  
C. Heparin 60 u/kg IV bolus then 30 u/kg/hr infusion  
D. Heparin 80 u/kg IV bolus then 18 u/kg/hr infusion

PE Management

Heparin dosing for pulmonary embolism is:
Load 80 units/kg IV, then initiate infusion at 18 units/kg/hr

Enoxaparin dosing for pulmonary embolism is:
1mg/kg subcutaneous every 12 hours

The CTA of the chest reveals extensive bilateral PE. Next step in management includes:

A. Heparin 20 u/kg IV bolus then 12 u/kg/hr infusion  
B. Heparin 40 u/kg IV bolus then 20 u/kg/hr infusion  
C. Heparin 60 u/kg IV bolus then 30 u/kg/hr infusion  
D. Heparin 80 u/kg IV bolus then 18 u/kg/hr infusion

PE Management

The patient's blood pressure decreases to 70/50. Additional immediate management should include:

A. Alteplase 100mg IV over 2 hours  
B. Discontinue heparin therapy  
C. Cautious IV fluid resuscitation  
D. All of the above  
E. A and C
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PE Management

References


... and that does it for

Non-Cardiac Chest

best of luck on the exam!