Pre-Hospital Treatment of Asthma

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Dispatch

- You, are part of a paramedic / EMT ALS unit. You are dispatched to a reported “difficulty breathing.”

Initial Impression

- You arrive on scene.
- It is a residential address.
- Scene appears to be safe.
- You knock on the front door and hear “come in” from inside the house.

Initial Impression

- 38-year-old (y/o) male presents
  - Conscious and alert
  - Anxious
  - Pale, diaphoretic skin
  - Obvious difficulty breathing

Discussion

- *What is your initial impression of the patient's status?*

- *What are your next, most immediate actions?*

Initial Assessment

- You perform an initial assessment.
- Your partner prepares a non-rebreather mask.

Initial Assessment

- You note
  - Airway open
  - Lung sounds with inspiratory and expiratory wheezes all fields

Initial Assessment

- You also note
  - Respiration, 30 and shallow
  - Prolonged expiratory phase
  - Skin cool, pale, and slightly diaphoretic
  - Patient is able to speak in two- to three-word sentences.
  - Accessory muscle use
  - Patient looks weak. Head occasionally bobs.

Discussion

- *What can immediately be done to improve the patient's tidal volume?*

Treatment/Assessment

- Oxygen administered via nonrebreather mask
- Vital signs obtained

Initial Assessment

- History of present illness
  - Patient has a past medical history of asthma.
  - Metered-dose inhaler (MDI) medication ran out yesterday.
  - Patient woke with shortness of breath one hour ago.
  - He has gotten progressively worse.

Initial Assessment

- Vital signs
  - HR = 118 regular
  - RR = 32 shallow
  - BP = 130/72
  - SpO_2 = 90% on 15 Lpm
  - Capnograph obtained

Initial Assessment

- Capnograph waveform

- Interpretation?

Discussion

- *What do you think is responsible for the patient's breathing difficulty?*
- *Should this patient be intubated?*
- *What are your treatment priorities?*

Assessment/Treatment

- Nebulizer is prepared.
  - 2.5 mg albuterol
  - 500 mcg ipratropium bromide

Assessment/Treatment

- Patient is placed on cardiac monitor.
- Nebulized medications are administered.

Discussion

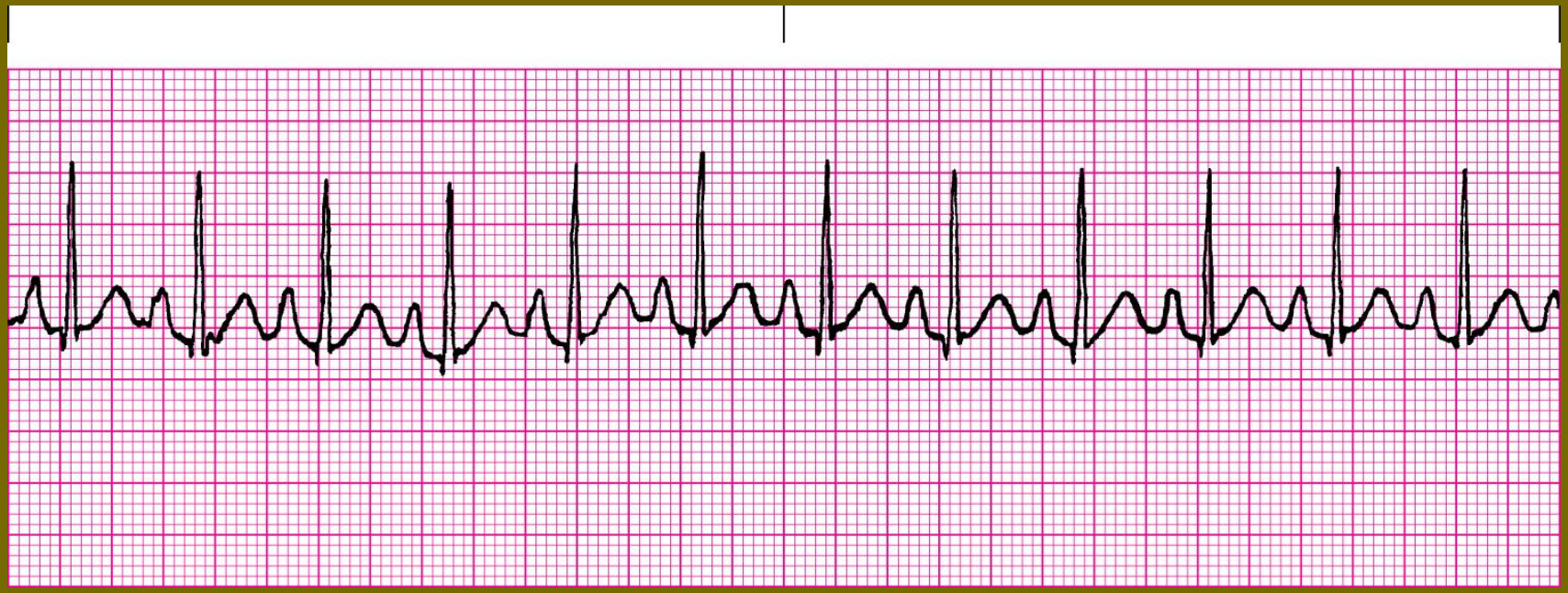
- *What additional medications may be considered?*

Treatment

- Reassessment is performed. No improvement after treatment is noted.
- Epinephrine 1:1,000, 0.3 mg IM x 1

Detailed Assessment

- Cardiac rhythm



- Interpretation?

Treatment

- IV access obtained

Discussion

- *What is your determination of the patient's condition?*

Treatment

- Patient moved to ambulance
- Transport to ED initiated

Discussion

- *What are your priorities during transport?*

Ongoing Assessment

- Reassessment reveals slight improvement in patient's condition.
  - Patient states he is doing better.
  - Lung sounds improving
  - SpO_2 increased to 92% on 15 Lpm
  - "Shark fin" capnograph flattening out

Assessment

- Capnograph waveform

- Interpretation?

Ongoing Assessment

- Report is given to ED.

Ongoing Assessment

- Reassessment reveals further improvement in patient's condition.
  - Lung sounds improving
  - SpO_2 increased to 97% on 15 Lpm
  - Anxiety relieved
  - No accessory muscle use
  - Skin cool, slightly diaphoretic, good color

Treatment

- Patient is prepared for transfer to ED staff.

ED Treatment and Beyond

- The patient is admitted into an ED bed.
- A second IV is placed.
  - Blood drawn for routine studies
- Patient is placed on a cardiac monitor with continuous pulse oximetry and capnography.

ED Treatment and Beyond

- Peak flow is measured using a peak flow meter to obtain a baseline value to monitor further treatment and quantify improvement or detect deterioration.
- The patient continued to wheeze, and the HR was 130/min after the first nebulizer and epinephrine administered by EMS.

ED Treatment and Beyond

- Racemic epinephrine (Xoponex) nebulizer administered in an effort to minimize further adrenergic stimulation.
- Solumedrol 125 mg IV x 1 was administered, given the severity of the asthma exacerbation.
- Magnesium 2 g IV x 1 was also administered.

ED Treatment and Beyond

- .
- After a few more rounds of nebulizers the patient's potassium was rechecked and found to be 3.1 mEq/L. The patient had potassium added to his IV fluids.

ED Treatment and Beyond

- Attempts were made to admit the patient to an ICU bed.
  - None was available.
- The patient continued to receive treatment and monitoring in the ED until nebulizers were spaced out to q4h.

Drug Calculation Review

Administration of Mag. Sulfate =

2 grams in 100 cc over 20 minutes

(100 cc / 20 minutes) x 60 gtts/ min=

300 gtts/minute

Review Material

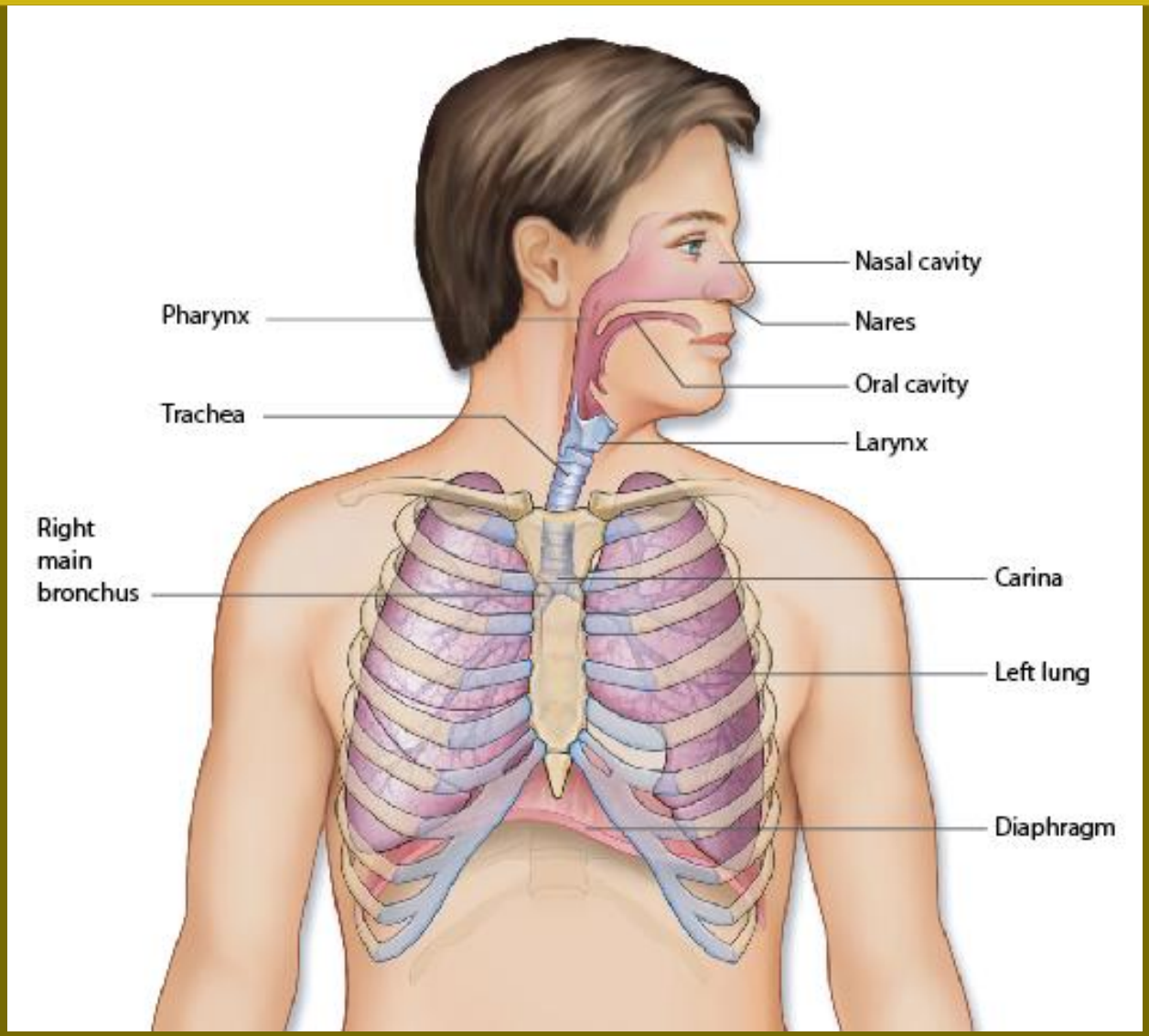
Epidemiology

- CDC reports that in 2001, 20.3 million people in U.S. had asthma.
  - 12 million had an asthma attack in the previous year.
  - Prevalence of 5%–10% in children
  - Prevalence of 7%–10% in elderly
- Half of cases develop before age 10.
  - Most common chronic disease of childhood

Epidemiology

- Prevalence of exercise-induced asthma 3%–10% of general population
- 40%–90% in persons with asthma
- Estimated 500,000 hospitalizations and 5,000 deaths annually
- Occurs predominantly in males in childhood (2:1)
  - Equalizes by puberty/early adulthood

A&P Review



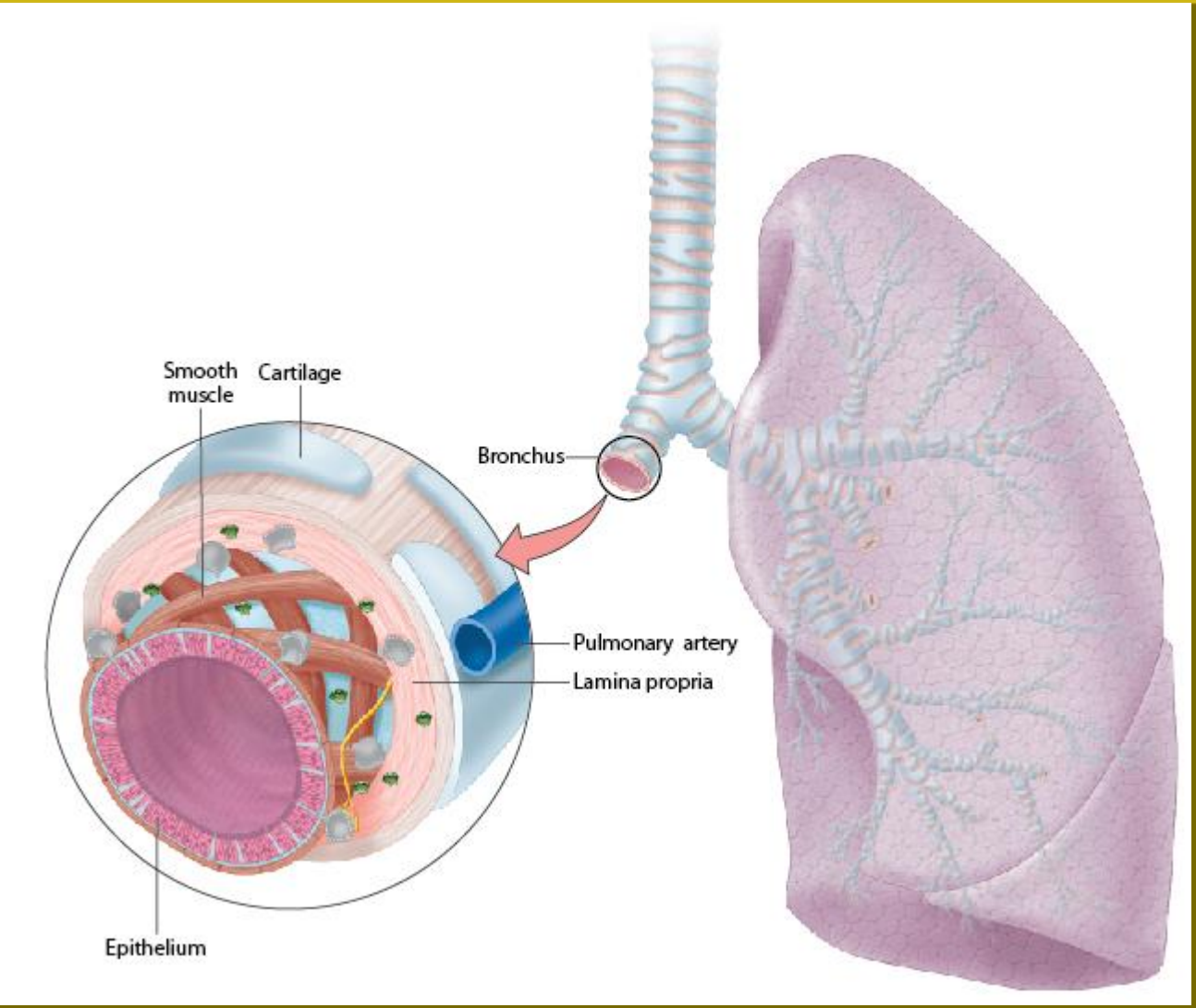
A&P Review

Lower Airway

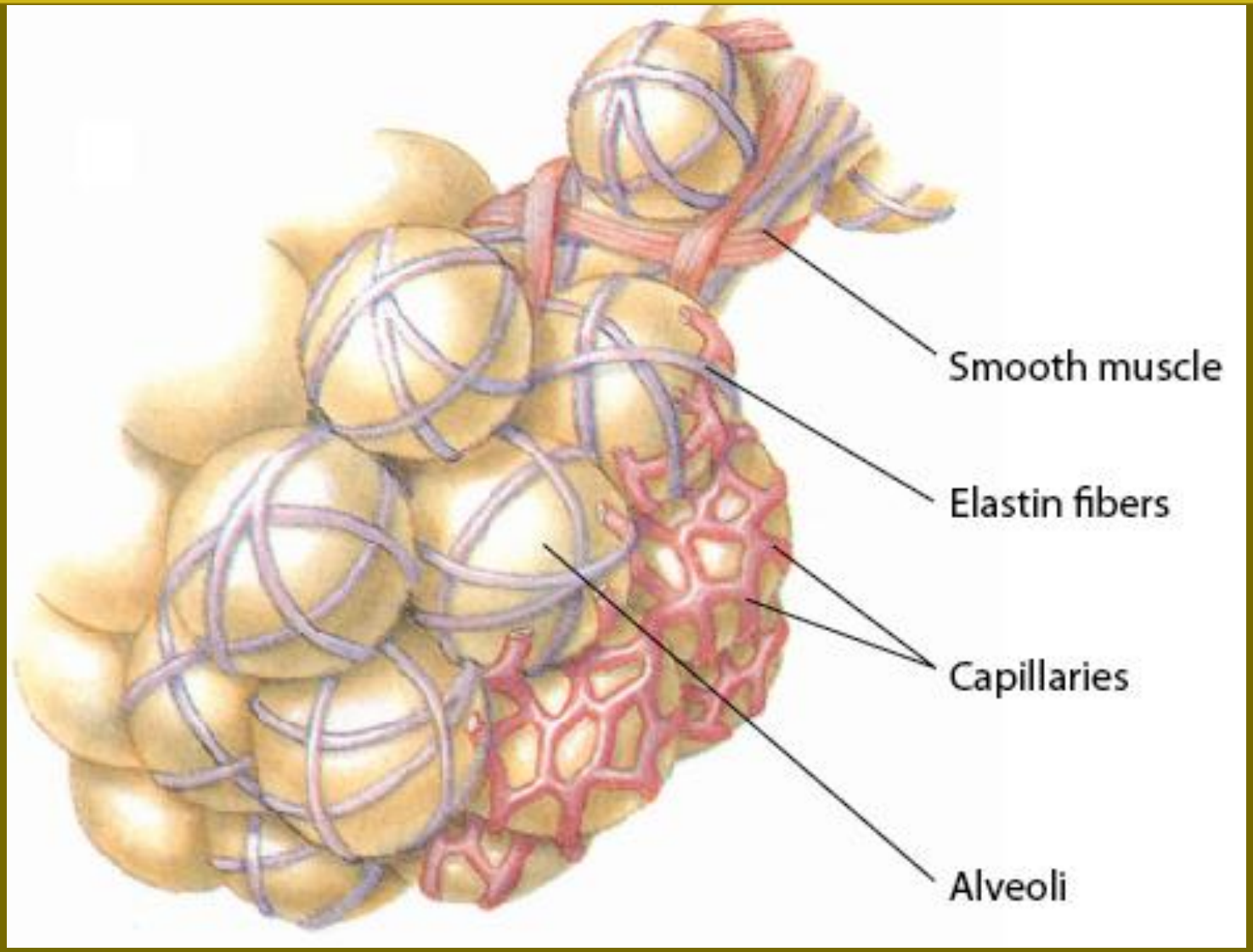
- Trachea
- Mainstem bronchi
- Bronchioles
- Tertiary bronchioles
- Respiratory bronchioles
- Alveolar ducts
- Alveolar sac
- Alveoli

Smooth muscle control

A&P Review



A&P Review



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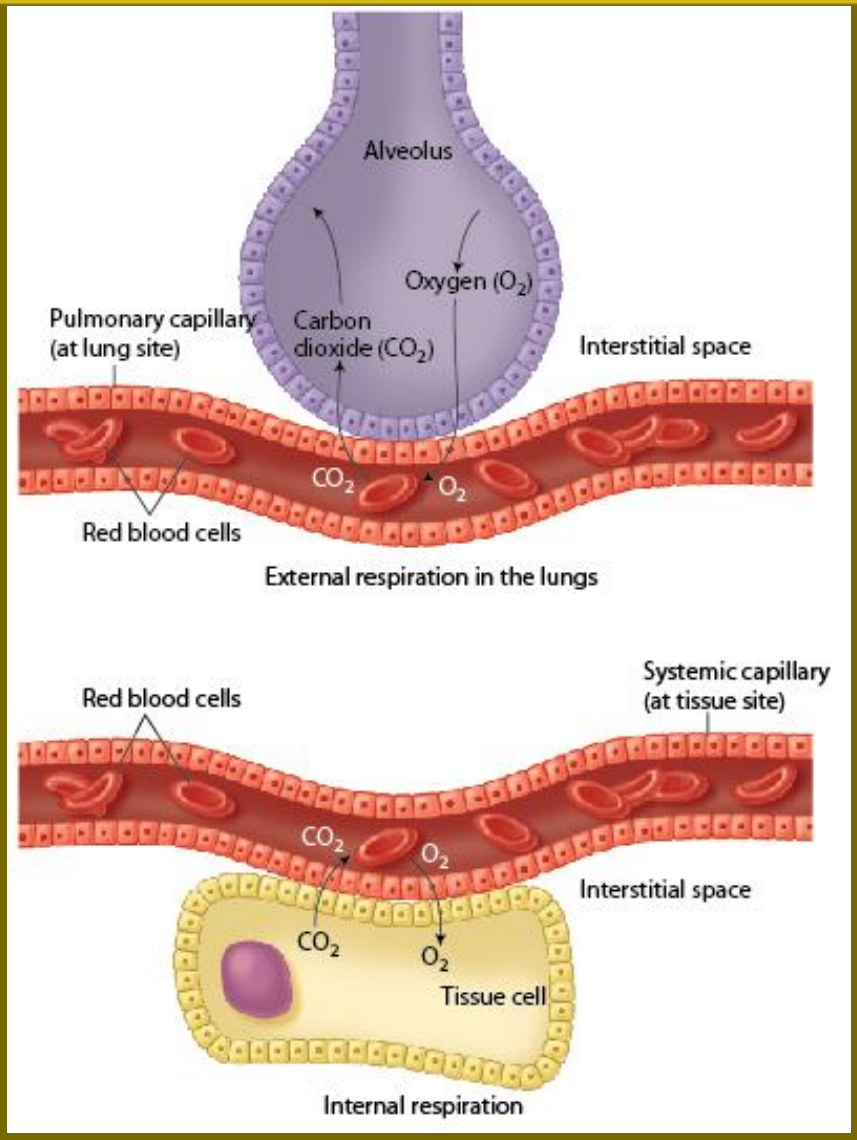
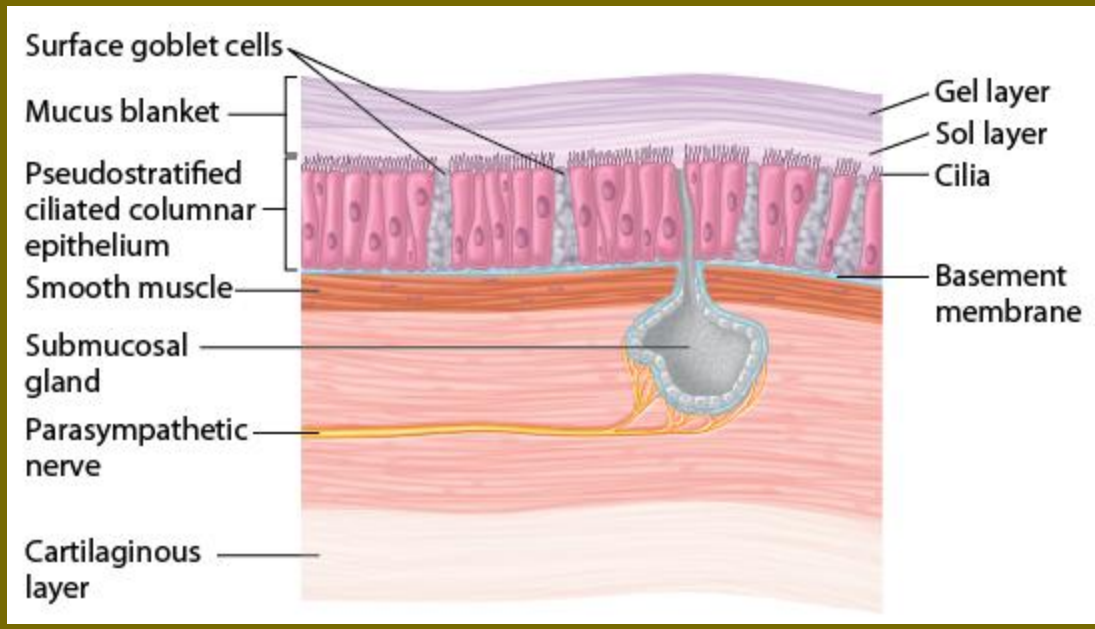


A&P Review

- Respiratory epithelium
  - Goblet cells
  - Mucous layer
  - Ciliated columnar epithelial cells

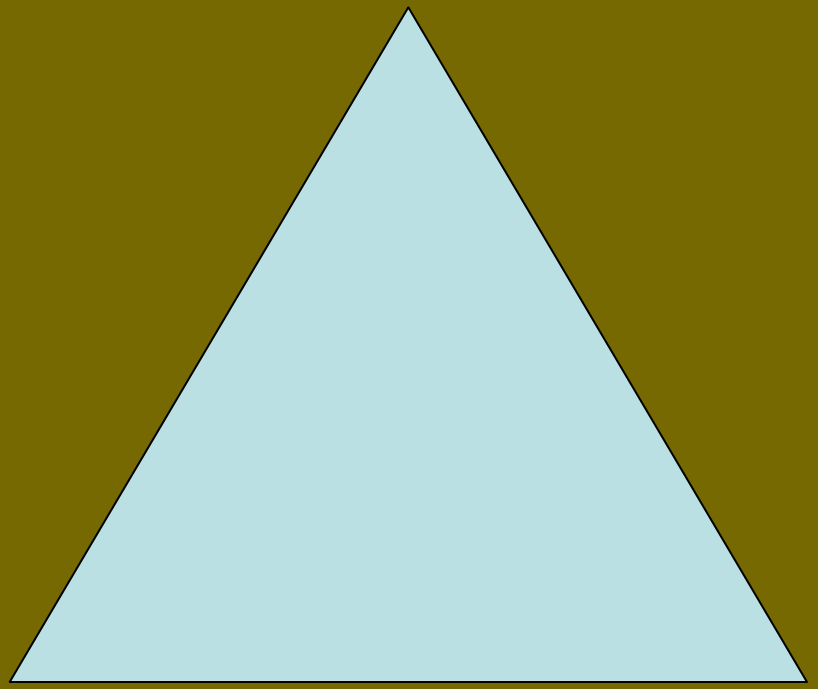


Animation

Asthma Animation

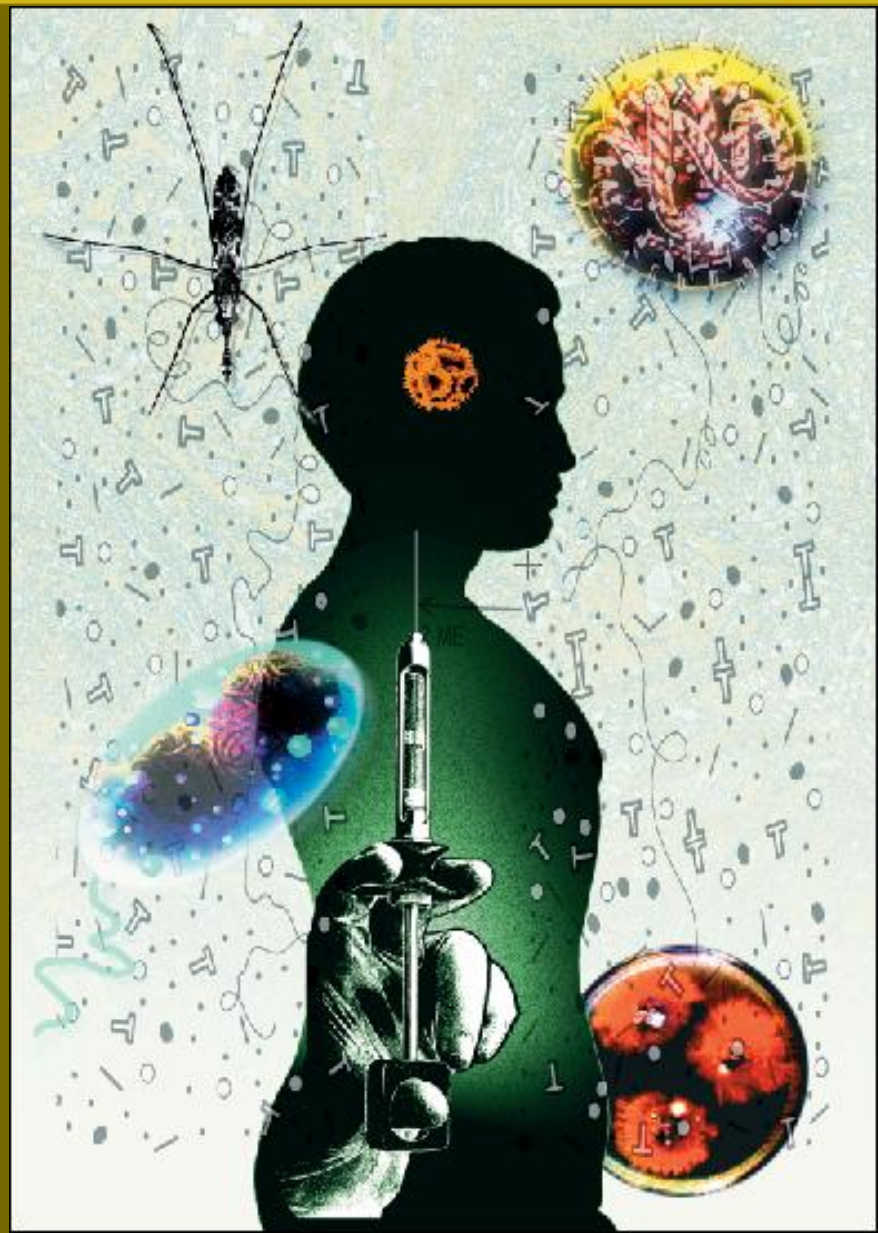
Pathophysiology

- Pathophysiology includes
  - Bronchial hyperresponsiveness
    - Smooth muscle constriction
  - Mucous production
  - Airway inflammation
    - Can be acute, chronic



Pathophysiology

- Asthma triggers
  - Medication sensitivity
  - Allergens
    - Pollen
    - Pet dander
  - Irritants
    - Paint fumes, cleaning product fumes
  - Exercise
  - Viral respiratory infections
  - Cold, dry air



Pathophysiology

- Mucous production
  - Increase in number of respiratory epithelial goblet cells
  - Chronic mucous plug formation
    - Chronic mucous plugs consist of mixture of serum proteins, inflammatory cells, and cell debris.
    - May take weeks to clear

Pathophysiology

- Airway inflammation: acute
  - Result of recruitment of cells to airway
  - Mast cells
    - Histamine and other mediator release
    - Intense, immediate inflammatory reaction
  - Eosinophils, T lymphocytes, macrophages, neutrophils
    - Additional mediator release
    - Contribute to inflammation

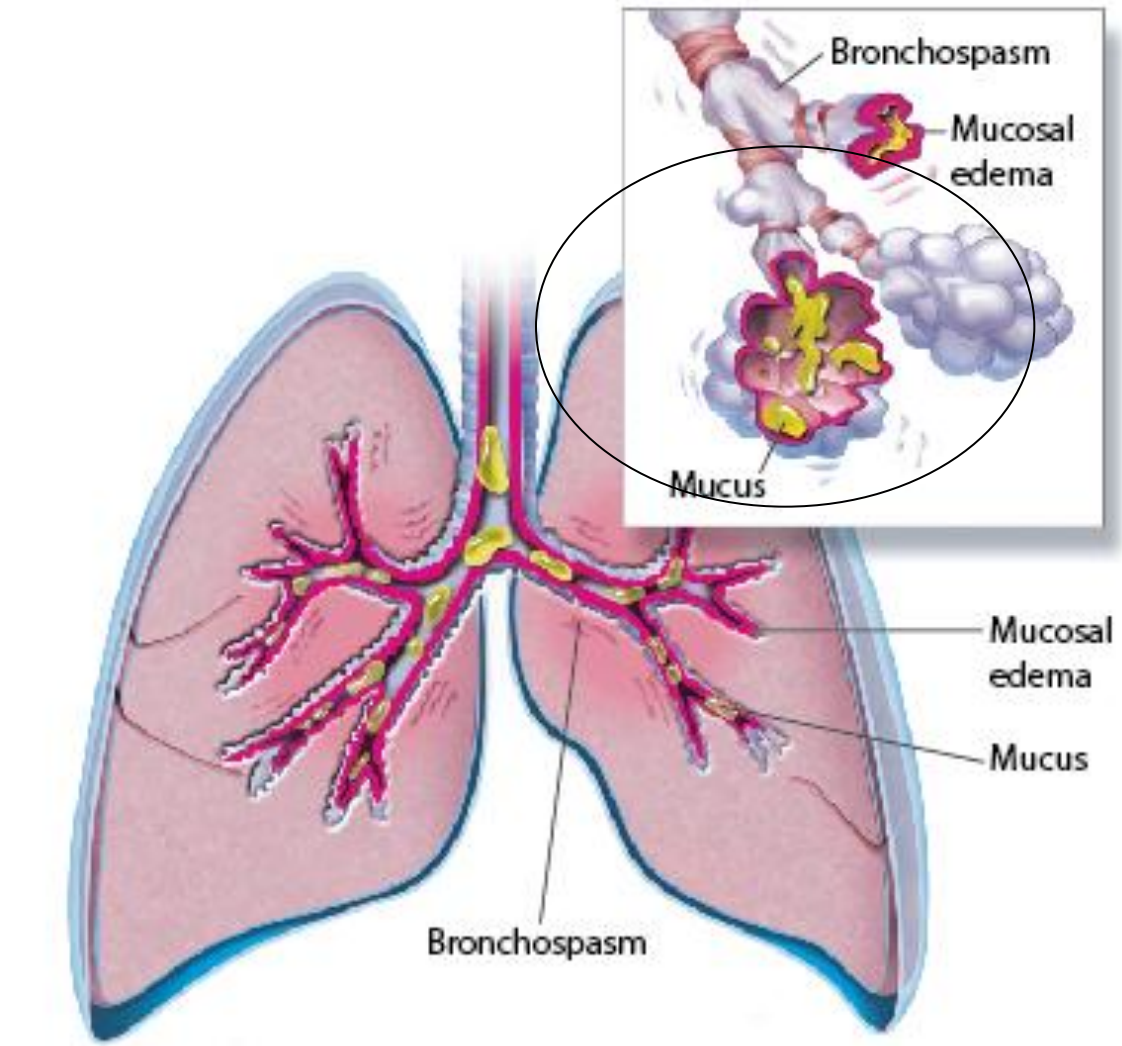
Pathophysiology

- Airway inflammation: chronic
  - Characterized by persistent epithelial cell damage and repair process
    - Epithelial cells, myofibroblasts deposit interstitial collagen
    - Fibroblasts release cytokines = inflammation
  - Result in microscopic changes to airway
    - Thickening of basement membrane

Pathophysiology

- Two phases of an asthma exacerbation
  - Phase 1
    - One to two hours after exposure to trigger
    - Bronchoconstriction secondary to histamine release
    - Mild airway edema
  - Phase 2
    - Six to eight hours after exposure to trigger
    - Invasion of respiratory epithelium by immune cells
    - Significant edema, swelling, mucous production

Pathophysiology



Pathophysiology

- Wheezing occurs as narrowed airways begin to obstruct air flow.
- Early in exacerbation, wheezing is heard at end of expiratory phase.
  - Wheezing moves toward beginning of expiratory phase, then into inspiratory phase as airflow restriction worsens.

Clinical Assessment

- Symptoms
  - Classic triad is dyspnea, wheezing, and cough.
  - Chest tightness
  - Sputum production

Clinical Assessment

- Signs
  - Tachycardia, tachypnea
  - Pulsus paradoxus
  - Wheezing, decreased breath sounds
  - Prolonged expiratory phase
  - Chest hyperinflation
  - Hyperresonance to percussion
  - Pale, cool, diaphoretic skin

Clinical Assessment

- Signs of severe exacerbation
  - Decreasing level of consciousness
  - Absent lung sounds
  - Accessory muscle use
  - Cyanosis

Clinical Assessment

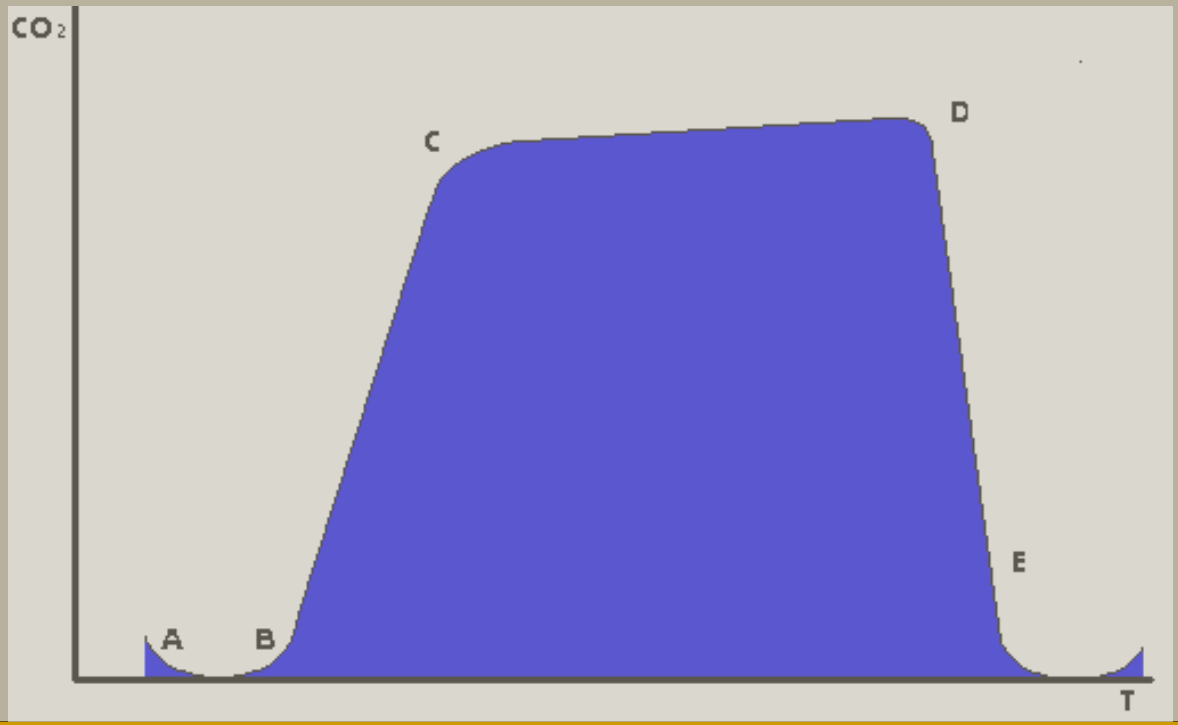
- SpO_2
  - Decreased
- $ETCO_2$
  - Decreased early in exacerbation secondary to hyperventilation
  - Normal, elevated later in exacerbation
- Capnogram
  - "Shark fin" appearance

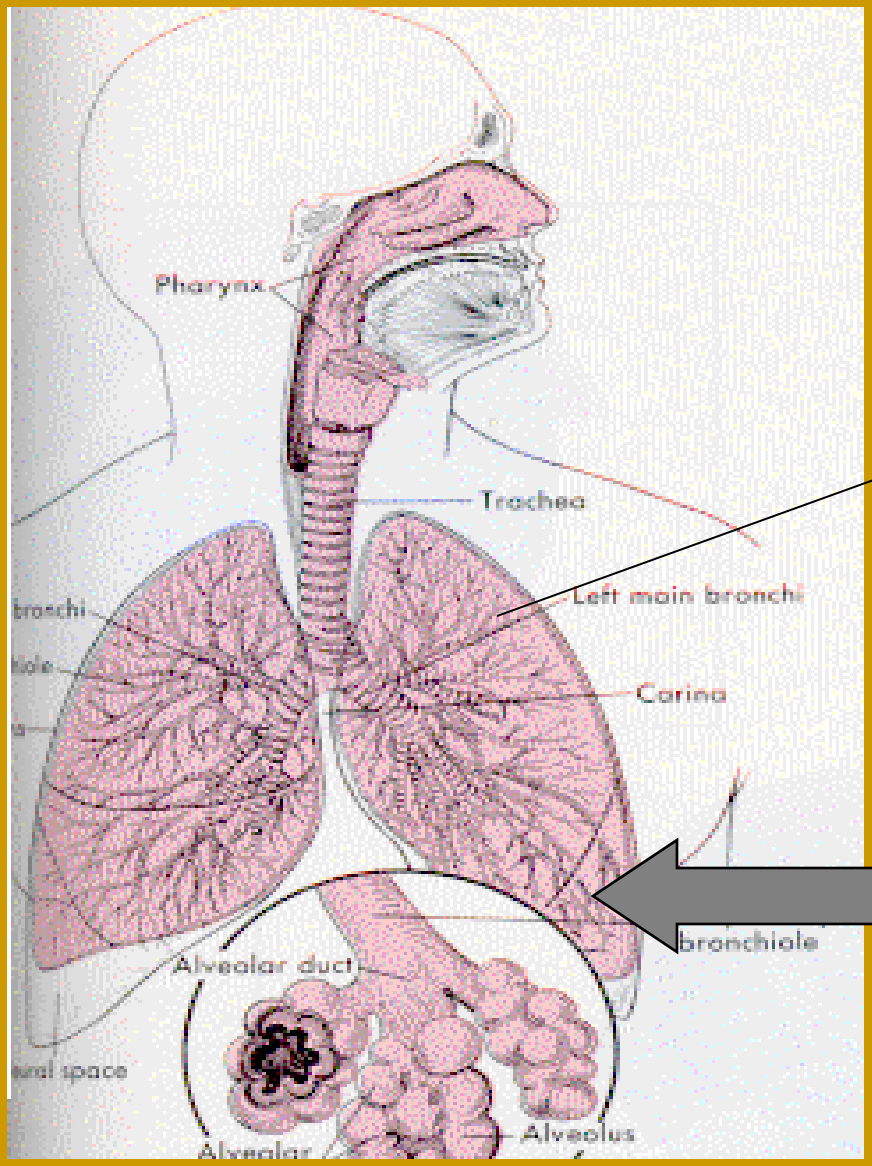
Clinical Assessment

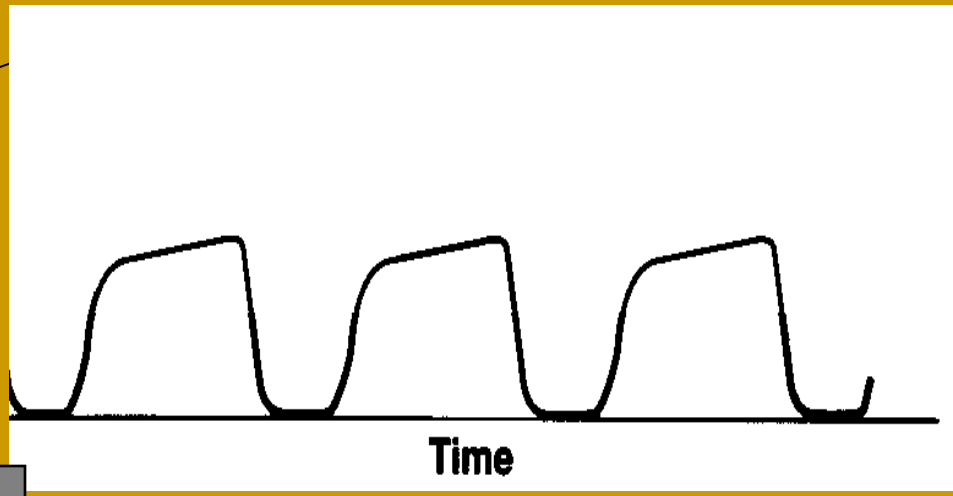
- Capnography: early asthma
  - Beginnings of “shark fin” appearance
  - Increased rate
  - Decreased peak $ETCO_2$ secondary to hyperventilation
    - Patient “blows off” CO_2

Normal Endtidal CO2

A-B: Early Exhalation, $C0_2$ free (dead space)
B-C: Combination of dead space and alveolar gas
C-D: Alveolar plateau
D: End Tidal C02 D-E: Inhalation







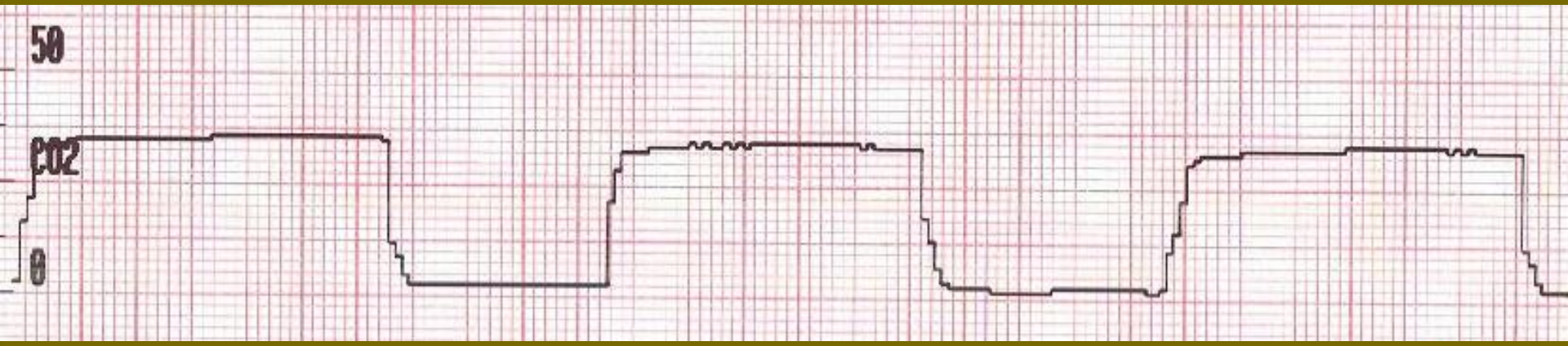
Depth = Height

Clinical Assessment

- Capnography
  - "Shark fin" appearance to waveform
    - Loss of alveolar plateau
  - May have elevated baseline secondary to air trapping

Clinical Assessment

- Compare with normal waveform.



Clinical Assessment

Phases of Acute Asthma Exacerbation		
Phase	**Clinical Assessment**	**$ETCO_2$ Levels (mm Hg)**
Mild	Hyperventilating	< 35
Moderate	Tiring	35 – 50
Sever	Tired	>

Clinical Assessment

- Spirometry
  - Forced expiratory volume (FEV1)
    - Determined when patient in normal health, not during acute exacerbation
    - Useful in determining general severity of patient's disease
  - Peak expiratory flow rate (PEFR)
    - Sequential measurements useful to determine response to therapy

Treatment

- Ensure patent airway
  - BLS, ALS intervention if necessary
  - Do not be overeager to perform endotracheal intubation
    - Numerous complications associated with intubation and mechanical ventilation of asthmatics

Treatment

- Decision to intubate the asthmatic patient is multifactorial.
- Guidelines
  - pCO_2 exceeding 40 mmHg
  - pO_2 less than 60
  - Labored breathing and accessory muscle use
  - Potential or developing myocardial ischemia
  - Declining mental status
  - Hemodynamic instability

Treatment

- Ensure adequate oxygenation and ventilation.
  - High-flow, 100% O_2 via nonrebreather mask
  - BVM assist if necessary
- IV initiation
  - Consider need for fluid administration.

Treatment

- Nebulized adrenergic agents
  - ß-2 agents preferred
  - Albuterol

Treatment

- Percutaneous adrenergic agents
  - Epinephrine 1:1000
    - SQ administration
  - Terbutaline
    - SQ administration

Treatment

- Anticholinergic agents
  - Nebulized ipratropium bromide
  - Cumulative effect when administered with ß-2 adrenergic agents

Treatment

- Corticosteroids
  - Highly effective in treatment of asthma
  - Onset of action, four to six hours
  - Methylprednisolone IV
  - Fluticasone

Treatment

- Magnesium sulfate
  - Smooth muscle relaxant
  - Indicated in severe exacerbations

Treatment: Hospital

- Theophylline
  - Provides bronchodilation of the small airways; improves respiratory muscle endurance
  - Administered IV infusion
  - Extremely toxic
    - Risk of seizures, cardiac dysrhythmias at plasma levels >30 mcg/mL

Treatment: Hospital

- Mast cell modifiers
  - Control mast cell media eosinophil recruitment
  - Decrease airway inflam bronchospasm
  - Examples
    - Cromolyn, nedocromil

Remember

- BLS:
  - Oxygen
  - Limit exertion
  - Ressure the patient

Thank You

For info on how to get a head start on medic class:

http://stevenkanarian.wordpress.com

References

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