EMERGENCIES OF THE Respiratory System

Respiratory Anatomy

Upper Airway

Lower Airway

Upper Airway - Pharynx

Nasopharynx

Oropharynx

Laryngopharynx

Vocal cords in the larynx
Sinuses – Functions

• Lighten the head
• Phonation (sound of your voice)
• Response to inhaled irritants and allergens

Pharynx

• Separation of air and food passages – the epiglottis
• Lymphatic tissue – tonsils and adenoids
• Regulation of ear pressure

Larynx – External Anatomy

• Thyroid Prominence (“Adam’s Apple”)
• Cricothyroid ligament
• Tracheal cartilage
• Thyroid cartilage
• Cricoid cartilage
• Thyroid gland
• Trachea
The Vocal Cords in the Larynx

Let's explore the upper airway and go over the top of the tongue, and then behind it to the epiglottis

Now let's go over the tip of the epiglottis and see what is beneath it
So this is what it really looks like….

Epiglottis
Vocal folds (cords)
Glottic opening

Clinical Correlations

• Laryngospasms
• Foreign bodies in the airway

The Larynx and the Tracheobronchial Tree
Bronchi

Cilia move mucus and debris away from lungs

Right Mainstem Bronchus
- Wider
- Straighter

Left Mainstem Bronchus
- Narrower
- Acute Angle

Bronchoscopy enables us to...

Explore the hundreds of branches of the tracheobronchial tree.

And as we explore this branch of the right mainstem bronchus...

Is that really a premolar...
The Thoracic Cage

During Inspiration and Expiration...

- Clavicle
- Sternum
- Xiphoid process
- True ribs
- False ribs
- 12 Pair of ribs
- Expands and contracts to move air
Muscles of Respiration

- Intercostal—literally “between the ribs”
- Diaphragm

Tracheal Bronchial tree with Diaphragm

- Trachea
- Lungs
- Diaphragm

Mechanics of Respiration

**INSPIRATION**
- Active
- Intercostal muscles and diaphragm
- Expands thoracic cavity

**EXPIRATION**
- Passive
- Forced exhalation by muscles
- Constricts thoracic cavity
Lungs

Right lung

Left lung

Three lobes

Two lobes

Bronchioles

- Walls - smooth muscle.
- Provide airway resistance.

Alveoli

Terminal portion of airway

Gas exchange takes place between the capillary network and the air within the alveoli
Terminal portion of the airway

Clinical Correlations

Lower airway disease
- Asthma
- Chronic Obstructive Pulmonary Disease (COPD)
- Emphysema
- Bronchitis
- Pneumonia

Life threatening emergency
- Emesis with Aspiration

Respiration

- **EXTERNAL RESPIRATION**
  - O₂ inspired air enters the body by coming in contact with blood in the alveoli.

- **INTERNAL RESPIRATION**
  - At the cellular level when O₂ from the blood enters the cell and CO₂ leaves the cell and returns to the blood.
Normal Ventilation

Right side of heart

Left side of heart

Body Cells

Alveoli

External Respiration

Conducting portion
Pharynx and the tracheobronchial tree
• Airway patency
• Dead space

Each molecule of hemoglobin...
CO₂ molecules enter the red blood cells

The Components of Blood

Hematocrit Values
- Male 45-52 %
- Female 37-48%

Control of Respiration
- Chemical – CO₂ and O₂ levels
- Neural – Respiratory Center in the medulla
- Voluntary Control
In respiratory depression the normal control mechanisms are impaired and respiration becomes slow and shallow.
Some Important Respiratory Terms

- Hyperpnoea – Rapid breathing.
- Dyspnea – Difficulty breathing.
- Apnea – Absence of breathing.

Asthma

A disease marked by recurrent Dyspnea caused by episodic bronchoconstriction.

Pathophysiology of Asthma

- Often associated with allergies.
- Increased secretions within the small airways.
- Mucus plugs block small bronchi, restricting air movement.
- Bronchospasm \wheezing.
Sympathetic Stimulation (Adrenergic) OR Parasympathetic Innervation (Cholinergic)

Sympathetic (Adrenergic) Effects
A. α Arteries & Veins (Vasoconstriction)
B. The Big Organs
   1. Heart – ↑ BP, ↑ HR
   2. Lungs – Bronchodilation

β - The Big Organs

β1 ONE HEART
   ↑ BP, ↑ HR

β2 TWO LUNGS
   Bronchodilation
Parasympathetic Innervation

- Stimulates the salivary glands to produce saliva for digestion of foods.
- Is counteracted by anticholinergic drugs such as atropine or glycopyrrolate which diminish salivary secretions.

Hi! - I'm Mr. Couch Potato, your vegetative state

Assessment of Patients with Asthma

- Frequency of attacks.
- Precipitating factors.
- Duration of attacks.
- Management of attacks.
  - Current prevention therapy.

Management of Asthma

Preventative Medications:
- Corticosteroids – anti-inflammatory (inhaled) - Aerobid®, Azmacort®, Flonase®, Pulmicort®.
- Selective beta-2-agonists - Bronchodilators (short/long acting) - acts on smooth muscle - Vanceril®.
- Combination therapy - a combination medication that includes a corticosteroid plus a long acting bronchodilator drug – Advair®.
Anesthetic Considerations of Patients with Asthma

- Defer treatment until uncontrolled asthma is controlled.
- Keep inhaler available for acute attacks, bronchodilator not steroid inhaler.
- Manage possible adrenal suppression if patient taking corticosteroids.
- Stress reduction.

Monitoring your patient’s asthma management with the Peak Flow Meter

A. Patient inhales as deeply as possible
B. Exhalation with maximal force into the peak flow meter
C. Repeat x 3 and compare maximal flow with table norms

COPD - Chronic Airflow Obstruction
COPD
(Chronic Obstructive Pulmonary Disease)

Pulmonary Emphysema

Normal alveoli

Weakened & collapsed alveoli with excess secretions
Chronic Bronchitis

• Daily cough and sputum production.
• Excess secretions.
• Prone to laryngospasm and bronchospasm.

Treatment of COPD

• Stop smoking.
• Supplemental oxygen.
• Bronchodilators will give most patients 10% increase in expiratory airflow.
Preoperative Evaluation

• Determine the severity of the disease.
• Determine if there are any reversible components such as bronchospasm or infection.

Dangers of Smoking

• COPD and Cardiovascular Disease.
• Increases anesthetic risk.
• Reactive airways (laryngospasm).
• Increased secretions.
• Increased postoperative infections.
• Increased dry sockets.

Smoking

Concerns:
• COPD and Cardiovascular Disease.
• Increases anesthetic risk.
• Reactive airways (laryngospasm).
• Increased secretions.
• Increased postoperative infections.
• Increased dry sockets.
Preoperative Cessation of Smoking

- Stopping smoking for > 8 weeks

Upper Respiratory Infections
- Colds (URIs) increase secretions in the airway.
- Increase the risk of anesthesia.
- Best to delay surgery.

Respiratory System
MONITORING TO ASSURE THAT THERE IS ADEQUATE VENTILATION AND OXYGENATION
The Capnograph

- The capnograph measures the amount of CO₂ in expired air.
- The capnograph displays a waveform – as well as a digital readout.
- In the open system often used in OMFS, the waveform shows trends but the digital readout is not accurate.
- The CO₂ is measured as end tidal CO₂ (ET CO₂).

Capnometer / Capnograph

- Measures the level of exhaled CO₂.
- Used to determine adequacy of ventilation (increase CO₂ = decreased ventilation).
- Best for closed systems.
- An optional monitor which should be used in combination with the pre-tracheal stethoscope and pulse oximetry.

Maintenance and Checks

- Check probe to make sure it is in correct position.

Using the Capnograph in an Open System

- The sensing catheter can be placed within a nasal mask or nasal prongs.
- The tube must be protected from condensation which will occlude the catheter.
Capnometer/Capnograph

- Increased CO₂
- Airway obstruction
- Respiratory depression
- No CO₂ detected
  System disconnect

Pulse Oximeter

- Measures the level of oxygenated hemoglobin compared with total hemoglobin at the site of the probe.
- Measures pulse rate, perfusion at the probe and ventilation.
- Normal “healthy” patients on room air >96%.

Maintenance and Checks
- Periodically check probes as they are fragile.

Pulse Oximeter

- The probe can be placed on either a finger or the thumb.
- The lead wire should be taped to the finger to prevent the probe from becoming dislodged.
- Alternatively an ear probe can be placed on the earlobe.
- Earlobe readings may be more accurate, but the probe and leads can interfere with surgery.
Monitoring of Ventilation
- Listen to breath sounds with a pre-tracheal stethoscope.
- Observe patient - watch chest and reservoir bag.
- Observe patient - mucosa, skin tone, nail beds, blood color - cyanosis.
- Observe patient - nasal flaring.
- Observe patient – retraction.

Monitoring of Oxygenation – the Pulse Oximeter
Limitations:
- Lag time (20 to 40 seconds).
- Patient movement.
- Fingernail polish (black blue or green).
- Venous congestion.
- Abnormal hemoglobin (e.g. carboxyhemoglobin in smokers).

Determination of Oxygen Saturation
- The oximeter does not directly measure arterial \( \text{O}_2 \).
- The device determines the amount of oxygenated hemoglobin based upon the difference in color of oxygenated and deoxygenated hemoglobin.

When hemoglobin is oxygenated, it has a reddish coloration.
When hemoglobin has been deoxygenated, it assumes a bluish coloration.
Pulse Oximeter – Relationship Between Arterial $O_2$ and $O_2$ saturation

The Oxyhemoglobin Desaturation Curve:
- Large drops in arterial oxygen pressure (below 70 mm Hg) can occur before oxygen saturation drops significantly.

At an oxygen saturation of approximately 93% the actual arterial oxygen pressure is only 70 mmHg.

Maintenance of the Airway to Prevent Respiratory Emergencies

Routine Airway Equipment:
- Nasal Hood
- Nasal Cannula
Routine Airway Techniques

Airway support:
- Head tilt/chin lift.
- Jaw thrust using the angles of mandible.

Tongue Manipulation

- Traction suture
- Tongue forceps
- Towel clip

Suction Equipment

- Equipment to clear secretions from the pharynx
- Induction a critical time
- Backup system
- Hand pump
Nasopharyngeal Tube
- Supports tongue.
- Easy to insert - lubricate, slide along nasal floor.
- Can be used on awake patient.
- Well tolerated.

Nasopharyngeal Airway (can be utilized in the sedated or sleeping patient)
- Nasopharyngeal airways:
  - Traditional trumpet – contains latex.
  - Non-latex trumpet
  - Adjustable length airway – non latex
- Sizing – tip of nose to earlobe.
- The surgical site is packed off and the lubricated airway passed through the naris. It should not be so large as to cause blanching of the soft tissues of the naris.

The airway passes posterior to the tongue so that air flow is not impeded by the relaxed tongue, which is positioned posteriorly in the throat.

A lubricated pharyngeal catheter can be utilized to remove secretions from the hypopharynx.

Positive pressure ventilation can be given with the airway in place.
Full Face Mask

- Useful for induction & emergency
- Use with airway support
- Can be used with:
  - Nasopharyngeal tube
  - Oral airway

Oropharyngeal Airway
(for the unconscious patient - not well-tolerated by an awake patient)

Sizes and styles of airways
- Sizing the airway - from the corner of the mouth to the angle of the mandible
- The surgical site is packed off and the airway inserted “upside down” with the tip toward the palate.
- As the airway is passed over the tongue posteriorly it is rotated 180°

The final airway position with the airway providing a channel for air to pass behind the tongue.
- The side channels of the hard molded plastic airway provide a means of passing an oropharyngeal catheter into the hypopharynx. The soft plastic oral airways have a lumen for the oropharyngeal catheter (red arrow).
- The airway assures passage of air posterior to the tongue during positive pressure ventilation
Laryngeal Mask Airway (LMA)

The King LT-D Airway

Ports for passage of air into the trachea through the larynx

1 Tube with two cuffs

Distal cuff inflates the esophagus and isolates the laryngopharynx from the esophagus

Proximal cuff inflates at the base of the tongue and isolates the laryngopharynx from the oropharynx and nasopharynx
The King LT-D Airway in Place

- On inflation air passes into the trachea
- Lower cuff "plugging" the esophagus
- Large proximal cuff above larynx

Airway Maintenance

- Endotracheal Intubation
  - Nasal
  - Oral
  - Through a tracheostomy site
- Placement
  - Direct Vision
  - Blind

Endotracheal Intubation Preparation

- Endotracheal tube
- Stylet
- Laryngoscope
- Muscle relaxant
- Connectors
- Oxygen
- Suction
- Mask
- Ambu bag
Intubation with a laryngoscope with a curved blade

Blade deflects tongue to left

Tip of blade between base of tongue and epiglottis

Airway Adjuncts

- Head tilt / Chin lift
- Pocket Mask
- Bag-Valve-Mask
- Laryngeal Mask Airway (LMA)
- Tongue Suture
- Nasal Airway
- Oral Airway
- Endotracheal Intubation
- Esophageal - Tracheal Combitube
- Cricothyroidotomy
- King Tube
- King LT-D Airway

Difficulty, Invasiveness

Respiratory System

MEDICAL AND ANESTHETIC EMERGENCIES
Respiratory Emergencies

- Airway obstruction
- Laryngospasm
- Bronchospasm
- Emesis / Aspiration
- Hyperventilation
- Respiratory Depression / Arrest

Emergencies involving the tracheobronchial tree and alveoli
The Tongue

Clinical Scenario
- 56 year old male for extraction of 6 maxillary teeth
- ASA II (hypothyroid)
- Patient requests to be “asleep”
- Anesthetic course
  - 5 mg midazolam
  - 50 mg meperidine
  - 20 mg of Propofol (for the local anesthetic injection)
  - 4 carpules lidocaine with epinephrine

To maintain the airway

Head tilt, chin lift

Patient not breathing – positive pressure $O_2$
Clinical Scenario

• Surgery was faster than expected (5-7 min).
• Doctor left room to see other patients.
• Patient became restless, agitated, spit out gauze.
• Required repacking 3-4 times by assistant.
• Continued to get more restless, agitated.
• Became less arousable.
• Assistant interpreted as more relaxed, removed monitors.

Diagnosis?

Clinical Scenario

• After patient became even more unresponsive, pulse oximetry reconnected
• Doctor called back into room
• Oxygen saturation 81%
• Gauze pack removed
• Saturation continued to drop
• Positive pressure oxygen attempted
• Intubation attempted X 3
• 911 called
• Surgical airway “attempted”

Clinical Scenario

• Post mortem: 2 X 2 gauze lodged in vocal cords
• Sedated and anesthetized patients should have monitors in place and be observed by trained personnel until awake and alert.
• Account for all gauzes and packs
  • Leave ends visible outside the mouth

Be Sure all Gauze/Packs are Clearly Visible!
Respiratory Emergencies – Airway obstruction

**DEFINITION:**
Complete or partial blockage of the airway resulting in insufficient gas exchange.

Always be prepared to manage foreign body obstruction!!!

- **Foreign Bodies**
- **Teeth and tooth fragments**
- **Implant wrenches and cover screws**
- **Pieces of soft tissue or bone**
- **Gauze packs**

Airway Obstruction

**SIGNS AND SYMPTOMS:**
- Stridor, wheezing
- Use of accessory breathing muscles
- Decreased O₂ saturation
- Cyanosis
Foreign Body Obstruction – Abdominal Thrusts (the Heimlich Maneuver)

Thrusts delivered just above the umbilicus and well below the tip of the xiphoid process (GR – “sword”)

ABDOMINAL THRUSTS FOR THE REMOVAL OF A FOREIGN BODY IN THE AIRWAY

Abdominal thrusts for the prone patient – more applicable to the oral and maxillofacial surgery office. Abdominal thrusts delivered immediately above the umbilicus, well below the xiphoid process of the sternum.

Foreign Body Obstruction – Direct Laryngoscopy

- Place laryngoscope
- Suction with tonsillar suction
- Visualize the Foreign Body
- Retrieve with Magill forceps
Persistent Obstruction
Cricothyrotomy

The trocar is removed and...

The cannula is placed through the overlying soft tissues and the cricothyroid membrane into the trachea.

The cannula secured to its tubing...

Which is attached to the oxygen supply.

Point of penetration is through the cricothyroid membrane.

Airway Obstruction

PREVENTION:

• Appropriate head position
• Throat Packs
• Adequate suction
• Good visualization

Laryngospasm

DEFINITION:

A protective reflex closure of the vocal cords that attempts to prevent passage of foreign matter, such as blood or saliva, into the larynx, trachea and lungs.
The Vocal Cords in The Larynx

Actual view of vocal cords through a laryngoscope

Pathophysiology for Laryngospasm

Laryngospasm Diagnosis

Early crawing, but no sound for complete spasms

↑↓ respiratory effort and exchange

Suprasternal retractions

↓↓ O₂ saturation
Laryngospasm – But what does it look like when it’s happening?

Initial treatment for Laryngospasm

Laryngospasm Treatment

02, suction oral cavity, pack site

Tongue forward, suction oral pharynx

Push, listen for “huff” – if not, mask

If still present – SUX, support respiration, monitor
Laryngospasm

PREVENTION
- Throat packs
- Effective suctioning
- Head position
- Careful titration

Respiratory Emergencies
- Airway obstruction
- Laryngospasm
- Bronchospasm

Bronchospasm - Pathophysiology

Generalized contraction of smooth muscles of the bronchioles

Constriction of the bronchioles due to asthma, an allergic reaction or chemical irritation

Results in restriction of air flow to and from the lungs
Bronchospasm - Diagnosis

- Skin and mucous membranes - cyanosis
- Wheezing
- Labored breathing, difficulty with expiration
- ↑O₂, ↑CO₂
- ↑ resistence to ventilation
- ↓O₂ Saturation

Bronchospasm Treatment

- Beta 2 Drugs
  - Albuterol
  - Epinephrine

- Constricted Bronchiole
- And, positive pressure O₂
- Bronchodilation

For the awake patient – the spacing chamber...

- When the inhaler is activated the mist fills the spacing chamber.
- Now the patient inhales deeply. And the mist “cloud” is inhaled into the tracheobronchial
Bronchospasm

PREVENTION:
• Keep a dry field
• Pre-operative inhaler puffs
• Avoid histamine releasing drugs (Demerol®)
• Careful with Brevital®

Respiratory Emergencies

• Airway obstruction
• Laryngospasm
• Bronchospasm
• Emesis / Aspiration

Clinical Scenario

• A 23 year old male presents to your office. He has been in severe pain and has been taking oxycodone/acetaminophen and ibuprofen but nothing seems to help. He says he does not feel well and vomits. He then starts to cough and wheeze.
• What is happening to this patient?
Answer: Emesis with possible aspiration

Emesis and Aspiration

DEFINITION
- Vomiting when the patient has depressed or absent laryngeal reflexes which may allow stomach contents to enter the lungs.

Emesis and Aspiration Pathophysiology

Acidic stomach contents digest the walls of the alveoli.
Emesis and Aspiration

**SIGNS AND SYMPTOMS:**
- Retching
- Large amounts of fluid in throat
- Gurgling sounds
- Signs of airway obstruction
- Wheezing

Emesis and Aspiration Diagnosis

Skin and mucous membranes cyanosis
Pre-tracheal Stethoscope gurgling / abdomen heaving
Tachycardia

Large amounts of fluid in throat
Dyspnea (difficulty breathing)
Rales (bubbling sound)

Emesis and Aspiration - Treatment

Trendelenburg, head to right, finger sweeps
Suction, O₂, auscultate, check O₂ sat
Magill forceps
Visualize with laryngoscope and remove large particles with Magill forceps
Suction
Intubate
To hospital!!!
Management of Emesis to Prevent Aspiration

Tip patient back into the Trendelenburg position

Management of Emesis to Prevent Aspiration – Rolling the Patient

Do Roll Patient On Their Right Side
Do Not Roll Patient On Their Left Side

Prevention of Emesis with Aspiration

- Standards of the American Society of Anesthesiologist (ASA)
- Solid foods – 6 hours before
- Clear liquids – 2 hours before
- Many surgeons prefer patient to be NPO (nothing by mouth) for 8 hours
Gastric Emptying

- Normal emptying time
  - 30-90 minutes
- Emptying time can be prolonged:
  - Apprehension
  - Pain
  - Opiate analgesics
  - Sedatives

Aspiration

- Preoperative normal X-ray
  - Note definition of ribs and lacy radiodensity pattern in lungs.
- Aspiration pneumonia
  - Note loss of definition of ribs and increased radiodensity in lungs.

Respiratory Emergencies

- Airway obstruction
- Laryngospasm
- Bronchospasm
- Emesis / Aspiration
- Hyperventilation
Clinical Scenario

• A 27 year old male presents to your office for a procedure. Previously he had a bad experience at another office. He is extremely anxious when he goes to the doctor. As you prepare him for his treatment, you notice he appears very nervous and begins breathing fast. He says he cannot breathe and he is unable to slow his rapid rate of breathing. Pulse 114, BP 130/88

• Respiratory Rate 28

• What is happening to this patient?

Answer:
Hyperventilation

Hyperventilation

DEFINITION:
Increased minute volume ventilation which results in a lowered carbon dioxide level.
Hyperventilation - Pathophysiology

- Blood CO2 ↓
- Cerebral Vasconstriction (light headedness)
- Muscle twitching and spasm

Hyperventilation - Diagnosis

- Anxiety
- Impaired consciousness
- Tachycardia
- Rapid breathing
- Tingling and muscle spasm
- Chest pain

ADRENALIN RUSH
Hyperventilation - Treatment

Build up CO₂ in the alveoli

Hyperventilation - Treatment

O₂ at 5 liters per minute

Respiratory Emergencies

- Airway obstruction
- Respiratory depression/arrest
- Laryngospasm
- Bronchospasm
- Emesis / Aspiration
- Hyperventilation
- Respiratory Depression/Arrest
Respiratory Depression

DEFINITION:
A decrease in the normal breathing rates and/or volumes
The many possible causes include:
• Narcotics
• Sedative drugs
• Muscle relaxants
• Hyperventilation
• Seizures

Respiratory Depression Diagnosis

Loss of Consciousness
Mental clouding, drowsiness

Skin : pallor, and ultimately cyanosis

↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓→

Respiratory Depression - Treatment

CAB’s of CPR
Circulation
Airway
Breathing
Defibrillation

Patient not breathing – positive pressure \( O_2 \)

Tongue closes off throat
Head tilt chin lift
Nasopharyngeal airway
Oropharyngeal airway

Attempt to determine cause and consider administration of Naloxone or Romazicon if depression due to narcotics or benzodiazipines.
Narcotic Overdose

**REVERSAL OF NARCOTICS:**
- Narcan® (naloxone) 0.4-2mg IV
- Repeat at 2-3 minute intervals, not to exceed 10mg
- IM or SubQ can be used if IV not available
- Observe for re-sedation

Benzodiazepine Overdose

**REVERSAL OF BENZODIAZEPINES:**
- Flumazenil® (Romazicon) 0.2mg IV initially
- Then 0.1mg/minute up to 1mg
- Observe for re-sedation

Clinical Scenario

- 16 yo male, mild ADHD on no medications, history of mild asthma that was seasonal and occasional use of albuterol inhaler. Larger child, weight 180lbs with BMI >30. Referred for removal of 3rds and IV/GA.
- On auscultation had normal lung and heart sounds. Tonsils, MP, TM distance were normal.
- IV started without difficulties
- Versed titrated 4mg, Fentanyl 50mcg, Ketamine 30mcg, Propofol titrated throughout procedure 50mg.
Clinical Scenario

- 15 mins into the procedure
- Apnea, O2 saturation dropping, EtCO2 not reading.
- Double check monitor and sensors.
- Suspected laryngospasm.
- Suctioned and repositioned.
- No improvement in O2 saturation or EtCO2.
- BVM started.
- O2 saturation improved to 90%.
- That remained difficult to bag.
- Albuterol was given, O2 saturation improved.
- Reversed narcotics and benzodiazepines.
- O2 saturation improved to 96-97% and was spontaneous breathing.
- Epinephrine was on standby.
- Procedure was terminated and patient was sent home.
- Procedure was completed 6 weeks later without incidence.