



We know children.

Respiratory Management in Pediatrics

Children's Hospital Omaha Critical Care Transport

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Objectives

- Examine the differences between the pediatric and adults airways.
- Recognize respiratory distress and impending respiratory failure.
- Discuss management of respiratory distress and respiratory failure.
- Case Scenarios.

Children are not small adults...

Children are still growing in every way.

Their bodies are different, they perceive things and communicate differently, and the long term implications of treatment are not the same.



Respiratory Emergencies

Pediatric Respiratory Emergencies

- # 1 reason for pediatric hospital admissions.
- # 1 cause of death during the first year of life with the exception of congenital abnormalities.

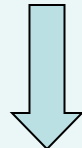


Early Intervention is Critical

Respiratory Distress



Respiratory Failure/Shock

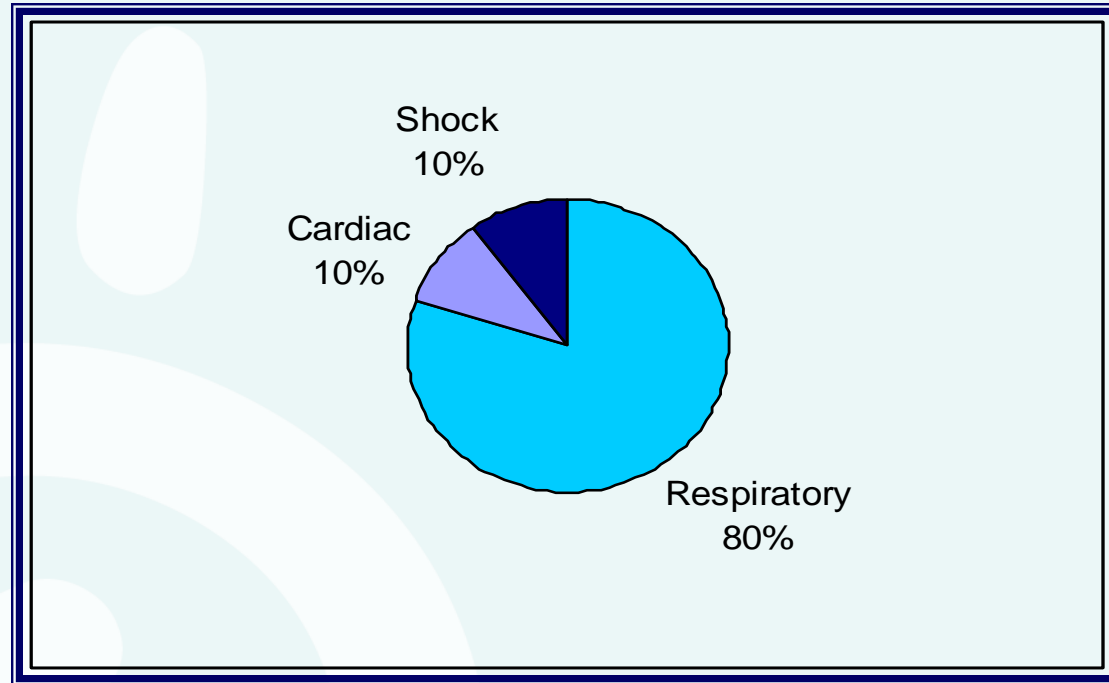


Cardiopulmonary Failure



Cardiopulmonary Arrest

Pediatric Cardiopulmonary Arrests



Most pediatric cardiopulmonary arrests begin as respiratory failure or respiratory arrest.

Decrease respiratory reserve + Increased O₂ demand =
Increased respiratory failure risk

Respiratory Emergencies in Pediatrics

@ Airway Diseases

- Croup, epiglottitis, asthma, bronchiolitis, foreign body aspiration, bronchopulmonary dysplasia.

@ Lung Tissue Diseases

- pneumonia, ARDS, aspiration, pulmonary contusion

@ Non-respiratory causes

- CNS depression, musculoskeletal disorders, thoracic disorders or injuries, shock

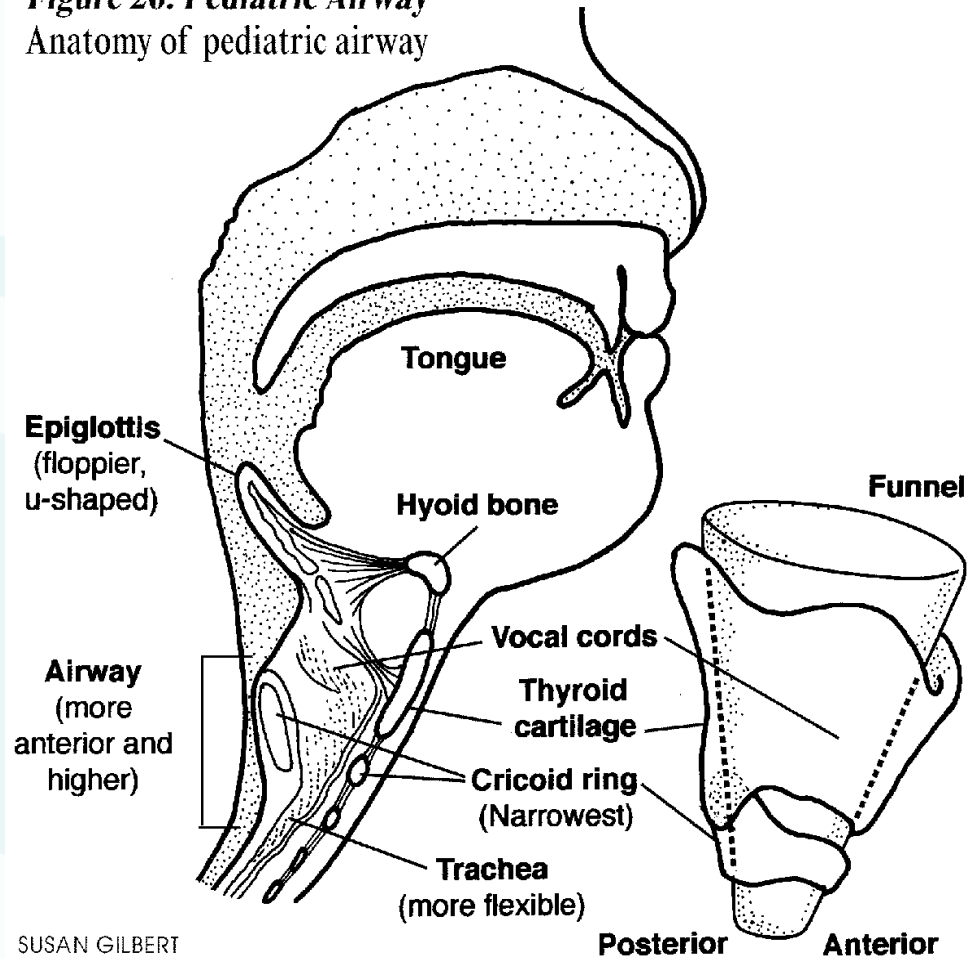
Why are children more vulnerable?

- Obligate nose breathers until 6 months
- Large tongue
- Lymphoid tissue achieves adult size at 2
- Large, anterior epiglottis
- Narrow subglottic region
- Fewer alveoli
- Smaller airways: Hagen-Poiseuille's Law
- Decreased cartilage in airways
- Increased chest wall compliance
- Increased metabolic rate, increased O₂ consumption
 - *© Typical oxygen consumption 6-8 ml/kg/min in a child vs. 3-4 ml/kg/min in adult*



Pediatric Airway

Figure 26: Pediatric Airway
Anatomy of pediatric airway



SUSAN GILBERT

Airway Resistance

Full Term Newborn Airway

1mm of edema, the diameter will be 44% of normal.

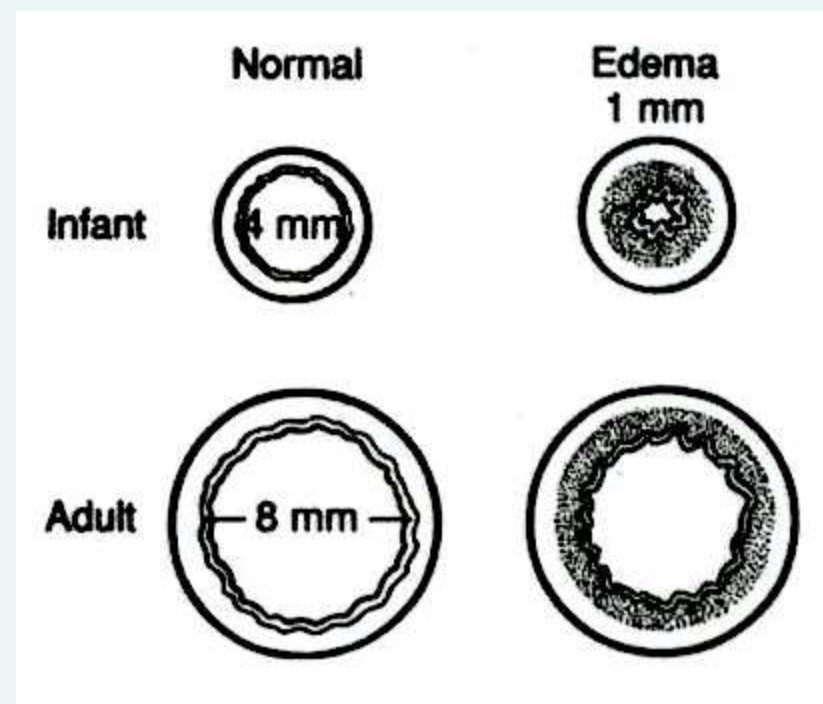
Adult Airway

1mm of edema, the diameter will be 81% of normal.

Ⓢ Poiseuille's law

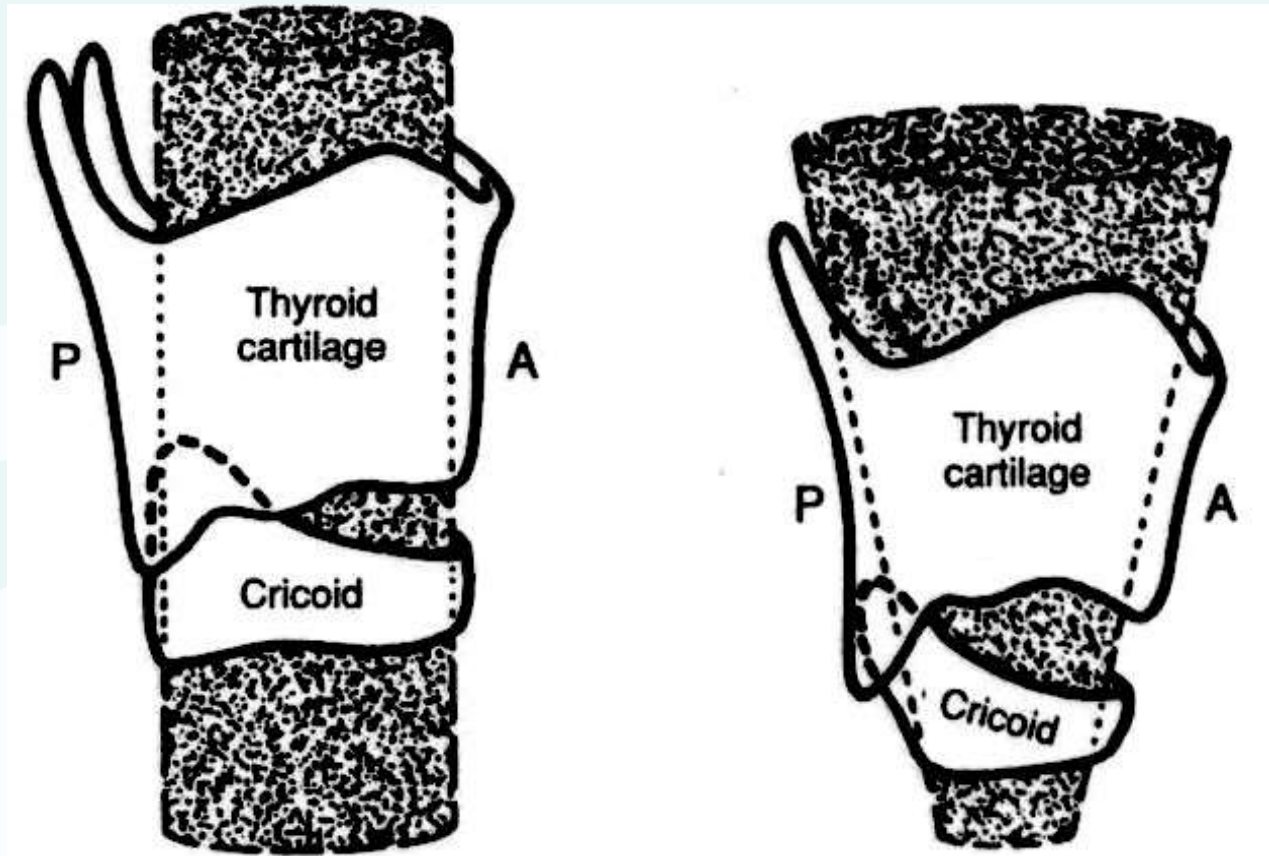
If radius is halved, resistance increases 16fold

Resistance increases 3x in an adult and 16x in an infant.



$$R = \frac{8 n l}{\pi r^4}$$

Adult Airway VS. Pediatric Airway



Adult

Pediatric

The Licorice Airway...

- Please bite a small piece off to top and bottom of your licorice. We will now perform a test on your airway.
 - Breath in and out of the licorice for 30 seconds.



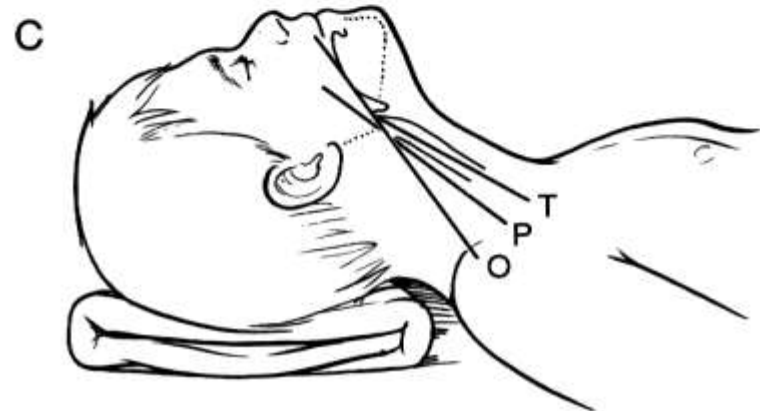
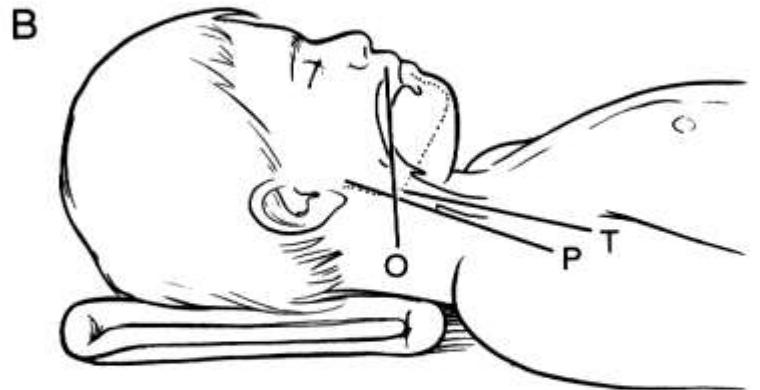
Airway Management



Position

Position

Position



Airway Positioning

**“Sniffing Position”
In the child older than 2 years**

Towel is placed under the head

Airway Position - Children



Airway Position - Children <2yrs



Pediatric Respiratory Management

Airway

Breathing

Circulation

“Without an “A” you will not get a “B”.

Airway Management

- **“A” Open it correctly!**
- Position the patient in the neutral, supine position.
- Use the head tilt, chin lift to open the airway and place the patient in a “sniffing” position. Use a shoulder roll.
- If you can not open the airway: Reposition!
- Clear the airway by suctioning any secretions within the mouth or nose.

Airway Assessment

OPEN and CLEAR

Able to Maintain

Unable to Maintain

Maintaining the Pediatric Airway

- Nasal Airway
- Oral Airway
- Bag Masking
- Intubation

Foreign Bodies

- ALWAYS consider a foreign body as a cause of Respiratory Distress.
- Usually will have a SUDDEN onset.



Signs of Respiratory Distress

- Tachypnea
- Tachycardia
- Grunting
- Stridor
- Head bobbing
- Flaring
- Inability to lie down
- Agitation
- Retractions
- Accessory muscles
- Wheezing
- Sweating
- Prolonged expiration
- Apnea
- Cyanosis

Signs of Impending Respiratory Failure

- Reduced air entry
- Severe work
- Irregular breathing or apnea
- Cyanosis despite Oxygen delivery
- Altered Level of Consciousness
- Diaphoresis

Respiratory Failure

- Respiratory Failure is the inability of the airway and lungs to meet the metabolic demands of the body.

Hypoxic Respiratory Failure

Inadequate oxygenation

Can't Get Oxygen in

Hypercarbic Respiratory Failure

Inadequate ventilation

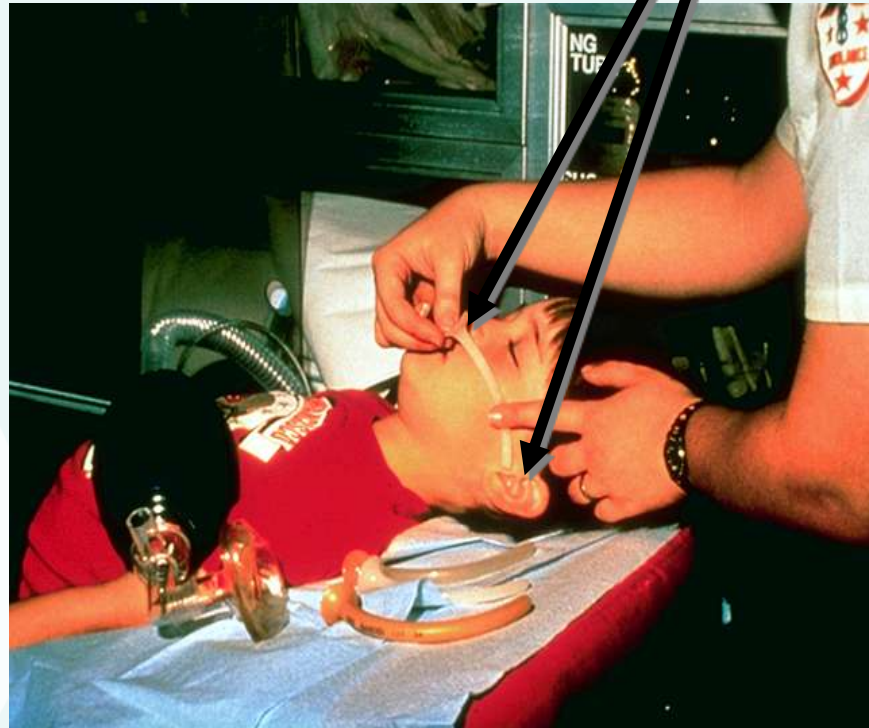
Can't Get CO₂ out

Nasopharyngeal Airway

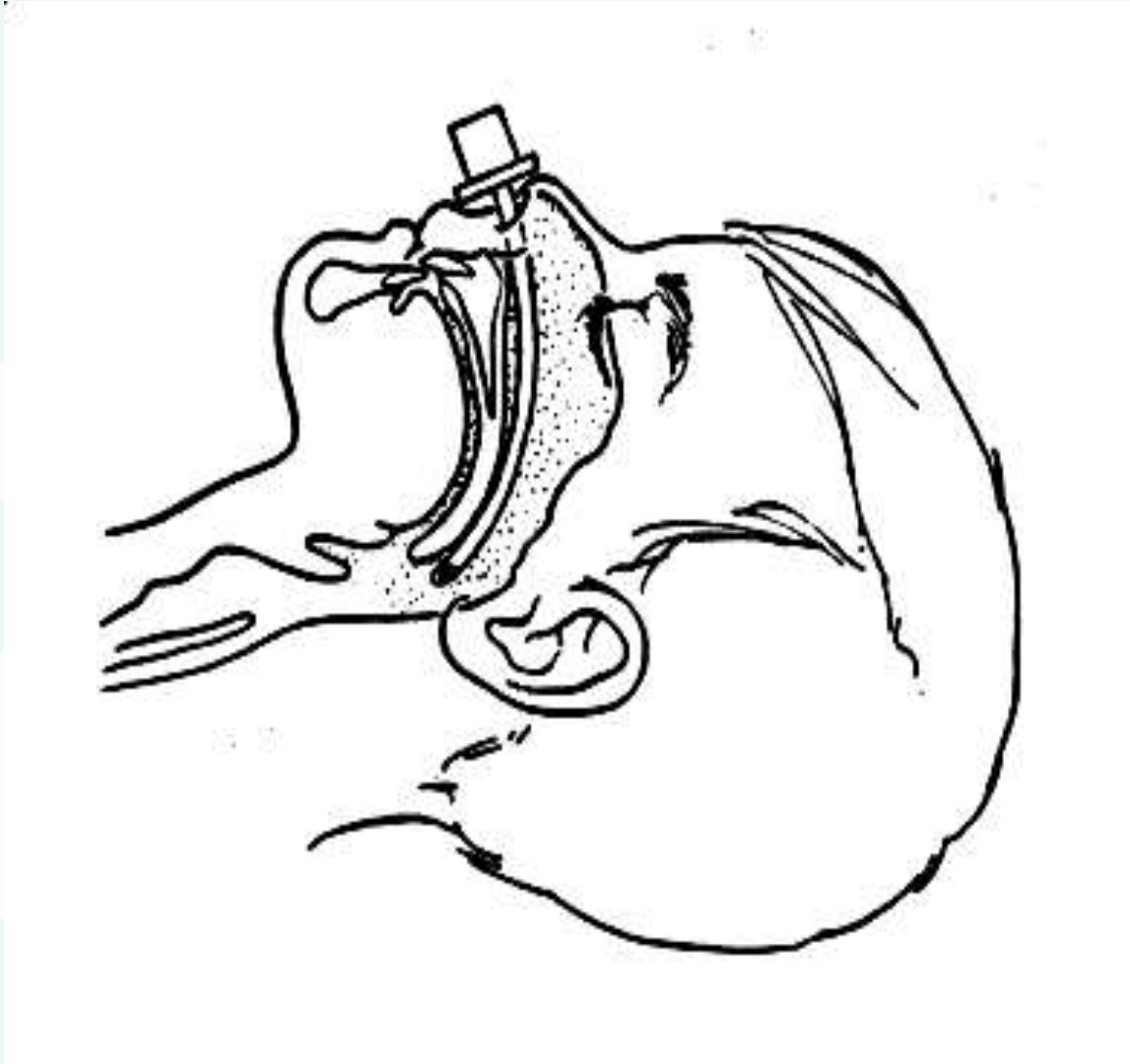
Length: Nostril to Tragus

Contraindications:

- **Basilar skull fracture**
- **CSF leak**
- **Coagulopathy**



Endotracheal tube as nasal airway



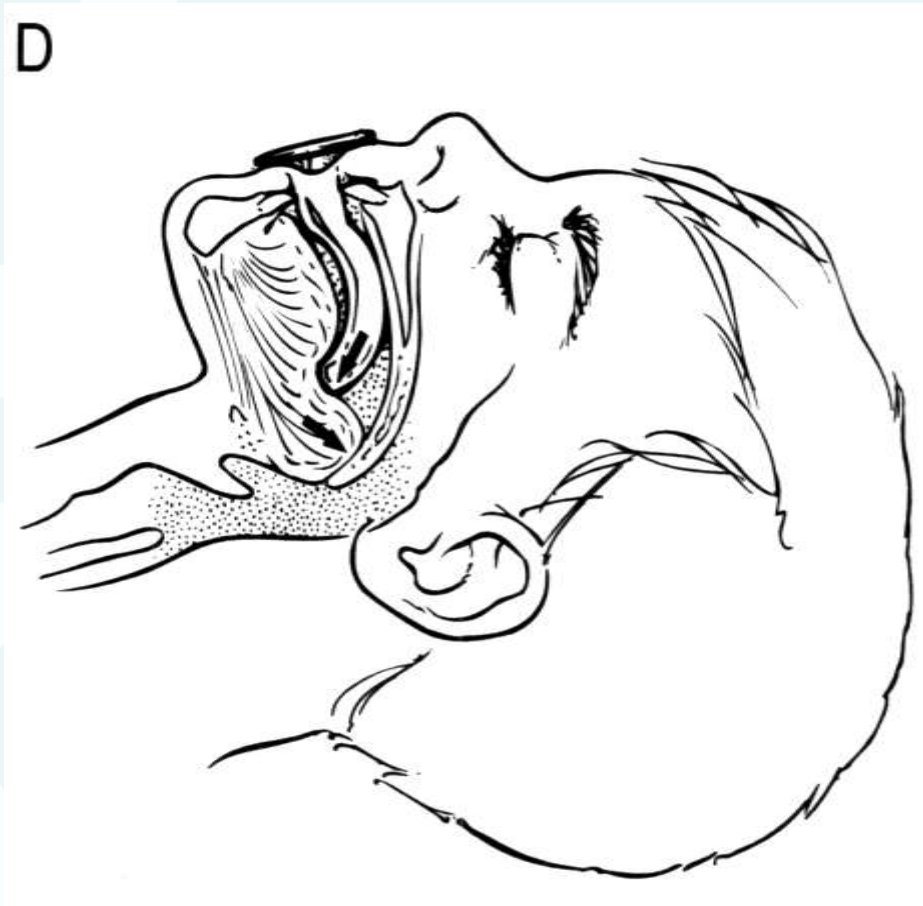
A regular ETT
can be cut and
used as a
nasal airway

Adjuncts: Oral Airway



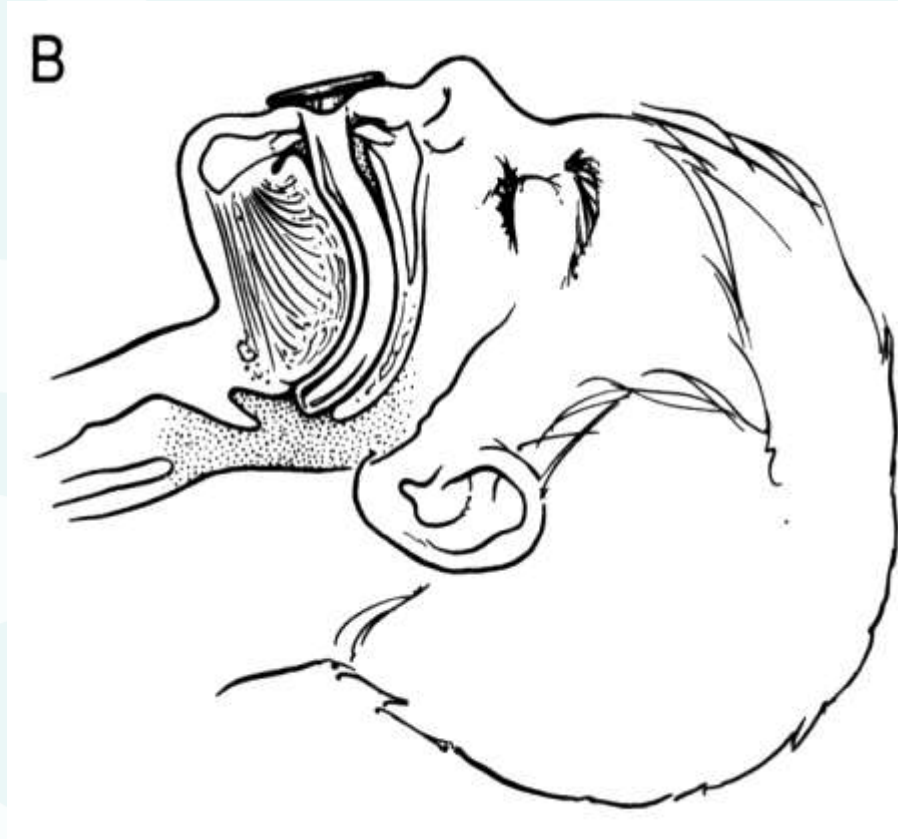
Wrong size: Too Long

Adjuncts: Oral Airway



Wrong size: Too Short

Adjuncts: Oral Airway



Correct size

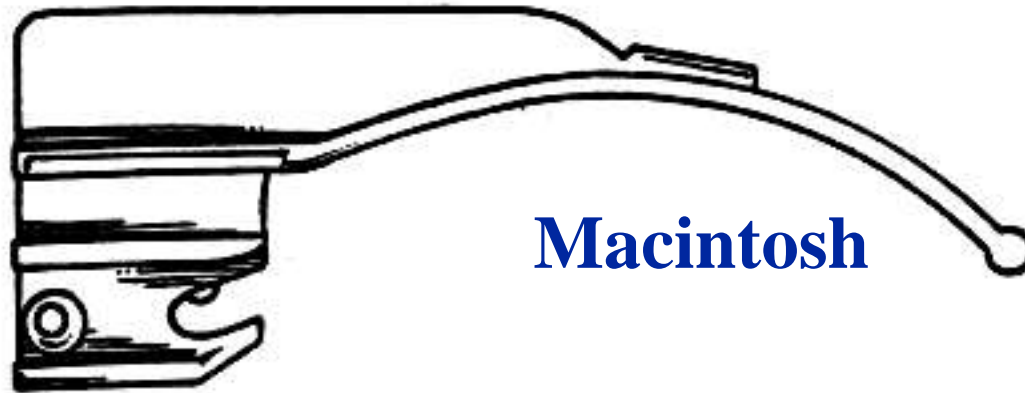
Bag Mask Ventilation



Intubation: Indications

- Failure to oxygenate
- Failure to remove CO₂
- Increased WOB
- Cardiovascular failure
- Neuromuscular weakness
- CNS failure

Laryngoscope Blades



Macintosh



Miller

Airway



**Pediatric Airway
with inflammation**

- Open?
- Able to maintain?
- Position and Assess?
- Bag/Mask?
- Intubation?

A Closer Look Normal Pediatric Airway



A Closer Look Abnormal Pediatric Airway







ET Tube Sizing

Age	kg	ETT	Length (lip)
Newborn	3.5	3.5	9
3 mos	6.0	3.5	10
1 yr	10	4.0	11
2 yrs	12	4.5	12

Children > 2 years:

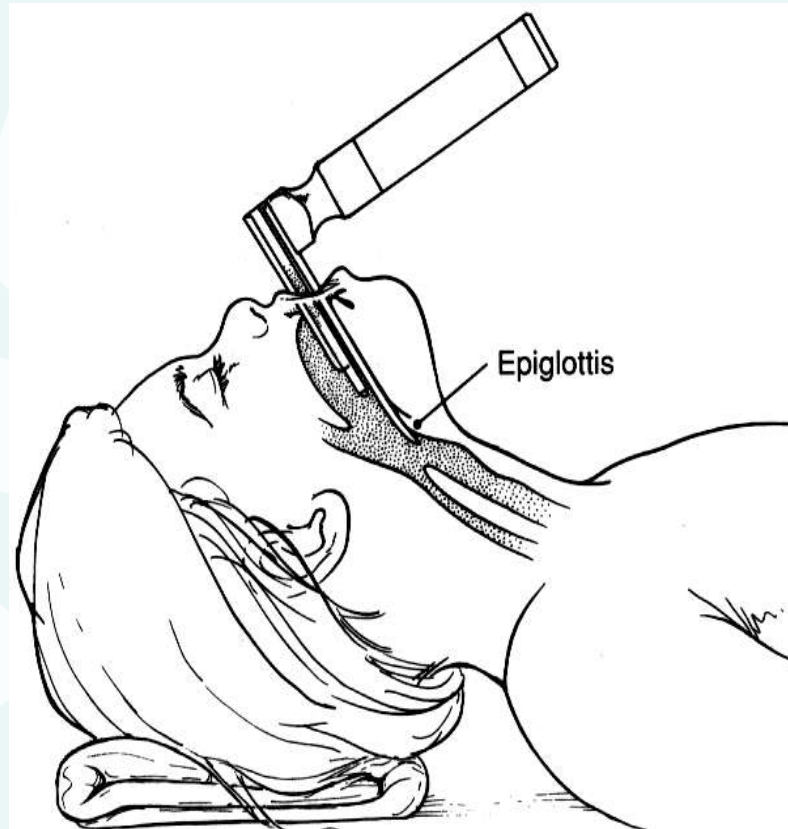
ETT size:

(Age +16)/4

ETT depth (lip):

Length of tube x 3 (Approximately)

Intubation Technique



**Better in
younger children
with a floppy
epiglottis**

**Straight Laryngoscope Blade – used to
pick up the epiglottis**

Rapid Sequence Intubation

- When: Intubation is emergent and there is concern for aspiration
- Why: Obtain airway control rapidly and minimize aspiration risk
- How:
 - All necessary intubation equipment and personnel
 - Preoxygenate
 - Rapidly acting sedative, analgesic and neuromuscular blocking agent are administered simultaneously

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Deterioration after Intubation

- **D**isplaced tube
- **O**bstructed tube
- **P**neumothorax
- **E**quipment

Respiratory Case Scenarios

Let's manage some
patients together...



Case scenario 1

- 3 month old is admitted to the hospital with a runny nose, poor appetite, and frequent coughing.

Classify patient

Scenario 1 Assessment



Scenario 1 Assessment

Vitals

H.R. = 136

R.R. = 60

WOB = Intercostal and subcostal retractions

B.S. = Noisy breathing (crackles and wheezing)

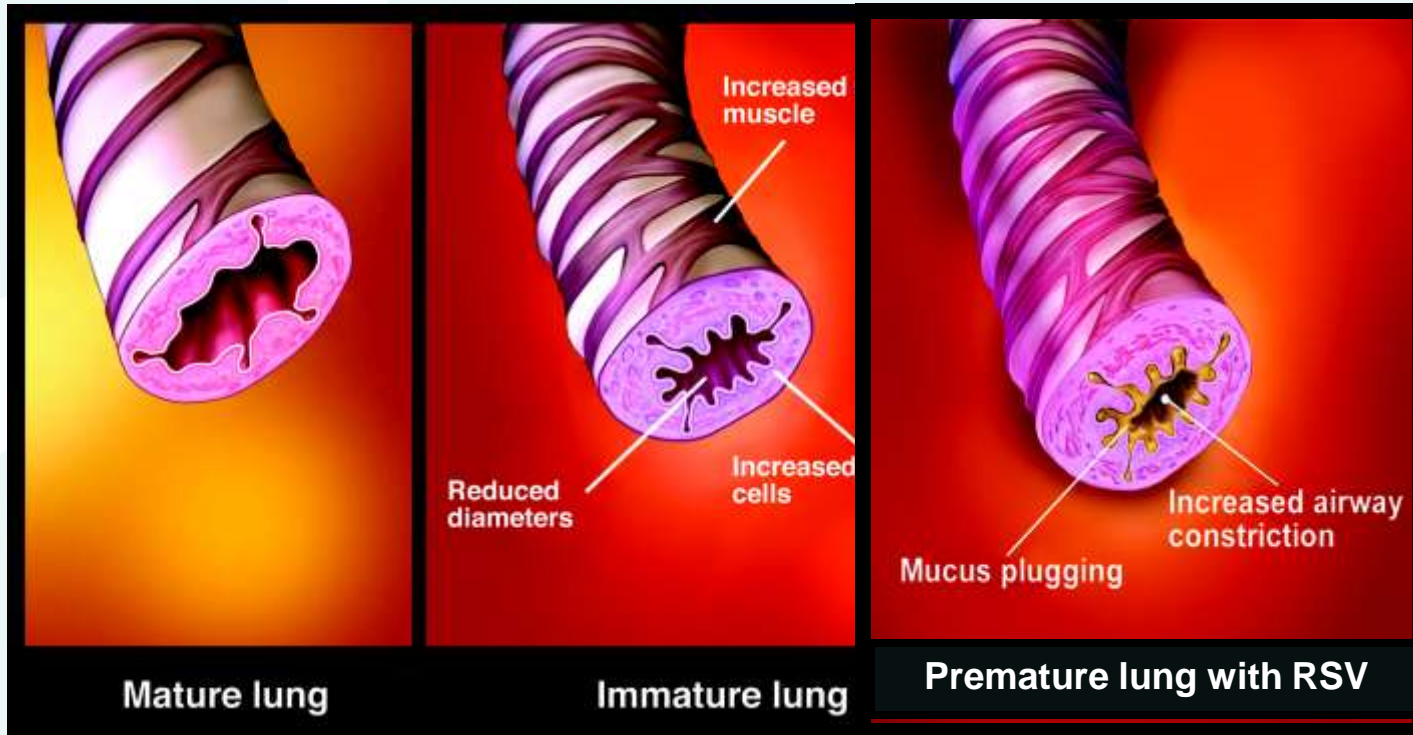
SpO₂ on Room Air = 88%

Diagnosis

Respiratory Syncytial Virus (RSV)

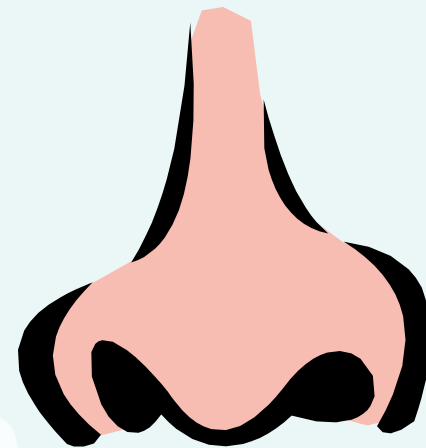
- RSV is a very common virus that infects half the children during their first year of life.
- Symptoms include wheezing, nasal congestion, rapid breathing, cough, irritability, retractions, poor feeding, sluggishness, and fever.
- Synagis is given as a prophylactic treatment to children with the highest risk for severe RSV.

RSV in the Airway



Scenario 1 Treatment

- “A” Airway Management
 - Secretion Management
 - * Suction before all feeds.
- “B” Breathing
 - Oxygen Therapy
- “C” Circulation
 - Hydration
- Treat symptoms
- Prophylaxis (Synagis)



SUCTION

The Nose

- Nose is responsible for 50% of total airway resistance at all ages



© ***Infant: blockage of nose = respiratory distress***

Case Scenario 2

- A 2 year old patient is admitted to the ED with lethargy, poor appetite for 3 days, fever, increasing respiratory distress.

Classify Patient

Scenario 2 Assessment



Case Scenario 2

Vitals

H.R. = 172

R.R. = 58

WOB = substernal retractions

B.S. = rales, diminished bases

SpO₂ on Room Air = 80%

Diagnosis

Scenario 2 Treatment

- “A” Airway Management
 - Position child to Open Airway
 - Clear Airway
- “B” Breathing
 - Oxygen Therapy
- “C” Circulation
 - Hydration

Case Scenario 2

- 30 minutes later:

Vitals

H.R. = 186

R.R. = 66

WOB = substernal and intercostal retractions

B.S. = diminished

SpO₂ on 10 liter O₂ mask = 90%

X-ray = hyperinflation, right lower lobe atelectasis

Cap gas results:

pH = 7.26, CO₂ = 75, O₂ = 53

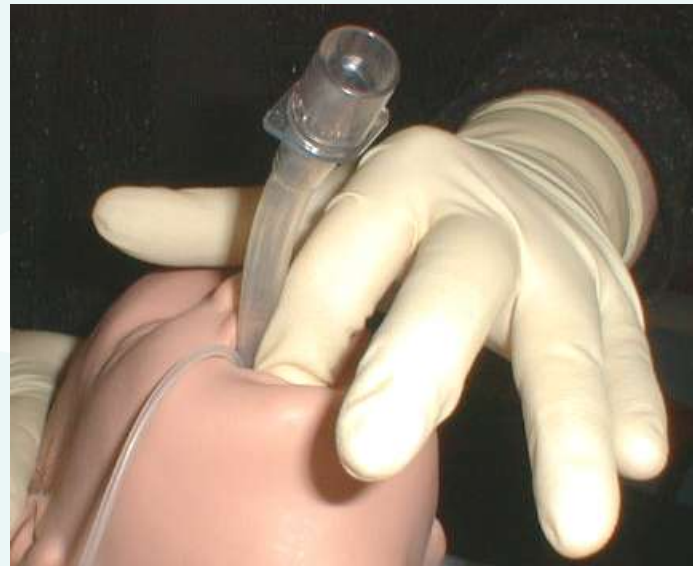
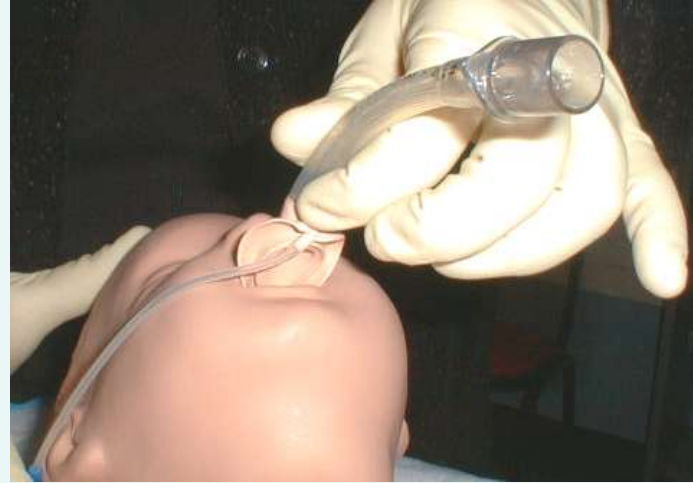
Case Scenario 2

- Chest X-ray



What is plan B?

Laryngeal
Mask
Airway



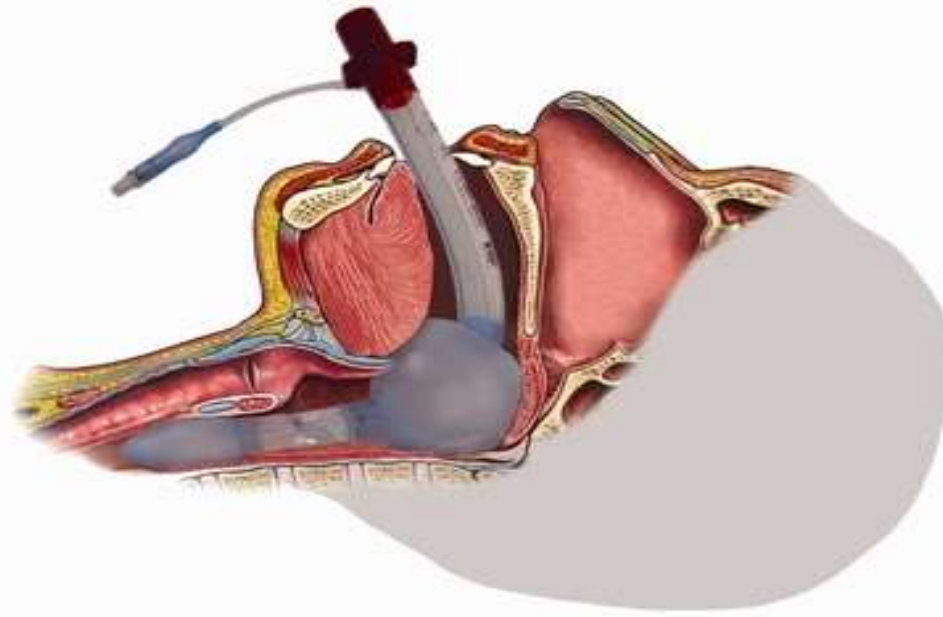
Needle Cricothyrotomy

- A “quick” fix, buys some time...
- Used when you can't intubate or ventilate...



King Airway

- Backup Airway...
- Inserted Blind....



Case Scenario 3

- 7 year old child is brought to the Emergency Department with a chief complaint of SOB.

Classify

Case Scenario 3

Vitals

H.R. = 132

R.R. = 28

WOB = substernal and intercostal retractions

B.S. = decreased

SpO₂ on Room Air = 87%

Diagnosis

Asthma Statistics

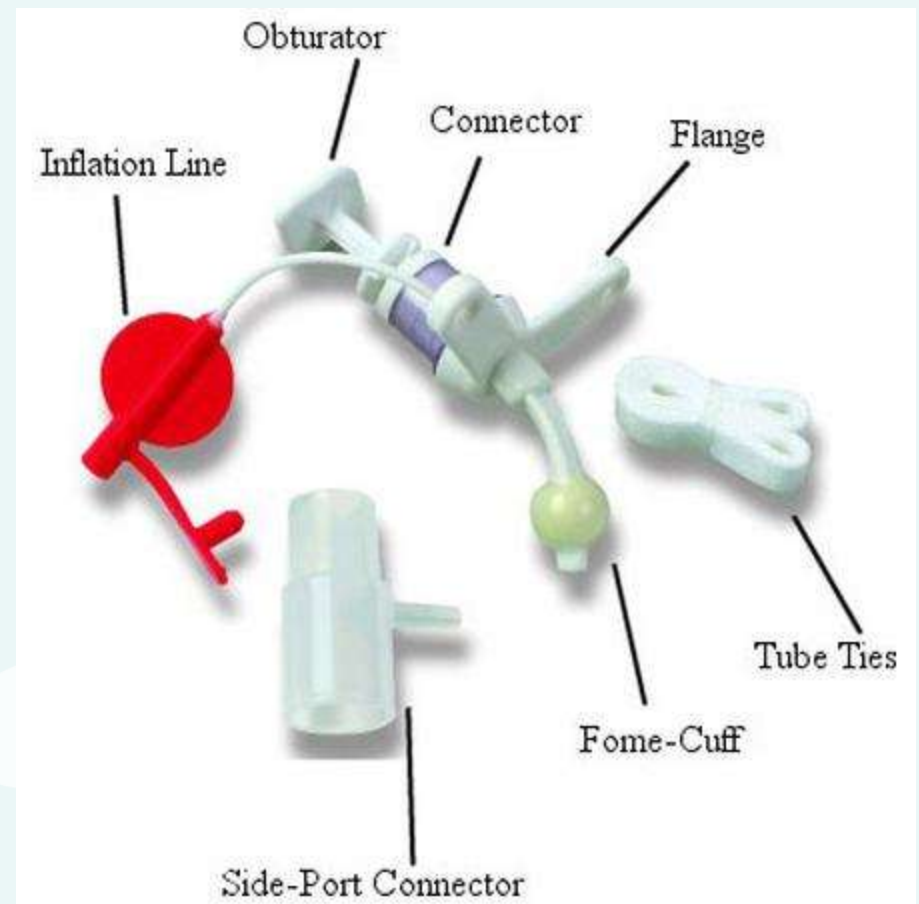
- 23 million Americans currently have Asthma.
- *Number of children who currently have Asthma: 7.0 million.*
- Students with Asthma miss nearly 13 million school days every year due to illness.

Scenario 3 Treatment

- “A” Airway Management
 - Oxygen
 - Sitting Position, Position of Comfort
- “B” Breathing
 - Albuterol 0.5 ml and more bronchodilators
 - Steroids
 - Encourage Coughing
- “C” Circulation
 - Hydration

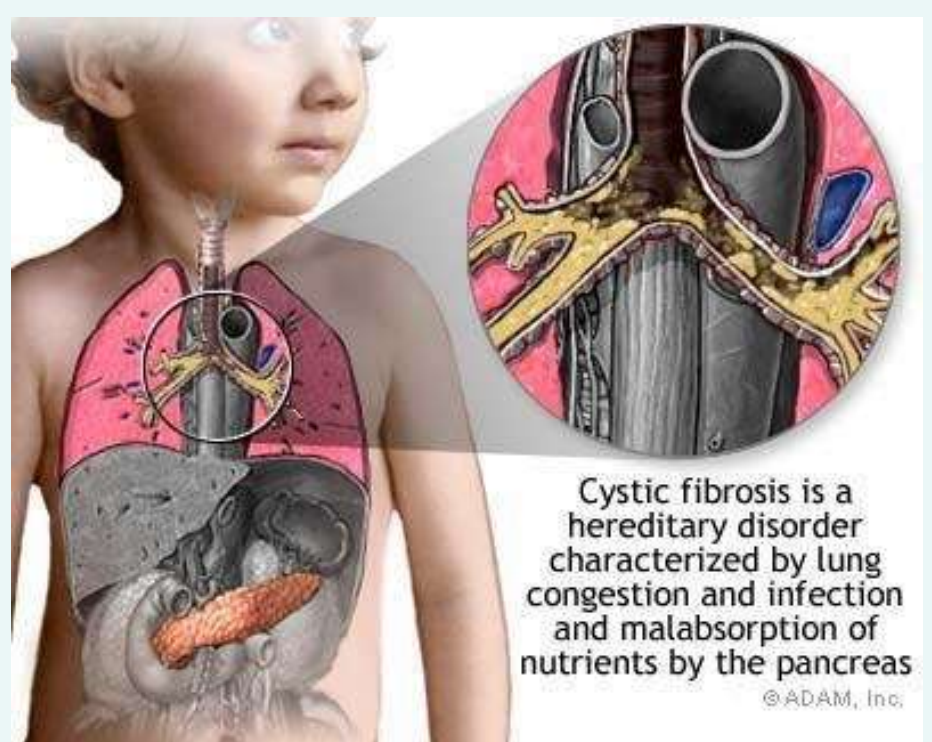
Special Populations

- Tracheotomies
 - Stay “CALM”!!



Special Populations

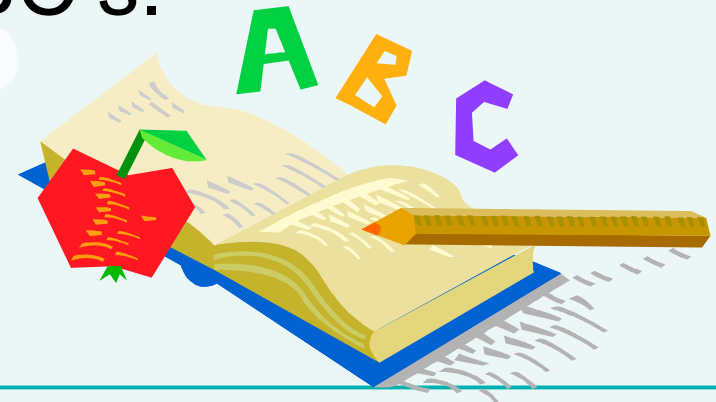
- Cystic Fibrosis
 - SUCTION, Position of Comfort, Cough
 - SUCTION
 - SUCTION



It is all about the ABC's...

- Airway
- Breathing
- Circulation

Recognize the signs of respiratory distress and use your ABC's.



Questions?

We know children.



Thank You!!!

