


Arkansas Children's Northwest
UAMS
 University of Arkansas for Medical Sciences

Management of Chronic Respiratory Failure
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Conflict of Interest

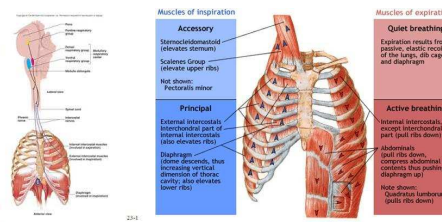
None



How do we Breathe?

Respiratory Areas in the Brainstem

- Medullary respiratory center**
 - Dorsal groups stimulate the diaphragm
 - Ventral groups stimulate the intercostal and abdominal muscles
 - This section is especially sensitive during infancy, and the section can be destroyed if the infant is dropped and/or shaken violently. The result can be death due to "shaken baby syndrome"
- Pontine (pneumotaxic) respiratory group**
 - Involved with switching between inspiration and expiration (one time the breathing system—there is a connection with medullary resp. center for precise function unknown)



Muscles of inspiration

Accessory

- Sternocleidomastoid (elevates sternum)
- Scalenes Group (elevate upper ribs)
- High shown: Pectoralis minor

Principal

- External Intercostals (lateral part of internal intercostals also elevates ribs)
- Diaphragm (flattens downward, thus increasing vertical diameter of thoracic cavity; also elevates lower ribs)

Muscles of expiration

Quiet breathing


Expiration results from passive elastic recoil of the lungs, rib cage and diaphragm

Active breathing

Internal intercostals, external intercostal part (pull ribs down)

Abdominals (and rib descent) contracts (pushes out) (pushing diaphragm up)


High shown: Quadratus lumborum (pulls ribs down)






Causes...

- Central Respiratory Control
 - Congenital Central Hypoventilation Syndrome
 - Spinal cord Injury
- Neuromuscular Disease
 - Muscular Dystrophy
- Other
 - Pulmonary Hypertension
- Chronic Lung Disease
 - Bronchopulmonary Dysplasia
 - Airway Malacia
- Advance Lung Disease
 - Cystic Fibrosis
- Neurodegenerative Disease
 - Mitochondrial Disorders

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Acute on Chronic Respiratory Failure

- Blunted Respiratory Control
 - Anesthesia, Sedatives, Opiates
- Reduced Ventilatory Muscle Power
 - Surgery, Electrolyte disturbance, Dehydration
- Upper and Lower Respiratory tract Infections
 - Changes upper and lower airway mechanics

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Goals of Chronic Ventilatory support

- Improve pulmonary gas exchange
- Reverse hypoxemia
- Relieve chronic respiratory acidosis
- Optimize patient work of breathing
- Provide airway protection
- Decrease oxygen cost of breathing
- Reverse respiratory muscle fatigue
- Permit lung and airway healing
- Minimize ventilator--induced lung injury




We Need Technology That..

- Provides safe and reliable ventilatory support
- Provides adequate gas exchange
- Maintains optimal Lung Mechanics

While expecting minimal need for adjusting settings and for troubleshooting...




And... is Portable





Modes of Ventilation

VENTILATOR MODE	INITIATED	LIMITED	CYCLED
VC	Time	Volume	Volume/time
PC	Time	Pressure	Time
SIMV	Time/pressure/flow	Volume	Volume/time



Approaches

- Non-Invasive Positive Ventilation
 - BIPAP
 - Mechanical Ventilation via mask
- Invasive Positive Ventilation
 - Mechanical Ventilation via tracheostomy



BIPAP

Spontaneous Time (ST) mode



BIPAP

Positives


- Portable One Circuit
- O2 and Humidification can be added
- Bronchodilator can be added
- Minimal training



BIPAP


Negatives

- Interface/skin breakdowns
- Back-up tubing not usually covered if needing replacement before 6 months
- Electrical power only
- Alarm




BIPAP

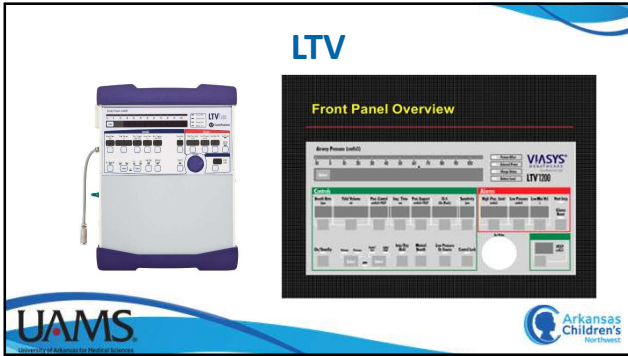
- Central Respiratory Control Disorders
 - Chiari Malformation on adolescent patient w PSG showing ETCO2 of 50 mm >40% of sleep time
- Neuromuscular Disease
 - Duchenne’s with Mild CO2 retention and SVC>65% predicted



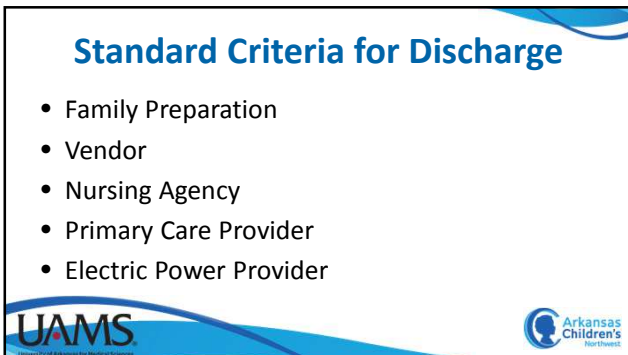
BIPAP

- Chronic Lung Disease
 - CF with Hypoxemia and PCO2 of 50 mmHg
- Neurodegenerative Disease
 - Combination Chronic bronchitis/Restrictive lung disease in a patient with bulbar dysfunction and epilepsy









Cost

- BiPAP: \$1,200-2,000
- Humidifier: \$80-150
- Interface: \$75-200
- Portable Ventilators: \$12,000
- Tracheostomy tubes: \$50-1000
- Suction Machine: \$250-300
- Pulse Oximetry rental: \$300/month or \$1,500 for purchase
- Home Nursing



Future Vents

Multifunction-Ventilator

- Ventilator
- Cough Assist
- Suction
- Nebulizer





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