



Respiratory Problems

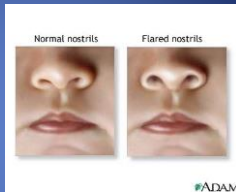
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Goals and Objectives

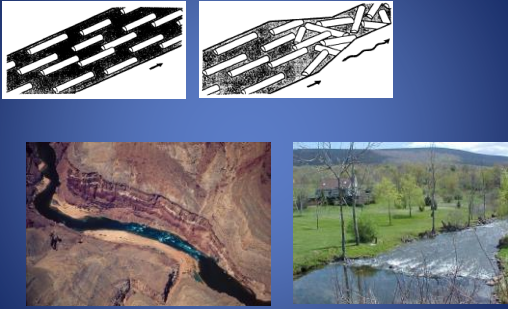
- Fill an hour with useless information.
- Avoid finishing early so there is no time for questions.
- Have enough money in my retirement plan so that in five years I can quit AMC and work part time at the LL Bean store.
- Go fly fishing in New Zealand.

General Symptoms of Respiratory Failure or Distress

- Grunting
- Flaring
- Retracting



Stridor (turbulent flow)



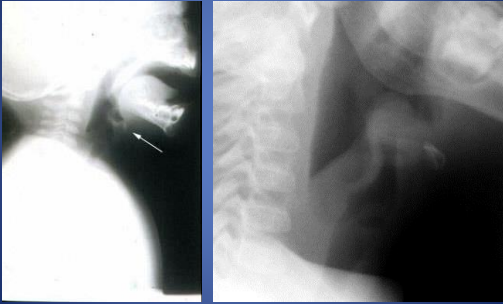
Stridor

- Turbulent air flow in a narrowed upper or lower airway
- Sign of partial airway obstruction (most common cause is the tongue)
- May be inspiratory, expiratory, or both
- May be chronic or acute
- Can cause very impressive retractions

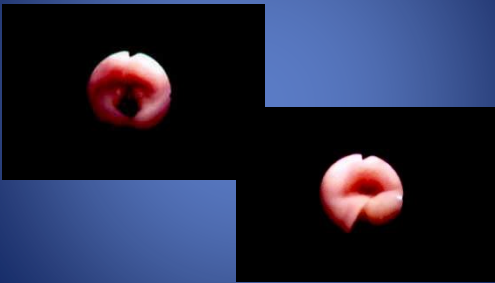
Stridor (retropharyngeal abscess)



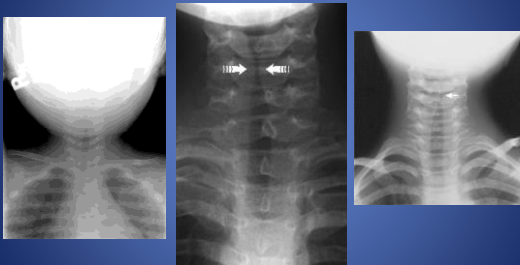
Stridor (epiglottitis)



Stridor (laryngomalacia)



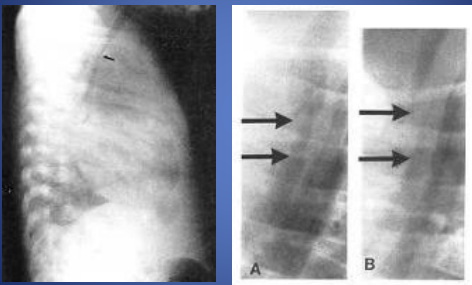
Stridor (croup)



Stridor (tracheomalacia)



Stridor (tracheomalacia)

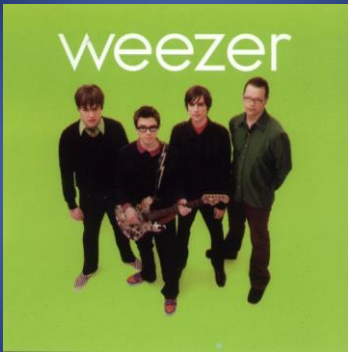


Stridor (bacterial tracheitis)

- At outset, similar to croup
- Secondary bacterial infection (mixed bacteria)
- High fever, child looks sick
- Diagnosis usually made at intubation
- Airway above the glottis is normal

Stridor Rx

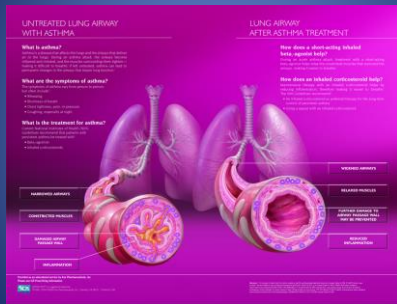
- Keep the child CALM
- Racemic Epinephrine
- Heliox
- IV or PO steroids



Wheezing

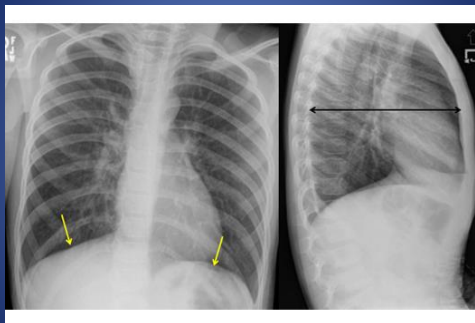
- Narrowing of small airway
- May be inspiratory, expiratory, or both
- May be chronic or acute
- Asthma in kids
- Bronchiolitis in infants

Asthma



Asthma

- Viral
- Allergic
- Exercise
- Cold air
- Seasonal
- Emotional
- Cardiac



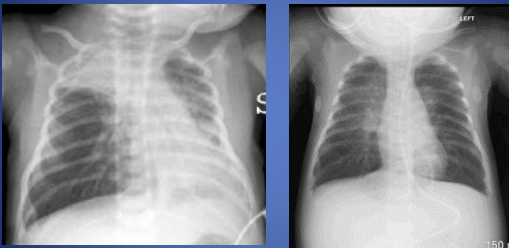
Asthma



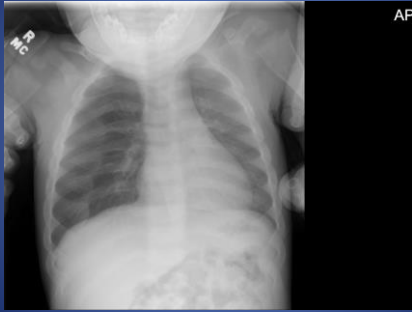
Asthma Rx

- Albuterol– and LOTS of it!
- Steroids– IV vs. PO
- Ipratropium
- Mg SO4
- Ketamine
- Terbutaline
- Endotracheal Intubation

Bronchiolitis



Peribronchial Cuffing



Causative Agents

- RSV
- Parainfluenza
- Adenovirus
- Influenza
- Metapneumovirus
- Rhinovirus
- Enterovirus

Virus! Virus!
"I've got the Virus!"

You have a lot of that these days! If you're one of the unlucky folks who has the kind of virus that causes a cold and leaves you with a hacking cough—like a respiratory virus—

The best way to get after a virus cough from a cold is to get after it with over-the-counter—usually over-the-counter—cough medicine. That medicine is **REM**.

SOOTHES IRRITATED THROAT
 REM is the only, non-steroidal, non-antibiotic preparation of an antitussive agent. It is scientifically formulated for a delicate purpose. REM is an expectorant medicine. It naturally loosens the chest mucus, making it easier to cough up. REM also soothes the throat, easing the coughing fits. Help loosen and expel germs that irritate the throat, ease the coughing fits, soothe the throat, and ease the coughing fits.

NEW WORKING THEORY
BRONCHIAL TUBES
 REM works down through the bronchial tubes for extra relief. It gets down

when a hacking cough causes so much discomfort. Don't take medicine because with an untamed, unrelenting cough or empty chest. Get after that cough from a virus with REM. For one really strong, REM has been the favorite medicine in millions of Americans' homes for cough and sore throats due to colds. REM contains an antitussive, drops, no irritation, soothing to sore throats. A good first choice as it is for adults. However REM—for soothing relief from cough caused by virus colds!

IMPORTANT: In case of high fever or persistent cough, consult a physician.

REM for coughs and sore throats from virus colds!

Copyright: Mylan Pharmaceuticals, Kansas, 1988



Seen mainly in fall and winter months, but.....



A Clinical Diagnosis

- URI symptoms
- Poor feeding
- Tachypnea, Flaring, Retractions
- Decreased SaO2
- Wheezing
- Apnea (sometimes, without wheezing)

Epidemiology

- 21% of North American infants develop lower respiratory tract illness
- 3% of all children in first year of life are hospitalized with bronchiolitis
- RSV causes about 80% of cases
- Hospitalization for kids <1yr with bronchiolitis has doubled in last 20 years (22% to 47%)

The Treatment Junkpile

- Syringes of Subcu Epi
- Vials of IV RSVIg
- Ampules of Interferon
- Boxes of Mist Tents
- Crates of SPAG units

Probably wasting time and money

- Inhaled furosemide
- DNase
- Antihistamines, decongestants, nasal vasoconstrictors
- Saline aerosols

Some say it works, some say it doesn't

- Albuterol
- Racemic Epi (2 studies show it improves clinical score, improves oxygenation)
- Steroids (3 of 7 studies showed longer term decreased wheezing and decreased need for asthma treatment)
- Ipratropium (1 of 3 studies showed better oxygenation and shorter hospitalization)

Why test for viruses?

- Positive in 26 to 95% of patients
- May eliminate the “sepsis workup”
- Diagnosis is unclear (if positive, may decrease the worry about pertussis)
- Identify cohorts for patient rooms
- Epidemiology
- Evaluation of therapies

Management

- Suctioning of oral and nasal secretions
- Chest PT (may or may not be helpful)
- Start O2 when SaO2 is consistently < 91
- Trial of albuterol
- Add racemic epi if no response to albuterol
- IV fluids, NPO
- Abx based on history, physical, CXR (serious bacterial infection is present in less than 2% of pts. 60 days or younger)
- AAP Recommendations: Oxygen and Fluids

Discharge

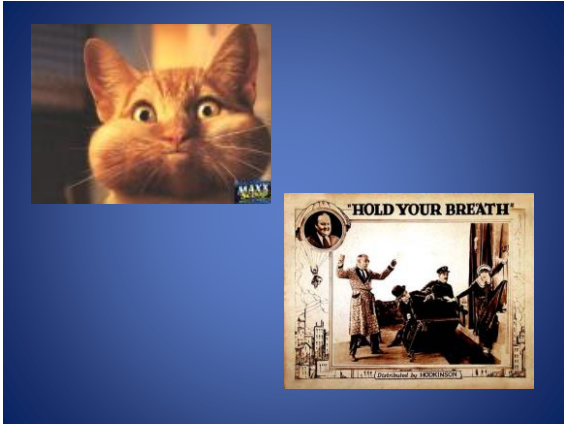
- RR less than 60, no increased work of breathing
- Parent knows how to bulb suction
- On RA or O2 at a level low enough to be managed at home
- Adequate oral feeding
- Parent is OK with going home
- Meds- depends on patient response

Prevention

- Decrease exposure
- Handwashing / Isolation
- Palivizumab: for kids <2 with chronic lung disease or \leq 32 wks. EGA
 - Debate about cost effectiveness continues
 - Medication: \$3000 to \$5000 per infant
 - Hospitalization: \$12,000 to \$120,000 per infant
 - Decreases hospitalization by 78% in premies < 6 mos., 39% in BPD, 55% in all infants
 - For children with CHD, BPD, Premies
 - Use in immunodeficiency still up in the air

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ALTE's



What is it?

- An acute, unexpected change in an infant's breathing pattern that frightens the caretaker
- May include:
 - Apnea
 - Color Change
 - Change in muscle tone
 - Choking or gagging

Key Ingredient



Classification



Sort of Life Threatening Events



Obvious Life Threatening Events



The Challenges of ALTE

- ALTE is a “wastebasket” term and not a specific diagnosis
- ALTE is a syndrome
- ALTE can be caused by a variety of things with diverse pathophysiology
- Management needs to be individualized

Epidemiology

- ALTE was coined in 1986 by an NIH consensus conference on Infantile Apnea and Home Monitoring.
- Replaced terms such as “near miss SIDS” and “aborted crib death”
- Potential for overdiagnosis since the case definition depends on observations of scared and medically untrained caregivers
- Incidence of ALTE is .05 to 1 percent

Causes

- ### GI (up to 50%)
- Gastroesophageal reflux
 - Swallowing abnormalities
 - Gastric volvulus
 - Intussusception
 - Other GI abnormalities

- ### Neurologic (30%)
- Neurologic conditions affecting respiration
 - Seizure disorder
 - Febrile seizure
 - CNS bleeding
 - Vasovagal reflexes
 - Hydrocephalus
 - CNS infection
 - Ventriculoperitoneal shunt malfunction
 - Malignancy

Respiratory (20%)

- Conditions affecting respiratory control (prematurity, central hypoventilation)
- Obstructive sleep apnea
- Vocal cord abnormalities
- Airway obstruction resulting from congenital abnormalities
- Foreign-body aspiration
- Laryngotracheomalacia
- Respiratory compromise from infection, respiratory syncytial virus, pertussis, mycoplasma, croup, other pneumonias
- Breath-holding spells

Cardiac (5%)

- Arrhythmia
- Long QT syndrome
- Wolff-Parkinson-White syndrome
- Congenital heart disease
- Myocarditis
- Cardiomyopathy

Metabolic (<5%)

- Inborn errors of metabolism
- Endocrine, electrolyte disorders
- Urinary tract infection
- Sepsis
- Other infections

Child Abuse (<5%)

- Events require CPR and occur only in the presence of a single caretaker
- Smothering (unintentional or intentional)
- Munchausen by proxy (suffocation, intentional poisoning, medication overdose)
- Diagnostic evaluation: no yield
- May require covert videography
- Abusive head injury (2003: of 243 babies admitted for evaluation of ALTE, 6 were diagnosed with head injury)

Other

- Food allergy (uncommon)
- Anaphylaxis
- Medication (prescription, over the counter, herbal remedies)
- Four calling birds
- Three French hens
- Two turtle doves
- And a partridge in a pear tree

Idiopathic (approximately 50 percent)

- This is the medical term for “We don’t know what the hell is causing this problem.”
- In layman’s terms, it’s just like the fame of Kim Kardashian, the popularity of Justin Bieber, and Bob Dylan’s Christmas CD: something that defies all explanation and happened for no apparent reason
- This is a diagnosis of exclusion

Clinical history in apparent life-threatening event	
Event	
State - asleep, awake, crying, relationship to feeding or emesis?	
Respiratory effort - none, shallow, increased, struggling or choking?	
Color - cyanotic, pallid, gray, red, purple?	
Color change - entire body, extremities, face, perioral, lips?	
Tone - limp, rigid, tonic/clonic?	
Eyes - open, closed, dazed, staring, rolled, bulging?	
Noise - none, cough, choking, stridor, cry, gasp?	
Fluid - none, mucus, milk, vomitus, blood?	
Duration - seconds, minutes?	
Intervention	
None	
Gentle stimulation or "puff of air in the face"?	
Vigorous stimulation?	
Mouth to mouth resuscitation?	
CPR by medical personnel?	
Duration?	

Parents: please circle one of the items in parentheses

- Little Johnny was (sleeping, eating) in his (crib, car seat, cardboard box) when he suddenly started to (choke, cry, cough, gasp) and stopped breathing for (10, 20, 30, 60, over 60) seconds. His (hands, feet, lips, face, entire body) turned (pale, red, blue, gray). To get him breathing again (I, grandma, the babysitter, the Lone Ranger) started (patting his back, shaking him, mouth-to-mouth, CPR) and he started to (cough, cry, breathe, vomit, have a seizure). After that, he looked (fine, sick, dazed) and he acted (sleepy, irritable, normally, just like his pain-in-the-ass father). After that (EMS, the Fire Department, the Police, his father) was called and he was brought to (the Emergency Room, an Urgi-Care Center, his pediatrician) by (ambulance, car, taxi, bus, police car). When he arrived he looked (not so good, happy, normal, orange because of the Cheez Doodles).

Initial labs

- When an explanation is not available from history and exam
- CBC, lytes, CXR, EKG, Tox screen
- Most helpful tests: Urinalysis and culture, CT/MRI brain, Polysomnography

Additional diagnostic studies to consider in the evaluation of ALTE*

Test	Potential diagnosis
Dilated funduscopic examination	Retinocardinal head injury (Shaken baby syndrome)
Bacterial and viral screening, including lumbar puncture	Infection (eg, sepsis, meningitis, pertussis)
Electroencephalogram	Seizure
Metabolic studies: Arterial blood gases, lactate, pyruvate, BH4, urine amino and organic acids, amylase/creatinase	Metabolic disease
Airway fluoroscopy	Anatomical abnormalities of the airway
Cine-esophagram and upper gastrointestinal series	Gastroesophageal reflux and anatomical abnormalities of the gastrointestinal tract
CT or MRI of the head, brainstem	Intracranial mass or hemorrhage
Skeletal survey	Child abuse
Esophageal pH monitoring	Gastroesophageal reflux
Polysomnography	Cardiologic, respiratory, neurologic, or oxygenation abnormalities
Holter monitoring	Arrhythmia
Echocardiogram	Structural or functional cardiac abnormality
Bronchoscopy	Anatomic abnormalities of the airway
Video surveillance	Child abuse, Münchausen syndrome by proxy

* ALTE: Apparent life-threatening event.
Adapted from Kahn, A. *Eur J Pediatr* 2004;167:108.



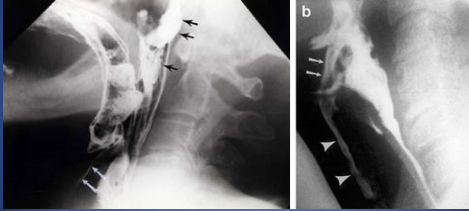
GERD

- Role of reflux in infants with ALTE is uncertain since all infants spit up and vomit
- Reflux may trigger laryngospasm
- Laryngospasm can also occur in the absence of reflux
- Austria: feeding difficulties (not just GERD) were associated with a greater than twofold increase in ALTE events
- Infant is usually miserable
- Treatment is not always effective
 - More likely to respond if emesis at the time of ALTE
 - More likely if episodes happen while awake and supine
 - More likely if component of obstructive apnea

GE Reflux



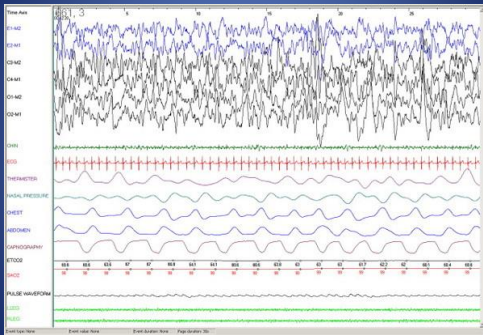
NP Reflux and Aspiration



Polysomnography

- Heart Rate and EKG
- Thoracic and abdominal wall impedance
- Oximetry
- Nasal thermistor +/- ETCO2
- Esophageal pH
- + / - EEG
- "Pneumograms" are outdated and should not be used
- Extremely helpful in diagnosis of ALTE that is not readily apparent from history, physical, and labs

Central Hypoventilation



SIDS vs. ALTE

- ALTE is a heterogeneous group of problems that range from benign to near fatal. SIDS is fatal.
- Majority of SIDS victims do not experience apnea prior to death (i.e.- no causal relationship between pre-existing apnea events and SIDS)
- Over 80% of SIDS deaths are between midnight and 5 am
- Over 80% of ALTE's happen between 8 am and 8 pm
- "Back to sleep" has not resulted in a decreased incidence of ALTE
- SIDS is a diagnosis, ALTE is a syndrome

Management

- Even if infant looks well, an ALTE must be taken seriously
- Requires in-hospital monitoring
- Medical or surgical treatment is possible in about 50% of patients with ALTE if a specific cause can be determined



Apnea

- Obstructive
- Central
- Sleep
- Infectious
- GERD
- Common to all are hypoventilation and hypoxia

Apnea (questions to ask)

- Has it happened before?
- How long did it last?
- What was the child doing when it happened?
- Any change in skin color?
- Any vomiting?
- What needed to be done for breathing to start again?

Apnea (differential diagnosis)

- Very broad!
- Seizures, infections, drug intoxications, aspiration, disordered respiratory center, head injury, anatomic abnormalities, cardiac disease, neuromuscular disease, metabolic disease, Munchausen's by Proxy

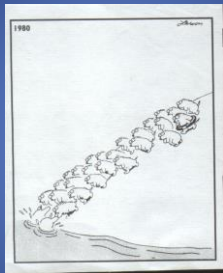
Apnea (treatment)

- Usually none required other than observation
- Otherwise: basic airway support with oxygen, stimulation, bag/mask ventilation
- Possible: anti-reflux measures, caffeine, surgery, tracheostomy, etc.
- Note: if needing vigorous stimulation or bag/mask ventilation, consider intubation!

A note on the “blue baby”

- If saturations do not improve with oxygen, consider cardiac disease
- Tiring while feeding and feeding intolerance are early symptoms of CHF
- The younger and bluer the baby, the higher the likelihood of congenital heart disease
- If prostaglandins are started, be prepared to treat apnea

Between the Devil and the Deep Blue Sea



Definitions

- Drowning- dies within 24 hours
- Near Drowning- survives 24 hours
- Wet Drowning- aspiration of fluid
- Dry Drowning- no aspiration
- Immediate Disappearance Syndrome
- Warm water- ≥ 68 degrees
- Cold water- < 68
- Very cold- ≤ 41

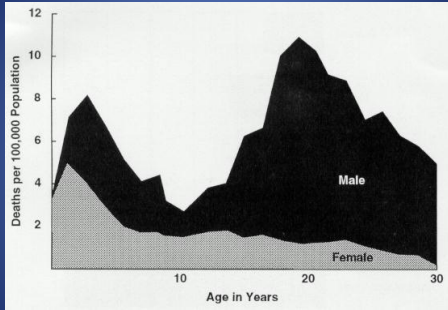
New Definitions

- The World Congress on Drowning and the World Health Organization: "the process of experiencing respiratory impairment from submersion/immersion in liquid."
- Outcomes: "death," "no morbidity," or "morbidity" (further categorized as "moderately disabled," "severely disabled," "vegetative state/coma," and "brain death").

Epidemiology

- WHO: 4th leading cause of death in 5-14 year olds, 11th in 0-4 year olds
- Est. 500,000 deaths annually worldwide
- US: 3rd most common cause of unintentional injury and 2nd leading cause of death in 1 to 19 year olds
- Temperate US: 70-90% of drowning deaths occur in pools
- Drowning rates have fallen steadily from 2.68 per 100,000 in 1985 to 1.32 in 2006.

Yes, women ARE smarter than men:



Epidemiology (continued)

- Adolescents more likely to drown in open water
- Teen drowning- 5 males:1 female
- Children ≤ 4 account for 60% of pool drowning accidents
- African American and Native American children have higher risk of death from drowning

Epidemiology (continued)

- 92% of survivors are found in less than two minutes
- 86% of non-survivors are found after 10 minutes
- 15% of all "drowning" admissions die in the hospital
- 20% suffer severe brain damage

Epidemiology (continued)

- 90% of all drownings occur within 10m of safety
- 40-45% occur during swimming
- 12-29% while boating
- 80% of ocean drownings occur in rips
- Pool drownings- missing from sight 5 minutes, in care of one or both parents
- Pools lacking fences are 60% more likely to cause drowning.

Pathophysiology

- instinctive drowning response
- breath holding
- increased PaCO₂
- involuntary gasping
- fluid enters larynx
- laryngo and bronchospasm
- +/- aspiration
- hypoxia and dysrhythmias

Water Temperature	Exhaustion or Unconsciousness in
70–80° F (21–27° C)	3–12 hours
60–70° F (16–21° C)	2–7 hours
50–60° F (10–16° C)	1–2 hours
40–50° F (4–10° C)	30–60 minutes
32.5–40° F (0–4° C)	15–30 minutes
<32° F (<0° C)	Under 15 minutes

Cold Water Drowning

- 2 1/2 y.o. survived after 66 mins
- 51 y.o. survived after 45 mins
- 62 y.o. survived after 15 mins
- Core body temperature must fall RAPIDLY
- Submerged dogs- core temperature dropped 7.5 C in 2 minutes
- "Diving reflex"- contribution may not be as great as once thought

Cold Water Drowning (continued)

- Seattle 1992- age < 20, water cold but rarely icy (no hypothermic protection): 92% of good survivors had core temp above 93.2. 61% of dead or PVS had core temp less than 93.2
- Finnish study- ped victims, water temp 61 deg.: no beneficial effect of hypothermia
- Sonoma County EMS: no bodies of water classify as "cold", question resuscitation efforts for those submerged more than 10 minutes

Predictors of Good (intact survival) Outcome

- 68-90% of all children with submersion accidents have good outcomes
- CPR within 2 minutes
- Spontaneous respiration after CPR (especially if at the scene)
- CPR duration less than 10 minutes
- GCS > 6
- Submersion time < 5 to 10 minutes

Predictors of Poor (Death or PVS) Outcome

- age < 3
- submersion > 10 minutes
- anoxia/asystole > 25 minutes
- CPR delayed > 10 minutes
- Ongoing CPR (apnea, asystole) in ED or CPR beyond 25 minutes
- GCS < 5
- pH < 7.1
- blood glucose > 250
- water temp > 50 F

Who should be hospitalized:

- submerged beyond one minute
- was cyanotic or apneic
- required pulmonary resuscitation
- need to monitor mainly for development of pulmonary edema and/or aspiration

Prevention

- Pool fences can reduce drowning accidents by 50 to 90%
- 84% of drownings happen because of inadequate adult supervision
- About half of pool owners do not know CPR
- Almost 50% overestimate their own swimming skills
- 85% of children \leq 14 who drowned in boating accidents were not wearing a PFD

Counseling (0 to 4 yrs)

- Never leave child alone, empty all buckets, accompany to toilet
- keep phone at poolside
- learn CPR
- For docs: identify pool owners in your practice
- Swim Lessons?

Counseling (5 to 12 yrs)

- Encourage swim lessons
- Never swim alone or without adult
- PFD for boating or fishing
- Jumping/Diving
- Drowning risks in Fall/Winter

Counseling (13 and up)

- Alcohol and water activities
- Drugs and water activities
- Learn CPR
- Learn to swim
- Baby sitters: pool safety and CPR

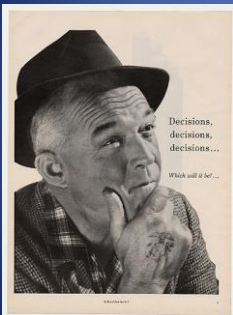
Transport



Transport goals

- Get to child as quickly as possible
- Prevent further deterioration
- Get the child to a facility with the proper services
- Provide a level of care equal to the accepting facility (within the limits of the transport environment)

Referring MD decisions



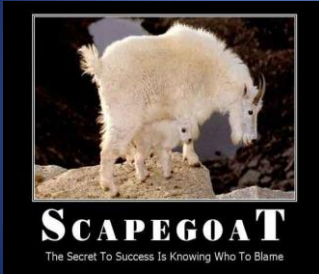
- Go to another facility?
- Which one?
- Mode of transport- Car? Ambulance? Helicopter?
- Team composition- Family? EMS? Paramedic/ALS? Ped Transport team?

Responsibilities

- Quickly assess child
- Secure all tubes and lines
- Obtain consent
- Call receiving hospital
- ANTICIPATE PROBLEMS THAT MIGHT BE ENCOUNTERED ON TRANSPORT
- Safe movement of patient
- Ongoing monitoring during transport



Accepting MD



- Evaluate appropriateness of transport team and mode of transport
- Advise referring MD for initial care
- Advise referring MD until transport team arrives
- Once the transport team arrives, the accepting MD is responsible for care

Things to ask yourself:

- How far am I from "home"?
- Will the weather slow us down?
- Has the child's condition improved, worsened, or stayed the same since I arrived here?
- Do I have all the equipment I might need readily available?



