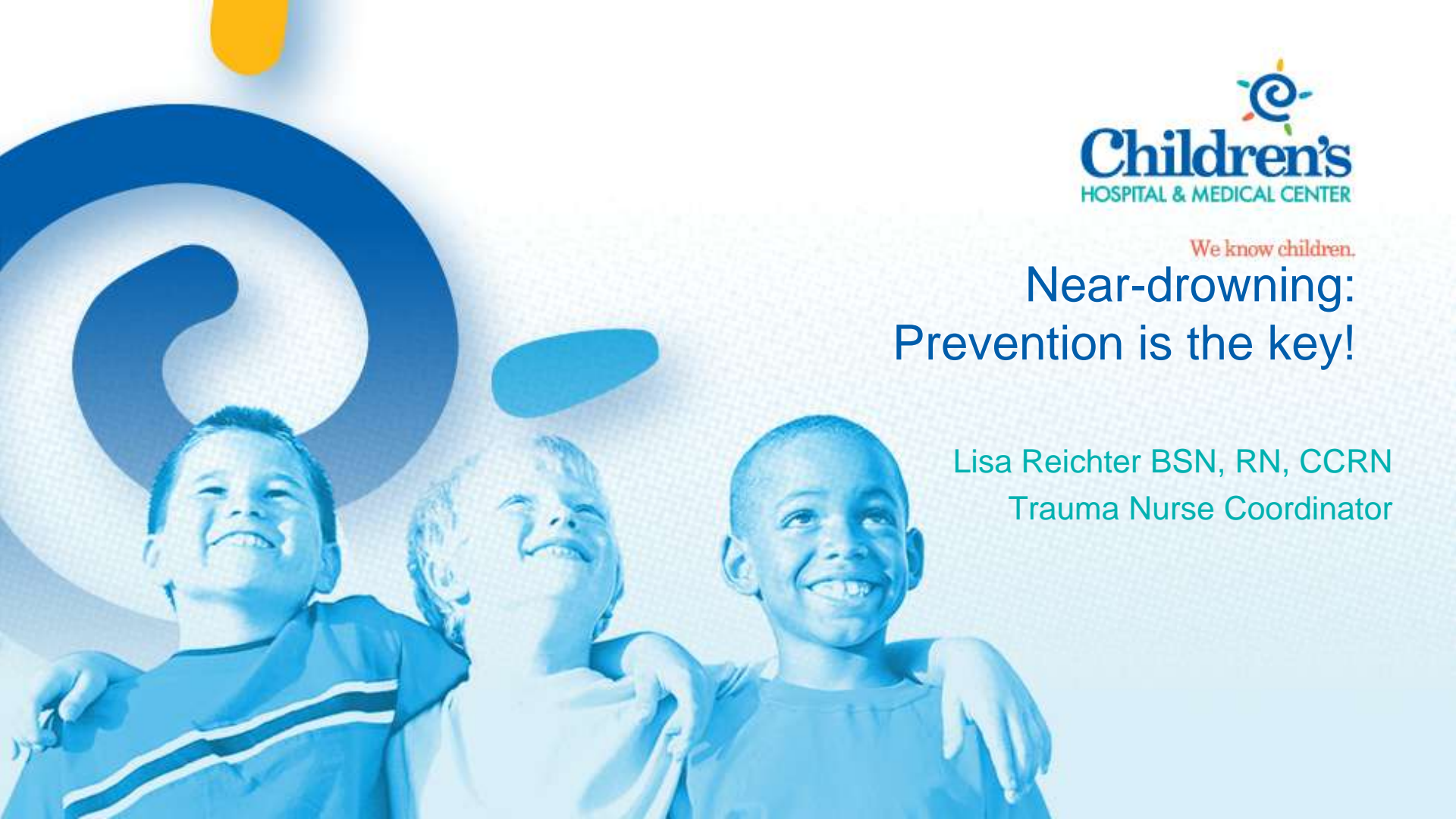




We know children.

Near-drowning: Prevention is the key!

Lisa Reichter BSN, RN, CCRN
Trauma Nurse Coordinator



AAP Latest Statistics: (Pediatrics (2012; 129:1-7)



We know children.

- Hospitalizations fell from an estimated 3623 in 1993 to 1781 in 2008
 - Pediatric (age 0-19 years) hospitalizations associated with near drowning declined 51%!
 - From 3623 in 1993 to 1781 in 2008
 - Annual hospital days declined
 - From 14,570 days in 1993; 6295 days in 2008

Relative Contribution of Various Submersion Media to Drowning Accidents

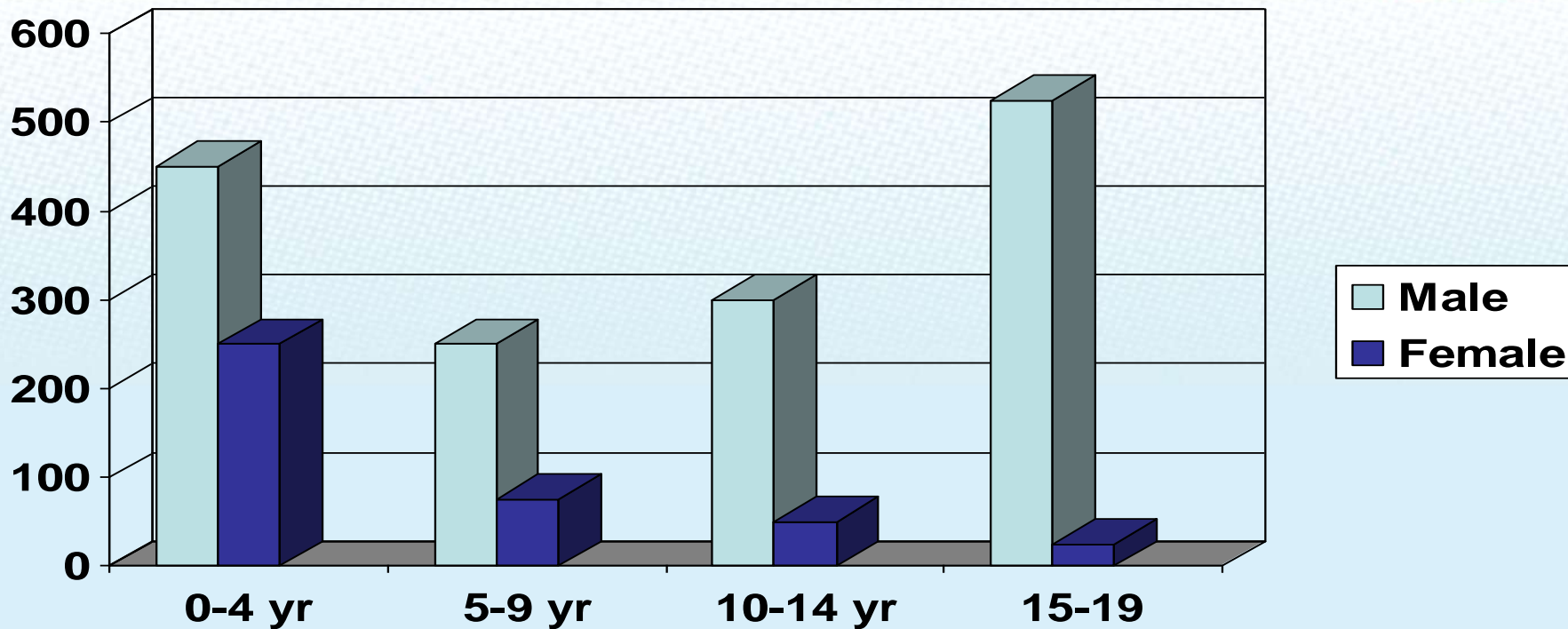
Salt Water		1 - 2%
Fresh Water		98%
swimming pools: public	50%	
swimming pools: private	3%	
lakes, rivers, streams, storm drains	20%	
bathtubs	15%	
buckets of water	4%	
fish tanks or pools	4%	
toilets	1%	
washing machines	1%	

Drowning Characteristics

- Differ by age and sex
- Young children (<4 yrs) have the greatest mortality rate
 - More likely to drown from bathing or falling into water
 - Reduction in these drownings from targeted injury prevention efforts
- Older children
 - More likely to drown while swimming in open water
- Males are 4-6x more likely than females
 - Overestimation of swimming ability
 - Greater use of alcohol by adolescent males

Near Drowning

Risk Factors: Age



Other Causes

Spas, Hot Tubs

- Entrapment
 - drains
 - hair, body parts, clothing
 - winter pool/spa covers

Decrease in Death Rates



We know children.

- In-hospital mortality decreased 42%
 - From estimated 359 deaths in 1993 to 207 in 2008

“Although improvements in treatment might be having an impact on survival, it is not clear from these data what level of neurologic functioning survivors may have. An alternate explanation is that better decision making in the pre-hospital period may be resulting in more pronouncement of death in the field for unsurvivable cases.” Dr. Stephen M. Bowman, PhD., of the Center for Injury Research and Policy at Johns Hopkins University

United States Epidemiology



We know children.

- For every child 14 years and younger who drowns, three receive emergency department care for non-fatal submersion injuries. More than 40% of these children require hospitalization (CDC 2004). Non-fatal incidents can cause brain damage that results in long-term disabilities ranging from memory problems and learning disabilities to the permanent loss of basic functioning (ie: permanent vegetative state).

Near Drowning

- “Tragically 90% of all fatal submersion incidents occur within ten yards of safety.”

Robinson, Ped Emer Care; 1987

Pediatric Drowning Epidemiology



We know children.

- Children <5 yrs have highest mortality rate
- <1 yr of age most frequently drown in toilets, bathtubs, buckets
- Often associated with lack of supervision
- Most young children who drowned in pools were last seen in the home, had been out of sight less than 5 minutes, and were in the care of one or both parents at the time they went missing.

Near-Drowning

Long QT Syndrome (LQTS)

- Swimming may be a trigger for LQTS event
- Near-drowning event may be first presentation of LQTS (15% of 1st LQTS syncopal events)
- Gene-specific KVLQT1 mutation associated with swimming trigger and submersion event
- Can test with cold water face immersion
- Importance: early diagnosis of survivor, or of family members; consider with unexplained submersion

-Ackerman et al., NEJM 1999

Drowning--Definition

Drowning is the process of experiencing respiratory impairment from submersion/immersion in liquid

- Patients may live or die
- Considered “near-drowning” if they live >24 hours
 - Hypothermic vs. normothermic
 - Associated Trauma
 - Respiratory Arrest/Cardiac Arrest
 - Should all be termed “drowned” if they die from the incident

Drowning Process

- Breath holding
- Liquid in oral pharynx and larynx
 - Laryngospasm
- Hypoxia
- Large swallowing of liquid
- Aspiration of liquid (amounts are variable)
- Changes in lungs, body fluids, blood gas tensions, acid-base balance, and electrolyte concentrations
- Hypoxemia (All contribute to hypoxemia)
 - Surfactant washout
 - Pulmonary hypertension
 - Shunting
- The patient can be rescued from this cascade of hypoxia at any time during the drowning process

Sequence of Events


Initial Period

- Characteristics of a drowning person
- Panic
 - “Active” or “Silent”
 - Change to “witnessed” or “unwitnessed”
- Heart and metabolic rate increase
- Breath holding—leads to respiratory acidosis
 - Increased $\text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{CO}_3 \rightarrow \text{HCO} + \text{Hydrogen}$



Sequence of Events (Continued)

The Terminal Gasp



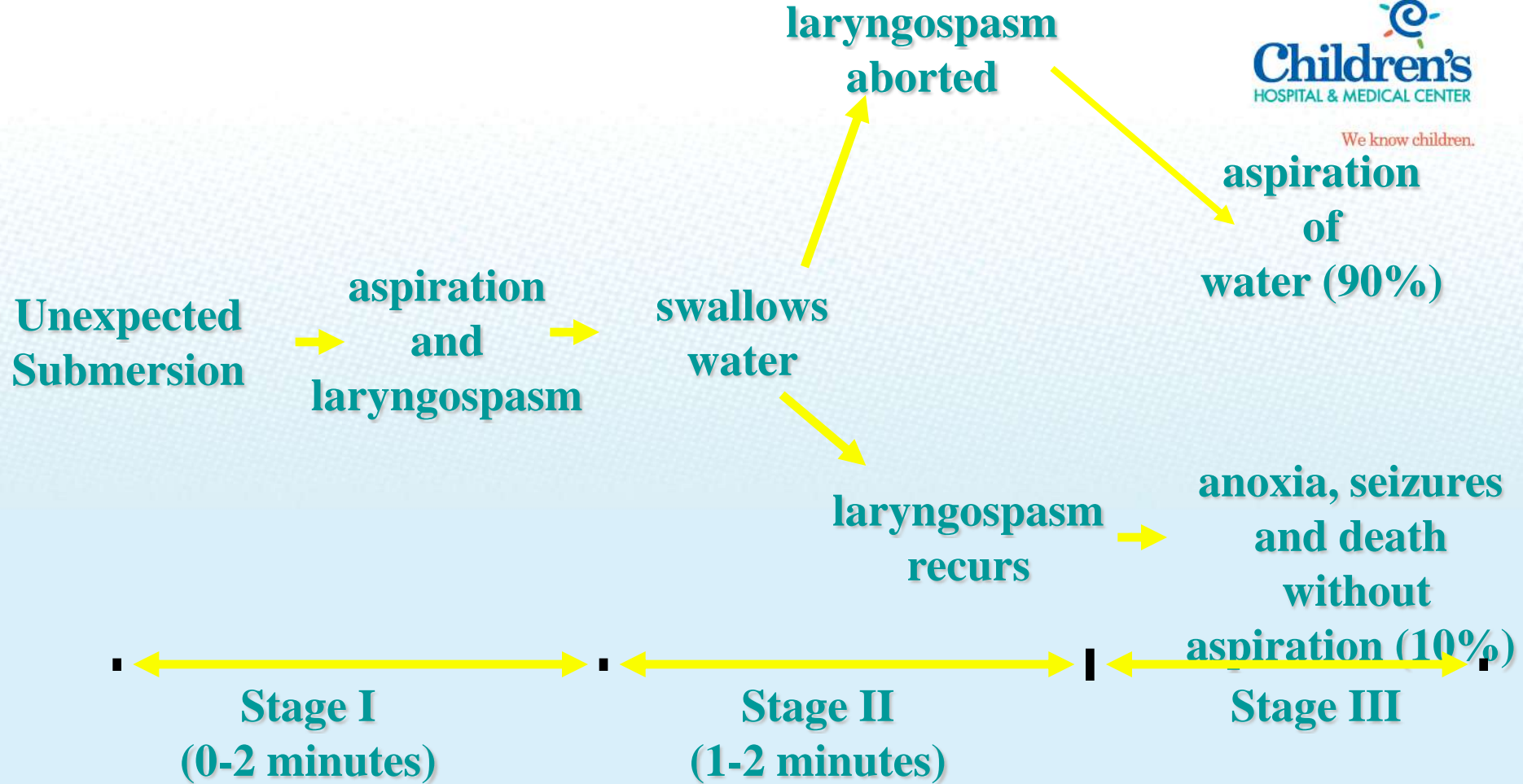
```
graph TD; A[The Terminal Gasp] --> B[Laryngospasm]; A --> C[Aspiration];
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Laryngospasm

Glottic spasm
Hypoxia

Aspiration

Pulmonary Edema
Atelectasis
Shunting



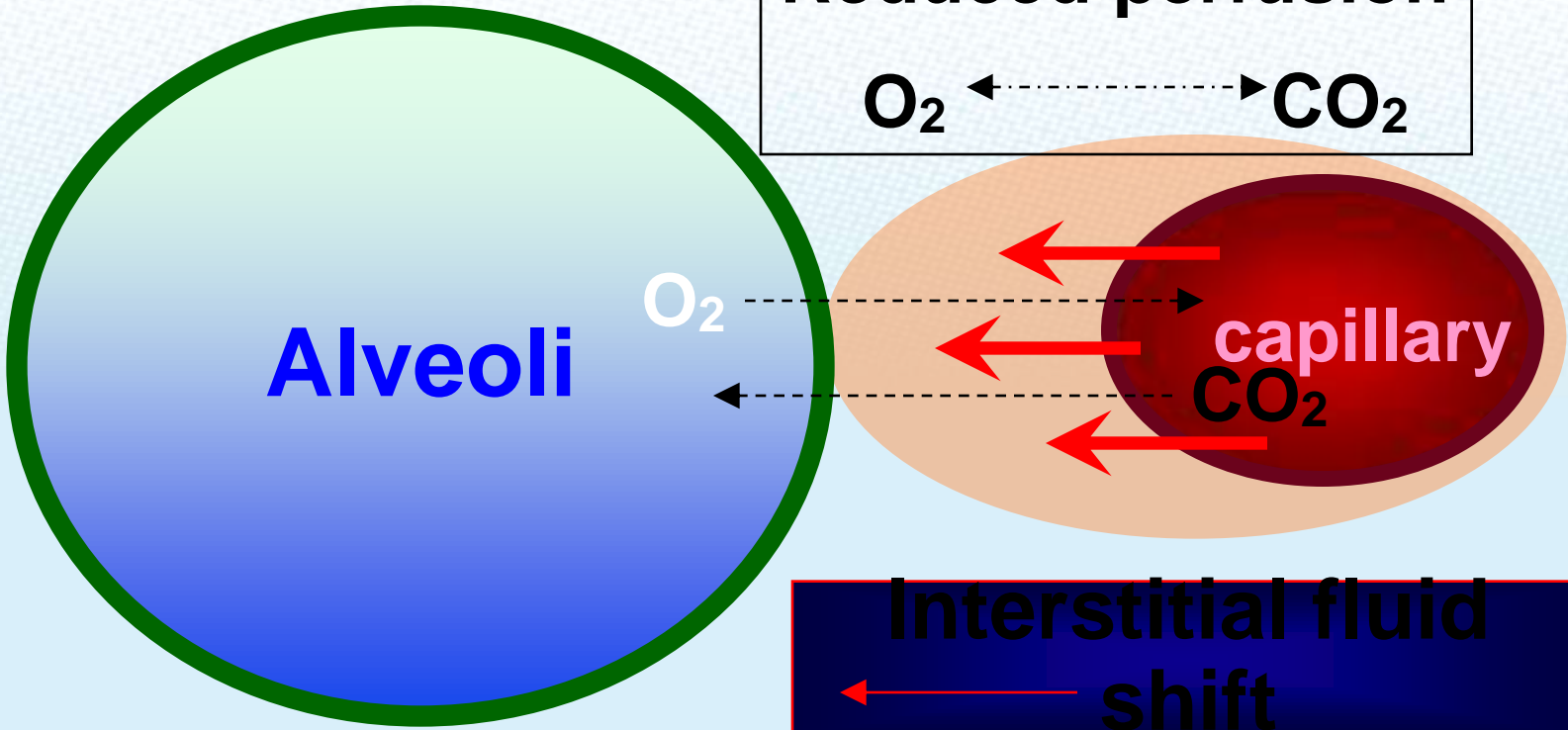
Secondary Problems

- Aspiration may lead to:
 - Unappreciated pulmonary edema and atelectasis
 - Pulmonary infections
 - ARDS
- Hypoxic Cerebral Injury

Pulmonary Edema

Reduced perfusion

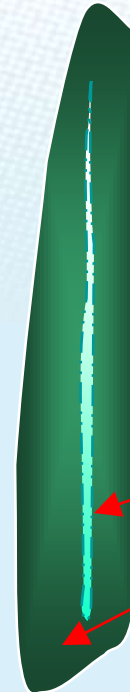
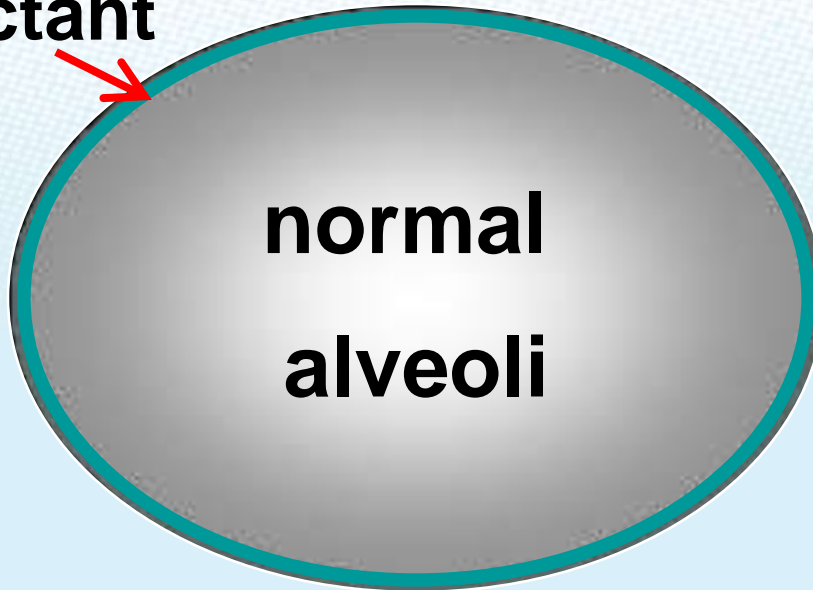
O_2 \longleftrightarrow CO_2



Atelectasis

collapsed alveoli

surfactant



Aspiration leads to collapse of the alveoli due to loss of surfactant and pulmonary edema

Near Drowning

CNS Injury

- Initial Hypoxia
- Post resuscitation cerebral hypoperfusion
 - Increased ICP (doubtful)
 - Cytotoxic cerebral edema
 - Excessive accumulation of cytosolic calcium causing cerebral arteriolar spasm
 - Increased free radicals

Early Signs and Symptoms

- Initial prolonged spasmodic coughing
- Dyspnea
- Inspiratory crackles on auscultation
- Signs of shock (increased CR)
- Shortness of breath and tachycardia

Other Complications



We know children.

- Hypothermia
- Alcohol or Drugs
- Cervical Spine injuries
- Seizures

Why is drowning “different” for kids?

- Less pulmonary oxygen reserve due to smaller residual volumes
- Develop hypoxia/hypoxemia faster due to higher metabolic rates
- Children are less likely to have a pre-existing condition
- Protective hypothermia more likely in children
- Effects of hypothermia are more frequently negative
- Adolescents tend to endanger themselves by high risk behaviors

Who needs further attention?

- Any loss of consciousness
- Any resuscitation (rescue breathing or CPR)
- Any concurrent condition (seizure, spinal injury, asthma exacerbation...)
- Just “not acting right”

Hypothermia

- Epidemiologically more bad outcomes than good
- Not protective if hypoxemic
- Detrimental effects:
 - Arrhythmias
 - Coagulopathy
 - Impaired immune function
 - Reduced myocardial function
 - Acidosis
 - Electrolyte abnormalities
- Ideal rate of re-warming
- Research

Treatment

- The Initial Response
 - Consider the hazards and the environment
 - Consider mechanism of injury (C-spine)
 - Back up needed? Further assistance?
 - Reach-throw-row-go-tow

Responsive patient

- Warm blankets
- Put patient in most comfortable position—usually semi-sitting (as long as no concern of c-spine)
- Assist (positive pressure ventilation PRN) with oxygen
- Be prepared for a possible rapid change in status

PEEP, CPAP, BiPAP

- Has been shown to improve ventilation patterns in the non-compliant lung in several ways:
 - Shifting interstitial pulmonary water into capillaries
 - Increasing lung volume by prevention of expiratory airway collapse
 - Better alveolar ventilation and decreasing capillary blood flow
 - By increasing the diameter of both small and large airways to improve distribution of ventilation

Unresponsive patient

- Get patient's head out of the water
- Assess ABC's
- Do not perform the Heimlich or abdominal thrusts
- Ventilate patient when "regurgitation" can be managed (head and body can be reposition to prevent aspiration)
- Once removed from water, maintain in a lateral position unless suction and definitive airway maintenance is available
- Positive pressure ventilation
- OXYGEN!
- Keep warm—Remove wet clothes!

Unresponsive patient (continued)

- Reassess circulation—manage ABC's
 - Monitor SaO₂
- Positive pressure ventilation
- IV infusion of warmed fluids
- Be prepared for change in patient status
- If further deterioration
 - Intubation and ventilate with 100%
 - PEEP

Unique consideration for children

- Prompt effective resuscitation is essential
 - Delay >8 minutes is usually lethal
 - Bystander CPR essential for recovery
 - Push hard and fast...minimize interruptions
- Hypoxic etiology (unlike adults)
 - Must reverse hypoxia
 - Fluid in lungs may be low volume
 - Fluid in GI system is usually high volume
 - Aspiration of great concern

Criteria for discharge @ 6 hours



We know children.

- No fever, no cough, no respiratory symptoms
- No crackles in lungs
- Normal PaO₂ on room air
- Normal chest xray

Outcomes

- Outcomes are often closely related to duration of submersion
- Poor outcomes with prolonged submersion (>25 minutes)
- Drowning in children is often a shocking surprise, very fast, and emotionally challenging

Effect of Immediate Resuscitation on Outcome



We know children.

- Review of 166 near-drowning children in California
- Children with good outcome 4.75 times more likely to have had immediate bystander CPR than poor outcome patients

-Kyriacou et al., Pediatrics, 1994

Outcome and Predictors of Outcome Pediatric Submersion Victims

- SURVIVAL:
 - 0/20 with CPR > 25 minutes

Quan et al, *Pediatrics*, Oct 1990

Post-Resuscitation Phase

- Outcomes reduced by:
 - Excessive hyperventilation
 - Hyper/Hypocapnia
 - Hyperglycemia
 - Hypoxia
- Controversial options:
 - Hypothermia—Not shown to be helpful
 - Prophylactic antibiotics—not helpful
 - Steroids—not helpful
 - Surfactant replacement—potentially helpful
 - Dobutamine is preferred inotrope

Clinical Indicators of Poor Outcomes



We know children.

- Rigor Mortis
- Documented to be submerged in non-icy water for prolonged period (>60 minutes)
- No response to resuscitation effort of 1 hour with core temperature above 90 degrees F/32 degrees C.

Scenario Practice



We know children.

- A 3yo is pulled out of a pool by a parent. You arrive as the child is beginning to wake up after being given one breath and vomiting.
 - What do you do first?
 - GCS 11, no eye opening, but coughing. Crackles heard bilaterally with oxygen saturations 92% on room air.
 - Now what?
 - Concerned?
 - Transport?

Scenario Practice #2

- A 16 year old male was drinking beer and “fooling around” in and around the pool. When the friends looked around, they found him face down in the pool.
 - What do you do first?
 - What concerns do you have?
 - Patient was pulled out of the pool by the friends with rescue breaths performed, but patient started breathing on his own. Pt is lying motionless except for coughing with eyes open, and stating “I’m fine”.
 - Now what?

Prevention



We know children.

- Educate adults about supervision
 - In the water with kids
 - Cell phones, books, magazines...
- Educate families with seizure disorders
- Fence, barrier, alarms around pools
- Take ladders out of above ground pools when not in use
- Promote water safety and learning to swim!
 - AAP recommendations
 - Joshua Collingsworth Foundation
 - Float 4 Life
 - Josh the Otter

Summary

- Don't forget cervical spine injuries should be considered with young adults
 - ABC's still take priority!
 - CPR is best treatment option
- If a child is quiet...may be more concerning
- OXYGEN!
- Morbidity and Mortality secondary to:
 - Hypoxic ischemic injury
 - Multi-system organ failure
- Don't hesitate to assist breathing as needed

Questions????



Therapeutic Communication

Lisa Reichter BSN, RN, CCRN
Trauma Nurse Coordinator

You are dispatched:

- 2yo girl is being babysat by a 15yo neighbor while Dad is at work for a few hours. Parents are in the process of a divorce. 15yo is making lunch for the 2yo when she turns around and the 2yo is nowhere to be found.
- Found outside house about 20 feet in a mud puddle—face down
 - Pulled out, apneic and pulseless
 - CPR started by babysitter, 911 called by a neighbor
 - EMS arrival in 4 minutes—still apneic and pulseless with CPR continued
 - Dad arrives home shortly thereafter
- Mother arrives (neighbor had called her)
 - Screaming at Dad!!
 - Laying on the child just telling her to “wake up”
 - Dad, crying silently off by himself

What happens next?

- Taken to hospital
- Placed on ECMO
- Continues to deteriorate
- Pronounced brain dead 2 days later
- Organ donation

Near Drowning

Social/Economic Effects

- Divorce
- Sibling psychosocial maladjustment
- 100,000 years of productive life lost
- \$4.4 million/year in direct health care costs
- \$350-450 million/year in indirect costs
 - \$100,000/year to care for the neurologically impaired survivor of a near drowning

Case study #2...



We know children.

- You are called to the scene in which a 5 month old baby is unresponsive
- What do you do to prepare?
- Possible causes?

On your arrival...

- Mother is anxious and holding the baby
- History: Rolled off the bed this morning (it is now 4pm)
- She was at work; boyfriend was watching the baby
- Mom's concerns:
 - Sleepy
 - Vomiting several times
 - Just "isn't acting right"

Assessment

- Eyes closed, no response to your arrival
- No increased work of breathing
- Color is pale pink, no cyanosis noted
- Interventions?
 - Primary assessment
 - Oxygen
 - Glucose check
- Exposure of patient reveals multiple bruises and a scalp hematoma
- Spine stabilization
- Elevate head of stretcher

Best approach...

- Treat parents with respect!
- Clearly communicate the seriousness of the patient's status.
“Baby could die without immediate treatment.”
- Facts only...don't speculate on mechanism of injury
- Reassure her that you and the hospital personnel will ensure the safety of her and her baby
- Police involvement...if not already there
 - Protective custody
- Duty to treat vs. doctrine of free will
- DOCUMENT!

Case progression...

- You tell the mother that you are concerned about a brain injury, so you will be transporting the patient to the hospital
- Mother becomes more anxious and pleads “you can’t take him until my boyfriend comes back...he will be so angry!”

The boyfriend returns...

- He is agitated and yells at the mother, “why did you call for an ambulance?! I told you to wait until I got back, there is nothing wrong with him...it is nap time.”
- The boyfriend orders you to leave stating he will take the baby to the doctor if needed
- Now what??

Your response...

- Police (if not already there)
- Ensure the safety of your team
- Do not engage the boyfriend in hostile discussion
 - Avoid accusations
 - Remain professional and calm
 - Keep focused on medical needs of patient
 - If possible, separate boyfriend from mother & patient
- Medical Direction
 - Temporary protective custody
- Transport the baby immediately
 - Encourage the mother to accompany you
- DOCUMENT objectively—use quotes

Findings...

- Head CT shows large subdural hematoma
- Eye exam reveals bilateral retinal hemorrhages
- Abusive Head Trauma

Case Study #3...



We know children.

You are dispatched to a suburban home for a 16 year old who has overdosed

- What do you need to have prepared?
- Common types of overdoses in teens

You arrive...



We know children.

- A 14yr old boy lets you into the house and he tells you that he saw his sister take a “handful of pills.” He goes on to say that the parents are away for the weekend and he couldn’t reach them by cell phone.
- Sister is seated with her head down at the kitchen table. She vehemently denies taking anything when asked.

Assessment...

- Skin is pink, warm and dry
- No increased work of breathing
- No neurologic depression
- Brother states that she has been complaining that her stomach hurts
- What now?

Case Progression...

- As you continue to question her, she becomes more agitated. She starts to cry and states “I just had a headache that I couldn’t get rid of; I took a handful of Tylenol. I just wanted my headache to go away.”
- The brother tells you that she has tried to commit suicide before.
- She states “I’m fine, just leave me alone. I’m not going to the hospital—the put me in restraints the last time!”

Case Progression...

- Can she refuse care? How do you convince her?
 - Dependent minor
 - Presumed incompetent based on current situation and past history
 - Potentially life-threatening overdose
- Treat her with respect
 - Attempt to establish rapport by acknowledging her concerns
 - Communicate medical urgency and your concern for her safety

Case Progression...



We know children.

Despite your attempt to reassure her, she refuses transport. She lashes out and screams when she is approached, “You can’t take me without my parents consent. They will sue you” then pointing to her brother states, “This is all your fault!”

Can you legally treat & transport?



We know children.

- Implied consent
 - Can be invoked when, the judgement of the prehospital professional, indications for treatment exist and a reasonably prudent guardian in a similar circumstance would consent.
- Continue to attempt to obtain her cooperation
 - Ensure your own safety to avoid further injury
- Reassure brother that he did the right thing by calling 911
 - Allow him to accompany her to the hospital if no one is there to remain with him at the scene.

C

Potential issues

- Minors able to refuse care:
 - Condition is not potentially life-threatening
 - They are legally emancipated
 - They demonstrate competency to refuse
- Patient may revert to child-like behavior
 - Maintain professionalism
 - Avoid expressing anger or frustration
- Suicide very common in teens
 - All attempts need to be taken seriously

Case Conclusion...

- Successfully transported
- Had a toxic acetaminophen level as well as positive toxicology screen for benzodiazepines. She admitted to also taking “a lot of pills” that also included tricyclics
- Arrhythmias upon arrival to the ED
- Treated in PICU for arrhythmias as well as Tylenol OD
- Transferred to inpatient psychiatric ward for further evaluation and treatment

Last case...

- You arrive at the scene of a home where a sobbing older woman tells you that her granddaughter has died. She hands you a signed DNR order and states that the child has cystic fibrosis and was “terminal” but that “I just didn’t expect her to die today!” She further states that she “was watching TV when she went in to check on her, and she was gone!”
- Child is cyanotic, apneic, and unresponsive

What do you do?

- Know local EMS policy
 - Define “death in the field criteria”
 - Lividity, rigor mortis, traumatic dismemberment don’t apply
 - Pediatric DNR orders
- Grandma insists that you “DO SOMETHING”!
- What next??

Patient's mother arrives...



We know children.

- She confirms that she does not wish her child to be resuscitated
- Contact Medical Direction—support your decision to withhold treatment
- Do you stay? Or go?
 - Coroner
 - Grief counseling resources

Key points...



We know children.

- Don't leave the family alone
- Be clear with communication;
 - Not “passed away” or “gone”
- Refer to the child by name
- Communicate empathy—don't be afraid to say “I'm so sorry”
- Emphasize that their needs are your primary concern
- Sit down, remain calm
- Allow for silence
- Anyone to call for them for support
- **ALLOW PARENTS TO HOLD CHILD!**

As you are leaving the scene...



We know children.

- Your partner looks at you with tears in their eyes and states “she looked just like my daughter, I can’t do this anymore!”

What is really important?



We know children.

For the family:

- Express empathy
- Acknowledge the child as a special person
- Allow the parents to grieve
 - This takes many shapes and forms!
- Avoid statements that may be construed as blaming or insensitive
- Know local resources and provide referrals for grief counseling

What is really important?



We know children.

For the pre-hospital provider:

- Experience grief
- Self-doubt and concerns about competence
- Anxiety about own children
- Acknowledge your feelings
- Critical Incident Stress Debriefing
- **ASK FOR HELP!**

How does all of this affect us?



We know children.

- Work Environment
- Team
- Experience
- Internally
- Relationships
- Spiritually

Teamwork



We know children.

- Regardless of your title or position
- Collaboration
- Escalation of care
- Support each other

Just suck it up!



We know children.

“It would seem that critical care providers, while differing in life circumstances, are still cut from the common cloth: appearing to thrive on the adrenaline that comes with life and death situations, able to maintain calm efficiency in the midst of great tragedy and sorrow, willing to share strength and comfort with family members who are still in shock, and ready to move on to the next patient minutes later because there will always be another admission or call that has just been posted.”

(Abazzia, et.al., 2010)

Helpers

- Those with high levels of empathy tend to be drawn into the caregiving profession.
- Empathy: Feeling *with* the person. Putting self in that person's place.
- Need empathy to be effective but also associated with stress.

When is it too much?

- Signs and Symptoms
 - Difficulty not thinking about work
 - Overwork or avoidance of work
 - Sleep difficulties
 - Increasing sense of futility about work: “It doesn’t really matter.”
 - Anxiety, depression, substance abuse

STSD/Compassion Fatigue

- Signs and symptoms:
 - 1) Re-experiencing – intrusive thoughts, dreams, reactive to triggers
 - 2) Avoidance – reminders, forgetful, lack of interest, detachment, numbing
 - 3) Psychological Arousal – poor sleep, anger, poor concentration, hyper vigilance.

Relationship Stress

What happens when...

- **...you had numerous difficult calls in one day, a patient died, and your spouse is miffed you didn't make the appt. for the oil change? (No words, too many words, #@!* words?)**
- **...your older parent is calling as you walk in the door after a difficult day. This parent always has requests for you to do things. (Do you let it ring? Do you make a face? Do you answer the phone but hear a clipped or angry tone in your voice?)**
- **...your daughter is headed out for the night with friends, and you've just completed a run of a teen drugged and raped as well as teen casualties from a car accident? (Does she get to go or does she get an extra lecture? Do the images of the victims come to mind? Can you sleep? How often do you text?)**

The cost of compassion fatigue...



- Substance use & abuse -> Health issues, unable to meet family/work obligations
- Isolation/Avoidance -> Emotionally unavailable to family and friends who need you
- Irritability/Anger -> Increased friction and fighting

The Highest Costs of Compassion Fatigue



We know children.

- Loss of a job/income
- Alienation from significant others
- Negative and unintended messages that impact your children's lives
- Divorce
- Loss of health (others must care for you)
- Higher mortality rate

What can we do?

- Recognize exposure and stress
- Connections with others – Sharing and support, humor
- Talk about successes
- Set limits/boundaries
- Self Care – Exercise, spirituality, nutrition, hobby, music, time in nature

-(Gentry & Baranowsky, 2010)

What can organizations do?

- Offer peer support groups
- Offer mentoring to less experienced professionals
- Monitor the number of intense patients/clients per staff member
- Promote education and wellness activities for employees (Stebnicki, 2000)
- Provide a positive physical environment
- Support a positive “culture”

Questions?

