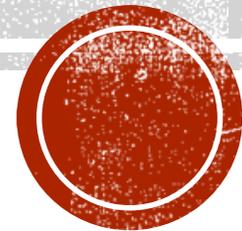


PEDIATRIC PEARLS AND PITFALLS

Jennifer Cooper-Lewis DO
Vice Chair Emergency Department
Pediatric Medical Director



DISCLOSERS

- None
- No children were harmed in the making of this presentation



TODAYS TOPICS

- One pill kills
- Head trauma
- Abdominal trauma
- Wheezing
- Vomiting



One Pill Kill





ONE PILL KILL

- More than 70,000 children are evaluated in Emergency Departments each year for unintentional medication and poison exposures
- In 2014, there were more than 1 million calls to Poison Control Centers for unintentional exposures in children under 6 years old
- The peak incidence for pediatric poisonings occurs in toddlers age 1 to 3 years, as does the peak incidence for hospitalization
- Younger children are more willing to taste dangerous substances than older children and perform hand-mouth behaviors nearly 10 times an hour



ONE PILL KILL

Drug	Potentially Fatal Dose (mg/kg)	Highest Dose Available (mg)	Mechanism of Toxicity	Signs/Symptoms of Toxicity
Calcium Channel Blockers	15	360	Myocardial suppression	PR prolongation, bradydysrhythmias, hypotension, CHF
Tricyclic Antidepressants	15	150	Na channel blockade, alpha 1 blockade	Coma, seizures, tachycardia followed by hypotension and bradydysrhythmias
Antimalarials	20	500	Na channel blockade, direct retinal damage	Prolonged QRS/QT, torsades, hypotension, tinnitus, vision loss, headache, vertigo, seizures
Opiates				
Codeine	10	60	Respiratory depression	Miosis, CNS depression, hypopnea
Hydrocodone	1-5	30		
Methadone	1-2	40		
Fentanyl Patch	1-2mcg	300mcg/hr		
Sulfonylureas	0.1	10	Activates insulin release	Hypoglycemia, irritability, lethargy, seizures and coma
Class 1 Antiarrhythmics	25	1 50	Na channel blockade	prolonged PR/QR, QT (Class 1A agents), headache, nausea/vomiting



ONE PILL KILL

Drug	Commonly Found In	Fatal Dose (mg/kg)	Highest [] Available	Mechanism of Toxicity	Signs/Symptoms of Toxicity
Camphor ³	Vaporub, Orajel, Tigerbalm	50	550mg/tsp	Unknown mechanism of neurotoxicity	Nausea, vomiting, agitation, myoclonus, hyperreflexia, intractable seizures
Oil of Wintergreen (Methyl Salicylate) ^{3,4}	Icy Hot, pure essential oil	400	7g/tsp	Organic ester, crosses BBB and interferes with cellular metabolism	Mixed respiratory alkalosis/metabolic acidosis, vertigo, AMS, coma, pulmonary edema
Liquid Nicotine ⁵	Vaping solution	1-13	35mg/ml	nAChR agonist at low doses, mAChR agonist at higher doses	Biphasic pattern: hypertension, tachycardia, vomiting, followed by autonomic ganglionic blockade, hypotension, bradycardia, coma
Selenium Dioxide ⁶	Gun bluing solution	7	25mg/ml	oxidative stress, direct myocardial depression	Hypotension, prolonged QT, Pulmonary edema, delirium, coma
?	Laundry Detergent Pods ^{8,9}	?	?	?	Nausea/vomiting, followed by respiratory and CNS depression.



CALCIUM CHANNEL BLOCKERS

- Act to slow the influx of calcium through L-type, voltage-sensitive channels present in a wide variety of tissue cell types, including cardiac myocytes, vascular smooth muscle, and sinoatrial and atrioventricular nodes
- Classic manifestations include hypotension and bradycardia, although reflex tachycardia may be seen
- Cardiac conduction system abnormalities include second and third-degree heart block



CALCIUM CHANNEL BLOCKERS

- Clinical effects often appear within 1 to 5 hours after ingestion of immediate-release preparations, may be appreciably delayed in cases of sustained-release preparation ingestion
- Hypotension may last more than 24 hours despite therapy, and cardiac conduction defects have been reported to last 7 days



CALCIUM CHANNEL BLOCKERS

- Treatment
 - Fluids
 - Activated charcoal within one hour of ingestion
 - Atropine
 - Inotropic agents, including dopamine, dobutamine, isoproterenol, epinephrine, and norepinephrine, have been used in isolated case reports
 - Calcium
 - High dose insulin



TRICYCLIC ANTIDEPRESSANTS

- Effects on norepinephrine and serotonin, diverse central and peripheral receptor systems, including inhibition of histamine H1 receptors, dopamine D2 receptors, muscarinic cholinergic M1 receptors, and sympathetic α_1 receptors
- Blockade of fast voltage-gated sodium channels in cardiac myocytes results in the typical finding of QRS interval prolongation
- CNS depression and seizures, conduction abnormalities, dysrhythmias, and hypotension
- Signs of significant toxicity can be expected to present within 6 hours of ingestion



TRICYCLIC ANTIDEPRESSANTS

- Aggressive supportive care, including airway management
- Sodium bicarbonate is the mainstay of treatment for reversing the cardiotoxic effects of TCA ingestion
- Seizures may be treated with benzodiazepines as a first-line agent
- Phenytoin is not recommended in the management of cyclic antidepressant–induced seizures



OPIATES

- Classically manifests as a toxidrome of CNS depression, respiratory depression, and miosis
- Most deaths are secondary to respiratory depression and subsequent hypoxia, although aspiration pneumonitis and pulmonary edema are additional concerns
- Half of children exposed to more than 1 mg/kg of codeine developed evidence of toxicity, often within 1 hour of ingestion
- In infants, 2.5 mg of hydrocodone has been lethal
- Peak effect for most oral preparations is less than 1 hour, and duration of action is 3 to 6 hours



OPIATES

- Treatment is naloxone
 - Onset of action is less than 2 minutes
 - Duration of action is 20 to 90 minutes and half-life is 60 to 90 minutes
 - Recommended initial dose in children younger than 5 years old is 0.01 mg/kg intravenously, treated initially with 0.1 mg/kg up to 2 mg intravenously, titrated to effect every 3 to 5 minutes to a maximum dose of 10 mg



SULFONYLUREAS

- Sulfonylureas modulate a reduction in serum glucose concentration by direct inhibition of an adenosine triphosphate–dependent potassium channel located in the membrane of the pancreatic beta cells
- Causes hypoglycemia, leading to lethargy, confusion, headache, irritability, and seizure
- Secondary sequelae of hypoglycemia include permanent neurologic impairment and death



SULFONYLUREAS

- All children suspected or known to have ingested sulfonylurea be admitted for a minimal 24-hour observation, even if not initially hypoglycemic
- Serial neurologic examinations and serum glucose measurements are essential
- Treatment is insulin and Octreotide (a somatostatin analogue which inhibits secretion of several hormones including glucagon and insulin)



CLONIDINE

- Patients may appear to have an opioid toxidrome, with decreased level of consciousness, miosis, bradycardia, hypotension, respiratory depression, and hypotonia
- Risk of bradycardia and atrioventricular nodal blockade, all patients with suspected exposure should undergo continuous cardiac monitoring
- Naloxone may or may not work
- Symptomatic bradycardia should be treated with atropine
- Hypotension unresponsive to fluid resuscitation or complicated by persistent bradycardia may require dopamine



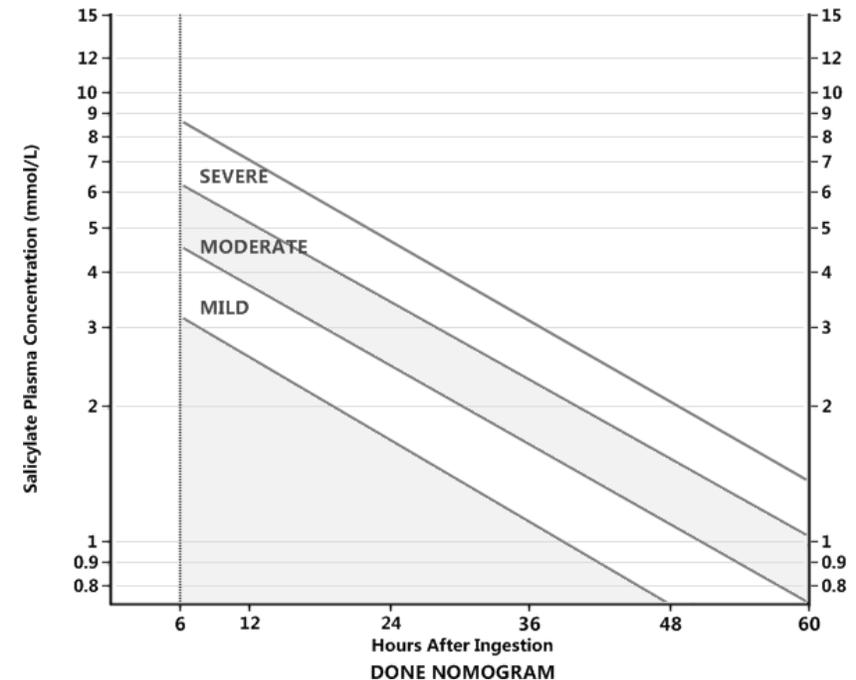
SALICYLATES

- Salicylates are present in numerous over-the-counter products, including aspirin (acetylsalicylic acid), oil of wintergreen (methyl salicylate), and Pepto-Bismol (bismuth subsalicylate)
- One teaspoon of 98% methyl salicylate contains 7000 mg (toxic dose is 150 mg/kg)
- Signs and symptoms of salicylate intoxication nausea, vomiting, diaphoresis, tinnitus, nonspecific neurologic findings including agitation, delirium, hallucinations, and lethargy
- Salicylates directly stimulate the brainstem respiratory center, resulting in hyperventilation and hyperpnea
- Severe intoxications may cause noncardiogenic pulmonary edema, cerebral edema, coma, and death



SALICYLATES

- Done nomogram indicates severity of toxicity based on a 6-hour level of non-enteric-coated aspirin rather than need for antidotal therapy
- Serum salicylate concentrations should be reassessed every 2 hours until the patient is clinically improving and has a nontoxic serum salicylate level (<30 mg/dL) with normal or alkalemic blood pH
- Peak salicylate levels may not occur for 12 or more hours after ingestion of enteric-coated products



SALICYLATES

- In addition to aggressive supportive care and appropriate gastric decontamination, treatment of salicylate poisoning is directed toward enhanced elimination through either urinary alkalization (“ion trapping”) or hemodialysis
- By increasing the urine pH, the relative fraction of salicylate present in the anionic form increases, reducing reabsorption in the distal tubules
- The goal of alkalization is a urine pH of 7.5 or greater, through administration of intravenous sodium bicarbonate
- Avoid serum pH greater than 7.55



SALICYLATES

- Indications for hemodialysis in salicylate toxicity
 - Pulmonary edema
 - Altered mental status/cerebral edema
 - Renal failure
 - Lack of response to standard therapy
 - Concomitant life-threatening acid-base or electrolyte abnormalities
 - Salicylate level: >100 mg/dL in acute intoxication; >60 mg/dL in chronic intoxication



Trauma



TRAUMA IN KIDS

- ⑩ Different body structure
- ⑩ Different response to stress
- ⑩ Moving target in terms of growth & development - age/size changes management
- ⑩ Need weight-based resuscitation



TRAUMA IN KIDS

- Larger abdominal organs
 - Surrounded by less fat
 - Liver, spleen more anterior
- Less developed abdominal musculature
- Increased compliance of the rib cage
 - Rib fractures are bad
- Increased energy needs (hypoglycemia)
- Increased body surface area (hypothermia)



TRAUMA IN KIDS

- Smaller body mass means increased force per unit of body surface area leading to significant injuries *WITHOUT* obvious external injuries
- Tachycardia is the earliest indication of badness
- Blood pressure will not change until 30-40 % of blood volume is lost





HEAD TRAUMA

- 5% of head trauma cases, patients die at the site of the accident
- Head trauma has a high emotional, psychosocial, and economic impact
 - Long hospital stays
 - 5-10% require discharge to a long-term care facility.
- Minor head trauma accounts for > 95, 000 visits to the ED annually
- The pediatric brain has a higher water content, 88% versus 77% in adult, which makes the brain softer and more prone to acceleration-deceleration injury



HEAD TRAUMA

- The unmyelinated brain is more susceptible to shear injuries
- Infants and young children tolerate intracranial pressure (ICP) increases better because of open sutures
- Head injury is estimated to occur in approximately 200 per 100,000 population per year
- MVA- 27-37% of all pediatric head injuries.
- 15-19yo- alcohol is often a contributing factor.
- Falls are the largest cause of injury in children < 4 years, contributing to 24% of all cases of head trauma



HEAD TRAUMA

- Mortality rate from head trauma is 29% in pediatrics based on death certificate data, underestimation of actual rate
- Head injury represents 75-97% of pediatric trauma deaths
- More 50% with GCS 3-5 have permanent neurologic deficits



TYPES OF HEAD INJURIES



BASILAR SKULL FRACTURES

- 6-14% of head trauma
- Blow to the back of the head, falls, MVC's
- Prolonged nausea, vomiting, and general malaise due to fracture near the emesis and vestibular brainstem centers
- Associated with poor outcomes
- Battle sign, raccoon eyes, and CSF otorrhea and rhinorrhea, hemotympanum, CN deficits

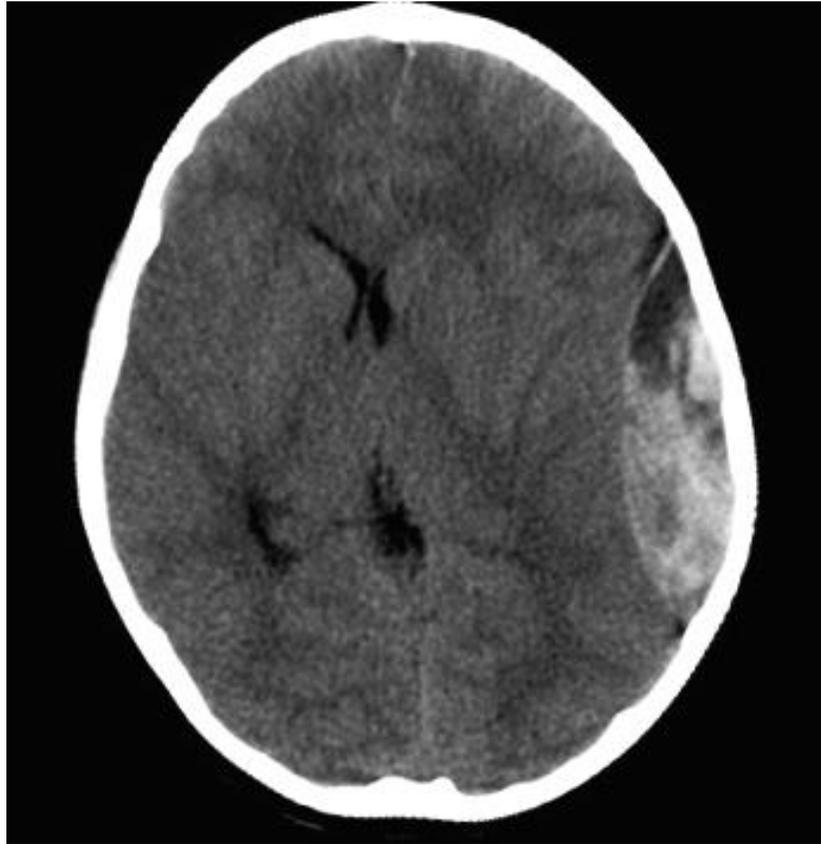


EPIDURAL HEMATOMA

- Between the skull and dura
- Peak in size at 6-8 hours post injury (arterial) to 24 hours (venous)
- Classic lucid interval between the initial loss of consciousness and subsequent neurologic deterioration- less frequent in the pediatric population
- Expansion of hematoma and exhaustion of compensatory mechanisms and compression of the temporal lobe and/or brain stem
- Scalp hematomas, especially in the temporal or occipital region, is concerning for underlying injury in asymptomatic infants younger than 12 months of age
- Irritability, anemia, vomiting, bulging fontanelle, lethargy, seizure, hypotonia



HEAD TRAUMA

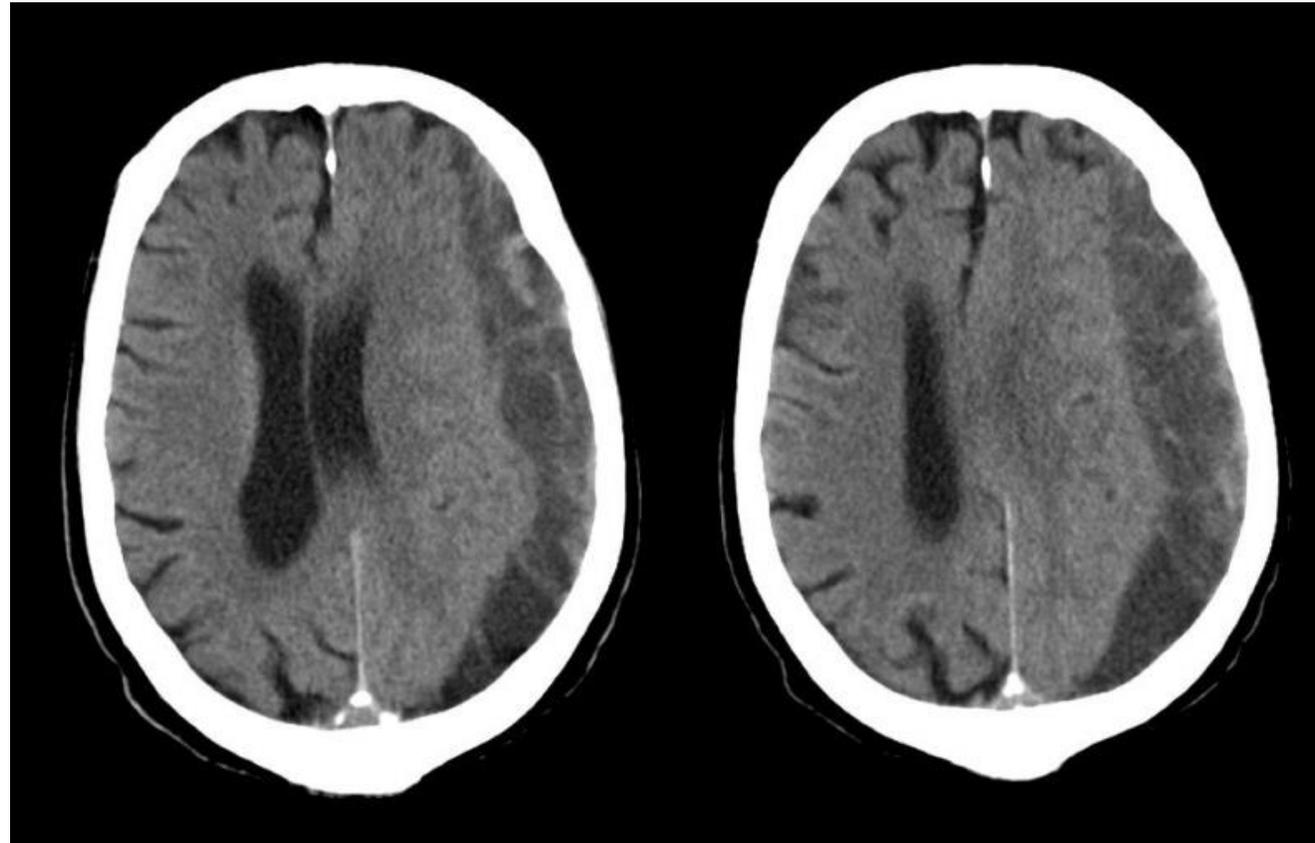


SUBDURAL HEMATOMA

- Between the dura and the cortex, results from tearing of the bridging veins across the dura or laceration of the cortical arteries during acceleration-deceleration forces
- Inflicted head injury is a common etiology
- New-onset seizures, increased head circumference, failure to thrive, tense fontanel, profound and progressive neurologic deterioration



HEAD TRAUMA



SUBARACHNOID HEMORRHAGE

- Most common form of hemorrhage associated with head trauma
- Disruption of the small vessels on the cerebral cortex, bleeding within the subarachnoid space (between the arachnoid and pia mater)
- Nausea, vomiting, headache, restlessness, fever, nuchal rigidity



HEAD TRAUMA

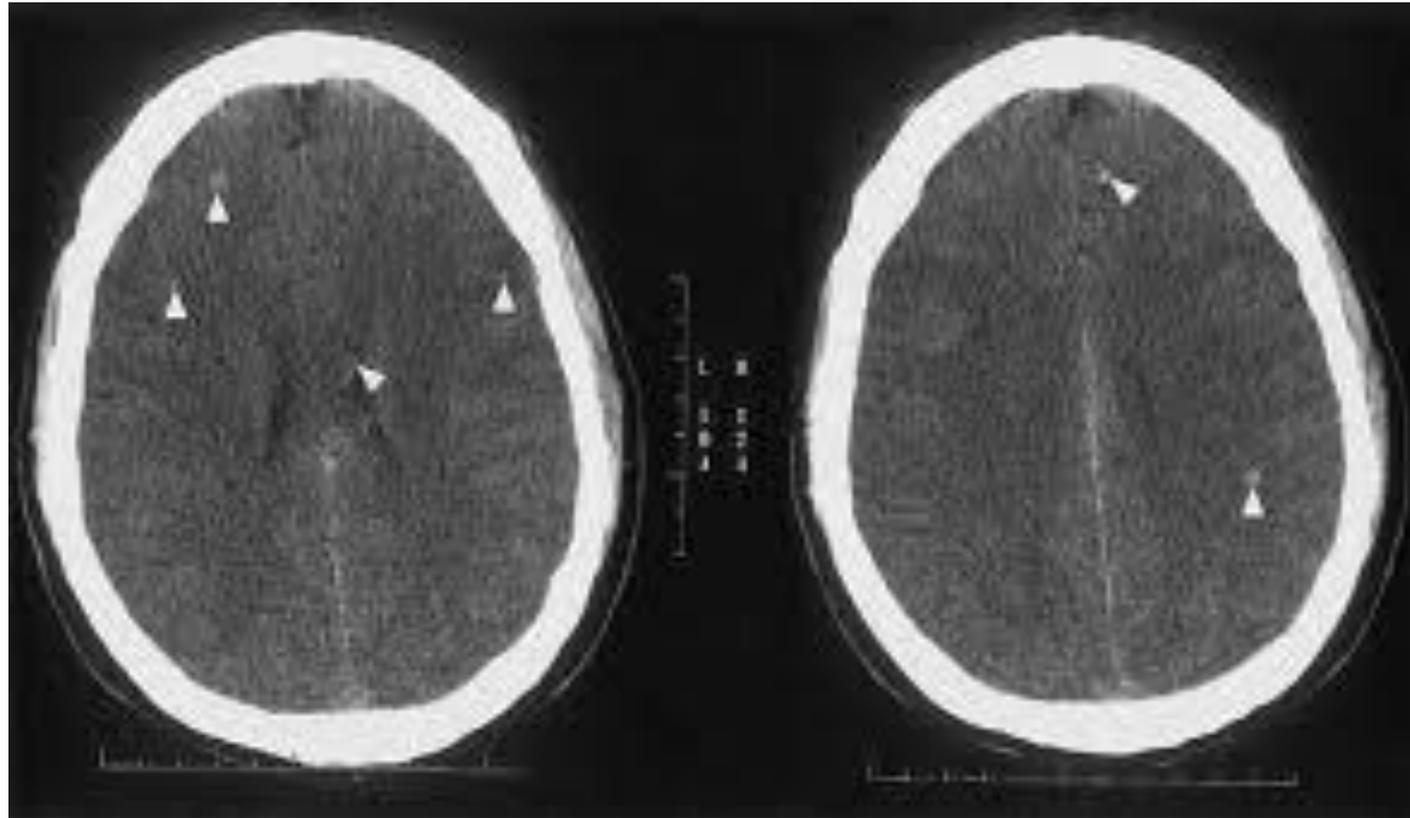


DIFFUSE AXONAL INJURY

- **Rapid acceleration-deceleration forces**
- **Disruption of the small axonal pathways**
- **Basal ganglia, thalamus, deep hemispheric nuclei, and corpus callosum**
- **Altered mentation and often prolonged vegetative state**
- **Abnormal neurologic examination findings and the lack of findings on CT scanning, small petechial hemorrhages may be present.**
- **Prognosis for full recovery often is poor**



HEAD TRAUMA



CONCUSSION

- Head injury that causes and alteration in mental status with or without loss of consciousness
- Concussion is a clinical diagnosis
- Symptoms are temporary but may vary in duration – headaches, problems with concentration and memory, dizziness, balance and coordination issues, nausea and vomiting
- Concussion may be caused by a direct blow to the head, face, neck, or elsewhere on the body with an 'impulsive' force transmitted to the head.
- The clinical signs and symptoms cannot be explained by drug, alcohol, or medication use, other injuries or other comorbidities



CONCUSSION

- Myths
 - They do not have to stay awake
 - You did not have to lose consciousness to have a concussion



CONCUSSION COMPLICATIONS

- Post concussive syndrome
 - The most common significant sequelae to concussions, 30-80% of patients will experience it
 - Physical, emotional, cognitive symptoms that may persist more than a year,
 - Subjective symptoms
 - Common signs include: decreased mental processing speed, decreased short term memory and attention span, irritability, fatigue, sleep disturbance, persistent headaches



CONCUSSION

- Second impact syndrome
 - Most feared and potentially catastrophic consequence of concussions
 - It is a second concussive injury that occurs before the initial concussion has completely resolved
 - Caused by cerebral edema and increased intracranial pressure due to loss of vascular auto regulation; may lead to herniation and death with even mild second injury
 - Only 17 cases reported, very rare



CONCUSSION

- **Key Recommendations from the CDC Pediatric mTBI Guideline:**
 - Do not routinely image patients to diagnose mTBI
 - Use validated, age-appropriate symptom scales to diagnose mTBI
 - Assess evidence-based risk factors for prolonged recovery
 - Provide patients with instructions on return to activity customized to their symptoms
 - Counsel patients to return gradually to non-sports activities after no more than 2-3 days of rest



CONCUSSION

- Management of minor head trauma
 - Avoid additional head injuries
 - Neurocognitive rest
 - Physical rest – 24-48 hours, then slow return to normal activity
 - Symptom treatment



HEAD TRAUMA

- Just CT all head trauma right?
 - Lethal malignancy risk from CT may be as high as 1:5000
 - Radiation exposure with CT 300-600 times of a CXR
 - There are about 600,000 abdominal and head CT examinations annually on children under age of 15, therefore it is estimated that this could result in 500 deaths from cancer attributable to CT radiation a year
- Who do you know who to scan?



HEAD TRAUMA - PECARN

- Included 43,904 pts from 25 US hospitals
 - 25% being less than 2 years of age
 - Presenting within 24 hours
- Exclusion Criteria
- Excluded trivial injuries
 - Ground level falls, walking/running into stationary objects (mild injuries) & no signs or symptoms of head trauma other than abrasions and lacerations, pre-existing neuro disorders, shunts, bleeding disorders
- Evaluated young pts separately:
 - Greater sensitivity to radiation
 - Decreased ability to communicate
 - Different mechanism of injury
 - Different risks for TBI

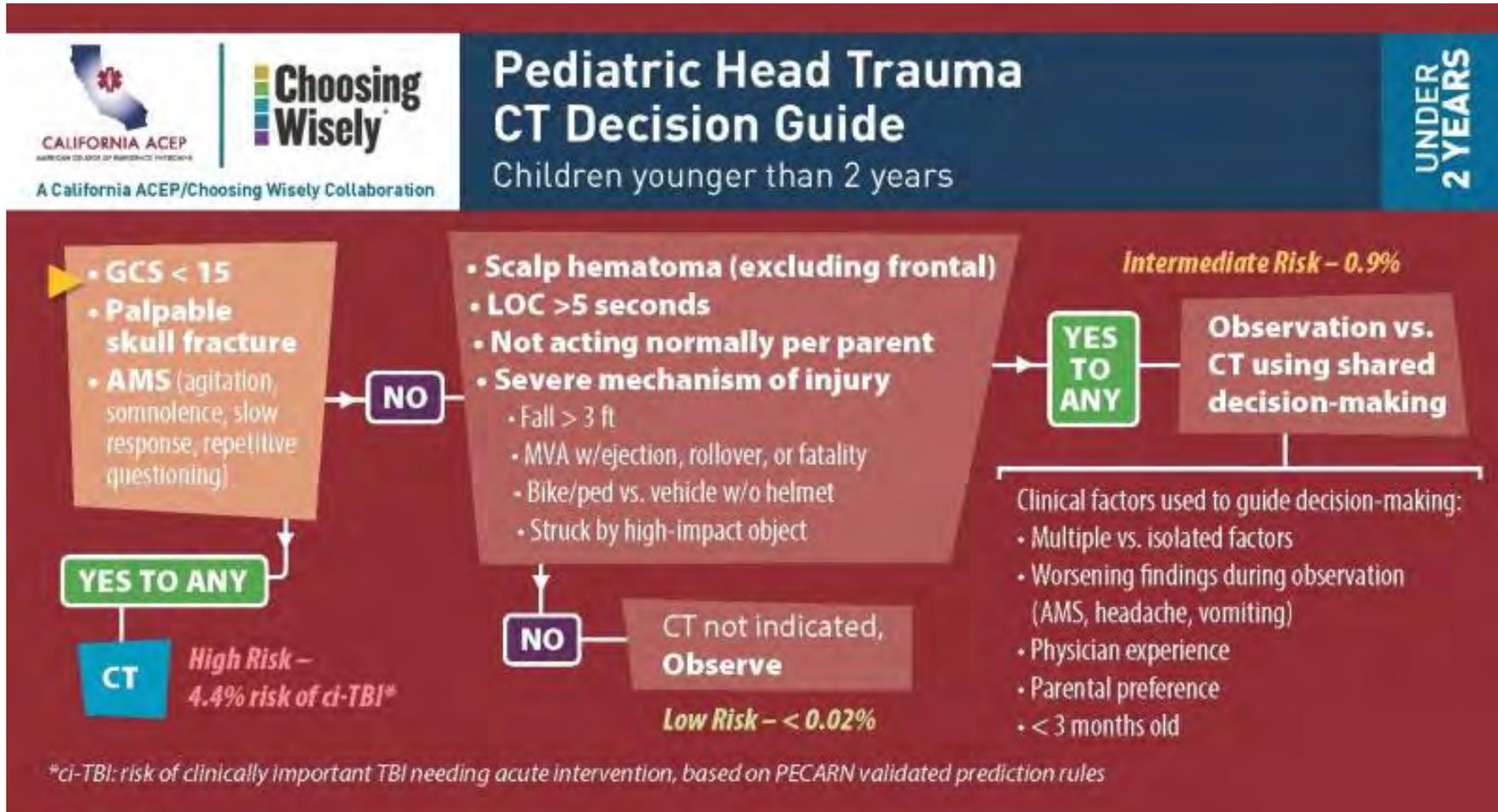


HEAD TRAUMA - PECARN

- PECARN
 - For patients < 2 years old - NPV of 100% and sensitivity of 100%
 - For patients > 2 years old – NPV of 99.95% and sensitivity of 96.8%
 - Prediction rule missed 2 (unhelmeted biker/inline skater) both had a frontal hematoma and moderate headache
- PECARN tells you who NOT to scan



HEAD TRAUMA



HEAD TRAUMA



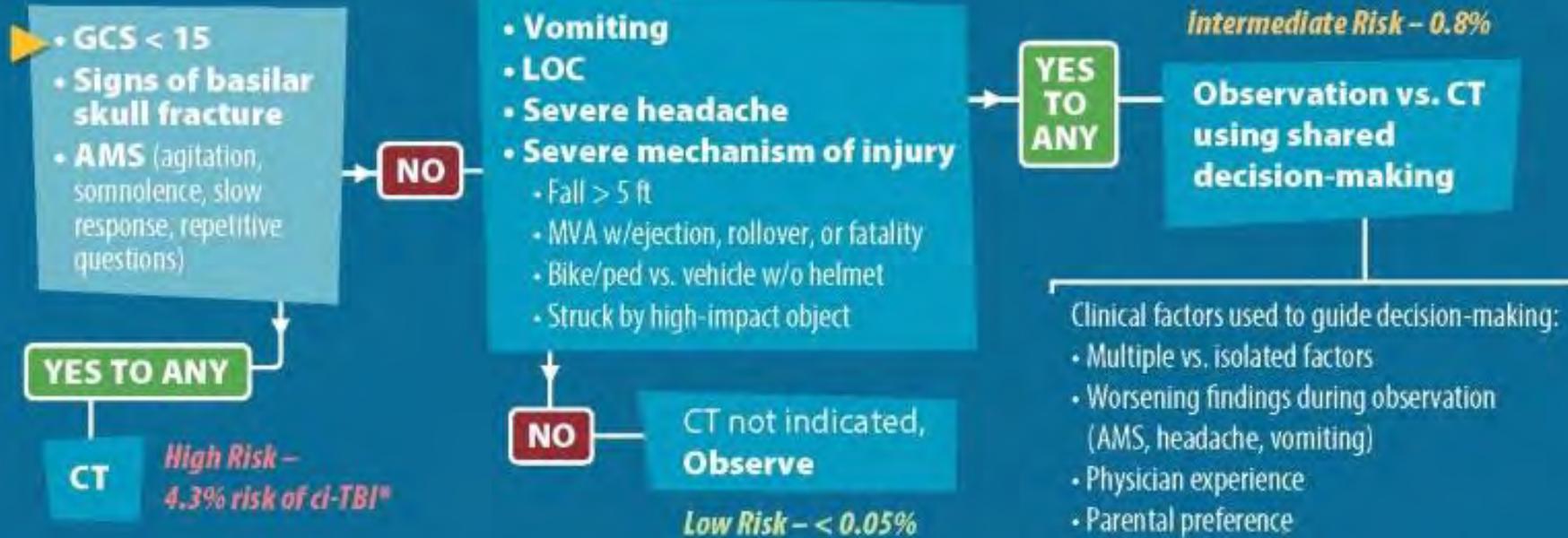
A California ACEP/Choosing Wisely Collaboration



Pediatric Head Trauma CT Decision Guide

Children 2 years and older

2 YEARS
& OLDER



*ci-TBI: risk of clinically important TBI needing acute intervention, based on PECARN validated prediction rules



Abdominal trauma





ABDOMINAL TRAUMA

- Abdominal trauma is present in approximately 25% of pediatric patients with major trauma and is the most common cause of unrecognized fatal injury in children
- 1/2 deaths in non-accidental trauma due to abdominal trauma
- Optimally restrained kids are 3x LESS likely to have abdominal injury
 - use lap/shoulder belt > 5 yo decreases mortality by 45%, morbidity 50%
 - Ages 5-9 most susceptible to abdominal injury because they have a higher rate of non-compliance with booster seat
- 90% of abdominal injuries from trauma are blunt abdominal injuries



ABDOMINAL TRAUMA

- Abdominal organs are relatively larger
- Abdominal muscles are poorly developed
- Less abdominal fat
- Ribcage compliant leads to transmission of force to liver and spleen
- Greater force per BSA leads to multiple injuries
- Difficult to identify if patient in pain
 - cry due to pain
 - cry because doctors are scary
 - cry because parents are not holding them



MVC'S

- Side impact has an increased rate of abdominal injuries
- Positive seatbelt sign
 - Indicates *SIGNIFICANT* force was transmitted to the abdomen
 - Hip and Abdominal Contusions, Pelvic Fx, Lumbar Spine Injury
- Rectal exam not routinely indicated
- Spleen and liver most commonly injured
- Injury **LIKELY** if gen pain/tenderness abdomen
 - Sn 79% if GCS 15, ↓32% if GCS 13
- Inappropriately restrained child 3x more likely to suffer abdominal injury



ABDOMINAL TRAUMA



ABDOMINAL TRAUMA



BICYCLE INJURIES

- #1 cause of SPORTS related ED visits
- Liver > Pancreas > Intestines
- 21% of bicycle injuries had intraabdominal injuries.
- 20% < 6yo required surgical tx
- Handlebar injuries 10% bicycle injuries
 - 10x more likely cause of severe injury than other bike-related causes
 - 50% misdiagnosed at first
 - May NOT have initial skin markings
 - Handlebar injury is from direct impact during a fall
 - Delayed presentation – average is 34.5 hours post fall



FALLS

- Most common non-fatal cause of traumatic injury
- 4% who fall have an intraabdominal injury
- **NO** association of intraabdominal injuries with falls down stairs
- If this history is given by parents suspect **non-accidental** trauma



NON ACCIDENTAL TRAUMA

- If story does not sound right, high suspicion for NAT
- Review of 6186 trauma patients <18 yo
 - 7.3% injury secondary to NAT
- Fall with injuries that do not explain the mechanism
- Multiple Injuries
- Abnormal bruising patterns

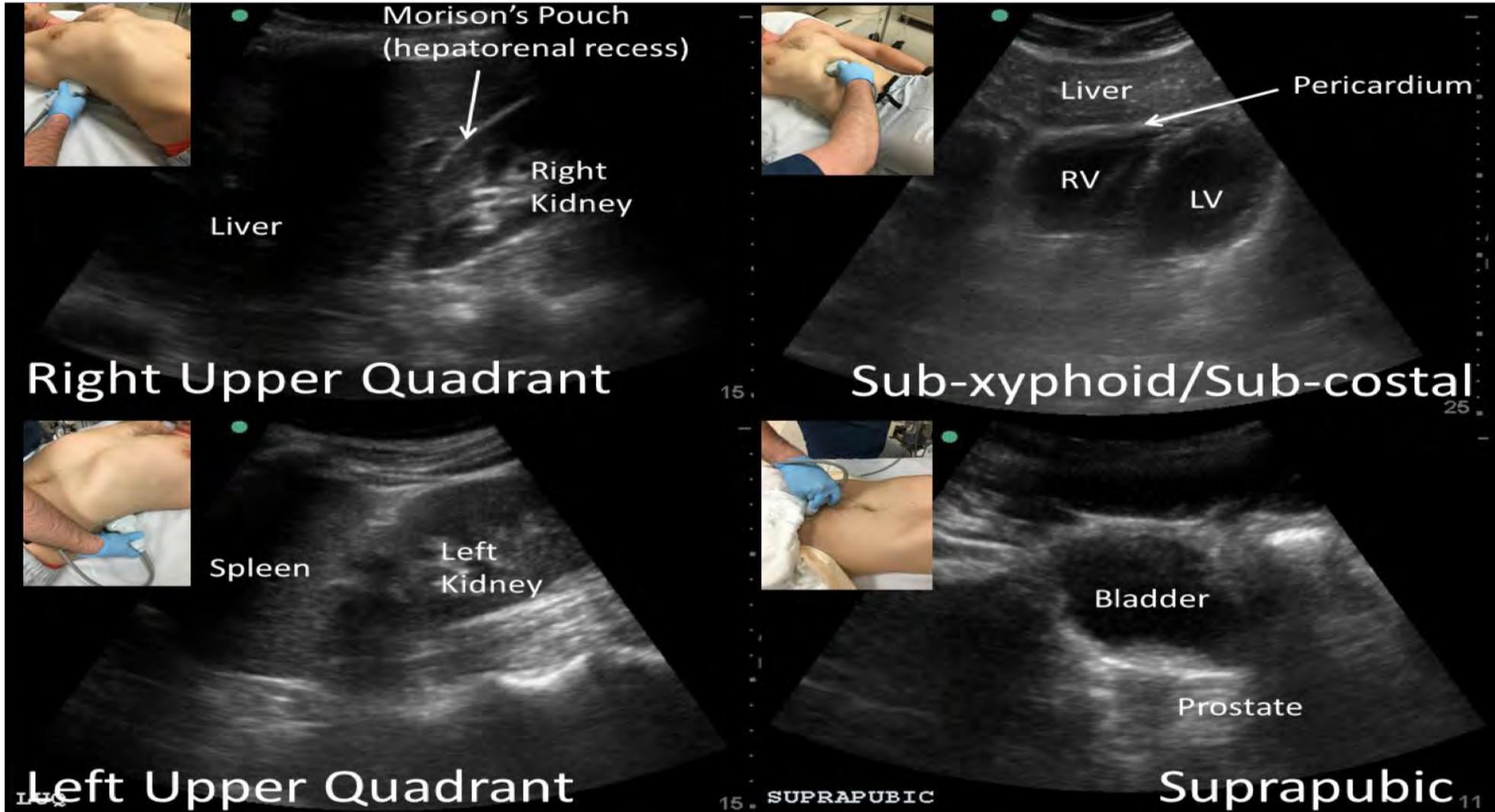


ABDOMINAL TRAUMA IMAGING

- Chest xray
 - only if have a suspicion significant thoracic trauma
- Pelvic xray
 - pelvic fx occur $< 4\%$ blunt peds traumas
 - pelvic exam is typically reliable



ABDOMINAL TRAUMA IMAGING



ABDOMINAL TRAUMA IMAGING

- <15% of all abdominal CT scans done for trauma reveal abdominal injury
 - in 90% pts CT does NOT change Tx
- Several scoring systems developed to evaluate the need for imaging



ABDOMINAL TRAUMA IMAGING

- Prospective Observational Study; One Level 1 Trauma Center
- 1,119/1,324 patients enrolled
- Utilizes 6 'High-Risk' variables, if any present – concern for significant intra-abdominal injury
 - 1. Low age-adjusted Systolic Blood Pressure**
 - 2. Abdominal Tenderness**
 - 3. Femur Fracture**
 - 4. Increased LFTs (AST >200 U/L, ALT >125 U/L)**
 - 5. Microscopic Hematuria (>5 rbc/hpf)**
 - 6. Initial Hematocrit <30%**



ABDOMINAL TRAUMA - PECARN

- PECARN rule for blunt abdominal trauma
 - Glasgow coma scale ≥ 14
 - No evidence of abdominal wall trauma or seat belt sign
 - No abdominal tenderness
 - No complaints of abdominal pain
 - No vomiting
 - No thoracic wall trauma or decreased breath sounds
 - No decreased breath sounds
- 99% sensitive



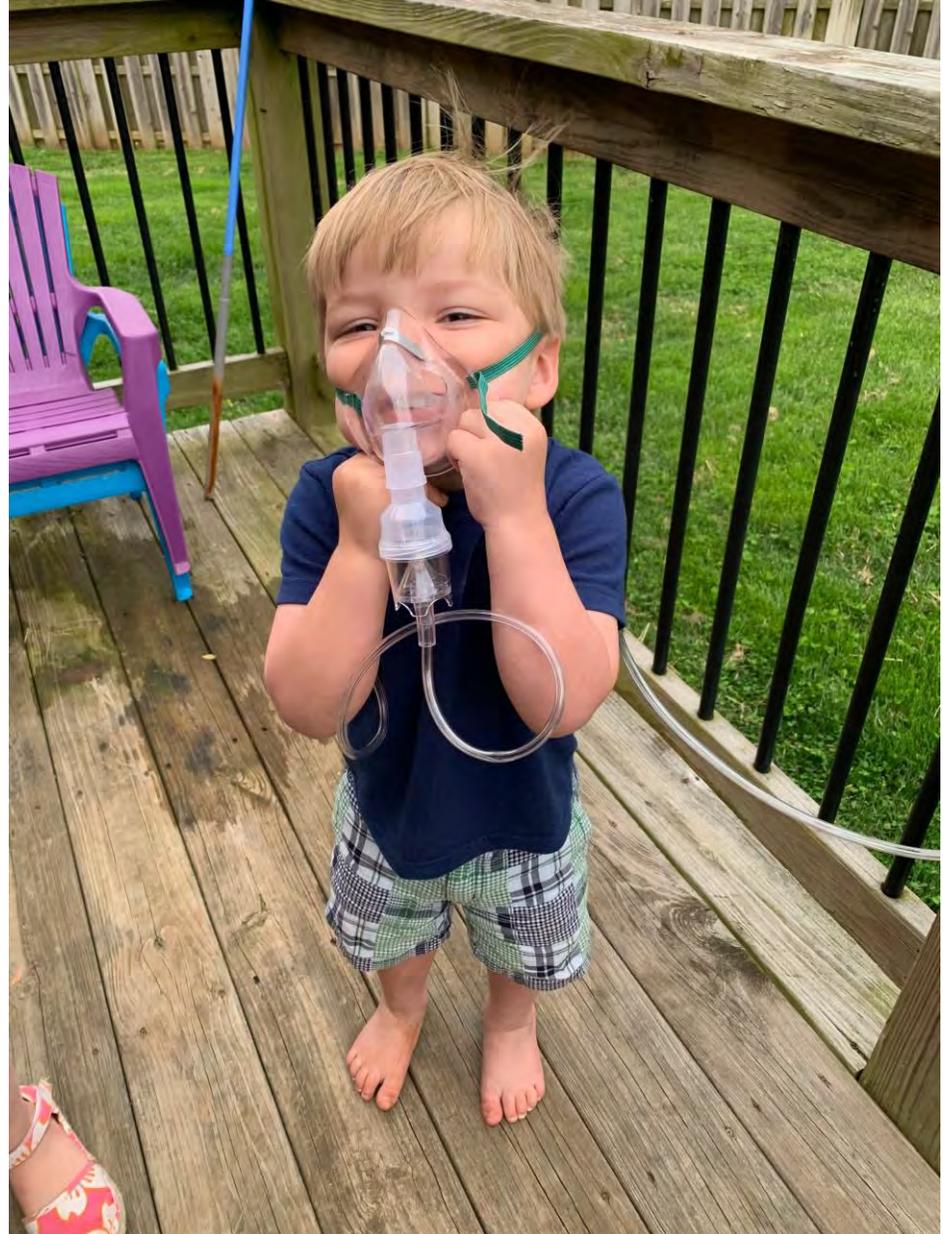
ABDOMINAL TRAUMA

- Management
 - Laparotomy
 - Positive CT or US
 - Hemodynamically unstable
 - Pneumoperitoneum
 - Increasing pain
 - Observation
 - Discharge
 - No abdominal pain
 - No seat belt sign
 - No concern for physical abuse
 - No serious associated injuries



Wheezing





WHEEZING

- Not all that wheezes is asthma
 - Infections
 - Cardiac diseases
 - Retained foreign bodies
 - Gastroesophageal reflux

Causes of wheezing in children

Acute	Chronic or recurrent
Asthma	Structural abnormalities
Bronchiolitis*	Tracheo-bronchomalacia*
Bronchitis	Vascular compression/rings*
Laryngotracheobronchitis ¶	Tracheal stenosis/webs*
Bacterial tracheitis	Cystic lesions/masses
Foreign body aspiration ¶	Tumors/lymphadenopathy
Esophageal foreign body	Cardiomegaly
	Functional abnormalities
	Asthma
	Gastroesophageal reflux
	Recurrent aspiration
	Cystic fibrosis
	Immunodeficiency
	Primary ciliary dyskinesia
	Bronchopulmonary dysplasia
	Retained foreign body (trachea or esophagus)
	Bronchiolitis obliterans
	Pulmonary edema
	Vocal cord dysfunction ^Δ
	Interstitial lung disease

* These disorders tend to present in infancy.

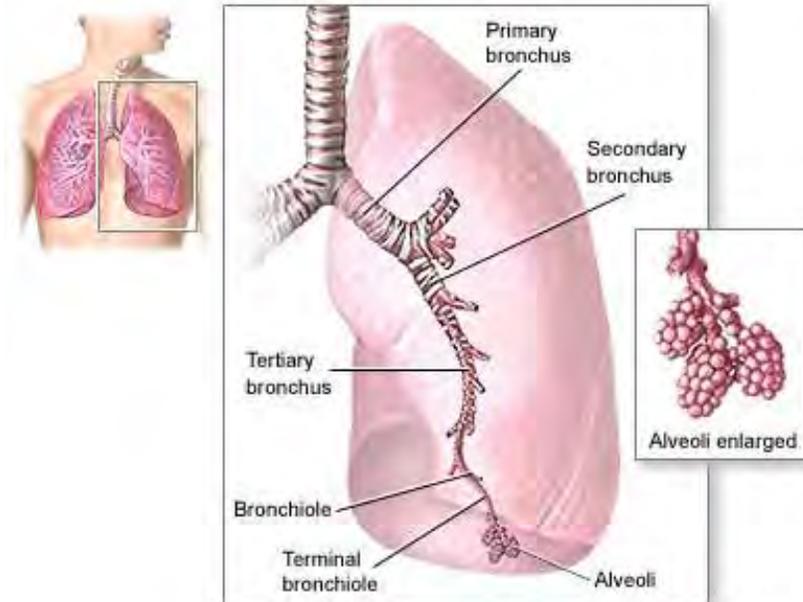
¶ These disorders are more commonly seen in young children (toddlers and preschoolers).

Δ These disorders are more commonly seen in teenagers.



WHEEZING

- What is wheezing?
 - A continuous musical sound that can be produced by oscillation of opposing walls of an airway that is narrowed almost to the point of closure
 - Wheezes are usually high pitched
 - Consist of single or multiple notes
 - Occur during inspiration or expiration



WHEEZING

- Infections
 - Bronchiolitis
 - Bronchitis
 - Epiglottitis
 - Pneumonia
 - RSV
 - Rhinovirus
 - Paramyxoviruses (parainfluenza virus and metapneumovirus)



BRONCHIOLITIS

- A lower respiratory tract infection that primarily affects the small airways
- Occurs in children <2 years of age
- Causes direct damage and inflammation in the small bronchi and bronchioles
- Edema, excessive mucus, and sloughed epithelial cells lead to obstruction of small airways and atelectasis
- Typically caused by a viral infection (RSV most common)
- Mainly seen during the fall and winter
- Remains a significant cause of respiratory disease during the first five years of life
- It is a leading cause of hospitalization in infants and young children



BRONCHIOLITIS

- Risk factors for severe or complicated bronchiolitis include
 - Prematurity (gestational age ≤ 36 weeks)
 - Low birth weight
 - Age less than 12 weeks
 - Chronic pulmonary disease, particularly bronchopulmonary dysplasia
 - Anatomic defects of the airways
 - Hemodynamically significant congenital heart disease
 - Immunodeficiency
 - Neurologic disease
 - Passive smoking
 - Crowded household
 - Daycare attendance
 - Being born approximately two months before or after the start of the epidemic
 - Concurrent birth siblings
 - Older siblings

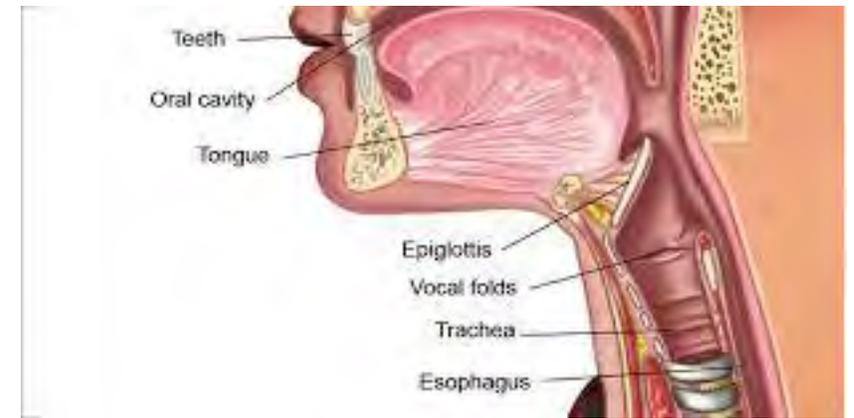


BRONCHIOLITIS

- Presents with fever, cough, and respiratory distress (eg, increased respiratory rate, retractions, wheezing, crackles)
- It often is preceded by a one- to three-day history of upper respiratory tract symptoms
- Symptoms peak on days 3 to 5
- Mean time to resolution of cough ranged from 8 to 15 days, can last up to 28 days
- Complications include dehydration, aspiration, apnea, respiratory failure and secondary infection
- Treatment consists of support of hydration and respiratory status
 - Nasal suctioning, O₂, CPAP, intubation



EPIGLOTTITIS



- The epiglottis forms the back wall of the vallecular space below the base of the tongue
- Consists of a thin cartilage that is covered by a stratified squamous epithelial layer
- A potential space on the lingual surface for edema fluid to collect
- Epiglottitis is a cellulitis of the epiglottis, aryepiglottic folds, and other adjacent tissues
- Results from bacteremia and/or direct invasion of the epithelial layer by the pathogenic organism
- Posterior nasopharynx is the primary source of pathogens



EPIGLOTTITIS

- *Haemophilus influenzae* type b (Hib) was the most common infectious cause of epiglottitis in children but the incidence declined after Hib was added to the routine infant immunization schedule
- Additional infectious causes
 - *H. influenzae* (types A, F, and nontypeable)
 - streptococci (including Group A streptococcus)
 - *Staphylococcus aureus*
- Traumatic causes of epiglottitis include thermal injury, foreign body ingestion, and caustic ingestion
- Median age is 6 to 12 years of age



EPIGLOTTITIS

- Young children classically present with respiratory distress, anxiety, and the characteristic "tripod" or "sniffing" posture
- They may be reluctant to lie down
- Drooling is often present
- Cough is typically absent
- Stridor is a late finding
- Maintenance of the airway is the focus of treatment
- A third-generation cephalosporin (eg, ceftriaxone or cefotaxime) AND an antistaphylococcal agent (eg, vancomycin)



CARDIAC DISEASE



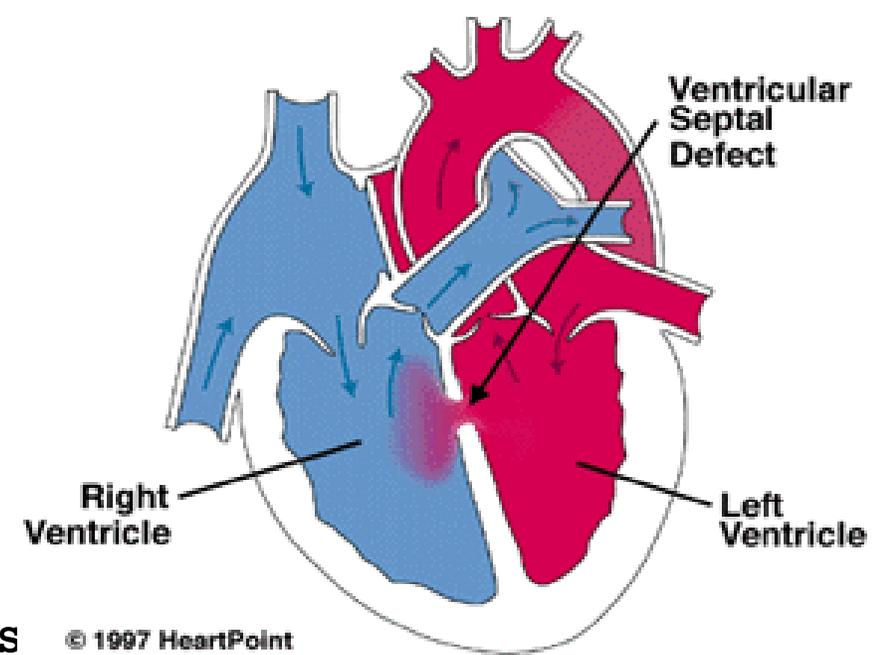
WHEEZING

- Cardiac disease
 - Ventricular Septal Defect (VSD)
 - Atrioventricular Septal Defect (AV Canal)
 - Patent Ductus Arteriosus (PDA)
 - Pulmonary Stenosis
 - Aortic Stenosis
 - Coarctation of the Aorta
 - Hypoplastic left heart syndrome
 - Heart valve disease
- Caused by left heart failure



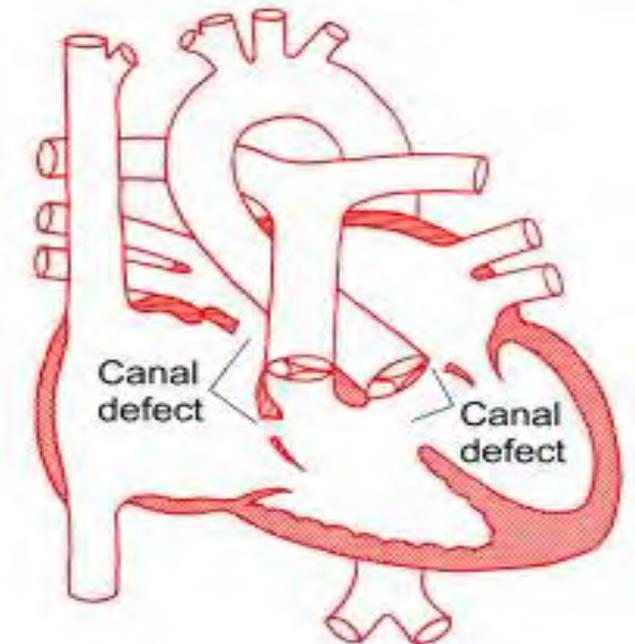
VSD

- Free communication between the R & L ventricles
 - Accounts for 25% of CHD
- The left to right shunt occurs secondary to PVR being less
- This leads to elevated RV & pulmonary pressures & volume hypertrophy of the LA & LV
- Symptoms develop between 1 – 6 months
- Small to moderate VSD, 3-6mm, are usually asymptomatic and 50% will close spontaneously by age 2yrs
- Moderate to large VSD, almost always have symptoms and will require surgical repair



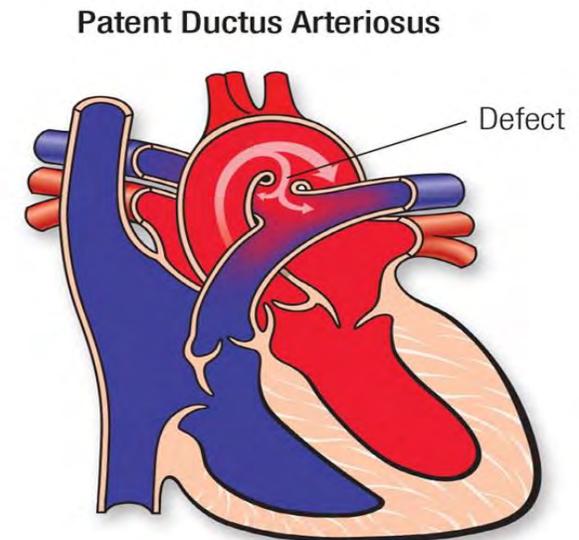
AVSD

- Results from incomplete fusion of the endocardial cushions, which help to form the lower portion of the atrial septum, the membranous portion of the ventricular septum and the septal leaflets of the tricuspid and mitral valves
- They account for 4% of all CHD
- Congestive heart failure in infancy
- Recurrent pulmonary infections
- Failure to thrive
- Easy fatigability
- Late cyanosis from pulmonary vascular dz w/ R to L shunt
- Surgery is required



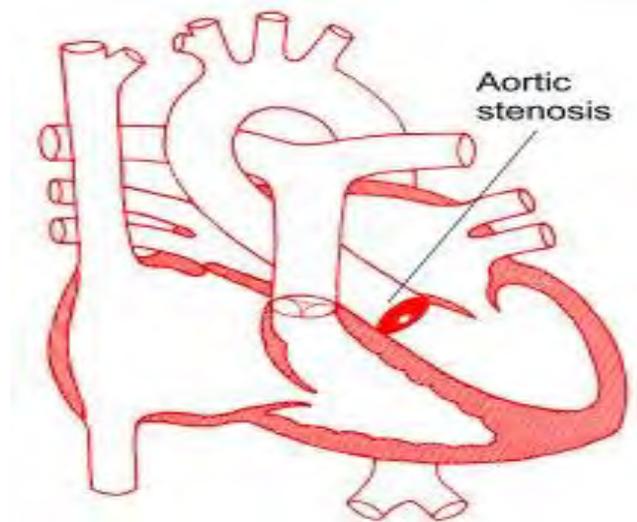
PATENT DUCTUS ARTERIOSUS

- Persistence of the normal fetal vessel that joins the PA to the Aorta.
- Normally closes in the 1st wk of life.
- Accounts for 10% of all CHD
- As a result of higher aortic pressure, blood shunts L to R through the ductus from Aorta to PA
- Surgery is required



AORTIC STENOSIS

- An obstruction to the outflow from the left ventricle at or near the aortic valve that causes a systolic pressure gradient of more than 10mmHg
- Accounts for 7% of CHD
- Aortic insufficiency & re-stenosis is likely after surgery and may require valve replacement
- Activity should not be restricted in Mild AS
- Mod-severe AS, no competitive sports
- Severe AS can result in sudden death



RETAINED FOREIGN BODY



FOREIGN BODY

- FB should be suspected in any patient who presents with wheezing of sudden onset, even in the absence of a clear history of a choking episode
- FB should be suspected in any child with a unilateral wheeze or unequal breath sounds
- In children the foreign body can lodge in any bronchus
- Patients can also present with chronic symptoms if FB is not recognized in the acute setting
- Esophageal foreign body also can present with acute wheezing secondary to compression of the airways
- A history of feeding and swallowing difficulties and the presence of dysphagia are important clues to the diagnosis

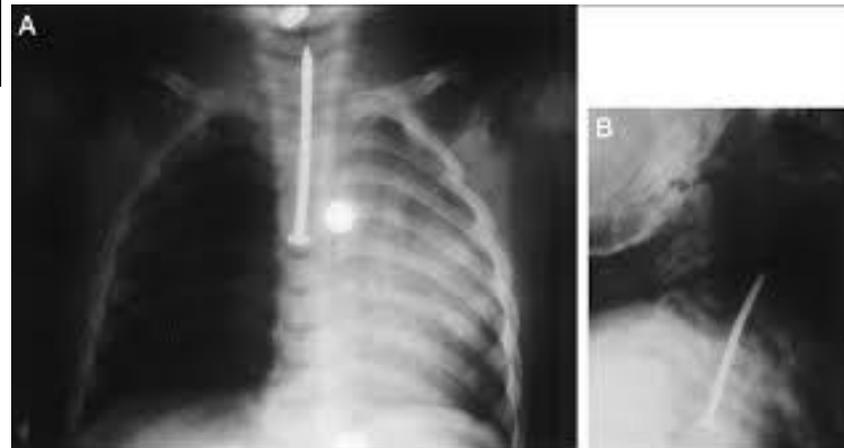
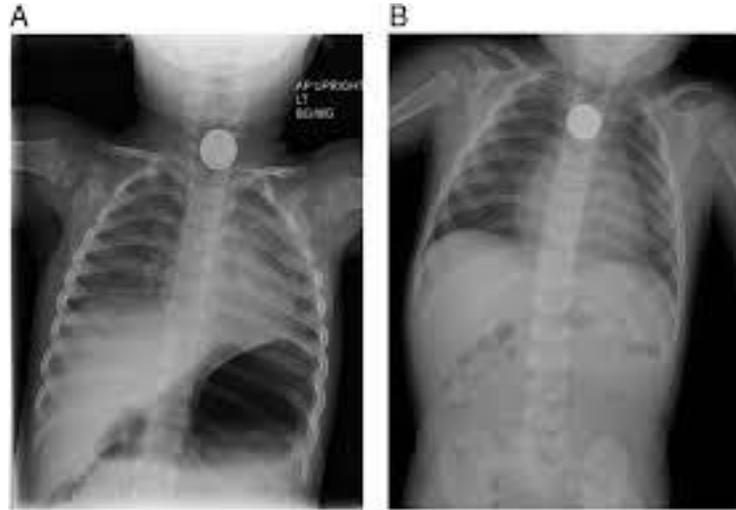


FOREIGN BODY

- FB aspiration was responsible for about 4800 deaths in 2013
- Death caused by suffocation following FB aspiration is the fifth most common cause of unintentional-injury mortality in the United States
- It is the leading cause of unintentional-injury mortality in children younger than one year
- The peak incidence is between one and two years of age with 80% of cases being in kids less than 3 years old
- Food items are the most common items aspirated by infants and toddlers, whereas nonfood items are more commonly aspirated by older children
- Certain medications such as iron or potassium may dissolve in the airways and cause intense inflammation and eventually stenosis



FOREIGN BODY



FOREIGN BODY

- Bronchoscopy is successful in removing the FB in about 95 percent of cases
 - complication rate of less than 1 percent
- Thoracotomy is indicated if bronchoscopy is unsuccessful
- Major complications of FB extraction include pneumothorax, hemorrhage, and respiratory arrest
- Prolonged retention may result in inflammation and/or infection



GERD



GERD

- Passage of gastric contents into the esophagus (gastroesophageal reflux, or GER) is a normal physiologic process that occurs in healthy infants, children, and adults
- Gastroesophageal reflux **disease** (GERD) occurs when the reflux episodes are associated with complications such as esophagitis or poor weight gain
- Gastroesophageal reflux (GER) is extremely common in healthy infants, in whom gastric fluids may reflux into the esophagus 30 or more times daily
- Treatment
 - Thickening food
 - Eat sitting up
 - PPI (for at least 3-6 months)



Vomiting





VOMITING

- Not always from a gastrointestinal source
 - Urinary tract infection and pyelonephritis
 - Brain mass or injury
 - Diabetes



UTI

PYELONEPHRITIS



UTI/PYELONEPHRITIS

- *Escherichia coli* is the most common bacterial cause of UTI
- The prevalence of UTI is highest in boys younger than one year and girls younger than four years
- Uncircumcised male infants have a four- to eightfold higher prevalence of UTI than circumcised male infants
- Classic presentation in acute pyelonephritis is the triad of fever, costovertebral angle pain, and nausea/vomiting



PYELONEPHRITIS

- Complications of pyelonephritis may involve any of the following
 - Acute kidney injury
 - Chronic renal damage leading to hypertension and renal failure
 - Sepsis syndromes
 - Renal papillary necrosis
 - Renal abscesses



BRAIN MASSES



BRAIN MASSES

- Primary malignant CNS tumors are the second most common childhood malignancies, after hematologic malignancies
- The most common pediatric solid organ tumor
- The leading cause of death from childhood cancer, surpassing the mortality rate of acute lymphoblastic leukemia



BRAIN MASSES

- Types
 - Low-grade gliomas, focal brainstem glioma and Malignant gliomas
 - Medulloblastoma
 - Craniopharyngioma
 - Ependymoma
 - Germ cell tumors
 - Intradural nerve sheath tumors, such as schwannomas, neurofibromas, and malignant peripheral nerve sheath tumors
 - Meningioma



BRAIN MASSES

- The most common types of brain tumors in children are gliomas and medulloblastomas
- Symptoms may include
 - Increased intracranial pressure
 - secondary to obstruction of CSF at aqueduct
 - hydrocephalus (infants), headache, papilledema, vomiting
 - Seizures
 - Focal neurological deficits
 - Hormonal changes (pituitary adenoma)
 - Visual changes (diplopia, field defects)



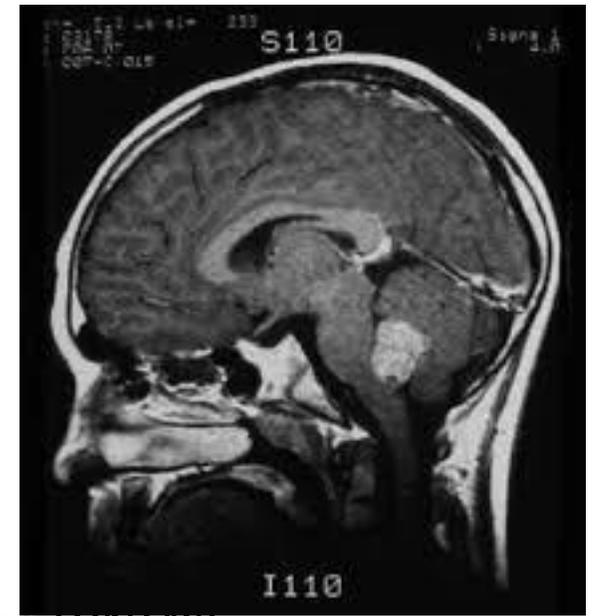
BRAIN MASSES

- Grade I and II (low-grade)
 - The tumor grows slowly
 - Rarely infiltrates into nearby tissues
 - Grade II can infiltrate into nearby tissues – Can be cured by surgery
- Grade III and IV (high-grade)
 - The tumor grows quickly
 - Likely to infiltrate into nearby tissue
 - Grade IV tumors usually cannot be cured/removed by surgery



MEDULLOBLASTOMA

- Accounts for 20% of brain tumors in children
- Form in the cerebellum
- Referred to as a infratentorial primitive neuroectodermal tumor (PNET)
- Can metastasize to the spinal cord
- Highly aggressive
- Peak incidence is between five and nine years of age
- Treatment consists of a combined-modality approach that includes surgery, radiation therapy, and chemotherapy
- Long-term survival is now achieved in approximately three-quarters of patients



BRAINSTEM GLIOMAS

- Located in the middle of the brainstem
- Majority of the tumors cannot be surgically removed
- Occur in school-aged children
- Symptoms include endocrine problems and paralysis of nerves/ muscles of the face
- Respiratory changes
- 10-20% of tumors in children
- Median age at diagnosis is five to nine years of age
- Many children with low-grade brainstem gliomas have a relatively long history of minor symptoms and signs, which may have been present for many years



DIABETES AND DKA



DIABETES

- Type 1
 - Autoimmune destruction of the pancreatic islet cell
 - Hallmark is lymphocytic infiltration of islets
 - Progresses over years
 - Leads to insulin deficiency
 - Later may be associated with glucagon deficiency as well



DKA

- 15-30% of new diabetics present in DKA
 - Less than 4 yrs of age, 40% present with DKA at diagnosis
- Most common cause of death in diabetics less than 20 years of age
- 70% of related deaths in diabetics less than 10 yrs of age
- Mortality: 5-15%
- Criteria
 - Blood glucose > 250 mg/dl
 - pH < 7.35
 - HCO₃ < 20 mEq/L
 - Anion Gap > 12
 - ketonemia



DKA

- Fluids or not?
 - Cerebral Edema
 - Etiology is not known
 - Occurs exclusively in pediatric patients
 - Mortality Rate = 21%
 - Morbidity Rate = 27% (permanent neurologic sequelae)
 - Clinical diagnosis
 - Signs include changes in mental status, urinary incontinence, and new headache or recurrence of vomiting
 - Treatment should be initiated promptly using mannitol (0.5 to 1 gm/kg) and/or hypertonic saline (3% saline, 5 to 10 mL/kg over 30 minutes)



DKA

- Fluids - average water losses in children with DKA are approximately 70 mL/Kg
 - Bolus 10 cc/kg at a time
- 0.1 unit/kg/hr continuous insulin drip (regular) until
 - Serum anion gap reduced to normal
 - Venous pH >7.3, or serum bicarbonate (HCO_3) >15 mEq/L
 - Blood glucose <200 mg/dL (11.1 mmol/L)
 - Patient is tolerating oral intake
- The serum sodium concentration should be measured every two to four hours during treatment to ensure that it is rising as expected, at a rate of approximately 1.6 mEq/L for every 100 mg/dL (5.5 mmol/L) decrease in glucose concentration
 - Can be a sign of impending cerebral edema



DKA

- If the patient is **hyperkalemic**, potassium replacement should not be given initially, but should be initiated when the serum potassium falls to normal
- If the patient is **normokalemic and voiding**, potassium replacement should be given with the start of insulin therapy. The usual starting concentration is 40 mEq/L (40 mmol/L) of potassium added to the IV fluid solution
- If the patient is **hypokalemic**, potassium replacement should be started immediately, and the insulin infusion should be delayed until serum potassium has been restored to a near normal concentration



THANK YOU FOR YOUR TIME

References available on request

