Non-accidental pediatric trauma

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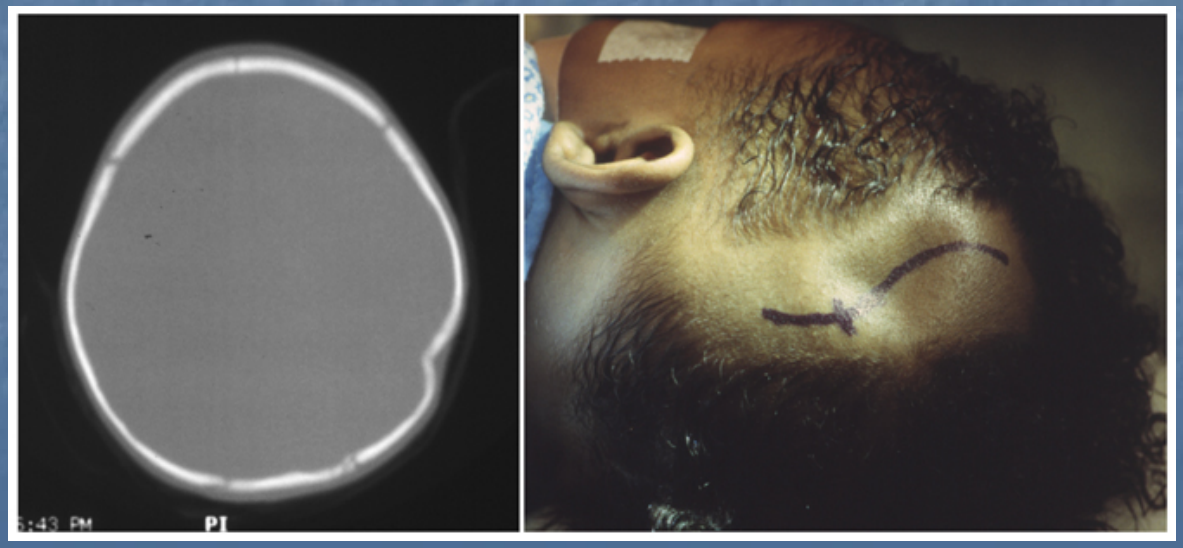
Birth related trauma

- Ping-pong ball fractures
  - Caving of a focal area of the skull
  - Usually seen in a newborn
  - Due to the plasticity of the skull
  - No treatment if occurs in temporal parietal area in the absence of underlying brain injury as the deformity will correct as the skull grows
  - Frontally located lesions corrected for cosmesis



Birth related trauma

- Acute subdural hematomas
  - Can occur as birth injuries
  - Present with
    - Seizures
    - Pallor
    - Tense fontanelle
    - Poor respirations
    - Hypotension
    - Retinal hemorrhages
  - Unilateral
  - High density on CT

Birth related trauma

- Cephalohematomas
  - Accumulation of blood under the scalp.
  - Occur almost exclusively in children
  - 2 types (subgaleal and subperiosteal)
- Subgaleal hematoma
  - The large majority of subgaleal bleeds in the newborn are associated with vacuum application
  - May occur without bony trauma, or may be associated with linear non-displaced fracture (especially in age < 1 yr)
  - Bleeding into loose connective tissue separates galea from periostium
  - May cross sutures
  - Starts as a localized hematoma but may grow huge (significant loss of blood in infants may require transfusion)
  - Presents as a soft fluctuating mass
  - These do not calcify

Subgaleal cephalohematoma

Birth related trauma

- Subperiosteal hematoma
  - Most commonly seen in a newborn
    - 1% of live births
    - Associated with parturition
    - Associated with neonatal scalp monitors
  - Bleeding elevates periosteum
  - Extent is limited by sutures
  - Firmer and less ballotable than subgaleal hematoma
  - Scalp moves freely over mass
  - Most commonly parietal
  - 80% reabsorbed, usually within 2-3 weeks
  - Occasionally may calcify

Birth related trauma

- Infants may develop jaundice as blood is resorbed, occasionally as late as 10 days after onset.
- Treatment
  - Usually resolves in 2-4 weeks
  - Analgesics
  - Do not aspirate due to risk of infection and risk of anemia in newborn
  - Follow serial hemoglobin and hematocrit in large lesions
  - If subperiosteol hematoma present for >6 weeks obtain a skull film
  - If the lesion is calcified, surgery may be indicated for cosmetic reasons, although with most of these the skull will return to normal contour in 3-6 months.

Birth related trauma

- Differentiate from caput succedaneum
  - Observed after vaginal delivery
  - Slightly hemorrhagic scalp edema
  - Located inside the scalp (crosses suture lines)
  - Edema pits upon pressure
  - Resolves over a few days

Birth related trauma

- Brachial plexus injuries
  - Incidence 0.3-2 per 1000 live births
  - Upper plexus injuries most common with half involving C5 and C6
  - Combined lower and upper lesions occur in 20%
  - Lower lesions rare in isolation (2%)
  - Risk factors
    - High birth weight
    - Primiparous mother
    - Shoulder dystocia
    - Forceps
    - Breech presentation

Birth related trauma

- Types
  - Klumpke's Palsy
    - Paralysis of the thoracic nerves, often causing the hand to be limp with immovable fingers
  - Complete Brachial Plexus Palsy
  - Erb's Palsy
    - Paralysis of the fifth and sixth cervical nerves, resulting in the arm being turned towards the body and the hand turned backward with no movement at the elbow
  - May be associated with Horner's Syndrome
- Management of brachial plexus injuries
  - 90% recover spontaneously (with 24 hours)
  - 4 to 15% result in some degree of permanent injury
  - Surgery not considered before 6 months of age and may be delayed to one year
  - Signs of EMG related reinnervation indicate further expectant management

Child Abuse

- Epidemiology
  - 10% of children under ten years old that are brought to the ER with alleged accidents are victims of child abuse
  - 25% of all hospital admissions for head injury in children younger than 2 years of age result from deliberately inflicted trauma
  - Incidence of accidental head trauma of significant consequence below age 3 is low but battering is highest in this age group

Child Abuse

- Risk factors
  - **Community/Societal**
    - High crime rate
    - Lack of or few social services
    - High poverty rate
    - High unemployment rate
  - **Child Related**
    - Prematurity,
    - Low birth weight
    - Handicap
    - Female
  - **Parent Related**
    - History of physical or sexual abuse (as a child)
    - Single or teen parents
    - Emotional immaturity
    - Poor coping skills
    - Low self-esteem
    - Substance abuse
    - Known past history of child abuse
    - Lack of social support
    - Domestic violence
    - Lack of parenting skills
    - Depression or other mental illnesses
    - Multiple young children
    - Unwanted pregnancy
    - Denial of pregnancy

Child Abuse

- Battered-child syndrome
  - Described by Kempe in 1962
  - Most common in children younger than 3 years of age
  - Children with this syndrome are brought to medical attention for an unrelated problem or with a particular acute injury
    - The accidental mechanisms offered are often of a relatively trivial nature
    - Parents may characterize infants as fussy or stubborn, and older children as clumsy, hyperactive, or accident-prone
  - Chronically abused children may appear passive and withdrawn but often show strong attachment to the parent even if he or she is the perpetrator
  - Episodes of physical trauma are recurrent rather then isolated

Child Abuse

- Diagnosis
  - History
    - Often sketchy and elusive
    - Not uncommon that the adult who brings the child to medical attention is not the patient's regular or exclusive caretaker
    - Use of child protection team invaluable (pediatricians, social workers)
  - Thorough physical examination
    - Entire body (must remove patient's clothes)
  - Labs
    - Toxicological screening
  - Imaging
    - XR for skeletal survey
    - Bone scan
    - CT
    - MR

Child Abuse

- Signs of chronic abuse
  - Poor hygiene
  - Malnutrition
  - Growth retardation
  - Multiple cutaneous bruises of different ages
  - Pattern injuries
  - Burn marks
  - Skeletal injuries at different stages of healing

Child Abuse

- Obvious evidence of chronic abuse may not be readily apparent in all children
- Factors which raise the index of suspicion
  - Retinal hemorrhages
  - Spiral fractures of the humerus or femur in infants
  - Metaphyseal fractures in infants
  - Duodenal hematoma
  - "Tin ear" (bruising of the ear)
  - Frenulum tears
  - Immersion burns
  - Patterned bruises

Child Abuse

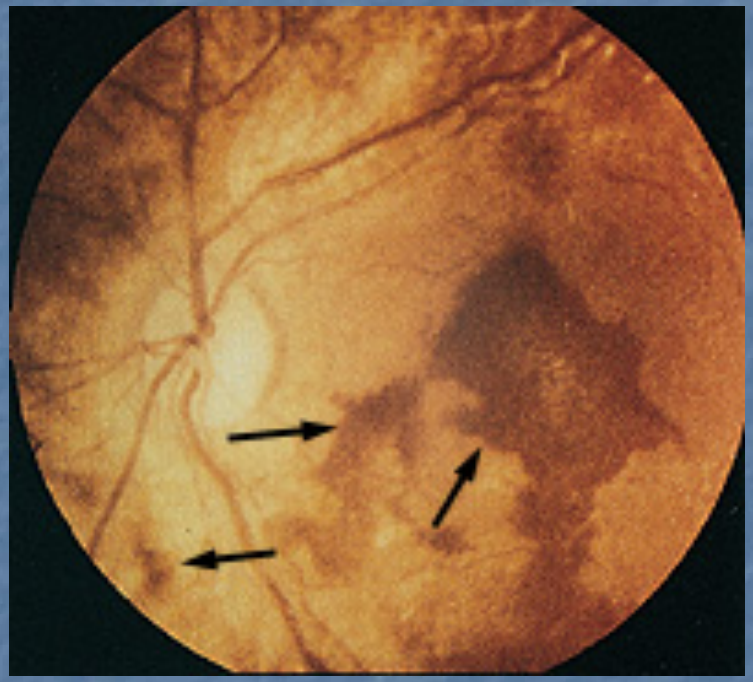
- Neurosurgical factors which raise the index of suspicion
  - Significant neurological injury with minimal signs of external trauma
  - Bilateral chronic subdural hematomas in a child < 2 years old
  - Intracranial hemorrhages or contusions
  - Skull fractures
    - Multiple
    - Stellate skull fractures
    - Associated with intracranial injury
  - Cephalohematomas (sometimes from severe hair pulling)

Child Abuse

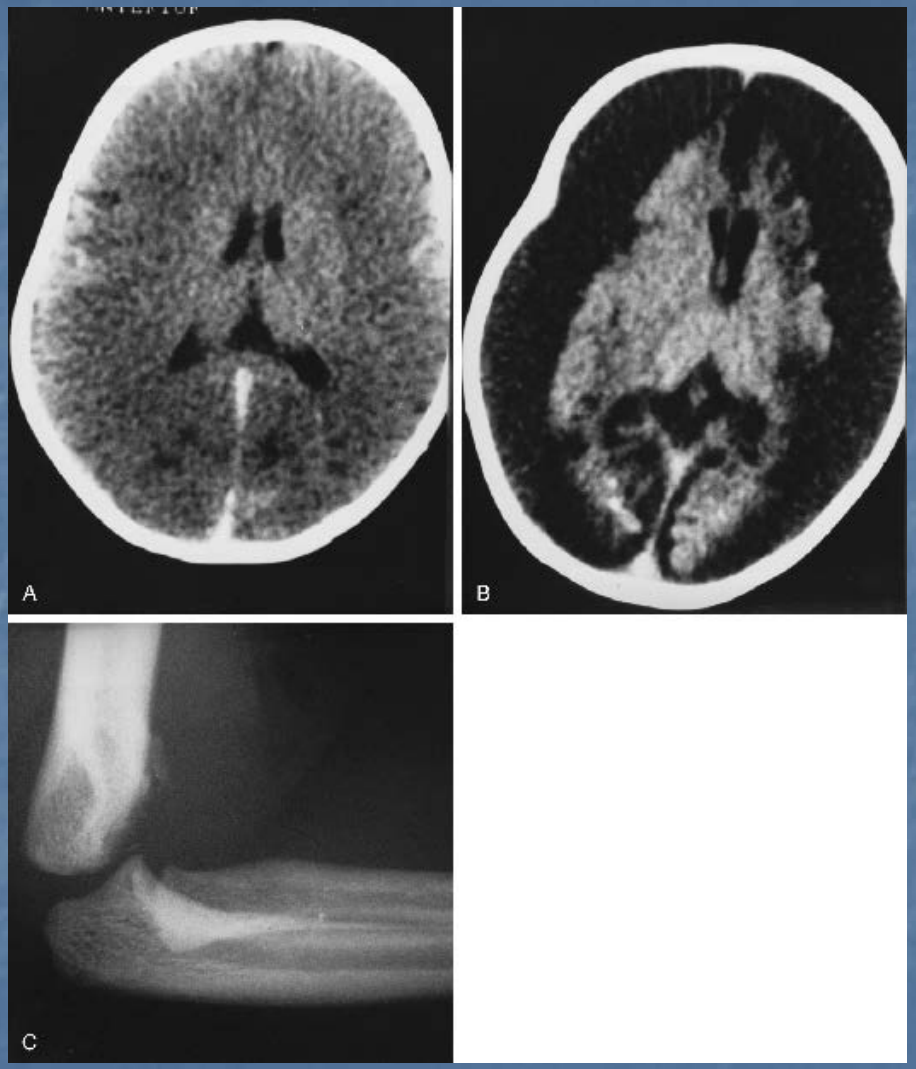
- Shaken baby syndrome
  - Described by Caffey in 1972
  - Children are nearly always 2 years of age and most are under 6 months of age
  - Brought to medical attention
    - Irritability, poor feeding, or lethargy in mild cases
    - Seizures, apnea, or unresponsiveness in more severe instances
  - The history is often vague,
    - No or trivial history of trauma is offered
    - Sometimes a history of shaking to resuscitate is obtained
  - Diagnosis may come to light when a lumbar puncture performed as part of an evaluation for sepsis reveals bloody CSF
  - Mechanism
    - Vigorous shaking produces whiplash acceleration-deaccelerations of the head
      - Large head, weak neck muscles, watery brain consistency
    - Impact may be involved
      - The final thrust often involves the head striking against a surface
      - Some authors prefer the term "shaking impact syndrome"

Child Abuse

- Shaken baby syndrome
  - Characteristic findings
    - Retinal hemorrhages
    - Acute subdural hematomas (80%)
    - Acute subarachnoid hemorrhages
    - Injury at cervicomedullary junction
  - Associated findings
    - Finger marks on chest
    - Multiple rib fractures and/or pulmonary compression
    - Parenchymal lung hemorrhages
    - Periosteal new bone formation at the epiphyseal regions of the long bones
  - Deaths due to uncontrollable intracranial hypertension



- Shaking baby syndrome
  - No history of trauma in this unresponsive 2-month-old infant.
  - A: Time of presentation shows subarachnoid and posterior interhemispheric collection of blood
  - B: Severe diffuse brain atrophy seen 2 months after injury
  - C: "Bucket handle" fracture of the distal humerus



Child Abuse

- Retinal hemorrhages
  - In traumatized child with multiple injuries and an inconsistent history, the presence of retinal hemorrhages is pathognomonic of battering (Eisenbrey 1979)
    - 16/26 battered children <3 years old had retinal hemorrhages on fundoscopy
    - 1/32 non-battered traumatized children with head injury had retinal hemorrhages
      - Single case was traumatic parturition where the incidence of retinal hemorrhages is 15-30%)
  - Retinal hemorrhages may also be due to
    - Benign subdural effusion in children
    - Acute high altitude sickness
  - Ophthalmological consultation to document
  - Amblyopia may develop if the macula is obscured by hemorrhage for a prolonged period