

Pediatric Head Injury

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Disclosures

I have no financial disclosures

Case 1

- 22 mo female fell from bed on tile
- Brief LOC of 2-3 seconds
- One episode of vomiting
- Acting normally
- Neuro exam unremarkable
- 3 cm swelling to right forehead with no appreciated step off

Case 2

- 15 yo male slipped on ice and hit back of head
- No LOC
- No vomiting
- No swelling or step off
- A&O x4 but requires repeated questioning
- Neuro exam otherwise unremarkable

Case 3

- 4 mo male fell 2 feet from carrier
- No LOC
- One episode emesis
- Abrasion to vertex with no swelling or step off
- GCS 15
- Unremarkable neuro exam

Case 4

- 12 yo female fell 4.5 feet from counter
- Brief LOC 2-3 seconds
- No vomiting
- Mild occipital swelling
- Normal neuro exam

Case 5

- 11 mo male fell 4 feet from mom's shoulders
- No LOC or vomiting
- 2 cm frontal hematoma without step off
- Normal neuro exam

Case 6

- 8 yo female fell from trampoline
- No LOC or vomiting
- Mild tenderness and swelling to occiput
- Bright red blood from right ear but has tube in place. No obvious canal laceration but blood obscures exam
- Normal neuro exam

Case 7

- 16 yo female in MVC 30 mph
- Unrestrained in back seat but no ejection
- No LOC or vomiting
- Right parieto-occipital swelling with no step off
- Unremarkable neuro exam

Case 8

- 14 yo male helmet to helmet hit
- No LOC or vomiting
- No swelling or tenderness
- GCS 14-confused
- Remainder of neuro exam unremarkable

Case 9

- 20 mo male fell 1 foot from swing
- No LOC or vomiting
- Moderate swelling to occiput with possible step off
- Neuro exam unremarkable

Traumatic Brain Injury

- Leading cause of death and disability worldwide
- 600,000 emergency department visits
- 60,000 hospital admissions
- 7400 deaths

Evaluation

- CT is modality of choice
- Excellent for diagnosing skull fracture or intracranial hemorrhage
- Quick and readily available
- Does not require sedation
- Easy to read

Radiation

- Estimated rate of lethal malignancies is between 1 in 1000 and 1 in 5000 pediatric cranial CTs
- Risk increases as age decreases
- Lower dose scanners are available but usually in Children's hospitals

Statistics

- Half of children seen in North American emergency departments for head injury receive CT scans
- Minor head trauma patients are the most frequently assessed
- Less than 10% of the patients have traumatic brain injury
- Even smaller number have clinically important injuries

PECARN

- Pediatric
- Emergency
- Care
- Applied
- Research
- Network

Study

- Prospective cohort study of patients less than 18 years presenting within 24 hours of head trauma
- 25 pediatric emergency departments
- Over almost 2 years
- Surpassed 2 years with validation period
- 42,412 patients enrolled and analyzed

Exclusion criteria

- Trivial injury mechanisms with only abrasion or laceration
- Penetrating trauma
- Known brain tumors
- Pre-existing neurological disorders
- VPS, bleeding d/o and GCS <13 separated

Outcomes

- Clinically important traumatic brain injury
- Death
- Neurosurgical procedure
- Intubation longer than 24 hours
- Admission 2 nights or more

Follow up

- Admitted patients had entire chart reviewed
- Discharged patients were contacted by telephone for 7-90 days following discharge

Analysis

- It was decided to group patients less than 2 years separately
- More sensitive to radiation
- Minimal ability to communicate
- Different mechanisms

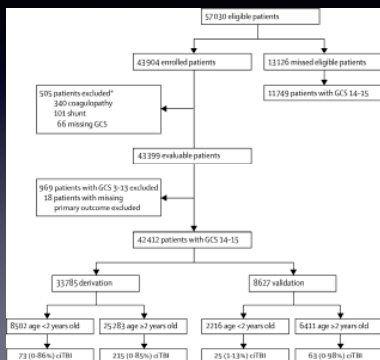
Analysis

- Goal was to identify patients at very low risk for clinically important traumatic brain injury
- Aimed to maximize negative predictive value and sensitivity

Analysis

- Excluded GCS less than 14 as this would artificially increase rule performance
- Excluded asymptomatic patients with trivial mechanisms as to not overinflate negative predictive value

Results



Age less than 2

- GCS 14 or altered mental status
- Palpable skull fracture
- Occipital, parietal or temporal hematoma
- LOC 5 seconds or longer
- Severe mechanism
- Not acting normally per parent

Altered mental status

- Agitation
- Somnolence

Severe mechanism

- MVC with patient ejection, death of another passenger or rollover
- Pedestrian without helmet struck by motorized vehicle
- Bicyclist without helmet struck by motorized vehicle
- Falls more than 3 feet
- Head struck by high impact object

Age 2 or greater

- GCS 14 or altered mental status
- Signs of basilar skull fracture
- LOC
- Vomiting
- Severe mechanism
- Severe headache

Altered mental status

- Agitation
- Somnolence
- Repetitive questioning
- Slow response to verbal communication

Signs of basilar skull fracture

- Battle's sign
- Raccoon eyes
- Hemotympanum
- CSF otorrhea
- CSF rhinorrhea

Severe mechanism

- MVC with patient ejection, death of another passenger or rollover
- Pedestrian without helmet struck by motorized vehicle
- Bicyclist without helmet struck by motorized vehicle
- Falls more than 5 feet
- Head struck by high impact object

- Two highest risk signs and symptoms are altered mental status or signs of skull fracture. What is the % risk of cITBI in these patients?
- A. <5
- B. ~10
- C. 15-20
- D. ~25

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- **A. <5 (4.4 and 4.3%)**
- B. ~10
- C. 15-20
- D. ~25

Results

- During the validation, no patients were missed <2yrs with ciTBI
- Only 2 patients age 2 or greater were missed and neither needed neurosurgery

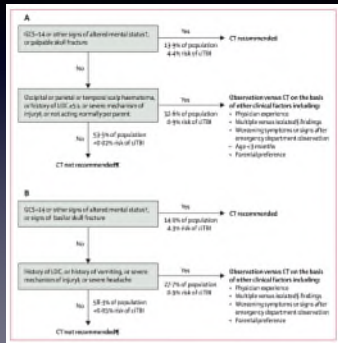
Results

- Non helmeted bicyclist with multisystem trauma including substantial pulmonary injuries with moderate headache and large frontal scalp hematoma
- Small frontal subdural

Results

- Non helmeted inline skater fell down ten steps with moderate headache and large frontal scalp hematoma
- Occipital lobe contusions and a linear fracture
- Admitted for 2 nights

Decision making



Decision making <2

- GCS 14 or other signs of altered mental status
- Palpable skull fracture
- CT recommended

Decision making 2 and up

- GCS 14 or other signs altered mental status
- Signs of basilar skull fracture
- CT recommended

Decision making

- If patient meets none of the 6 risk criteria
- No CT recommended

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- LOC
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- Severe mechanism
- Severe headache

Decision making

- Any patient not falling in either group is low risk but not very low risk
- Observation vs CT
- No guidelines given for observation but generally 6 hours in ER vs some combination of ER and home

Observation

- Physician experience
- Multiple versus isolated findings
- Worsening symptoms or signs after observation period
- Age <3 months
- Parental preference

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Isolated vomiting

- PECARN went back to look at isolated vomiting and the risk of ciTBI
- Data from the original study was used
- Vomiting is not included as a decision factor for less than age 2

Results

- 0/567 patients aged <2 had ciTBI with isolated vomiting
- 10/1,501 (0.7%) aged 2-18 had ciTBI with isolated vomiting
- 5 of those 10 patients required neurosurgery
