Facial Fractures

Brain Protection Patterns

Roderick Zickler MD
Physics of Force & Energy

- Kinetic Energy = \( \frac{1}{2} m v^2 \)
- 1 Newton (N) = 1 kg m/sec\(^2\)
- 1 Joule (J) = work (energy) done by 1N over 1m
  - = 1 kg m\(^2\)/sec\(^2\)

Geisinger
Energy of injury
Energy of Injury
fall from standing height
Energy of Injury

- Fall from standing  less than 1,000j
Energy of Injury
Energy of Injury
Energy of Injury

- Fall from standing: less than 1,000j
- “2 dudes”: 1,000–3,000j
Energy of Injury
Energy of Injury

- Fall from standing: less than 1,000j
- "2 dudes": 1,000–3,000j
- Fall from height (30ft): 10,000j
Energy of Injury
Energy of Injury

- Fall from standing: less than 1,000j
- "2 dudes": 1,000–3,000j
- Fall from height (30ft): 10,000j
- Bullet impact (rifle): 2,070j
Energy of Injury
Energy of Injury

- Fall from standing: less than 1,000j
- “2 dudes”: 1,000–3,000j
- Fall from height (30ft): 10,000j
- Bullet impact (rifle): 2,070j
- MVA (37mph): 13,916j
- (56mph): 31,360j
Protect the Brain
Protect the Brain
Protect the Brain

Frontal bone
Glabella
Supraorbital margin
Nasal bone
Temporal bone
Infraorbital margin
Zygomatic bone
Perpendicular plate of ethmoid bone
Vomer
Nasal septum
Nasal cavity
Maxilla
Alveolar processes
Body of mandible
Mental foramen

Genu

Superior orbital fissure
Supraorbital foramen
Orbital plate of frontal bone
Parietal bone
Sphenoid bone (greater wing)
Lacrimal bone
Middle nasal concha
Infraorbital foramen
Inferior nasal concha
Anterior nasal spine
Oblique line of mandible
Mandibular symphysis

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Protect the Brain
Protect the Brain

Geisinger
Protect the Brain

- Face as Crumple Zone
Nasal Fractures

- Most common facial fracture (all sources)
- Most common facial fracture from MVA
- 50% risk of fracture @450–850N
- (even average “dude” has 50% chance of scoring a fracture)
Nasal Fracture
Maxillary Fractures

- 50% risk of fracture with 970–1223N
- Old bone even easier to break
Maxillary Fractures
Maxillary Fracture
Blowout fractures
Blowout Fracture

\[ F_1 = 10 \text{ N} \quad \text{Applied force to the stopper} \]

\[ A_1 = 5 \text{ cm}^2 \]

\[ P_1 = \frac{10 \text{ N}}{5 \text{ cm}^2} = 2 \text{ N/cm}^2 \]

Like a liquid lever, changing areas in an enclosed fluid permit multiplication of force.

Pressure is transmitted undiminished in an enclosed static fluid.

\[ F_2 = P_2 A_2 = (2 \text{ N/cm}^2)(500 \text{ cm}^2) = 1000 \text{ N}!! \quad \text{Resulting force on bottom of jug.} \]

\[ P_2 = P_1 + \rho g h \]

Static fluid pressure
Blowout Fracture
Enophthalmos
Enopthalmos
Tripod fracture

Zygomaticomaxillary complex (Tripod) fracture

Direct blow to the malar eminence of the zygomatic bone

- Lateral orbit
- Zygoma
- Maxilla
Tripod Fracture
Mandible Fractures

Mandibular fractures
Frequency by location

- Condyle 30%
- Ramus 3%
- Angle 25%
- Body 25%
- Coronoid process 2%
- Parasympphyseal/Mental 15%
LeFort Fractures
LeFort I Fractures
LeFort II Fractures
LeFort III Fractures
LeFort III
LeFort III
Le Fort III

[Image of a person with severe injuries]

Geisinger
LeFort III
Le Fort III

Geisinger
LeFort III
LeFort III
LeFort III
LeFort Fractures
LeFort Fractures
LeFort Fractures
Frontal Bone Fractures

- Supraorbit fractures
- Almost always head injury
- Worry about orbital Apex/superior orbital fissure
Summary slides coming
Low energy fractures

- Nasal fracture: reexamine after soft tissue swelling subsides and treat if deformity
- Maxillary fracture: isolated sinus fractures can often be left untreated
- Orbital Blowout fracture: often can be left untreated if no diplopia. Treatment if diplopia after rectus muscle swelling resolves or risk of enopthalmos with large defect.
- Low probability of c-spine injury
Moderate energy fractures

- Tripod fracture: usually displaced and will require non-urgent treatment to prevent deformity (usually within 2wks)
- Mandible fracture: usually will require prompt treatment for pain control or open bite (usually within 24 hrs). If high energy mechanism worry about airway swelling
- Think about c-spine injury
High energy fractures


- Supraorbital fractures: Call the neurosurgeon first. Almost always closed (or open) head injury. Possible orbital apex/superior orbital fissure injuries.
Facial Fractures

Brain Protection Patterns

Roderick Zickler MD
Trauma Conference
10/26/17
OH NO! WE'RE MAKING IT WORSE!

AAAA! I HAVE NO THUMBS!

WHY ALL THE KING'S HORSES WERE USELESS