DEFINITIONS

• LOC – level of consciousness.

• MVC – Motor vehicle collision.

• CSF – Cerebrospinal Fluid bathes and cushions the brain and spinal cord.

ANATOMY OF HEAD

• The face receives its blood supply from the internal and external carotid arteries. Bleeding may look bad but as long as an airway can be maintained it is usually non-life threatening.

• Scalp – outermost part of head. Bleeds a great deal because of the increased number of vessels to keep the brain a constant temperature. Help to cushion blows to the head.

• Bones – Sutures are the interlocking joints. They close around age 3. Foramen Magnum is the pass between opening for brainstem and spinal cord.

• Meninges – Dura mater, arachnoid membrane, pia mater. The meninges line the outer brain and spinal cord for protection. The area between the skull and dura mater is the epidural space. The subdural space is between the dura and the skull.

Fractures to Mandible
• Facial fractures: Mandible fractures rank second only to nasal fractures.

• Complaint: Malocclusion - teeth not fitting together. Inability to open mouth.

• Dislocation of mandible results in a wide open and frozen mouth.

Fractures to Midface

• Includes maxilla, zygoma, floor of orbit, and nose.

• Most commonly associated with CNS injury and spinal trauma.

• Note: Lengthening of face, epistaxis, CSF discharge, etc.

• Note: Nasal tubes and airways are contraindicated with basal skull or facial fractures.

Fractures of Zygoma

• Cheek bone

• Very stable - most commonly fracture with direct assault or MVC. Lots of energy to fracture.

• Signs: Flatness of cheek, nose or upper lip.

Fractures of Orbit

• Bones a thin and fuse together to make the orbit. Fractures easily by direct blows "blow out fracture of orbit."
Fracture of Nose

- Of all facial bones the nasal bone is the weakest.

Management of Facial Fractures

- Protect the spine. Facial fractures are commonly associated with cervical spine fractures.

- Airway - blood, swelling, vomit, bone fragments.

- Suction as needed.

- Control bleeding by direct pressure.

- Epistaxis apply external pressure on the anterior nares and have suction readily available. - Do not pack.

  Lean forward if not spinal precautions.

Nasal and Ear Foreign Bodies

- Beans and crayons are common. Pebbles from playgrounds. Bugs.

- May cause infection.

- As a rule foreign bodies in the nose should not be removed in the field unless it is contributing to airway compromise or unless it can be removed easily without equipment. Same rule applies for the ear.

Contact Lenses
• Hard (not is wide use), Soft (daily or extended wear), rigid (low water content and high oxygen permeability.

• As a rule, EMS should not attempt to remove contact lenses in an injured eye.

• If contact lenses are interfering in treatment (chemical burns) medical control may order them to be removed.

Dental Trauma

• Adults have 32 teeth. Two sections - crown and root.

• Three layers of hard tissues; enamel, dentin (ivory), and cementum. The soft tissue is pulp and membrane of inner tooth.

• 2 Most common dental trauma; fractures and avulsions of anterior teeth. Fall face first or direct trauma causes.

• Painful and may bleed profusely.

• Many teeth can be saved if proper EMS care is provided. Definitive care within 1 hour odds are good. If tooth is out for less than 15 minutes medical control may direct EMS to place the tooth back in the socket. Follow these guidelines:

Never dry the tooth or crush the outside of the tooth.

Do not handle the tooth roughly.

Do not rinse it off or rub the outside.
Store tooth in a pH-balanced, isotonic, calcium fluid. (Whole milk is the best medium to use.)

Anterior Neck Trauma


- X-ray needed but does not rule out cervical spine injury.

- Blood vessels are the most commonly injured structures in neck. EMS should only apply pressure to the affected vessels.

- Severely lacerated neck - patient should be transported on left side with head slightly lower than feet to avoid air embolisms.

- If major neck laceration and shock developing place one IV in upper extremity and one IV in lower extremity.

- Care Priority: Airway and C-spine are top priority with lacerated necks. Followed by control bleeding and positioning.

Head Trauma
• Most likely patient to experience a major head injury are middle aged males.

• Most common scalp injury is linear lacerations and fractures. May bleed heavily. Care: Prevent contamination, control bleeding with direct pressure and pressure dressing, head (of backboard) elevated if not in shock.

• Skull fractures have cranial nerve injury, vascular bleeding of meningeal arteries, infection, brain injury.

80% of all isolated skull fractures are linear (straight line) and have a low rate of complications. If the fracture crosses the temporal-parietal area, midline, or occipital may produce epidural bleeds.

Basilar Skull Fractures - associated with major trauma. Battle sign, Raccoon eyes, bleeding from the ear canal, cranial nerve damage, and massive hemorrhage. Base of skull is weaker than other parts, it is a rough surface, as well as the area of the foramen magnum. Early signs include CSF from ears (otorrhea), nose (rhinorrhea), and mouth are common. Unexpected findings in the pre-hospital setting are battle signs and raccoon eyes. Treatment includes; bed rest, hearing test and cranial nerve tests. Not much we can do.

• Depressed Skull Fractures - Usually a small object hitting the skull at high speed. 30% of depressed skull fractures have associated hematoma (visible) and cerebral contusion of the brain. Often require surgical remove of fragments.

• Open Vault Fractures - Associated with multi trauma victims. High mortality rate. Care: C-spine, Airway, load and go.

• When positioning a head injured patient with ICP a 30 degree elevation is ideal.

CSF LEAK
• Blood coming from the nose or ears after head trauma has to be treated as coming from the brain. Do not stop the flow of blood. Place a dry sterile napkin/dressing to collect the blood and keep contaminates out.

• Do a TARGET TEST (HALO TEST) to see if CSF is present. Take a drop of blood on a 4x4. Let it sit and look for the CSF to go to the outside and be clear. THIS IS HARD TO DO AND NOT THAT ACCURATE, but should know. In the field this test is not a priority so prepare for transport.

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Cranial Nerve Injuries

The 12 Cranial Nerves

  Olfactory
  Optic
  Oculomotor
  Trochlear
  Trigeminal
  Abducens
  Facial
  Vestibulocochlea
  Glossopharyngeal
  Vagus
  Accessory Spinal
  Hypoglossal

• The acronym - Oh, Oh, Oh, to touch and feel ______ girls ________ and ________.
The acronym's are not meant to offend anyone. These are acronym's taught in medical school to remember the 12 cranial nerves.

Damage results in:

- **Nerve I (olfactory nerve)**
  
  Loss of smell
  
  Impairment of taste
  
  Hallmark of basilar skull fracture

- **Nerve II (optic nerve)**
  
  Blindness in one or both eyes
  
  Visual field defects

- **Nerve III (oculomotor nerve)**
  
  Dilated, fixed pupils

- **Nerve VII (facial nerve)**
  
  Facial paralysis
  
  Basilar skull fracture
• Nerve VIII (auditory nerve)

Deafness

Basilar skull fracture

• Brain injury is defined as "a traumatic insult to the brain capable of producing physical, intellectual, emotional, social and vocational change."

Divided into two categories;

1. Primary brain injury - Direct trauma and vascular injuries that occur to the initial injury.
2. Secondary brain injury - Intracellular and extracellular derangements caused by the insult.

COUP AND CONTRECOUP

• Pronounced "kontra koo".

• Occurred on the opposite side. Injury to the brain opposite the site of impact.

CONCUSSIONS

• "Shaking of the brain" with a loss of brief consciousness that constantly improves post event.

• Fully reversible is known as an event episode then improves. No true damage to the brain structures.

• Brain is shaken and as safety procedure shuts down. Usually less than 5 minutes.
• Signs after are vision problems, headache, event memory loss but usually not long term memory loss.

• May have no recall of event (retrograde amnesia) or antegrade amnesia like "Where am I?"

• Usually will be able to recall date of birth, year, etc.... Not usually affected.

BRAIN CONTUSION

• Vessel rupture in the brain usually caused by shaking or massive direct blow to skull.

• Due to bleeding structural changes in the brain take place.

• Most common is football player, boxer. After so many hard hits (concussion) the brain has been

  loosened and the vessels become more vulnerable to tear and bleed. The bleeding (contusion) pools in

  the brain just like a body bruise.

• Signs after are like concussion but has long memory loss. Cannot tell concussion versus contusion

  without CT and MRI testing. Treat them the same. Look for Cushing for ICP.

Diffuse Axonal Injury

• Most severe form of brain injury. Once known as "brain stem injury"

• Results in movement of brain within the skull from acceleration and deceleration. Shearing, stretching

  or tearing of nerve fibers causing damage.

• Coma state with posturing.

POSTURING
• Posturing indicate and high brain stem injury.

• Decorticate posturing is arms flexed.

• Decerebrate posturing arms extended.

• The key to tell the difference is the elbow. Is it flexed or extended.

• Some say decerebrate is worse. In the total picture dead is dead. Both indicate a high brain stem injury.

CUSHING’S TRIAD

• Signs and symptoms for ICP

• Increased BP, Lower Pulse, Widening Pulse Pressure, Projectile Vomiting, and Irregular Respirations.

• These signs result from swelling and pressure of the brain stem which controls vital signs.

CARE FOR ICP

• Limit glucose unless needed. Glucose makes vessels in brain dilate.

• Elevate head if BP is elevated to alleviate some pressure.

• If critical - herniation present, hyperventilate to blow off CO2 to shrink vessels to reduce blood flow to the brain. THIS IS STILL DONE TODAY EVEN THOUGH SOME THINK IT IS NOT ADVISED. IT IS UP TO YOUR MEDICAL DIRECTOR. Hyperventilate to no less than 28 PaCO2 and a rate not to exceed 20 - 24 ventilations per minute. Your trauma exam says not to exceed 20 breathe per minute. Try to fix with volume first and not rate.
• For your TRAUMA exam the answer will be maintain an O2 of 95% or higher and a CO2 reading of 35 to 40 mmHg for a non-herniated head injury.

RESPIRATIONS OF HEAD TRAUMA PATIENT

• Carbon dioxide pressure plays the greatest role in the vascular diameter and breathing patterns.

• Cheyne-Stokes Breathing – fast, slow, stop, deep, shallow, none. Supports central herniation syndrome.

• Neurogenic hyperventilation – fast and shallow.

• Result from ICP and Cushing's.

GLASGOW COMA SCALE

• Used to assess neurological function not LOC.

• Three categories and even if dead the person gets a 3 total. 1 per category.

• Less than 8 intubate. Not good probably if less than 8, will not most likely interact with his kids again.

  Life support most likely.

• Categories are eye, verbal, and motor skills.

• The best and simplest way to assess in the field for neurological function is still AandOx4.

BLEEDING OF THE BRAIN
• Epidural Bleeds – 0.5 to 1% of all head injuries. Bleeding between the dura and skull are fast onset because the vessel is more likely to be an artery. If associated with a tear in the middle meningeal artery will develop on rapidly formed hematoma.

• Subdural Bleeds – Commonly associated with skull fractures. 50 to 80% mortality. Acute develops within 24 hours and chronic over 2 to 10 days. Bleeding between the dura and the brain are slower onset because the vessel(s) is more likely a vein or smaller artery.

• Intracranial Bleeds – is like a hemorrhagic stroke. Bleeding in the brain directly.

• As a rule if the vessel is big the pressure buildup is massive and a bleed is a bleed.

Drugs:

Mannitol to decrease edema in brain
Diazepam/Lorazepam for seizures
Lidocaine to reduce ICP during intubation

Revised Trauma Score

• Uses GCS score, systolic BP, respiratory rate - all given 0 to 4 points for a perfect score of 12.

Ventilatory Rate - 10-29 4pts, less than 8 2pts
Systolic BP - over 89 4pts, less than 50 1pt.
GCS score - above 13 4pts, less than 8 2pts.