Chapter 47
Head and Face Trauma

Learning Objectives
● Describe the etiology, history, and physical findings of facial injuries
● Using the mechanism of injury, patient history, and physical examination findings, develop a treatment plan for facial injuries
● Describe the etiology, history, and physical findings of eye injuries

Learning Objectives (Cont'd)
● Using the mechanism of injury, patient history, and physical examination findings, develop a treatment plan for eye injury
● Describe the etiology, history, and physical findings of ear injuries
Learning Objectives (Cont'd)

- Using the mechanism of injury, patient history, and physical examination findings, develop a treatment plan for ear injury
- Describe the etiology, history, and physical findings of neck injuries

Learning Objectives (Cont'd)

- Using the mechanism of injury, patient history, and physical examination findings, develop a treatment plan for neck injury
- Explain the anatomy and relate the physiology of the central nervous system to head injuries
- Distinguish between head injury and brain injury

Learning Objectives (Cont'd)

- Describe the etiology, history, and physical findings of skull fracture
- Using the patient history and physical examination findings, develop a treatment plan for skull fracture
- Explain the pathophysiology of head and brain injuries
Learning Objectives (Cont'd)

- Predict head injuries on the basis of the mechanism of injury
- Explain the pathophysiology of increasing intracranial pressure and the process involved with each level of increase

Learning Objectives (Cont'd)

- Describe the etiology, history, and physical findings of:
  - Concussion
  - Diffuse axonal injury
  - Cerebral contusion
  - Epidural hematoma
  - Subdural hematoma
  - Intracerebral hemorrhage
  - Subarachnoid hemorrhage

Learning Objectives (Cont'd)

- Using the patient history and physical examination findings, develop a treatment plan for the following:
  - Concussion
  - Diffuse axonal injury
  - Cerebral contusion
  - Epidural hematoma
  - Subdural hematoma
  - Intracerebral hemorrhage
  - Subarachnoid hemorrhage
Learning Objectives (Cont’d)

- Develop a management plan for the removal of a helmet for head-injured patient

Maxillofacial Injury

- Face anatomy
  - Blood supply
    - Branches of external carotid artery
    - Superficial temporal, mandibular, and maxillary arteries

Maxillofacial Injury (Cont’d)
Maxillofacial Injury (Cont’d)
- Face anatomy
  - Nerves
    - Fifth cranial (CN V)
    - Seventh cranial (CN VII)
    - Oculomotor (CN III)
    - Trochlear (CN IV)

Maxillofacial Injury (Cont’d)
- Face anatomy
  - Bones
    - 22 skull
      - 8 cranial
      - 14 facial

Maxillofacial Injury (Cont’d)
- Mechanism of injury
  - Blunt trauma
  - Penetrating trauma
  - Toxic exposure
Maxillofacial Injury (Cont’d)

- Soft tissue injuries
  - Etiology and demographics
    - Most common, motor vehicle crashes
    - Assaults, personal altercations
    - Elderly, falls
    - Airbags

Maxillofacial Injury (Cont’d)

- Soft tissue injuries
  - History and physical findings
    - Mechanism of injury
    - Time injury occurred
    - Signs and symptoms
    - Allergies
    - Medications
    - Last oral intake
    - Past medical history

Maxillofacial Injury (Cont’d)

- Soft tissue injuries
  - History and physical findings
    - Events leading to injury
    - ABCDs
    - Symmetry, deformity
    - Eyes level, medial and lateral corners level, in line with top 20% of auricles
    - Mouth corners move symmetrically
    - Nose straight, midline
Maxillofacial Injury (Cont’d)

• Soft tissue injuries
  - History and physical findings
  - Evaluate for asymmetry
  - Palpate facial structures with both hands simultaneously
  - Palpate nasal bones, visualize nasal cavity
  - Jaw movement/alignment, bite down
  - Facial nerve injury, drooping

Maxillofacial Injury (Cont’d)

• Soft tissue injuries
  - History and physical findings
  - Deep cheek laceration
  - Parotid duct, parotid gland, facial nerve branch damage
  - Temporal branch of facial nerve damage

Maxillofacial Injury (Cont’d)

• Soft tissue injuries
  - History and physical findings
  - Temporal/zygomatic branch damage
  - Facial nerve buccal branch damage
  - Mandibular branch damage
  - Oculomotor nerve damage
Maxillofacial Injury (Cont’d)

- Soft tissue injuries
  - History and physical findings
    - Trochlear nerve damage
    - Human/animal bites
    - Mouth injuries

Maxillofacial Injury (Cont’d)

- Soft tissue injuries
  - Therapeutic interventions
    - Calming, reassuring
    - Open airway, adequate breathing, spinal precautions
    - Head/neck trauma, head in neutral position, in line with body

Maxillofacial Injury (Cont’d)

- Soft tissue injuries
  - Therapeutic interventions
    - Airway compromise
      - Excessive bleeding/secretions, suction
      - Displaced mandible
      - Alcohol, drugs, brain injury
      - Suction, intubate, position
      - Raise stretcher head 15-30° without cervical spine injury
      - Bag-mask device
      - Facial bleeding, direct pressure
Skill 47-1 Manual Stabilization

- Head and neck stabilization with patient supine
- Head and neck stabilization from patient's side

Skill 47-1 Manual Stabilization (Cont'd)

- Head and neck stabilization from behind
- Head and neck stabilization from front

Skill 47-1 Manual Stabilization (Cont'd)

- Head and neck stabilization in a standing patient
Maxillofacial Injury

- Nasal and ear foreign bodies
  - Etiology and demographics
    - Common foreign bodies
      - Beads, pebbles, buttons
      - Toy parts
      - Vegetables
      - Crayons
      - Bolts, screws
      - Sticks
      - Paper
      - Insects
    - Ear wax

Maxillofacial Injury (Cont’d)

- Nasal and ear foreign bodies
  - History and physical findings
    - Nasal signs/symptoms
      - Nosebleed
      - Fever
      - Pain
      - Swollen nasal mucosa
      - Purulent discharge
      - Foul-smelling discharge

Maxillofacial Injury (Cont’d)

- Nasal and ear foreign bodies
  - History and physical findings
    - Ear signs/symptoms
      - Bloody, purulent discharge
      - Decreased hearing
      - Pain/discomfort
      - External ear swelling
      - Insect buzzing sound
      - Foul-smelling discharge
      - Fullness sensation
Maxillofacial Injury (Cont’d)

- Nasal and ear foreign bodies
  - Therapeutic interventions
    - Left alone; physician evaluated
    - Attempt removal if airway is compromised
    - Block unobstructed nostril, close mouth, forcefully expel air
    - Insect in ear, shine flashlight to draw out

Maxillofacial Injury (Cont’d)

- Orbital fractures
  - Eye anatomy
    - Seven bones in orbit
    - Orbits are cone shaped, wide end of face narrows down as progress into skull, ending at small place
    - Eyes, globe-shaped, 1 inch diameter
Maxillofacial Injury (Cont’d)

- Orbital fractures
  - Eye anatomy
    - Eyeball outside tissue layers
      - Sclera
      - Choroid
      - Retina

Maxillofacial Injury (Cont’d)

- Orbital fractures
  - Inner eye
    - Anterior cavity
      - Anterior, posterior chambers
      - Connected by pupil, iris opening
      - Aqueous humor, regenerated if injured
      - Protrudes slightly forward
Maxillofacial Injury (Cont’d)

- Orbital fractures
  - Inner eye
    - Posterior cavity/vitreous chamber
    - Eyeball remainder, 80% of eye
    - Filled with vitreous humor, cannot regenerate if injured

Maxillofacial Injury (Cont’d)

- Orbital fractures
  - Inner eye
    - Eyeball shape maintained by hydrostatic pressure
      exerted by aqueous and vitreous humor
    - Iris, continuation of choroid membrane layer

Maxillofacial Injury (Cont’d)

- Orbital fractures
  - Inner eye
    - Pupil
      - Central iris opening
      - Connection between anterior and posterior chambers
      - Allows light, images into vitreous chamber, contact
        with retina
      - Constricts, dilates
      - Affected by autonomic nervous system, medications,
        recreational drugs
Maxillofacial Injury (Cont’d)

- Orbital fractures
  - Inner eye
    - Lens
      - Divides anterior from posterior cavity
      - Focus images on retinal surface
    - Myopia/nearsightedness, light focuses in front of retina
    - Hyperopia/farsightedness, light focuses behind retina
    - Presbyopia, unable to adjust from far to near vision
    - Visual acuity check

Maxillofacial Injury (Cont’d)

- Orbital fractures
  - Ophthalmoscope
    - Retina appears smooth, reddish-purple, lined with blood vessels
    - Optic disk appears yellowish, distinct blood vessels at center, no retina
  - Eyebrows, eyelashes
    - Catch small particles

Maxillofacial Injury (Cont’d)

- Orbital fractures
  - Eyelids
    - Major source of eye protection
    - Conjunctiva
    - Lacrimal gland
Maxillofacial Injury (Cont’d)

- Orbital fractures
  - Etiology and demographics
    - Orbital fracture
      - Involves bony cavity containing eyeball

Maxillofacial Injury (Cont’d)

- Orbital fractures
  - Etiology and demographics
    - Orbital blowout fracture
      - Orbital floor bone
      - Mechanism of injury

Maxillofacial Injury (Cont’d)

- Orbital fractures
  - History and physical findings
    - Orbital blowout fracture signs/symptoms
      - Double vision
      - Nosebleed
      - Pain
      - Soft tissue discoloration
      - Limited ability to look upward
      - Crepitus
      - Sunken appearance of eye
Maxillofacial Injury (Cont’d)

Orbital fractures
- History and physical findings
  - Blowout injury causes muscles, nerves, fat, connective tissue entrapped by fractured segment

Maxillofacial Injury (Cont’d)
Maxillofacial Injury (Cont’d)

- Orbital fractures
  - Therapeutic interventions
    - ABCs
    - Jaw thrust without head tilt maneuver
    - Airway adjuncts
    - Severe facial injury contraindication to nasotracheal route
    - Limited eye movement, loose bandages
    - Orbital fracture, avoid nose blowing, sneezing, straining

Maxillofacial Injury (Cont’d)

- Nasal fractures
  - Nose anatomy
    - Supports respiratory system
    - Olfactory nerves, smell
    - Filters, warms, humidifies air before reaching lungs
    - Remove pollen, dirt, debris

Maxillofacial Injury (Cont’d)

- Nasal fractures
  - Nose anatomy
    - Right, left nasal cavities uppermost part of respiratory tract
    - Septum
    - Hard palate
Maxillofacial Injury (Cont’d)

- Nasal fractures
  - Nose anatomy
    - Sphenoid, ethmoid, frontal bones
  - Nasal cartilage, shapes/support to outer nose
  - Upper third of nose, bone
  - Turbinates
Maxillofacial Injury (Cont’d)

- Nasal fractures
  - Nose anatomy
    - Olfactory region
    - Epithelial cells contain nerve endings, numerous cilia
    - Molecules from inhaled air pass by, attach, stimulate olfactory receptors
    - Chemoreceptors initiate direct chemical reactions
    - Paranasal sinuses

Maxillofacial Injury (Cont’d)

- Nasal fractures
  - Etiology and demographics
    - Nose most commonly fractured

Maxillofacial Injury (Cont’d)

- Nasal fractures
  - History and physical findings
    - Nasal fractures signs/symptoms
      - Swelling
      - Nosebleed
      - Soft tissue discoloration
      - Pain on palpation
      - Crepitus on palpation
      - Obvious deformity
Maxillofacial Injury (Cont’d)

• Nasal fractures
  ➢ History and physical findings
    ➢ Hematomas
    ➢ Localized clotted blood collection in tissue/organ
    ➢ Septal hematoma

Maxillofacial Injury (Cont’d)

• Nasal fractures
  ➢ Therapeutic interventions
    ➢ ABCs
    ➢ Spinal precautions
    ➢ Actual/potential obstruction, suction
    ➢ Adequate oxygenation, ventilation
    ➢ Nosebleed, direct external pressure
    ➢ Skull fracture with CSF from nose/ear, cover ear with loose, sterile dressing

Maxillofacial Injury (Cont’d)

• Zygomatic fractures
  ➢ Cheek anatomy
    ➢ Zygoma forms lateral rim of orbit
    ➢ Meets lateral skull from zygomatic arch
Maxillofacial Injury (Cont’d)

- Zygomatic fractures
  - Etiology and demographics
    - Zygomatic fractures common
    - Assault, MVC
    - Left fractured more
    - Subarachnoid hemorrhage, orbital blowouts

Maxillofacial Injury (Cont’d)

- Zygomatic fractures
  - Etiology and demographics
    - Zygomatic fractures types
      - Zygomatic arch, only arch fractured
      - Tripod fractures, through three suture lines where zygoma attaches to facial skeleton
Maxillofacial Injury (Cont’d)

- Zygomatic fractures
  - History and physical findings
    - Signs/symptoms
      - Paresthesia of anterior cheek
      - Facial asymmetry
      - Double vision
      - Soft tissue swelling, discoloration around eye
      - Pain, tenderness on palpation
      - Limited mouth movement
    - Step-off deformity
    - Sunken globe
    - Facial swelling
    - CSF from nose
    - Unequal pupil height
    - Crepitus on palpation
    - Obvious deformity
    - Bleeding from nose

Maxillofacial Injury (Cont’d)

- Zygomatic fractures
  - Therapeutic interventions
    - ABCs
    - Cervical spine precautions
    - Loose bandages covering eye with limited movement
    - Talk to patient

Maxillofacial Injury (Cont’d)

- Maxillary fractures
  - Upper jaw anatomy
    - Paired facial bones between orbit and upper teeth
    - Right, left maxillae joined by intermaxillary suture
Maxillofacial Injury (Cont’d)

• Maxillary fractures
  ➢ Etiology and demographics
    ➢ Maxillary, midface fractures
      ➢ Combination involving several facial structures
      ➢ Significant force required

Maxillofacial Injury (Cont’d)

• LeFort fractures involve maxilla
  ➢ Lower and middle third, orbital complex fractures
  ➢ LeFort I from blunt trauma to midface, just below nose
  ➢ LeFort II from blunt trauma aimed at face
  ➢ LeFort III, separation of entire midface from cranial skeleton

Maxillofacial Injury (Cont’d)

• History and physical findings
  ➢ Severe facial pain
  ➢ Upper lip anesthesia/paresthesia
  ➢ Visual disturbances
  ➢ Facial swelling
  ➢ Subconjunctival hemorrhage
  ➢ Face elongation
  ➢ Ecchymosis
  ➢ Periorbital/orbital swelling
  ➢ Facial asymmetry
  ➢ Epistaxis
  ➢ Malocclusion
  ➢ CSF from nose
Maxillofacial Injury (Cont’d)

- Maxillary fractures
  - History and physical findings
    - LeFort I fracture
    - Horizontal, maxilla separated from skull base, above palate, below zygoma
  - LeFort II
    - Central maxilla, nasal area, ethmoid bones
    - Forms tripod shape with nose apex
    - Nose, upper lip movement, no movement of orbital complex
    - Nose, lips, eye swelling
    - Subconjunctival hemorrhage, epistaxis
    - Cervical spine fracture, dislocation suspected
    - CSF rhinorrhea suggests open skull fracture
  - LeFort III
    - Total separation of head from face
    - Nose, dental arch move without frontal bone movement
    - Massive edema
    - Ecchymosis
    - Epistaxis
    - Malocclusion with spoon appearance from profile

Maxillofacial Injury (Cont’d)

- Maxillary fractures
  - History and physical findings
    - LeFort II
    - Central maxilla, nasal area, ethmoid bones
    - Forms tripod shape with nose apex
    - Nose, upper lip movement, no movement of orbital complex
    - Nose, lips, eye swelling
    - Subconjunctival hemorrhage, epistaxis
    - Cervical spine fracture, dislocation suspected
    - CSF rhinorrhea suggests open skull fracture

Maxillofacial Injury (Cont’d)

- Maxillary fractures
  - History and physical findings
    - LeFort III
    - Total separation of head from face
    - Nose, dental arch move without frontal bone movement
    - Massive edema
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    - Epistaxis
    - Malocclusion with spoon appearance from profile

Maxillofacial Injury (Cont’d)

- Maxillary fractures
  - History and physical findings
    - LeFort I fracture
    - Horizontal, maxilla separated from skull base, above palate, below zygoma

Maxillofacial Injury (Cont’d)

- Maxillary fractures
  - History and physical findings
    - LeFort II
    - Central maxilla, nasal area, ethmoid bones
    - Forms tripod shape with nose apex
    - Nose, upper lip movement, no movement of orbital complex
    - Nose, lips, eye swelling
    - Subconjunctival hemorrhage, epistaxis
    - Cervical spine fracture, dislocation suspected
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Maxillofacial Injury (Cont’d)

- Maxillary fractures
  - History and physical findings
    - LeFort III
    - Total separation of head from face
    - Nose, dental arch move without frontal bone movement
    - Massive edema
    - Ecchymosis
    - Epistaxis
    - Malocclusion with spoon appearance from profile
Maxillofacial Injury (Cont’d)

- Maxillary fractures
  - History and physical findings
    - LeFort III
    - Assess eye movement
    - Cribiform plate fracture, middle meningeal artery bleeding
    - Basilar skull fracture
    - Eye injury
    - Open/closed head injury
Maxillofacial Injury (Cont’d)

- Maxillary fractures
  - Therapeutic interventions
    - Cervical spine precautions
    - Patent airway, priority
    - Frequent suctioning
    - Orotracheal intubation
    - Ice packs

Maxillofacial Injury (Cont’d)

- Mandibular fractures
  - Lower jaw anatomy
    - Mandibular body anteriorly
    - Mandible ramus posteriorly
    - Body and ramus meet posteriorly, form mandible angle
Maxillofacial Injury (Cont’d)

- Mandibular fractures
  - Etiology and demographics
    - Facial blunt trauma from domestic violence, sports
    - Penetrating trauma from gunshot wounds, blast injuries, industrial injuries
    - Most common, mandibular angle, condyle, molar, mental, symphysis
    - Reciprocal fracture, mandible opposite side

Maxillofacial Injury (Cont’d)

- Mandibular fractures
  - History and physical findings
    - Teeth malocclusion, jaw curvature misalignment
    - Point tenderness, crepitus, step-off deformity, trismus, facial asymmetry
    - Inspect mouth for loose teeth, sublingual swelling, hematomas
    - Skull fracture signs

Maxillofacial Injury (Cont’d)

- Mandibular fractures
  - Therapeutic interventions
    - ABCs
    - Cervical spine stabilization
    - Suction bone fragments, blood, clots, vomitus
Dental Trauma

• Tooth anatomy
  ➢ Children
    • 20 primary, erupt, 6 months to 2 years
    • Permanent teeth, 6–14 years
    • Wisdom teeth, 17–21 years
  ➢ Adult
    • 32 permanent
    • 28 if wisdom teeth removed

Dental Trauma (Cont’d)

• Tooth anatomy
  ➢ Attached to sockets in bone arches of maxillae and mandible
  ➢ Gums
    • Specialized oral mucosa, tooth base
  ➢ Crown
    • Visible tooth part
    • Covered with enamel

Dental Trauma (Cont’d)

• Tooth anatomy
  ➢ Neck of tooth
    • Connects crown and root
  ➢ Root
    • Extends into maxilla/mandible
    • Anchors tooth
    • One to three roots
    • Cementum anchors root to periodontal membrane and ligament
Dental Trauma (Cont'd)

- Tooth anatomy
  - Pulp
    - Soft tooth center
    - Nerves, blood vessels, connective tissue
    - Highly vascular, sensitive nerve endings
    - Produces dentin

- History and physical findings
  - Teeth fractures
    - Involve dentin, mild discomfort
    - Involve pulp, significant pain
    - Deep fracture involves root
Dental Trauma (Cont’d)

- History and physical findings
  - Avulsed tooth
    - Completely removed from ligamentous attachments
  - Look for tooth
  - Loosened teeth

Dental Trauma (Cont’d)

- Therapeutic interventions
  - ABCs
  - Significant bleeding, suction
  - Avulsed tooth, consider spinal precautions

Dental Trauma (Cont’d)

- Epidemiology and demographics
  - Dental trauma peaks, ages 2–5 years
  - Men twice as often as women
  - Sports, fights, family violence
Eye Trauma

- Corneal abrasions, lacerations
  - Etiology and demographics
    - Foreign bodies
    - Rub eyes too vigorously

Eye Trauma (Cont’d)

- Corneal abrasions, lacerations
  - History and physical findings
    - Involves only eyeball, reddened, sore
    - Burning in eye, pain when closed
    - Sensitivity to light
    - Decreased visual acuity
    - Large corneal lacerations require surgery

Eye Trauma (Cont’d)

- Corneal abrasions, lacerations
  - Therapeutic interventions
    - Rise with clear fluid
    - Cover eyes
    - Corneal laceration, transport to center with ophthalmologist
Eye Trauma (Cont'd)

- Burns of eye
  - Etiology and demographics
    - Thermal, chemical, ultraviolet
    - Most superficial, contact cornea
    - Vision changes
    - Most common, chemical 15–20% of ocular injuries
    - Majority work related
    - Thermal, second most common, damage to cornea

Eye Trauma (Cont'd)

- Burns of eye
  - History and physical findings
    - Chemical, most damaging
      - Vision loss
      - Facial skin burns
      - Acid burn, epithelial cornea damage

Eye Trauma (Cont'd)

- Burns of eye
  - History and physical findings
    - Alkaline substances
      - Not neutralized
      - Emulsification
      - Expose iris, ciliary body, lens
      - Concrete, lye, drain cleaners
      - Continue damage until removed
      - Simulate inflammatory response, further damages
        issued by proteolytic enzyme release
      - Permanent scarring, vision loss
Eye Trauma (Cont’d)

• Burns of eye
  ➢ History and physical findings
    ➢ UV burns
    ➢ Sun, unprotected welding
    ➢ Pain
    ➢ Tearing sensation
    ➢ Photophobia
    ➢ Foreign body sensation
  ➢ Flash burns
    ➢ Unshielded exposure to welding arc, explosion
    ➢ Temporary blindness, overstimulation of retinal surfaces
    ➢ Corneal surface damage
  ➢ Therapeutic interventions
    ➢ Acid, alkali
      ➢ Pain control, flushing with normal saline
Skill 47-2 Morgan Lens

- Flush eye with 0.9% normal saline or Ringer’s lactate

Skill 47-2 Morgan Lens (Cont’d)

- Attach Morgan Lens set, IV
- Start flow
- Insert lens under upper eye lid

Skill 47-2 Morgan Lens (Cont’d)

- Release lower eyelid over lens
- 2 hours of flushing/2 L of fluid
- Do not allow solution to run dry
Eye Trauma

- Eyelid lacerations
  - Etiology and demographics
    - Superficial
    - Full thickness, eyelid function interference
  - History and physical findings
    - Identified by observation

Eye Trauma (Cont’d)

- Eyelid lacerations
  - Therapeutic interventions
    - Must see physician
    - Control bleeding
    - Irrigate with saline solution
    - Sterile dressing
    - During transport, patch

Eye Trauma (Cont’d)

- Corneal foreign body
  - History and physical findings
    - Pain when exposed to light
    - Burning sensation
    - Increased pain when eye is closed
    - Shine penlight, object is dark shadow on eye
    - Penetrates anterior chamber, vitreous humor on eyeball
Eye Trauma (Cont'd)

- Corneal foreign body
  - Therapeutic interventions
    - Flush with clear fluid
    - Do not remove in field, stabilize object, transport

Eye Trauma (Cont'd)

- Hyphema
  - Etiology and demographics
    - Rupture of iris small blood vessel
    - Direct trauma to globe
    - 8-ball hyphema
    - 20 in 100,000
    - Elderly, younger
    - African American observed, sickle cell

Eye Trauma (Cont'd)

- Hyphema
  - History and physical findings
    - Shine penlight from angle through anterior chamber
    - Photophobia, pain, blurred vision
    - Drowsy
    - Assess for ruptured globe
Eye Trauma (Cont’d)

- **Hyphema**
  - Therapeutic interventions
    - Spinal precautions
    - Patient should not cough, strain, anything that increases intraocular pressure
    - Communicate with patient
    - When lying down, blood changes position, blurs vision
    - Transported
    - Blood reabsorbs over time

Eye Trauma (Cont’d)

- **Penetrating globe injuries**
  - Etiology and demographics
    - Traumatic vision loss
    - Industrial setting, no protective eyewear worn
    - Blast injury, stab wound, gunshot wound
    - Eyelid laceration

Eye Trauma (Cont’d)

- **Penetrating globe injuries**
  - History and physical findings
    - Embedded object, laceration
    - Globe perforation/rupture
Eye Trauma (Cont’d)

- Penetrating globe injuries
  - Therapeutic interventions
    - Impaled, stabilize for later removal by physician
    - Both eyes covered
    - Globe rupture, hard shield over eye
    - Never place pressure on globe
    - Analgesics per medical direction
    - Rapid transport

Eye Trauma (Cont’d)

- Retinal detachment
  - Etiology and demographics
    - Retina separation from eye choroid
    - Myopia, eyeball elongation
    - High BP, diabetes
    - Blunt/penetrating trauma/spontaneous
    - 40+ years
    - Men, whites

Eye Trauma (Cont’d)

- Retinal detachment
  - History and physical findings
    - Vision changes, possible loss
    - Bright light flashes in visual field opposite damage
    - Curtain coming into visual field
Eye Trauma (Cont’d)

- Retinal detachment
  - Therapeutic interventions
    - Rapid treatment
    - Immobilize head if traumatic injury
    - Cover both eyes
    - Transport to hospital with ophthalmologist
    - Head movement restrictions

Eye Trauma (Cont’d)

- Traumatic iritis
  - Etiology
    - Iris inflammation from blunt trauma
  - History and physical findings
    - Reddened eye, small/distorted pupil
    - Eye, brow pain, light sensitivity
    - Excessive tearing

Eye Trauma (Cont’d)

- Traumatic iritis
  - Therapeutic interventions
    - Physician evaluation
    - Analgesics per medical direction
Ear Trauma

- Ear anatomy
  - External/outer ear
    - Auricle, pinna sticks out from head
  - Ear canal

Ear Trauma (Cont’d)
Ear Trauma (Cont'd)

- Ear anatomy
  - Middle ear
    - Hollowed-out area of temporal bone
    - Transmit vibrations of tympanic membrane across middle to inner ear
    - Lined with mucous membranes filled with air
    - Separated by eardrum/tympanic membrane

- Ear anatomy
  - Middle ear
    - Ossicles
      - Linked, movable bones
      - Transmit vibrations from tympanic membrane to oval window, which separates middle from inner ear
      - Eustachian tube
      - Opens into middle ear
      - Connects middle ear to pharynx, respiratory system
      - Equalizes pressure between air outside and air within middle ear
Ear Trauma (Cont'd)

- **Ear anatomy**
  - Inner ear
  - Fluid-filled tubes within temporal bone
  - Bony labyrinth
  - Sound vibrations transferred to inner ear, become fluid waves in cavity, lined with periosteum, filled with clear fluid
  - Hairlike structures bend, flex in response to wavelengths
  - Nerve impulses generated in inner ear travel along vestibulocochlear nerve (CN VIII) to brain

Ear Trauma (Cont'd)

- **Mechanism of injury**
  - Blunt trauma
  - Penetrating trauma
  - Blast injuries
  - Pressure injuries

Ear Trauma (Cont'd)

- **Etiology and demographics**
  - Outer ear lacerations
  - Ear hematoma, sports, falls
  - Ruptured eardrum
  - External ear prone to injury from temperature extremes
Ear Trauma (Cont’d)

- **History and physical findings**
  - External ear canal, middle ear assessment cannot be done in field
  - Ruptured eardrum signs/symptoms
    - Sharp pain
    - Dizziness
    - Blood/purulent drainage
    - Decreased hearing
    - Ear infection pain relief, built-up fluid drained

Ear Trauma (Cont’d)

- **Therapeutic interventions**
  - ABCs
  - Spinal precautions
  - Laceration, control bleeding
  - Hematoma, aspirated with needle
  - Draining ear, dressing

Neck Trauma (Cont’d)

- **Neck anatomy**
  - Zone I
    - Between cricoids cartilage, extends to clavicle and sternum
    - Injuries, highest mortality
    - Carotid, vertebral arteries
    - Subclavian veins
    - Brachiocephalic veins
    - Jugular veins
    - Aortic arch
Neck Trauma

- Neck anatomy
  - Zone I
    - Lungs
    - Trachea
    - Esophagus
    - Thoracic duct
    - Cervical spine
    - Spinal cord

Neck Trauma (Cont’d)

- Neck anatomy
  - Zone II
    - Between table of mandible, cricoids cartilage
      - Carotid, vertebral arteries
      - Jugular veins
      - Pharynx
      - Larynx
      - Trachea
      - Esophagus
      - Cervical spine
      - Spinal cord

Neck Trauma (Cont’d)

- Neck anatomy
  - Zone III
    - Above mandible angle
    - Carotid, vertebal arteries
    - Jugular veins
    - Salivary, parotid glands
    - Esophagus
    - Pharynx
    - Trachea
    - Cervical nerves IX-XII
    - Cervical spine
    - Spinal cord
Mechanism of injury
- Blunt
  - MVCs
  - Trachea, larynx compression against cervical vertebrae, improperly worn shoulder belts
  - Anterior chest, sports
  - Clothesline injuries, separation of larynx, trachea
  - Strangulation injuries
Neck Trauma (Cont’d)

- Mechanism of injury
  - Penetrating
    - Gunshot wound
    - Slab wound
    - Laceration
    - Puncture wounds

Neck Trauma (Cont’d)

- Etiology and demographics
  - 10% of people with blunt vascular injuries develop symptoms within the first hour
  - Larynx, trachea compression
    - Vocal cord swelling/bruising
    - Normal airway landmark disruption
    - Soft tissue swelling

Neck Trauma (Cont’d)

- Etiology and demographics
  - Tracheal injury
    - Subcutaneous emphysema
    - Hemoptysis
    - Open wound
    - Esophageal trauma
    - Cervical spine
Neck Trauma (Cont’d)

- History and physical findings
  - Swelling, lacerations, puncture wounds, soft tissue discoloration, obvious deformity
  - Neck veins normal
  - Accessory muscles

Neck Trauma (Cont’d)

- History and physical findings
  - Respiratory distress signs
  - Sucking neck room
  - Crepitus, subcutaneous emphysema, tracheal position

Neck Trauma (Cont’d)

- History and physical findings
  - Signs
    - Pale/cyanotic face
    - Neck bruising, redness
    - Sucking, hissing, or air frothing through neck wound
    - Subcutaneous emphysema
    - Neck hematoma
    - Active bleeding
    - Supraventricular retractions
    - Vocal cord dysfunction
    - Weak cough
    - Bruit/thrill
    - Shock

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Neck Trauma (Cont’d)

• History and physical findings
  ➢ Signs
    • Stridor
    • Signs of paralysis, paresthesia, or neurogenic shock if spinal cord is involved
    • Signs of stroke with air
    • Emboli or infarct

Neck Trauma (Cont’d)

• History and physical findings
  ➢ Symptoms
    • Voice changes
    • Tickle, feeling of fullness in throat
    • Cervical pain
    • Weakness
    • Numbness
    • Hoarseness
    • Dyspnea
    • Dysphagia
Neck Trauma (Cont’d)

- History and physical findings
  - SAMPLE
    - Mechanism of injury
    - LOC
    - Drug/alcohol use

Neck Trauma (Cont’d)

- Therapeutic interventions
  - Life-threatening
  - Cervical spine stabilization
  - ABCs
  - Hemorrhage control
  - Pharynx, larynx, trachea, epiglottis, vocal cord swelling
  - Tracheal intubation, aim for bubbles

Neck Trauma (Cont’d)

- Therapeutic interventions
  - Cricothyrotomy
  - Open wound, airtight dressing
  - Hemorrhage, direct pressure to vessel
  - Vascular access en route
  - IV catheter opposite side of injury
  - Rapid transport
Head Trauma

- Scalp and skull anatomy
  - **Scalp**
    - Protects head from invading organisms
    - Regulates body temperature
    - Keeps extracellular fluid from being lost to evaporation
    - Hair location
    - Layers

Head Trauma (Cont’d)

- Scalp and skull anatomy (Cont’d)
  - **Skull**
    - Facial bones
    - Cranial bones
    - Roof dome-shaped, protects upper brain
    - Middle meningeal artery under temporal bone, artery tear, epidural hematoma
    - Foramen magnum
Head Trauma (Cont’d)

- Scalp and skull anatomy
  - Meninges
    - Three layers, protective tissue, surrounds and protects CNS
    - Dura mater, thickest layer
    - Arachnoid membrane

Head Trauma (Cont’d)

Skull Bones

Head Trauma (Cont’d)

- [Diagram showing skull bones and anatomical structures]
Head Trauma (Cont’d)

- Scalp and skull anatomy
  - Cerebrospinal fluid (CSF)
    - Clear, watery fluid circulates beneath arachnoid membrane, bathes brain and spinal cord
    - Cushions, provides nutrients to CNS
    - Bleeding rapidly fatal
  - Pia mater
    - Coats crevices, cavities of brain, spinal cord

Head Trauma (Cont’d)

- Scalp and skull anatomy
  - Mechanism of injury
    - MVC
    - Fall
    - Abuse
    - Impaled object
    - Cranial vault fractures more common than skull base
    - Skull bone fractured related to responsiveness level

Head Trauma (Cont’d)

- Etiology and demographics
  - Head injury
    - Insult, soft tissue/bony structure injury
    - Closed, blunt trauma
    - Open, penetrating trauma
Etiology and demographics

- Head injury
  - Avulsion
  - Flap injury to scalp
  - Skull fracture types
    - Linear
    - Depressed
    - Basilar
    - Comminuted
    - Compound
Head Trauma (Cont’d)

- History and physical findings
  - Manually stabilize cervical spine
  - Depressed, open skull fractures, found on palpation
  - Linear fractures, bruise/swelling of soft tissue
  - DCAP-BLS-TIC
  - Finger pads for palpation

Head Trauma (Cont’d)

- History and physical findings
  - Infants, check fontanelles for bulging
  - Bleeding, direct pressure
  - Check ears for DCAP-BLS, Battle’s sign, blood/clear fluid
  - Palpate for tenderness, pain
  - Inspect face, eyes for DCAP-BLS

Head Trauma (Cont’d)

- History and physical findings
  - Anterior fossa fracture signs/symptoms
    - Epistaxis
    - CSF drainage from nose
    - Absence of sense of smell
    - Raccoon eyes
    - Visual disturbances
    - Subconjunctival hemorrhage
Head Trauma (Cont’d)

Middle fossa fracture signs/symptoms
- CSF drainage from ears
- Hearing loss
- Bleeding behind tympanic membrane
- Soft tissue discoloration behind ears
- Facial nerve injury
Therapeutic interventions
- Cervical spine precautions
- Monitor airway
- Do not insert tube through nose for intubation
- Depressed skull fracture, cover with sterile dressing

Therapeutic interventions
- CSF fluid drainage, cover with loose, sterile dressing
- Exposed brain tissue, wet, sterile dressing
- Rapid transport
Brain Trauma

- Brain anatomy
  - Cerebrum
    - Largest, two hemispheres
    - Four lobes
    - Cerebral cortex controls voluntary movement

Brain Trauma (Cont’d)

Brain Trauma (Cont’d)
Brain Trauma (Cont’d)

- Brain anatomy
  - Diencephalon
    - Thalamus
      - Relay station, switchboard
      - Sorts sensory information, routes to brain for processing
    - Hypothalamus
      - Vomiting, temperature regulation, water balance

Brain Trauma (Cont’d)

- Brain anatomy
  - Brainstem
    - Connects spinal cord with higher brain structures
    - Midbrain, pons, medulla oblongata
    - Contains nuclei for most cranial nerves
    - Coughing, swallowing, respiratory/heart rates, regulation of blood vessel diameter

Brain Trauma (Cont’d)

- Brain anatomy
  - Cerebellum
    - Controls fine movement
    - Coordinates skeletal muscle movement
    - Balance
Brain Trauma (Cont’d)

- Brain anatomy
  - Reticular formation
    - Nerve cell collection, maintains attention, wakefulness
  - Cerebral ventricles
    - Connect to each other and subarachnoid space that surrounds CNS

Brain Trauma (Cont’d)

- Brain anatomy
  - Reticular formation
    - CSF
      - Formed by choroid plexus in ventricles
      - Flows around brain, through spinal cord, subarachnoid space that surrounds CNS
      - Reabsorbed from subarachnoid space, enters venous bloodstream

Brain Trauma (Cont’d)

- Brain anatomy
  - Needs constant O₂, nutrients
    - Receives 15–20% of cardiac output, 20% of body’s O₂
      - Via vertebral, carotid arteries
      - O₂ interruption, mental status changes, vital sign changes
Brain Trauma (Cont’d)

- **Brain anatomy**
  - Skull rigid, volume increases cause increased pressure within cranial cavity
  - Cerebral perfusion pressure (CPP)
    - Normal, 70–90 mm Hg
    - Pressure of blood filling brain
    - CPP = MAP – ICP
    - Mean arterial BP (MAP)
    - Intracranial pressure (ICP)

Brain Trauma (Cont’d)

- **Brain anatomy**
  - Autoregulation
    - Brain’s ability to regulate vessel diameter to MAP differences

Brain Trauma (Cont’d)

- **Brain anatomy**
  - Monroe-Kellie Doctrine
    - Responding to intracranial pressure, body expels CSF, venous blood out of cranial vault
    - ICP increases, body increases MAP
Brain Trauma (Cont’d)

- Brain anatomy
  - Brain swelling, bleeding, requests more O₂, vicious cycle
  - Hemiation
    - Uncus displaced laterally before moving downward through tentorium incisura
    - Oculomotor nerve compressed by uncus, pupil dilation, contralateral dysfunction

Brain Trauma (Cont’d)

- Brain anatomy
  - Pressure exerted on brain tissue
    - Altered responsiveness level
    - Bradycardia
    - Abnormal respiratory patterns
    - Ataxic respirations
    - Decorticate, decerebrate posturing
    - Seizures

Brain Trauma (Cont’d)

- Brain anatomy
  - Capnography
    - Measures CO₂ levels
    - Normal, 30–35 mm Hg
    - No ability to monitor CO₂, ventilate at 10 breaths/min adult, 20 breaths/min child, 25 breaths/min infant
Brain Trauma (Cont’d)

- Brain anatomy
  - Increased ICP
    - Infant signs
    - Full fontanelle
    - Altered mental status
    - Irritability
    - Persistent vomiting
    - Cannot fully open eyes

Brain Trauma (Cont’d)

- Brain anatomy
  - Increased ICP
    - Signs in children
      - Headache
      - Stiff neck
      - Photophobia
      - Altered mental status
      - Persistent vomiting
      - Cranial nerve involvement symptoms
      - Cushing’s triad
      - Decomp/decerebrate posturing

Brain Trauma (Cont’d)

- Brain anatomy
  - ICP levels
    - Cerebral cortex and upper brainstem involvement
      - BP and heart rate begin slowing
      - Pupils still reactive
      - Cheyne-Stokes respirations
      - Initially tries to localize, remove painful stimuli
      - Withdraws, then fixation
      - Reversible
Brain Trauma (Cont’d)

- Brain anatomy
  - ICP levels
    - Middle brain involvement
    - Wide pulse pressure, bradycardia
    - Pupils nonreactive/sluggish
    - Central neurogenic hyperventilation
    - Extension
    - Few patients survive with normal cerebral function at this level

Brain Trauma (Cont’d)

- Brain anatomy
  - ICP levels
    - Lower brainstem involvement
    - Pupil dilation on same side as injury
    - Ataxic respirations
    - Flaccid
    - Changing heart rate, irregular
    - QRS, ST segment, T-wave changes
    - Decreased BP
    - Not considered survivable

Brain Trauma (Cont’d)

- Mechanism of injury
  - Force great enough to move brain inside skull
  - Brain injury, primary, secondary, tertiary
  - MVCs
  - Recreational, sports
  - Falls
  - Assaults
  - Firearms
  - Sharp projectiles
Brain Trauma (Cont’d)

- Etiology and demographics
  - Coup, directly below impact point
  - Countercoup, at another site, usually opposite site of impact

- Diffuse axonal injury
  - Shearing, tearing, stretching force of nerve fibers with axonal damage
  - Concussion
    - Grade 1: Transient confusion, no LOC, mental status abnormalities >15 minutes
    - Grade 2: Transient confusion, no LOC, mental status abnormalities >15 minutes
    - Grade 3: LOC

- Postconcussion syndrome
- Moderate, tiny brain tissues, basilar fracture, focal deficit
- Severe
Brain Trauma (Cont’d)

- Etiology and demographics
  - Focal Injuries
    - Cerebral contusion
      - Brain tissue bruised, does not puncture pia mater
      - Mental status changes
      - Swelling
      - Skull laceration
      - Confusion, unusual behavior
      - Progressive headache, photophobia
      - Increased ICP signs

Brain Trauma (Cont’d)

- Etiology and demographics
  - Focal injuries
    - Intracranial hemorrhage
      - Epidural, momentary LOC, rapid decline
      - Subdural, blood collection in subdural space
      - Intracerebral, bleeding within brain tissue
      - Subarachnoid, blood collection between arachnoid layer of meninges and pia mater
Brain Trauma (Cont’d)

- History and physical findings
  - TBI, cervical spine injury until proven otherwise
  - ABCs
  - Abnormal rate, pattern of breathing
  - GCS score
  - Vital signs
  - ICP symptoms

Brain Trauma (Cont’d)

- Therapeutic interventions
  - Time on scene <10 minutes
  - Manual spine stabilization
  - Open airway
  - O₂, suction
  - Pulse oximeter
  - ECG monitor, capnography
  - Bag-mask
Brain Trauma (Cont’d)

- Therapeutic interventions
  - Ventilation
  - Orogastric tube
  - ET intubation if GCS <8
  - Vascular access
  - Maintain euvoeemia
  - Glucose level
  - Elevate head of stretcher 15°-30°
  - Helmet removal considerations

Brain Trauma (Cont’d)

- Therapeutic interventions
  - Restraints
    - Harmful to self, others
    - Must be monitored at all times
    - ABCs
    - Follow policies, procedures

Brain Trauma (Cont’d)

- Therapeutic interventions
  - Restraints
    - Documentation
      - Reason restrained
      - Physician name providing online medical direction
      - Restraint type used
      - Patient position during treatment, transport
      - Regular ABCs, vital sign monitoring
      - Assessment findings of distal pulses while restrained
      - Total time restrained
      - Patient condition at time of transfer of care
Brain Trauma (Cont’d)

- Therapeutic interventions
  - Restraints
    - Mechanical patient restraint
      - Four people, each extremity
      - One communicator
      - Do not place patient face down
      - Stretcher head raised 30°

Brain Trauma (Cont’d)

- Therapeutic interventions
  - Restraints
    - Chemical patient restraint
      - Compromised airway
      - Intramuscular, IV, oral
      - Frequent reassessment
      - Stretcher head raised 30°

Chapter Summary

- Facial injuries may be the result of blunt/penetrating trauma.
  - Airbag deployment can cause abrasions to the face, neck, and upper chest.
- Orbital fracture, any fracture that involves the bony cavity containing the eyeball, may occur as an isolated injury or in conjunction with another injury, such as a zygomatic fracture or fractures of the midface.
Chapter Summary (Cont’d)

- Nose is the most commonly fractured bone of the face
  - Most nasal fractures are the result of blunt trauma
- Zygomatic fractures are common; they are usually the result of assault or MVC
  - Maxillary/midface fractures are usually a combination of fractures involving several structures of the face
  - Significant force is required to fracture this area

Chapter Summary (Cont’d)

- Mandibular fractures are common, caused by blunt trauma to the face, most commonly from domestic violence or contact sports; they are also caused by penetrating trauma, such as gunshot wounds, blast injuries, and industrial injuries

Chapter Summary (Cont’d)

- Two million brain injuries occur every year, most of them mild, with a ratio of 8:1:1
  - Assessment is the key to the proper care and evaluation of the injury
  - Correctly identifying and prioritizing injuries can greatly improve patient outcome
  - Appropriately treat injuries, always assessing airway, breathing, circulation, and deficits
  - Never occlude the nose and ear, especially if CSF fluid leaks are present
Chapter Summary (Cont’d)

- In loss of consciousness with facial/head injuries, protect the spinal cord
- If in doubt, treat the patient for traumatic brain injury

Questions?