Sanders: Mosby's Paramedic Textbook, Revised 3rd Edition

PowerPoint Lecture Notes

Chapter 24: Head and Facial Traumas

Chapter 24
Head and Facial Trauma

Objectives

- Describe mechanism of injury, assessment, and management of:
  - Maxillofacial injuries
  - Ear, eye, and dental injuries
  - Anterior neck trauma
  - Injuries to the scalp, cranial vault, or cranial nerves

Objectives

- Distinguish between types of traumatic brain injury
- Outline the prehospital management of patients with cerebral injury
- Calculate a Glasgow Coma Scale, trauma score, revised trauma score, and pediatric trauma score for a given scenario

Scenario

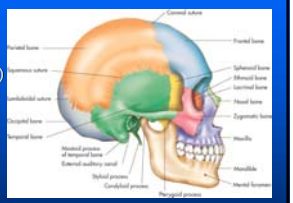
A10-year-old boy is carried into your station, his arms and legs draped limply over his frantic father's arms. He fell off an ATV about an hour ago, was knocked out briefly, then seemed fine until he suddenly had a seizure and "passed out." Your crew carefully immobilizes him while you determine the following: his airway is noisy, and he has no gag reflex; he is breathing irregularly about 10 times/min; BP 72/50 mm Hg; P 68/min; right pupil 2 mm and reacts to light, left pupil 5 mm and unreactive; flaccid response to pain; wt 35 kg.

Discussion

- What are your immediate priorities for his care?
- Calculate his GCS, RTS, and PTS
- What type of brain injury is likely in this child?
- Explain the significance of his pupillary findings
- Why might his blood pressure be low?

Maxillofacial Injury

- Arteries
- Nerves
  - 5th cranial nerve (trigeminal)
  - 7th cranial nerve (facial)
- Frontal bone
- Nasal bones
- Maxilla
- Zygomatic bone
- Mandible



Maxillofacial Injury

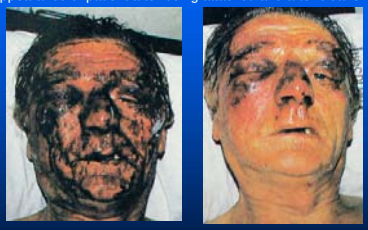
- Causes
  - Motor vehicle crashes
  - Home accidents
  - Athletic injuries
  - Animal bites
  - Intentional violent acts
  - Industrial injuries
- Maxillofacial trauma classified as:
  - Soft tissue injuries
  - Facial fractures

Soft Tissue Injuries

- Facial soft tissue injuries often appear serious
  - Seldom life threatening
  - Exceptions
    - Compromised upper airway
    - Potential for significant bleeding

Soft Tissue Injury

Appearance of patient after being attacked and after cleansing



History

- Mechanism of injury
- Events leading up to injury
- Time of injury
- Associated medical problems
- Allergies
- Medications
- Last oral intake

Management

- Spinal precautions
- Assess for airway obstruction
  - Apply suction as needed
- Secure and maintain airway
- Ensure ventilation and oxygenation
- Control bleeding
  - Direct pressure and pressure bandages

Facial Fractures

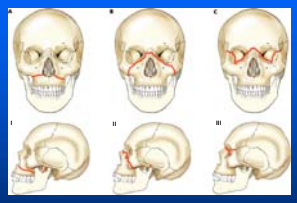
- Common after blunt trauma
- Signs and symptoms
- Fractures of the mandible
- Dislocations of the mandible

Fractures of the Midface

- Middle third of face
  - Maxilla
  - Zygoma
  - Floor of the orbit
  - Nose

Fracture of middle 1/3 of face

Le Fort Fractures



Fractures of the Zygoma

- Zygoma articulates with frontal, maxillary, and temporal bones
- Associated with orbital fractures and has similar clinical signs
- Signs and symptoms

Fractures of the Orbit

- Blowout fractures to orbit
- Periorbital edema, subconjunctival ecchymosis, diplopia, enopthalmos, epistaxis, anesthesia, impaired EOM
- Suspect injury to orbital contents with any facial fracture

Blowout fracture caused by ball's impact

Fractures of the Nose

- Most often fractured structure
- Injuries may
  - Depress dorsum of nose
  - Displace it to one side
  - Result in epistaxis and swelling (without skeletal deformity)
- Orbital fractures may also be present

Epistaxis

- Apply external pressure to anterior nares
- Conscious patient
  - Seated upright or leaning forward while paramedic compresses nares
- Unconscious patient
- Positioned on side (if no spinal injury is suspected)
- Treat for shock if bleeding is severe

Management of Facial Fractures

- Assume spine is injured
  - Use spinal precautions
- Assess airway for obstruction
  - Apply suction as needed
- Ensure adequate ventilation and oxygenation
- Control bleeding through direct pressure and pressure bandages
- Control epistaxis by external direct pressure

Nasal and Ear Foreign Bodies

- Foreign bodies in nose or ear common in children
  - May need transport for physician evaluation
- Remove foreign body in ear if easily retrieved
- Do not remove nasal foreign body in field unless it:
  - Compromises airway
  - Can be easily removed without equipment

Ear Trauma

- Lacerations and contusions
  - Usually blunt trauma
  - Treated by direct pressure to control bleeding and ice or cold compresses
    - To decrease swelling

Ear Trauma

- Retrieve avulsed tissue if possible
  - Wrap in moist gauze
  - Seal in plastic
  - Place on ice
  - Transport with patient for surgical repair

Ear Trauma

Partially detached pinna

Loss of rim

Ear Trauma

- Thermal injuries
- Chemical injuries
- Traumatic perforations
  - Impaled objects
- Barotitis

Eye Trauma

- Common causes of eye injury
  - Motor vehicle crashes
  - Sports and recreational activities
  - Violent altercations
  - Chemical exposure
  - Foreign bodies
  - Animal bites and scratches
- Evaluation

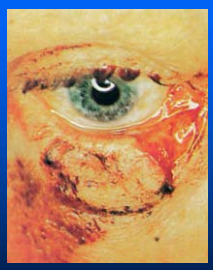
Eye Trauma Evaluation

- History
  - Exact mode of injury
  - Use of corrective glasses or contact lenses
- Visual acuity
  - Test injured eye first; compare to uninjured eye
- Pupillary reaction
- Extraocular movement

Specific Eye Injuries

- Ocular trauma should be evaluated by physician
- Foreign bodies
- Corneal abrasion
- Blunt trauma
- Penetrating injury
- Protruding intraocular foreign bodies
- Chemical injuries to the eye

Avulsion of Lid



Hyphema

Ruptured Globe

Acid Burn

Alkali Burn

Corneal Abrasion Care

Contact Lenses

- Hard lenses
- Soft hydrophilic lenses
- Rigid gas-permeable lenses
- As a rule, EMS personnel should not attempt to remove contact lenses in patients with eye injuries

Dental Trauma

- 32 teeth in adult
- Sections
  - Crown
  - Root
- Hard tissues of teeth
- Soft tissues of teeth
- Tooth fracture
- Tooth avulsion

Anterior Neck Trauma

- Blunt and penetrating trauma
- Can damage:
  - Skeletal structures
  - Vascular structures
  - Nerves, muscles, and glands of neck

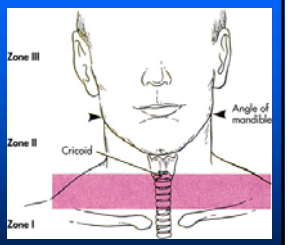
Self-inflicted stab wound that had entered pharynx

Common Mechanisms of Injury

- Motor vehicle crashes
- Sports and recreational activities
- Industrial accidents
- Violent altercations
- Hangings

Evaluation of the Neck

- Zone I
  - Injuries carry highest mortality
- Zone II
  - Most common injuries but lower mortality than zone I injuries
- Zone III
  - Greatest risk of injury to distal carotid artery, salivary glands, and pharynx



Hematomas and Edema

- Edema of pharynx, larynx, trachea, epiglottis, and vocal cords may obstruct airway completely
- Consider oral or nasal intubation with spinal precautions in patients with airway compromise
  - Smaller ET tube may be needed

Hematomas and Edema

- Other measures to treat edematous airways
  - Cool, humidified oxygen
  - Slight elevation of patient's head (if not contraindicated)

Lacerations and Puncture Wounds

- Superficial injuries
  - Usually managed by covering wound
- Deep penetrating wounds
  - Serious injuries may require:
    - Aggressive airway therapy and ventilatory support
    - Suction
    - Hemorrhage control by direct pressure
    - Fluid replacement

Lacerations and Puncture Wounds

- Signs and symptoms of significant penetrating neck trauma
  - Shock
  - Active bleeding
  - Tenderness on palpation
  - Mobility and crepitus
  - Large or expanding hematoma
  - Pulse deficit
  - Neurological deficit
  - Dyspnea
  - Hoarseness
  - Stridor
  - Subcutaneous emphysema
  - Hemoptysis
  - Dysphagia
  - Hematemesis

Vascular Injury

- Blood vessels are most commonly injured structures in the neck
  - Blunt or penetrating trauma
- Vessels at risk of injury
  - Carotid
  - Vertebral
  - Subclavian
  - Innominate
  - Internal mammary arteries
  - Jugular and subclavian veins

Vascular Injury—Management

- Secure airway with spinal precautions
- Adequate ventilatory support
- Control hemorrhage by direct pressure
- Fluid replacement for hypovolemia guided by medical direction

Laryngeal or Tracheal Injury

- Blunt or penetrating trauma to anterior neck may cause:
  - Fracture or dislocation of the laryngeal and tracheal cartilages
  - Hemorrhage
  - Swelling of air passages
- Rapid airway control can save patient

Laryngeal or Tracheal Injury

- High degree of suspicion for:
  - Vascular disruption
  - Esophageal, chest, and abdominal injury
- Emergency airway management in these injuries is controversial

Esophageal Injury

- Suspect in patients with trauma to neck or chest
- Specific injuries that require a high degree of suspicion for associated esophageal injury include:
  - Tracheal fractures
  - Penetrating trauma from stab or gunshot wounds
  - Ingestion of caustic substances

Esophageal Injury

- Signs and symptoms may include:
  - Subcutaneous emphysema
  - Neck hematoma
  - Oropharyngeal or nasogastric blood (indicating esophageal perforation)

Head Trauma

- Anatomical components of skull
  - Scalp
  - Cranial vault
    - Dural membrane
    - Arachnoid membrane
    - Pia
    - Brain substances

Scalp

- Hair
- Subcutaneous tissue
  - Major scalp veins bleed profusely
- Muscle
  - Attached above eyebrows and at base of occiput
- Galea
  - Freely movable sheet of connective tissue
  - Helps deflect blows
- Loose connective tissue
  - Contains emissary veins that drain intracranially

Soft Tissue Injuries to the Scalp

- Irregular linear laceration common
- May lead to profuse bleeding and hypovolemia
  - Particularly in infants and children

Soft Tissue Injuries to the Scalp

- Management
  - Prevent contamination of open wounds
  - Direct pressure or pressure dressings to decrease blood loss
  - IV fluid replacement if needed
  - Consider potential for underlying skull fracture and brain and spinal trauma

Skull

- Facial bones
- Cranial bones
  - Double layer of solid bone surrounds spongy middle layer
  - Frontal, occipital, temporal, parietal, and mastoid
- Middle meningeal artery
  - Under temporal bone
  - Can tear artery if fractured
- Skull floor—many ridges
- Foramen magnum
  - Opening at base of skull for spinal cord

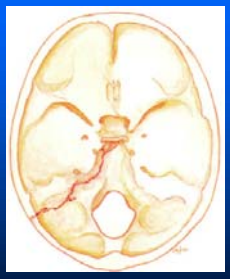
Classification of Skull Fractures

- Linear fractures
- Basilar fractures
- Depressed fractures
- Open vault fractures

Linear Fractures

- 80% of all skull fractures
- Not usually depressed
- May occur without an overlying scalp laceration
- Generally low complication rate (if isolated injury)

Basilar Skull Fracture



Basilar Skull Fracture—Signs and Symptoms

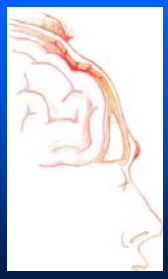
- Ecchymosis over mastoid process
  - Temporal bone fracture
  - Battle's sign
- Blood behind tympanic membrane
  - Fractures of temporal bone
  - Hemotympanum

Basilar Skull Fracture—Signs and Symptoms

- Ecchymosis of one or both orbits
  - Fracture of base of sphenoid sinus
  - Raccoon's eyes
- CSF leakage
  - Can result in bacterial meningitis

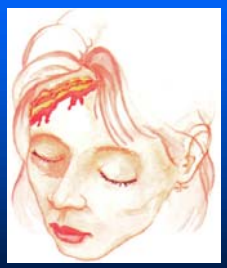
Depressed Skull Fractures

- Relatively small object strikes head at high speed
  - Often scalp lacerations
- Frontal and parietal bones most often affected



Open Vault Fractures

- Direct communication between a scalp laceration and cerebral substance
  - Often occur with multisystem trauma
  - High mortality rate
  - May lead to infection (meningitis)
- Prehospital management



Severe Fracture of Base of Skull

Skull Fractures—Complications

- Cranial nerve injury
- Vascular involvement
  - Meningeal artery
  - Dural sinuses
- Infection
- Underlying brain injury
- Dural defects caused by depressed bone fragments

Cranial Nerve Injuries

- Usually associated with skull fractures
- Cranial nerve I (olfactory nerve)
  - Loss of smell
  - Impairment of taste (dependent on food aroma)
  - Sign of basilar skull fracture
- Cranial nerve II (optic nerve)
  - Blindness in one or both eyes
  - Visual field defects

Cranial Nerves

- Cranial nerve III (oculomotor)
  - Origin from midbrain
  - Controls pupil size
  - Pressure on nerve paralyzes nerve
    - Pupil nonreactive
- Cranial nerve X (vagus)
  - Origin in medulla
  - Nerves that supply SA and AV node, stomach, and GI tract
  - Pressure on nerve stimulates bradycardia

Cranial Nerve Injuries

- Cranial nerve III (oculomotor nerve)
  - Ipsilateral, dilated, fixed pupil
  - Vulnerable to compression by temporal lobe
  - Mimic direct ocular trauma
- Cranial nerve VII (facial nerve)
  - Immediate or delayed facial paralysis
  - Basilar skull fracture
- Cranial nerve VIII (auditory nerve)
  - Deafness
  - Basilar skull fracture

Brain Trauma

- Traumatic insult to the brain is capable of producing physical, intellectual, emotional, social, and vocational change
- Primary brain injury
- Secondary brain injury

Brain Trauma

- Brain occupies 80% of intracranial space
- Components
  - Brain stem
  - Diencephalon
  - Cerebrum
  - Cerebellum

Brain Trauma

- Categories
  - Mild diffuse injury
  - Moderate diffuse injury
  - Diffuse axonal injury
  - Focal injury

Mild Diffuse Injury (Concussion)

- Fully reversible brain injury
- No structural damage to brain
- Causes
- Signs and symptoms
- Management

Moderate Diffuse Injury

- Minute petechial bruising of brain tissue
  - Brain stem and reticular activating system involvement lead to unconsciousness
- Signs and symptoms
- Management

Diffuse Axonal Injury (DAI)

- Most severe brain injury
  - Brain movement within skull secondary to acceleration or deceleration forces
- DAI may be classified as mild, moderate, or severe

Diffuse Axonal Injury

- Mild DAI
  - Coma of 6- 24 hrs
- Moderate DAI
  - More common
  - Coma >24 hrs and abnormal posturing
- Severe DAI
  - Formerly known as brainstem injury
  - Severe shearing of axons in both cerebral hemispheres extending to brain stem

Focal Injury

- Specific, grossly observable brain lesions
- Result from:
  - Skull fracture
  - Contusion
  - Edema with associated increased ICP
  - Ischemia
  - Hemorrhage

Intracranial Contents

- Brain water: 58%
- Brain solids: 25%
- Cerebrospinal fluid: 7%
- Intracranial blood: 10%

Cerebral Contusion

- Bruising of brain around cortex or deeper within frontal, temporal, or occipital lobes
  - Structural change in brain tissue
  - Greater neurological deficits and abnormalities than with concussion
  - Coup injuries
  - Contrecoup injuries

Edema

- Significant brain injuries may result in swelling of brain tissue
  - With or without associated hemorrhage
- Swelling results from humoral and metabolic responses to injury
  - Increase in intracranial pressure
  - May be decreased cerebral perfusion or herniation

Ischemia

- Can result from:
  - Vascular injuries
  - Secondary vascular spasm
  - Increased intracranial pressure
  - Focal or more global infarcts can result

Hemorrhage

- Into or around brain tissue
- Epidural or subdural hematomas can compress underlying brain tissue or intraparenchymal hemorrhage
- Often associated with:
  - Cerebral contusions
  - Skull fractures

Cerebral Blood Flow

- Oxygen and glucose delivery are controlled by cerebral blood flow
  - A function of cerebral perfusion pressure (CPP) and resistance of the cerebral vascular bed
  - CPP = MAP - ICP
    - MAP = Diastolic pressure + 1/3 Pulse pressure

Cerebral Blood Flow

- As ICP approaches MAP:
  - Gradient for flow decreases
  - Cerebral blood flow is restricted
- When ICP increases, CPP decreases
  - Cerebral vasodilation occurs
  - Increased cerebral blood volume (increasing ICP)

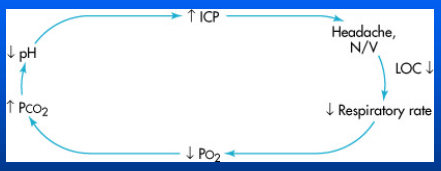
Cerebral Blood Flow

- Vascular tone in brain regulated by:
  - Carbon dioxide pressure (PCO_2)
  - Oxygen pressure (PO_2)
  - Autonomic and neurohumoral control
- PCO_2 has greatest effect on intracerebral vascular diameter and subsequent resistance

Intracranial Pressure (ICP)

- Normal range is 0-15 torr
- When ICP rises above this level
  - Cerebral blood flow decreases
- Body tries to compensate for decline in CPP by a rise in MAP:
  - Further elevates ICP, and CSF is displaced to compensate for the expansion
- If unresolved, brain substance herniates

Effects of Increased Intracranial Pressure



Increased Intracranial Pressure

- Early
  - Headache
  - Nausea and vomiting
  - Altered level of consciousness
- Eventually, Cushing's triad
  - Increased systolic pressure (widened pulse pressure)
  - Decreased pulse rate
  - Irregular respiratory pattern

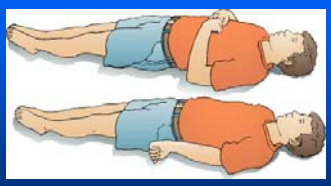
Increased Intracranial Pressure

- Herniation through temporal lobe causes compression of cranial nerve III (oculomotor)
- Patient rapidly unresponsive to verbal and painful stimuli
  - Exhibits decorticate posturing or decerebrate posturing

Posturing

Abnormal flexion (decorticate posturing)

Abnormal extension (decerebrate posturing)



Critical Signs of Herniation

- Unresponsive patient with:
  - Bilateral, dilated, unresponsive pupils

    OR
  - Asymmetric pupils (>1 mm)

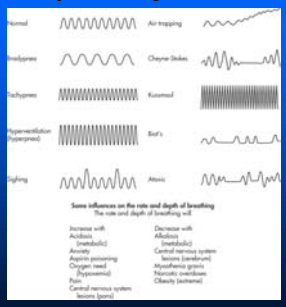
    AND
  - Abnormal extension (decerebrate) posturing

    OR
  - No motor response to painful stimulus

Respiratory Patterns

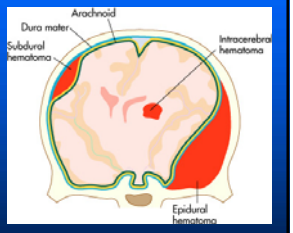
- Associated with increased intracranial pressure and brain stem injury:
  - Hypoventilation
  - Cheyne-Stokes breathing
    - May accompany decorticate posturing
  - Central neurogenic hyperventilation
    - May accompany decerebrate posturing
  - Ataxic breathing

Respiratory Patterns



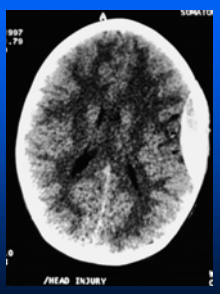
Types of Brain Hemorrhage

- Classified according to location:
  - Epidural
  - Subdural
  - Subarachnoid
  - Cerebral (intraparenchymal)



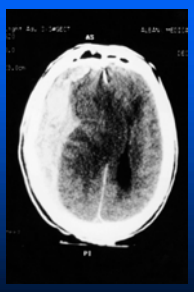
Epidural Hematoma

- Collection of blood between cranium and dura in epidural space
  - Rapidly developing lesion from laceration of middle meningeal artery
- Common causes
- Signs and symptoms
- Management



Subdural Hematoma

- Blood between dura and surface of brain in subdural space
  - Usually bleeding from veins that bridge subdural space

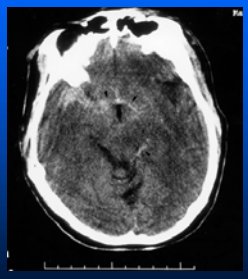


Subdural Hematoma

- Classifications
  - Acute— symptoms ≤24 hours
  - Subacute—symptoms 2-10 days
  - Chronic—symptoms >2 weeks
- Signs and symptoms

Subarachnoid Bleeding

- Intracranial bleeding into CSF, resulting in bloody CSF and meningeal irritation
- Signs and symptoms



Intracerebral Hematoma

- > 5 mL blood somewhere within brain
  - Commonly frontal or temporal lobe
- Causes
- Signs and symptoms

Penetrating Injury

- Missiles fired from handguns
- Stab wounds
  - Falls
  - High-velocity motor vehicle crashes
- Associated injuries
- Complications
- Definitive care

Assessment and Evaluation

- Consider:
  - Mechanism and severity of injury
  - Level of consciousness
  - Associated injuries
- Assess GCS every 5 min
- Determine pupil
  - Size
  - Reactivity

Assessment and Management

- Maintain airway
- Maintain SaO_2 >90%
- NS or LR fluid bolus if adult BP <90 mm Hg
- Hyperventilate only when critical signs of herniation are present
- Neurological exam

Assessment and Management

- Drug therapy
  - Medical direction may prescribe drugs for head injuries (considered controversial)
    - Mannitol for cerebral edema
    - Lorazepam and diazepam for seizure activity
      - Rarely used in prehospital setting in HI due to sedation
    - Lidocaine to control ICP that occurs with ET intubation
    - Sedatives and paralytics for airway management

Glasgow Coma Scale (GCS)

- Evaluates:
  - Eye opening
  - Verbal responses
  - Brain stem reflex function
- Evaluate at least every 5 min
  - Mild head injury: GCS 13-15
  - Moderate head injury: GCS 9-12
  - Severe head injury: GCS ≤8

Trauma Score (TS)

- Predicts outcome of patients with blunt or penetrating injuries
- Modified trauma index to include systolic blood pressure, respiratory rate, and the GCS
- Limited use in prehospital setting

Revised Trauma Score (RTS)

- GCS with systolic blood pressure and respiratory rate
- RTS essentially same as TS except for consideration of capillary refill
- Patients with RTS of ≤11 should be transferred to a level I trauma center

Pediatric Trauma Score (PTS)

- Evaluates:
  - Size (weight)
  - Airway
  - Central nervous system
  - Systolic blood pressure
  - Open wound
  - Skeletal injury
- Pediatric trauma patient with PTS <8 should be transported to a level I trauma center

Other Methods

- CUPS system
  - Assigns patients to one of four categories
- Constant monitoring of patient is crucial
- Changes in patient's status may alter the course of a treatment plan

Conclusion

Head injuries affect nearly 4 million people each year in the United States. Approximately 50,000 patients with severe head trauma die each year before reaching the emergency department. Accurate assessment and appropriate prehospital intervention can improve survival and brain function for patients with these injuries.

Questions?