Head & Spinal Cord Injury

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Objectives

♦ Upon successful completion of this module, the ECRN should be able to:

– identify mechanisms of injury that can cause traumatic head and neck injuries
– describe the interventions performed in the field for patients with head and spinal injuries
– describe the signs and symptoms of increased intracranial pressure
Objectives continued

– describe field interventions performed for increased intracranial pressure
– discuss field care for the patient wearing a helmet
– review scoring of the Glasgow Coma Scale
– review protocol for conscious sedation
EMS vs ED Care

- EMS must follow the Region’s SOP’s
- The ECRN can only give a verbal order to EMS if it is written in the SOP’s/protocol
- Any deviation from the SOP’s/protocol must be at the direction of the ED MD
- Many activities in the field (assessment, interventions) can easily be duplicated or modified to be used in the hospital setting by the ED RN
- This packet contains information to share what EMS will do as well as ED’s actions
Incidence, Morbidity, Mortality

♦ 4 million people per year have a significant head injury
♦ Severe head injury is the most frequent cause of trauma death
♦ 11,000 permanent spinal cord injuries occur per year
♦ Populations most at risk are:
  ★ males between 15 and 24 years of age
  ★ infants and young children
  ★ elderly
Contributions to Injuries

- Violent
- Sports
- MVC
- Alcohol
- Falls
- Recreational
- Falls
**Prevention Is Key**

- Restraints - seat belts; car seats; boosters
- Helmets - organized sports; bicycles; skateboarding; motorcycles
- Bike Rodeos - Rules of the Road; proper sizing of bike to rider
- Educational programs regarding drinking and driving
- Following safety practices in workplace and in the home
Anatomy of the Head

♦ Scalp
  – strong, flexible mass of skin
  – can absorb tremendous kinetic energy
  – extremely vascular therefore open injuries tend to bleed heavily

♦ Skull
  – cranium (collection of bones fused together) encloses the brain
  – facial bones
Anatomy of Head continued

♦ Meninges

✓ dura mater - outermost layer; connective tissue
  • bleeding between dura & skull are epidural bleeds
  • bleeding between dura & arachnoid space are subdural bleeds

✓ arachnoid membrane - suspends brain in cranial cavity; arachnoid space under membrane filled with cerebrospinal fluid (CSF)
  • CSF provides cushioning & nutrients to brain
  • bleeding under this area are subarachnoid bleeds

✓ pia mater - delicate tissue covering brain and spinal cord; highly vascular
In order:

1. Skull bone
2. Periosteum of the skull
3. Dura
4. Arachnoid
5. Subarachnoid space
6. Pia mater
Anatomy of Head continued

♦ Brain - 3 major structures

★ cerebrum
  • largest element of nervous system
  • occupies most of cranium
  • highest functional portion of brain
  • center of conscious thought, personality, speech, motor control, and visual, auditory, & tactile perception

★ cerebellum
  • fine tunes motor control, allows smooth motion from one position to another
  • responsible for balance & maintenance of muscle tone
**Brainstem**

- central processing center & communication junction
- midbrain
  - hypothalamus
    - controls much of endocrine function, vomiting reflex, hunger, thirst, kidney function, body temperature, emotions
- pons
- medulla oblongata
  - respiratory center (depth, rate, rhythm)
  - cardiac center (rate & strength of cardiac contractions)
  - vasomotor center (control of distribution of blood and maintenance of blood pressure)
CNS Circulation

- 4 major arterial vessels
- Capillaries unique
  - walls thicker so less permeable
  - protected environment via the blood-brain barrier
- Cerebral perfusion
  - changes in ICP are met with compensatory changes in blood pressure
Cerebral Perfusion Pressure

♦ Intracranial pressure - pressure within cranium
  – pressures within cranium create a natural resistance to control the amount of cerebral blood flow
  – blood flow to the brain remains adequate as long as pressures within the cranium are appropriate

♦ 3 major cranial contents
  – brain, blood, & cerebrospinal fluid

♦ Any changes in one of the 3 cranial contents is at the sacrifice to one of the others

♦ When perfusion pressures drop, ICP rises to try to maintain adequate cerebral perfusion
Cranial Nerves

♦ Cranial nerves are nerve roots that originate in the cranium and along the brainstem

♦ 12 distinct pathways known as CN I-XII
  – control senses
    • smell; sight; touch; hearing; taste
  – control the facial area
    • eye movement; facial muscle movement; chewing; swallowing
  – control significant body functions
    • monitors receptors in major blood vessels; major nerve of parasympathetic nervous system (CN X - vagus nerve)
Form of Trauma: Blunt Trauma

♦ Blunt trauma - closed injury
♦ Transmission of energy causes damage to tissues & organs beneath the skin
♦ True nature of injuries often hidden & evidence of injury are often subtle
♦ Sources of blunt trauma
  • MVC
  • falls
  • body to body contact
  • augmented forces (sticks, clubs)
Form of Trauma: Penetrating Trauma

- Penetrating trauma - open wounds
- Injuries influenced by degree of transfer of kinetic energy & characteristic of the projectile
- True knowledge of degree of bodily injury obtained after wound exploration
- Sources of penetrating trauma
  - GSW, stabbings
  - bites - dog, human
Head Injuries

- Caused by blunt and penetrating forces
- Any injury above the level of the clavicles is considered to involve the C-spine until proven otherwise
- Repeated reassessments will be key in determining patient trends (VS, neuro signs)
- Secondary insults - negative patient outcomes based on what we do or don’t do while caring for the patient
  - airway control, O₂ therapy, fluids, c-spine control, aspiration precautions
Head Injuries

♦ Coup injuries
  - Directly below point of impact
  - More common when front of head struck

♦ Contrecoup injuries
  - Injury on the pole on opposite site of impact
  - More common when back of head struck
Levels of Head Injury

♦ Focal injury
  – An identifiable site of injury limited to a particular area of the brain
  ✔ Contusion
    • blunt trauma
    • capillary bleeding into brain
    • often see prolonged confusion
    • neurological deficits related to site of injury
  ✔ Intracranial hemorrhage
    ☀ epidural
    – arterial bleed (often from artery in temporal area)
    – rapid build in intracranial pressure
    – quick onset altered level of consciousness
Focal Injuries continued

Subdural hematoma
- slow bleeding, usually venous
- blood is above pia mater so do not get cerebral irritation like in intracerebral hemorrhages
- onset of signs & symptoms may be delayed for hours or days
- need to look for mechanism of injury; injury often prior to day of patient interaction
- increased incidence in elderly and chronic alcoholism
  - reduced size of brain allows greater movement of brain within the skull and increases the chance of injury & room to bleed

Intracerebral hemorrhage
- ruptured blood vessel within brain; local irritation
Levels of Head Injuries

♦ Diffuse axonal injury (DAI)
  - Type of brain injury characterized by shearing, stretching or tearing of nerve fibers with subsequent axonal damage
  - Axons are the communication pathways of nerve cells
  - Injuries are spread over wider areas of the brain
  - More common with vehicular occupants and pedestrians struck by vehicle due to acceleration/deceleration forces
  - Injuries can range from mild to severe and life threatening
**Diffuse Axonal Injury (DAI)**

- **Concussion**
  - Most common outcome of blunt trauma to the head
  - Nerve dysfunction without anatomical damage
  - Transient confusion, disorientation, amnesia of the event
  - Management - quiet, calm atmosphere, constant orientation, intact airway, adequate tidal volume

- **Moderate DAI**
  - Accounts for 45% of all cases of DAI
  - Minute petechial bruising of brain tissue
  - May lead to unconsciousness
  - Commonly associated with basal skull fractures
  - Residual neurological impairment is common
**Diffuse Axonal Injury (DAI)**

**Moderate DAI continued**

- Short and long term deficits
  - Immediate unconsciousness
  - Persistent confusion, disorientation
  - Retrograde amnesia - past memory affected
  - Anterograde amnesia - no memory of incident and forward in time
  - Inability to concentrate
  - Frequent & significant mood swings & anxiety
  - Headache; other focal neurological deficits
  - Light sensitivity (photophobia)
  - Altered sense of smell and other senses
Diffuse Axonal Injury (DAI)

✓ Severe DAI

- Formerly called brain stem injury
- Severe mechanical disruption of many axons in both cerebral hemispheres and extending into brainstem
- Accounts for 36% of all cases of DAI
- Prolonged unconsciousness
- Decorticate (flexion) or decerebrate (extension) posturing common
- Signs of ↑ ICP
  - bradycardia, increasing B/P, altered respiratory pattern
- High mortality rate
- Significant neurological impairment for survivors
Intracranial Perfusion

♦ Brain has a high metabolic rate
♦ Brain needs constant fresh blood supply - the brain has no stores of energy sources
♦ Brain consumes 20% of body’s oxygen
♦ Cranial volume fixed, does not vary
  – 80% of the volume is the brain
  – 12% of the volume is blood flow
  – 8% of the volume is cerebrospinal fluid (CSF)
♦ Intracranial pressure (ICP) rises if any one of the cranial contents increases; an increase in one is at the sacrifice of another
ICP & Compensation

♦ If a mass expands in the cranium, vessels are compressed

♦ The next compensation is to push CSF out of the cranium and into the spinal canal

♦ As ICP goes up, arterial blood flow is restricted to reduce inflow of blood volume

♦ ↓ in cerebral blood flow → rise in systemic B/P to maintain cerebral perfusion → ↑ ICP → more resistance to cerebral blood flow → more hypoxia, hypercarbia (↑CO₂) and acidosis (unhealthy tissue/cell environment)
**CO₂ Levels and Head Injuries**

♦ **↑ CO₂ level causes cerebral arteries to dilate**
  – blood flow volume is increased to the brain
  – increased volume of blood is detrimental
  – body’s response to try to lower CO₂ is hyperventilation & increasing B/P

♦ **Causes of ↑ or retained CO₂ levels**
  – any thing that causes ineffective breathing (hypoventilation) causes CO₂ to be retained
    • head injury with altered level of consciousness
    • drug and alcohol overdose
    • ineffective use of ambu bag
↓CO₂ level triggers cerebral arterial constriction
- constriction minimizes blood flow to brain;
  brain dependent on constant flow of oxygenated blood
- brain insult will develop due to lack of adequate blood flow from the vasoconstriction

Causes of ↓ or low levels of CO₂
- any thing that causes rapid breathing (hyperventilation) causes CO₂ to be blown off
  • from head injury reflex
  • overly aggressive use of ambu bag on patient
CO$_2$ Levels continued

♦ Major insults to brain occur in presence of low blood pressure & poor ventilation
  – low B/P causes poor perfusion (hypoxia) & stimulates anaerobic metabolism that results in acidosis
  – poor ventilation produces retained CO$_2$ (acidosis) & hypoxia
  – elevated levels of CO$_2$ cause vasodilation which further elevates intracranial pressure with increased blood flow

♦ Goal of respiratory care: keep CO$_2$ levels normal by monitoring ETCO$_2$
  – immediate care provided after insult will positively or negatively affect outcome based on what is done or not done for the patient
  – normal CO$_2$ level is 35 - 45
Brain Stem Insults

- Upper brain stem involvement
  - Cushing’s Triad: B/P rising; pulse slowing;
  - Cheyne-Stokes respirations
    - alternating apnea/tachypnea
  - Pupils small & reactive
  - Initially localizes pain & tries to remove painful stimuli; then withdraws from pain; then flexed posturing (decorticate posturing - arms, wrists flexed & legs extended)

- All effects reversible at this time
**Middle Brain Stem Involvement**

- Widened pulse pressure (difference between systolic & diastolic B/P) as systolic pressure increases
- Bradycardia (from head injury and not a diseased heart)
- Pupils nonreactive or sluggish bilaterally
- Central neurogenic hyperventilation (CNH)
  - respirations deep & rapid
- Extension posturing (decerebrate - rigid extension of arms & legs, backward arch of head)
- Few patients will be able to return to normal function once they reach this level of intracranial pressure
Lower Brainstem Involvement

- Pupils dilated & unreactive
- Respirations ataxic (erratic, no pattern) or absent
- Pulse rate often irregular with great swings in rate
- Flaccid; no response
- EKG complex changes
- High mortality rate for patients who reach this level of function
Injuries of the Head & Neck

♦ Major concern will be airway patency

♦ Eye injury
  – fracture - may entrap a nerve
  – hyphema - blood in anterior chamber, threat to sight

♦ Nasal injury
  – epistaxis may interfere with airway
  – swallowed blood can make a patient nauseated

♦ Mandible injury
  – fracture and dislocation
  – immobility of jaw (watch airway); painful injury
Maxillary fracture
- Classified as LeFort I, II, or III based on degree and involvement of bony fractures

Basilar skull fracture
- Leakage of CSF (nose or ears)
- Route for infection into the brain
- Late development of raccoon’s eyes or battle’s sign
Soft Tissue Injury of Head & Neck

- Associated problems
  - cosmetic importance of appearance
  - highly vascular region
  - potential for blood loss
  - airway involvement
  - potential for hypoxia-induced secondary injury or insult
  - potential for cervical spine injuries
Mechanisms of Spinal Injury

- Flexion - fall; MVC; diving
- Hyperextension - fall; MVC; diving; football
- Flexion-rotation - fall; tackled in football; MVC
- Compression - diving; fall from height
- Distraction - hanging; bungee jumping; clothesline
- Penetration - foreign object
Traumatic Spinal Cord Injury

♦ Cord transection
  - Complete
    • All tracts of spinal cord completely disrupted
    • Cord-mediated functions below transection permanently lost
    • Long term prognosis more accurately determined at least 24 hours post injury
  - Incomplete
    • Some tracts of spinal cord remain intact
    • Some cord-mediated functions intact
    • Function may be lost temporarily
    • Has potential for recovery
Spinal Cord Injury

♦ Cord transection

• Injury at cervical level
  – Quadriplegia
  – Loss of all normal function below injury site
  – Injuries from C3 to C5 increases risk for respiratory paralysis due to involvement of phrenic nerve that is responsible for control of the diaphragm

• Injury below beginning of thoracic spine
  – Paraplegia
  – Loss of lower trunk function
  – Incontinence
Incomplete Spinal Cord Injuries

♦ Some spinal tracts remain; potential for some recovery; 3 syndromes of injury

★ Anterior cord syndrome
  • Bony fragments or pressure on spinal arteries
  • Potential for recovery is poor
  • Loss of motor function and sensation to pain, temperature and light touch
  • Likely to retain motion, positional, and vibration sensation
Incomplete Spinal Cord Injuries

- Central cord syndrome
  - Usually occurs with hyperextension of cervical spine (ie: forward fall with facial impact)
  - Weakness/paresthesia upper extremities
  - Usually normal strength in lower extremities
  - Varying degrees of bladder function
  - Best prognosis for recovery of the 3 syndromes
Incomplete Spinal Cord Injuries

- Brown-Sequard syndrome
  - Usually caused by penetrating injury affecting one side of the cord (hemitransection)
  - Sensory and motor loss to same side of body (ipsilateral) as the injury
  - Pain and temperature sensation lost on opposite side of body (contralateral)
  - Injury rarest of the 3
  - May have some recovery
Neurogenic Shock

- Malfunction of autonomic nervous system in regulating vessel tone & cardiac output
- Lack of sympathetic tone
  - vasoconstriction limited so vessels dilate
  - reduced preload causes decrease in atrial filling volume and weakens cardiac contractions
  - no release of epinephrine or norepinephrine
- Assessment
  - normal skin color & temperature (warm & dry)
  - bradycardia (no catecholamines circulating)
  - hypotension (pooling of blood)
  - priapism
Treatment of Neurogenic Shock

♦ Airway control & supplemental O₂
♦ Spinal immobilization starting with manual control (document techniques/equipment used)
♦ IV - O₂ - monitor
♦ Fluid bolus 20 ml/kg; reassess
♦ Dressings & splinting as needed and potentially done enroute to the ED
♦ Watch for respiratory compromise due to loss of phrenic nerve stimulation
  – adults with excessive belly breathing are using alternate muscles to breathe and will tire & arrest
Non-traumatic Spinal Conditions

♦ Low back pain
  – 60 - 90 % of population have some form of low back pain
    • Affects men and women equally
    • Reported more commonly in women over 60 years
  – Most causes of LBP are idiopathic
    • Precise diagnosis difficult to determine
  – Affected area
    • Between lower rib cage and gluteal muscles
    • May radiate to thighs
  – 1% of acute low back pain is sciatica
    • Usual cause is in lumbar nerve root
    • Pain accompanied by motor and sensory deficits
      (ie: weakness) of lower extremities
Causes of Low Back Pain

- Tension from tumors
- Prolapsed disk
- Bursitis
- Synovitis
- Rising venous pressure
- Tissue pressure from degenerative joint disease (DJD)
- Abnormal bone pressure
- Problems with spinal mobility
- Inflammation from infection (osteomyelitis)
- Fractures
- Ligament strains
Low Back Pain

♦ Risk factors
  – Repetitious lifting
  – Vibrations from industrial machinery
  – Osteoporosis
Anatomical Considerations

♦ Pain from innervated structures
  – Varies from person-to-person

♦ Disk has no specific innervation
  – Compresses cord if herniated

♦ Pain in L-3, 4, 5 and S-1 may be interspinous bursae
Anatomical Considerations

- Anterior and posterior longitudinal ligaments and other ligaments richly supplied with pain receptors

- Muscles of spine vulnerable to sprains/strains
Degenerative Disk Disease

- Common over age 50

- Causes
  - Degeneration of disk
    - Biomechanical alterations of intervertebral disk
  - Narrowing of disk
    - Results in variable segment stability
**Spondylolysis**

- Structural defect of spine
  - Involves lamina or vertebral arch
- Usually between superior and inferior articulating facets
- Heredity a significant factor
- Rotational fractures common at affected site
Herniated Intervertebral Disk

- Also called herniated nucleus pulposus
- Tear in posterior rim of capsule enclosing the gelatinous center of the disk
Causes of Herniated Intervertebral Disk

♦ Trauma
♦ Degenerative disk disease
♦ Improper lifting  – Most common cause
♦ Men ages 30 - 50 most prone

♦ Commonly affects L-4, L-5, and S-1 disks
♦ May occur in C-5, C-6 and C-7
Spinal Cord Tumors

- Problems noted:
  - Compression of cord
  - Degenerative changes in bones/joints
  - Interruption of blood supply

- Manifestations dependent upon
  - Tumor type and location
Management of Non-traumatic Spinal Conditions

♦ Primarily palliative/supportive to decrease pain from movement

♦ May elect to immobilize to aid in comfort
  – Long back board - pad as needed
  – Vacuum type stretcher

♦ Full spinal immobilization not required unless condition results from trauma
  – EMS will follow In-field Spinal Clearance protocol to determine need for immobilization
  – ED walk-in may need immobilization
Assessment and Care of the Patient with Head and Neck Injuries
Trauma Patient Assessment

- Patients may present by private vehicle or walk-in and not by EMS
- ED staff may adopt some or all of the assessment steps used in a field assessment
- All assessments performed need to be a systematic process used repeatedly by the individual
  - less likely to miss some detail
  - gives assessor a way to focus for the first few minutes while gathering information
Trauma Patient Field Assessment

♦ Scene size-up - BSI, scene safety, determine mechanism of injury, locate all patients

♦ Primary survey- initial assessment
  – to identify immediate life threats
  – general impression, LOC (AVPU), ABC’s, manual c-spine immobilization

♦ Decision: Is this critical? Interventions needed right now including transport?

♦ Rapid trauma assessment head-to-toe or focused if isolated injury

♦ A decision of when and where to transport to made now if not done earlier
Trauma Patient Assessment cont’d

♦ Secondary survey
  – Gather history (SAMPLE), GCS, vital signs
    • S - signs and symptoms
    • A - allergies
    • M - medications (prescription, over-the-counter, herbal)
    • P - past pertinent medical history
    • L - last oral intake including food and water
    • E - events leading to the incident
  – Pulse oximetry, ECG monitoring
  – If applicable: blood glucose level

♦ Detailed assessment - head-to-toe again
♦ Ongoing assessment - monitor for changes
  – will not be aware of patient deterioration unless repeated reassessments are performed
  – document your findings
  – consider use of same rescuer for repeated reassessment - will best pick up subtle changes
  – includes: vital signs, EKG monitor, pulse ox, hands-on reassessment, asking the patient how they feel, reassessing any interventions already performed (ie: meds, fluids, splinting, dressings)
Region X Field Triage Criteria for Assessing Trauma Patients

♦ Criteria helps EMS determine transportation of patient to Level I, II or closest hospital

♦ Evaluation of patient helps to determine appropriate receiving facility
  – vital signs and level of consciousness
  – assessment for anatomy of injury
  – evaluation of mechanism of injury
  – assessment for co-morbid factors

♦ If Level I is >25 min away, transport to II
♦ No airway - transport to closest hospital
**Ventilation Rates in Head Injuries**

- If rapid neurological deterioration of the patient, the patient should be initially ventilated with BVM
  - adult (>8 years old) 20 bpm (every 3 seconds)
  - children (1-8 years old) 30 bpm (every 2 seconds)
  - infants (<1 years old) 35 bpm (every 1.7 seconds)
- Avoid hyperventilation at higher rates
- Consider conscious sedation intubation
- If seizure activity, give valium 5 mg IVP or 10 mg IM/rectally. May repeat to 10 mg max
Neurological assessment

✓ AVPU - evaluates mental status
  • *alert* meaning *awake* (may be oriented or confused)
  • responds to *verbal* prompts (includes moaning)
  • responds only to *painful* stimuli (may be to light touch and not necessarily something painful)
  • *unresponsive* - comatose; absolutely no responses

✓ Glasgow Coma Scale (GCS)
  • evaluates level of consciousness

✓ Pupillary reaction
  • eyes are specialized tissue
  • eyes indicate problems with 4 cranial nerves
  • reflect adequacy of perfusion of cerebral blood flow
    - ↓ perfusion and the eyes lose their luster
Glasgow Coma Scale - GCS

- Scale that awards points based on patient’s best responses
  - Modified for developmental age
- Moderately good predictor of head injury severity
- Total score ranges 3-15
  - 13-15 - mild head injury
  - 9-12 - moderate head injury
  - ≤8 - severe head injury (patient usually in coma)
- Note differences right side to left side and upper versus lower extremities
Glasgow Coma Scale

- **Eye Opening**
  - spontaneous 4
  - to voice 3
  - to pain 2
  - none 1

- **Verbal response**
  - oriented 5
  - confused 4
  - inappropriate words 3
  - incomprehensible words 2
  - none 1

- **Motor response**
  - obeys commands 6
  - purposeful movement to pain 5
  - withdraws to pain 4
  - abnormal flexion 3
  - abnormal extension 2
  - none 1
GCS Pearls & Pitfalls

♦ Eye opening
  – don’t touch patient before calling their name - you will not be able to determine if they are responding to voice (3) or to touch (pain - 2)

♦ Verbal response
  – inappropriate words (3) are beyond confusion (4)
  – muttering is incomprehensible words (2)

♦ Motor response
  – purposeful is the patient pulling at what annoys them (B/P cuff, cervical collar) (5)
  – withdrawal is trying to move away from pain & annoyance (4)
Glasgow Coma Scale - GCS

* Per Region X SOP’s, EMS is to do GCS on all patients
* CMC patient care run report provides space to document two GCS scores
  – additional assessments would be in the comments
* Components should be assessed and results should be available at the time of the first radio contact to medical control
* Components or the total score may be given during the radio report
Glasgow Coma Scale

♦ EMS will not normally calculate the RTS (revised trauma score)
♦ EMS will provide the components of the RTS in report for the ECRN to do the calculation
  – Glasgow coma scale score
  – systolic blood pressure
  – respiratory rate
In-field Spinal Clearance

♦ When in doubt, fully immobilize the patient

♦ EMS will evaluate:
  ✓ mechanism of injury
  ✓ signs & symptoms
  ✓ patient reliability

♦ No spinal immobilization needed if:
  ✓ negative mechanism of injury
  ✓ no neurological signs or symptoms
  ✓ patient is reliable

♦ Spinal clearance is not a priority but restricting spinal motion is
Spinal Immobilization Required Related to Mechanism of Injury

- High velocity MVC $\geq 40$ mph
- Unrestrained occupant in MVC
- Passenger compartment intrusion $> 12”$
- Ejection from vehicle
- Rollover MVC
- Motorcycle collision $> 20$ mph
- Death in same vehicle
- Pedestrian struck by vehicle
- Falls $\geq 2$ times patient’s height
- Diving injury
Spinal Immobilization Required
Related to Signs and Symptoms

♦ Pain in neck or spine
♦ Tenderness/deformity of neck or spine upon palpation
♦ Paralysis or abnormal motor exam
♦ Paresthesia (pins & needles) in extremities
♦ Abnormal response to painful stimuli
Spinal Immobilization Required Related to Patient Reliability

♦ Signs of intoxication
♦ Abnormal mental status
♦ Communication difficulty
♦ Abnormal stress reaction

* When in doubt, fully immobilize
Spinal Immobilization

♦ Cervical collars
  – limit flexion, extension, & lateral movements
  – must be combined with additional pieces of equipment to be effective
  – start with manual stabilization, neutral position with eyes forward
  – do not move neck if movement:
    • increases muscle spasms
    • neck pain increases
    • neurological deficits are aggravated
    • airway becomes compromised
Measuring C-Collar Sizes

- Measure with fingers held horizontally and tucked in tight at base of neck (top of shoulder) to horizontal line drawn even with bottom of chin
- Size the collar from bottom of the rigid plastic edge (not the foam edge)
- Find window closest to top of your fingers
- Adjust sizing and snap to lock collar into place
- If a collar is too short it causes flexion
- If a collar is too tall it causes extension
Cervical Collars

- It is rare for the patient to be sized a no-neck
- If the majority of your patients are being sized as no-necks, then measurements are probably not accurate!!!
- Directions are printed on the collars if you need a reminder
Conscious Sedation

- Procedure performed when the airway needs to be secured and the patient is not in full arrest (inadequate airway; aspiration risk; GCS <8)
  - Note: not all patients with a GCS <8 need to be intubated in the field or the ED; evaluate each individual situation (ie: patient with a GCS <8 under the influence of alcohol does not necessarily get intubated!)

- Conscious Sedation can be utilized for trauma & medical patients (ie: stroke)
Conscious Sedation cont’d

- Contraindications - EMS to call medical control if they feel need to intubate exists but a contraindication is present:
  - coma
  - B/P < 100 mmHg
  - known hypersensitivity/allergy to meds used
  - age < 13

- Need to weigh the risks versus the benefits of spending extra time in the field to administer medications and perform this invasive procedure
Conscious Sedation Meds

♦ Lidocaine
  – 1.5 mg/kg IVP bolus (no drip) to suppress cough reflex in head injured/insulted patient (ie: trauma and stroke)
    • coughing increases intracranial pressures
    • can be given in presence of bradycardia because the bradycardia is due to brain irritation versus sick heart

♦ Morphine
  – given for relief of pain & reduce anxiety
  – 2 mg slow IVP for pain; repeat 2 mg every 3 minutes up to maximum of 10 mg
  – monitor for hypotension & resp depression
Conscious Sedation Medications

♦ Versed
- 2 mg slow IVP for sedation & amnesia
- repeat 2 mg every minute until sedated-max 10mg
- does not take away any pain sensations
- need to call medical control for more versed to maintain sedation if needed after intubation

♦ Benzocaine
- 1-2 short sprays using long red nozzle to spray back of throat
- suppresses the gag reflex
- gagging stimulates vagus nerve (bradycardia) & increases potential for vomiting
**In-line Intubation**

- Procedure performed to secure the airway if neck injury is suspected
- Best when accomplished with 2 persons
- One person secures manual control of head
- Intubator must position their body to be in-line with anatomical structures
  - crouching down and leaning backwards
  - lying on belly; sitting on buttocks works in the field
- ET tube position confirmed and secured in normal manner
In-line Intubation continued

♦ Confirming ET tube placement
  – direct visualization
  – 5 point auscultation (epigastric area, bilateral upper lobes, lateral chest area bilaterally)
  – chest rise and fall
  – ETCO₂ confirmation (yellow)
  – EDD if ETCO₂ not definitive

♦ ET tube position confirmed every time the patient is moved; document confirmation

♦ Securing ET tube
  – collar patient to minimize/prevent head movement which may move distal tip ET tube
Care of Soft Tissue Injuries

♦ Dislodged/knocked out tooth
  - gently rinse off gross contaminant with saliva or sterile saline
  - only handle tooth by the crown
  - do not allow tooth to dry out
    • transport tooth moist - best solution is in milk; can be covered with patient’s saliva or sterile saline gauze
    • milk is used only if it were readily available at the scene
  - tooth can be replaced into socket facing the correct way if airway will not be compromised
  - referral to dentist important (< 2 hours)
Soft Tissue Injuries

- Open neck wounds
  - risk of airway compromise due to injury and swelling
  - risk of blood loss because area is vascular
  - risk of air embolism into open blood vessel
  - wounds must be immediately covered with occlusive dressing
  - observe for changes in voice due to swelling and any dyspnea
  - stabilize impaled objects in place
**Pearls and Pitfalls of Head & Neck Injuries**

- Any injury above the level of the clavicles is considered to have a spinal injury until proven otherwise.

- Additional associated injuries to watch for:
  - Airway compromise
    - open airway using jaw thrust maneuver
    - intubation via in-line technique
  - Brain injury
    - address hypoxia
  - Dental trauma or avulsion - airway compromise
Distractions

- Evidence of alcohol (ETOH) on board
  - Can make it difficult to determine true cause of altered level of consciousness
  - Patient will often be uncooperative
  - EMS and ED will be challenged to do the right thing and protect the patient from harming himself further
    - will most likely need longer manual control of c-spine than usual
  - Remember to check blood sugar levels
Helmets

♦ Purpose of helmet
  – protect head
  – protect brain
  – cervical spine remains vulnerable

♦ Types of helmets
  – Full face or open face
    • motorcycle, bicycle, roller blade
  – Sports helmet
    • football, motor-cross
Helmets

- Helmet removal controversy: Scene vs hospital
  - Priorities for rapid/early removal
    - Airway management
    - Difficult spinal immobilization
  - Determining factors for immediate removal
    - Helmet prevents airway care needed immediately
    - Presence of airway or breathing problems
    - Helmet does not immobilize head within
    - Inability to immobilize the helmet to long board
    - Helmet prevents assessment of anticipated injuries
    - Helmet removal will not compromise patient status
Helmets

Other considerations

- Ready access of athletic trainer
  - Need for special equipment to remove face piece
- Presence of garb such as shoulder pads
  - May compromise the cervical spine if only helmet removed - additional space under head will need to be padded to avoid neck extension
- Firm fit of helmet may provide firm support for head
Helmets

- Cervical spine immobilization must be done whether or not a helmet is present
- When helmet removal occurs
  - Often can wait until ED arrival
  - Requires sufficient help - may stay to help in ED
  - Training in specific technique necessary for efficient removal
  - Requires sufficient padding to accommodate bulk of shoulder pads
Helmet Removal

- Takes a minimum of 2 people
- Cut away or remove as much additional pieces as possible (strap, face mask, visor)
- One person slides hands under helmet to support occiput and immobilize head
- Second person spreads helmet laterally to clear ears, then rotates helmet to clear chin, occiput, nose, and brow
- First person needs to be sliding hands to constantly be supporting occiput as helmet is removed
Abbreviated Radio Report

- In situations where manpower is limited and the patient’s condition is critical, EMS should provide to the ED:
  - provider’s name, vehicle ID, and include name of receiving hospital you are talking to
  - nature of situation & protocol you are following
  - age, sex, chief complaint; brief history of present illness/injury
  - airway & vascular access status
  - current vital signs
  - major interventions completed or attempted
  - ETA
GCS Review - You Score The Pt

- Patient responds to their name being called
  - ✓ eye opening to voice - 3 points
- Patient asks repetitively “what happened”
  - ✓ verbal response confused - 4 points
- Patient obeys commands
  - ✓ motor response - 6 points
- Total GCS - 13

- Needs to be watched for change in level of consciousness & worsening condition
**GCS Review - You Score The Pt**

- Patient must be shook to respond to EMS; flutters eyelids when touched
  - √ eye opening is “to pain” - __2__ points

- Patient muttering words but not appropriate to the situation
  - √ verbal response is inappropriate - __3__ points

- Patient is trying to pull off cervical collar and rip off blood pressure cuff
  - √ motor response is to purposeful movement; patient knows what is bothering them - __5__ points

Total __10__ points
**GCS Review - You Score The Pt**

- Patients eyelids flutter when they are given a sternal rub
  - \( \sqrt{\text{eye opening is to pain}} \) - 2 points
- Patient mutters & moans when stimulated
  - \( \sqrt{\text{verbal response is incomprehensible}} \) - 2 pts
- Patient pulls away when arm is touched to start an IV or take a B/P
  - \( \sqrt{\text{motor response is withdrawal}} \) - 4 points
- Total GCS is 8 points
- Need to consider airway protection-intubation
Documentation

♦ Any patient with an altered level of consciousness must have a documented blood glucose level

♦ Assess for and document a GCS (EMS does GCS on all patients)
  – guideline reminder on back side of run report

♦ Neurological assessment includes:
  – level of consciousness (blood sugar if altered)
  – GCS
  – pupillary response
  – movement & sensory - right compared to left and upper compared to lower extremities