Lecture Objectives:

1. Compare and contrast injuries associated with blunt and penetrating trauma.
2. Discuss mechanism of injury, pathophysiology, assessment findings, medical management, and nursing management of traumatic injuries to the following sites: head, spinal cord, heart, lungs, abdomen, genitourinary tract, and pelvis.
3. Describe the assessment and assessment findings that would indicate complications from blunt or penetrating injuries. Prepare a plan of care for patients developing complications.

Terms:

Golden Hour - 1 hr from injury to definitive care
ICP - normally maintained below 15 mm. Hg. Rapid changes (such as an epidural hematoma) in mass result in increases in ICP more than chronic changes, such as a tumor.
CPP - cerebral perfusion pressure - see p. 313 for formula. NOTE: must be 80 mm. Hg. to provide adequate blood supply to the brain; 30 or less results in hypoxia and cell death.
CSF = 10% of intracranial contents.
CHI - closed head injury
TBI - traumatic brain injury
EDH - epidural hematoma - usually the middle cerebral artery
SDH - subdural hematoma - venous - between the dura and the arachnoid mater
ICH - intracerebral hematoma - cerebral tissue
DAI - diffuse axonal injury
GCS - Glasgow Coma Scale
decerebrate posturing - extension, internal rotation of upper extremities with wrist flexion; and extension, internal rotation and plantar flexion of the lower extremities. Clenched jaw and hyperextension of neck. Symmetrical.
decorticate posturing - abnormal flexor posturing. Bilateral adduction of the shoulders, pronation and flexion of the elbows and wrists and extension, internal rotation, and plantar flexion of the lower extremities.
SCI - spinal cord injuries
DPL - diagnostic peritoneal lavage
LECTURE

I. Introduction - trauma is the leading cause of death for those under 44 years of age.

II. Mechanisms of injury - mechanical, electrical, thermal, chemical, liquid.

III. Affects - neuro, tissues and internal organs, bones, and skin.

IV. Definitions
   A. Blunt trauma - injuries received due to rapid changes in velocity, either an increase or a decrease. Important note: MPH of vehicle in which the victim is traveling matters. Force is calculated by multiplying the MPH x the victim’s weight. A 220 lb. person in a vehicle going 40 MPH will sustain 8800 lbs. of force within milliseconds. A 220 lb. person in a vehicle going 70 MPH sustains 15,400 lbs. of force. E. G.: A head strokes the windshield; the brain continues to fly forward.
   B. Penetrating injury - injuries resulting from firearms, knives or other impaling objects. The outside appearance of the wound does not always indicate the extent of the internal injuries. The nature of the impaling object, its velocity, and the location of the injury affect the total damage incurred. E. G.: Penetrating injuries resulting from bullets include ricochet effects.

V. Phases of trauma care
   A. Prehospital resuscitation - goal is stabilization and transportation.
      1. Airway maintenance
      2. Control of external bleeding and shock
      3. Immobilization of the patient
      4. Immediate transport to closest appropriate medical facility
         a. Heart
         b. Neuro!!!!
         c. Ortho
         d. ER on diversion
   B. Emergency Department Resuscitation
      1. Emergency room assessment - more info on p. 421, Urden.
         a. Airway maintenance with cervical spine protection
         b. Breathing (ventilation) - remove foreign objects if necessary. May need intubation or cricothyrotomy.
         d. Disability - neuro status - check level of consciousness
         e. Exposure/environmental control - are they covered with chemicals
      2. Shock - hypovolemia is MOST common cause
         a. Identify it and treat it rapidly. Pressure, Pressure, PRESSURE.
         b. May need 2 large-bore (at least 16 ga.) IV catheters or a central catheter.
            (1) draw blood samples when IV started!
            (2) Ringer’s lactate solution, rapid flow
(3) may need fluid warmers

c. Blood
(1) type specific preferred
(2) O- in an emergency - physician must order it and sign as this being an emergency
(3) autotransfusion - collected; filtered; reinfused.
d. Urinary catheter
(1) output important. Looking for rehydration and renal damage. (both trauma and acute tubular necrosis).
(2) gastric catheter - (NG tube like a Salem sump tube) - keeps patient from vomiting and aspirating.
e. Goal of treatment
(1) improved vital signs
(2) correction of pO2 and acidosis
(3) increased hemoglobin and hematocrit
(4) adequate urinary output

3. Secondary survey
a. Review ABCs
b. History - head to get if head injury, shock, drugs or alcohol intake. Use other sources, to include ambulance drivers and police and anyone else. See Box 25-1, p. 422, Urden.
c. Complete ordered procedures, such as ECG or X-ray.
d. Explain what’s happening to patient and family and provide emotional support.

4. Definitive care/operative care - trauma pts. frequently have to go to OR.

5. Critical care - may go to critical care directly from ED or may go there from OR.
a. Ensure adequate oxygen. - pulse ox
b. Monitor physiologic response to medical and nursing interventions
(1) vital signs
(2) LOC

VI. Traumatic brain injury
A. Etiology
  1. Penetrating injuries
  2. Blunt injuries
B. Pathophysiology
  1. Primary injury
  2. Secondary injury
C. Skull fracture
  1. Open
  2. Closed
  3. Basilar skull fracture symptoms
a. CSF leaking from ear (otorrhea)
b. CSF leaking from nose (rhinorrhea)
c. Battle’s sign
d. Raccoon eyes

D. Concussion - brain injury that results in brief loss of neurologic function, especially loss of consciousness.
1. Symptoms
2. Treatment

E. Contusion - usually related to acceleration-deceleration injuries
1. Coup injury
2. Contrecoup injury
3. Symptoms
4. Temporal lobe - Carefully watch LOC, pupils, and VS.
5. Diagnosis - CT scan.
6. Secondary injury is common.

F. Hematomas
1. Epidural - usually the middle meningeal artery.
   a. Symptoms
   b. Treatment - surgery
2. Subdural
3. Intracerebral

G. Missile injuries - depressed, penetrating, perforating (goes all the way through).

H. Diffuse axonal injury -.
1. Mild -
2. Moderate -
3. Severe -

I. Assessment -
1. Level of consciousness
2. Motor and sensory function

J. Degree of Injury
1. Mild injury
2. Moderate injury
3. Severe injury

K. Diagnostic procedures - CT and EEG

L. Surgical management
M. Nonsurgical management

N. Nursing management
1. Stabilizing vital signs
2. Preventing further injury
3. Reducing increased ICP and maintaining adequate CPP.
4. NOTE: assess, assess, assess!!! to prevent secondary brain injury from cerebral edema and increased ICP. Also, monitor oxygen requirements, fluid and electrolyte imbalances, hemodynamic stability, nutrition, and family support and education.

VII. Spinal cord injuries
A. Mechanism of injury
1. Hyperflexion
2. Hyperextension
3. Rotation
4. Axial loading (vertical compression) -
5. Penetrating injuries

B. Pathophysiology

C. Functional injury
1. Complete
   a. Quadriplegia SEE Table 24-2.
   b. Paraplegia
2. Incomplete

D. Spinal shock

E. Autonomic dysreflexia - IMMEDIATE intervention needed to prevent cerebral hemorrhage, seizures, and ACUTE PULMONARY edema. Treatment - alleviate noxious stimuli.

F. Assessment - ABCs with neurologic status assessment.
1. Spinal cord precautions - is mandatory. Bedrest with log-rolling and a hard cervical collar until definitive stabilization is achieved.
2. Airway - oral airway or endotracheal intubation.
4. Circulation - alterations in cardiac output and tissue perfusion can occur - dysrhythmias, cardiac arrest, orthostatic hypotension, emboli, and thrombophlebitis.
5. Neurologic status - initial assessment is not indicative of permanent function. Ongoing assessments must be documented in ICU.

G. Diagnostic procedures
1. Anteroposterior and lateral views of spinal cord. Especially all seven cervical plus T1.
2. CT, tomograms, myelography, and MRI.
H. Medical management
1. Pharmacologic
2. Surgical management
   a. For spinal column stability. Fusion and rodding.
   b. Decompression - laminectomy
3. Nonsurgical management
   a. Cervical injury - Skeletal Tx with 2 point tongs. (Gardner-Wells and Crutchfield). Bedside procedure. Then place pt. on kinetic therapy bed. After realignment has occurred, the pt. can be placed in a halo traction brace, which allows the pt. to ambulate.
   b. Thoracolumbar injury - skeletal Tx, bed rest, plastic or fiberglass jacket, a body cast, or a brace.

I. Nursing management - prevent life-threatening complications!
1. Prevent secondary damage to spinal cord
2. Manage cardiovascular and resp complications
3. Coach pt. to overcome psychosocial challenges associated with severe neurologic deficit.
4. Also, optimize nutrition, elimination, skin integrity, and mobility.

VIII. Thoracic injuries
A. Mechanism of injury
   1. Blunt trauma “It’s not the fall that hurts; it’s the stop.”
   2. Penetrating injury
B. Chest wall injuries
   1. Rib fractures
      a. Associated injuries include injuries to the brachial plexus and great vessels (for ribs 1 and 2); injuries to liver and spleen for ribs 7 - 10.
      b. Pain on respiration - results in shallow breaths, refusal to cough, atelectasis and pneumonia.
   2. Flail chest
      a. Decreased tidal volume, impaired cough, hypoventilation - leading to atelectasis and lung collapse.
      b. Punctures of lungs with pneumothorax or hemothorax and cardiac injury may result.
   3. Ruptured diaphragm
C. Pulmonary injuries
   1. Pulmonary contusion - The inflammation affects alveolar-capillary units, compliance decreases, pulmonary vascular resistance increases, and pulmonary blood flow decreases, resulting in ventilation/perfusion (V/Q) imbalance, causing hypoxemia and poor ventilation. Usually begins resolving after about 48 hrs, but sometimes ARDs seen.
   2. Tension pneumothorax -
      a. Usually, chest wall and pleural space are both perforated; air flows
into pleural space with inspiration and becomes trapped; lung on injured side collapses; mediastinum is pushed to opposite side. Pressure is exerted on heart and thoracic aorta, venous return decreases, cardiac output decreases, oxygenation decreases.

b. Manifestations - dyspnea, tachycardia, hypotension, sudden chest pain. Tracheal deviation (a late sign) may be seen. Also, decreased or absent breath sounds and hyperresonant sound on injured side.

c. Diagnosis - assessment and X-ray (if there’s time).

d. Treatment - large bore needle or chest tube.

3. Open pneumothorax - “sucking chest wound” - open communication between the atmosphere and intrathoracic pressure results in immediate lung deflation. Air moves in and out. Sucking sound on inspiration. SQ emphysema may be palpated around the wound.

a. Sx - see above

b. Treatment - close wound (at end of expiration) with sterile occlusive dressing such as plastic wrap or petroleum gauze. Tape securely only on 3 sides. Chest tube is inserted as soon as possible.

4. Hemothorax - bleeding into the pleural space. Can be as much as 1500 ml in the chest cavity. Bleeding may come from intercostal or internal mammary arteries, lungs, heart OR great vessels.

a. Symptoms - decreased breath sounds and dullness to chest percussion. Hypotension, hypovolemic shock, low CO, and tissue ischemia.

b. Treatment - IV resuscitation and a chest tube.

5. Nursing management

a. Oxygenation - may need intubation and mechanical ventilation. Suctioning!! Get pulse ox readings and ABGs.

b. Ventilation

c. Pain management - IV fluids and ANALGESIA

D. Cardiac injuries

1. Penetrating cardiac injuries - most common site is right ventricle because of its anterior position, BUT bullets aren’t very particular. Mortality is high! Death is due to exsanguination or cardiac tamponade.

2. Cardiac tamponade - the accumulation of blood in the pericardial sac compresses the atria and ventricles and increases INTRA cardiac pressures. Venous return decreases, CO decreases, cardiogenic shock develops.

a. Manifestations:
   (1) Beck’s triad: (1) elevated central venous pressure (CVP) with neck vein distention; (2) muffled heart tones and (3) hypotension.
   (2) pulsus paradoxus
(3) pulseless electrical activity (PEA)

3. Blunt cardiac injuries (myocardial contusion)
a. Sudden deceleration
b. Sudden acceleration
c. Contusion, concussion, rupture.
d. Usually the right atrium and ventricle (anterior in chest).

4. Nursing management - recognize, prevent and treat cardiac complications.
a. Monitor ECG
b. Replace magnesium, K.
c. Administer antidysrhythmics.
d. Investigate and treat chest pain.
e. Monitor for heart failure!!! Utilize hemodynamic monitoring and assess for tissue perfusion.

E. Abdominal injuries
1. Blunt trauma - likely to be HIDDEN and therefore fatal.
a. Hepatic injury
b. Spleen
c. Pediatrists - everywhere
d. Thoracic injuries
e. Spinal cord injury
f. Deceleration and direct force.

2. Penetrating trauma - caused most often by knives or bullets. Outside appearance DOES NOT indicate degree of internal injury. Knives usually hit liver, spleen, diaphragm or colon. Bullets enter and ricochet. Death depends on injury to major vessels and resultant hemorrhage.

3. Assessment -
a. Physical
   (1) inspect for signs of trauma
      (a) document entry and exit sites
      (b) note purplish discoloration of flanks (Turner’s signs) or umbilicus (Cullen’s sign)
      (c) distention may indicate accumulation of blood, fluid, or gas secondary to perforated organ or ruptured blood vessel.
   (2) auscultate for bowel sounds
      (a) friction rubs over liver or spleen may indicate rupture
      (b) absent bowel signs occur in severe injury
   (3) percuss to detect intraabdominal fluid or air
      (a) dullness on lower sides of abdomen suggest internal
bleeding
(b) tympanic response suggests “free air”

(4) palpate for signs of tenderness or distention
(a) rebound tenderness and rigidity indicate peritoneal inflammation.
(b) pain referred to the left should (Kehr’s sign) may signal ruptured spleen or irritation of diaphragm from bile or other material
(c) subq emphysema on abdomen suggests free air as result of ruptured bowel.

b. Diagnostic procedures

4. Liver injuries - primary organ injured in penetrating trauma and the second most often injured organ in blunt trauma. Can cause life-threatening hemorrhage.
   a. Diagnosis
   b. Treatment

5. Spleen

6. Intestinal injuries - Watch for sepsis, abscess or fistula.

F. Genitourinary injuries
1. Assessment -
   a. inspection of the pelvic and perianal area
      (1) for blood at urethral meatus
      (2) bluish discoloration of flanks
      (3) perineal discoloration (pelvic fracture and possible bladder or urethral injury
      (4) c/o flank or colic pain
      (5) rebound tenderness
   b. testing the urine for hematuria - most common finding!!!

2. Renal trauma - suspected when flank ecchymosis seen and fx of inferior ribs or spinous processes present. Hematuria may be seen. Postop complications: infection, hemorrhage, infarction, extravasation, calcification, ATN and hypertension.

3. Bladder trauma
   a. Sx.
   b. Rx

4. Nursing management
   a. monitoring blood volume
   b. Monitoring electrolyte balance
   c. Monitoring patency of drains and tubes - gentle irrigation may be required

G. Pelvic fractures - can cause long term disability, can cause death! Results from MVCs, crushing accidents, falls from > 12 feet.
1. Assessment
   a. Inspection of pelvic and perianal area
      (1) ecchymosis of scrotum or vulva
      (2) pain on palpation or “rocking” of iliac crests
      (3) lower limb paresis or hyperesthesia
      (4) hematuria
      (5) shortening of a lower limb
   b. Assessment of neurovascular status of lower extremities
   c. Surveillance for complications of pelvic trauma
      (1) fat embolism
      (2) DVT
   d. Dx - AP pelvic X-ray
2. Classification
3. Medical management -
   a. Prevent or control hemorrhage
   b. Bedrest
   c. Orthopedic stabilization, including internal or external fixation devices
4. Nursing management
   a. Achieving adequate tissue perfusion
      (1) IVs - crystalloid, colloid, blood transfusions
      (2) ck pulse ox
      (3) serial Hgb, Hct
   b. Preventing further pelvic injury
   c. Ensuring adequate pain management - more required in unstable
   d. Preventing infection for pts with external fixation devices
IX. Complications of trauma
A. Nursing management to prevent complications
   1. Preventing infection
   2. Recognizing early signs of respiratory failure - ARDS, fat embolism, deep vein thrombosis
   3. Relieving pain - PCAs with safeguards
   4. Providing nutrition - trauma causes hypermetabolism. Enteral nutrition recommended.
   5. Preventing renal failure - monitor BUN and Cr. Patients with crush injuries must be observed especially closely. Myoglobin con block the renal tubules. Urine will be dark-red or burgundy and output will decrease.
   6. Evaluating risk for compartment syndrome - increased pressure in limited space results in ischemia and necrosis. Symptoms include swelling, tightness, paresis, pain. Treatment may include loosening dressing or splint, or may require fasciotomy.
   7. Discovering a missed injury - may see unexpected drainage, hypotension,
falling Hct, edema where not expected, complaint of pain.

8. Assessing risk of systemic complications
   a. Systemic inflammatory response syndrome
   b. Multiple organ dysfunction syndrome