Care of the Orthopedic Trauma Patient

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Jackson HEALTH SYSTEM
Care of the Orthopedic Trauma Patient

- Objectives
  - Identify the common mechanisms of orthopedic trauma
  - Describe assessment of orthopedic trauma patient
  - Describe treatment and nursing interventions associated with orthopedic trauma injuries
Risk factors

- According to the Centers for Disease Control (CDC), Trauma is the 5th most common cause of death in the United States
- Trauma is leading cause of death for ages 15-24, because of their participation in high risk activities
- Males suffer more injuries than females, but women are more likely to be victims of fatal domestic violence
- In the elderly, death and injuries are higher from falls and often aggravated by medical co-morbidities. The elderly may suffer greater physical injuries from lesser traumatic events than younger adults
- The potential and severity of musculoskeletal injury is increased by alcohol and drugs
Risk factors

- Unintentional injury rates are higher in low income areas and more fatal to Native Americans than other races.
- African Americans have the highest homicide rate.
- Intentional injuries, such as homicides, are higher in urban settings while unintentional injuries such as falls can occur in either environment.
- In rural settings, the mortality rates from farming accidents, such as machinery injuries, and motor vehicle accidents may be higher in urban areas because of the time it takes to be transported to the nearest trauma center.
Mechanisms of injury

• Awareness of mechanism of injury will help to identify the pattern of injury the patient is likely to have suffered
• What helps predict the extent and severity of the injury?
• Type of injury
• Speed with which it occurred
• Location in the body
Classification of injury

A. Blunt Trauma

Blunt trauma - caused by combination of forces such as
1. Compression
2. Deceleration
3. Acceleration
4. Shearing
5. Crushing

Blunt trauma results in multiple life threatening injuries with diagnoses that are complex and less obvious than injuries from penetrating trauma.

Age of patient must be considered as children experience different pattern of injury than adults because of their size.
Classification of injury

A. Blunt trauma – Types:

1. Compression
   - Most common type of blunt trauma
   - Skeletal injury often results from compression forces
   - Injury depends upon
     a. Length of time of the compression
     b. Force of the compression
     c. The areas and tissue compressed

2. Shearing - involves twisting and tearing of tissue which occurs when structure slip relative to one another
Classification of Injury

A. Blunt trauma — Types: (con’t)

3. Motor vehicle crash
   • Acceleration / Deceleration – involves 3 different impacts
     – The vehicle strikes an object
     – The occupant collides with the inside of the vehicle
     – The occupant’s internal organs collide with the rigid structure of the body

4. Fall – often results in skeletal injuries or fracture
   • Height, position upon impact, and cause of the fall determine the impact of the trauma
Acceleration / Deceleration

Fall

http://www.centralphysicaltherapy.com/Auto-Accident/Whiplash/a~5633/article.html

http://www.legaljuice.com/ladder.jpg
Classification of Injury

B. Penetrating trauma

1. Occurs through the introduction of a foreign object into the body

2. The severity of the wound is defined by the amount of tissue damage

Trauma.org

Traumatic Orthopedic Injuries

C. Strains — excessive stretching or tearing of a tendon or muscle caused by indirect force
   – may occur as a result of a fall, heavy lifting, exercise, or inappropriate use of body mechanics

Classified as:

- Mild (first degree) - inflamed muscle from mild stretching
- Moderate (second degree) – partial tearing of the muscle/tendon
- Severe (third degree) – severe muscle/tendon stretching in which the involved tissue ruptured, tore completely, or pulled away from the bone
Traumatic Orthopedic Injuries

Therapeutic intervention for strain:

RICE

1. Rest – reduced activity is key to treatment
   - may include use of sling, crutches, immobilizers, splints
   - immobilization decreases pain, reduces inflammation and allows torn muscle ends to approximate

2. Ice (cryotherapy)
   - application of ice decreases bleeding from injured blood vessels, more blood that collects in the wound, the longer it takes for the injury to heal
   - use 30 minutes on and 15 minutes off up to 72 hours after injury
   - provides analgesic effect
3. Compression
   - application of compression limits the swelling which could delay healing
   - blood and fluid from surrounding tissue leak into damaged area and distend the tissue
   - ACE bandage most common type of compression device used and should be applied after application of ice
   - apply enough to compress and promote venous return but not compromise venous return

4. Elevation
   - place injured part at or above the heart level so that gravity drains off excess fluid
   - decreased edema facilitates pain relief and allows injured areas to move freely
   - elevation contraindicated in the presence of arterial deficiency
Traumatic Orthopedic Injuries

Therapeutic intervention for strain:

- RICE
- Pharmacological intervention which may include anti-inflammatory medication and muscle relaxant
- Surgical intervention of muscle or tendon for third degree
Traumatic Orthopedic Injuries

D. Sprain — Involves excessive stretching or tearing of a ligament that may occur from a fall or twisting motion during a sporting activity

Classified as:

- Mild (first degree) — involves torn ligaments without joint impairments
- Moderate (second degree) — involves additional ligament fibers with maintenance of joint stability
- Severe (third degree) — ligament injury results in joint instability, complete ligament tear
Traumatic Orthopedic Injuries

D. Sprain

Therapeutic Intervention

– RICE
– Second and third degree requires immobilization with compression bandages, immobilizers, braces, splints or casts for up to 6 weeks or until healing occurs
– Analgesics as needed
– Surgical intervention to restore joint stability
Traumatic Orthopedic Injuries

E. Dislocation

– Joint injuries in which bones ends are forced from their normal position as a result of trauma (falls, MVA, sports injuries)
– Upper extremity dislocations are commonly due to a direct blow or to an indirectly applied force resulting from a fall on the outstretched arm or hand
– Knee dislocations are usually caused by a severe twisting or blow to the knee, most common is motor vehicle crash
– In the hip, posterior dislocation is most common; force along the shaft of the femur when the hip is flexed and adducted
– Surrounding nerves may be involved resulting in a loss of feeling or inability to move
Traumatic Orthopedic Injuries

E. Dislocation

Treatment is based on the extent of the injury and can range from:

1. Gently maneuvering the bones back into position (reduction)
2. Joint immobilization for several weeks with a sling, splint or traction
3. Surgical intervention – open reduction with internal fixation
Traumatic Orthopedic Injuries

F. Stress Fractures

– As muscles become too fatigued to absorb additional shock from an increased amount of intensity of activities, the stress load is transferred to the bone resulting in a small crack
– Type of overuse of repetitive use injury commonly seen in people of all ages who participates in sports such as running, tennis, track and field, gymnastics, and basketball
– Repetitive impact on hard playing surfaces or use of improper footwear or equipment are contributing factors
Traumatic Orthopedic Injuries

F. Stress Fractures

- Treatment includes resting from the activity responsible for the fracture for 6-8 weeks to allow for healing
  - Early resumption of causative activities may result in re-injury and led to chronic problems
  - Prevention can be achieved by gradually increasing activity when participating in a new sport, cross-training to accomplish fitness goals, maintaining a healthy diet, and proper equipment
G. Fractures

- Occurs as a result of excessive external force applied to the body
- Results from a direct blow, a fall from a height, a motor vehicle accident, or from twisting, crushing, penetrating or compression forces
- A fracture is a partial or complete structural break in bone continuity
Fracture Classification

Simple/ Closed fracture
- Normal
- Transverse
- Oblique
- Spiral
- Comminuted

Compound/ Open fracture
- Segmental
- Avulsed
- Impacted
- Torus
- Greenstick

http://www.mfmec.com/Education_pics/Types-of-Bone-Fractures.gif
Traumatic Orthopedic Injuries

Compound / Open fracture

- Grade I
  - Skin is punctured
  - Minimal soft tissue injury and contamination
  - Intact vascular status

- Grade II
  - Accompanied by skin injury and contamination
  - Moderate wound contamination.
  - Comminuted bone fragments

- Grade III
  - Extensive soft tissue damage involving skin, muscle, blood vessels and nerves
  - Usually associated with massive contamination
  - Highly comminuted or segmental fracture
Treatments

- The primary goals of fracture management are:
  
  1. Prevent complication while restoring optimum mechanical function.
  2. Reduction which will approximate fragment bone ends, restore original length and maintain neurovascular function
Treatments

1. Immobilization
   – Includes casts, slings, straps, tape or surgical rods, plates screw, wires and pins

2. Closed Reduction
   – The re-alignment of fractured bone ends into anatomical position by manual manipulation or traction without surgical intervention.

3. Open reduction
   – The re-alignment of fractured bone ends into anatomical position by surgical intervention

4. Internal / External Fixation
   – Immobilization of fracture site during surgery with pins, wires, screws, rods, nails, or other types of hardware applied during surgical procedures
Pelvic Fracture

- Represents 3% of all fractures in the US
- Males sustains more high energy pelvis fractures such as MVA
- Women sustain more low-energy pelvis fracture such as falls
- Often accompanied by other injuries including abdominal, thoracic, soft tissue, genitourinary, and head injury
Pelvic Fracture

- Common mechanism of injury
  - MVA, particularly side impact crashes
  - Person hit by motor vehicle
  - Motorcycle accidents
  - Falls
  - Crush injury
Pelvic Fracture Classification

- Classified according to mechanism of injury and displacement or anatomical location

- According to mechanism of injury
  - Open book fracture – distraction of two sides of the pelvis anteriorly at the symphysis pubis
  - Lateral compression fracture – two sides of the pelvis are driven into each other, anteriorly and posteriorly
  - Vertical shear fracture – two sides of the pelvis are driven in opposite directions, up/down or forward/backward
Pelvic Fracture Classification

• According to anatomical location

1. Avulsion fracture – separation of a small fragment of bone
2. Acetabular fracture
3. Stable fracture – single break in the pelvic ring
4. Unstable fracture - double break in the pelvic ring
5. Saddle fracture – bilateral ischial and pubic rami
6. Malgaigne fracture – any combination of one anterior and one posterior fracture of joint disruption
Assessment

- Establish relevant history and mechanism of injury
- Assess for presence of hypovolemia and hemorrhage
  - Priority is to prevent and control bleeding and hemorrhage
  - 90% of blood loss can occur from venous bleeding
- Initial exam includes abdomen, pelvis, back, perineum, and upper legs to assess for:
  - Laceration
  - Abrasion
  - Open fracture wounds
  - Swelling
  - Bruising
  - Location of pain
Assessment

- Presence of hematuria
- Possibility of pregnancy
- Severe back pain
  - May indicate hemorrhage into the retroperitoneal space
- Rectal digital exam
  - Evaluate presence of blood in rectal vault, assess rectal wall and prostate gland and determine sensation and tone in rectum
- Vaginal exam
  - Rule out possibility of open fracture and check if vaginal wall is intact
- Inspection of pelvis to assess for rotation of iliac crest
- Neurovascular assessment of lower extremities to determine presence of circulation, sensation, strength, and deep tendon reflex
Radiologic Assessment

- Anteroposterior pelvic X-ray
- CT Scan
- Chest x-ray if indicated (as part of trauma workup)
- Laboratory test appropriate to trauma
Pelvic Fracture Stabilization

• Early stabilization reduces risks of long-term pain and reduced mobility that often follows traumatic pelvis fracture

• Goal: manage hemorrhage and reduce long-term effects of pelvic ring fracture
Pelvic Fracture Stabilization

- **Stable fracture**
  - Pelvic sling
  - Traction

- **Unstable fracture**
  - External fixation
    - Application of a simple frame with 2-3 pins in each iliac crest
    - Usually used in “open book” fracture
  - Internal fixation
    - Follow in 48-72 hours once patient is hemodynamically stable
    - Provides more stable fracture reduction and helps with early mobilization
Spinal fractures

- More common in adults because in children, the spine is more mobile, and the force is dissipated more easily and over a great number of segments.
- Compression fractures are most common in the midlumbar region and are usually stable.
- Facet dislocations are one of the most common cervical spine injuries, and are often associated with motor vehicle accidents, or falls from heights and usually occurs at C5 – C6 or C-6 –C7.
Spinal fractures

- Mechanism of injury
  - Traumatic origin
    - Diving accidents
    - Motor vehicle crashes
    - Falls or blows to the top of the head
    - Falls in a sitting position such as race car drivers and pilots who use an ejection seats
    - Children under 2 years of age: child abuse
Spinal fractures

• Assessment
  – Mechanism of injury, look for associated visceral injuries, bruising, and lacerations of head
  – Progression of symptoms such as sensation of extremities, motion of extremities and level of consciousness
  – Presence of pain
  – Respiratory function – important for cervical fractures
  – Presence of bowel, bladder function – for lumbar fractures
Therapeutic Modalities for spinal fractures

- **Nonsurgical treatments**
  - **Cervical**
    - Halo apparatus, cranial tongs, rigid cervical collar/brace, cast
  - **Thoracic**
    - Body cast, thoracolumbosacral orthosis (TLSO) until fracture is healed
    - Bed rest, avoid sitting
  - **Lumbar**
    - Bed rest until comfortable, lumbar corset/brace

- **Surgical treatment (unstable fractures): ORIF**
  - Decompression fusion
  - Spinal instrumentation
Bullet Injury

- Gunshot wounds have caused over 30,000 fatal injuries and approximately 100,000 non-fatal injuries
- Can result in damage to soft tissue, major organs, bony tissue with fracture and damage to blood vessels
Bullet Injury

• Categorized according to velocity
  – Low velocity wounds
    • May include laceration and crushing of tissue
    • Entry wound smaller than exit wound
    • Bullet may not travel all the way through the body and may be retained
  – High velocity wounds
    • Causes laceration and crushing of tissue and damage to other structures along the trajectory path
    • Bullets often pass completely through the body leaving entry and exit wounds
    • The trajectory cavity will contain bacteria and debris sucked in at the point of entrance, resulting in greater damage to tissue along the missile tract
Blast Injury

- Results when explosive is detonated
- Blast injuries to the extremities are most commonly seen in the military
- The effect of the blast injury is related to how close the person is to the explosion, and whether the explosion is inside or outside
- Explosions in confined spaces (buildings, vehicles, mines) are associated with greater morbidity and mortality
Blast Injury

• Types of injuries from a blast:
  – Traumatic amputation of a limb
  – Concussion
  – Gross wound contamination
  – Compartment syndrome
  – Crush syndrome
    • Rhabdomyolysis
    • Acute renal failure
  – Severe burns
  – Ear and Eye injury
Blast Injury

- Phases of Blast injury:
  - Primary blast – injury from over-pressurization force (blast wave) impacting the body surface causing tympanic membrane rupture, pulmonary damage, air embolism, hollow organ damage
  - Secondary blast – injury from projectiles (bomb fragments, flying debris causing penetrating trauma, fragmentation injuries, and blunt trauma)
  - Tertiary blast – injuries from displacement of victim by the blast wind or structural collapse and entrapment causing blunt/penetrating trauma, fractures, and traumatic amputations
  - Quarternary blast – all other injuries from blast causing crush injuries, smoke inhalation from burns, asphyxia, toxic exposures, exacerbations of chronic illness
Penetrating Injury

- Foreign object is forced through the dermis and into underlying tissues, crushing and tearing the structures
- Usually result in tissue contamination with high risk of infection

Causes:
- Bullet from firearm
- Flying debris from a blast
- Stab wounds caused by knives, sharp objects
- Impalement on objects
Crush injury

- Involves compression of upper or lower extremities or any part of the body that causes fracture, hemorrhage, edema of muscle tissue, and neurologic compromise.

- Potentially life-threatening and causes systemic complications including ischemia of the muscle tissue followed by necrosis. Sudden release of the crushed body part results in reperfusion syndrome and release of myoglobin into the circulation. Myoglobin obstructs the renal tubules resulting in acute renal failure.
Crush injury

- Body involvement

  - Lower extremity 74% many are due to motor vehicle accidents, either driver, passenger, or pedestrians
  - Upper extremity 10% many are due to catching the hand or arm in machinery
  - Trunk 9%
Crush injury

- http://drugline.org/img/ail/390_393_1.JPG
Amputation

- In the US, approximately 1.7 million live with limb loss
- May be done electively by surgical removal or traumatically as a result of an accident
- Males higher risk than females
- Need for amputation is precipitated by vascular disease, trauma, cancer, and congenital anomalies
Amputation

- Traumatic amputation is the 2nd leading cause
  - 68% involving upper extremities
  - 32% involving lower extremities
- Traumatic amputation often result from accidents with tools such as lawn mowers, snow blowers, and power tools such as saw
- Blast injuries from improvised explosive devices used in roadside bombs and suicide bombing account for approximately 70% of the injuries seen in Iraq
- Crush injuries often results in blood vessel and nerve damage and leads to amputation as a way to preserve function in the residual limb
Amputation

http://openi.nlm.nih.gov/imgs/rescaled512/1501113_jobw04e3_fig1.png

http://www.trauma.org/images/image_library/11291826816AMPUTMAN02.JPG
Complications associated with orthopedic trauma and surgeries

- Hemorrhage—can be related to the nature of the injury or musculoskeletal condition, the specific surgical procedure or postoperative complication

- Venous thromboembolic event such as deep vein thrombosis and pulmonary embolism are the most common life-threatening complications associated with major orthopedic trauma and surgery
Complications associated with orthopedic trauma and surgeries

- Fat embolism syndrome is mechanical blockage of blood vessels by circulating fat particles occurring mostly following fractures of long bones and incidence increases with multiple fractures.

- Compartment syndrome occurs when swelling of the muscle inside the compartment in the upper and lower extremities occurs resulting in compression of nerves and blood vessels. Significant swelling can cause muscle ischemia.
Complications associated with orthopedic trauma and surgeries

- Postoperative nausea and vomiting — common complication after anesthesia and surgery. It occurs in the first 24 hours after surgery, with the highest incidence during the first 2 hours.

- Postoperative urinary retention — occurs as a direct result of the type anesthetic, advanced age, total amount fluid replacement over a 24 hour postoperative period, the type and amount of analgesics, and history of postoperative urinary problems.
Complications associated with orthopedic trauma and surgeries

- Hospital acquired pneumonia occurs 48 or more hours after hospital admission. It requires early recognition and adequate and timely antimicrobial therapy to reduce mortality.

- Surgical site infection – the incidence of infection varies according to the site and extent of injury and, the specific surgical procedure, and the general health of the patient.
Nursing Consideration in Care of Trauma Patient

• Emergency room
  – Stabilization of patient’s condition
    • Airway – assess airway for ineffective airway clearance and airway obstruction
    • Breathing – assess ineffective breathing patterns and impaired gas exchange
    • Circulation – assess decreased cardiac output, impaired tissue perfusion and decreased fluid levels
    • Disability – assess level of consciousness and neurologic status
    • Exposure – assess all body surfaces for injury and protect from hypothermia
  – Preparation for operative fixation of fractures
  – Wound debridement and exploration, and repair of other injuries
Nursing Consideration in Care of Trauma Patient

- Postoperative care
  - Assessment for bleeding and hemodynamic stability
  - Neurovascular assessment
  - Neurologic assessment
  - Pain assessment and management
  - Management of external fixation, wounds, and dressings and drains, and other equipment and devices
  - Prevention of complications associated with orthopedic trauma and surgery
References