Overview Musculoskeletal System

Purpose:
- support
- protection
- locomotion
- performance of tasks
- production blood cells/storage of ions/endocrine regulation

Consist of
- bone
- skeletal muscle
- ligaments and tendons
- cartilage

Bone
- Composed of organic matrix that consists of collagen fibers embedded in a cementing gel made up of calcium and phosphate
- Constantly undergoing remodeling according to mechanical stresses
- Long bones are composed of cortical (compact) bone that surrounds a medullary cavity of cancellous (spongy) bone
- Cortical bone is for support and cancellous for hematopoiesis and bone formation
- Osteoclasts reabsorb bone and osteoblasts lay new bone
- Growth plate: for a period of time layer of cartilage that exists between diaphysis (shaft of long bone) and epiphysis (end of long bone)

Muscle
- An organ in which it’s contraction produces movement, stability, communication, control of opening and closing passages, and heat production
- Skeletal, cardiac and smooth
- Muscular system contains 600 muscles (not including smooth or cardiac)

Ligaments
- Attach bone to bone
- Short band of tough, flexible, fibrous connective tissue
Tendons
- Attach muscle to bone
- Fibrous connective tissue

Cartilage
- Type of connective tissue with great resilience
- Firm connective tissue that is softer and more flexible than bone
- Has no blood supply so grows and repairs slowly

Bursa
- Viscous fluid filled sac
- Provides cushion between bones and tendons or muscles around a joint
- Reduces friction

Joints
- Basic functional unit
- The union of two or more bones
  - immovable: fixed, example sutures of the skull
  - moveable: bones in contact with each other, covered with hyaline articular cartilage, capsule surrounds the joint, and contains synovial fluid for lubrication and nourishment of the cartilage
    - Hinge joint
    - Pivot joint
    - Condyloid joint
    - Saddle joint
    - Ball and socket joint
    - Plane joint

Sprains, Strains

Stability depends on
- Shape of the articular surfaces
- Ligaments
- Associated muscles
Strains
- Involves the muscle-tendon unit
- Stretching or partial tear of a muscle
- A complete tear is referred to as a rupture

Sprain
- Involves the supporting structures of a joint
- Stretching or tearing of a ligament or joint capsule

Fractures
- Disruption in the continuity of the bone
- Three stages of healing
  - **Inflammatory** - vascular event in which hematoma develops
    - building block of healing
    - loss of blood supply along fracture lines
    - bone absorption
    - new bone laid
  - **Reparative** - new vessels form to supply nutrients to fracture site
    - immobilization to allow these vessels to develop
  - **Remodeling** - completely ossified/ bone undergoes remodeling

Potential Blood Loss
- tibia/ fibula: 500-1000 cc
- Femur: 1000 cc
- pelvis: 1500- 3000 cc
- humerus: 250-750 cc
- radius/ ulnar: 150- 500 cc
Nursing Process
- assess
- diagnosis
- outcome identification and planning
- implementation
- evaluation

Assess: The History
- medical history/ comorbidities/ prior insult to the area
- medications
- prior to the event/ mechanism of injury/ events immediately after
- S/S: pain, disability, associated s/s
- initiating and alleviating factors
- specifics related to corrections: assault, secondary gain, avoidance
- red flags

Red Flags- Universal
- Fever
- Chills
- Night sweats
- Unintentional weight loss

Red Flags Specific to M/S Injuries
- Compromised circulation
- Loss of movement
- Gross deformity/ instability
- Break in the skin over the site of injury
- Loss of all sensation
- Compartment syndrome
- Events prior to the injury suggestive of systemic etiology

Assess: The Physical Exam
- VS
- inspection
- palpation
- percussion
- auscultation

Inspection
- general appearance
- state of nutrition
- habitus
- symmetry
- posture/ gait/ splinting
- presence of alteration of skin integrity
Palpation
- start distal and move central
- compare affected and unaffected side
- joint above and below
- circulation/ sensation
- soft tissue/ bone
- active then passive ROM

Percussion and Auscultation
- Rarely needed

Diagnosis
- interpret and analyze the data
- identify patient strengths and health problems
- nursing diagnosis
- detect and refer S/S that are beyond your experience or scope

Outcome identification and Planning
- Design plan of care that once implemented results in the prevention, reduction or resolution of the problem
- Establish priorities
- Expected patient outcomes
- Evidence based nursing intervention
- Communicate the plan of care

Implementation
- Goals
  - Promote healing
  - Monitor for complications
  - Return to optimal level
  - Prevention
- Nursing Protocols
  - clear treatment guidance
  - documentation
  - monitoring, reassessing or referring
Protocol Treatments

- PRICE (RR)
  - Protect/ positioning
  - Rest
  - Ice/ heat
  - Compression
  - Elevate
  - Restrictions/ Refer
- Pain control
  - NSAID
  - APAP

Canes, Walkers and Crutches

- Canes
  - Held on contralateral side
  - Optimal fitting is 20-30 degrees elbow flexion with the tip of the cane placed 6” in front of and 6” lateral to the little toe
  - 4 prong increases base of support
  - Spade handle easier on the hand than standard crook
- Walker
  - Provide greatest support, can be used for balance or to transmit load
  - Position hand grip at 30 degree flexion of the elbow in neutral standing position

- Crutches
  - More support than a cane but less than a walker
  - Require proper fit to prevent arterial or venous thrombosis or brachial plexus compression
  - With patient erect top of crutches 2” below ampits and hand pieces even with the hips allowing 20-30 degree flexion of the elbow
  - Recommended gait pattern is advance both crutches, lift the body and advance to line of crutches

ROM and Rehab

- Goal is to maintain function of the area
- Starts at the time of injury and is stepwise
- Examples: alphabet, Pendulum, muscle memory

Evaluation

- measure how well patient has achieved outcomes
- identify factors contributing to success or failure
- modify plan of care

Common Injuries Head to Toe
Head
- Fracture

- Orbital Fracture

Upper Extremities
- Jaw
- Sprain
- Impingement

Shoulder Joint - Structure
- The acromion is the top part of your shoulder.
- The clavicle (collarbone) is the bony link that holds the shoulder to the body.
- The humeral head is the rounded top (ball) of your arm bone.
- The capsule is a pocket that provides stability.
- The bursa is a lubricating sac.
Dislocation

Causes and Types of Shoulder Joint Dislocation

- Posterior Dislocation
- Anterior Dislocation
- Inferior Dislocation

Bicep Tear

- Ruptured biceps tendon
- Characteristic bulge

Elbow Fracture

- Fracture

Elbow Tendonitis

- Medial (inside) Epicondyle
- Lateral (outside) Epicondyle
- Flexor Pronator Muscles
- Wrist Extensor Muscles

Forearm

- Forearm Fracture
- Wrist Fracture

Rotator Cuff

- Rotator cuff
- Wrist sprain, strain, overuse
  
  **Grade I**
  - Ligaments stretched or slightly torn

  **Grade II**
  - Ligaments partially torn

  **Grade III**
  - Ligaments completely torn

- Carpal Tunnel
  - Median Nerve
  - Transverse carpal ligament

- Hand and finger fracture
  - Scaphoid Fractures
  - Lunate Fracture or Necrosis
  - Triquetrum Fracture
  - Colles’ Fracture

- Finger Dislocation
  - Boudonniere Deformity
  - PIP Joint in Flexion
  - DIP Joint in Hyperextension

- Lower Extremities
Hip Sprain

Hip Dislocation

Hip Fracture

Femur Fracture

Knee

- Strain/ sprain
- effusion
- Bursitis
- Derangement
- Patellar femoral pain syndrome
- Patellar rupture
- Baker cyst

Knee Effusion
Bursitis

Bursae in the Knee

- suprapatellar bursa
- infrapatellar bursa
- patellar tendon

- prepatellar bursa
- sartorius tendon
- gracilis tendon
- semitendinosus tendon
- pes anserine bursa
- shin bone

Derangement

- Patella (reflected)
- Patellofemoral groove
- Patellar ligament
d-cruciate ligament
- Posterior cruciate ligament
- Lateral meniscus
- Medial meniscus
- Tibial collateral ligament
- Tibial plateau
- Tibia

Patellar rupture

- Femur
- Patella
- Tibia
- Rupture
- Patella tendon

Ottawa Knee Rules

- Age 55 years or older
- Tenderness at head of fibula
- Isolated tenderness of patella
- Inability to flex to 90°
- Inability to bear weight both immediately and in the emergency department (4 steps)
1C/2C: Strains, Sprains, and Breaks ... Oh My!

**Ottawa Ankle Rules for Foot and Ankle Radiographic Series in Patients with Acute Ankle Injury**

- An ankle radiographic series is required only if patient has pain in malleolar zone and any one of the following findings:
- A foot radiographic series is required only if patient has pain in midfoot zone and any one of the following findings:
- Bone tenderness at the posterior edge or tip of the lateral malleolus
- Bone tenderness at the base of the fifth metatarsal
- Bone tenderness at the posterior edge or tip of the medial malleolus
- Bone tenderness at the navicular
- Inability to bear weight both immediately and in emergency department
- Inability to bear weight both immediately and in emergency department
Conclusion

- TAKE A DEEP BREATH!
- Don’t focus on just the site of injury
- Look for the universal and musculoskeletal red flags
- Assess and reassess
- Encourage graduated rehab
- Prevention

References

**Orientation/extension of fracture line**

- **Transverse**: A fracture that is perpendicular to the shaft of the bone.
- **Comminated**: A fracture in which there is more than two fracture fragments.
- **Oblique**: An angulated fracture line.
- **Segmental**: A type of comminuted fracture in which a completely separate segment of bone is bordered by fracture lines.
- **Spiral**: A multiplanar and complex fracture line.
- **Intra-articular**: The fracture line crosses the articular cartilage and enters the joint.
- **Torus**: An incomplete buckle fracture of one cortex, often seen in children.
- **Greenstick**: An incomplete fracture with angular deformity, seen in children.
- **Impaction**: A fracture that occurs when one bone hits or “impacts” an adjacent bone.
- **Compression**: A type of impaction fracture that occurs in the vertebrae, resulting in depression of the end plates.
- **Depression**: A type of impaction fracture that occurs in the knee when the femoral condyle strikes the softer tibial plateau.
- **Stress (fatigue)**: A fracture in normal bone that has been subjected to repeated or cyclical loads that in and of themselves are not sufficient to cause a fracture.
- **Stress (insufficiency)**: A fracture in weakened bone that has been subjected to a load insufficient to fracture normal bone.
- **Pathologic**: A fracture through bone weakened by tumor, metabolic bone disease, or osteoporosis.