

MEDAVIE

HealthEd

ÉduSanté



MUSCULOSKELETAL ILLNESS AND INJURY

Advanced Care Paramedicine

Module: 08

Section: 04

Musculoskeletal Illness and Injury

MUSCLE

- Second in frequency only to soft-tissue trauma
- Usually result from significant direct or transmitted blunt kinetic forces
- Painful and debilitating but rarely threaten life

- Optimal way to reduce musculoskeletal injuries
 - Application of modern vehicle and highway designs
 - Workplace safety standards
 - Protective sports equipment
 - Good safety practices and public education

- Can occur due to:
 - Overexertion where fibers are broken
 - With trauma muscles can be bruised, crushed, cut, or even torn even without a break in the skin.
- Injured muscles tend to be:
 - Swollen, tender and painful, weak

- Muscle fatigue
- Muscle cramp
- Muscle spasm
- Muscle strain

- Muscle fatigue
 - Occurs as muscle reach limits of performance
 - Cell environment becomes hypoxic
 - Strength diminishes, further exertion becomes painful
- Muscle cramp
 - Muscle consume oxygen and energy sources
 - Circulation cannot clear metabolic wastes
 - Irritation, muscle contraction (spasm)

- Muscle spasm
 - Affected muscle goes into contraction
 - Clonic: intermittent
 - Tonic: constant
 - Usually subsides with restoration of circulation



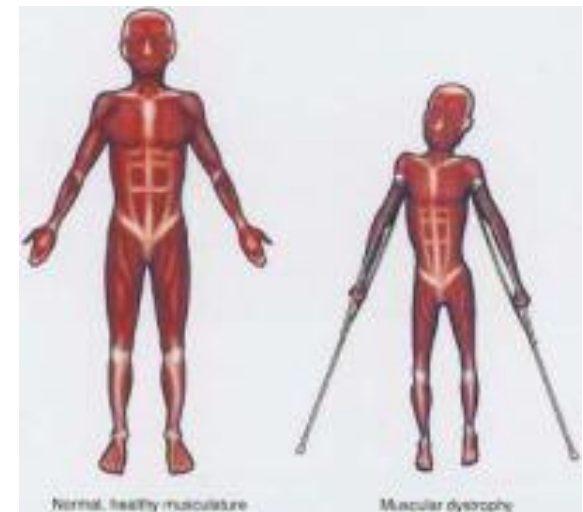


- Strain
 - Muscle overstretched by forces stronger than muscle
 - Muscles stretch
 - Ligaments may stretch or tear
 - Pain that increases with use

- Diseases of muscles connected to bones
- Inherited genetically – MD
- Also by
 - Endocrine disorders
 - Inflammatory disorders (polymyositis)
 - Metabolic disorders

- Myopathies
 - Dystrophies
 - Myotonia
 - Congenital
 - Inflammatory
 - Metabolic
 - Polymyositis
 - Chronic inflammation of many muscles
 - Rhabdomyolysis
 - Damaged skeletal muscle tissue breaks down rapidly
 - Myoglobin released into the bloodstream, are harmful to the kidneys and may lead to kidney failure

- Symmetrical weakening and atrophy of the muscles
- No change in sensation
- Duchenne's is most common, affects children and adolescents, and has short life span



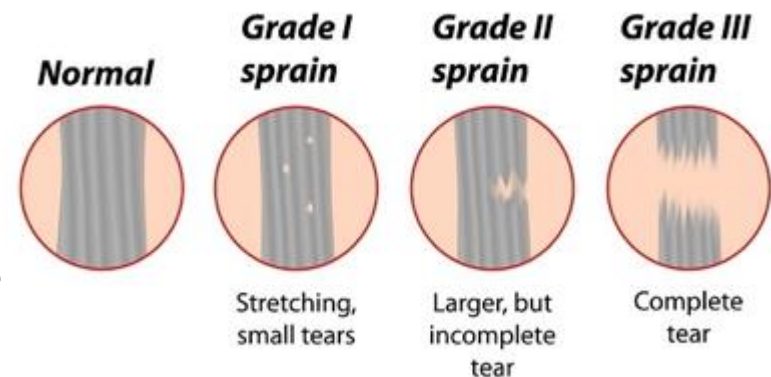
- Myotonic MD affects young adults and lasts twenty years +
- MD's are hereditary
- Slow but steady deterioration

Musculoskeletal Illness and Injury

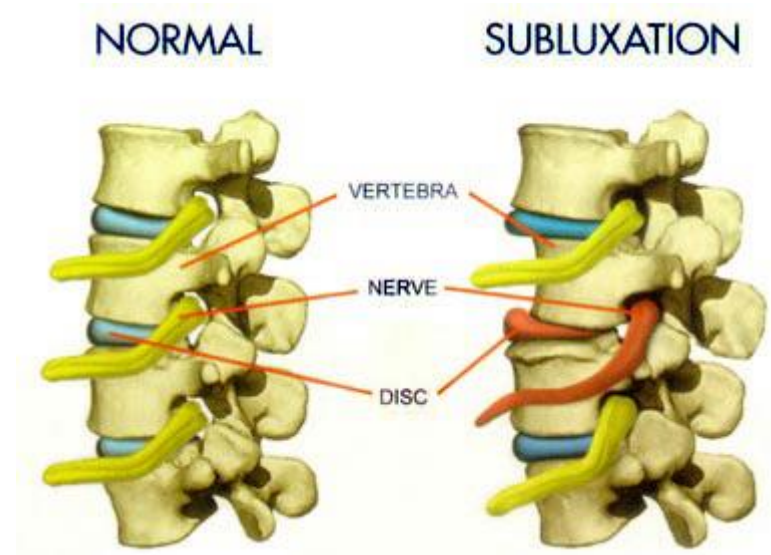
SKELETAL

- Sprain
- Subluxation
- Dislocation

- Tearing of a joint capsule's connective tissue
 - Grade I
 - Minor and incomplete tear of muscle fibers
 - Mild painful but minimal swelling
 - Joint stable
 - Grade II
 - Partial tear
 - Moderate to severe pain and swelling
 - Joint intact but unstable
 - Grade III
 - Complete tear
 - Severe pain and spasm
 - Loss of function/Joint unstable



- Partial displacement of a bone end from its position within a joint capsule
- Significantly reduces joint's integrity
- Caused by:
 - Hyperflexion
 - Hyperextension
 - Rotation beyond normal
 - Extreme forces



- Complete displacement of a bone end from its normal joint position
- Danger of entrapping, compressing or tearing blood vessels
- Caused when joint moves beyond its normal range of motion
 - Usually with great force



a. Presentation of a knee dislocation

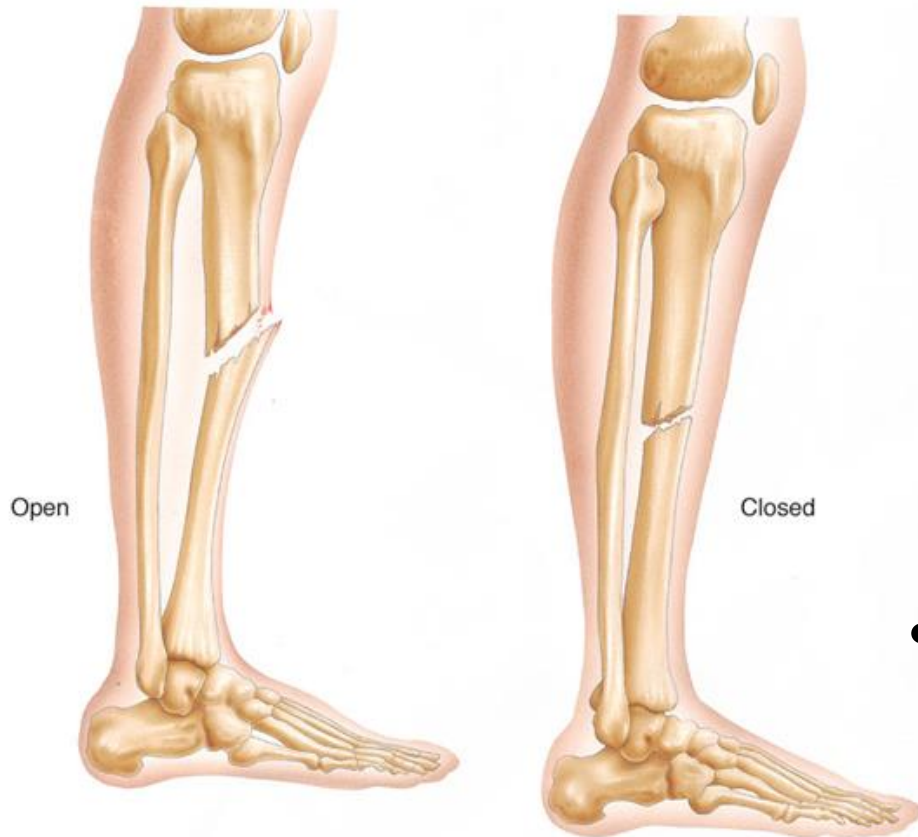


b. X-ray of the dislocation

FIGURE 22-1 Knee dislocation.

- Fracture
 - An involved fracture that ultimately interrupts the continuity of bone
- May be by direct or indirect
- Complications:
 - Nerve damage
 - Vascular damage
 - Associated injuries to muscles, tendons, ligaments, etc

- Open fracture
- Closed fracture
- Hairline fracture
- Impacted fracture
- Transverse fracture
- Oblique fracture
- Comminuted
- Spiral fracture
- Fatigue fracture
- Greenstick fracture
- Epiphyseal fracture



- Open
 - Bone is displaced and moves through muscle, sub Q tissue and the skin
 - Bone does not have to be visible to be classified as open
- Closed
 - Bone is not displaced enough to cause disruption in the skin

- Hairline
 - Small crack in bone that does not disrupt integrity of the bone
- Fatigue
 - Associated with prolonged or repeated stress
 - Bone weakens and fractures without force



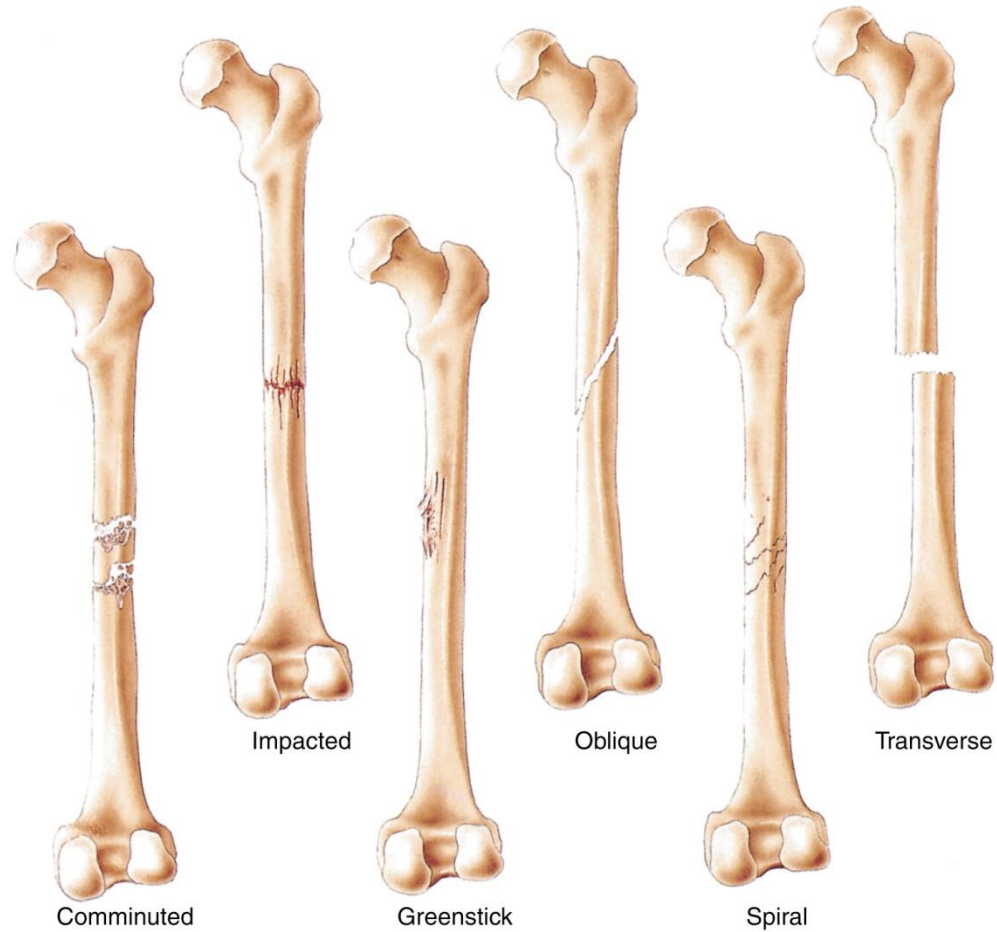
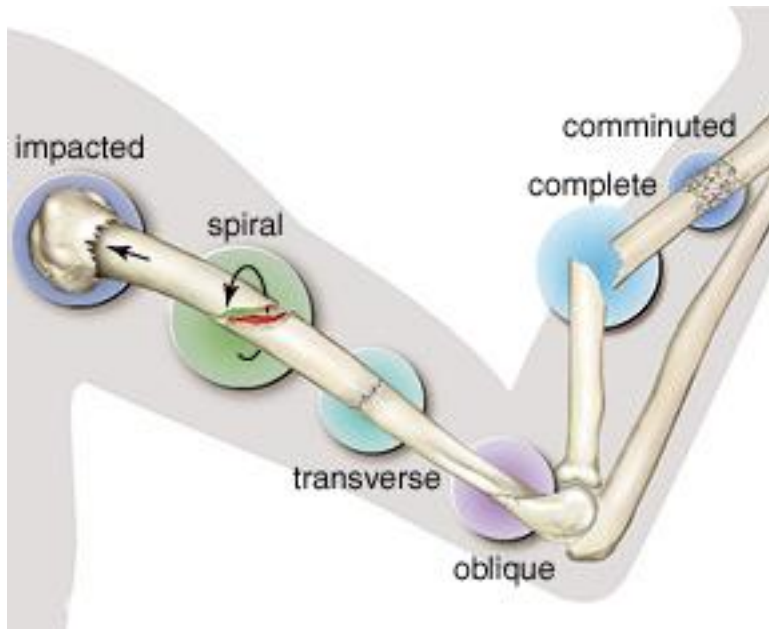
- Open vs closed



- Simple vs Comminuted



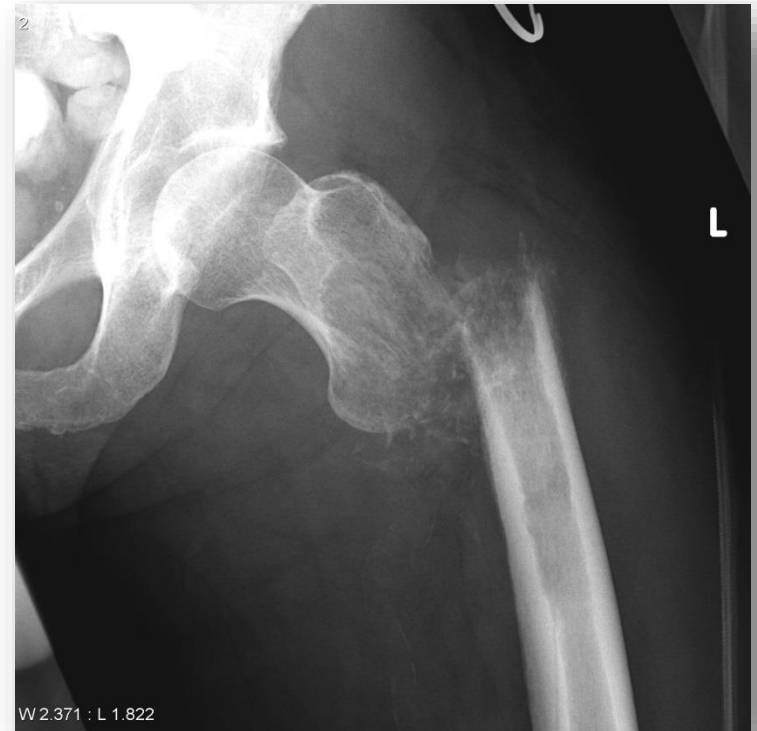
Types of Fractures



- Contain greater proportion of cartilage than adult bones
- Flexible nature of bone
 - Susceptible to greenstick fracture
- Bone grows from epiphyseal plate
 - More prone to epiphyseal fractures

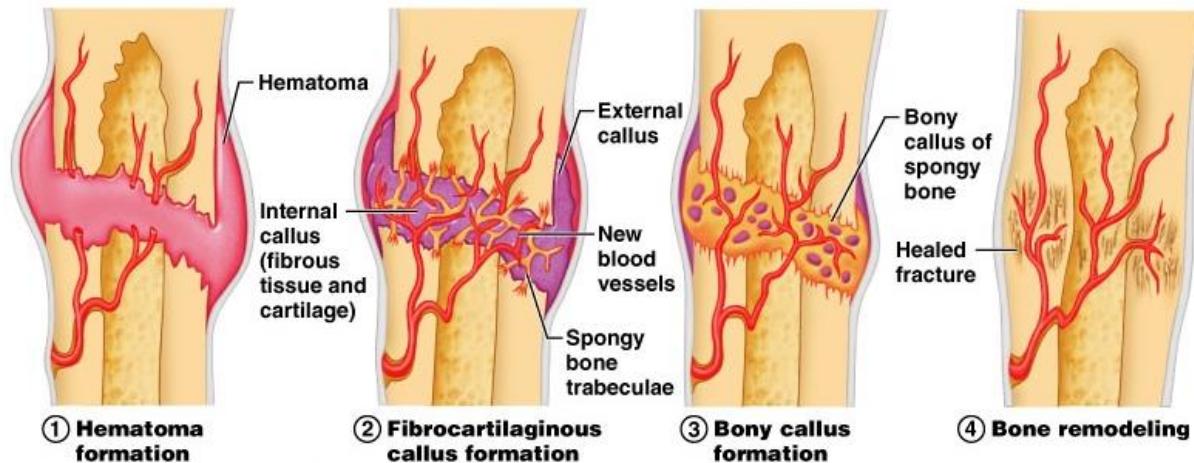
- Aging causes changes to musculoskeletal system
 - Gradual decrease in bone mass and collagen structure
 - More brittle bones that heal more slowly
- Osteoporosis
 - Accelerated degeneration of bone tissue due to loss of essential minerals
 - Becomes most serious after menopause

- Disease processes that affect bone development or maintenance
 - Tumours and other diseases
 - Radiation treatment
- Fracture not likely to heal well if at all

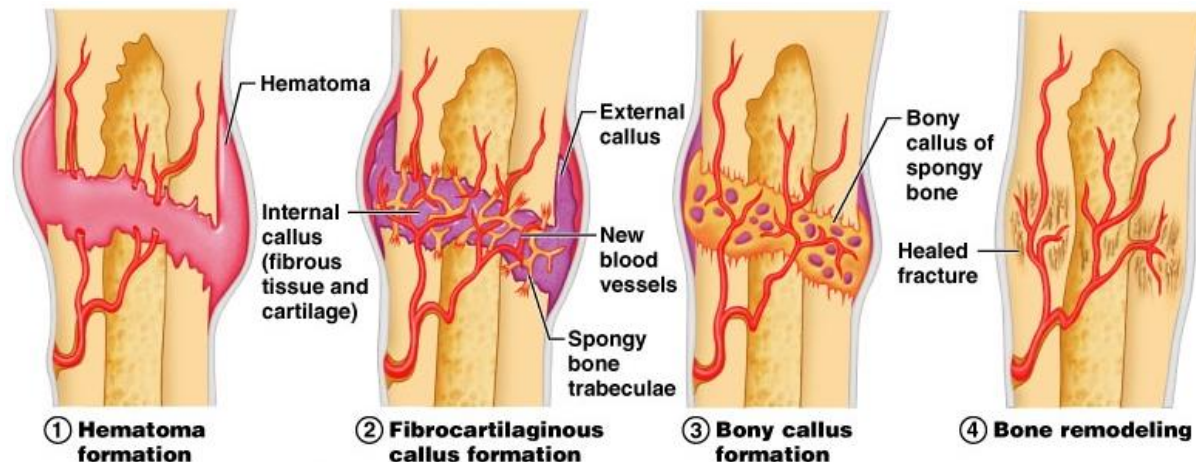


- Limited soft tissue surrounding joints
 - Compromised nerve and blood supply distal
- Blood vessels enter bone through diaphysis
 - Compromised blood supply to distal bone end
- Reduced stability
 - Damage to soft tissue, vascular and nerve involvement
- Muscle spasm
 - May cause bone ends to over-ride each other

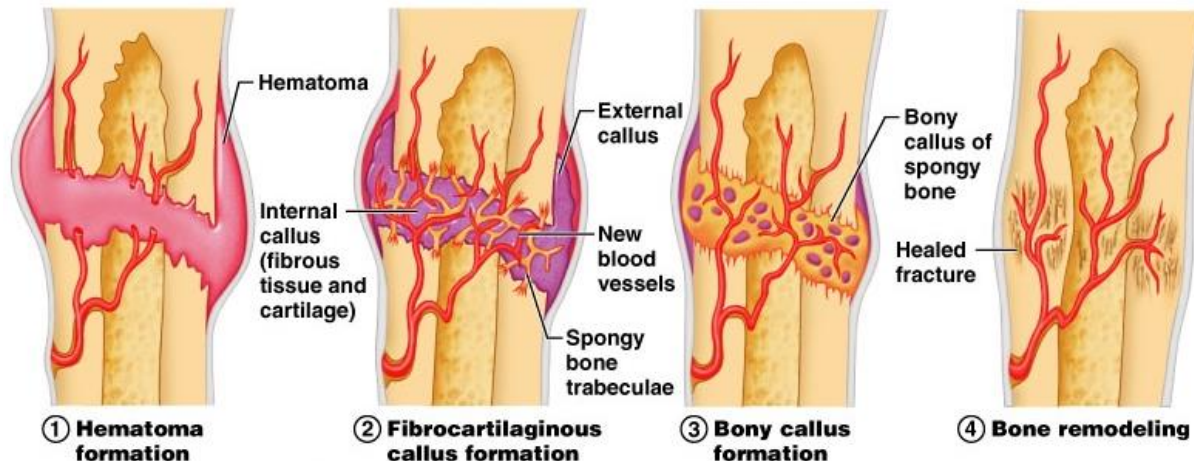
- Hemorrhagic clot
 - Fracture tears periosteum
 - Blood fills area and congeals



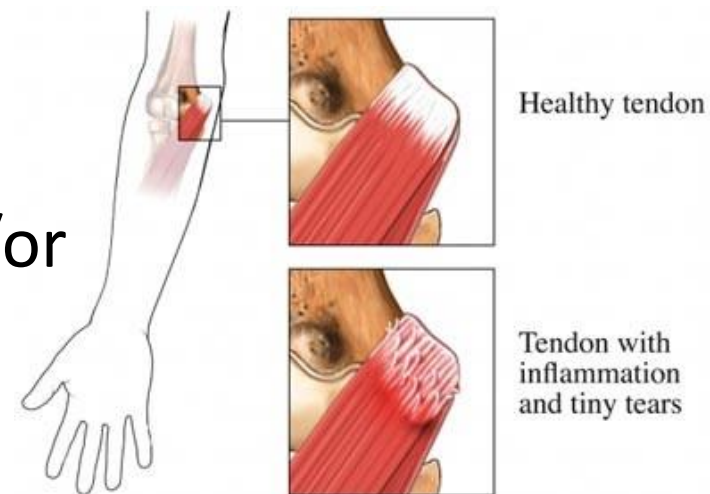
- Bony callus formation
 - Osteocytes from bone ends multiply and produce osteoblasts
 - Lay down salt crystals with collagen clot fibres
 - Two ends join and form knob of cancellous bone



- Remodelling
 - Continued deposition of salts/collage strengthens and stabilizes bone
 - Dissolved in low stress areas, added to high stress areas
 - Bone remodelled
 - If bone experiences interruption in healing, site may never return to normal

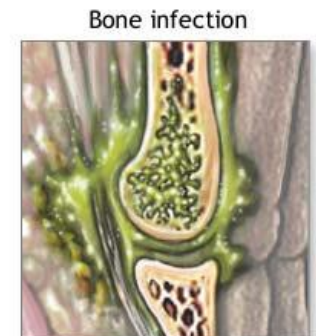


- Bursitis
 - Acute or chronic inflammation of the small synovial sacs
- Tendonitis
 - Accumulation of small tears in the tendon that have not healed properly over time
 - Inflammation of a tendon and/or the protective sheath



- Osteomyelitis
- Osteoarthritis
- Rheumatoid arthritis
- Gout

- Acute or chronic bone infection
- Usually caused by bacteria or fungus
 - Original site of infection is elsewhere in the body, and spreads to the bone by the blood



- Long bones usually in children
- Vertebrae, pelvis are most common in adults
- Pus is produced within the bone, which may result in an abscess
 - Then deprives the bone of its blood supply
- Chronic osteomyelitis results when bone tissue dies as a result of the lost blood supply
 - Chronic infection can persist intermittently for years

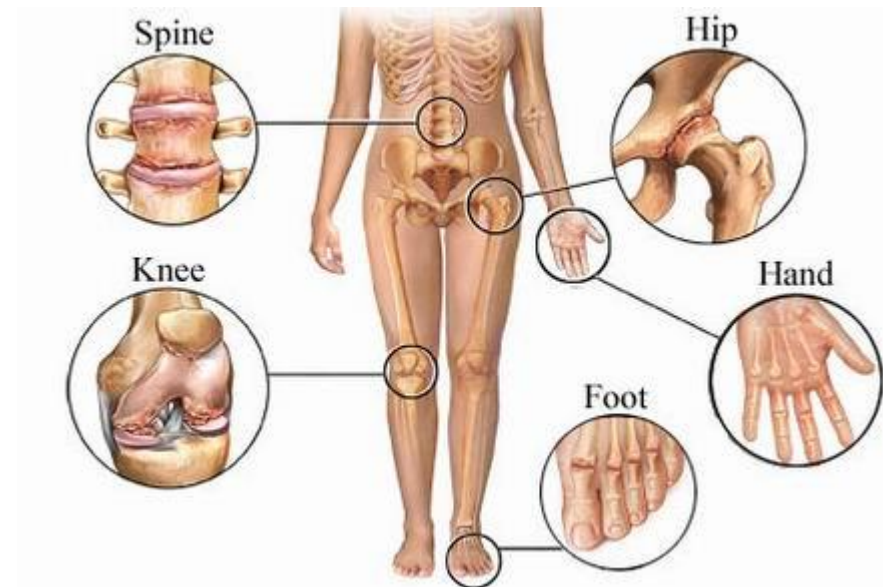
- Risk factors
 - Recent trauma
 - Diabetes
 - Hemodialysis
 - IV drug abuse
 - Splenectomy

- Signs and Symptoms
 - Pain in the bone
 - Local swelling, redness, and warmth
 - Fever
 - Nausea
 - Malaise
 - Drainage of pus through the skin (in chronic osteomyelitis)
- Additional symptoms
 - Excessive sweating
 - Chills
 - Low back pain
 - Swelling of the ankles, feet, and legs

- Treatment:
 - Eliminate the infection
 - Antibiotics
 - Surgery may be needed to remove dead bone tissue

- Osteoarthritis
 - Inflammation of a joint from wearing down of the articular cartilage
- Rheumatoid arthritis
 - Chronic disease that causes deterioration of the peripheral joint capsule
 - Extreme cases causes flexion contractures
- Gout
 - Inflammation in joints and connective tissue produced by accumulation of uric acid crystals

- A group of mechanical abnormalities involving degradation of joints
- A variety of causes
 - hereditary, developmental, metabolic, and mechanical
- Most common form
- Causes pain, swelling and reduced motion in your joints
- Can occur in any joint, but usually it affects your hands, knees, hips or spine
- Breaks down the cartilage in your joints



- Factors include
 - Being overweight
 - Getting older
 - Injuring a joint
- Therapies
 - Manage pain
 - Improve function
 - Exercise, weight control, rest, pain relief, alternative therapies and surgery

- Chronic systemic inflammatory disease that causes deterioration of the peripheral synovial joint capsules (may affect tissues and organs)
 - Inflammatory response of the capsule around the joints secondary to swelling (hyperplasia) of synovial cells, excess synovial fluid, and the development of fibrous tissue (pannus) in the synovium
 - Disease process often leads to the destruction of articular cartilage and ankylosis (fusion) of the joints
- Can also produce diffuse inflammation in the lungs, pleura, pericardium, sclera and also nodular lesions.
- Considered a systemic autoimmune disease
- Extreme cases causes flexion contractures

Osteoarthritis vs Rheumatoid Arthritis



- Inflammation in joints and connective tissue produced by accumulation of uric acid crystals
- Arises directly from elevated levels of uric acid within the blood
- Determined by the balance between the amount being produced and the amount being excreted
- Uric acid is produced when purines are broken down by enzymes in the liver
 - Generated via the breakdown of cells in normal cellular turnover
 - Ingested in purine-rich foods (e.g. seafood, beer)
- Most people with gout tend to be underexcretors

- Signs and Symptoms
 - Excruciating and sudden pain, swelling, redness, warmth and stiffness in the joint
 - Low-grade fever may also be present
 - Two sources of pain
 - Crystals inside the joint
 - Inflammation of the tissues around the joint
 - Gout usually attacks the big toe (approximately 75% of first attacks) however it can also affect other joints such as the ankle, heel, instep, knee, wrist, elbow, fingers, and spine



- Patients with longstanding hyperuricemia can have uric acid crystal deposits called tophi in other tissues
- Uric acid stones can form as one kind of kidney stone in some occasions



- Gout can also develop as co-morbidity of other diseases:
 - Polycythaemia
 - Leukemia
 - Intake of cytotoxics
 - Obesity
 - Diabetes
 - Hypertension
 - Renal disorders
 - Hemolytic anemia
 - Diuretics (particularly thiazide diuretics)

- Four distinct stages:
 - Asymptomatic
 - Plasma uric acid level increases, but there are no symptoms
 - Acute
 - Mild attacks usually go away quickly, whereas severe attacks can last days or even weeks
 - Intercritical
 - Symptom-free interval that may last months or even years
 - Chronic
 - Frequent and become polyarticular
 - Large tophi
 - Kidney damage or stones, HTN

Musculoskeletal Illness and Injury

ASSESSMENT AND TREATMENT

- Scene assessment
 - Look for indications of severity of trauma forces
 - Kinetic energy forces may also cause internal and spinal injuries
 - Don't let injuries be a distracter

- As you begin the assessment, examine the patient quickly for MSK injuries; but remember that they are not often life threatening.



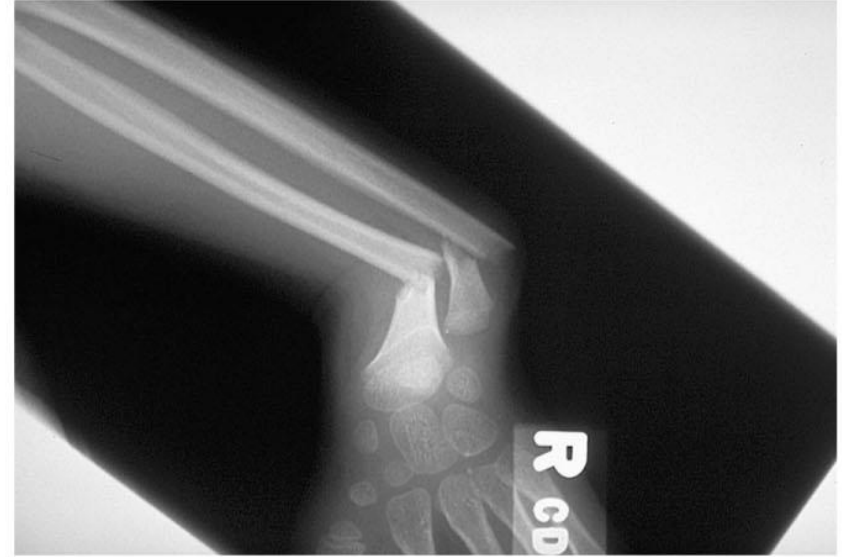
- Classification of patients with musculoskeletal injuries:
 - Life and limb threatening injuries
 - Life-threatening and minor musculoskeletal injuries
 - Non-life-threatening but serious limb threatening injuries
 - Non-life-threatening and only isolated minor musculoskeletal injuries

- 80% of patients with multi-system trauma have associated musculoskeletal trauma
- Look for specific fractures
 - Pelvis: up to 2 litres of blood loss
 - Femur: up to 1500 mL of blood loss

- Six Ps of evaluating a limb injury
 - Pain
 - Pallor
 - Paralysis
 - Paraesthesia
 - Pressure
 - Pulses



a. A fracture will often present with deformity.



b. An x-ray of the fracture.

FIGURE 22-5 Presentation of a forearm fracture.

- Palpation
 - Instability
 - Deformity
 - Crepitus
 - Muscle tone
 - Temperature
- Evaluate distal sensation, circulation and mobility



FIGURE 22-6 Evaluate the distal extremity for pulse, temperature, colour, sensation, and capillary refill.

- Feelings of tension within limb
- Loss of distal sensation
 - Especially in webs of fingers and toes
- Complaints of pain
- Condition more severe than mechanism of injury would indicate
- Pain on passive extension of extremity
- Pulse deficit (late sign)

- Protect open wounds
- Proper positioning
- Immobilize the injury
- Monitor neurovascular function

- Any open wound in close proximity to a fracture
 - Open fracture
- Cover with a sterile dressing
- Realignment/splinting may draw bone ends back into skin
 - Report to receiving physician

- When possible place injured limbs in position of function or a neutral position
 - Ensure patient comfort
 - Reduce chances of further injury
 - Encourage venous drainage
 - Stop realignment if there is any pain or resistance
- Do not attempt alignment of dislocations or serious injuries within 7 cm of a joint



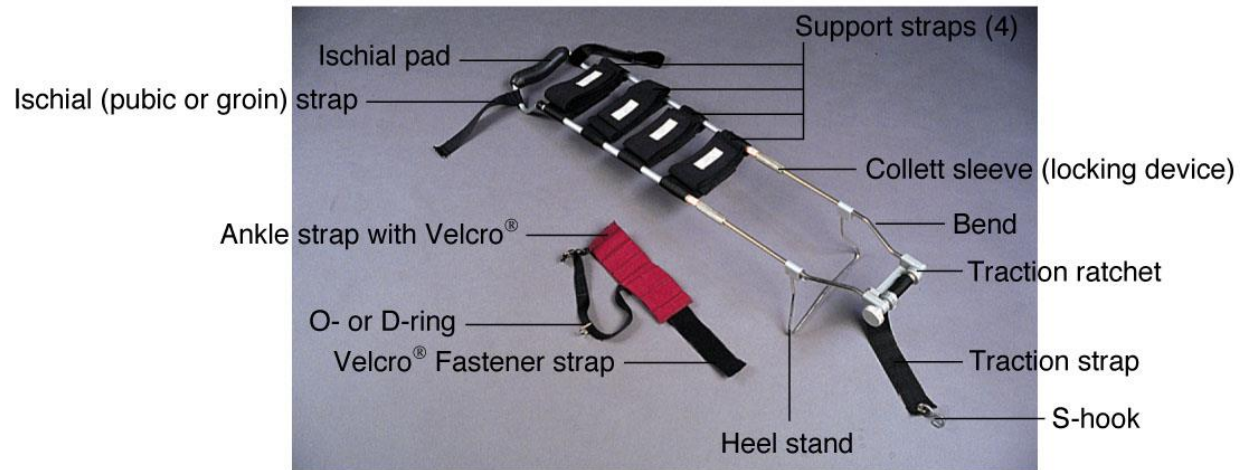
FIGURE 22-7 Gently position the limb in the position of function, unless your attempts meet with resistance or a significant increase in pain or the injury is within 7 cm of a joint.

- Prevents further injury
- Above the joint above and below joint below
- Wrap from distal to proximal
- Reassess distal properties before, during and after immobilization

- Rigid splints
- Formable Splints
- Soft Splints
- Traction Splints
- Other Splinting Aids
 - Vacuum Splints
 - Air Splints
 - Cravats or Velcro Splints

FIGURE 22-8 A variety of splints are available for musculoskeletal injuries.





a. A bipolar frame traction splint



b. A unipolar frame traction splint

FIGURE 22-9 Traction splints.

FIGURE 22-10 Suction the air out of a vacuum splint until the device is rigid. Reassess pulse, motor function, and sensation in the extremity after application.



- Assess neurovascular status
 - Correct compromise with traction/ realignment
- Use gentle traction to realign limb
 - Immobilize proximal limb and apply traction to distal
- Splint with appropriate device
- Secure limb
- Constant reassessment of distal neurovascular status

- Assess neurovascular status
 - If compromised, consider moving limb to re-establish it
 - Rapid transport
- Immobilize joint in position found
- Reduction
 - Return displaced bone to normal position

- Rest the extremity
- Ice for the first 48 hours
- Compress with elastic bandage
- Elevate the extremity

- Pelvic ring fractures are serious life-threatening injuries
 - Hemorrhage
 - Fat emboli
- Significant kinetic forces
- Stabilize fracture
 - Wrap, scoop stretcher
- Hemodynamic support

- Usually the result of violent forces
- Severe pain
 - May result in muscle spasms
 - Cause bone ends to over-ride
 - Traction splint
- Proximal fractures
 - Differentiate from fractured hip



- Align limb
- Determine neurovascular status
- Apply traction splint
- Reassess patient
- Consider other injuries/transport



- Can occur separately or together
- Tibia is more commonly fractured
- If only fibula is broken, limb may be stable
- Generally air or rigid splints are most effective



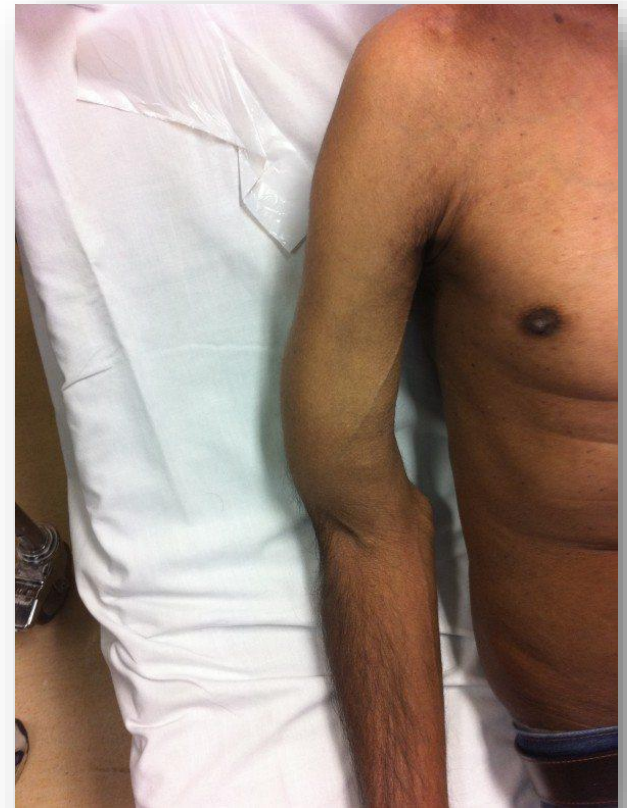


FIGURE 22-12 Placement of long padded board splints laterally and medially can effectively splint tibia/fibula fractures.

- Most commonly fractured bone
- Usually the result of transmitted forces directed along the upper extremity
- Sling and swathe or figure eight bandage
- Monitor for risk of internal hemorrhage or respiratory compromise



- Difficult to immobilize at proximal end
 - Bone buried deep within muscle and shoulder joint
- Sling and swathe tends to be most effective method



- Most commonly fractured at distal end
 - Colles' fracture, silver fork deformity
- Major concern is neurovascular compromise
- Short padded rigid splint
 - Leave at least one digit exposed



FIGURE 22-13 A malleable splint can effectively splint fractures of the radius and/or ulna.



- Anterior dislocation
 - Head of femur palpable in inguinal area
 - Externally rotated
 - Minimally flexed
 - Abducted
 - Generally cannot be reduced prehospital
- Posterior dislocation
 - Most common
 - Knee flexed and foot rotated inwardly
 - Adducted
 - Reduce only if there is neurovascular compromise
- Otherwise secure with fracture board or scoop stretcher



- May include:
 - Fractures of femur, tibia or both
 - Patellar dislocations
 - Frank dislocations
- Immobilize in position found
 - Unless there is neurovascular compromise
- Patellar dislocations very painful
 - Occasionally reduced in prehospital setting (according to local protocol)



FIGURE 22-14 Angulated knee dislocations can be immobilized with two padded rigid splints.



- Often produce distal lower limb that is grossly deformed
- Dislocations may be anterior, posterior or lateral
- Pillow splint is often most effective

FIGURE 22-15 A pillow splint can be used for injuries to the ankles and feet.



- Most commonly involve proximal humerus, lateral scapula and distal clavicle
- Immobilize in position found
- Reduction often occurs as a result of patient body position



- Anterior dislocation
 - Humeral head displaced forward
- Posterior dislocation
 - Rotate arm internally, displaced away from chest
- Inferior dislocation
 - Humeral head displaced downward, arm locked over shoulder

- High incidence of neurovascular involvement
- Blood vessels running through elbow are held firmly in place
- Careful and minimal movement required to restore distal function
- Elbow dislocations should not be reduced in the prehospital setting



FIGURE 22-16 Use a corrugated board splint such as a Speedsplint to immobilize angulated fractures or dislocations of the elbow.

- At risk due to high activity levels and incompletely developed coordination
- Greenstick fracture
 - Stable but angulated limb
 - Do not realign
- Epiphyseal fracture
 - Endangers future growth
 - Treat as a potentially limb-threatening injury

- At risk due to high activity levels and incompletely developed coordination
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- Epiphyseal fracture
 - Endangers future growth
 - Treat as a potentially limb-threatening injury

- Higher incidence of injuries in contact sports
- Establish rapport with athletic trainers
 - Patient becomes part of EMS system
- RICE

- Used to relieve pain and pre-medicate
- Pain Management
 - Nitrous oxide
 - Morphine
 - Fentanyl
 - Meperidine (Demerol)
- Sedation
 - Diazepam
 - Midazolam