



[Color index : **Important** | **Notes** | Extra] Editing file [link](#)

Introduction to the Orthopedics

Objectives:

- ★ To explain what Orthopedic is and what conditions will be discussed during this course
 - ★ Explain what we mean by Red Flags
 - ★ List the different causes of orthopedic disease.
 - ★ Describe some of clinical examination tests
- ★ Introduce titles of Clinical Skills which will be taught during this course.

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References: slides + Toronto notes + 433 team + 435 team group A

Introduction

Orthopedic specialty:

- ★ Branch of surgery concerned with conditions involving the **musculoskeletal system**. Orthopedic surgeons use both surgical and nonsurgical means to treat musculoskeletal trauma, spine diseases, sports injuries, degenerative diseases, infections, tumors, and congenital disorders.
- ★ It includes: **bones, muscles, tendons, ligaments, joints, peripheral nerves** (peripheral neuropathy of hand and foot), , **vertebral column, spinal cord and its nerves**. NOT only bones.
- ★ **Subspecialties:** General, pediatric, sport and reconstructive (commonly ACL “anterior cruciate ligament” injury), trauma, arthroplasty, spinal surgery, foot and ankle surgery, oncology, hand surgery (usually it is a mixed speciality depending on the center. Orthopedics = up to the wrist joint. Orthopedics OR plastic surgery = from carpal bones and beyond, upper limb (new) elbow & shoulder.

Red Flags: will be discussed in details in a separate lectures

- ★ Red Flags = warning symptoms or signs = necessity for **urgent** or **different** action/intervention.
- ★ Should always be looked for and remembered. **you have to rule out red flags with all emergency cases!**
Fever is NOT a red flag! Do not confuse medicine with ortho. Post-op day 1 fever is considered normal!
- ★ There are **5 main red flags**:
 - 1. Open fractures**
More serious and very high possibility of **infection** and complications
 - 2. Complicated fractures** fracture + neurovascular injury
Fracture with injury to the major blood vessel, nerve or nearby structures.
 - 3. Compartment Syndrome**
Increase in intra-compartment pressure which endangers the blood circulation of the limb and may affect nerve supply. **you have to diagnose it early** (in early stage very severe pain with the extension the pt will jump from the pain) the 5Ps are in the late stage which is not reversible
 - 4. Cauda Equina Syndrome** patient might come to the ER or clinic
Compression of the nerve roots of the Cauda Equina at the spinal canal which affects motor and nerve supply to lower limbs and bladder (**incontinence**) (**also saddle or peri-anal area(sensory)**)
(you have to take the patient immediately to the OR for **spine decompression**) if you wait the damage is irreversible (permanent damage)
 - 5. Infection** (it is a red flag because the bones are deep and serious and take a long admission time)
 - **Osteomyelitis**: Infection of the bone.
 - **Septic Arthritis**: Infection of the joint.
Critical situation and needs to be treated immediately in the OR within 6 hours, otherwise it will lead to degeneration of the cartilage and subsequently early arthritis. Be cautious - especially in young patients.
 - **Cellulitis**: spreading Infection of the soft tissue. May cause septicemia or irreversible damage. Make sure it is not evolving rapidly. Progressive cellulitis may lead to **necrotizing fasciitis**.
- + **Multiple Trauma or Pelvic Injury** can be added to #2 (complicated fractures)
More than one fracture or injury sustained at the same time. Consider massive blood loss and associated injuries
- + **Acute joint Dislocations** can be added to #2 (complicated fractures)
Requires urgent reduction or may cause serious complications

Alignment terminology:

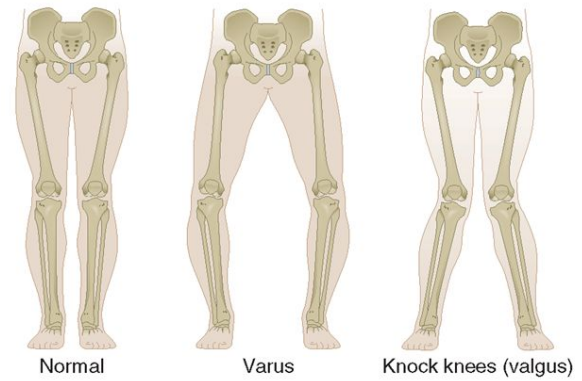
We describe the alignment (angulation) as:

- ★ **Normal** leg is straight
- ★ **Varus** (bow-legged) < | > **TOWARDS** the Body's central line
- ★ **Valgus** (knock-kneed) > | < **AWAY** from the Body's central line

L: lateral from the central line

When describing alignment you need to look at the relation between:

(1) **DISTAL** PORTION of fracture (2) **CENTRAL LINE** of the body.



Cubitus Varus



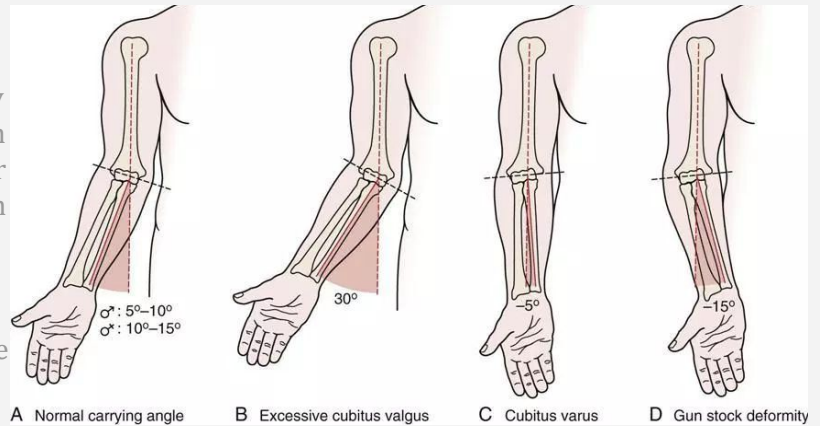
Elbow joint. Distal piece of humerus is going towards the ulna, medially (you can kind of see the olecranon)

Cubitus Valgus



Elbow joint. Distal piece of humerus is going away from the ulna (away from olecranon)

In the anatomical position the forearms are normally angled slightly outward relative to the line of the arm a carrying angle of 5–15 degrees of valgus. 'Varus' or 'valgus' deformity is determined by angular deviation towards the body or away beyond those limits or, in unilateral abnormalities, by comparison with the normal side. Gunstock deformity = cubitus varus (look at the angle between the longitudinal axis of the arm and the forearm)



Hallux Varus



Hallux Valgus



Big toe of the left foot is pointing towards the central line of the body.

Big toe of right foot is pointing **away** from the central line.

Deformities

Congenital: will be discussed in details in future lectures

- ★ Common congenital Anomaly: **Talipes Equino-Varus (TEV)** varus: it is going towards central line also known as **clubfoot** (very common in KSA).

Easily treated. 95% will resolve with serial casting.



Acquired: will be discussed in details in future lectures

| | | |
|---|---------------------------|--|
| 1 | Trauma most common | It includes: fractures, dislocations, soft tissues injuries (ligaments, tendons), nerve injuries and epiphyseal injuries (occur in pediatrics, arrest growth) |
| 2 | Developmental | Developmental Dislocation of Hip, Developmental Foot deformity, Slipped Capital Femoral Epiphysis, Spinal Deformities |
| 3 | Inflammation | rheumatological dx, autoimmune |
| 4 | Infection | Osteomyelitis |
| 5 | Neuromuscular | Poliomyelitis. <i>ex. duchenne muscular dystrophy (DMD)</i> <i>cerebral palsy</i> |
| 6 | Degenerative | Primary or secondary. <i>ex. osteoarthritis</i> (commonly of the hip & knee) |
| 7 | Metabolic | Rickets, osteoporosis. |
| 8 | Tumor | <i>osteosarcoma, myosarcoma, chondrosarcoma</i> |

1) Traumatic Injuries

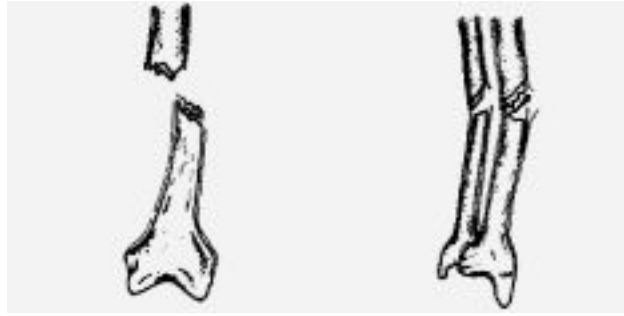
Fractures

Break in the continuity of bone
There are two types:

1. **Complete**
complete separation

2. **Incomplete**

there is contact between the two segments



Dislocations

Complete separation of the articular surface

1. **Complete**

2. **Partial (subluxation):** some contact

Distal to proximal fragment

Anterior, Posterior, Inferior, Superior

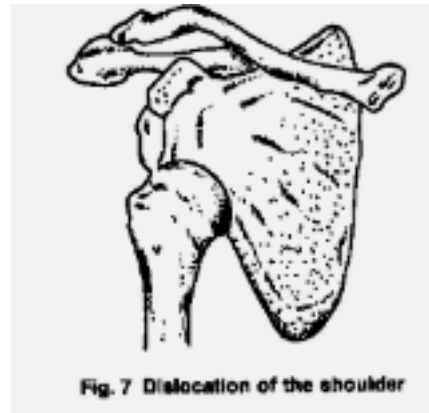
Example: if you had an x-ray (you have to see 2 views in x-ray) of the knee which shows posterior displacement of the femur.

Q1: what is the type of dislocation?

Anterior dislocation

Q2: Why?

Because the tibia -distal part- is anterior.



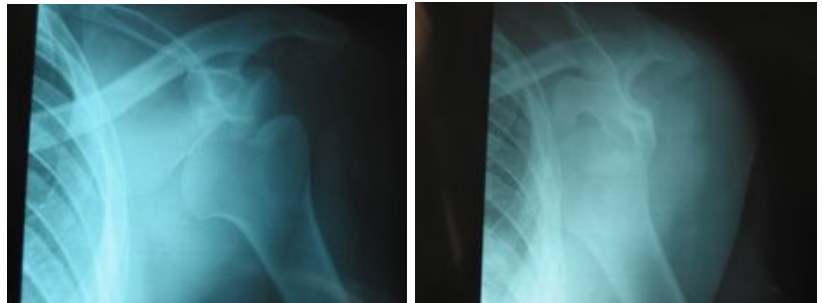
Fracture Dislocation

Dislocation with fracture of the bone

Adequate x-ray:

1. at least two views.
2. joint above & below is shown.

always get an adequate x-ray!



Avulsion Fracture

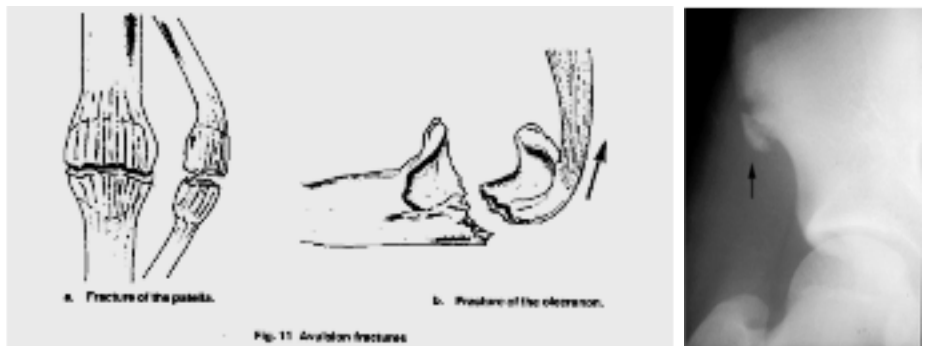
Force due to resisted Muscle Action with force part of the bone attached to muscle tendon will break off from its origin → tendon becomes stronger than bone → shearing or tearing off “avulsion” of tissue (it always transverse)

Common in patella [**knee**] + olecranon [**elbow**] (triceps tendon at the back of elbow is very strong) + abductor tendons of the [**hip**]

“look to the X-ray picture”

“Avulsion of the hip”

Transverse pattern



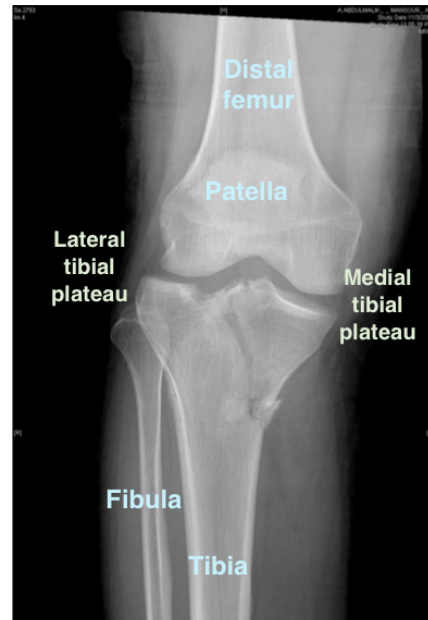
Intra-articular Fractures

If displaced (needs to be fixed); should always be treated by **Open Reduction and Internal Fixation (ORIF)**

basically realign cartilage + fixation
failure to reduce and fix such fracture results in loss of function, deformity and early degenerative changes.
(early arthritis)

Picture:

Fracture line coming from the metaphysis all the way to the joint line. There is also comminution + displaced intra-tibial fracture (space).



Soft tissue injury

- Most common soft tissue injury:
knee joint

- Most common knee joint injury:
Anterior Cruciate Ligament (ACL)

Anterior Cruciate Ligament injury seen a lot with soccer players & athletes

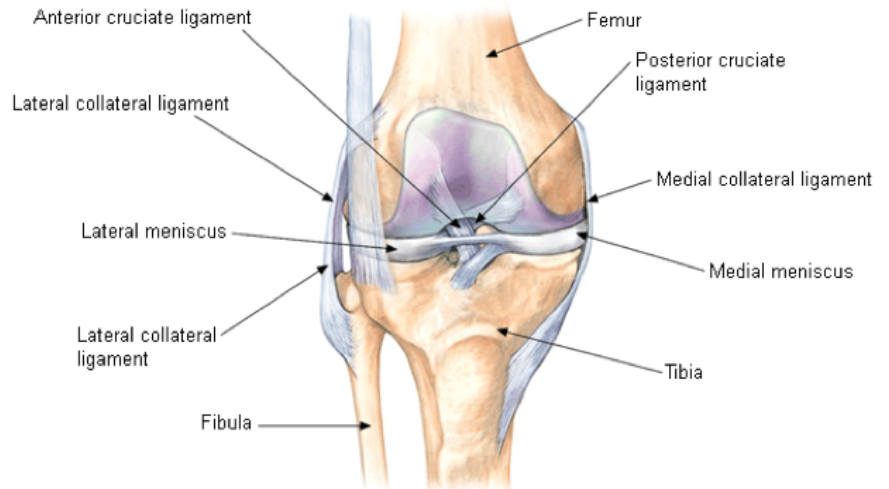
+ Posterior Cruciate Ligament injury

+ Medial & lateral collateral ligaments injury (which gives coronal stability to the knee joint)

(you need to know how to perform knee examination. You'll be taught in future sessions.)

MRI

normally you can see the ACL fibers going from the tibia to the femur but in this image ACL is ruptured and fibers are missing.



2) Developmental Deformities:

Developmental Dislocation (Dysplasia) of Hip (DDH)



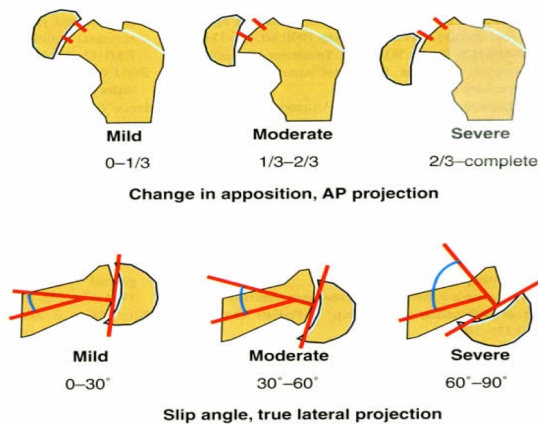
Underdeveloped Epiphysis (seen on the left side of the x-ray). Common disease we see it in **pediatrics** through which the hip is out of joint. On the left side the femoral head is completely within the joint, and on the right side is dislocated out.

Developmental Foot Deformity



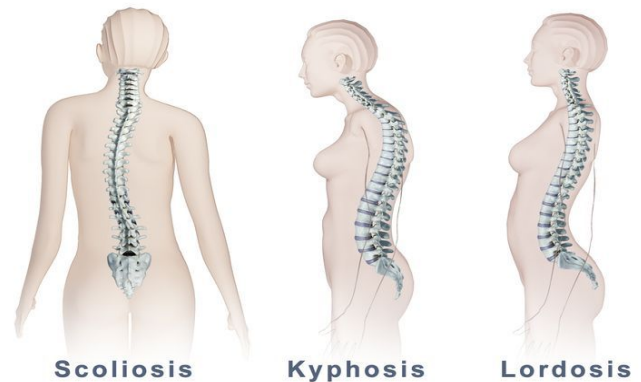
Hallux Valgus causes symptoms on the medial edge of the foot, the sole, and the small toes. **Causes:** tight shoes, heels, familial or hereditary with genetic predisposition. Usually happens quickly in early age. Very common problems (especially in female) in foot and ankle surgery

Slipped Capital Femoral Epiphysis (SCFE)



(SCFE or skiffy, slipped upper femoral epiphysis, SUFE or souffy, coxa vara adolescentia) is a medical term referring to a fracture through the growth plate (physis), which results in slippage of the overlying end of the femur (epiphysis). For many reasons like endocrine "hypothyroidism", severe obesity and metabolic bone disease, this epiphysis is very weak so it cannot hold the weight of hip so it will slip off. There are several grades depending on the severity of displacement. If it happens, we usually take the patient to OR, get it reduced and fix it with one or two screws.

Spinal Deformities

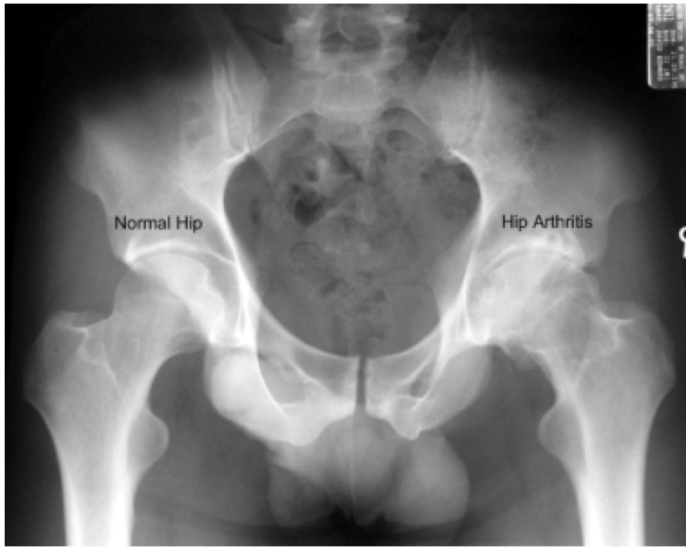


These deformities may be congenital or acquired **Hyperlordosis** is an excessive inward curvature of the **lumbar (lower)** spine. It's very common among females in our society. **the back is bent backward** **Kyphosis** is an exaggerated curvature of the upper (**thoracic**) spine that creates a hunchback appearance. **back is bent forward** **Scoliosis** it is the lateral deviation of the spine from the midline: Most of the time it's painless and Developmental (but it could be congenital). Mostly affect female more than male. **most common**. Curved either medially or laterally. Divided to either thoracic segment or lumbar scoliosis segment. This is the most common we see in spine pediatric surgery

3) Degenerative disorders

Occur at any joint. | Can be primary or secondary (more common) | Can lead to pain and/or deformity and/or loss of function

Osteoarthritis of Hip



On the right side: somewhat normal hip. There is joint space but there is still sclerosis + mild arthritic changes.

On the left side: you see complete loss of joint space + cystic changes + sclerosis and osteophytes

4 signs of OA on x-ray: osteophytes- sclerosis- decrease in joint space - cystic changes

Mnemonic "LOSS": L: loss of joint space, O: osteophytes, S: subchondral sclerosis, S: subchondral cyst.

Osteoarthritis of Knee



In this image all the changes of osteoarthritis are present **except** for cystic changes

4) Metabolic Disorders

Rickets



Bow Legs

Bowling of both, femur and tibia. Occurs due to imbalance in Ca and vitamin D "acquired" Seen by endocrine pediatric team

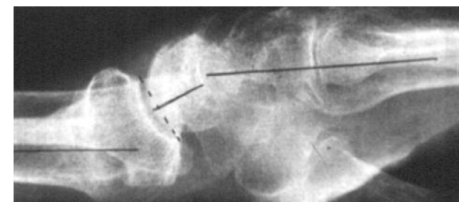
Osteoporosis



Hip Fracture

Decreased density of bone, seen in elderly. Pathological fractures seen most commonly in hip, spine & distal radius.

Colles fracture
Distal radial fracture, you see the fracture line in AP view. In the lateral view is very clear "dorsally angulated distal radial fracture or colles fracture"



5) Bone Tumors



Acquired deformity. Can be a soft tissue or bony tumor.



X-ray of humerus

Shows severe lytic lesion with soft tissue swelling.
If the transition between normal bone and pathological bone is **clear** → sign of **benign** tumor
If the transition is **NOT clear** → sign of **malignancy** especially if associated with periosteal reaction
Periosteal reaction and soft tissue swelling could be either infection or malignant tumor.

5) Infection

Chronic Osteomyelitis



Discharging sinus

If you have a sinus draining pus it is usually due to chronic osteomyelitis.
prolonged infection → bone becomes infected → sinus discharge from bone.

treatment is amputation and eradication of bacteria



Sequestrum

2 things you need to know in the x-ray of infection:

- 1. Sequestrum:** cystic changes or radiolucency within the bone. Due to infection, the bone will lose blood supply and becomes necrotic (dead) then detach from the bone appearing as a cyst.
- 2. Involucrum:** periosteal reaction overlying the sequestrum. Seen in all types of chronic osteomyelitis. Seen in tibia and fibula in the image.

6) Neuromuscular

Poliomyelitis

Very rare due to vaccination
it is pure motor



7) Nerve Injury

Axillary Nerve Injury



Wasting of right deltoid muscle due to Axillary nerve injury (and also it can be C5)

Spinal Cord Injury

- ★ Often results from fracture dislocation of spine.
- ★ When injury is at cervical spine it may result in **tetraplegia**.
- ★ Injury at dorsal spine may result in **paraplegia**. lumbar (lower spine) → lower limb paralysis (paraplegia)

Neurological Evaluation: Sensory & Motor

We don't focus on the dermatomes unless it's spine injury.
We focus on the nerve itself in the upper and lower extremities.

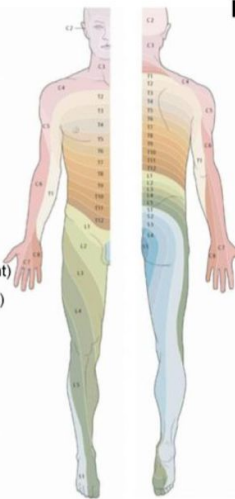
3 nerves in upper extremity: median + radial + ulnar

5 nerves in lower extremity: 3 mixed (common and superficial peroneal nerves, tibial nerve) 2 sensory (sural "lateral" and saphenous "medial" nerves)

YOU NEED TO KNOW HOW TO EXAMINE UPPER & LOWER EXTREMITY NERVES!

Dermatomes

- C4 (collar)
- C5 (lateral shoulder)
- C6 (thumb)
- C7 (no Heaven)
- C8 (pinkie)
- T4 (teet-pore)
- T7 (xiphoid)
- T10 (belly-butTen)
- L1 (Inguinal Ligament)
- L4 (medial malleolus)
- L5 (top of foot)
- S1 (Heel)



Myotomes

- C5 – Shoulder abduction (deltoid)
- C6 – Elbow flexion (biceps;brachiorad)
- C7 – Elbow extension (triceps)
- C8 – Wrist flexion (FDS)
- T1 – Finger abduction (DABs)
- L2 – Hip flexion (iliopsoas)
- L4 – Knee extension (quad fem)
- L5 – Dorsiflexion (tibialis anterior)
- S1 – Plantar flexion (gastrocnemius)

Physiotherapy for Orthopaedic Patients:

Not every orthopedic case is treated surgically. In fact, most are treated conservatively.

Conservative treatment includes: pain killers, rest, activity modification, special brace or splinting.

- ★ Physiotherapy is an important part of recovery, It is used for: pain relief, prevention of stiffness by improving the range of motion, muscle strengthening and preventing wasting and muscle atrophy, mobilization of stiff joint or spine, training non-weight bearing or partial weight bearing or full weight bearing.
- ★ Physiotherapy modalities include: **heat, cold, exercise, ultrasound, traction, electrical simulation** activating the muscle by placing an electrode which will enhance muscle strength.