

* Introduction to orthopaedics

- **Sesamoid bone**: bone within tendon, muscle ... largest is Patella (knee), 2 sesamoid bones in distal portion of 1st Metacarpal (hand), Pisiform (wrist), 2 bones in 1st Metacarpal bone (Foot), Lenticular Process of the incus (ear)

• **Note that**: Origin of sesamoid bones are from CT found in tendons & ligaments ... they have very limited bld supply & very difficult to heal (when not tx early)

- **Gait**: Stance Phase & Swing Phase

- ⊗ high steppage gait → Neurological defect
- ⊗ Atalgic gait → Acute pain in leg; stance shorter than swing
- ⊗ Trendelenburg gait → unilateral hip pathology; muscle weakness
- ⊗ Waddling gait → Bilateral Trendelenburg

↳ gluteus medius Lurch ...
↳ Lesion in Super. gluteal Nerve
causes weakness in hip Abduction
(Pelvis tilt down on opposite side)

• **Note that**: gluteus maximus, gluteus minimus & medius
↳ Extension of hip ↳ Abduction of hip &
& Minor ext. rotation minor internal rotation

- **Compartment Syndrome**:

↑ Intra-compartmental Pressure leading to ↓ bld supply to tissue
Symptoms; Severe Pain Out of Proportion ... ↓ Ability to move leg/limb, Pale color of affected limb (Presence of Pulses doesn't exclude Compartment)

2, 3, 10 → arm, forearm, hand

3, 4, 9 → hip, leg, foot

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- Rule for BLS in orthopedic Life > Limb > wound > Frac.

- Pulses locations:

Upper Limb → Axillary, brachial, radial & Ulnar

Lower Limb → Femal, Popliteal, Dorsalis Pedis, tibial Post.

- Fracture definition: discontinuity of bone as a result of high force impact or stress or weakened bone

First of ALL → GIVE ANALGESIA

then Assess the type

Intra / Extra - Articular / Capsular

- Dislocation = Luxation; Abnormal separation in the joint

↳ So Partial dislocation is Subluxation

- Tx of Any Fracture = reduction, immobilization, rehabilitation

• Note that rule of 2 for Fracture X-ray constitutes

2 views, 2 Joints, 2 Limbs, 2 locations

M. Imp. X-ray in Trauma → AP chest, AP Pelvis, C spine

- Carpal bones of hand (lateral to medial)

Scaphoid Lunate Triquetrum Pisiform

Trapezium Trapezoid Capitate Hamate

- Vertebral Column constitutes 33 vertebrae;

7 cervical, 12 thoracic, 5 lumbar, 5 sacrum 4 coccyx

- About elbow joint:

Ulnohumeral, radiohumeral, Proximal radioulnar

- About Wrist Joint:

radiocarpal, Ulnocarpal, distal radioulnar

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- X-ray Features :

- * Non uniform Narrowing of Joint space
- * Subchondral Cyst & Sclerosis
- * Osteophyte Formation without bone erosions

- Treatment :

Usually Conservative; Analgesia (NSAID), ↓ weight, ↑ Movements
(But) IF Symptoms are severe (↑ Pain, ↓ Life quality)

Surgery is the only cure for OA --

- Total / Partial Joint replacement; Hip / knee
- Arthrodesis (Surgical Fusion that's Fixed & Permanent)
↳ Ankle, wrist & Spine
- Arthroplasty; Best for Elbow Joint destruction
(Try to repair the joint as much as you can --)

- Notes :

- * M.C. Joint Involved in OA is knee joint
- * Poor correlation btw radiology & Symptoms
- * We Tx Pts NOT images....

* Osteonecrosis / Avascular Necrosis *

- **AVN definition**: Most serious of bone problems complications and it's death of bone tissue due to interruption of Bld sup.

→ Pt will Complain from: Pain, Limited movement

- **risk Factors**:

bone Fractures, Joint dislocation, Alcoholism, Infection; Septic Arthritis, Trauma - Sickle cell, Perthes, Caisson Dis.

- **M.C. affected Joint** is Femur

other sites are; head of humerus, Proximal scaphoid & talus

- **Note that**:

High dose steroid, immunosuppressant after transplant can cause AVN especially if combined with Azathioprine, Alch.

- **Dx & Imaging**:

* X-ray → changes appear only after several months with subarticular segment of ↑ bone density (New)

* MRI → The only method for picking up early signs

* Radioscintigraphy → reveal AV segment (cold area; ↓ Activity) and hot area around the infarct (↑ Activity, hyperaemia)

- **Tx**: Total or Partial joint replacement (shoulder)

For Hip almost always THR especially in elderly ... short life span (A)

⑥

* Osteomyelitis *

- **Defined As:** Infection of BM with Symptoms of:
Pain with redness, hotness & swelling - sudden / gradual
- **M.C. Joints:** Children → knee, long bones (Arm, leg)
Adults → spine, hip, feet
- **Cause:** Bacterial Infection (Staph. Aureus M.C.C)
- **risk Factors:** DM, IV Drug use, splenectomy, trauma
- **Dx:** based on Symptoms with labs & Imaging
- **Tx:** Antimicrobial (Augmentin) & Surgery

Amputation may be required (↓ Bld)

* Notes:

- Disease of Pediatric Age... rarely in Adults
- Other organism depend on Age group

< 1 year	1-4 year	> 4 year	Sickle
Klebsiella, Listeria, E-coli, group B	Staph, H. Influenza Pneumococcus	Staph Aureus	Staph her Salmonella

- Clinical Presentation: M.C. Hx (50%)

Hx: Previous URTI, surgery (Trauma) (Infection in general)

PE: Swelling, warmth, very tender limb, ↓ ROM

Sym: Adult (Back Pain) children (Fever, refuse feeding, irritable & failure to thrive)

- routes of Infection:

* Hematogenous (M.C) after inf. bacteria spread by Bld to diaphysis then Metaphysis (Plate) to end up in sinusoids (velocity reach zero / Bld stasis / bacteria settle down)

M.C. site → Distal Femur, Proximal tibia (knee joint)
(child) ↑ Bld supply ↑ Stagnation

M.C. site → Vertebra due to valveless veins
(Adults)

* Direct Inoculation: Open Fracture / Post Surgery

* Direct Spread: DM, Pressure Sores

- Pathophysiology:

Infection then $\uparrow$ Intraosseous Pressure leads to elevation in local inflamm.; $\rightarrow$ $\downarrow$ Perfusion Pressure $\rightarrow$ Periosteum then Bld $\downarrow$ Vasodilation -- $\downarrow$ Bld Supply (Ischemia) eventually bone is dead ($\uparrow$ Vas. Permeability Thrombosis from $\uparrow$ Pus (Digest vessel wall) (sequestrum) $\rightarrow$ Fracture then new bone will be Formed (Involucrum)

- VIP Note:

Acute OM is up to 10 Days

After that it's chronic >14 Days

So Periosteal rxn is early sign of chronic OM -- Codman's Triangle

Periosteal rxn
@ earliest stage
on X-ray (2w)
chronic OM

- Another Note:

IP sinus (Pus) Formed inside the involucrum this is called Cloaca $\rightarrow$ opening that allows drainage of Purulent & Necrotic material out of dead bone. if tract extend to skin surface it's called (Sinus Tract)

- Imp Note:

Even in Acute OM $\rightarrow$ It's a gradual process (12-24) hrs due to the pressure that's needed to be build up inside bones

- Labs

* CBC (leukocytosis & shift to the left) & $\uparrow$ ESR $\uparrow$ CRP

* Bd Culture (DON'T give Antibiotic before confirm Dx)

- Imaging

* MRI: M. sensitive measure (Don't do Aspiration / Puncture)
But Not Specific, -ve MRI rules out OA

* U/S: For Abscess

* X-ray: For signs of chronic OM (sequestrum, cloaca)
(No bone finding in Acute) Involucrum; New bone rarefaction

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Tx: Systemic IV Antibiotic (Augmentin for 6 weeks)
Covers 2/3 of bacteria but 1/3 need Surgery
In emergency $\rightarrow$ Bld culture (+ve in 30% cases)

Note

If Antibiotic Failed within 72 hrs & Pt have
Persistent Symp., Febrile, $\uparrow$ CRP $\rightarrow$ Surgery
Also in chronic OM.

Complications:

chronic OM, 2ndary septic Arthritis, DVT & PE,
Septicemia, growth disturbances.

Subacute OM

- Brodie's Abscess: subacute OM... may persist for yrs before converting to a frank OM...
- **M.C. organism** $\rightarrow$ Staph. Aureus in Metaphysis of long bones (tibia & femur) $\rightarrow$ knee
- **Tx:** Surgery (evacuation & curettage)
- **Symptoms:** Dull aching pain $>$ 3 months that's localized nocturnal alleviated by Aspirin. Appears sclerotic margins & radiolucent center.

Osteoid Osteoma

$< 1\text{cm}$

Brodie's Abscess

$> 1\text{cm}$

Chronic OM

- **M.C.C** is mixed Bacteria
- **Tx:** Surgery then 6w Antibiotics after taking culture

* **Note that:**

- In Post-OP Osteomyelitis M.C. agent is Staph. epidermidis (have affinity for Metals. can cause chronic OM)
- VIP Note → **Acute** Post-OP OM is caused by **Staph. Aureus** & Managed by Irrigation but IF after **year** of Surgery then it's **Epidermidis** causes Biofilm Above the metal & should be removed

* But Post-Traumatic OM Caused by Staph. Aureus -
Garden Fracture

* **Septic Arthritis** * **Top Emergency In orthopedics**

- **Features of Disease:** Pediatric age group, Staph Aureus M.C., hematogenous spread, severe rapid sudden Pain, NO ROM
- **M.C. site** → Adults; knee
→ Peds; ~~XXXXX~~ Hip
- **Top emergency means:** Needs operation within 8 hrs. in order Not to lose cartilage & Joint (lifelong handicap if left untreated)
- **Hx:** Fever, redness, irritable, ↓ Feeling, NO ROM actively, Admitt Pt & Prepare for operation. Position that ↓ Pain hip Flexion & Ext. rotation / knee Flexion / Shoulder Adduct.
- **Investigation:** CBC, **x-ray**, **MRI**, **Joint Aspiration** (M.I.M.P)
 - ④ Normal at early stage OM exclude WBC > 50K
 - ④ Then widening of joint space & Absent cartilage at late stage
 - Differential 790% Neutrophils
 - ↓ glucose ↑ Protein
 - Single bacteria (gram stain)
 - +ve Culture**
 - Pathognomonic
- **Tx:**
 - Drainage & Antibiotic**
 - Surgery**
- **Complicated by:** Dislocation, growth disturbance, Ankylosing (Late)

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* Note that *

Kocher criteria differentiate Btw
Septic Arthritis & Transient Synovitis

* Fever $>38^{\circ}\text{C}$

* WBC $>12 \text{ k}$

* ESR >40 CRP >20

* Inability to bear weight

↓
Hip Pain & 4 Above is Septic Arthritis until Proven other
wise 3 Above 93%, 2 Above 40%, 1 Above 3%.

But what is Transient Synovitis ?!

Inflam. of Synovium after viral Infection due to cross
reaction Produced by Antibodies from remote Infection

* Osteoporosis *

* **Definition:** Normal qualitative bone (but) there's quantitative depletion of bone tissue. (Low bone mass & defect in bone structure)

* **Dx:** DEXA scan (dual Energy X-ray absorptiometry) is gold standard for Dx ... bone mineral density is ≤ -2.5 standard deviations below that of young (30-40) yr old

T-score

* **Note that;**

Normal T-score is ≥ 1.0

* Clinical Picture *

In Women / Postmenopausal OP $\rightarrow$ back Pain & $\uparrow$ thoracic kyphosis
Hx of Colles' Fracture of Ankle or Femoral N. due to $\downarrow$ estrogen

$\rightarrow$ Prevention;

Avoid Smoking & Alcohol, Physical Activity, Adequate Vit. D & Ca^{2+}

$\rightarrow$ Tx;

Ca^{2+} , Vit. D, Bisphosphonates,

** PostClimacteric Osteoporosis in Men

gradual depletion of Androgenic hormone ... Osteoporotic Fractures in male under 60 yr old $\rightarrow$ Look for underlying Disease
Hypogonadism, MM, liver disease, Alcohol, malnutrition

* About (Vit. D-resistant rickets) / Familial Hypophosphatemic ricket

- Normal Ca^{2+} level but defective bone mineralization
- X Linked with dominant Inheritance
- Starts in infancy with Progressive bone deformity -- ex genu varum $\rightarrow$ when begin to walk (But) No myopathy
- $\uparrow$ significant X-ray changes, Normal Ca, Low Phosph.

(Tx)

* Large doses of Vit. D (50,000 IU) & 4g of inorganic phosph

* Bone deformity may require bracing / Osteotomy

Inadequate Mineralization of Bone

Osteomalacia

- * Adults
- * Defect in Metabolic Pathway for Vit D $\rightarrow$ $\downarrow$ Vit. D
- * Bone Pain, backache & muscle weakness, Present for yrs...
- * Pts may be living on poor diet with $\downarrow$ Sun exposure...
- * X-ray: generalized rarefaction (low density) & sing of Previous Fractures in vertebrae, ribs...
- $\rightarrow$ Pathognomonic: Looser Zone (Poorly healing stress Fracture appears as thin transverse band)

Investigation

- $\downarrow$ Ca, Vit. D, 25-HCC, 1,25HCC
- $\uparrow$ ALP, biopsy shows excessive amount of unmineralized Osteoid

Tx

Vit. D & Ca Supplements

Rickets

- * children
- * Inability to calcify the intercellular matrix
- * Dietary lack / $\downarrow$ Sun exps.
- * Infants with Tetany / convulsions, Failure to thrive, early bone change
- * enlargement of costo-chondral Junction (rickety rosary)
- * lateral indentation of chest (Harrison's Sulcus)
- * Distal Tibial bowing
- * Spinal curvature, Coxa

Investigation

- $\downarrow$ Ca, Vit. D, Phosphate
- $\uparrow$ ALP $\downarrow$ Ca Urinary excret.

Tx

Vit. D administration --
(Calciferol 400-1000 IU Per day)

* Peripheral Nerve Injury *

→ Pathology of Nerve injuries; classification depends on:

- Nerve component affected
- loss of function
- Ability to recover

Nerve Injury By Seddon's

Neuropraxia

* Nerve remain intact, reversible block of nerve conduction

* Temporary loss of motor & sensory function of the nerve

* recovery after few days or weeks -- still it's mildest form of injury

* Demyelination, grade 1

* example; radial Nerve (Wrist Drop)

Axonotmesis

* Axon is damaged but surrounding CT remains intact.

* Occurs in closed injury / Fractures or dislocation (No conduction distally)

* recovery / Axonal regeneration occurs 1mm/day -- Starts few hours after injury & may take weeks - Months (No need for surgery)

* Demyelination & Axon loss (II)

Neurotmesis

* Axon & surrounding CT is damaged, (M. severe form)

* gun shot, laceration severe Isch. Injury (open wounds)

* No recovery, Needs surgery, There's division of Nerve Trunk... motor Neuron is Absent

* Axon loss

* Notes

- Acute injuries of Nerves are easily missed...
- Neuropraxia is associated with low-energy trauma while Axonotmesis & Neurotmesis are with high-energy trauma.
- Nerve conduction & electrophysiology help to establish level & severity test

Nerve Injuries affecting Upper Limb

** Brachial Plexus: Nerve roots from C5-T1

Stab wound, severe traction

Supraclavicular / Infraclavicular lesion

↙ Motorcycle Accidents

↙ Fractures, Dislocation of Shoulder

Presentation; Depend on

- level of lesion
- Preganglionic / Postganglionic
- Type of damage

About level of lesion

Upper Plexus

* (C5 - C6)

- * Arm hangs close to body & internally rotated with loss of sensation

Total Plexus

- * Paralysis & Numbness of entire limb

Pure lower (rare)

- * Best Prognosis

About Pre / Post-ganglionic

Preganglionic lesion

- * burning Pain
- * Horner's Syndrome
- * Spinal Cord Dysfunction
- * Paralysis of Scapular muscle
- * Severe Vascular injury

Postganglionic

⊗ +ve histamine test

⊗ -ve histamine Test

Type of Damage

NeuroPraxia & Axonotmesis

Neurotmesis

Management

Emergency Surgery

** Obstetrical brachial Plexus :

↓ Upper root Injury
(Erb's Palsy)

- * C5, C6
- * In Overweight babies with Shoulder Dystosia
- * recover spontaneously
- * IF No recovery by 3 months of age.. surgical consideration should be taken

↓ lower root Injury
(Klumpke's Palsy)

- * C8, T1
- * After breech delivery at small babies -- loss of Intrinsic muscle (Flexor) of hand, arm supinated & elbow flexed...

↓ Total Plexus Injury

** Long thoracic Nerve → Serratus Ant. Palsy
(winging of scapula)

** Spinal Accessory Nerve → runs in Posterior triangle of Neck
to innervates trapezius Muscle
(Become injured in stab wounds)

** Axillary Nerve (C5) → Deltoid weakness (Impaired Abduct.)
Injured during shoulder dislocation

** Radial Nerve → Injured At elbow, in upper arm or axilla..
Caused by Pressure (crutch, tourniquate,
Saturday night Palsy)

→ low Lesion, high lesion, Very high lesion
At Elbow Fractures of humerus

Nerve Injuries affecting lower Limbs

** Femoral Nerve

Thigh Injury - weakness in knee extension & knee Jerk is depressed
Also, there's Numbness of Ant. thigh & medial Aspect of leg

** Sciatic Nerve

- due to Compression in local Trauma -- Foot drop & Paresthesia in leg & Foot... recognized usually as a complication of hip replacement & following surgery
- Causes weak ankle dorsiflexion / Planter flexion, Foot eversion & inversion (But) hip abduction, internal rotation is strong

** Peroneal Nerves

- due to lateral ligament injuries in ① knee Forced into varus
② Pressure from splint / cast
③ Lying with leg ext. rotated
- Only weak Foot eversion & dorsiflexion → Foot Drop with
loss of Sensation over front & outer half of leg & dorsum of Foot

→ Superficial Nerve; Weak eversion But dorsiflexion is intact
→ Deep Nerve; Loss of sensation over first Web space on dorsum of Foot & Ant. Compartment Syndrome

* Cause of (Foot Drop)

Bilateral

Peripheral Neuropathy, Bilateral radiculopathy
Cauda equina, Motor Neuron disease,
Spastic Paraplegia, distal Myopathy

Unilateral

L5 segment lesion, Common
Peroneal injury, sciatic IN,
Cortical lesion (UMN lesion)