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LEARNING OBJECTIVES

UNIT 1: BONE & IMAGING

- **Orthopedics History**
  - Introduction of orthopedics
  - History of orthopedics
  - Image based questions approach

- **Bone structure**
  - Basics
  - Bone composition
  - Skeletal maturity
  - Zones of articular cartilage
  - Epiphysis
  - Growth plate

- **Parathyroid hormone on bone**
  - Re modelling of bone
  - Calcium homeostasis

- **Approach to normal limb x-ray**
  - X-rays: Cortex, Marrow, Soft tissue plane, Joint space
  - Shoulder
  - Wr
  - Ossification of carpal bones
  - Pelvis

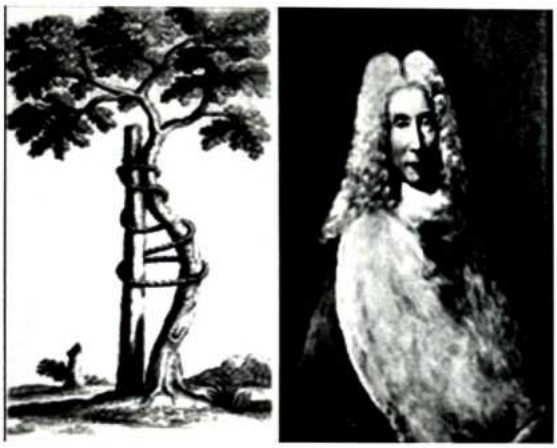
- **Imaging in orthopedics**
  - Different views in X ray
  - CT
  - MRI
  - Stress fracture/Occult fracture
  - PETCT
  - Investigations for infection
  - Bone tumors
  - Bone biopsy
  - Periosteum & Classical radiological features

1 HISTORY OF ORTHOPEDICS

Introduction and History of Orthopedics 00:03:30

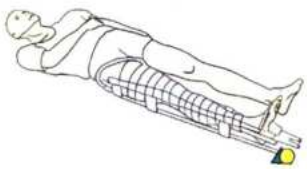
Nicolas Andry

- Term Orthopedics is coined by Nicolas Andry
- Ortho- Straight, Pedis-Child
- Nicolas Andry wrote the 1st book of orthopedics & the emblem of orthopedics



H. O. Thomas (Hugh Owen Thomas)

- Contributions include
  - Thomas splint
  - Wrench: For correction of Deformities
  - Thomas test: For flexion deformity of the hip
  - Collar: For cervical spine injuries
  - CTEV (Congenital Talipes Equino Varus) Shoes



Important Information

- Father of Orthopedics: Nicolas Andry > H.O. Thomas
- Father of Modern orthopedics: Robert jones

Watanabe

- Father of Arthroscopy
- M/c joint in which arthroscopy done is: Knee > Shoulder
- Largest joint in our body: Knee

John Charnley

- Father of Arthroplasty
- M/c Joint where Arthroplasty is done: Knee
- Arthrodesis: Fusion of 2 or more bones in a joint

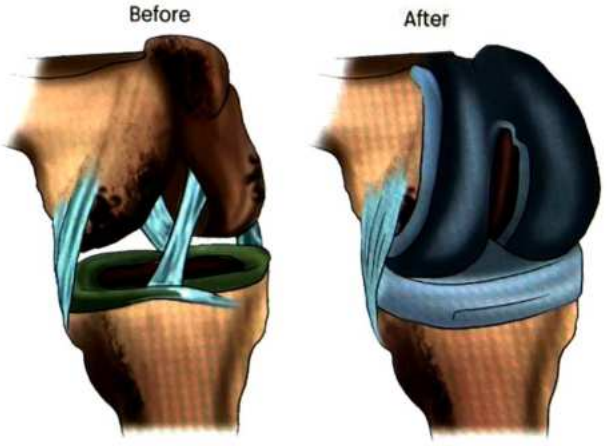
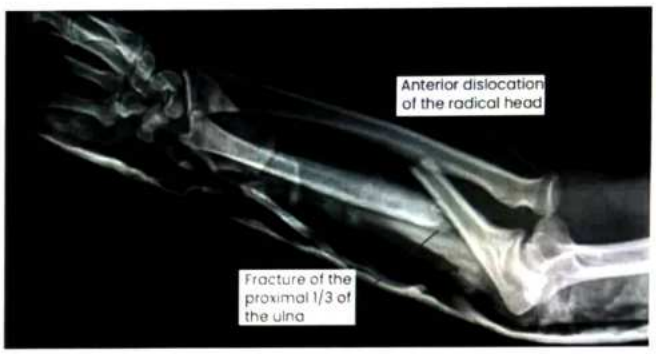


Image Based question approach 00:09:26

- Keep optimum distance
- Keep looking – don't hurr
- Seeing & believing that you have seen

- Localize the body part
- In an image go from normal to pathological area
- Then look at choices
- Sometimes you actually don't need an image
- Monteggia fracture [Fracture Ulna with Radial dislocation]



CLINICAL QUESTIONS

Q. A 10-year-old obese boy was referred to the emergency with a history of hip pain. He was observed to be limping and complained of severe pain. Which of the following investigation is not required:

A. X-ray of the hip
B. MRI of the hip
C. CT scan of hip
D. USG of hip

Answer: C

Solution

Order of Investigations in any inflammatory Joint Swelling

X-ray
↓
MRI
↓
Aspiration

X-ray
MRI
Aspiration by USG
Swelling of a joint
X-M A S

- This patient is an Obese limping child with hip pain, the possible differential diagnosis would be
  - Osteomyelitis (X-MAS)
  - Septic arthritis (X-MAS)
  - Slipped capital femoral epiphysis (X-MRI)
  - Transient synovitis (X-MAS)
  - Hence CT will be least preferred.

Q. Which X ray view is depicted in the given image ?

A. Judet View
B. Swimmer's View
C. Von Rosen View
D. Broden's View

Answer: B

Solution

- Named X Ray views
  - **Judet** View -Different orientation of Acetabulum
  - **Swimmer's** View: Cervico-thoracic junction
  - **Von Rosen** View: DDH
  - **Broden's** View: Subtalar Joint

Q. After various medical and physical examinations conducted, you have been selected for the post of Medical Officer in Paramilitary forces. As a part of training, you are undergoing rigorous physical training, in few days of training you have started to develop pain over right foot while running which diminishes on rest. X ray of right foot was taken shown below. What will be the probable diagnosis of the same?

A. Metastatic fracture
B. Pathologic fracture
C. Runners fracture
D. Fatigue fracture

Answer: D

Solution

- MARCH FRACTURE
  - It is a 'Fatigue' fracture of second or third metatarsal neck, resulting from long continued or often repeated stress, particularly from prolonged walking or running in those not accustomed to it. Thus, it may occur in army recruits freshly committed to marching – hence the term 'March fracture'. The fracture heals spontaneously, so treatment is purely symptomatic.

- Above image shows fatigue fracture of 2nd metatarsal
- Radiograph helps in the diagnosis and the treatment is rest, NSAIDs, splints, elastic crepe bandage application, etc. This is an important cause of chronic midfoot pain and it requires prompt identification and treatment.
- In the given case, X ray was negative for metatarsal fracture, in such cases MRI is the modality of choice.

2 BONE STRUCTURE

Basics
00:02:18

- Metaphysis
  - Most vascular area of Bone
  - Most common Location for infection & Tumor
- Diaphysis
  - Middle part
  - Ewing sarcoma occurs here.
- Epiphysis
  - Present towards the end of a Bone
  - Covered by Articular cartilage
- Upper end of bone: Epiphysis + Physis + Metaphysis
- Middle of bone: Diaphysis

Bone Composition
00:02:15

- 65% Inorganic [$(ca)_{10}(PO_4)_6(0H)_2$]: Calcium hydroxyapatite
- 35% organic (Type 1 collagen)
- Organic Component
  - Matrix 95% + cells 5%
    - → Matrix composed of Proteoglycans (compressile strength)
  - Proteins
    - → Composed of Collagen: Type 1
    - → Provides Tensile strength
    - → Non-collagen proteins are also present which includes
      - Osteocalcin
      - Osteopontin
      - Osteonectin
- Bone formation marker
  - Osteocalcin
  - Osteopontin
  - Osteonectin
  - Enzymes: Bone specific ALP
- Terms
  - Osteoid: Immature Bone
  - Osteon: Mature (Mineralized) Bone

Skeletal Maturity
00:03:53

- Age at which the physis disappears and the Epiphysis Fuses to Metaphysis is K/a Age of skeletal maturity
- Shoulder joint
- Wrist joint
- Knee joint

} Ossify at 18 years of age

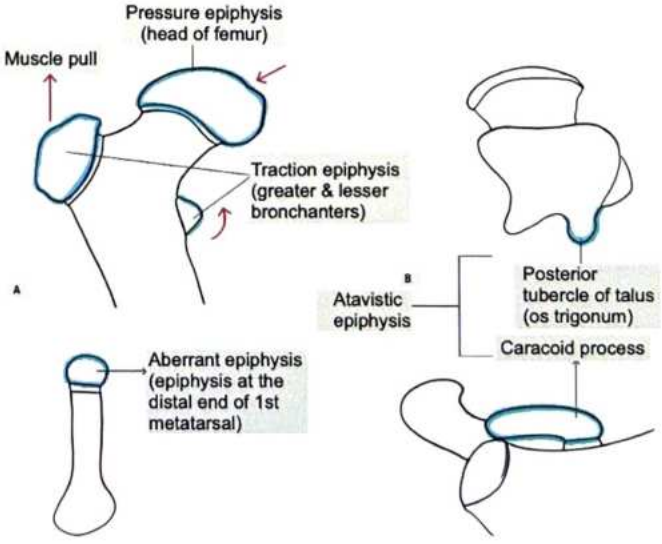
- Elbow joint
- Hip joint
- Ankle joint

} Ossify at 16 years of age

Zones of Articular cartilage
00:05:21

- Zone 1
  - Superficial zone
  - Has high water content (as it is close to joint fluid)
  - Contains
    - → Progenitor cells for articular cartilage
    - → High density chondrocytes
- Zone 2
  - Transition zone: Thickest zone
  - Chondrocytes are in low density
- Zone 3
  - Middle zone
  - Most active chondrocytes
  - Highest density proteoglycans
  - Low density water content
- Zone 4
  - Calcified cartilage
- Above articular cartilage, joint fluid is present

Epiphysis
00:06:46



Types of Epiphysis

1. Pressure Epiphysis
- Intra Articular & Weight Bearing
- E.g. Head of Humerus, Lower end of radius

2. Traction Epiphysis
- Extra articular
- K/a Apophysis
- Severe to pull & site of muscle attachment ossify later than pressure epiphysis.
- E.g. Greater & Lesser trochanter of femur, and Tubercles of Humerus.

Important Information

Rotator Cuff Muscles
Mnemonic: Sit-s
- Supraspinatus
- Infraspinatus
- Teres Minor

} Attached to Greater tuberosity. does external rotation

- Subscapularis: Attached to lesser tuberosity
  Lift off test: To test for a lesion of the subscapularis Muscle & scapular instability

3. Aberrant Epiphysis
- Anatomical anomaly
- Accessory ectopic epiphysis
- E.g. Head of 1st metatarsal (or) Base of 5th Meta carpal.

4. Atavistic Epiphysis
- Phylogenetically independent but becomes fused.
- E.g. Coracoid process of scapula. 00:09:31

Growth plate
- Bridged between Epiphysis & Metaphysis
- Consist of
  - Resting zone (Reserve)
    → Storage disorders affects resting zone
    → E.g. Gaucher disease
  - Proliferative zone (Growth)
    → Affecting the dwarfs and giants
    → E.g. Laron syndrome (dwarfs + truncal obesity), Scurvy.
  - Maturation zone
    → Zone where fractures occurs
    → Hypertrophic
  - Zone of provisional calcification
    → Mineralization disorder like Rickets affects zone of provisional calcification

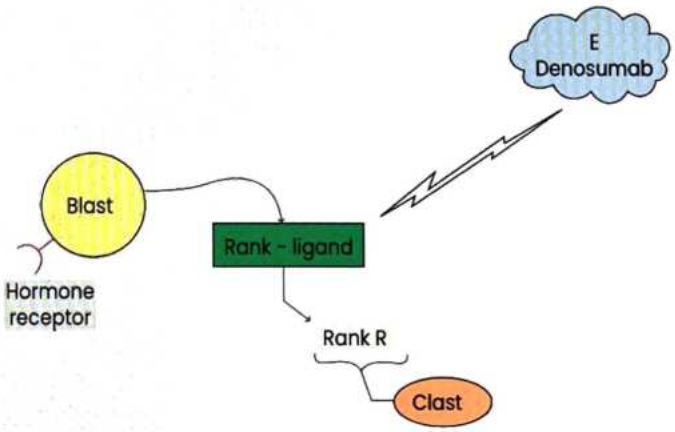
Important Information

- Beneath zone of provisional calcification is the Spongiosa
- Scurvy affects the spongiosa because it affects the cross-linking of collagen

3 PARATHYROID HORMONE ON BONE

Remodeling of bone 00:00:15

- PTH acts on its receptor on Osteoblast which release the Rank-Ligand
- Rank Ligand attach to the receptor on the Osteoclast and stimulate it causing remodelling



- When there is excessive PTH levels
  - E.g. Hyper parathyroidism due to PTH adenoma, there will be H/o Young female with renal stones, abdominal groans (dyspepsia), psychic moans and Bones
  - Bones: High level of PTH →↑ stimulation of osteoblast → ↑release of RANK ligand → ↑osteoclast stimulation →Osteoclast causes more Lysis → Bones become more hollow K/a Cystica → Cyst is filled with fibrous tissue K/a Fibrosa Cystica
  - When bone is getting involved its k/a Osteitis fibrosa cystica
  - When there is blood in it then its K/a Brown tumor
- Treatment of Osteoporosis
  - Drugs inhibiting the osteoclast
    - → Bisphosphonates
      - DOC for Osteoporosis
      - Rare side effect: It inhibit the remodelling cycle and prolonged usage for many years has a high chance of causing fractures
    - → Calcitonin
  - Drugs that inhibit the Rank ligand
    - → Estrogen
    - → Denosumab (S/c)
  - Low dose PTH (20 μ s/c daily) stimulates osteoblast but cannot release RANK ligand, hence, it can be used for treatment of Osteoporosis
  - Strontium
    - → Acts both ways i.e. stimulates formation & inhibits resorption as well.
    - → Not preferred because of cardiac side effect

Calcium Homeostasis 00:05:20

- Decreased serum calcium stimulate calcium sensory receptors on parathyroid gland causing PTH release
- PTH action

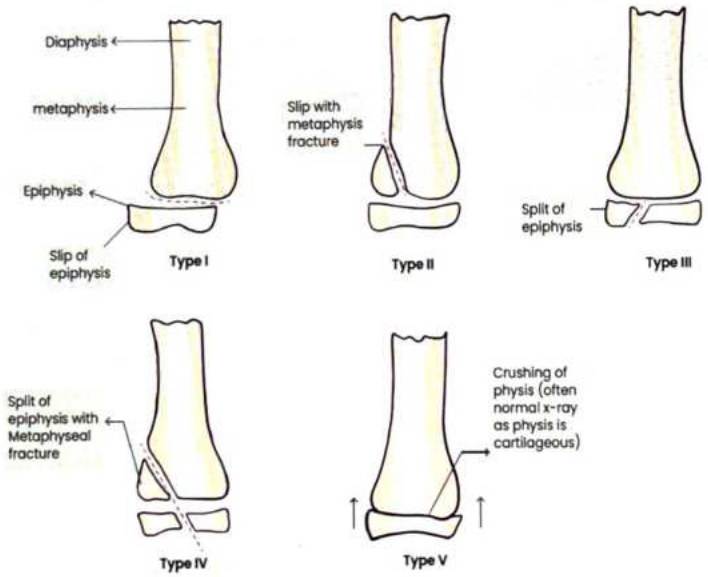
1. On the Bone: Stimulates specific receptors causing bone resorption thereby increasing the serum calcium
2. Stimulate 1-alpha-Hydroxylase causing formation of 1,25 $(OH)_2$ D_3 which will intern result in Increased intestinal absorption of calcium
3. Acts on specific receptors on kidney causing Phosphaturia and decreased S. phosphate

Important Information

- Any vitamin D deficiency will usually have a secondary hyper parathyroidism
  - Serum PTH will be High
  - Serum phosphate will be low
- In Renal Rickets (phosphate retention disorder), the phosphate levels in blood will be high

4 APPROACH TO NORMAL LIMB X-RAYS

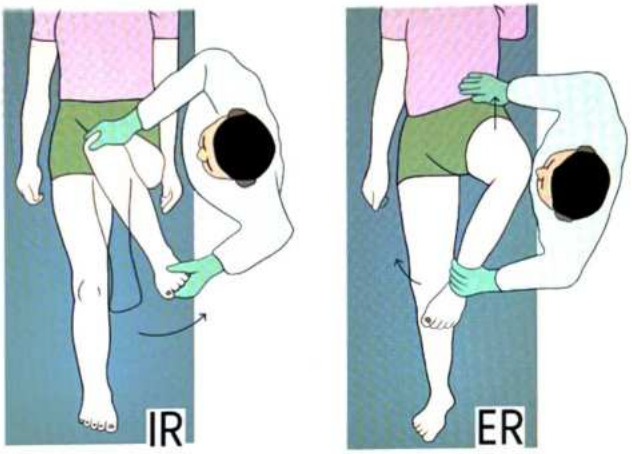
Salter-Harris Classification in children 00:00:14

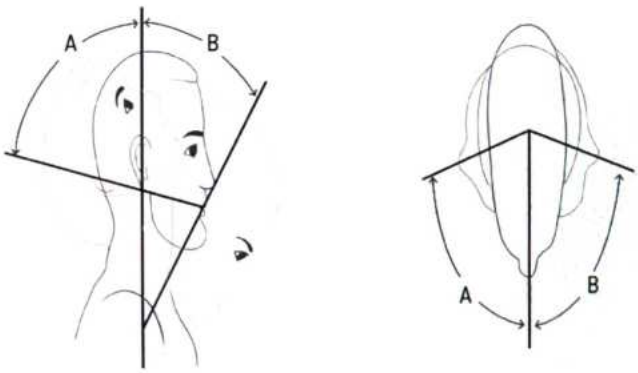


- Type 1: Slip of Epiphysis
- Type 2
  - Fracture line through the physis & extending to the metaphysic
  - Most common type
  - Aka Thurston – Holland
- Type 3
  - Fracture Line through the physis splitting Epiphysis into two
- Type 4
  - Split of epiphysis with metaphyseal fracture
- Type 5
  - Crush injury to the physis
  - Often normal x-ray as physis is cartilaginous

Ball & Socket Joints 0:02:22

- Includes
  - Incudostapedial joint
  - Shoulder joint
  - Hip joint
  - Talocalcaneal-navicular joint
- If Abduction & Internal rotation is normal there is no problem with hip & shoulder joints.





X-rays 00:04:05

a. Cortex
- Cortex: bone in the periphery
- Fracture is a break in the cortex of the bone

b. Marrow: Central part of a bone

c. Soft tissue plane
- Consists of Muscles & fascia
- In osteomyelitis, Earliest radiological feature is loss of soft tissue plane after 24 hours > periosteal reaction (7-10 days)

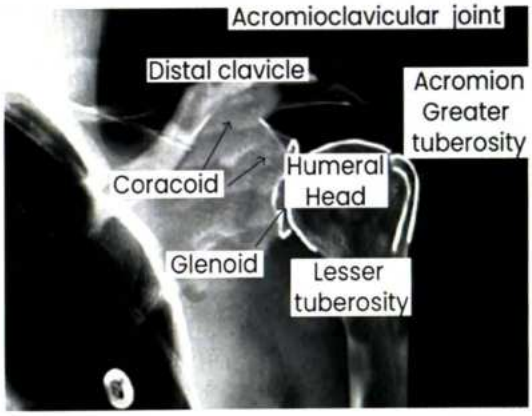
d. Joint space

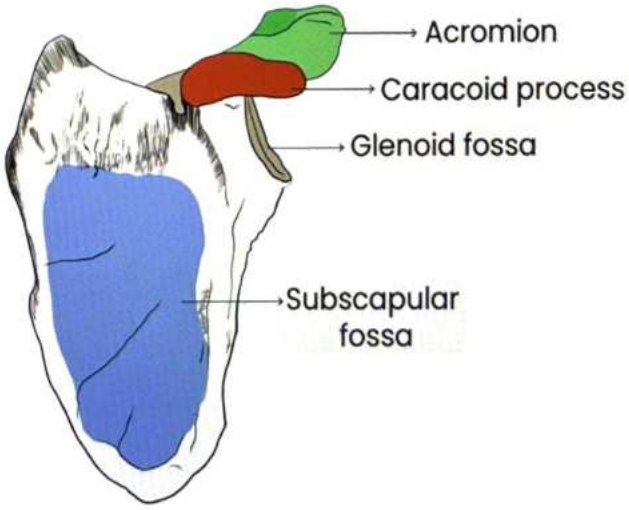
- Consist of cartilage (not seen in x-rays)
- Reduction of joint spaces refer to Arthritis
- X-rays is the first investigation for glass injury
- Glass is coated with lead which is Radio-opaque
- The medial compartment of the joint is destroyed leading to reduction in joint space & Distal part is deviated Medially in Osteoarthritis: VARUS
- In Rheumatoid Arthritis Distal part is deviated laterally: VALGUS (Knock knee)

Important Information

- Break in cortex: Fracture
- Osteomyelitis: Loss of soft tissue planes after 24 hrs of osteomyelitis and periosteal reaction happens later
- Tuberculosis loss of curvature of spine> reduced disc space
- Joint spaces is cartilage (not seen on x-rays) and reduced joint space means arthritis

Shoulder
- Clavicle is the highest bony landmark in AP X-ray of shoulder
- Ratio between head of humerus& Glenoid 4:1 k/a "Golf ball on a tee"
- In the Infra-clavicular area the bony landmark palpable is "Coracoid"





Elbow

00:10:34

- Capitulum is the first centre to ossify around elbow
- Radial head: 2nd centre to ossify
- Ossification around elbow

Bone	Age of ossification
• **C** - Capitulum	• 2 years
• **R** - Radial head	• 4 years
• **I** - Inner/medial epicondyl	• 6years
• **T** - Trochlea	• 8years
• **O** - Olecranon	• 10 years
• **E** - External / lateral epicondyle	• 12 years

How to remember

- CRITOE

Wrist

00:11:45

Radiocarpal joint

- In AP view lower end of radius is wider, on it there is a boat shaped bone called as scaphoid and next to it is the moon shaped lunate
- The first metacarpal go anterior
- Ossification of carpel bone

Bone	Age of ossification
• **She** – Scaphoid	• 5years
• **Looks** - Lunate	• 4 years
• **Too** - Triquetrum	• 3 years
• **Pretty** - Pisiform	• 12 years
• **Try** - Trapezium	• 5 years
• **To** - Trapezoid	• 5 years
• **Catch** - Capitate	• 1 year
• **Her** - Hamate	• 1 year

How to remember

- She Looks Too Pretty Try To Catch Her

Pelvis

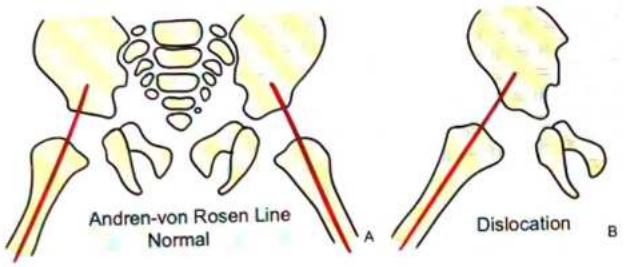
00:13:45

- Sacroiliitis: inflammation of sacro- iliac joint
- Young man with lower back ache, reduced hip extension, HLA B27+ve suggest Ankylosing spondylitis

5 IMAGING IN ORTHOPAEDICS

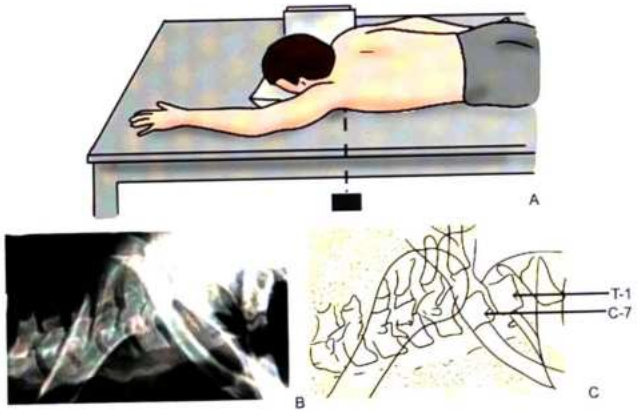
Different views in X-ray

1. Von-Rosen view



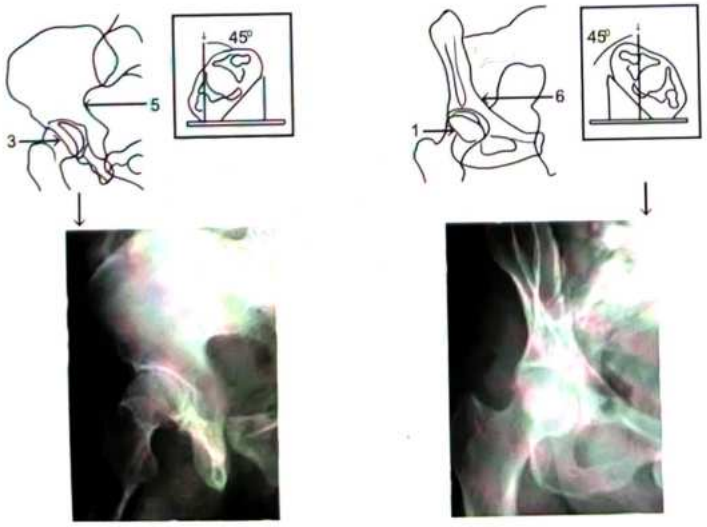
- For developmental dysplasia of Hip
- Shows Shallow acetabulum

2. Swimmer's view



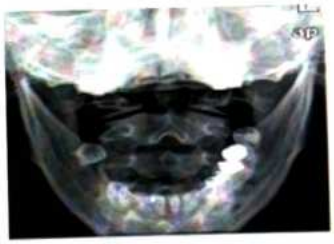
- For cervico thoracic junction

3. Judet View



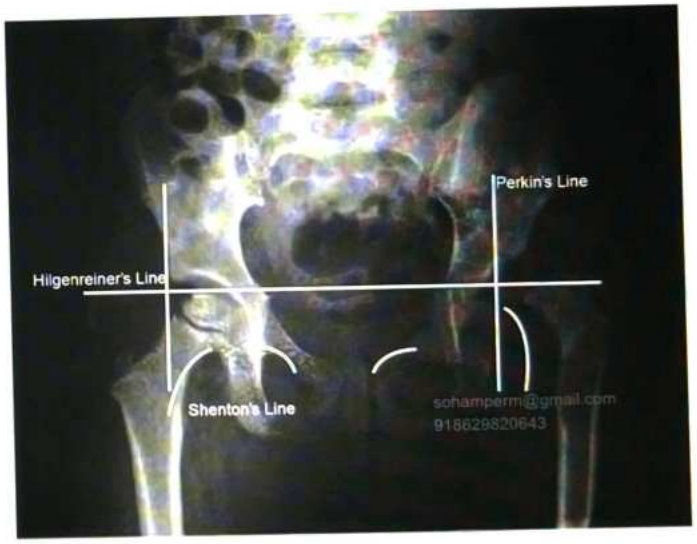
- To view different orientation of acetabulum

4. Open mouth view



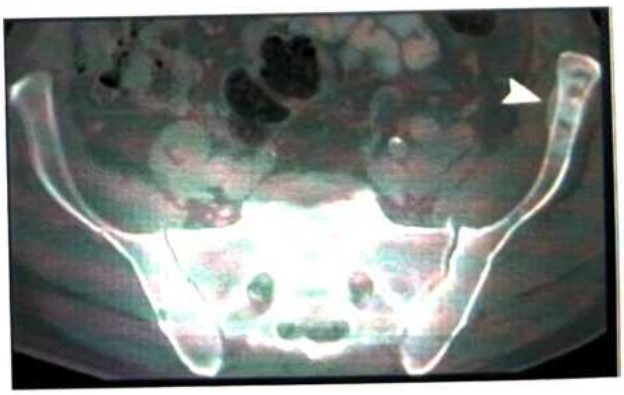
- Used for Odontoid fracture and to see upper cervical spine C_1 and C_2

5. Shenton's Arch



- Lost in fracture or dislocation (Fracture of pubic rami or dislocation of Hip)

CT scan



- Shows cortex and calcification
- Cortex looks white on CT

MRI

- Cartilage and soft tissues are seen on MRI
- Soft tissues include Nerve, Muscle, fascia, Ligament etc.

LEARNING OBJECTIVES

UNIT 2: BONE & JOINT INFECTIONS

- **Osteomyelitis**
  - Osteomyelitis basics
  - Ober's test
  - Osteomyelitis of Adult
  - Osteomyelitis in Newborn
  - Joint infections: Tom smith arthritis, Brodies abscess

- **Chronic osteomyelitis**
  - Chronic osteomyelitis
  - Garre's sclerosing osteomyelitis
  - Paprika sign
  - Negative pressure wound therapy
  - Multifocal osteomyelitis
  - Septic arthritis: Clinical features, Investigations and Treatment

- **Joint & soft tissue infection: Infections of Hand, Spaces of hand and Mycetoma**

6 OSTEOMYELITIS

Osteomyelitis basics 00:13:53

- Mc organism: Staphylococcus Aureus.
- Mc location: Metaphysis
- Mc spread of infection: Hematogenous

Exceptions

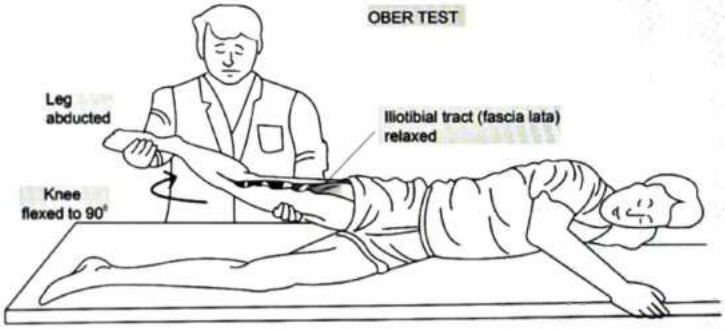
- Sickle cell anemia: Salmonella
  - Salmonella affects the Diaphysis (MC)
  - S. Aureus affects the Metaphysis
- IV drug users: Pseudomonas
- Foot infection: Pseudomonas.
- Human bites: Eikenella
- Animal bite: Pasteurella
- Open injuries: Staph Aureus.

Positions of Lower limb 00:15:57

- FABER
  - Flexion + Abduction+ External rotation
  - Position in which joint have maximum capacity
  - Seen in
    - →Synovitis
    - →Infection (Septic arthritis - Misnomer)
    - →Iliotibial band contracture (Polio)
    - →Anterior dislocation

- FADIR
  - Flexion + Adduction + Internal rotation
  - Less capacity
  - Seen in: Posterior dislocation/ Arthritis
- Posterior dislocation > Anterior dislocation

Ober's Test 00:18:26



- It is a test for iliotibial band contracture
- The examiner Abduct the hip, flex the Knee, external rotate the hip and drops the Thigh
  - If the thigh drops towards the opposite knee: test is Negative
  - If the thigh stays up: positive test

Osteomyelitis in adults 00:18:53

- Cause
  1. Depleted RES (Monocyte macrophage system weak)
  2. Vascularity High
  3. Hair pin loop system (Stasis of circulation)
  4. Micro trauma (occurs here commonly)

- Overall most common site: lower end femur
- Overall most common site in adult: vertebral body (Spine)
- Overall most common joint: Knee

Osteomyelitis in newborn

- Reduce movement of limb, Toxic child, and Metaphyseal tenderness establishes the diagnosis of osteomyelitis

	Osteomyelitis <24 hrs	Osteomyelitis >24 hrs
• **X-ray**	• No loss of soft tissue planes	• Loss of soft tissue planes
• **MRI**	• Marrow changes in metaphysis	• Marrow changes in metaphysis
• **Bone scan**	• Increased activity	• Increased activity
• **Treatment**	• Started with IV antibiotics • Once conditions begins to improve or CRP values return to normal (usually for 2 weeks) then antibiotics are given orally for another 4 weeks	• Evacuation and exploration of pus and antibiotics for 6 weeks

- MRI change occur within 6 hrs of infection
- Bone scan changes within 12 hrs of infection
- X-ray changes occurs after 24 hrs of infection (X-ray differentiates whether to operate or not)

Joint Infections 00:22:23

- Faber at Hip
  - 0-5 year old, toxic child, Absent mobement of joint: septic arthritis (S. aureus)
    → Diagnosis by X-MAS (Xray, MRI, Aspirate by Ultrasound guidance)
    → Treatment: Surgery
  - 6-12 years of age, Non-toxic, decreased movements of joint: Transient synovitis
    → Diagnosis by X-Mas (Xray, MRI, Aspirate by Ultrasound guidance)
    → Treatment: Rest

	Septic arthritis	Transient Synovitis
• **FABER**	(+)	(+)
• **AGE**	<5 years	
• **Movement of joint**	Absent	Decreased

Tom Smith Arthritis

- AKA Septic Arthritis of Hip in infants
- Destroyed femoral epiphysis leading to hyper mobility of Hip Joint

Brodie's Abscess 00:25:13

- Sub-Acute Osteomyelitis > Chronic Osteomyelitis
- Location: upper end of tibia
- Lytic Lesion with sclerotic margin
- Seen in Immunocompetent host

Brodie's Abscess

CLINICAL QUESTIONS

Q. A 10-year-old boy presents with gradually progressing swelling and pain for 6 months over the upper tibia. A radiographic image of the tibia is given. Identify the given condition?

A. Subungual infection
B. Subacute osteomyelitis
C. Web space infection
D. Infected hematoma

Answer: B

Solution

Brodie's Abscess:(subacute osteomyelitis**)**

- Seen in immunocompetent Host
- Long-standing localized pyogenic abscess in the bone (long-standing because of the strong defense mechanism of the body).
- Involves long bones (metaphysis or diaphysis), e.g. Upper-end tibia.
- Classical Brodie's abscess looks like a small walled-off (Sclerotic margins) cavity in bone with little or no periosteal reaction.
- The usually isolated organism is Staphylococcus aureus (although most cultures are negative).

- **Treatment:** Immobilization and antibiotics for 6 weeks if the diagnosis is clear.
- When the diagnosis is unsure then an open biopsy is needed and the lesion may be curetted at the same time.

Q. A 12-year-old boy injures his lower left thigh during a high school football game. The pain subsides for several hours but returns during the night, and the boy develops chills followed by a fever of 39.5°C. A physician examines him the next morning and notices that the lower left thigh is hot, swollen, and tender. The knee joint appears normal and has a full range of motion. The patient has a temperature 38.3°C. X-rays of the left femur was done which indicates soft tissue swelling without any obvious abnormalities of the bone. Identify the most commonly affected area in the given clinical scenario?

A. Epiphysis
B. Diaphysis
C. Metaphysis
D. Articular surface

Answer: C

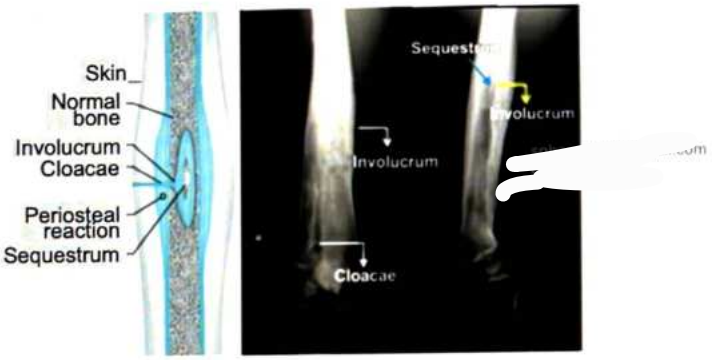
Solution

- The given case is a typical presentation of Acute Osteomyelitis
- In children osteomyelitis typically presents with some combination of fever, pain, swelling, erythema and warmth to the involved area. Patients will commonly have symptoms for 6–8 days prior to presentation, although this varies with the microbial etiology. Patients also frequently report a history of minor blunt trauma to the affected area. Although osteomyelitis may involve any part of the skeleton, the long bones of the lower extremities are among the most frequently affected followed by the pelvis.
- Metaphysis of long bone is the earliest and most common site involved in osteomyelitis.
- It starts in metaphysis because of:
  - Rich blood supply
  - Hair pin bend of metaphyseal vessels (leads to vascular stasis and decreased oxygen tension)
  - Metaphyseal hemorrhage due to repeated trauma (acts as culture media)
  - Defective phagocytosis in metaphysis (Inherently depleted Reticuloendothelial System

7 CHRONIC OSTEOMYELITIS

Chronic Osteomyelitis

- Acute: <2 weeks
- Sub acute: 2-3 weeks
- Chronic: > 3 weeks (AKA dead bone)
- Sequestrum: Dead bone (Sequestrum is cause of sinus)
  - Looks white on X ray
  - Surrounded by infected granulation tissue
- Involucrum: Reactive live bone outside of sequestrum
- Cloacae : sinuses through involucrum
- Complications
  - Amyloidosis
  - Malignancy: Squamous cell carcinoma



Garre's Sclerosing Osteomyelitis

00:03:09

- Chronic Osteomyelitis
- Mandible > Tibia

Treatment

- Remove Sequestrum
- Control the infection
- Fill the Gap using
  - Bone graft: Taken from iliac crest
  - Bone cement: Poly methyl Meth Acrylate (PMMA)
- Negative pressure Wound therapy (NPWT)

Paprika Sign

00:04:54

- While removing the dead bone, there is presence of bleeding from the live bone underneath the dead bone known as paprika sign.

Negative pressure Wound therapy (NPWT)

00:05:47

- AKA vacuum assisted closure (VAC)
- Vacuum dressing enhances healing of wound by removal of fluid collecting with it.
- Suction pressure: 75 to 125 mm Hg
- Continuous or intermittent
- Gives Good Granulation tissue
- Contraindications
  - Malignancy
  - Untreated OM

- Necrotic Eschar
- NPWT is also used for pressure sore.

Osteomyelitis in new born

- Organism: S. Aureus
- Location: Metaphysis
- Mechanism of spread: Haematogenous
- Multifocal (spread wide)
- Paucity of clinical signs (new born has less immunity)
- Poor prognosis

Multifocal osteomyelitis 00:07:21

1. Sapho Syndrome

- Synovitis
- Acne
- Pustulosis
- Hyperostosis (Thickened bone)
- Osteitis (inflamed bone)
- Auto immune Disease (HLA $B27^{(+)}$)
- Treatment: NSAIDS/Steroids/DMARDS

Septic arthritis 00:08:33

- Diagnostic criterion (Morrey and associates criterion) 5 out of 6 must be present
  1. >38.3°C temperature
  2. Swelling of suspected joint
  3. Pain in joint that increase with movement
  4. Systemic symptoms
  5. No other pathologic process'
  6. Satisfactory response to antibiotics therapy
- Knee is the most commonly affected joint: position is flexion
- Hip: Position is Flexion, abduction, and external rotation as this is the position of maximum capacity of joint to accommodate pus
- Treatment
  - Arthrotomy (opening the joint capsule), Surgical drainage (decompression), synovectomy and antibiotics (2 weeks IV and 4 weeks oral)
  - No role of conservative management
  - Septic arthritis results in bony ankylosis and it is the most common cause of bony ankylosis

- Kochers criteria
  - Inability to bear weight
  - Temperature > 38.5°C
  - WBC>12000/microliter
  - ESR>40 MM/HR

CLINICAL QUESTIONS

Q. A 45 years old male patient has developed pain and swelling in thigh on further query he states that he had met up with road traffic accident 2 years back, His X-ray is shown in the image given below. What is the finding which makes you arrive at the most probable diagnosis?

A. Sequestrum
B. Cloacae
C. Involucrum
D. Brodie's abscess

Answer: A

Solution

- Sequestrum is the dead bone separated out from the living bone by the granulation tissue.
- This sequestrum acts as a nidus for infection.
- It is the most common cause of non-healing in chronic osteomyelitis.
- The factors responsible for bone death in chronic osteomyelitis are:
  - Raised intravascular pressure
  - Vascular stasis and small vessel thrombosis
  - periosteal stripping
  - bacterial toxins
  - Sequestrum is the hall mark of chronic osteomyelitis.
  - Involucrum—periosteal new bone forming later.
- Involucrum is the dense new sclerotic bone surrounding the sequestrum. It is formed from deep layers of stripped periosteum.
- Cloacae are the perforations in the involucrum. Pus and tiny spicules of bone may be discharged through them.

Q. A 20-year-old male presents to you with an x-ray showing expanded bone with generalized sclerosis. Identify the false statement about the given condition?

A. It is a type of chronic osteomyelitis
B. Tibia is more commonly involved than mandible
C. Long segments of bone are involved
D. Associated with excessive bone formation

Answer: B

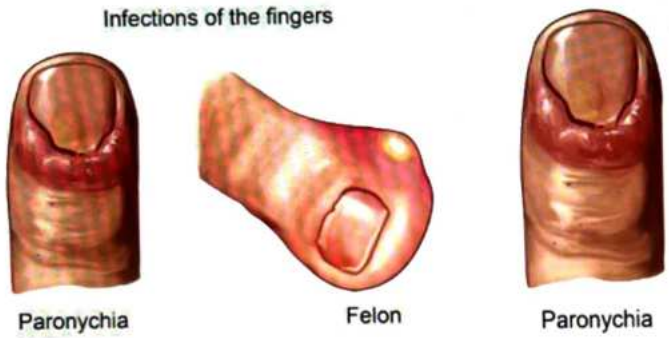
Solution

- The given findings point towards is Garre's sclerosing osteomyelitis
- Garre's sclerosing osteomyelitis is characterized by the absence of pus.
- It is caused by a mild anaerobic infection that is effectively contained by the host's immune system. Hence there is no abscess formation or sequestration.
  - Involves long segments of bone
  - Mandible > Tibia
  - A low-grade inflammatory lesion with reactive bone formation
  - Microorganisms are seldom isolated but staphylococcus is considered as the causative agent.
  - Th[illegible]periosteal reaction by an extremely sensitive periosteum in response to a low-grade anaerobe.
  - Manifests as long-standing chronic Osteomyelitis without any abscess or sequestrum formation.
  - Xray: Expanded bone with generalized sclerosis
  - ESR: usually elevated
  - Culture: Usually Negative
  - Antibiotics and fenestration of the sclerotic bone is usually helpful

8 JOINTS & SOFT TISSUE INFECTION

Infections of hand 00:00:13

- Mc Infection of Hand: Paronychia
- Mc organism: S. Aureus



1. Felon or Whitlow
- Involves pulp space
- Usually involves the Thumb > index finger
- Treatment: Vertical incision: preferred
- Fish mouth (Horizontal) incision: Not preferred
- Complication: Osteomyelitis> Tenosynovitis

Previous Year's Questions

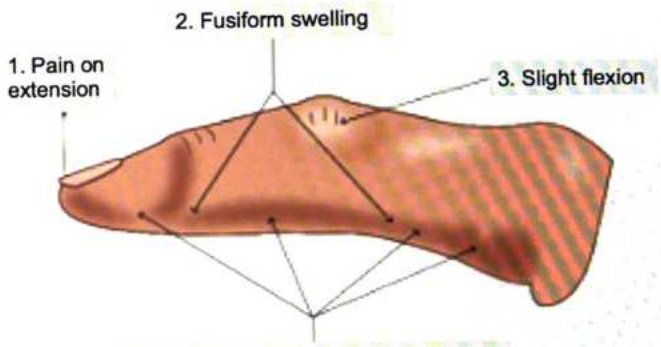
Q. Which of the following is not true about the given image? (FMGE Aug 2020)

A. May cause Osteomyelitis
B. May be caused due to pin prick injury
C. Causative Organism is staph epidermidis
D. May be treated initially by antibodies

2. Paronychia
- MC infection of Hand
- Involves nail bed
- MC organism S.Aureus
- Rx: Antibiotics + surgical drainage (sometimes requires removal of part of nail)

3. Infectious Tenosynovitis 00:01:32

Purulent tenosynovitis
four cardinal signs of Kanavel



- Infection of flexor tendon sheath of finger causing flexion, Percussion tenderness, and pain on stretch

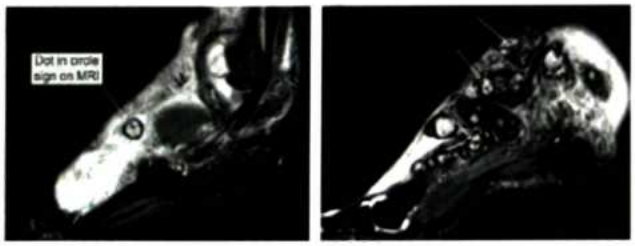
4. Kanavel's Sign
- Pain on extension (stretch)
- Fusiform swelling
- Flexion of finger
- Tenderness along tendon sheath: Most specific

Spaces of hand 00:02:32

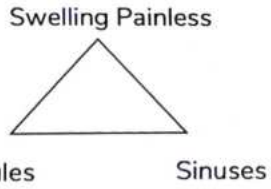
Refer Image 8.1

- Thenar Space: Index finger tendon &1st Lumbrical
- Mid palmar space: Middle finger, Ring & Little fingers 2nd, 3rd, & 4th Lumbricals
- Forearm Space of Parona
  - The place where Radial & Ulnar bursa joins
  - Infection of Little finger can go to thumb but not to index finger
- Function of lumbricals: Metacarpophalangeal joint flexion and Interphalangeal joint extension
- Nerve supply: 1st two lumbricals supplied by Median nerve, 3rd & 4th Lumbricals are supplied by Ulnar nerve
- Injury to Median / Ulnar nerve will cause Claw Hand
  - Hyper extension of Metacarpophalangeal joint
  - Flexion of Inter phalangeal joint
- Rx of Claw Hand: Knuckle bender splint

Mycetoma 00:05:08



- AKA Madura Foot
- Has multiple discharging sinuses
- "Dot Circle Sign" in MRI
- Mycetoma is a Chronic progressive granulomatous exogenous infection of subcutaneous tissue
- Actinomycetoma (Rapid) and eumycetoma (slow)
- Caused by thorns / soil (barefoot: Exogenous
- Involves all structures except nerves and tendons
- Triad: Tumor like swelling (painless), sinuses and Granules



- Sunray appearance &Codman's triangle is seen
- Involves all structures except nerves & tendons
- Lytic cavities in bone

Important Information

- **Painless conditions**
  1. **Mycetoma**
  2. **Charcot's Joint (neuropathic)**

PRACTICE QUESTIONS

Q. True/ false in view of septic arthritis? 00:23:10

A. Widening of joint space is there

B. Staph aureus is the most common organism in young children & neonates

C. I/D done after culture & aspirate & antibiotics for 24 hrs

D. Kocher's criteria is used to differentiate from transient synovitis

E. Position of hip is FADIR

Ans. F, T, F, T, F

KOCHER'S CRITERIA

- Patient is not able to bear weight
- ESR ≥ 40 mm/hr
- Fever > 38.5°C
- WBC > 12,000 cells / µl

Important Information

- **From 3% for one positive to more than 90% for four positive is the sensitivity of Kocher's criteria**

Q. Synovial tenosynovitis of flexor tendon. What is the correct statement? 00:24:20

A. The affected finger is extended at all joints

B. It has to be conservatively managed

C. Little finger infection can spread to thumb but not to index finger

D. Patient presents with minimal pain

Ans. C

Q. Multifocal osteomyelitis is associated with?

00:24:26

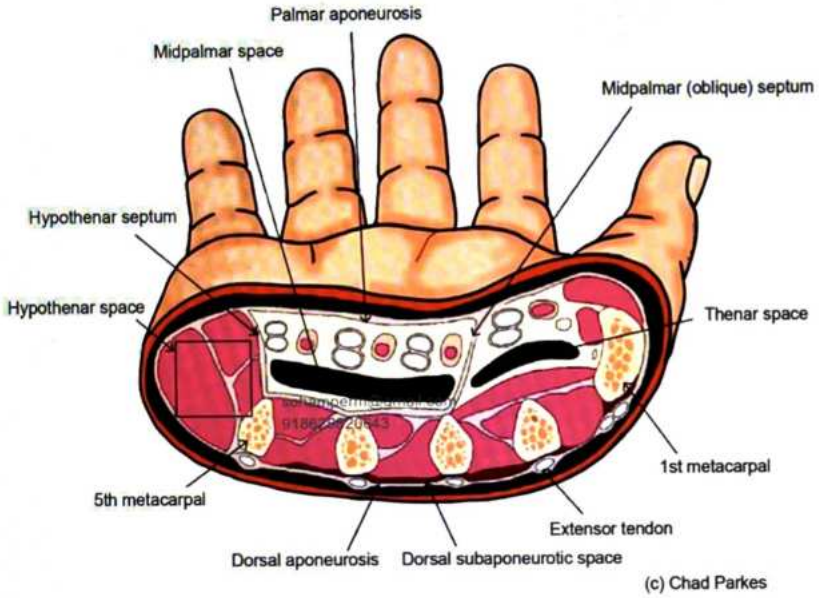
A.SAPHO syndrome
B.Sickle cell anaemia
C.Thalassemia
D.Salmonella infection
Ans. B

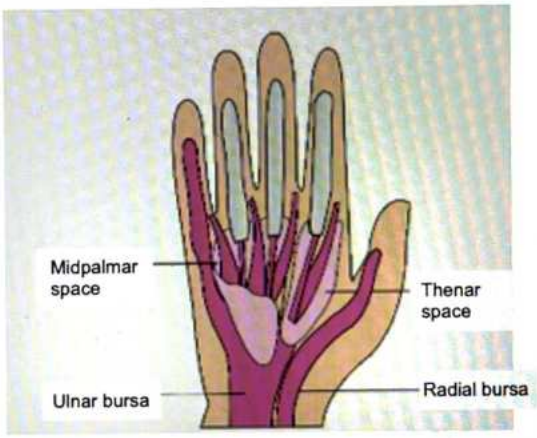
Q. In osteomyelitis of spine, most common causative organism is?

00:24:33

A.Staphylococcus aureus
B.Pseudomonas
C.Tuberculosis
D.Streptococcus
Ans. A

Images 8.1





CLINICAL QUESTIONS

Q. A 18 year old presents with the given condition. Identify the correct statements regarding the given condition?

A. The affected finger is extended at all joints
B. It has to be conservatively managed
C. Little finger infection can spread to thumb but not to index finger
D. Patient present with minimal pain

Answer: C

Solution

- The given clinical condition is Synovial tenosynovitis
- Synovial tenosynovitis is a very painful condition that presents with Kanavel's sign which has the following features:
  1. Flexion of fingers
  2. Pain on active flexion
  3. Pain on stretch
  4. Percussion tenderness
- Little finger infection can spread to the thumb but not to the index finger:
- In the thumb and little finger, the sheaths are co-extensive with the radial and ulnar bursae, which envelop the flexor tendons in the proximal part of the palm and across the wrist; these bursae also communicate with Parona's space in the lower forearm. In neglected cases infection may spread proximally within the radial or ulnar bursa, or from one to the other (a 'horse-shoe' abscess);
  1. The affected finger is extended at all joints: It is flexed
  2. It has to be conservatively managed: Surgery is required if no improvement within 24 hours
  3. Patient present with minimal pain: It is a very painful condition

Treatment

- Conservative management
- Surgery (drainage and irrigation)

Complications

- Tendon necrosis
- communication of infection with radial or Ulnar bursa or both(horseshoe abscess) or with Parona's space(deep to flexor tendons).

Q. You are posted in the casualty department and receiving a 21 yr old sexually active male presented with complaints of severe pain, pus discharge from the right lower limb. On examination, multiple sinus tracts and tissue necrosis over the underlying bone are noted. On further asking about the sinus tract discharge, patient admits that he had seen bony spicule discharge from the tracts. Radiographs ordered and you suspect him as a case of Chronic Osteomyelitis. Which of the following organism would be the most probable cause of the disease in this patient?

A. Staph aures
B. Neisseria gonorrhea
C. Group B Streptococcus
D. Brucella bacillus

Answer: B

Solution

- Agent Factors:
  - The following myriad of incriminating organisms is responsible for its causation:
  - "S" series organisms ("S" denotes severe osteomyelitis and those organisms causing it start with the letter "S")
    - → Staphylococcus aureus (60-85%): This is the most common organism causing acute osteomyelitis.
    - → Streptococcus hemolyticus (8-10%)
    - → Salmonella: Osteomyelitis is relatively rare and presents an interesting picture as most of its features start with "S".
      - Several bones involved
      - Symmetrical involvement of bones
      - Severe osteomyelitis
      - Spine may be involved
      - Sickle cell anemia present
      - Stool culture may be positive.
  - P-series organisms (their mode of entry is through punctured wounds)
    - → Pseudomonas
    - → Pneumococcus.
  - C-series (C denotes compound fractures)
    - → Clostridium welchii
    - → Coliforms (E. coli).
  - B-series
    - → Brucella bacillus.
  - H-series

- → Hemophilus influenzae (7 months to 4 years) This is known to cause osteomyelitis in the age group of 7 months to 4 years.
- T-series
  - → Treponema pallidum (syphilitic osteomyelitis)
  - → Tubercle bacillus (Mycobacterium).
- Fungal osteomyelitis (ABC)
  - → Actinomycosis
  - → Blastomycosis
  - → Cryptococcosis and coccididomycosis

LEARNING OBJECTIVES

UNIT 3: TUBERCULOSIS OF BONES & JOINTS

Tuberculosis

- Basics, Tb spondylitis, Pott's spine
- Surgical approach for TB spine
- Joint replacement
- TB HIP
- Tb knee

9 TUBERCULOSIS OF BONE & JOINTS

Basics

- MC primary site: Lung > Lymph nodes
- Hematogenous spread & lesions are paucibacillary (difficult to isolate)
- Order of involvement of various parts: Spine > Hip > Knee
  - TB Spine: "Pott's spine"
  - Shoulder: "Caries Sicca" (dry, does not produce effusion)
  - Digits: "Spina Ventosa" (periosteal reaction is seen)

TB spondylitis

- TB of spine is also called as TB Spondylitis
- TB spine involves 2 consecutive vertebrae (lower half of upper vertebra & upper half of lower vertebra) along with disc in between
  - As they arises from same mesodermal somite, they have common segmental artery supplying it
  - That is why TB is always a two vertebral disease, & disc, involves bone & cartilage both.
- TB is called as Paradiscal Lesion (Involves 2 contiguous vertebra along with abscess)
- M/c Paradiscal lesion
- This infection is anterior to neural tissue
- Malignancy involves posterior elements & is a single vertebral disease
- Rarest lesion: Facet joints > Spinous process

Pott's spine

- 2 vertebral disease
- Involves the vertebra and disc
- Bone and cartilage
- Paradiscal
- Anterior disease
- Posterior elements and single vertebral disease is malignancy
- Winking Owl Sign: Destruction of one of the pedicles

- Blind bat sign: Destruction of both the pedicles
- Location: DL> D>L>DL junction

- DL junction: D_{11}-D_{12}, L_1
- Earliest symptom: Pain
- Earliest sign: Tenderness
- Earliest neurological sign: Increased deep tendon reflex (Clonus)

Treatment

- ATT + Rest+ Surgery when indicated (middle path regimen)
- Indication of surgery in any disease of spine

1. Bowel bladder involvement
2. Worsening
3. No improvement

Surgery approach for TB spine 00:08:10

- Anterior: Not used, because of too many structures
- Posterior: Not used, can damage posterior structures of vertebrae leading to instability
- Left side approach: Aorta; preferred as artery can be repaired
- Right Side approach: IVC, not used (difficult to repair once torn cannot be repaired)
- Two surgical approaches in TB Spine:
  1. Antero lateral decompression + Bone grafting
  2. Anterior decompression + Bone grafting: Better Results

Important Information

- **Never touch posterior elements in Pott's spine**

Previous Year's Questions

Q. Surgery including biopsy is indicated in Tb spine in all except? (AIIMS June 2020)

A. Evolving cauda equina syndrome
B. Cold abscess without equina syndrome
C. Drug resistant TB
D. Doubtful

Good prognostic factors

1. Young age
2. Early disease
3. Active disease
4. Slow worsening
5. Normal spinal cord

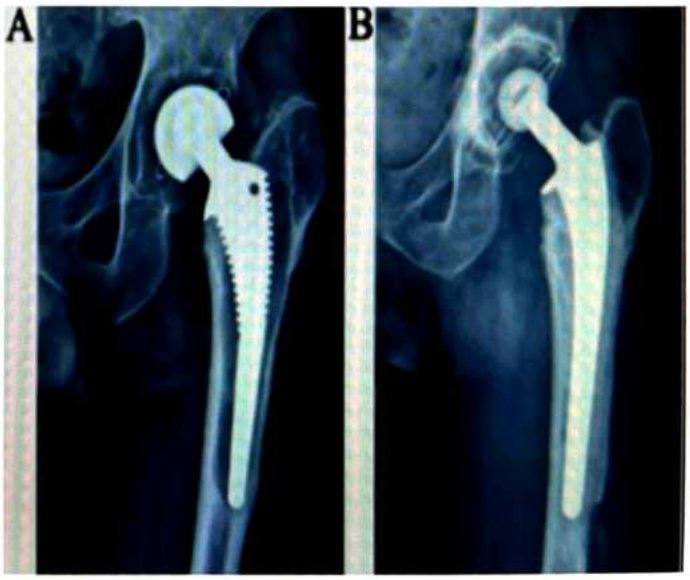
Features	Better prognosis	Poor prognosis
• Duration of cord involvement	• Shorter	• Longer (>12months)
• Speed onset	• Slow	• Rapid
• Age	• Younger	• Older
• Vertebral disease	• Active	• healed
• Cord on MRI	• Normal	• Myelomalacia/ syrinx (cord damaged)

Few terminologies

- Arthrodesis
  - Surgical fusion
  - Bony
  - Painless
  - [illegible] plate is used for hip arthrodesis
- Ankylosis: Pathological fusion of a joint

Fibrous ankylosis	Bony ankylosis
• Painful (because some movement is present in fibrous)	• Painless
• TB hip & knee • RA	• Septic arthritis > TB spine > ankylosing spondylitis

Joint replacement 00:13:14



Cemented	Uncemented
1. Using cement	1. Using porous coating
2. Cheap	2. Expensive
3. Elderly patients	3. Patient with normal bone quality (young patients)
4. Shorter half life	4. Longer half – life Image

Types of prosthesis

- Austin Moore: Stem has two fenestrations/holes
- Thompson: Prosthesis without fenestrations

THOMPSON PROSTHESIS

AUSTIN MOORE

Total Hip replacement:

- Replace both sides of the joint
- Both acetabulum & femur

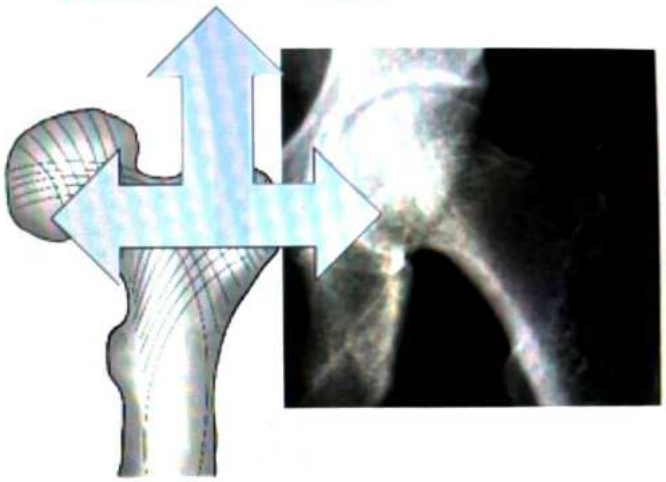
Complications of THR

- Infection (rare)
- Dislocation (rare)
- Mortality Cause: MI>CRA (cardio-respiratory arrest) >PE (Pulmonary embolism)
  - Pulmonary embolism - 48 hrs after THR
- Metal associated complications
  - Hypersensitivity
  - Teratogenicity (Contraindicated in young female)
  - Renal insufficiency
  - Chromosomal abnormalities (prostate& lung CA)
  - Carcinogenesis

TB HIP 00:18:02

Babcock's triangle

Babcock's triangle



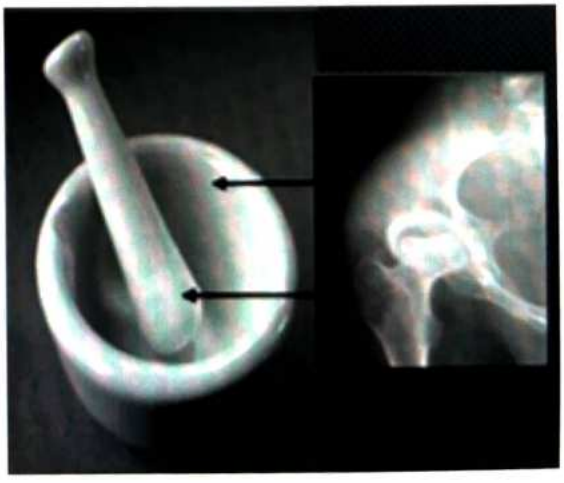
- Area of femur with decrease monocyte macrophage system
- Commonest area where TB bacilli sit
- Commonest area affected in TB hip: Acetabulum
- Mc site in femur: Babcock's triangle

Stages of TB Hip

1. Synovitis: FABER (lengthening)
2. Early Arthritis: FADIR + < 1 cm shortening
3. Late Arthritis: FADIR + >1 cm shortening (gross movements restricted)
4. Wandering acetabulum (misnomer – femoral head wanders)
5. Fibrous ankylosis (TB arthritis)

Peri articular osteopenia

- Due to hyperemia caused by inflammation of TB hip
- 1st radiological feature of TB arthritis: Peri articular osteopenia
- 1st radiological feature of TB spine: Loss of curvature of spine



TB Knee

00:20:04

- Gradual pain: as TB is a Chronic infection
- Limp
- Knee flexion: More capacity
- Synovitis: flexion of knee joint
- Radiological evidence: Synovial proliferation / Synovitis
- Complication: TRIPLE Deformity
  1. **P** - **P**osterior subluxation of tibia
  2. **ER** - **E**xternal **R**otation of leg
  3. **F** - **F**lexion of knee

How to remember

- PERF

- Triple deformity of knee is also seen in
  - Tuberculosis
  - Rheumatoid arthritis
  - Iliotibial band contracture
  - Polio
  - Low clotting power
  - Excess bleeding

PRACTICE QUESTIONS

Q. A 30/M HIV positive on antiretroviral therapy is now having pain in right hip region & flexion, abduction & external rotation deformity of right hip since last 2 months, what is the most likely diagnosis?

A. Avascular necrosis
B. TB hip
C. Transient synovitis
D. Septic arthritis

Ans. B

- HIV + FABER - TB hip is most likely

Q. A 30/M HIV positive on antiretroviral therapy (protease inhibitors), is now having pain in right hip joint for 2 months. He has difficulty in abduction & internal rotation. Which of the following is most likely diagnosis?

A. Avascular necrosis
B. TB hip
C. Transient synovitis
D. Septic arthritis

Ans. A

- Protease inhibitors - vascularity is compromised - Avascular necrosis

CLINICAL QUESTIONS

Q. A 62-year-old man who had suffered a tuberculous coxitis in early childhood associated with severe low back pain. Has been taken up for Total hip Replacement by the surgeon. What is the most common complication which can lead to death in this patient?

A. Myocardial Infarction
B. Cardio- Respiratory arrest
C. Pulmonary embolism
D. Infection

Answer: A

Solution

- Total Hip replacement: Replace both sides of the joint Both acetabulum & femur

Complications

- Infection (rare)
- Dislocation (rare)
- Mortality Cause: MI>CRA (cardio-respiratory arrest) >PE (Pulmonary embolism)

Metal ion associated complications:

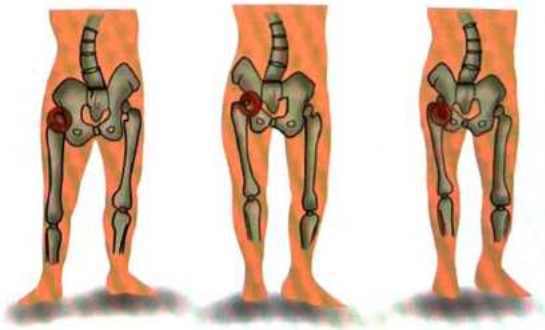
- Hypersensitivity
- Teratogenicity (Contraindicated in young female)
- Renal insufficiency
- Chromosomal abnormalities (prostate& lung CA)
- Carcinogenesis

Q. 30 year old male who is positive for HIV and on antiretroviral therapy has pain in right hip region. Flexion, abduction and external rotation deformity of right hip for 2 months. What is the most likely diagnosis?

A. Avascular necrosis
B. TB hip
C. Transient synovitis
D. Septic arthritis

Answer B.

Solution



Stages of Tb hip:

- Stage of synovitis: The hip joint is held in flexion, external rotation and abduction causing apparent lengthening (FABER) Joint is in position of maximal capacity.
- Stage of early arthritis: Damage to articular cartilage sets in. Deformity: flexion, adduction and internal rotation (FADIR). Shortening<1cm.
- Stage of advanced arthritis: Further advancement of destruction and above clinical signs
- Advanced arthritis with subluxation or dislocation

	TB hip in HIV	AVN hip in HIV
Incidence	• More Common	• Less Common
Deformity	• FABER-stage of synovitis may be prolonged on treatment, then subsequently with onset of arthritis – FADIR ensues.	• Limitation of abduction and internal rotation so initially position is adduction and external rotation (opposite to movements limited) and then subsequently with onset of arthritis FADIR ensues.
	• Unilateral (usually)	• Bilateral (usually)

LEARNING OBJECTIVES

UNIT 4: ORTHOPEDICS ONCOLOGY

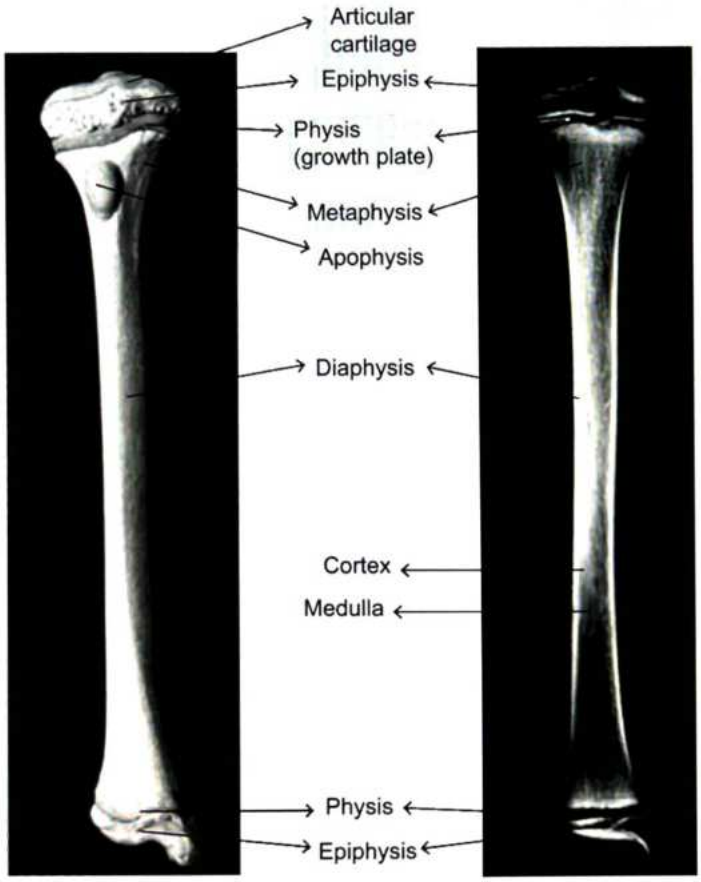
- **Orthopedics oncology**
  - General principles
  - Skeletal maturity
  - Occurrence sites of bone tumors
  - Enneking staging
  - General principles

- **Benign bone tumors**
  - UBC
  - ABC
  - Codman's tumor
  - Non ossifying fibroma
  - Osteochondroma
  - Osteoidosteoma, Ivoryosteoma
  - Enchondroma, Syndromes associated with enchondroma
  - Giant cell tumor
  - Fibrous dysplasia
  - Mc cune Albright, Mazarbraud's syndrome
  - Langerhans cells histiocytes
  - Hemangioma, chondroma

- **Malignantbonetumors**
  - Osteosarcoma
  - Ewing's sarcoma
  - Chondro sarcoma
  - Multiple myeloma
  - Chordoma
  - Synovial sarcoma
  - Lytic lesions in skull
  - Plasmacytoma
  - Langerhans cell histiocytosis
  - Metastatic tumors of bone

10 GENERAL PRINCIPLES OF BONE TUMOR

General principles



- Dx of bone tumor: Part affected > Age of patient
- Part affected
  - Metaphysis: Osteo sarcoma
  - Diaphysis: Osteoid osteoma, Adamantinoma, Ewing's sarcoma
  - Epiphysis: Chondroblastoma > Giant cell tumor
    →Epiphysis with calcification: Chondroblastoma
- Upper end of humerus: Simple bone cyst (unicameral bone cyst) > Chondroblastoma (calcified)
- Aneurysmal bone cyst: Tibia
- Lower end femur: Osteosarcoma and Giant cell tumor
- Epithelial Tumors
  - Tibia: Adamantinoma
  - Mandible: Ameloblastoma
- In mandible, most common tumor is SCC

Enneking staging of Bone tumors

- Part affected > age
- Age
  - 1st decade: Ewing Sarcoma
  - 2nd decade: Osteo Sarcoma
  - After skeletal maturity (20-40 years): GCT
  - ES 2^{nd} > 1^{st}decade
  - After 40 years: Metastasis > Multiple myeloma
- Most common tumor of bone: Metastasis
  - Metastasis usually come from: breast > Prostrate > Lungs
  - If metastasis occur in children, then it will be from: Neuroblastoma
- Most common primary tumor of bone: Multiple myeloma

Polyostotic lesion / multiple lesions

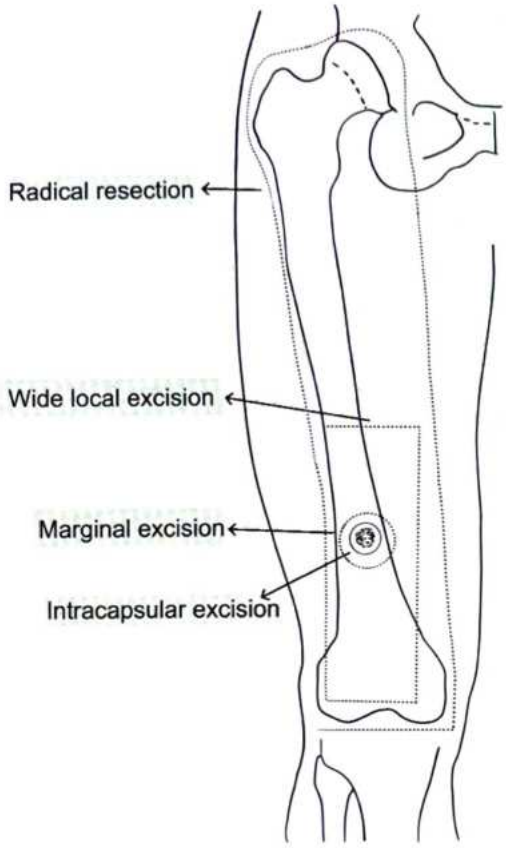
- Exostosis aka Osteo chondroma (developmental malformity)
- Fibrous dysplasia (develo[illegible]rmity)
- Enchondromas
- GCT
- Ewing sarcoma

Radioresistant Bone tumors

- Osteo sarcoma
- Chondrosarcoma
- Malignant fibrous Histiocytoma

Treatment of bone tumors

1. Curettage
   - Simple Curettage
   - Extended Curettage: Curettage + installation of phenol.
2. Excision



- Intracapsular excision: remove tumor from centre
- Marginal excision: remove tumour from the pseudocapsule
- Wide local excision (3cm margin): Commonest sx procedure done in orthopaedic oncology
- Radical excision: entire bone or segment is removed

General principles

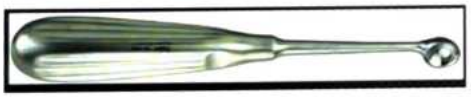
- Benign and cartilaginous tumors: Operated
- Most common surgery wide local excision (3cm margin)
- Cystic lesions: curettage (UBC)
- With chemical to kill residual cells: extended curettage
  - M/c chemical: Phenol
  - Best chemical: Liquid N2
  - Conditions in which Extended curettage is done
    - → Aneurysmal Bone Cyst
    - → Chondroblastoma
    - → Giant Cell Tumor
    - → Enchondroma
- Malignant Tumors: neoadjuvant Chemotherapy followed by Sx with 3 cm margin followed by Adjuvant Chemotherapy
- Ewing's is most radiosensitive bone tumor
- Both Ewing's and Osteosarcoma peak in the 2nd decade
- Ewing's sarcoma and osteosarcoma presents like Osteomyelitis
- Ewing's sarcoma and osteosarcoma involve the Femur
  - Ewing's sarcoma: Diaphysis
  - Osteosarcoma: Metaphysis
- Both Ewing's sarcoma and osteosarcoma are Treated by neoadjuvant Chemotherapy followed by Sx with 3 cm margin followed by Adjuvant Chemotherapy

11 BENIGN BONE TUMORS

Unicameral Bone Cyst

- Upper end of Humerus
- Single cavity, central
- In Metaphysis
- AKA Simple Bone Cyst
- 1st decade of life
- Filled with straw coloured fluid
- Trapdoor sign
- Fallen leaf sign (Fallen fragment sign)


- Treatment
  - Curettage + Bone grafting (iliac crest)
  - Aspiration + steroids
  - Aspiration + sclerosants




Aneurysmal Bone Cyst (ABC)

- Multiloculated Eccentric & Expansible
- 2nd decade of life
- In metaphysis
- Commonly in Tibia
- MRI "Fluid Fluid Level" seen (Multiple septate)
- Treatment
  - Extended curettage: best chemical used (liquid nitrogen)
  - Embolization: Highly vascular tumor (Blocks Arterial supply)

	UBC	Aneurysmal bone cyst
Age	1st decade	2nd decade
Site	Proximal humerus, femur	Lower limb (however can occur anywhere)
Location	Central (concentric)	Eccentric
Expansile	Expansile	More expansile
Symptoms	Asymptomatic	Pain is present
Cavity	Single, straw-coloured fluid	Multiloculated, Hemorrhagic fluid
Treatment	Curettage	Extended curettage

Codman's tumour 00:05:16

- AKA Chondroblastoma
- Epiphyseal tumor with calcification
- Usually seen before skeletal maturity
- Seen in upper end of Humerus
- Rx- Extended curettage

Important Information

- Codman's tumor: Chondroblastoma
- Codman's triangle: aggressive bone lesions or periosteal reactions

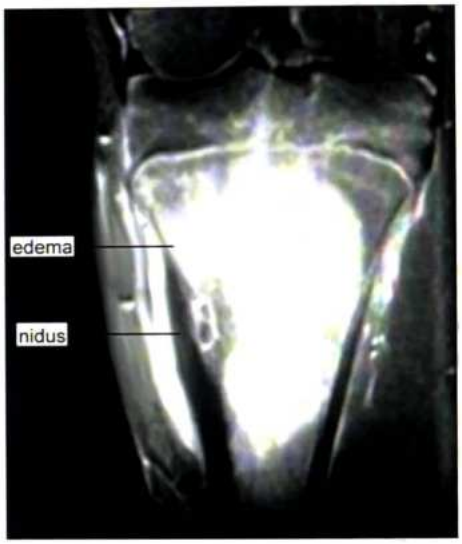
Non-Ossifying Fibroma 00:06:36

- AKA Fibrous cortical defect
- Most common Benign lesion
- In 1st decade
- Involves the Metaphysis
- Self-resolving
- Not premalignant

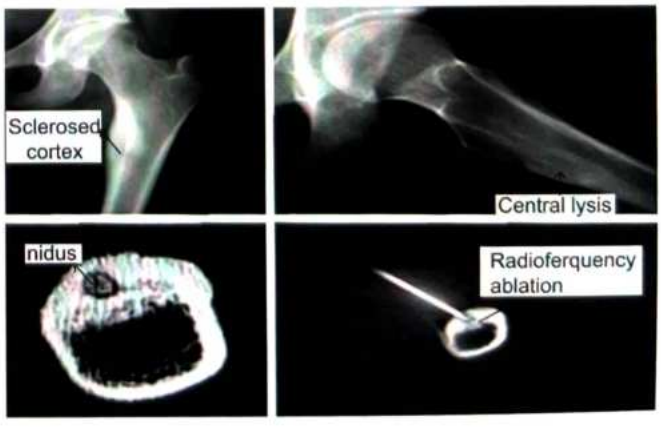
Osteochondroma (Exostosis) 00:07:04

- Before Skeletal maturity
- Diaphyseal aclasia (development malformation)
- Large to feel small on X-rays
- Usually grows away from the joint
- Very commonly seen around the knee and around the shoulder
- Malignant transformation
  - Solitary osteochondroma in <1% can turn malignant into Chondrosarcoma
  - Multiple osteosarcomas in <6% can turn into malignant Chondrosarcoma
- Malignant degeneration to Chondrosarcoma can be suspected when
  - Cartilage thickness > 2cm (measured by MRI)
  - Rapid increase in size
  - Growth after Skeletal Maturity
  - Loss of Differentiation (Cortico-Medullary differentiation)
- Treatment: Extraperiosteal resection (Removal along with periosteum)

Osteoid Osteoma 00:09:36

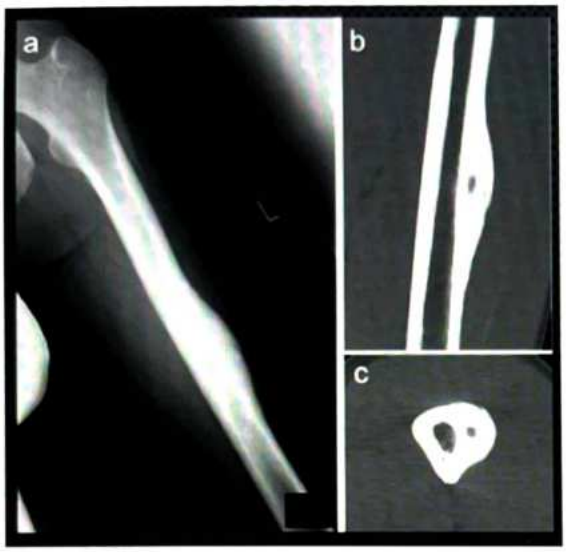


- Night pain relieved by taking salicylates
- Diaphyseal lesion
- Cortical tumour "Thickened Cortex"
- Nidus: Lytic centre with Sclerotic margin
- Nidus has both Osteoblastic and Osteolytic cells



- Rx: Radio frequency ablation > surgical excision

Ivory Osteoma 00:10:36



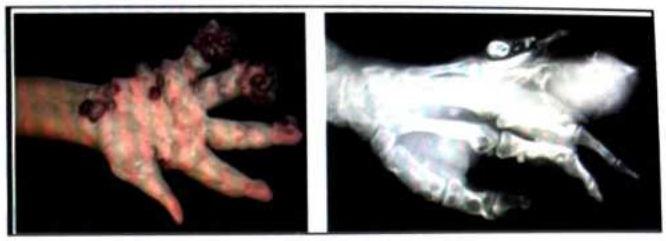
- AKA Compact Osteoma or Eburnated Osteoma
- Seen in skull vault
- Incidental finding
- Requires no treatment

Enchondroma 00:11:11

- Most common tumor of bones of hand / feet
- It calcifies
- On biopsy Hyaline cartilage can be seen
- Rx extended curettage
- 5% cases premalignant

Syndrome associated with Enchondroma

1. Ollier's Syndrome
   - Only enchondromas
   - Multiple
   - Malignant in 30% cases
2. Mafucci Syndrome



- 100% pre-malignant
- Multiple enchondroma + Haemangioma + Phlebolith (calcified superficial veins)

Chondroma

- Popcorn calcification
- O-ring sign

Important Information

- Popcorn calcification is also seen in Breast Fibroadenoma, Lung Hamartomas, Bone-Chondroma
- Ring Sign: Scaphoid-Lunate dissociation
- Rim sign: Chronic Osteomyelitis

Giant Cell Tumour (GCT)

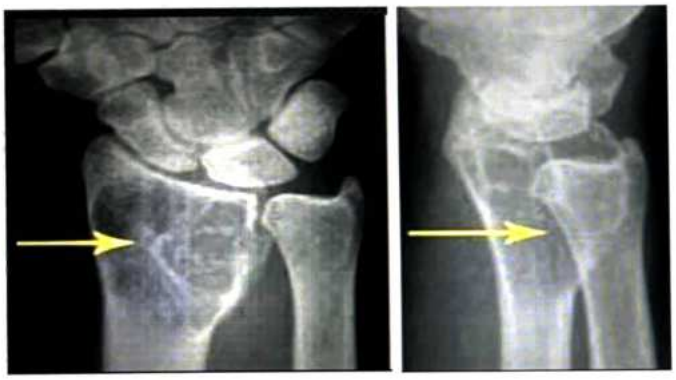
- To differentiate between Aneurysmal bone cyst and GCT

ABC	GCT
• Metaphyseal before skeletal maturity	• Seen at epiphysis after skeletal maturity

ABC

GCT

- Only tumour that can involve the joints
- Only tumour that can involve the cartilage
- GCT has 2 types of cells
  - Giant cells
  - Mononuclear cells: Malignant cells



- GCT: Soap bubble appearance
- Egg shell crackling

Important Information

- Tumor of distal end radius is always GCT until proven otherwise
- Mc site of giant cell tumor is lower end femur
- Lower end femur is Mc site for
  - Giant cell tumor
  - Osteosarcoma
  - Osteomyelitis

- Giant cell variants
  1. FCD (or) non–Ossifying fibroma (commonest) fibrous cortical deficit
  2. FD (fibrous Dysplasia)
  3. ABC closest
  4. UBC
  5. Chondroblastoma
  6. Chondro myxoid fibroma
  7. Osteoblastoma / osteosarcoma
  8. Brown tumor (Hyper parathyroidism)

GCT	GCT variants
• Identical Nucleus (Multiple Mono nuclear cells combine to form a giant cell) • Mets to lungs 3% cases	• Non-Identical Nucleus

- Tissue biopsy to differentiate b/w GCT &GC variants
- Treatment
  - M/c treatment: Extended curettage
  - Excision: More common in upper end of fibula / Lower end of ulna
  - Excision + Reconstruction: Lower end radius

Important Information

- Two locally Aggressive Tumor
  - GCT
  - Adamantinoma

- 3% of GCT can have metastasis

Previous Year's Questions

Q. 46-year-old male presents with lesion involving epiphyseal region of lower end of femur. The multinucleated giant cells and mononuclear cell can be seen on histopathology.
What is the probable diagnosis?

(FMGE Aug 2020)

A. UBC
B. ABC
C. GCT
D. Osteosarcoma

Fibrous dysplasia

- Shepherd crook deformity bone is replaced by fibrous tissue
- Ground glass appearance & bone looks hazy
- At upper end of femur can have a Lytic lesion with sclerotic margin K/a "Rind Sign"
- Developmental malformation
- Associated with McCune Albright syndrome

McCune Albright syndrome

- Has 3 P
  - Polyostotic fibrous dysplasia (multiple bones involved)
  - Precocious puberty
  - Pigmentation (café Au lait- coffee colored spots)

Mazarbraud's syndrome

- Mazarbraud's syndrome is polyostotic fibrous dysplasia- with intramuscular myxomas
- McCune-Albright syndrome
  - Fibrous dysplasia
  - Café au lait spots E
  - Endocrine dysfunction

Important Information

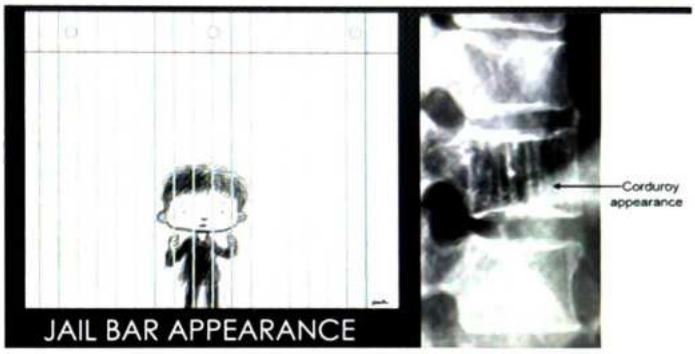
- **Multiple GCT: Goltz syndrome**
- **Olliers syndrome: Enchondromas**
- **Mafuci syndrome: Enchondromas+ hemangiomas + phleboliths**

Langerhans cell Histiocytosis

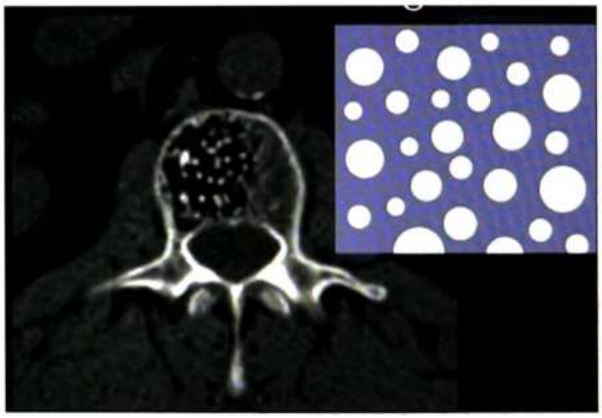
- Letter siwe disease: <3 years fatal
- Hand schuller Christian disease: Lytic skull lesion, Exophthalmos & Diabetes insipidus

- Eosinophilic Granuloma
  - Solitary bone (or) lung lesion (Pulmonary Histiocytosis)
  - Skull: most common bevelled lytic lesion
  - On Biopsy: ells with "Birbeck Granules" (Tennis Racket appearance)
  - Spontaneous resolution

Hemangioma



- X-rays shows
  - Corduroy appearance
  - Vertical striations in vertebra: "Jail bar appearance"
- CT Scan
  - Shows unequal dot signs K/a "Polka Dot Sign", characteristic & very rare



- Rx: Spontaneous Resolution (rarely requires Radio therapy)

Chordoma

- Origin: Notochordal remnants
- 2nd common malignancy of spine after multiple myeloma
- Most common site: Sacrum
- Physaliferous cells are seen
- Rx: Surgical excision +/- Radio therapy

Synovial sarcoma

- The term "Synovial cell sarcoma" is a Misnomer as Synovial cell sarcoma do not arise from Synovium

- Characteristic Translocation (x:18) giving rise to SYT-SSX fusion genes
- Near the joint bursa

  Synovial sarcoma is Biphasic tumour with Epithelial & mesenchymal components
- Treatment: Excision

Vanishing Bone Disease

- Aka Gorham's disease
- Cause: Angiomatosis of bone

CLINICAL QUESTIONS

Q. A 15 yr school going student complains of moderate amount of occasional pain and swelling over the right knee joint. X ray was done which shows a lesion in right femoral distal epiphysis is suggestive of:

A. Enchondroma
B. Osteochondroma
C. Osteoclastoma
D. Chondroblastoma

Answer D

Solution

- Chondroblastoma and GCT are epiphyseal tumours.
- GCT occurs in 20-40th decade

Chondroblastoma

- 8-16 years of age group.
- Mc site of chondroblastoma is epiphysis of the distal femur
- Xray - expansile, epiphyseal, slightly symmetrically expansile.
- Mimics synovitis
- C/F - pain and swelling.
- Biopsy: - Chicken wire calcification
- Rx curettage with bone grafting or bone curettage.

Q. A 19-year-old male with a short history of pain in the right groin that worsens at night time and has a small circumscribed sclerotic swelling over diaphysis of femur. Likely diagnosis is:

A. Osteoclastoma
B. Osteosarcoma
C. Ewing's sarcoma

D. Osteoid osteoma

Answer: D

Solution

- Osteoid Osteoma:
  - Night pain relieved on taking salicylates (NSAID)
  - Cortical tumor "thickened cortex" (CT)
  - In diaphysis shows Nidus- Lytic center with sclerotic margin
  - Rx: Radio-frequency Ablation →Preferred

12 MALIGNANT BONE TUMORS

Pulsatile bone tumor

- "When we open the tumor, the margins of tumor have pulsatility"
  - Aneurysmal Bone Cyst
  - Giant cell tumor
  - Osteosarcoma (Most Important)

Osteosarcoma

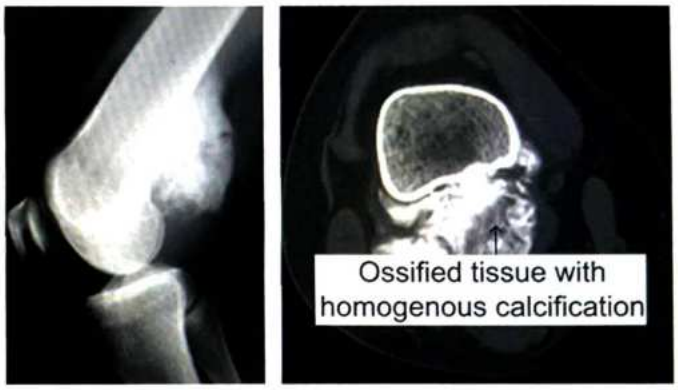
- Cancer of the Young
- Occurs in 2nd decade
- Radiation induced sarcoma (after 10-15 year of Radiotherapy)
- Radio-resistant bone tumor
- Matrix (Osteoid) forming bone tumor
- OS & soft tissue sarcomas are associated with germline retinoblastomas
- <1% Paget's aka Osteitis deformans will have Osteosarcoma
- Feature: Pain / Night pain

Important Information

- **Night pain relieved on taking salicylates: osteoid osteoma**

- Types

1. Classical: Intramedullary / intra-osseous
2. Periosteal: Arise from cambium layer
3. Parosteal: Posterior aspect of lower femur - Good prognosis
4. Pagetoid: AKA Osteitis deformans - Worse prognosis



- Treatment: T-10 protocol
  - Methotrexate is a very important drug (Etoposide not used)
  - Chemotherapy → Excision → Calculate the % of necrosis
    - → > 95% necrosis: chemosensitive tumor, Same chemotherapy is given post-op
    - → < 95% necrosis: chemo-resistant, New Chemotherapy combination
  - T-10 Protocol: 70% of 5 years survival
- Prognosis
  - Depends on
    - → Extend of disease
    - → Pulmonary metastasis (M/c site of metastasis)
    - → Systemic metastasis> Pulmonary metastasis: Liver metastasis have poorer prognosis as compared to pulmonary metastasis
    - → Grade of lesion: higher the grade poorer the prognosis
- OS is malignancy causing pneumothorax

Ewing's sarcoma 00:05:48

- Origin: marrow cells (marrow biopsy usefull to see the extent of the disease)
- Localizes in the diaphysis
- Age: second decade> First decade
- Pain: universal complaint
- Presents as osteomyelitis

- Genetic defects
  - Ewing sarcoma is round cell tumor with glycogen positive cells
  - Associated with Trisomy 8, Trisomy 12
  - Translocation t(11;22) is the most common translocation
  - Other diagnostic translocations are: t(21;22) and t(7;22)
  - Specific marker: MIC2 (CD99)
- Poor prognostic factors
  - Age >12, Male, Proximal, fever, Anemia
  - Increased TLC/ Platelets/ ESR/ LDH
  - Poorest Factors include
    - →Metastasis
    - →Chemoresistant
    - →Relapse
- All Ewing's sarcomas are always high grade
- Treatment
  - Pre-op CT
  - Wide excision

Previous Year's Questions

Q. Which of the following is the most Radiosensitive tumor?

(FMGE Dec 2020)

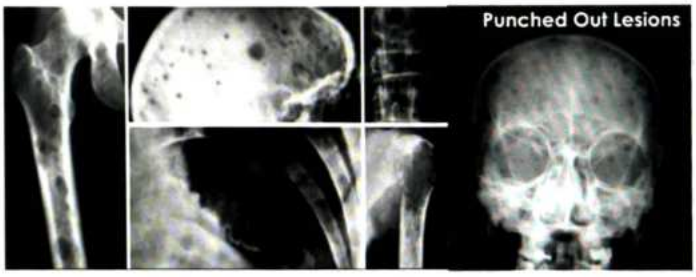
A. Histiocytoma
B. Ewing's sarcoma
C. Osteosarcoma
D. Chondrosarcoma

Chondrosarcoma 00:09:07

- Involves the Pelvis
- Has dense calcification
- Associated with Hyperglycemia
- Best prognosis amongst the malignant tumors
- Chondro sarcoma (Be[illegible] Osteo sarcoma >>> Ewing's sarcoma (worst prognosis)

Multiple Myeloma 00:09:40

- Lytic tumor
- Plasma cells (destroys whole body / bone)
- Features: Bone pain + High ESR + Hypercalcemia
- Criteria
  1. M proteins in serum / urine
  2. Bone marrow plasma cells / Plasmacytoma
  3. End organ damage like Lesion, anemia, hypercalcemia, ↑ creatinine, hyper viscosity, amyloidosis, bacterial infection (> 2 episodes per year)
- Punched out lytic lesions
- Plasma cell leukemia > 20% plasma cells in peripheral smear



Chondroma 00:10:37

- Rare malignant Tumor
- Origin: from the remnants of primitive notochord
- Commonly occurs in the sacrococcygeal or in the spheno-occipital regions.
- Most common site: sacrum (50%)> clivus (35%)> Junction of cervico thorax / lumbar (15%)
- On Biopsy: Physaliferous cells are seen
- Treatment

- Surgery is the mainstay
- ± Radiotherapy (if required)

Synovial sarcoma

- Misnomer (Do not arise from synovium)
- Characteristic translocation → (X:18) giving rise to SYT-SSX fusion gene
- Near the joint bursae
- It is a biphasic tumor with epithelial and mesenchymal components
- Treatment - **Excision**

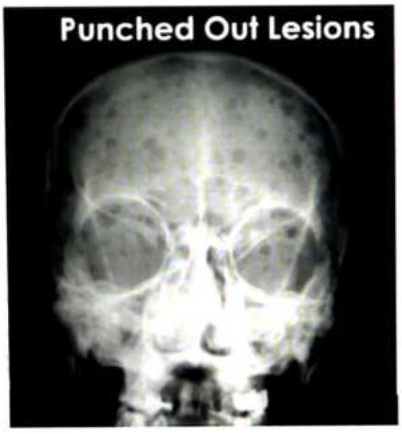
Lytic lesions in skull

- Causes
  - **M** - Metastasis
  - **E** - Eosinophilic granuloma
  - **L** - Langerhans' [illegible]s &Lymphoma
  - **T** - Tuberculosis
  - **H** - Hyperparathyroidism (Rarest cause)
  - **O** - Osteomyelitis
  - **R** - Radiotherapy
  - **M** - Multiple myeloma
  - **E** - Epidermoid

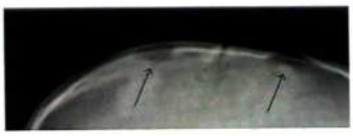
How to remember

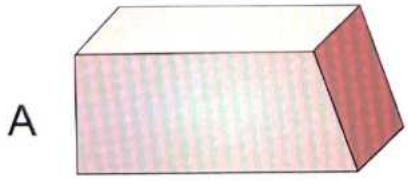
- MELTHORME

- Punched out lytic lesion: Multiple myeloma

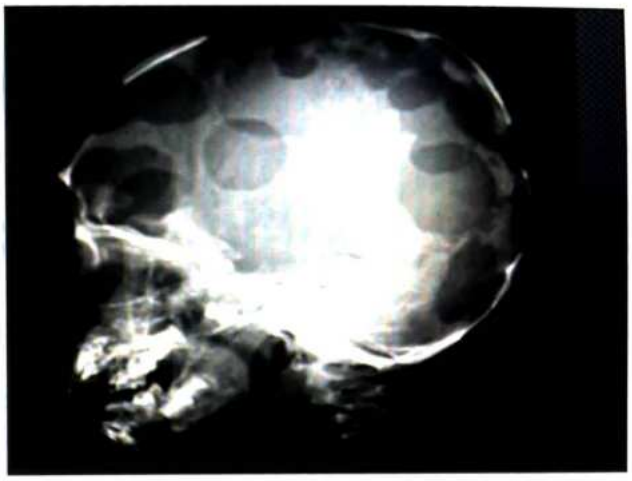


- Bevelled lytic: Eosinophilic granuloma

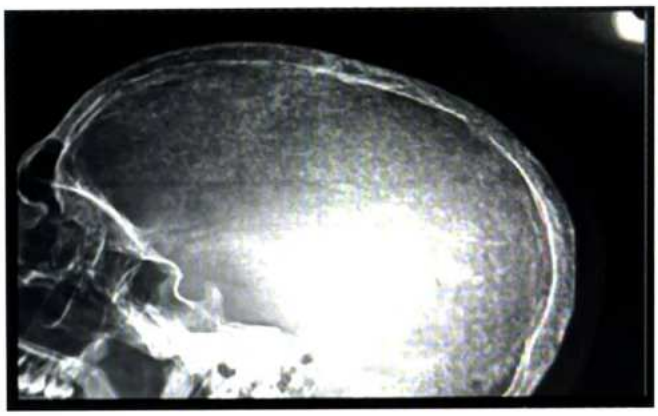




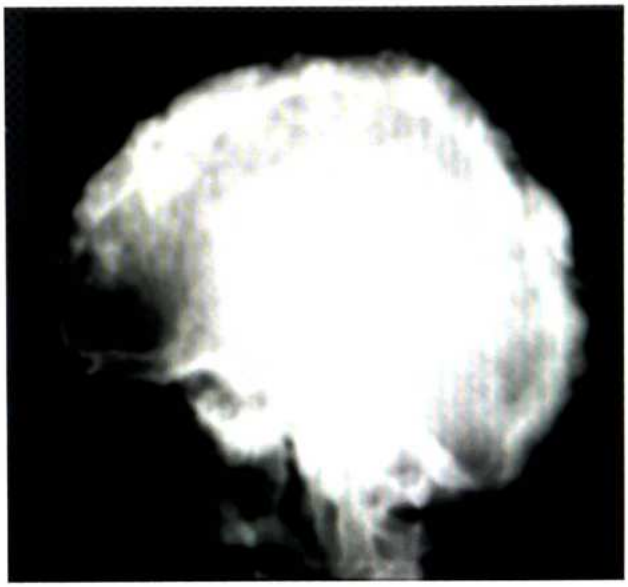
- Permeative (big) lesion: Langerhans's cell Histiocytosis



- Salt & pepper skull: Hyperparathyroidism (rarest)

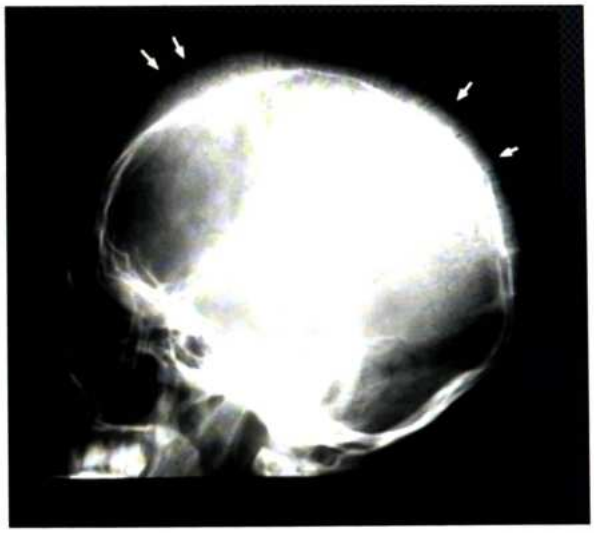


- Cotton wool skull: Paget' Disease

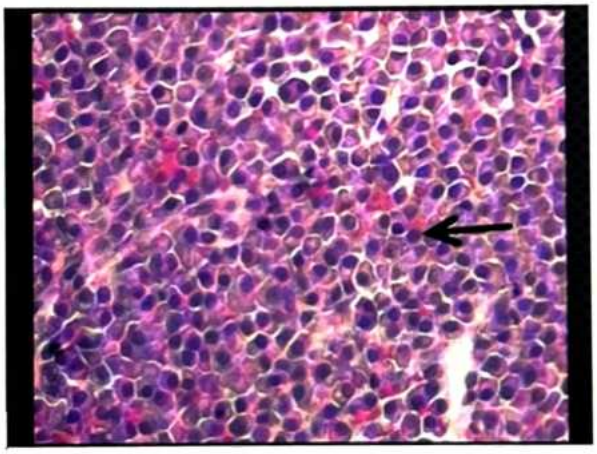


- Osteoporosis circumscripta: Paget's Disease

- Hair on end appearance: Hemolytic anemia (BV) & Thalassemia

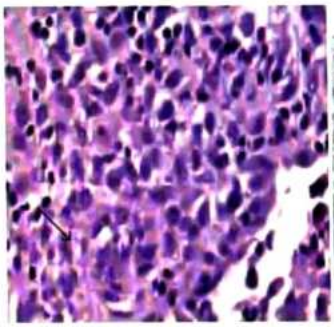


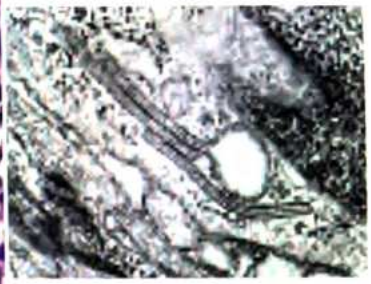
Plasmacytoma 00:16:18



- Solitary Bone Lesion
- May occur in spine, pelvis, skull, ribs (or) Femur
- No Plasmacytosis in Marrow, no other clinical manifestations of Myeloma.
- Absence of Hypercalcemia, renal failure, anemia (or) additional bone Lesions
- Microscopy: Tumor is composed of neoplastic plasma cells.

Langerhans cell Histiocytosis (Eosinophilic granuloma)





- May present as solitary Lytic Lesion or Multi systemic involvement
- In the skull, present as Lytic Lesion of Bone
- Histiocytic cells, admixed eosinophils, plasma cells, Giant cell
- Langerhans cells- oval nuclei with Longitudinal grooves resembling coffee bean.
- IHC: CD1a+, S100+
- EM: Birbeck Granules, Tennis racket shaped organelles in cytoplasm

Metastatic tumors of bone

- Most common primary is Breast (Also into orbit) > Prostrate Overall
- Most common site of primary for bone metastasis
  - In males: prostrate> Lung
  - In Female: Breast> Lung
  - In Children: Neuroblastoma
- Skeletal sites most frequently involved spine (Dorsal)
- Lytic expansile metastasis seen in
  1. Renal cancer
  2. Thyroid carcinoma
- Purely osteoblastic secondaries: prostate/ Carcinoid/ medulloblastoma
- Metastasis distal to knee and elbow is rare and usually arise from a primary tumor of the bronchus, bladder and colon (BBC). "BBC can go anywhere even distal to Elbow and Knee

PRACTICE QUESTIONS

Q 9-year-old boy presenting with lytic lesion on midshaft tibia. On HPE, there are grooved nuclei, giant cells, eosinophilic cytoplasm & fibroblastic proliferation X ray is shown below. What is the likely diagnosis?

A. Langerhans cell histiocytosis
B. Giant cell tumor
C. Chondroblastoma
D. Osteoid osteoma
Ans. A

Q. Which of the following is a sign of metastasis?
A. Single pedicle destruction (winking owl)
B. Paradisical lesion
C. Central lysis of vertebral body
D. Anterior lysis of vertebral body
Ans A

Important Information

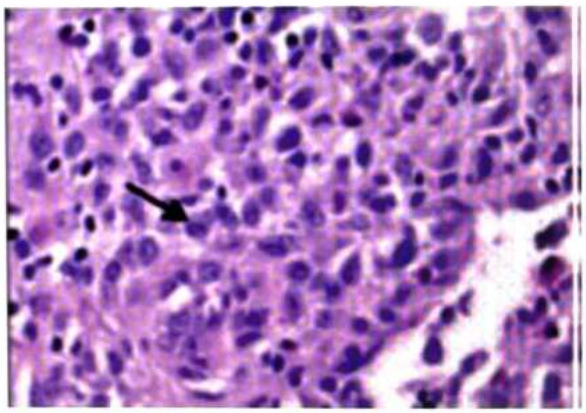
- If one pedicle destroyed: WINKING OWL SIGN
- If both are destroyed: BLIND BAT SIGN

Q. MC type of fibrous dysplasia is?
A. Polyostotic FD
B. Monostotic FD
C. Both are equal in incidence
D. None of the above
Ans. B

- Monostotic FD - femur

Q. Middle age patient present with back pain, on bone scan osteolytic lesions are seen, which of the following can be possibility?
A. Prostate cancer
B. Carcinoid
C. RCC
D. Medulloblastoma
Ans. C

Q. A 70 years old male has a single well defined lytic lesion of skull. The patient had no other complaint & urine examination had no abnormality. What is the likely diagnosis?



A. LCH
B. Localised myeloproliferative disorder
C. Generalised myeloproliferative disorder
D. Tumor of osteoblasts
Ans. A

Q. A patient with GCT which of the following is false?

A. Epiphyseo-metaphyseal location
B. Eccentric
C. Defined margins
D. Chemotherapy is the mainstay of treatment
Ans. D

- Extended curettage is the mainstay of treatment

Q. Which metabolic condition has phosphaturia & osteomalacia?
A. Fibrosarcoma
B. Osteosarcoma
C. Undifferentiated sarcoma
D. Malignant peripheral nerve sheath tumor
Ans. A

- Fibrous origin tumor produces phosphatonin phosphaturia & osteomalacia

Q. What is the diagnosis?

A. Aneurysmal bone cyst
B. GCT
C. Osteosarcoma
D. Osteoclastoma
Ans. B

- GCT is more classical name

Q. MC tumor of hand
A. Enchondroma
B. SCC
C. Chondroblastoma
D. Melanoma
Ans. B

Q. 8-year-old male complaints of pain & swelling over upper end tibia, local temperature is raised, margins are irregular, has variable consistency. What is the likely diagnosis?
A. Ewing sarcoma
B. Osteogenic sarcoma
C. GCT
D. Secondary mets
Ans. B

Important Information

- Part affected is more important than age
  - Upper end is affected (metaphysis) - Osteogenic sarcoma
  - Ewing sarcoma- affects diaphysis

Q. Ewing sarcoma is associated with which genetic defect?
A. 13914
B. C - myc
C. Trisomy 8
D. T (22;11)
Ans. C

CLINICAL QUESTIONS

Q. 12-year-old boy presents with progressive swellings at upper end of tibia – irregular, local temperature raised, invariable consistency and ill-defined margins most probable diagnosis is

A. Giant cell tumor
B. Ewing's sarcoma
C. Osteogenic sarcoma
D. Secondary metastasis

Answer: C

Solution

- The clinical presentation in question can occur both in Ewing's sarcoma and osteosarcoma.
- However, swelling is around the knee joint at upper end of tibia, which favours the diagnosis of osteosarcoma (metaphyseal lesion).
- Ewing's sarcoma usually occurs in the diaphysis of the bone (middle of the shaft).
- Giant cell Tumor site- Epiphysis
- Secondary metastasis occurs in old age usually.

LEARNING OBJECTIVES

UNIT 5: NERVE & INJURIES

- **Nerve injuries 1**
  - Seddon's classification
  - Tinel's sign
  - Nerve injury basics
  - Axilary nerve injuries
  - Management of Axillary nerve injury
  - Musculo cutaneous nerve injury
  - Ulnar nerve injuries
  - Median nerve injuries
  - Claw hand

- **Nerve injuries 2**
  - Radial nerve injuries
  - Posterior interosseous nerve injuries
  - Erb's & Klumpke's palsy
  - Carpal tunnel syndrome
  - Thoracic outlet syndrome
  - Popliteal entrapment
  - Sciatic nerve injuries

13 NERVE INJURY PART - 1

Seddon's classification 00:02:50

- Seddon's Neuropraxia
  - Physiological block in the Nerve conduction
  - There is 100% recovery
  - Occurs spontaneously
  - Tinel sign negative
- Seddon's axonotmesis
  - Damage to Axon sheath/Motor march
  - Tinel sign positive
  - Progressive
- Neurotmesis
  - Complete nerve transection
  - Tinel sign positive

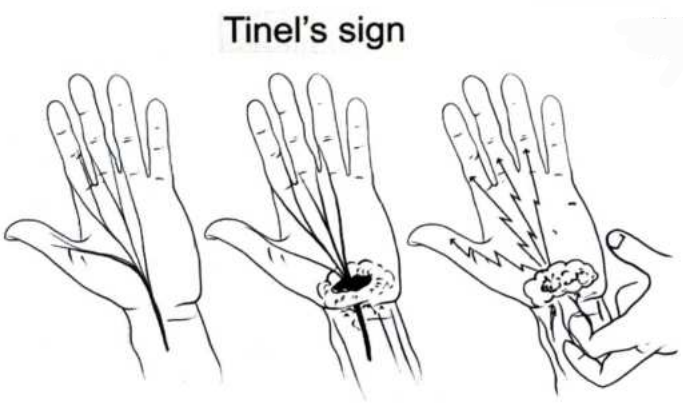
Sunderland's classification

- Sunderland's Type 1 is Seddon's Neuropraxia
- Sunderland's type 2, 3, and 4 is Seddon's Axonotmesis
- Sunderland's type 5 is Seddon's neurotmesis

Important Information

- **Based on prognosis Sunderland type 4 behaves as type 5**

Tinel's sign 00:07:20



- Based on Law of projection
- Indicates regeneration of nerve
- Law of projection says that we can stimulate only damaged nerve, but not physiologically damaged nerve like neuropraxia
- Hence Tinel's sign is negative in Neuropraxia.
- Law of projection says when we stimulate anatomically damaged (demyelinated) nerve along its course by closing the eyes of the patient
- Speed of nerve regeneration is 1mm/day or 1 inch / month
- Tinel's sign in
  - Neuropraxia: Negative
  - Neurotmesis: positive but static
  - Axonotmesis: Positive and progressive

Axillary Nerve 00:13:15

- Supplies Teres minor & deltoid
- Sensation: upper arm
- Regimental Badge area: Loss of sensation at this site known as Regimental badge Sign
- Damaged due to
  1. Shoulder dislocation: Anterior or Inferior
  2. Fracture of upper end of Humerus
  3. Injection into deltoid muscle

Management of axillary nerve injury 00:14:33

- Excellent response to nonoperative treatment
- Favourable results can be expected for the rest if surgical repair is undertaken within 6 months of injury
- Surgical options include neurolysis, nerve grafting, and neurotization.
- Majority of patients who required a surgery underwent a nerve grafting procedure.
- The result of nerve grafting have been encouraging, due to the relatively short distance from the lesion to the motor end plate and the mono fascicular nature of the proximal portion of the axillary nerve

Musculocutaneous nerve injury 00:16:03

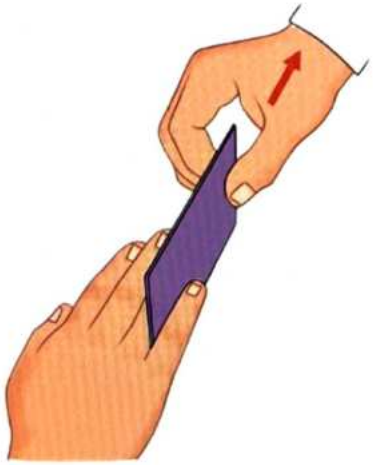
- Largest branch of the lateral cord
- C5-7
- Brachialis, coraco-brachialis, and biceps
- End as lateral cutaneous nerve of forearm
- Uncommon injuries: iatrogenic, stab injuries to axilla
- Only cause weakening of flexion at shoulder, elbow, and supination at elbow
- Loss of lateral forearm sensations

Lumbricals

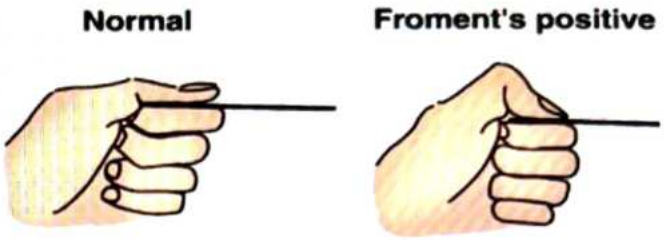
- Medial 2 lumbricals supplied by ulnar nerve
- Lateral 2 lumbricals supplied by median nerve
- Action of lumbricals
  - Extension of interphalangeal joint
  - Flexion of metacarpophalangeal joint
- Paralyzed lumbricals: Claw Hand (Hyperextension of MCP Flexion of IP joint)

Ulnar Nerve injuries 00:19:20

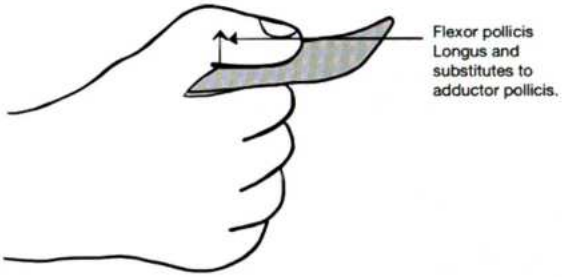
- Palmar interosseous Nerve: Adduction
- Dorsal interosseous Nerve: Abduction
- Test for ulnar nerve injuries
  - Card Test: Holding a card between fingers (adduction) & trying to pull the card out.



  - Igawa Test: Middle finger has only dorsal interossei can move middle finger to either side ("Abduction")
  - Book Test: Ask patient to hold book between his thumb & finger



  - Froment's sign: Flexor pollicis longus is substituting for adductor pollicis



Important Information

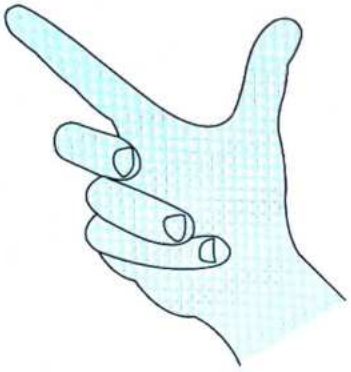
- **Flexor pollicis longus is supplied by AIN, branch of median nerve**

  - Wartenberg Test: little finger stays abducted due to paralysis of Ulnar Nerve

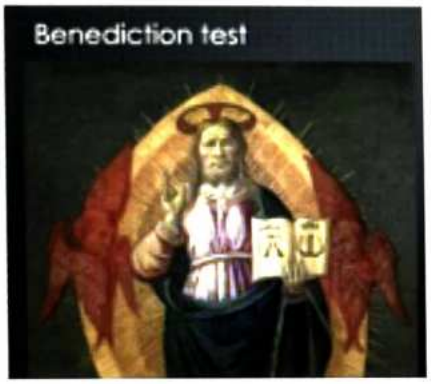
- Ulnar paradox: the amount of clawing is dependent upon the site of ulnar nerve injury
  - If injury is around the elbow: High ulnar nerve palsy, less clawing
  - If Injury is at the wrist: Low Ulnar nerve palsy, More clawing

Median nerve injuries 00:27:04

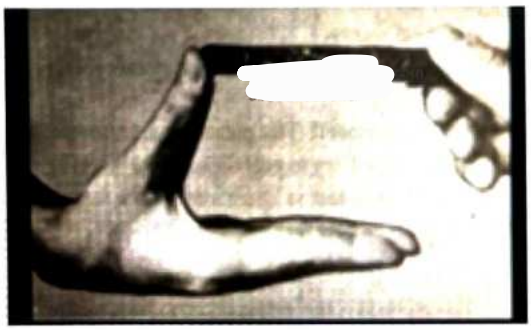
- Test for median nerve injury
  - Pointing Index



  - Benediction Test or Pope's attitude

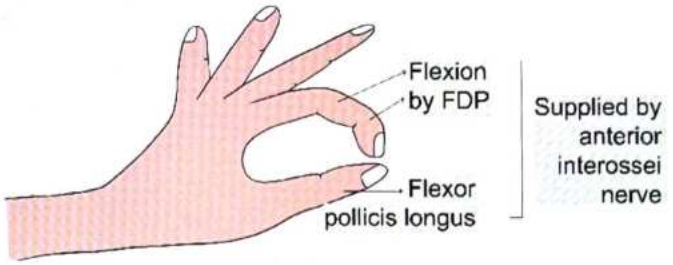


  - Pen test: Abductor pollicis brevis



  - Ape thumb deformity

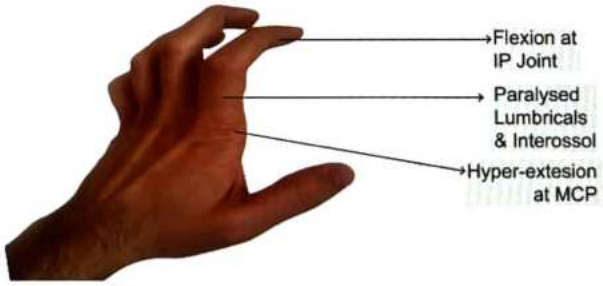
  - Kiloh Nevin Sign: Checks for AIN, branch of median nerve



Important Information

- Muscles supplied by AIN
  1. Flexor Digitorum profundus (Lateral half)
  2. Flexor pollicis longus
  3. Pronator quadratus
- AIN is commonly damaged in Supracondylar fracture of Humerus

Claw Hand 00:32:32



- Medial 2 lumbricals: Ulnar nerve
- Lateral 2 lumbricals: Median nerve
- Action of lumbricals: Extension of interphalangeal joint and Flexion of metacarpophalangeal joint
- Knuckle bender splint: Used for Ulnar nerve > Median nerve

Previous Year's Questions

Q. Hyperextension at MCP joint and flexion at IP joint occurs due to involvement of which muscle?
(NEET Jan 2020)

A. Lumbricals
B. Palmar interossei
C. Dorsal interossei
D. Adductor pollicis

CLINICAL QUESTIONS

Q. Identify the deformity and choose correct statement regarding the condition

1. Loss of abduction of the arm
2. Loss of lateral rotation of the arm
3. Loss of sensation in the medial 2 fingers
4. Loss of extension of the elbow

A. 1, 2 are correct
B. 3, 4 are correct
C. Except 4 all are correct
D. All the above are correct

Answer: A

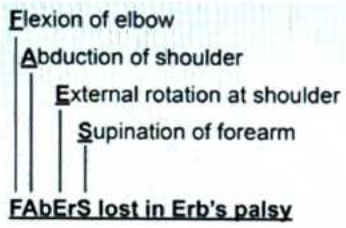
Solution

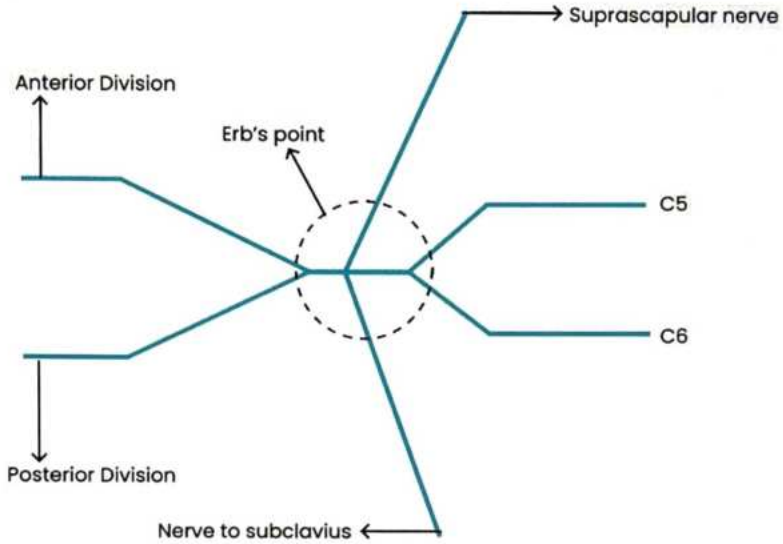
- The image shows Erb's palsy in which there is a loss of sensation over a small area of the lower part of the deltoid, Loss of abduction and lateral rotation of arm, Loss of flexion (not extension) and supination of forearm.
- It is caused by injury to C5, C6 and rarely C7. It is seen most commonly in babies with shoulder dystocia at delivery.

Deformity and Loss of Movements 'FABER'S Lost in Erb's palsy:

- **Policeman/Waiter/Porter's tip hand:**
  - Arm: adducted and medially rotated
  - Forearm: extended and pronated
  - Arm hangs limply by the side
  - Lost movements—All movements opposite to the deformity

- Actions that would be lost:
  - → Loss of abduction and lateral rotation of arm
  - → Loss of flexion and supination of forearm.





- In Klumpke's paralysis, there is loss of strength in intrinsic muscles of the hand causing claw hand deformity
- The site of injury is at the lower trunk of brachial plexus, where the nerve roots C8 and T1 are affected.

The following are seen in Klumpke's paralysis:

- Loss of strength in intrinsic muscles of the hand causing claw hand deformity.
- Unilateral Horner's syndrome (ptosis, miosis and anhidrosis)
- Loss of sensation along the medial border of forearm and hand.

Q. Seddon's Classification all are true except:

1. Complete anatomic division of nerve is classified as Neurotmesis
2. Axonotmesis has Tinel's sign positive and progressive

3. Neurotmesis has complete recovery with/without surgical intervention
4. Saturday night palsy involves radial nerve

A. 1, 2, 3 are correct
B. 2, 3, 4 are correct
C. except 1 all are correct
D. 1, 2, 4 are correct

Answer: D

Solution

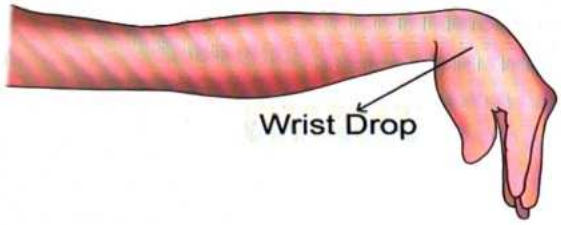
- In Neurotmesis there is Complete anatomic section of the nerve. Hence there is no recovery without surgical intervention.

Seddon's Classification	
Neuropraxia: Tinel's Sign Negative	• Temporary physiological disruption of nerve impulse conduction. The loss of function is incomplete. • Complete recovery in 3–6 weeks and comes back like lightening, i.e., completely recovers in one go. • No Wallerian degeneration takes place • Tinel's sign is negative. • Crutch palsy • Saturday night palsy • Tourniquet palsy • Few traumatic nerve injuries are neuropraxia
Axonotmesis: Tinel's Sign Positive and Progressive	• It is axonal breakdown, • Tinel's sign is positive, • Motor March is seen. • Recovery is usually not complete. • Seen in closed fractures and dislocations
Neurotmesis: Tinel's Sign is Positive and Non progressive	• Complete anatomic section of the nerve. • No recovery without surgical intervention. • Degeneration distal to injuries (Secondary or Wallerian degeneration) • Degeneration in proximal segment (Primary or retrograde degeneration) • At proximal end forms— Neuroma • At distal end forms— Glioma

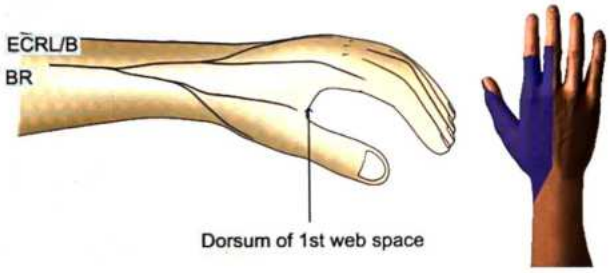
14 NERVE INJURIES PART-2

Radial Nerve injuries 00:01:09

- Most common nerve damaged in human body
- Most common cause: Fracture of shaft of Humerus



- Shaft of Humerus divided into 3 parts
  - Upper 1/3rd
  - Middle 1/3rd
  - Lower 1/3rd: Radial nerve injured (50%)
- Holstein Lewis sign: Radial nerve injury in lower 1/3rd fracture of shaft of Humerus
- Paralysis of ECRL & ECRB (radial N1) will cause Wrist drop



- Posterior interosseous nerve injury: Loss of finger extension called as finger drop
- Sensory distribution of radial nerve is Dorsum of 1st web space.
- Saturday night / crutch palsy
  - Occurs due to compression of radial nerve In the radial groove while putting hand on chair or the crutch

Radial Nerve Injury			
High	**Low**	**PIN**	**SRN**
• BR Paralyzed + • Wrist drop + • Finger drop + • Sensory loss	• Wrist drop + • Finger drop + • Sensory Loss	• Finger drop • Pure motor Nerve so no sensory loss	• Sensory loss + • ECR B

Posterior Interosseous nerve injury

- Pierces Arcade of Frohse (area in supinator)
- Causes finger drop
- No sensory loss
- Injury occurs at Head of radius

Previous Year's Questions

Clinical scenario

Q. A 30 years old male wit RTA – complains of injury of upper limb, no sensory loss + wrist drop. What is the site of nerve injury?

Ans: spiral groove

- Sometimes, during nerve injury, only one components of the nerve is affected sparing the other component.

- Cock-up splint is used for radial nerve palsy

- Modified jones transfer
  - Pronator teres to wrist extensor: For wrist drop
  - Flexor carpi ulnaris to finger extensor: For finger drop
  - Flexor carpi radialis to thumb

Injury to nerve

Open	Closed

• Neurotmesis
• Sunderland 5
• Repair
	• Splint
	  ○ Radial nerve: Cockup splint
	  ○ Ulnar/median nerve: Knuckle Bender splint
	• If it doesn't recover: EMG

Good Prognostic Factors for a nerve injury

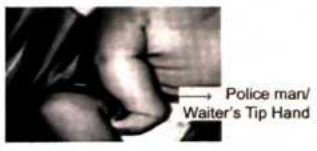
- **G - G**rowing Age: Good repair
- **O - O**nly motor
- **O - O**nly sensory
- **D - D**istal
- **N - N**europraxia: 100% recovery
- **E - E**arly repair
- **R - R**adial nerve: best prognosis
- **V - V**ascularity maintained
- **E - E**nd to end

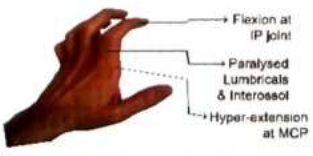
How to remember

- GOOD NERVE

Erb's palsy and Klumpke's Palsy 00:12:12

Erb's palsy	Klumpke's palsy (claw hand)
• Upper trunk of brachial plexus • C_5/ C_6 • More common • Waiter tip deformity • Better prognosis	• Lower trunk of brachial plexus • C_8 / T_1 • Claw Hand + Horner's syndrome • Poor prognosis





- Movement lost in Erb's palsy
  - **F - F**lexion of elbow
  - **A - A**bduction of shoulder
  - **bE - E**xternal rotation
  - **rS - S**upination of forearm
  - **Lost in erbs** - Movements are Lost

How to remember

- FAbErS Lost in erbs

- Most common tendon to be used for graft

1. Palmaris longus: bridges gap between hand and fingertip
2. Plantaris: Bridges gap between forearm & fingertip

Compression Neuropathy

- AKA Nerve entrapment syndrome
- It is compression of a nerve in a closed space
- Most common compromised nerve: Median Nerve
- Most common entrapment syndrome: Carpal Tunnel syndrome
- Femoral nerve very rarely involved in Nerve entrapment syndrome

Carpal tunnel syndrome 00:15:34

- More common in females
- Cause
  - Idiopathic (most common)
  - Pregnancy
  - Hypothyroidism
  - Hyperparathyroidism
  - RA
  - Colle's (fracture of distal radius)
- Tests

Entrapment Syndrome	Nerve Involved
• Carpal tunnel syndrome	• Median Nerve (at wrist Common): Phalen's / Reverse Phalen's Test
• Pronator syndrome	• Median nerve (proximally compressed beneath ligament of Struthers, bicipital aponeurosis, or origin of pronator teres or FDS)
• Cubital tunnel Syndrome	• Ulnar nerve (between two heads of flexor carpi ulnaris)
• Guyon's Canal syndrome	• Ulnar nerve (at wrist)
• Thoracic outlet syndrome	• Lower trunk of brachial plexus (C8 and T1) and subclavian vessels (between clavicle and first rib)
• Piriformis syndrome	• Sciatic nerve

• Meralgia paraesthetica	• Lateral cutaneous nerve of thigh
• Tarsal tunnel syndrome	• Posterior tibial nerve (behind and below medial malleolus)
• Morton's metatarsalgia	• Interdigital nerve compression (Usually of 3rd, 4th toe)
• Cheralgia Paraesthetica	• Superficial radial nerve

Previous Year's Questions

Q.Most specific test for Carpel tunnel syndrome?
(AIIMS June 2020)

A. Cozen test
B Phalen test
C. Durkan test
D. Tourniquet test

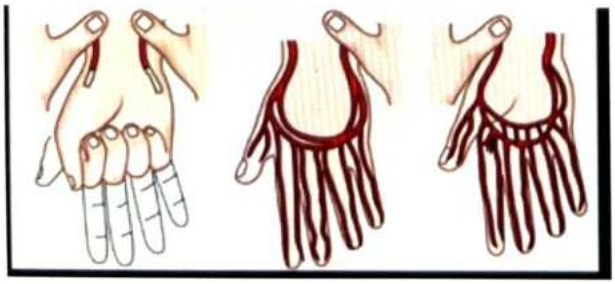
Thoracic outlet syndrome 00:18:46

- Tests
  - Adson's test
  - Wright's test
  - Roos test
- Presents with C8 & T_1 Symptoms (T_1 is more common)

Adson's test Wright's test Roos test

Management of compression neuropathy

- Plan A: Rest + NSAIDS → if not treated give Local steroids → if not treated then do Surgery
- Allen's Test: indicates the patency of the radial and ulna artery in profusely supplying the hand



Popliteal entrapment syndrome 00:22:51

- Compression of popliteal artery at medial head of gastrocnemius
- Exercise induced claudication
- Decreased pulses on ankle flexion

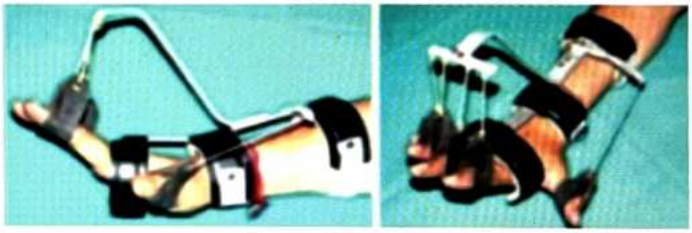
Sciatic Nerve injury 00:23:18

- Two components tibial nerve centrally arranged fibres and common peroneal nerve peripherally arranged fibers
- The injury to sciatic nerve sometimes can present as an injury to common peroneal nerve because these fibers are peripheral and more prone to pressure.
- Sciatic nerve divides into

1. Common peroneal nerve: further divides into
   a. Superficial peroneal nerve
   b. Deep peroneal nerve
2. Tibial nerve: gives Sural nerve supplying lateral part of foot

PRACTICE QUESTIONS

Q. Identify the splint?



A. Cock up splint
B. Knuckle bender splint
C. Dynamic finger splint
D. Sugar tongs
Ans. A

Q. Middle finger extension test is useful for all except?
A. PIN palsy
B. Radial tunnel syndrome
C. Tennis elbow
D. Multifocal motor neuropathic disorder
Ans. D

Important Information

Middle finger extension test in painful in
- Radial tunnel syndrome
- Tennis elbow

Q. A patient can't extend his wrist but he has no sensory loss, after he has met with an accident. Level at which the affected nerve got injured is?

A. Spiral groove of humerus
B. Head of radius
C. Near medial epicondyle
D. Surgical neck of humerus
Ans. A

Important Information

- Head of radius: PIN involvement - only finger drop
- Near medial epicondyle: Ulnar nerve
- Surgical neck of humerus: Axillary nerve

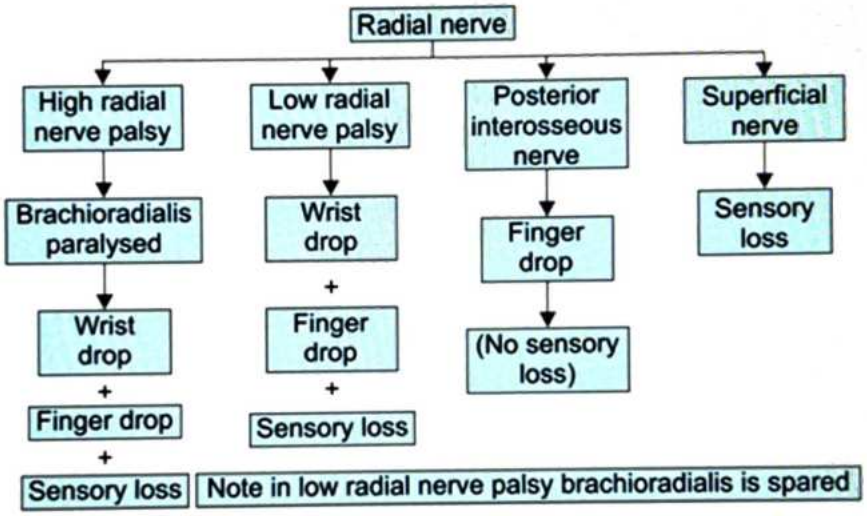
CLINICAL QUESTIONS

Q. A patient can't extend his wrist after he has met with an accident. He has no sensory loss. Level at which the affected nerve is injured?

A. Spiral groove of humerus
B. Head of radius
C. Near medial epicondyle
D. Surgical neck of humerus

Answer: A

Solution



- Patient has wrist drop so radial nerve is involved, the[illegible]e sensory sparing in radial nerve injury.
- Radial nerve is most commonly involved at the spiral groove and commonly associated with fractures of distal third of the humerus (Holstein-Lewis fracture) causing neuropraxia of the nerve.
- High radial nerve palsy: compression of the nerve at the axilla a.k.a 'saturday night palsy' or 'crutch palsy'.
- Posterior interosseous nerve: damaged in injuries around elbow like elbow dislocations or radial neck/head injuries
- Superficial nerve: injured due to elbow dislocations or tight casts.

Q. Cock up splint is used for which nerve injury?

A. Median nerve
B. Ulnar nerve
C. Radial nerve
D. Brachial plexus

Answer: C

Solution

- High radial nerve injury: brachioradialis paralyzed+ wrist drop + finger drop + sensory loss
- Low radial nerve injury: wrist drop + finger drop + sensory loss (brachioradialis is spared)
- PIN injury: finger drop + sensory loss
- Superficial: sensory loss

Splints used in other nerve injuries

- Brachial plexus injury- Aeroplane splint
- Ulnar nerve > Median nerve- Knuckle bender splint

LEARNING OBJECTIVES

UNIT 6: GENERAL + UPPER LIMB TRAUMATOLOGY

Trauma general

- Sure signs of fracture
- Commonest
- Markers
- Stages of fracture healing
- Types of fractures
- Pathologic fractures
- Mirel's criteria
- ATLS
- Damage control orthopedics
- Supracondylar fracture of humerus
- Lateral condylar articular fracture
- Fracture healing
- Non union types
- Fractures known formal union
- Gustilo Anderson classification

Upper limb1

- Rotator cuff injuries
- Shoulder dislocation: Shoulder In stability, Anterior, posterior & inferior shoulder dislocation
- Nerve injuries
- Fracture shaft of humerus
- Clavicle
- 3-pointrelation of elbow
- Coronal plane deformities
- Supracondylar fracture humerus
- Lateral closing wedge osteotomy
- Bauman's angle
- Fracture lateral condyle humerus
- Gartland Classification
- Monteggia's fracture
- Bato Classification of Monteggia's fracture
- Galeazzi fracture
- Colle's fracture
- Smith's fracture
- Pulled elbow

Upper limb2

- Fracture of lower end of radius
- Barton fracture
- Anatomy of wrist
- Scaphoid fracture
- Scapho- lunate dislocation
- Fracture at base of 1stmeta carpal

- Compartment syndrome
- Volkmann's ischemic
- Contracture
- Myositis ossificans
- Sudeck's dystrophy

15 TRAUMA GENERAL

- Fracture: Break in continuity of cortex (macro or microscopic)
- According to ATLS: ABC (Airway, Breathing, Circulation) but Cervical spine has to be stabilized 1st.
- In Cardiac Patients According to ATLS: CAB (Circulation, Airway, Breathing)

Sure signs of Fracture

- Includes

1. Abnormal mobility (best option)
2. Failure to transmit movements proximally
3. Crepitus

- Most Consistent sign: Tenderness

Commonest 00:02:21

- Bone to Fracture in Human body: Clavicle (middle 3rd)
- Bone to Fracture at birth: Clavicle
- Bone to Fracture in children: Forearm (radius>ulna)
- Dislocation: Shoulder (Anteriorly)
- Dislocation in children: Elbow (Posterior)
- Rarest to dislocate: Ankle
- M/c ligament injury / Sprain: Anterior Talofibular Ligament
- Medial ligament damaged around ankle: Deltoid ligament
- Most common tendon injured: Supraspinatus > Biceps Brachii >Tendo Achilles

Markers 00:04:04

- Bone resorption markers
  - Hydroxyproline
  - Pyridinoline
  - Deoxypyridinoline
  - Telopeptides (N & C terminal)
- Bone formation markers
  - Osteocalcin
  - ALP
  - Serum Pro-collagen type 1(N & C terminal)

Important Information

- Paget's disease: All markers are increased (↑ Bone formation and ↑ Resorption)
- Multiple Myeloma: No increase in bone formation marker (ALP) as it is a lytic disease
- ↑ALP in multiple myeloma seen only in fracture

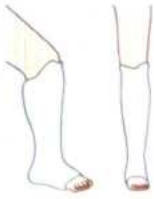
Stages of Fracture Healing 00:05:03

1. Stage of fracture Hematoma
   - If Hematoma is inside the skin: closed fracture
   - If skin broken & blood comes out: Open Fracture
2. Granulation tissue
3. Callus formation (takes place after 3 weeks)
4. Consolidation (where solid bone starts forming)
5. Remodeling

Previous Year's Questions

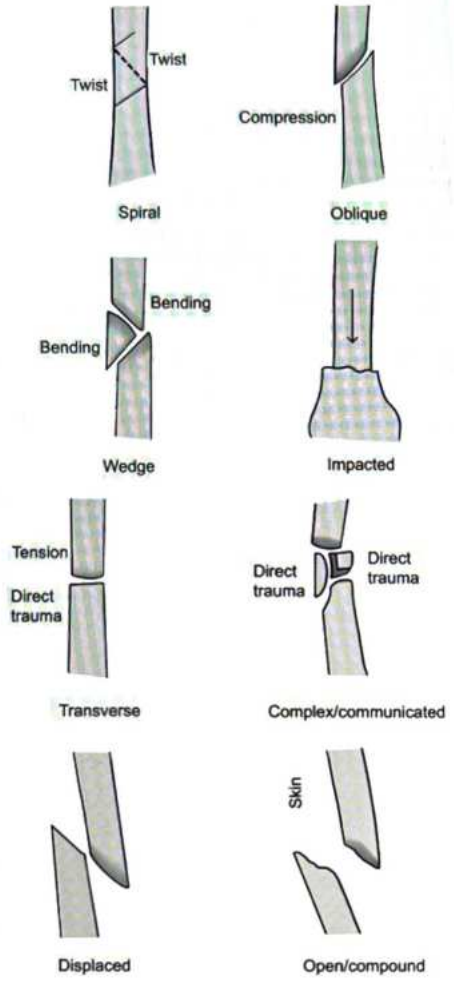
Q. A doctor removed the cast and found that the area was deformable but not displaceable. The doctor applied the cast and want stage it belongs to?

(FMGE Aug 2020)



A. Soft callus
B. Hard callus
C. Remodelling
D. Hematoma

Types of fractures based on pattern



- Transverse fracture
  - Fracture forms an angle of less than 30 degrees with horizontal
  - Cause: Tension / direct trauma
- Oblique fracture
  - Fracture forms an angle of more than 30 degrees with horizontal
  - Cause: Compression injury
- Spiral fracture
  - Cause: twisting injury
  - Has maximum chances of union
- Comminuted fracture
  - Direct trauma/ Bending
  - Bone is broken into multiple fragments

Types of fracture based on environment

- Open / Closed

Pathological Fractures 00:09:57

- A fracture in an abnormal bone is referred to as pathological fracture.
- Vertebral bodies (thoracic and lumbar) are the most often affected bones followed by neck femur and lower end radius (collie's fracture).
- Most common cause is osteoporosis followed by metastasis.
- In India most common cause is nutritional
- Commonest local cause of pathological fracture is secondary to malignant lesion
- Most common site is Thoracic vertebrae
- Commonest generalized cause is osteoporosis (Site is vertebral column)
- Pathological fracture in generalized disease usually heal in time
- Pathological fracture in benign lesion usually heal but take longer time
- Pathological fracture in infected / Malignant lesion may not unite at all

Mirel's criteria 00:11:17

	Number Assigned		
• Variable	• 1	• 2	• 3
• Site	• Upper limb	• Lower limb	• Peritrochanteric
• Pain	• Mild	• Moderate	• Severe
• Lesion	• Blastic	• Mixed	• Lytic
• Size	• <1/3 diameter of bone	• 1/3 – 2/3	• >2/3 diameter of bone

- So, patients with maximum risk of pathological fractures are having lytic peritrochanteric lesion involving > 2/3 diameter with severe pain
- Patients with ≤ 7 score are observed, but those with score > 8 should have prophylactic internal fixation

ATLS: Advanced Trauma Life Support 00:12:36

- The Assessment of severely injured patients consists of four overlapping phases

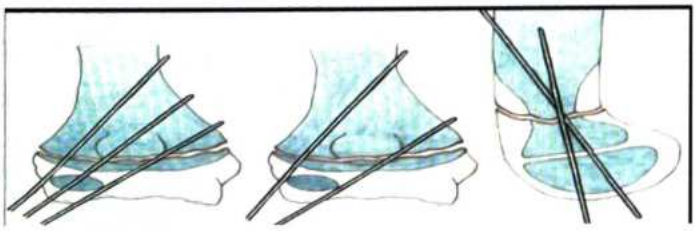
1. Rapid primary evaluation
2. Restoration of vital functions
3. Detailed secondary evaluation
4. Definitive care
   - Prehospital phase: ± Airway maintenance ±Control of external bleeding and shock ± Immobilization of the patient ± immediate transport to closest appropriate facility
   - Hospital phase: ± Triage ± primary survey (ABCDEF)
     - → **A** – **A**irway and cervical spine stabilization
     - → **B** – **B**reathing and ventilation
     - → **C** – **C**irculation and control of bleed
     - → **D** – **D**isability and deformity
     - → **E** – **E**nvironment and Exposure
     - → **F** – **F**racture splintage

DCO: Damage control Orthopedics

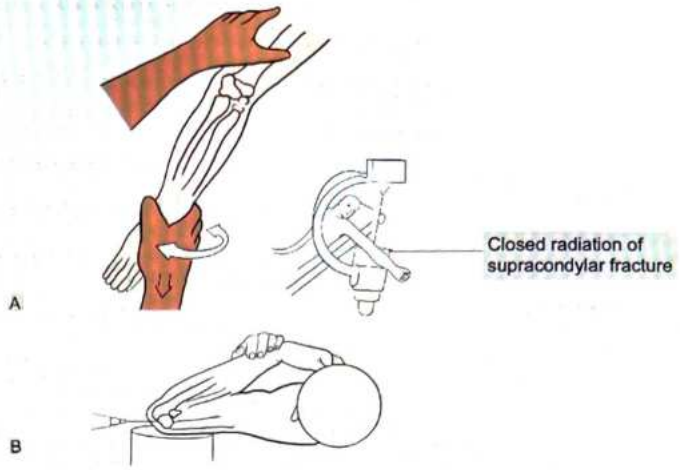
- Early fracture stabilization while minimizing the second hit cause by prolonged surgical procedures
- Shorter procedures are favored
- Closed reduction with minimally invasive temporary fixation

1. Mostly done with borderline patients: ISS > 20 with thoracic injury or > 40 without thoracic injury
2. Polytrauma patients with abdominal / pelvic trauma and hemodynamic shock (BP <90 mm hg)
3. Lung contusion
4. Mean pulmonary artery pressure > 24 mm Hg
5. If MPAP increases by 6 mm while reaming

Supracondylar fracture of humerus 00:15:40



- Extra-articular fracture (Occurs away from the joint)
- Rx: Closed Reduction and fixation



Lateral condyle intra-articular fracture 00:16:25

- Joint is affected
- Articular surface needs to be restored
- Rx: Open reduction

Fracture healing 00:17:04

	Primary healing	Secondary healing
Callus	• Absent	• Present
Biological healing	• No	• Yes
Examples	• Plating	• Nailing / casts

Non-Union Types

- Condition where the fracture does not unite for 9 months of which the last 3 months, there is no progress in healing.
- Types

1. Hypertrophic (Vascular)
2. Atrophic (avascular)

Hypertrophic	Atrophic
• Vascular	• Avascular
• High amount of callus	• No callus
• Rx: stabilize, callus will change into consolidation	• Rx: Freshen the fracture + stabilize + Bone graft

- Fractures [illegible]inion
  - **F** - **F**emur Neck fracture: (Cambium layer absent)
  - **L** – **L**ateral condyle of Humerus
  - **U** – **U**lna lower 1/3rd
  - **T** – **B**ody of Talus, Lower 1/3rd of Tibia
  - **S** – **S**caphoid

How to remember

- FLUTS

- Most Common Complication in Scaphoid: Non-union > Avascular necrosis

Fractures known for malunion

- **M** - **M**alunion
- **I** - **I**ntertrochanteric Fracture Femur
- **S** - **S**upracondylar Humerus
- **C** - **C**olle's Fracture / Clavicle fracture

How to remember

- MISC

Gustilo Anderson classification 00:22:31

- Grades of classification
  - Grade 1: Clean wound of < 1 cm length
  - Grade 2: Wound > 1cm in length without extensive soft tissue damage, skin flap or avulsion
  - Grade 3: Wound associated with extensive soft tissue damage, comminution, contaminated, segmental fractures, Gunshot injuries or farm house injuries
  - Grade 3_a: Adequate periosteal coverage is there
  - Grade 3_b: Significant periosteal stripping and it requires secondary bone coverage procedure like skin grafting or flap
  - Grade 3_c: Open fracture with Vascular injury that requires vascular repair
- Treatment
  - Overall treatment: Debridement + External fixator

CLINICAL QUESTIONS

Q. A 45 -year-old postmenopausal woman presents to ER with pain and limitation of right arm movements after a FOOSH injury. On Physical examination, there is soft tissue swelling, ecchymosis and tenderness over the right shoulder region. The normal convex contour of the shoulder is maintained. The most likely diagnosis in the given clinical scenario?

A. Acromio-clavicular dislocation
B. Proximal humerus fracture
C. Shoulder dislocation
D. Fracture of the clavicle

Answer: B

Solution

- Based on the clinical scenerio there is fracture of the proximal humerus.
- Fracture of the proximal humerus is usually seen after middle age, most commonly in osteoporotic, postmenopausal women. The most common mechanism of injury is falling on the outstretched hand. The patient usually presents with localized shoulder pain and limitation of movement in the affected arm.
- Clinical features: On examination, soft tissue swelling and ecchymosis may be seen over the shoulder. Bony tenderness may be elicited over the upper part of the humerus. The normal

Clinical eatures:

- On examination, soft tissue swelling, and ecchymosis may be seen over the shoulder.
- Bony tenderness may be elicited over the upper part of the humerus.
- The normal convex contour of the shoulder is usually retained, but it may be lost in severe fractures and in fracture dislocations.
- The axillary nerve must be tested as it is the most common nerve to be injured in proximal humerus fractures.

Management:

- Undisplaced proximal humerus fractures are treated using an arm pouch or sling.
- Displaced and unstable fractures are treated by open reduction and internal fixation.

Q. A 28-year-old, archaeological student was involved in a motor vehicle accident as a motorcyclist who slipped on an oil spill on an urban road. He was admitted to the trauma unit in your hospital. An urgent whole-body CT scan revealed a closed fracture of the humerus shaft. The nerve commonly injured in these kinds of fracture is:

A. Radial nerve
B. Ulnar nerve
C. Axillary nerve
D. Posterior interosseous nerve

Answer: A

Solution Fractured shaft of humerus

Mechanism of injury

- A fall on the hand may twist the humerus, causing a spiral fracture.
- A fall on the elbow with the arm abducted exerts a bending force, resulting in an oblique or transverse fracture.

- A direct blow to the arm causes a fracture which is either transverse or comminuted.
- Fracture of the shaft in an elderly patient may be due to metastasis.

Pathological anatomy

- With fractures above the deltoid insertion, the proximal fragment is adducted by pectoralis major.
- With fractures lower down, the proximal fragment is abducted by the deltoid.
- Injury to the radial nerve is common, though fortunately, recovery is usual.

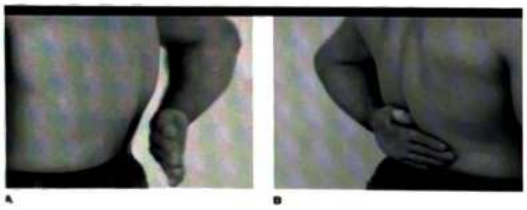
Clinical features

- The arm is painful, bruised, and swollen. It is important to test for radial nerve function before and after treatment.
- This is best done by assessing active extension of the metacarpophalangeal joints; active extension of the wrist can be misleading because extensor carpi radialis longus is sometimes supplied by a branch arising proximal to the injury.

16 UPPER LIMB - 1

Rotator cuff injuries 00:00:29

- Rotator cuff muscles: Sit-s
  - Supraspinatus
  - Infraspinatus
  - Teres minor
  - Subscapularis: inserts on lesser tuberosity, Internal rotator
- Lift off test: To check damage to subscapularis



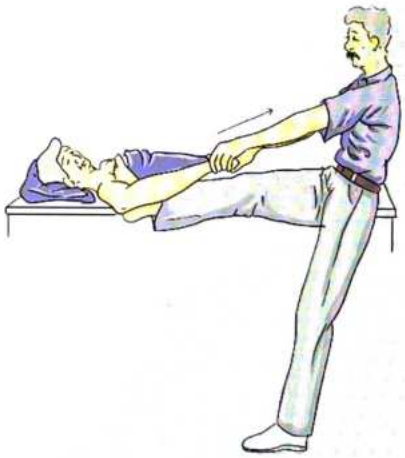
- Treatment for Rotator cuff tear
  - Repair
  - If Irreparable, then do tendon transfer

Shoulder Dislocation 00:01:41

- Usually occurs with abduction and external rotation force
- In Anterior Dislocation: Down/Out (Arm's abducted)
- In Posterior Dislocation: Up/In (Arm's Adducted)
- Tests
  - Dugas Test: Inability to touch the opposite shoulder in dislocated shoulder
  - Callaway Test: Circumference of axilla lengthens in dislocated shoulder.
  - Hamilton Ruler Test: When ruler placed on lateral epicondyle ruler touch lateral epicondyle and acromion simultaneously in dislocated shoulder. (Normally it can't)
  - Bryant's test: lower level of axillary fold which can be observed from a distance in dislocated shoulder.

- Management
  - Kocher's maneuver: most common
  - Stimpson's maneuver: gravity assisted reduction.
  - Hippocrates Maneuver: not used

Stimpson's maneuver



Shoulder Instability

- Anterior: ABER (Abduction + External rotation) +Extension
- Posterior: ADIR (Adduction + Internal rotation)
- Inferior: Multi directional (Hyperlaxity, Ehler Danlos, Marfan syndrome, Osteogenesis imperfecta Aka Laxed joint/ Luxatio Erecta)

a. Anterior Instability

- Tests
  - Anterior drawer
  - Apprehension test
  - Fulcrum / Crank test

Abduction + External Rotation

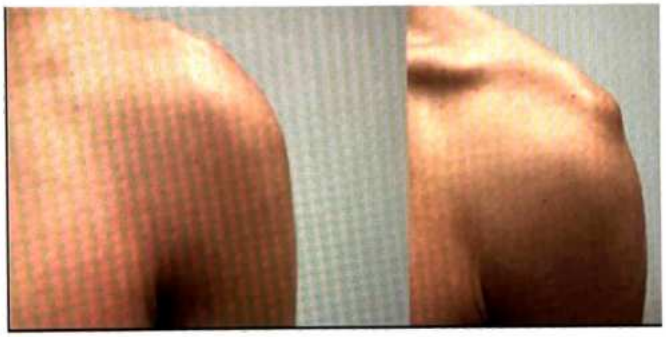
- Mechanism: Abduction + External rotation

b. Posterior Instability

- Test: jerk test
- Mechanism: Adduction + internal rotation

c. Inferior instability

- Sulcus test for multidirectional instability



Complications of shoulder dislocation

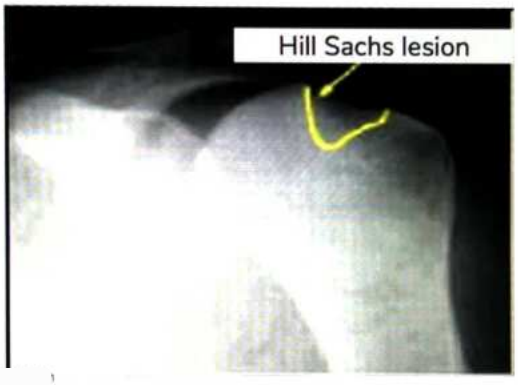
- MC complication of shoulder dislocation: Recurrent shoulder dislocation

a. Bankart's lesion

- Anterior tear in Glenoid labrum in anterior dislocation

b. Hill Sachs posterolateral defect

- Defect of Humeral head in Anterior dislocation



c. Reverse Hill Sach's: Anteromedial defect in Posterior dislocation

Matsen's classification for recurrent instability of shoulder 00:08:52

TUBS	AMBRII
• T - Traumatic	• A - Atraumatic
• U - Unidirectional	• M - Multi directional
• B - Bankart's	• B - Bilateral
• S - Surgery	• R - Rehabilitation (Hyperlaxity)
	• I - Inferior capsular shift procedure
	• I - Internal closure
• Good Prognosis	• Poor Prognosis

Surgery for shoulder instability 00:09:36

- Bankart's repair
- Putti plat: double breasting of subscapularis (tightening)
- Bristow Latarjet: Coracoid transfer to anterior glenoid

Posterior Dislocation

- Causes: Epilepsy, Electric shock
- Empty Glenoid sign or Electric bulb sign: Glenoid cavity is relatively empty because head is out
- Most missed dislocation in human body.

Inferior Dislocation

- Hyper abduction
- Luxatio erecta (Hyperlaxity Syndrome)

Nerve Injuries 00:11: 47

Injury	Common Nerve Involvement
• Shoulder	• Axillary, (circumflex humeral) Nerve
• Fracture shaft Humerus	• Radial Nerve
• Fracture Supracondylar Humerus	• AIN > median > radial > ulnar
• Elbow dislocation	• Ulnar Nerve
• Cubitus Valgus	• Tardy Ulnar Nerve Palsy
• Wrist Dislocation	• Median Nerve
• Hip Dislocation	• Sciatic nerve
• Knee Dislocation	• Common Peroneal Nerve (foot drop)
• Monteggia's fracture dislocation	• Posterior interosseous nerve
• Volkman's ischemic contracture	• Anterior interosseous nerve

FOOSH: "Fall on outstretched Hand"

a. Colle's fracture: Most commonly seen in elderly, osteoporotic
b. Scaphoid: young
c. Supracondylar # of Humerus: In children
d. Fracture clavicle
e. Surgical neck of humerus fracture
f. Lateral condyle fracture humerus
g. Head and neck fracture of radius
h. Galeazzi fracture dislocation
i. Radial styloid fracture

Previous Year's Questions

Q.A 35-year female came with history of fall in bathroom. she was managed conservatively clinical picture of patient is given. The deformity is due to?
(AIIMS June 2020)

A. Intra-articular fracture at wrist
B. Extra-articular fracture at wrist with dorsal displacement
C. Extra articular fracture at wrist with volar displacement
D. Boxer's fracture

Fracture of humerus 00:15:14

- Indication of surgery

1. Vascular injury (Absolute indication)
2. Multiple fracture (As part of damage control)
3. Pathological fracture (fix / tissue)
4. Radial Nerve involvement after reduction

Important Information

- Surgical Emergencies in Ortho
  1. Pelvic Fracture
  2. Compartment Syndrome
  3. Vascular Injury
  4. Septic Arthitis

Clavicle 00:16:26

- MC bone to fracture
- Occurs in Middle 1/3rd

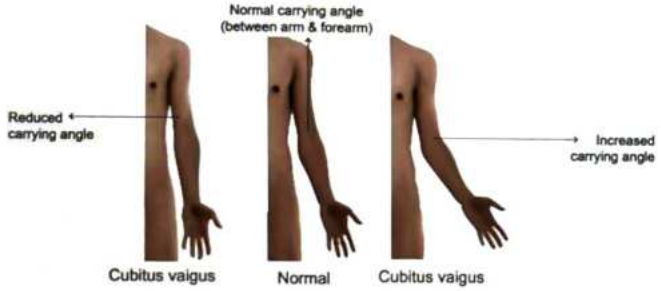
- At junction of Medial 2/3rd and Lateral 1/3rd
- Treatment: Observation / Sling / Figure of 8 Bandage
- Operative indications are increasing
- Indication for Surgery
  a. Comminuted fracture
  b. Open fracture
  c. Floating shoulder

Three-point bony relationship in elbow 00:17:26

- Medial epicondyle
- Lateral epicondyle
- Tip of Olecranon

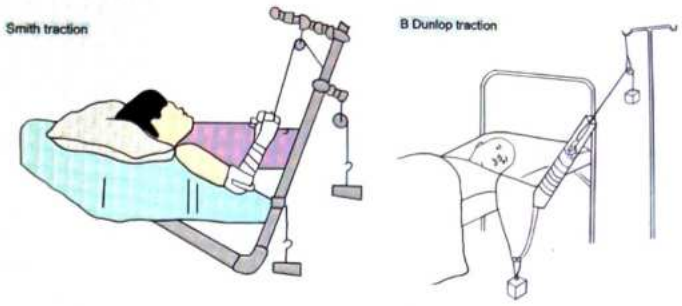
Coronal plane deformities

- Cubitus Varus
  - Carrying angle decreases
  - Seen in supracondylar fracture humerus
- Cubitus Valgus: Lateral (distal part goes laterally)
  - Carrying angle increases
  - Seen in lateral condylar humerus



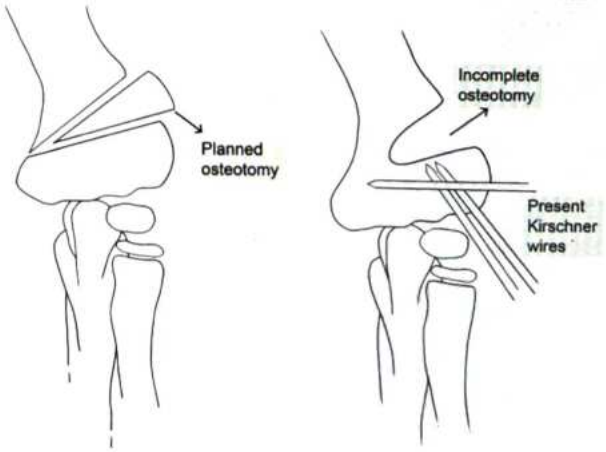
Supracondylar Humerus fracture 00:19:25

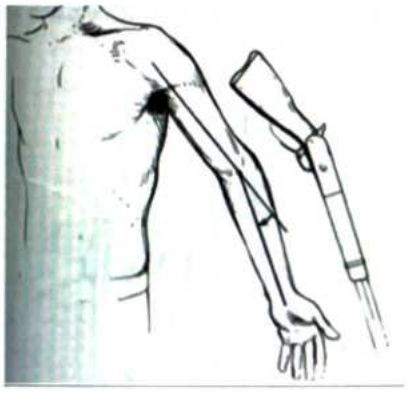
- Undisplaced fracture of humerus: Posterior fat is elevated "Fat pad sign"
- Fracture is displaced: Distal fragments goes posteriorly Extension
- Treatment: close reduction and look for reappearance of pulse
- Other Treatment
  - Smith's traction
  - Dunlop traction
- If reduction is not proper, it can lead to cubitus Varus (Gun stock deformity)



Lateral Closing wedge osteotomy 00:21:22

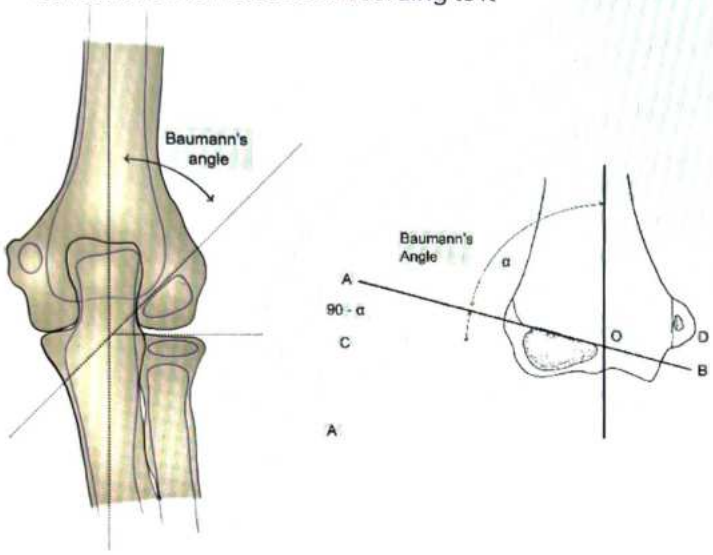
- To treat any varus, a wedge of Bone from Lateral side is taken out (more from lateral and less from medial) as lateral border is bigger and medial border is shorter k/a Lateral closing wedge osteotomy



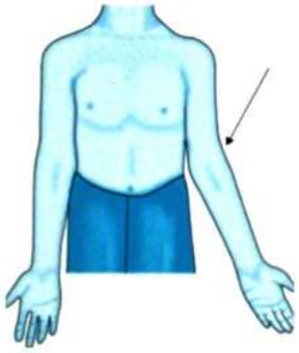


Bauman's angle

- Angle between elbow and cubitus Varus & it's corrections are measured according to it



Fracture Lateral Condyle Humerus 00:22:00



- Intra-Articular Fracture
- Treatment: Open Reduction + K wire
- Complication
  - Non Union (Cubitus Valgus)
  - Malunion (Cubitus Varus) Very rare
- This can also lead to "Tardy Ulnar nerve palsy"

Important Information

- Malu[illegible]
  - [illegible] common
  - Lead to cubitus Varus

Gartland classification – Supracondylar fracture of humerus

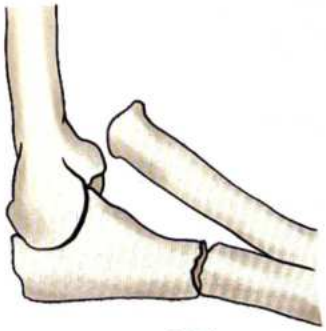
- Extension type of injury (95%)
- Types
  - Type 1: Un displaced
  - Type 2: Displaced with posterior hinge intact
  - Type 3_a: Displaced fracture with lateral hinge broken (PM)
  - Type 3_b: Displaced fracture with medial hinge broken (PL)
  - Type 4: Completely displaced flexion type (5%)

Monteggia Fracture 00:24:10

- Medial bone (Ulna)
- Mouth (upper ½) # with Radial head dislocation Classified by Bado's classification
- Types
  - Type I: Radial Head goes anterior→ Most Common
  - Type II: Radial Head goes posterior
  - Type III: Radial Head goes lateral
  - Type IV: Forearm → both bone fractured + radial head dislocated.
- Surgery: Bell tawse procedure

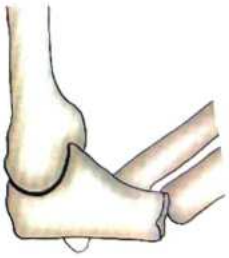
Bado classification of Montegia fracture 00:25:18

- Type 1: Anterior dislocation of radial head with proximal third ulnar fracture
  - Classical monteggia fracture dislocations
  - This type was originally described by monteggia in 1814
  - Most common type



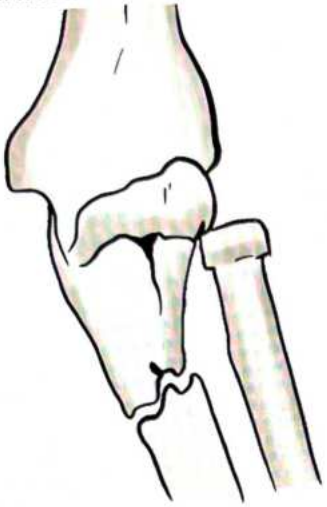
Type I

- Type 2: Posterior dislocation of radial head with proximal third ulnar fractures



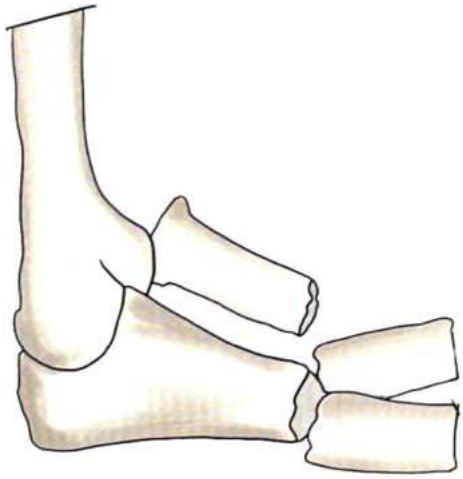
Type II

- Type 3: lateral dislocation of radial head with proximal third ulnar fracture



Type III

- Type 4: anterior radial head dislocation as well as proximal third ulnar and radial shaft fractures



Type IV

Galeazzi fracture 00:26:23

1. Fracture of Radius (Lower ½)
2. Dislocation of Distal Radio-Ulnar Joint
3. Interosseous Membrane Damaged
4. Triangular Fibro-Cartilage Complex (TFCC) Damaged (Found in Distal Radio-Ulnar Joint)

Previous Year's Questions

Q. Identify the condition show below?

(FMGE Dec 2020)

A. Galeazzi fracture
B. Monteggia deformities
C. Monteggia fracture
D. Green stick fracture

Colle's and Smith fracture 00:27:13

- Colle's fracture
  - Extra articular
  - Most common Fracture of elderly females
  - Fracture of distal radius in the Forearm with dorsal (posterior displacement) of the wrist & hand
  - "Dinner fork" / "Bayonet deformity"
  - Mech of injury fall on outstretched hand
  - Distal part is supinated, Lateral displacement, Imapacted Bony fragments
  - Treatment
    - → Pronation + Palmar Angulation + Ulnar Evasion
    - → Cast Below Elbow (Exception) Handshaking Cast
- Smith's fracture (Reverse Colle's)
  - Fracture of distal radius in which the distal fracture fragment is displaced volarly (ventrally)
  - Mech of injury: fall on outstretched hand
  - Garden spade deformity
  - Treatment : Supination + Lateral displacement + Impacted bones + Posterior Displacement

Pulled elbow (Traction injury) 00:30:31

- History of traction
- Radial head pulled out of annular ligament "Nursemaid elbow"
- Radial head: Responsible for 85% of pronation & supination
- Position: Forearm is pronated (supination is lost)
- Age: 1 – 4yrs (mean = 3yrs)
- X- rays: insignificant
- Treatment
  - Forceful supination + Flex it to position the head back
  - Self- resolving condition
  - As supination can be gravity assisted.

Previous Year's Questions

Q. A small child was playing with her maid where she rotated him by holding from arms. Immediately after, the child started crying. On examination, his arm was presented. What is likely diagnosis?

(NEET Jan 2020)

A. Dislocation of elbow
B. Pulled elbow
C. Fracture head of radius
D. Fracture Coronoid process

CLINICAL QUESTIONS

Q. A 40-year-old, allegedly involved in a motor vehicle accident and was thrown from his motorcycle and hit by a car from behind. There was no loss of consciousness, and no pain was noted elsewhere. He could move all fingers, wrists, and elbows, and no other injuries were noted. On examination, the right-side clavicle was tender. He was unable to raise the right arm due to severe shoulder pain. If an Xray was taken in this patient the most probable site of the clavicle that could have been fractured is:

A. Lateral 3rd
B. Coracoid end
C. Sternal end
D. Middle third

Answer: D

Solution

Clavicle fracture

- Associated injuries - open clavicle fractures associated with high rates of pulmonary and closed-head injuries

Treatment

- Nonoperative treatment: mid-third fracture has traditionally been treated nonoperatively, in a sling.
  - No difference in outcome between the regular sling and figure-eight bandage
  - The risk of nonunion after midshaft fracture is higher in female and elderly patients and with fractures that are displaced, shortened more than 2 cm, or comminuted.
  - Lateral fractures have higher rates of nonunion compared with midshaft fractures.

Q. A 60-year-old woman fell at home and presented to the hospital. She had a history of hypertension. The right shoulder joint was locked in 120° of abduction; thus, moving the shoulder was difficult. No findings suggestive of nerve or vascular injury were observed. Plain radiography was done for the patient (shown in the image). The likely diagnosis is:

A. Inferior dislocation
B. Posterior dislocation
C. Posteromedial dislocation
D. Anterior dislocation

Answer: A

Solution

- Initial radiographs showing right shoulder inferior dislocation
- An inferior shoulder dislocation is the least common form of shoulder dislocation.
- The condition is also called luxatio erecta because the arm appears to be permanently held upward, in fixed abduction.
- The patient will often present with their hand placed on the head or near it.

Diagnosis

- Associated with motor vehicle collision or sporting injury
- Arm is typically abducted between 100 and 160 degrees.
- Diminished or absent pulses

Treatment

- Closed reduction successful in 50%
- Capsular reconstruction if unstable

17 UPPER LIMB 2

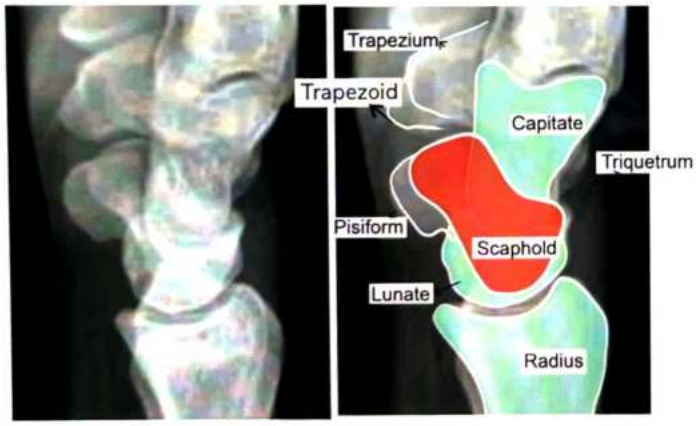
Fractures of lower end of radius 00:00:13

- Lateral view: 1st Metacarpal is anterior.
- Fracture breaks the joint: intra-articular
- Away from joint: extra-articular

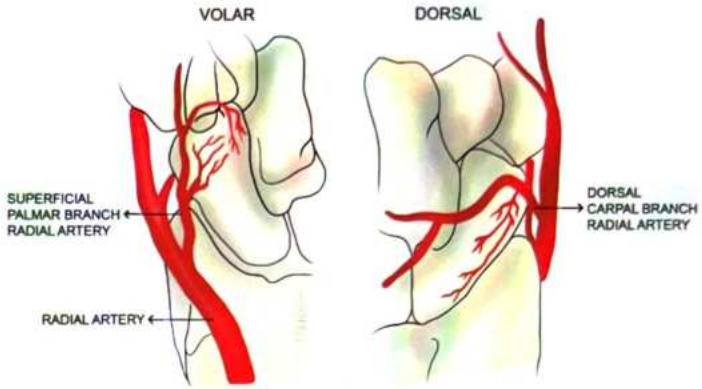
Barton fracture

- Intra-articular fracture: Fracture of articular surface of radius with Volar (anterior) subluxation of wrist.
- Volar Barton > Dorsal Barton
- Treatment
  - Fixation by plating Volar Barton: Anterior
- Dislocation: Complete loss of contact of 2 joint structures
- Subluxation: Partial loss of contact of 2 joint structures

Normal Anatomy of wrist 00:01:00



- Lateral view
  - Radius
  - Anterior scaphoid
  - In the center capitate
  - Moon shaped bone lunate
- The blood supply will come from distal to proximal



Previous Year's Questions

Q. Muscle Inserted at 1st metacarpal base is:

(INICET Nov 2020)

A. Dorsal Interossei
B. FPL
C. Opponens pollicis
D. Abductor policis longus

Scaphoid fracture

- Most common carpal bone to fracture
- Blood Supply is distal to proximal
- Fracture usually occurs in the waist (mid-point)
  ↓
- Blocks bl. Supply distal to proximal Scaphoid fracture
  ↓
- Avascular necrosis of proximal pole
- In children, distal pole fracture is common
- Overall, Most common site of #→waist of the scaphoid

- Scaphoid # shows tenderness in anatomical snuff box.
- Management
  - Glass holding cast
  - Herbert screw

AVN Scaphoid

Herbert screw

Glass holding cast

- AVN of scaphoid: AKA Osteonecrosis occurs in proximal pole

Scapho-Lunate dissociation

- Gap between scaphoid & lunate k/a Terry Thomas sign / David letterman sign
- Ring sign: Scaphoid looks like a ring

Ring sign

Bennetts Fracture Dislocation

- Fracture at base of 1st Metacarpal
- Rolando fracture: Only # at base of 1st MC, No dislocation
- Bennett's Fracture dislocation (common in boxers)# at base of 1st MC due to pull off a muscle "Abductor pollicis longus tendon" displaced

1. Bennett's fracture	2. Rolando fracture
• Fracture dislocation at base of 1st MC due to pull of a muscle causing dislocation Intra – articular joint	• Intra – articular fracture (as it involves base of 1st Mc) • Fracture at base of 1st MC • No dislocation

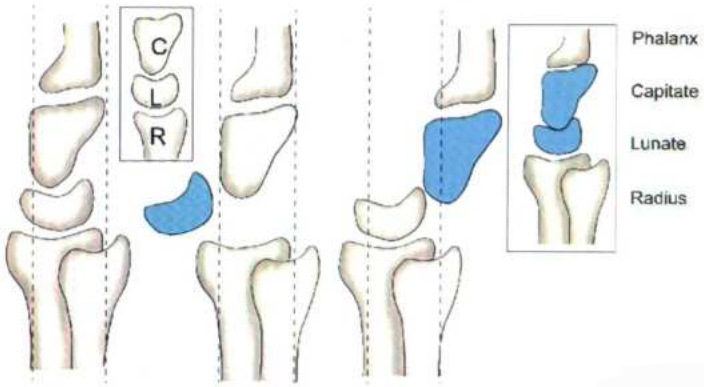
Reverse Bennetts fracture

- Fracture involving base of 5th metacarpal

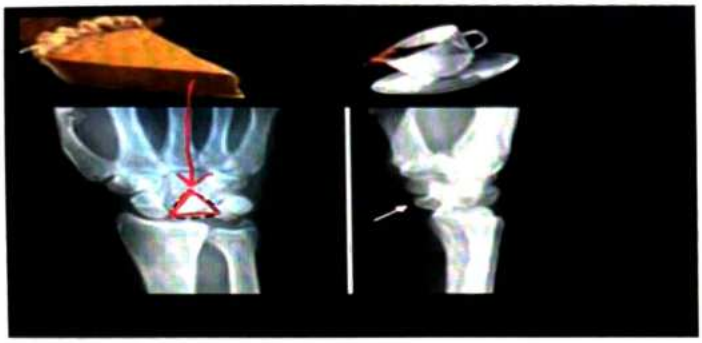
Boxers fracture

- Fracture involving the neck of 5th metatarsal
- Commonest

Wrist dislocation



- Lunate dislocation: lunate comes out and rest of the bone stay
  - "Pie sign" in AP view
  - Spilled tea cup / Pot sign in lateral view



- Perilunate dislocation: Lunate stays and rest of the bone goes out
  - More common

	Articular	Extra-articular
• Definition	• # at articular surface	• # at shaft, ligament / tendon / Muscle / Nerve
• Restricted movements	• Active & passive	• Active

Complications of trauma 00:26:58

- Compartment syndrome: Cast
- Myositis ossificans: H/o Massage
- Sympathetic overactivity: Sudeck's Fracture of femur/ Forty-eight hours
- Fat embolism: Worst prognosis

Previous Year's Questions

Q. A child brought to emergency medicine department with multiple injuries which included a femur fracture as well. He was confused with dyspnoea and rash over the body. What is the diagnosis?

(NEET Jan 2020)

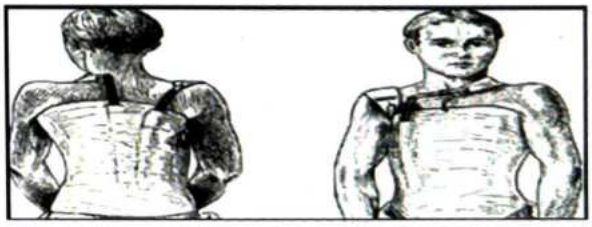
A. Fat embolism
B. Air embolism
C. Pulmonary embolism
D. DIC

Compartment Syndrome

- History of tight cast
- MC area: Deep posterior compartment of leg > Deep flexor forearm
- Earliest symptom - pain out of proportion to injury
- Earliest sign - pain on passive stretch at distal most joint of extremity Management: Remove the cast (pain – not controlled by analgesics)
- Pulse Normal: because micro-circulation is only affected. Hence, it is not a reliable indicator.
- Normal Pressure at leg: <11 mmHg
- Calf pressure during walking: 200 – 300 mm Hg
- Treatment: Fasciotomy (release up to deep fascia
- Indication
  - Pressure > 30 mm Hg
  - Neurovascular compromise
  - Paresthesia (+): do fasciotomy

Volkmann's ischemic contracture

- Sequelae of compartment syndrome
- More common in upper limb
- Deep flexor compartment of forearm
- Flexor digitorum profundus > flexor pollicis longus
- Order of N. involvement: Anterior interosseous> Median > Ulnar
- Management
  - Turn buckle splint
  - Max page muscle sliding operation



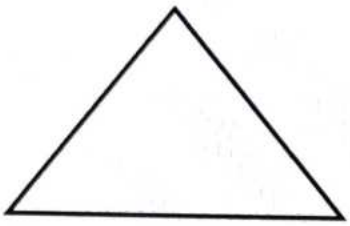
Myositis ossificans 00:30:44

- H/o of massage often present
- Unilateral
- Elbow
- Brachialis > Biceps
- Management
  - Immobilization = 1st 3 weeks
  - Only Active exercises (no passive exercise) = 3 weeks to 1 yr.
  - Surgery > 1 yr.

Sudeck's dystrophy 00:31:44

- Complex regional pain syndrome
- Sympathetic over-activity
- Lankfort's Triad

Stimulus (injury)



Response **Activity (sympathetic)**

- Response: Due to sympathetic overactivity

1. red hot shining skin
2. Patchy osteopenia / hyperemic osteopenia

- Types
  - Type 1: Post – traumatic (after Colle's #) ~ sudeck's
  - Type 2: nerve injury (usually medial nerve) ~causalgia

Treatment: Exercises to continue Results are poor

Complications of Colle's

1. Finger stiffness – most common
2. Mal union → dinner fork deformity
3. Rupture of extensor pollicis longus
4. Carpal tunnel syndrome
5. Sudeck's dystrophy

PRACTICE QUESTIONS

Q. Patient known case of epilepsy presents with abnormal right shoulder, on X ray electric bulb sign seen, type of dislocation?

A. Anterior
B. Posterior
C. Inferior
D. None

Ans. B

Q. Which of the following fracture is seen in patients who fall over flexed wrist?

A. Scaphoid fracture
B. Colle's fracture
C. Bennet's fracture
D. Smith fracture

Ans. D

Q. What is the most common sequelae of traumatic shoulder dislocation in young adults?

A. Frozen shoulder
B. Recurrent shoulder dislocation
C. Normal shoulder healing & movements
D. Subscapular tendinitis

Ans. B

CLINICAL QUESTIONS

Q. A 20-year-old male met up with road traffic accident in which he had a direct blow to the elbow the radiograph of the patient is given below. What is the ideal management for the given condition?

A. Excision and re-suturing
B. Tension band wiring
C. Elbow is immobilized by cast
D. Open reduction and external fixation

Answer: B

Solution

- The given radiograph shows olecranon fracture type II (displaced but stable)
- Olecranon fracture (Mayo classification)
- Type I can be managed non operatively while
- Type II and Type III are managed surgically

Types of olecranon fracture

- Type I: Crack without displacement of fragments.
- Type II: Clean break with separation of fragments.
- Type III: Comminuted fracture

Treatment

Type I	above-elbow plaster slab in 30 degrees of flexion
Type II	open reduction and internal fixation using tension-band wiring
Type III	plating or tension-band wiring or excision of the fragments

- Simple Olecranon fracture without communication or instability are managed with Tension band wiring, Plate fixation or an Intramedullary rod

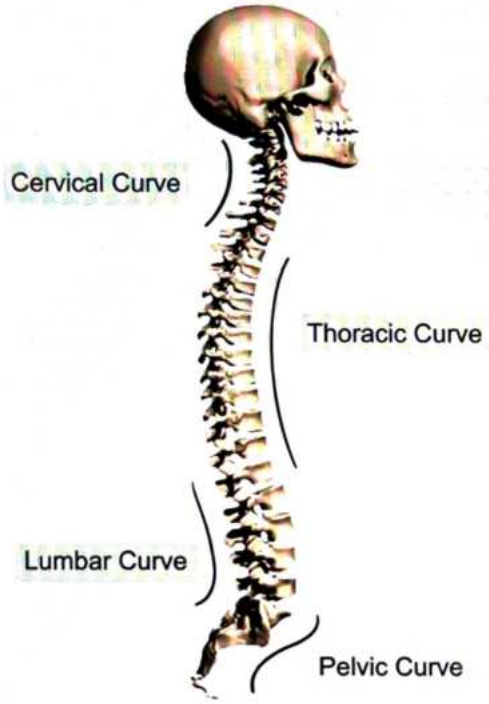
LEARNING OBJECTIVES

UNIT 7: SPINE, PELVIS & LOWER LIMB

- **Spine**
  - Lordosis
  - Scoliosis, Adam's test
  - Cobb's angle
  - Risser's sign
  - Jefferson's fracture
  - Hangman fracture
  - Whiplash injury
  - SCIWORA
  - Crutch field tongs
  - Neurogenic shock
  - Management of spinal cord injury

- **Pelvis**
  - Trendelen burg test
  - Thomas test
  - Upper end femur
  - Neck of femur fractures
  - Garden's and Pauwels classification
  - Neck of femur vs inter trochanteric fractures
  - Anatomical classification of Fracture neck of femur
  - Delbert classification of pediatric fracture of neck of femur
  - Patellar fracture
  - Tibial fracture
  - Plaster of paris
  - Casts & splint
  - Fat embolism
  - Gurd's criteria
  - Floating knee
  - Hip dislocation
  - Dashboard injury
  - Posterior dislocation of Hip
  - Central dislocation of Hip
  - Angels in orthopedics
  - Casts, Splint & traction

18 SPINE, PELVIS AND LOWER LIMB



- Normal curvature of spine
  - Cervical Lordosis (inwards)
  - Thoracic - Kyphosis (outwards)
  - Lumbar - Lordosis

Exaggerated lumbar Lordosis

- Excessive inward curvature
- Causes
  - **S** - **S**pondylo-listhesis
  - **O** - **O**besity/ **O**steoporosis
  - **A** - **A**chondroplasia
  - **P** - **P**ostural

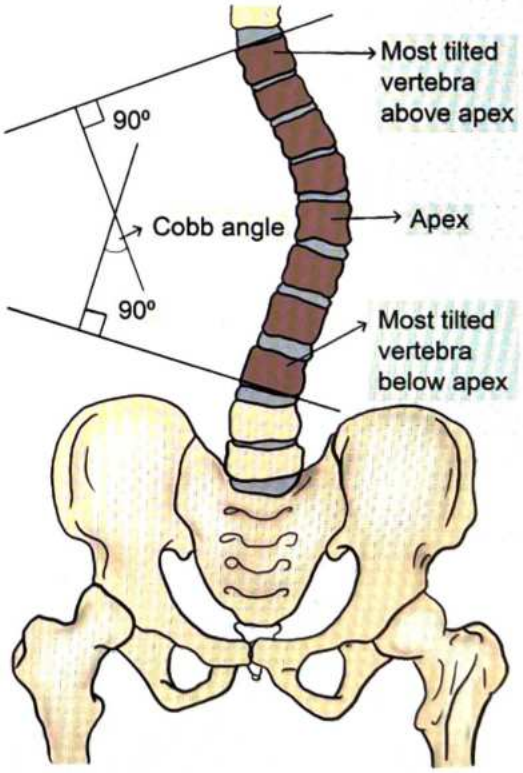
How to remember

- SOAP

Scoliosis

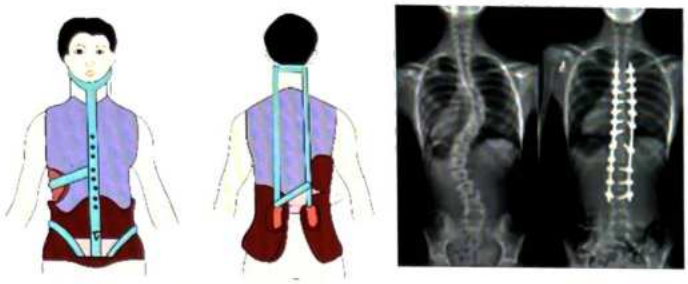
- Lateral curvature of spine with rotational element of vertebra
- Causes
  - Idiopathic
  - Congenital
  - Postural
- Adam's test: when the patient bends forward, the spine will become straight if it's a postural (or) nonstructural scoliosis
- Failure of segmentation
  - Block vertebra
  - Unsegmented vertebra
- Mixed – unsegmented bar with hemivertebrae
  - Hemi vertebra can be
    - → Fully segmented
    - → Semi segmented
    - → Incarcerated
    - → Non segmented

Cobb's angle 00:02:43



- Two imaginary lines are drawn one at the top of the curve and other at the bottom of the curve
- The angle between the perpendicular's of these lines is the angle between the two

- The angle between the two lines is same as the angle between the perpendiculars to each line
- It is important to quantity & treat it
- Rx
  - Cobb's angle 30 degree: Observation
  - 30-45 degree: Brace (milwake / boston)
  - >45 degree: Corrective surgery

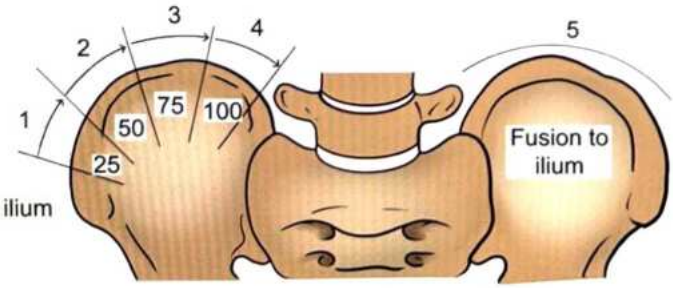


Previous Year's Questions

Q. Identify the angle of Scoliosis shown in the image (NEET Jan 2020)

A. Kites angle
B. Cobbs angle
C. Bohlers angle
D. Gissaine angle

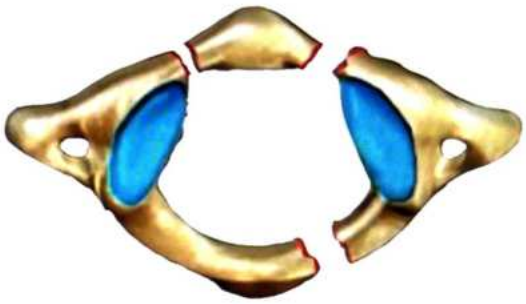
- Risser's sign

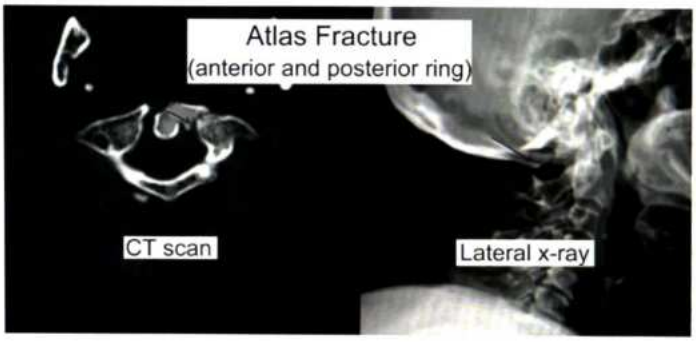


Percent ossification of iliac epiphysis

  - If a patient has almost fused skeletal maturity, the scoliosis won't change much for the growth
  - Dividing iliac crest from anterior superior iliac spine to PSIS as its fuses
  - Fusion
    - → 0-25% - Risser sign 1
    - → 26-50% - Risser sign 2
    - → 51-75% - Risser sign 3
    - → 70-100% - Risser sign 4
    - → Complete Fusion - Risser sign 5
  - In Risser sign 4 or 5 surgery is done if the curves > 50 degree
  - In Risser sign 1 & 3 observation is done as there is a chance of correction as the child grows older.

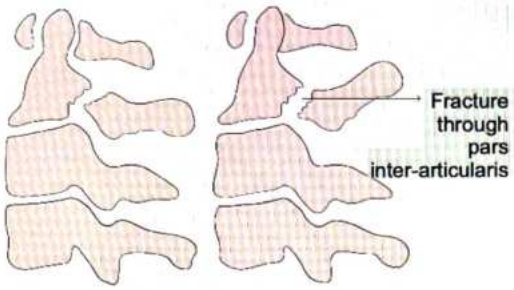
Jefferson's fracture 00:04:37





- Fracture of Atlas's (C1)
- Occurs due to vertical compression force, causing the disruption of the ring of C1 known as the burst fracture
- Neural deficit is rare (because wide spinal canal)

Hangman's fracture



- Traumatic spondylolisthesis of C_2 (axis) over C_3 with fracture through pars – inter articularis of C_2
- Slip of C2 over C3 verterba called as spondylodisthesis.

Clayshoveller's fracture 00:05:07

- Fracture of spinous process of G>D1.

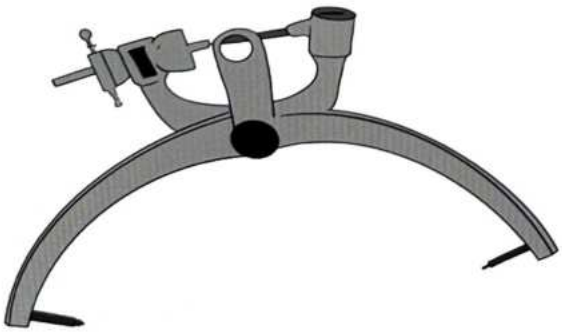
SCIWORAC (spinal cord injury without radiographic abnormality)

- Occurs in pediatric age group <8 years.
- X rays: Normal
- But there is neural deficit due to lax ligaments (flexibility in children) permitting fraction injury to cord.
- MC affected cervical spine

Whiplash injury /railroad spine /Erichsen's disease

- Sprained neck due to hyperextension followed by flexion
- Happens when sudden breaks are applied in a fast moving vehicle.

Crutchfield tongs



- Applied on the parietal bone of the skull
- Use for cervical spine traction.

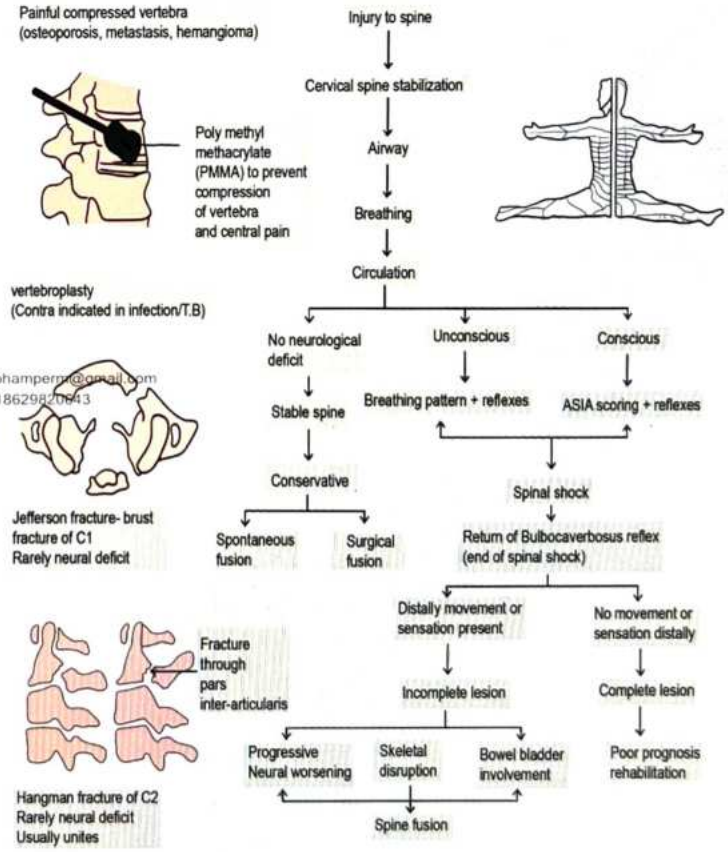
NEUROGENIC SHOCK

- Autonomic dysregulation seen in the patients with spinal cord injuries
- The trauma leads to a state of shock caused unopposed parasympathetic action with a complete loss of sympathetic response.
- It is a diagnosis of exclusion
- Triad of hypotension. bradycardia. and temperature dysregulation is seen.
- Systolic blood pressure of < 100 mmHg heart rate of less than 80 per minute.
- Other causes of neurogenic or spinal shock apart from trauma are spiral anesthesia (most common), Guillain-Barre syndrome, autonomic nervous system toxins, transverse myelitis.

SPINAL SHOCK

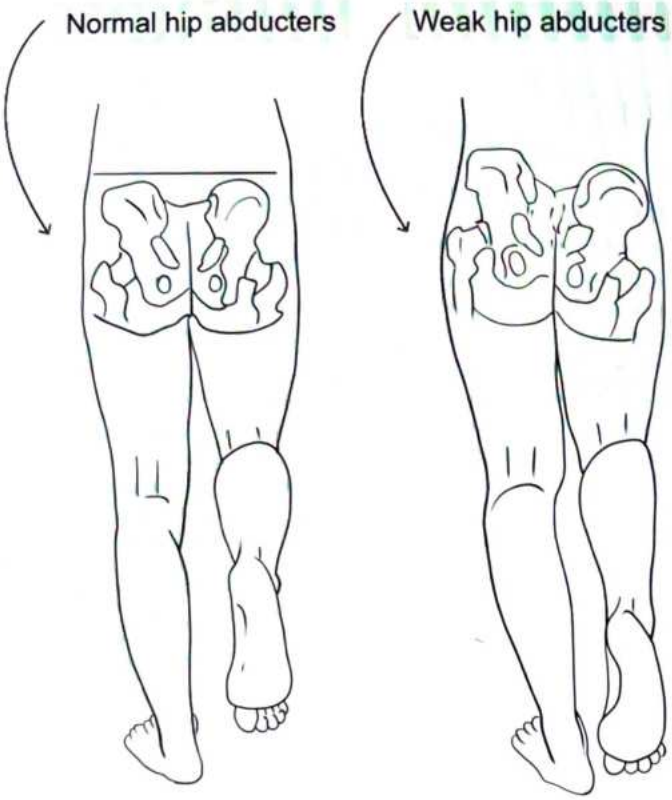
- Acute loss of motor, sensory and reflex functions below the level of injury.
- Absence of anal wink and bulbocavernosus reflexes and by flaccid paralysis.
- It is a temporary phenomenon and recovers usually in 24 to 48 hours even in severe injuries but can persist for weeks or rarely months.
- There is no specific treatment for spinal shock.

Management of spinal cord injury



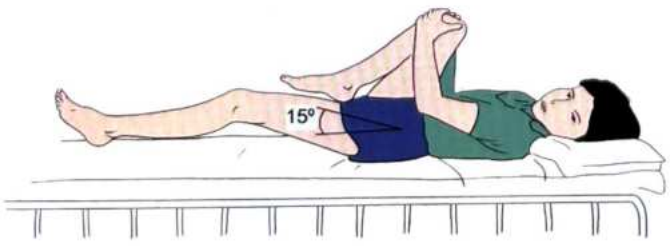
- ATLS
- ASIA Evaluation
- Investigate
- Steroid infusion
- Conserve/ operate

Trendelenburg test



- To check stability of hip
- Stability of hip depends on
- Proper femur head & Acetabulum
- Normal hip abductors (G. medius & Minimus)
- Superior gluteal nerve
- Positive means drop of pelvis on opposite (normal) side
- Trendelenburg test is normally negative (hip muscles & hip nerves are normal).
- When stood on one leg, despite gravitational pull the pelvis doesn't drop down due to the muscle, the hip is kept straight.
- In the same scenario, if the side of the hip is not normal (or) there is a damage in hip muscles (or) nerve the pelvis will drop and cannot be elevated on the opposite side. Known as positive Trendelenburg sign.
- Drop is on opposite side to the damage.
- Bilateral positive: Waddling gait.

Thomas test



- Done for hip flexion deformities
- When the hip of the opposite side is flexed lumbar lordosis is obliterated by rotation of pelvis on obliteration of lumbar lordosis, flexion deformity of hip becomes prominent.
- Lumbar lordosis is compensated up to 30 degree hip flexion
- If flexed > 30 degree the flexion deformity of the abnormal side of hip will be prominent which was hidden by lumbar lordosis.

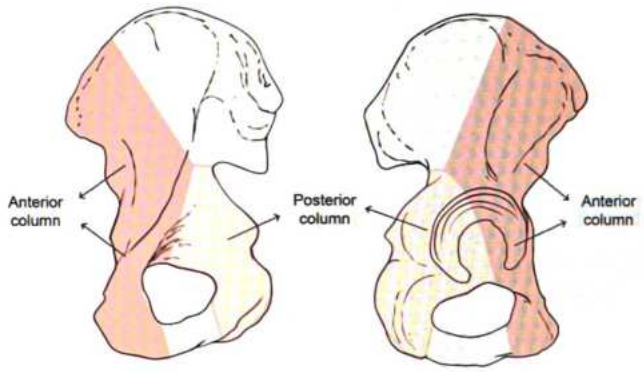
Important Information

- **Thomas test: hip**
- **Thompson test: Tendo-achilles Tear**

Thompson test

- Tendo-achilles tear
  - 2-6 cm above the insertion

Pelvis



- When there is an injury to the pelvis, it will disseminate through the acetabulum (fusion of Ilium, Ischium & Pubis) it will dissipate in the entire pelvis
- IOC for anterior /posterior column fracture – CT scan, x

ray – Judet view

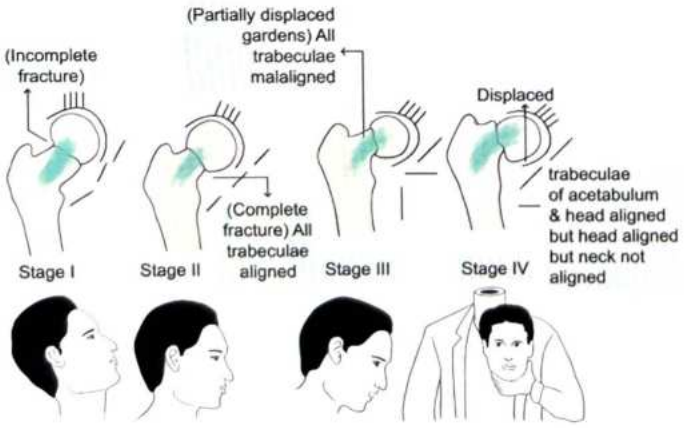
- Spur sign: Bilateral columnar fracture.
- "Judet & Letournal classification".

Upper end of femur ⏱ 00:03:58

- Mainly weight bearing
- The weight of the upper limb & trunk is transmitted to the lower limb & to the ground through the hip joint
- Wolfe's law: bone formation is along the lines of stress

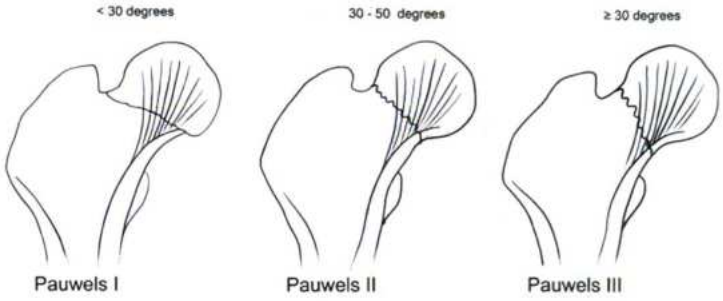
- The trabeculae of acetabulum are in same line with the head of femur and neck of femur
- It is continued till the posteromedial aspect at upper end of femur [calcar femorale]
- When there's a fracture of neck of femur the trabaculae b/w acetabulum, head of femurs neck relationship is altered.

Gardens classification



- Stages
  - Stage 1: When there is a fracture that is incomplete, but the trabeculae goes into valgus
  - Stage 2: complete fracture, all trabeculae aligned
  - Stage 3: Partial displacement, All trabeculae malaligned
  - Stage 4: Trabeculae of acetabulum and head aligned but neck not aligned
- Stage 1 and 2 behaves similar in treatment and prognosis
- Stage 3 and 4 behaves similar in treatment and prognosis

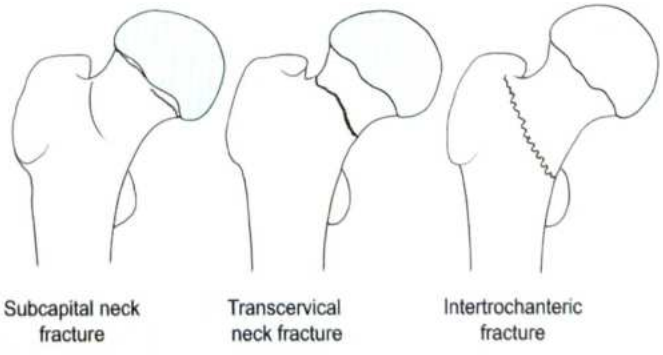
Pauwels classification



- Pauwels 1: Angle the fracture line makes with horizontal is < 30 degrees
- Pauwels 2: angle 30 – 50 degrees
- Pauwels 3: Angle ≥50 degrees

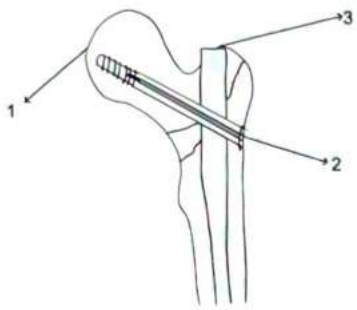
Neck of femur vs inter trochanteric fracture

Neck of femur	Inter trochanteric area
• Intracapsular area	• Extracapsular area
• 60-year, female	• 80-year, male
• Less pain	• More pain
• Less shortening	• More shortening
• Less external rotation (<45 degrees)	• More external rotation (>45 degrees)
• Known for Avascular necrosis	• Known for malunion

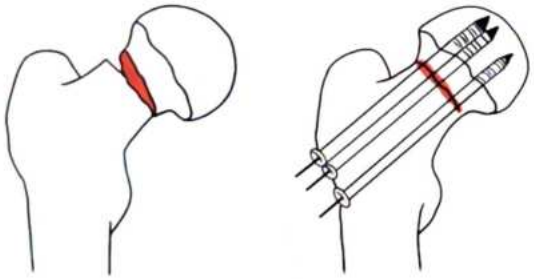


Treatment

- Cephalo-medullary nail aka proximal femoral nail
- Intertrochanteric fracture: Dynamic Hip screw



Delbet classification for pediatric Fracture Neck femur

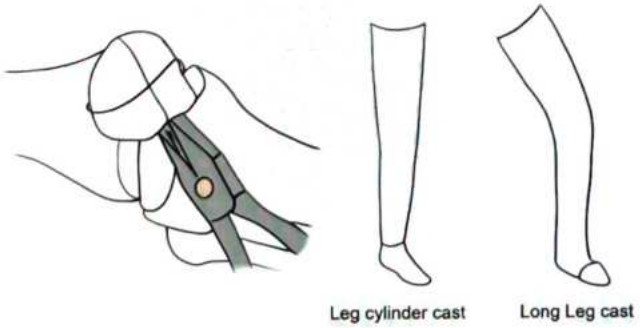


- Type

1. Trans epiphyseal
2. Transcervical
3. Cervico trochanteric
4. Intertrochanteric

- Incidence: 2>3>4>1

Fracture neck femur



Leg cylinder cast Long Leg cast

- Treatment
  - <65 years of age, > 3 weeks of fracture: Bone graft or osteotomy
  - ≥65 years: hemiarthroplasty
  - If Fracture neck femur + Arthritis: Total hip replacement

Patellar fractures 00:11:26

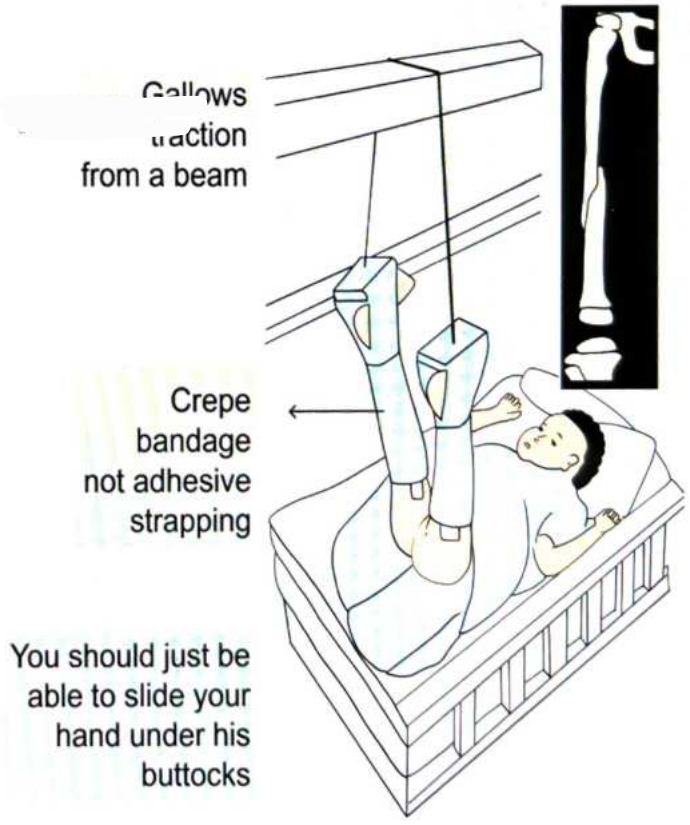
- Occurs due to vilolent muscular pull (indirect), direct trauma
- Tube cast may be used
- Displaced transverse fracture: tension band wiring by k-wire and stainless steel (ss) wire
- Comminuted fracture: at least proximal third of patella is intact (partial patellectomy)
- Severe comminution: total patellectomy

Tibial fracture

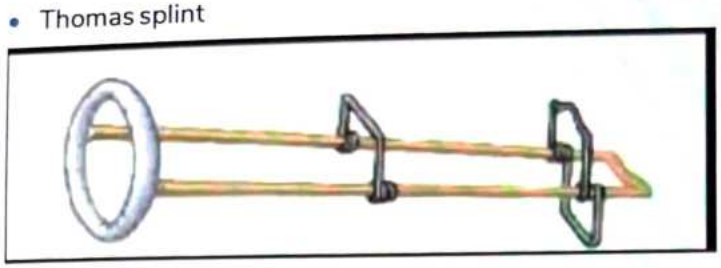
- Proximal tibia fractures: Schatzker classification, three column classification- split/ depression/ comminution, lateral/ medial/ anterior/ posterior
- Tibia shaft fractures- transverse / oblique spiral
- Distal tibial pilon fracture
- Ankle fracture-medial and posterior malleolar fractures
- Tibia is very commonly associated with open injuries

Cast and splints

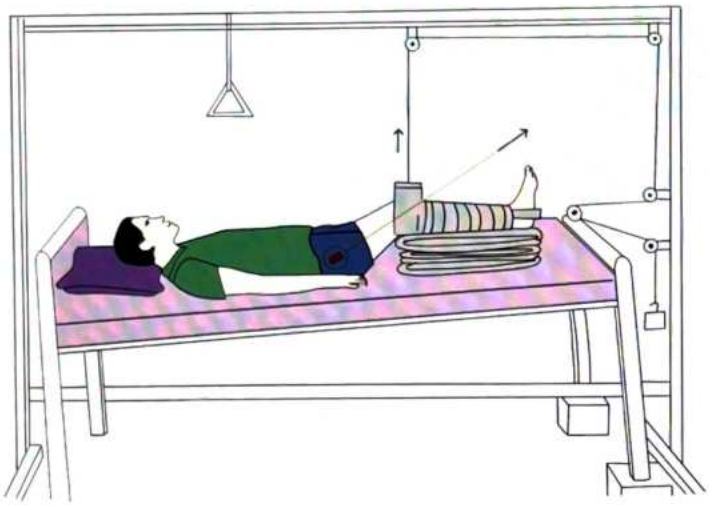
- Gallows traction-shaft femur fracture< 2 years age



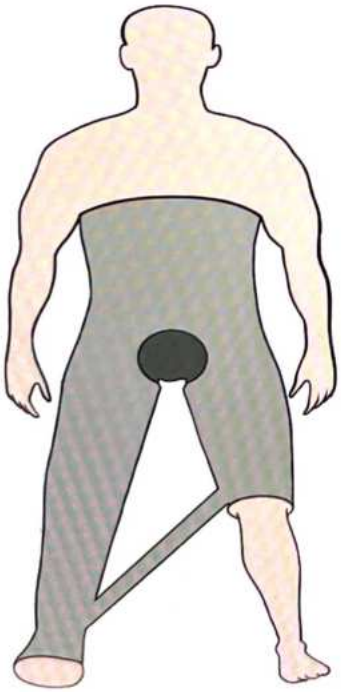
- Thomas splint



- Thomas splint with Fisk splint



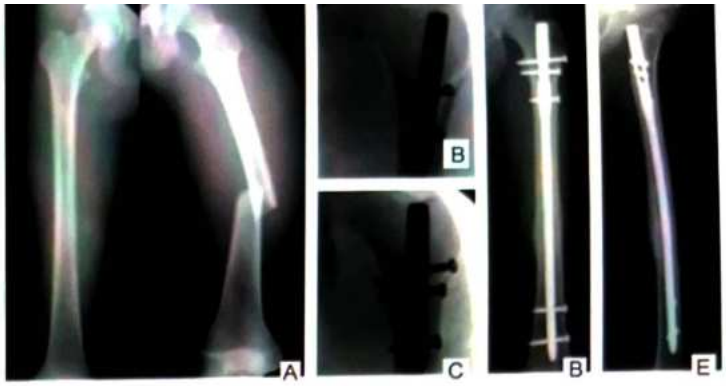
- SPICA



  - Plaster of paris: $CaSo_4$ ½ H_2O

Age wise treatment of fracture shaft of femur

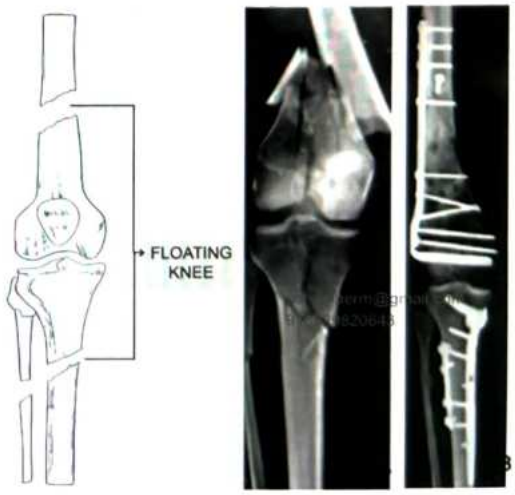
- If child is < 2 /< 5 years: SPICA
- 5-10 years: TENS -Titanium Elastic Nail System
- ≥10 years: interlock nail



Fat Embolism 00:16:48

- 1 major + 4 minor criteria = Fat embolism
- Gurd's Major criteria
  - Axillary or subconjunctival petechia
  - PaO_2 below 60 mm Hg
  - CNS depression
  - Pulmonary oedema
- Gurd's Minor criteria
  - Tachycardia
  - Pyrexia
  - Anemia
  - Thrombocytopenia
  - Fat Globules present in sputum
  - Fat present in urine
  - Increasing ESR or plasma viscosity (PV)
  - Emboli present in retina
- Treatment
  - Oxygen<40%
  - IPPV
  - Dextran (decreases RBC AGG)
  - Aprotinin (decrease platelet AGG)
  - Lipolytic: Heparin
  - Hypertonic glucose (Decrease FFA production)
  - Steroids to Avoid pneumonitis

Floating Knee 00:18:42



- Fracture involving a major bone above and a major bone below a joint is k/a floating knee
- Treatment: fixation

Hip dislocation

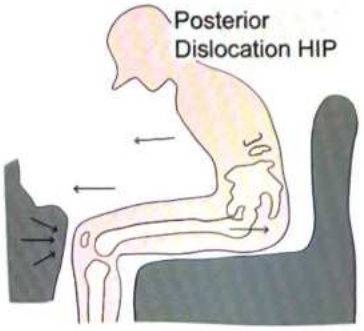
00:18:48

- Dislocation have typical presentation: FABER / FADIR
- Fracture dislocation have atypical presentation
- Anterior Lengthening
- Posterior And central shortening

Dashboard injury

00:23:16

- Posterior hip dislocation
- Flexion, adduction, internal rotation and shortening
- Femoral artery pulsation felt around head of femur k/a Vascular sign of Narath
- In posterior dislocation vascular sign of Narath is positive



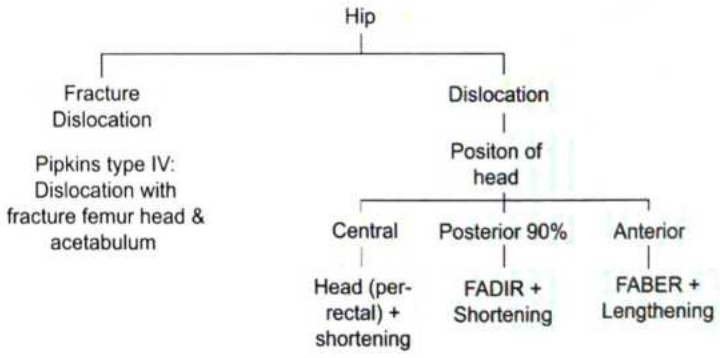
Central dislocation of hip

00:24:40

- Head of femur felt on per rectal examination
- Limb shortening

Head with acetabular fracture

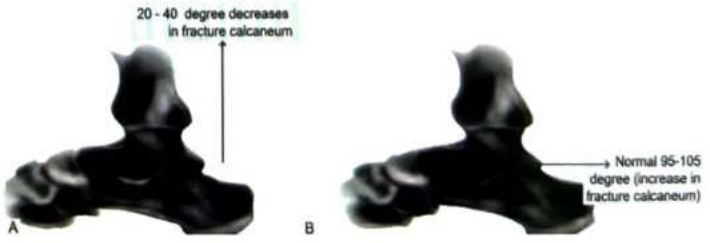
- Shortening
- Classical deformities of posterior dislocation not present
- Head posterior
- Pipkins type 4: shortening and gluteal mass with atypical features



NOTE : "Any mass that moves with rotation of thigh is femoral head"

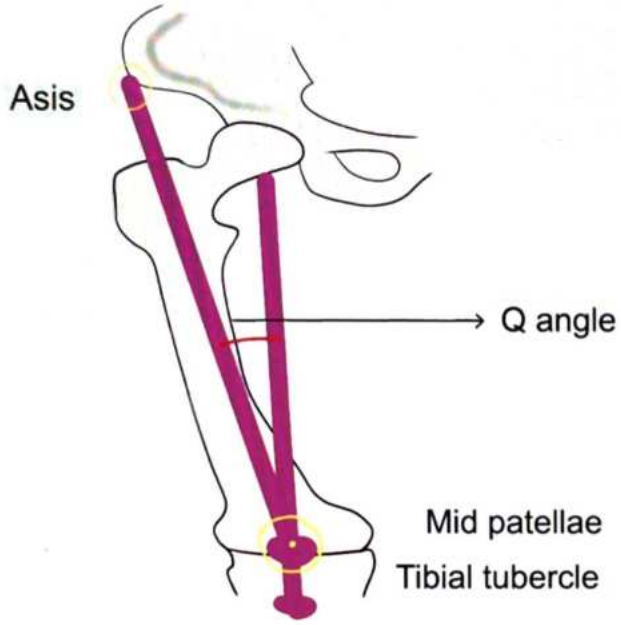
Angles in orthopedics

- Bohlers angle



- Angle along the joint line and calcaneal tuberosity
- 20-40 degree
- Decrease in fracture calcaneum

- Angle of gissaine
  - Angle on the articular surface
  - Normal: 95 – 105 degrees
  - Increases in fracture calcaneum
- Q angle



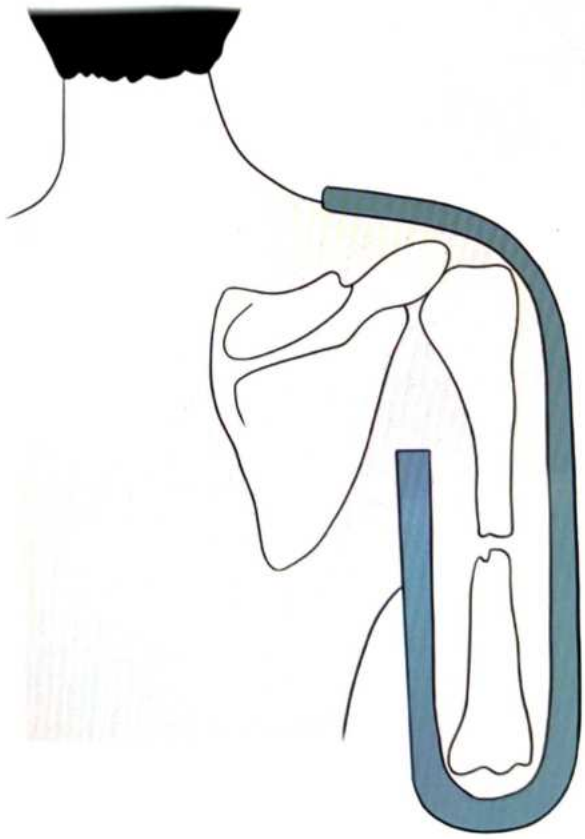
  - If Increased then there is higher chance of patella subluxation or dislocation
- Insall Salvati ratio = ligamentum patellae / patellar length
  - < 0.8 = patella baja
  - >1.2 = patella alta

- Kites angle: CTEV
- Cobbs angle: Scoliosis

Cast, Splint and Traction

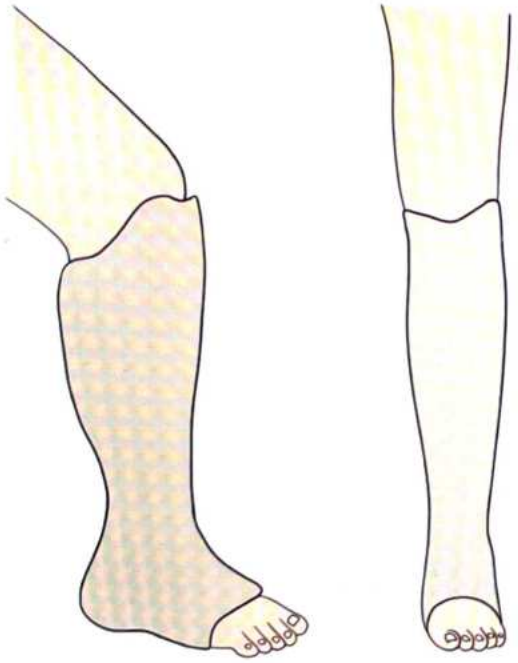
- Hanging cast

- U slab



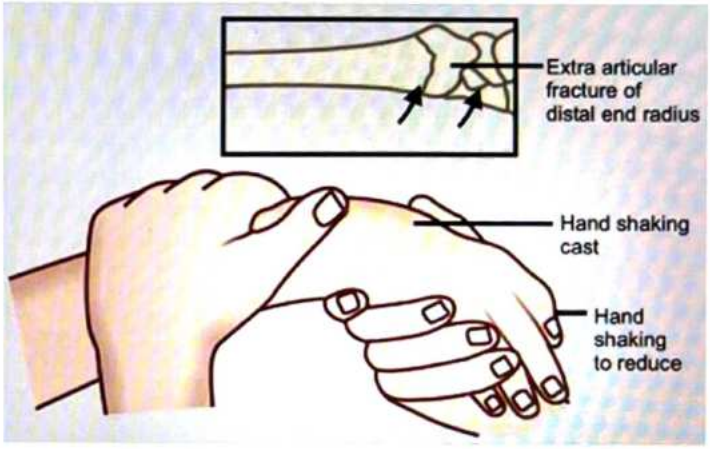
- Cylinder cast: fracture of patella

- Patella tendon bearing cast: Tibia fracture



- Glass holding cast

- Hand shaking cast



- Dunlop traction
- Clavicle figure 8
- Mallet finger splint

CLINICAL QUESTIONS

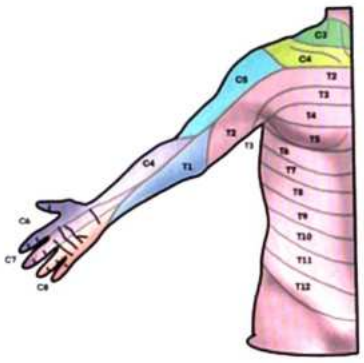
Q. A patient involved in a road traffic accident presents with quadriparesis, sphincter disturbance, sensory level up to the upper border of sternum and respiratory rate of 35/minute. The likely level of lesion is

A. C1 – C2
B. C4 – C5
C. T1 – T2
D. T3 – T4

Answer: B

Solution

- C2 dermatome: Occiput and upper part of neck.
- C3 dermatome: Lower part of neck up to the clavicle.
- C4 dermatome: Area just below the clavicle (Area which coincide with upper border of sternum).
- Motor supply of upper limb is C5 to T1
- Motor supply of diaphragm (Phrenic nerve) is C3 to C5
- Thus, C4 to C5 involvement will cause increased respiratory rate with all the above-mentioned features.



Q. A 23-year-old man who had a road traffic accident was brought to the emergency room. His right leg is shortened, internally rotated and adducted. The pulsation of the femoral artery is not felt. An X-ray was done STAT showing the following findings. What is the diagnosis?

A. Posterior dislocation of hip
B. Anterior dislocation of hip
C. Fracture shaft of femur
D. Fracture neck of femur with injury to femoral vessels

Answer: A

Solution

- Above clinical scenario shows characteristics of posterior dislocation of the hip.
  - The shortening and attitude of the limb in flexion, adduction and internal rotation is characteristic of posterior dislocation of hip.
  - The femoral artery pulsation is usually felt against the neck of the femur.
  - Due to the posterior dislocation of the hip joint, the vessels fall backwards, and the pulsation of the femoral artery cannot be felt. This is called as vascular sign of Narath.
- The posterior dislocation is the most common type of dislocation of hip.

The radiograph shows the following findings:

- The femoral head is displaced superiorly and laterally
- The left femoral head appears slightly smaller than the right femoral head
- The limb is adducted and internally rotated

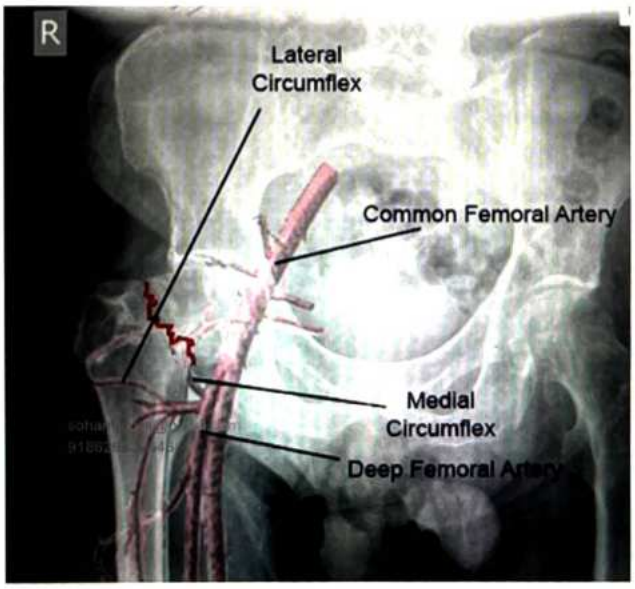
Type of hip dislocations

- Posterior- Seen in motor vehicle accidents where the flexed knee of the passenger hits the dashboard.
- Anterior- It is seen in high energy injuries.
- Central- It is seen when there is a blow over the greater trochanter or fall on the side.

Dashboard injury can lead to

- Posterior hip dislocation
- Acetabular fracture
- Patellar fracture
- Fracture of neck of femur
- Shaft of femur fracture
- Posterior cruciate ligament injury

Q. A 20-year-old male met up with Road Traffic Accident and brought to the emergency department. His Pauwels's classification for neck of femur fracture is given below. If the angle increases which of the following, does it indicate



A. Good prognosis
B. Impaction
C. More chances of displacement
D. Trabecular alignment displacement

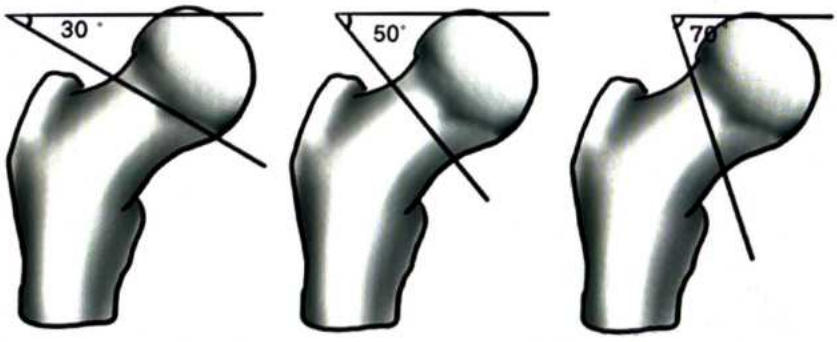
Answer: C

Solution

Pauwel's classification

- Depending on angle (Pauwel's angle) formed by the # line with the horizontal.
- More the Pauwell's angle, more unstable is the fracture with poorer prognosis
  - Type I: <30°
  - Type II: 30-50°
  - Type III: >50°(worst prognosis)

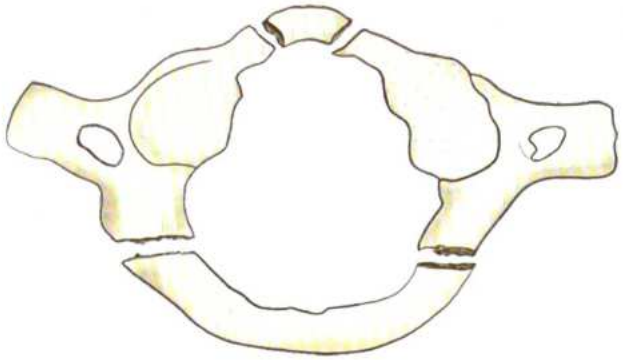
Pauwels-1	Pauwels-2	Pauwels 3
• Angle - <30 degree	• 30-50 degree	• >50%
• Favourable		• Unfavourable
• Horizontal		• Vertical
• The more the fracture is horizontal the better it is for repair		
• Better prognosis • More chances of compression		• Poor prognosis • More chances of displacement



19 FRACTURE MANAGEMENT

TYPES OF FRACTURE

Jefferson fracture



- Fracture of Atlas's (C1)
- Occurs due to vertical compression force, causing the disruption of the ring of C1 known as the burst fracture
- Neural deficit is rare (because wide spinal canal)

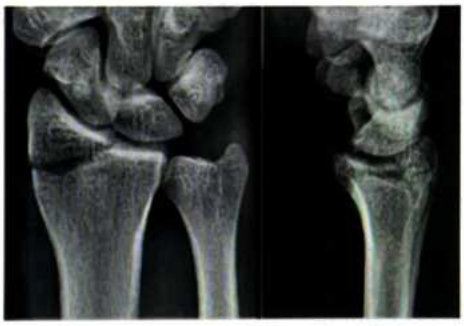
Hangman fracture 00:00:33

- Traumatic spondylolisthesis of C_2 (axis) over C_3 with fracture through pars – inter articularis of C_2
- C2 over C3 slip of verterba called as spondylodisthesis.

Night stick fracture 00:00:42

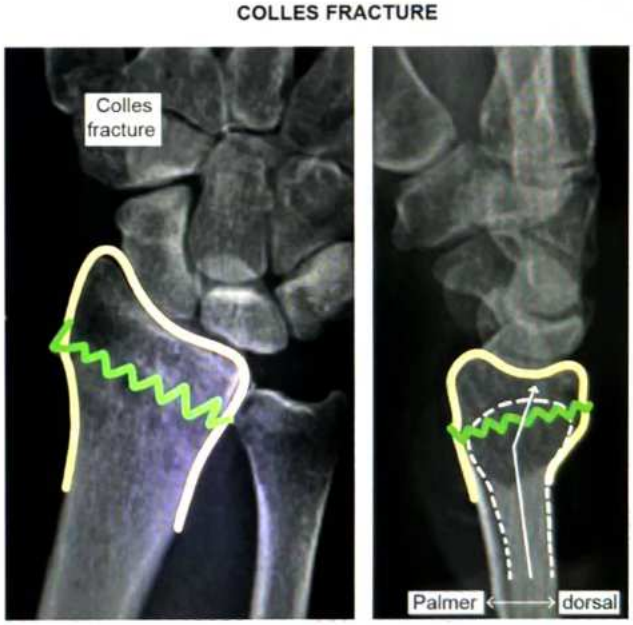
- Isolated fracture of the shaft of ulna
- No dislocation of proximal (or) distal joint
- Eg: A thief defending the stick of the guard with the Forearm in front

Chauffer's fracture 00:00:54



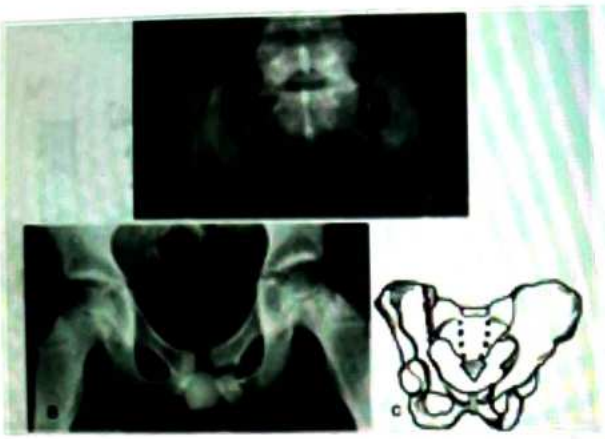
- Intraarticular fracture Involving radial styloid

Colle's Fracture 00:01:04



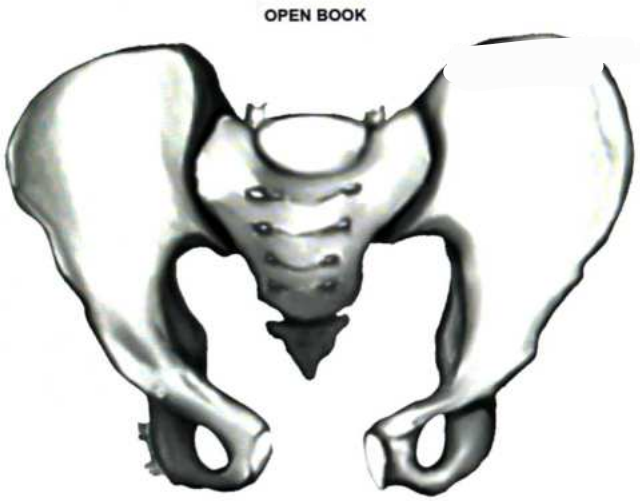
- Extra articular Fracture
- 1st metacarpal is Anterior with a Posterior Displacement

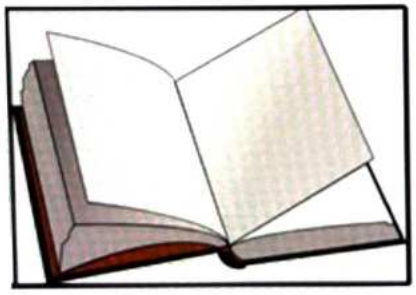
Bucket handle fracture 00:01:14



- Fracture of Posterior element on one side and the Anterior on the other side
- Type B pelvic injury

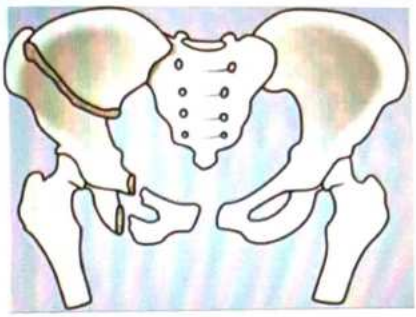
Open Book fracture





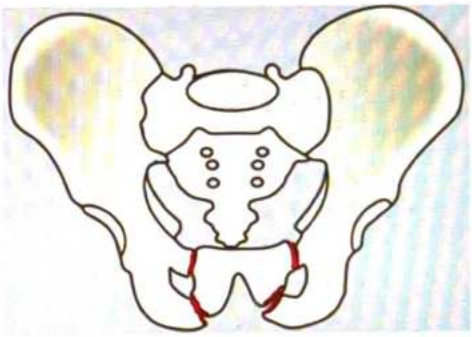
- When the posterior elements provides a hinge and the anterior elements open on it, it's an Open book Fracture
- Type B pelvic injury

Malgaigne Fracture 00:02:08



- Fracture of Anterior and Posterior elements of Pelvis on the same side

Straddle Fracture 00:02:34



- Bilateral superior and Inferior Pubic Rami Fracture

Pilon Fracture

- Intra articular
- Communited fractured involving the lower end of the Tibia

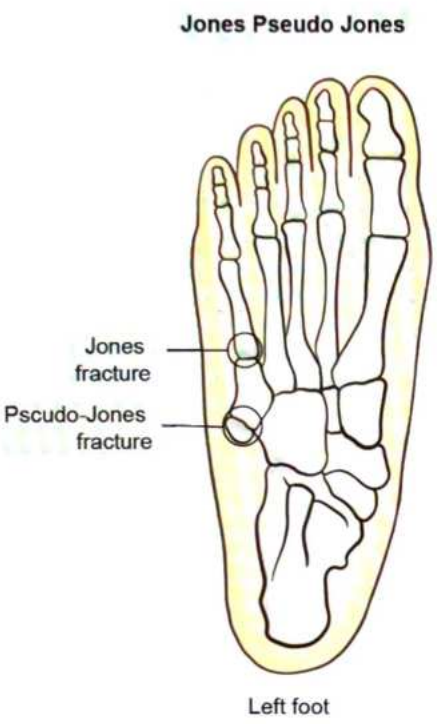
Aviators Fracture

- Vertical fracture d/t Force on the body of talus

Jones fracture

- Fracture of base of 5th metatarsal

Pseudo Jones fracture 00:02:41



- Fracture of Tip of base of 5th metatarsal

Proximal Humerus Fracture

1. Shaft
2. Head
3. Greater tuberosity
4. Lesser tuberosity

Supra condylar Fracture Humerus 00:03:27

- Extension type Posterior Displacement

Monteggia's Fracture 00:03:31

- Fracture of Ulna with a Dislocated Radial Head
- Type I MC

Galeazzi Fracture 00:03:42

- Fracture to the Radius with damage to the Distal Radio-Ulnar joint

Previous Year's Questions

Q. Identify the condition show below?

(FMGE Dec 2020)

A. Galeazzi fracture
B. Monteggia deformities
C. Monteggia fracture
D. Green stick fracture

Boxer's Fracture

00:03:49

- AKA street fighters' fracture
- Fracture neck of 5th metacarpal

Bumper Fracture

00:03: 53

- Fracture involving the upper end of lateral tibial plateau

Cotton Fracture

00:04:01

- AKA Tri-Malleolar Fracture
- Fracture involves 3 malleoli
  - Lateral Malleolus involving Fibula
  - Medial Malleolus involving Tibia
  - Posterior Malleolus involving Tibia

Pott's Fracture

00:04:24

- Bimalleolar Fracture
- Medial and Lateral Malleoli are Fractured

Chopart's Fracture

00:04:36

- Inter-tarsal injury

Lis-Francs Fracture

00:04:42

- Tarso-metatarsal Injury

March Fracture

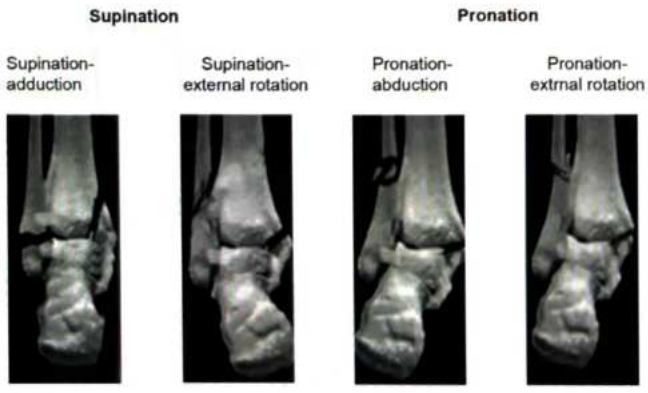
00:05:02

- Involves the neck of 2nd metatarsal > 3rd Metatarsal

ANKLE INJURIES

00:05:03

Lauge- Hansen Classification of Ankle Fractures



Foot Position	Supination	Pronation
Force	Adduction + Inversion	Abduction + Ext. Rotation

Position – Force (First word is position & second is force)	Fracture
• Supination – Adduction	• Vertical fracture of Medial Malleolus • Horizontal Fracture of Lateral Malleolus
• Supination – External (MC) Rotation • Pronation - Abduction • Pronation – External Rotation	• Horizontal fracture of Medial Malleolus
• Supination – External Rotation • Pronation – External Rotation	• Oblique fracture of Lateral Malleolus (Fibula)
• Pronation –Abduction	• Horizontal fracture of Medial Malleolus • Comminuted Fracture of Lateral Malleolus

Summary

Foot	Force	M. Malleolus	L. Malleolus
	Adduction	Vertical	Horizontal
Supination	External Rotation*(MC)	Horizontal	Oblique
	Ext. Rotation	Horizontal	Oblique
Pronation	Abduction	Horizontal	Horizontal (comminuted)

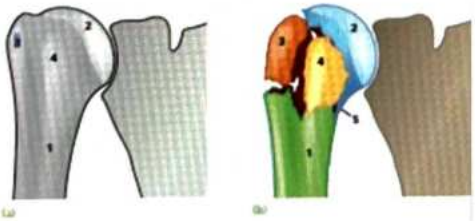
Runner fracture 00:06:52

- Fracture of lower end of f...

CLASSIFICATION OF FRACTURE 00:06:57

1. Allman's: Fracture clavicle
2. Campbells/ Rockwood: Ac joint
3. Neers: Proximal humerus
4. Gartland: Supracondylar humerus
5. Milch: Lateral condyle humerus
6. Masons: Head radius
7. Bados: Monteggia
8. Frykmanns/ Fernandez: Colles
9. Dennis: 3 Columns of spine
10. Young & Burges/ Tiles: Pelvis
11. Judet & Letournel: Acetabulum
12. Thompson & Epstein: Posterior dislocation
13. Pipkins: Head of femur
14. Gardens/Pauwels/ Anatomical: Neck femur
15. Boyd Griffith/ Evans: Intertrochanterlc fracture
16. Winquist Hansen's: Shaft femur
17. Schatzkers: Proximal tibia
18. Ruedl and Allgower : Distal tibia
19. Hawkins: Neck talus
20. Essex Lopresti (X-ray)/ Sanders (CT scan): Calcaneum
21. Gustilo Anderson: Open fracture
22. Tscherne: Soft tissue Injury in closed fracture

Neers classification 00:07:44



- For proximal humerus

Dennis 3 column theory 00:07:55

- Divides vertebra into 3 parts
  - Anterior part in the anterior column
  - Posterior in the middle column
  - Pedicle in the posterior column
- If 2 out of 3 columns are involved: unstable injury

TREATMENT OF FRACTURE

Operative management of injuries 00:08:10

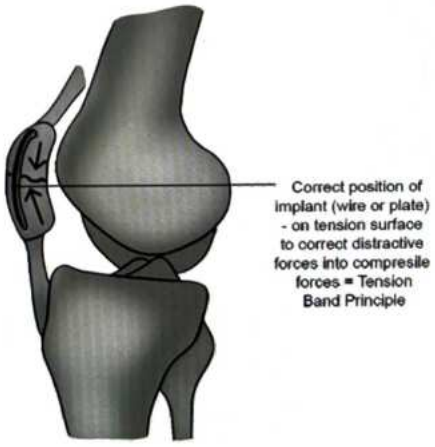
- Extra articular fractures CR: Hematoma preserved
- Intra articular fracture OR: Prevent the Arthritis
- Small bone fracture screws / K wires
- Children non-operative except Peri-articular fractures Children K (Kirschner wires)

Kirschner Wires

Tractions 00:08:48

- Are conservative Methods
- Skin traction: Pad the area apply the splint apply weight 3-4 kg
- Skeletal traction: Steenmanpin, k-wires or any metallic pin will go into the bone and apply traction where up to 10% of bodyweight or 20kg of Weight is used

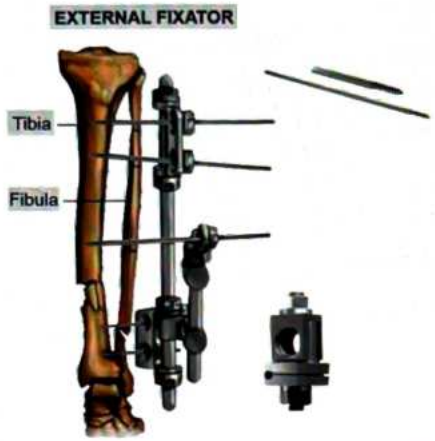
T & W: Tension Band Wiring 00:09:32



- It is a correct position of implant which can be a wire/plate by which there is conversion of distractive forces into compressile forces on the tension surface.
- Done for patellar, Olecranon and medical malleolus fractures.

External fixators 00:10:49

- Used for open injuries
- Debridement is done and applied outside the skin.
- Schanz screws of different size is used
- Universal Clamp and Rods



TYPES OF PLATES 00:11:24

1. Dynamic compression plate: (DCP)

- Used to fix the diaphyseal region and can be used as neutralization Buttress mode (or) compression mode and compress mode and compress the fracture site.
- A drill is used to make hole into the bone and threads are made. Screws are used to fix the plate

2. Limited contact -DCP (LCDCP)

- It decreases the contact with bone surface
- Hence preserving bone vascularity

3. Locking Compression plate

- The screw locks in screw holes of the plates hence the name locking plates
- Indications
  - Osteopenic bone
  - Metaphyseal areas
  - Periprosthetic fractures
  - Failed fixation (non-Union)

1. Cancellous Bone Screw

- More distance between threads

2. Cortical Bone Screw

- Threads throughout the screw

INSTRUMENTS USED IN ORTHOPEDICS 00:14:08

Osteotome

- Used for cutting by the both cutting edges / sides

Curette

- Used for scooping out the dead necrotic material

Bone cutter

- Used to freshen the margins and prepare the grafts to be placed at any place.

Bone Nibbler

- Used to nibble out pieces of bone to freshen the margins.

Bone holding forceps

- Always have dentations

Bone plate holding forceps

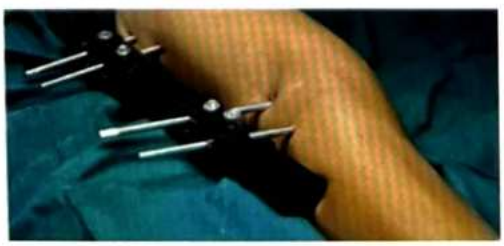
- One side is toothed and the other side is smooth
- Toothed side is for bone holding and smooth side for plate

Interlock nailing

- Used for Lower limb fractures (Intramedullary implant)
- Secondary healing
- Callus will be formed
- Bone is Locked with Screw to prevent mal-rotation

External Fixators

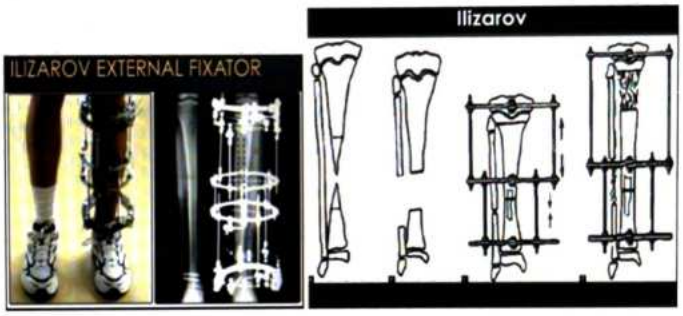
RAIL FIXATOR



- For open Injuries

Ilizarov External fixator 00:15:59

- Used in cases of non-union.
- In case of shortening used to increase the length of the Limb
- Works on the principle of "Distraction Histogenesis"
- Cut at different bony ends
- Wait for callus to form and gradually distract it



Some common errors in the book 00:18:17

Incorrect	Correct
Rolando: Extra-articular	Intra-articular
Lisfrancs	TMT
M/c bone to fracture at birth: humerus	Clavicle
Thurston Holland: Type 4	Type 2
Supracondylar: radial nerve	AIN
CTEV cast / B/K	A/K
Fracture healing	Consolidation / remodelling
EGAWA test	IGAWA Test

CLINICAL QUESTIONS

Q. A 65-year-old male brought to casualty with history of fall. The patient is in severe pain, there is tenderness on the greater trochanter and the patient is not able to walk. The lateral border of the foot touches the bed. What is the most common complication in the given clinical scenario?

A. Nonunion
B. Ischemic necrosis
C. Malunion
D. Pulmonary complications

Answer: C

Solution

- The given clinical scenario depicts the Fracture neck of femur (inter-trochanteric).

Fractured neck of femur presents with the following clinical features:

- Painful movements of the hip joint
- Shortening and external rotation of the affected limb

Plain radiograph of the fracture neck of the femur may show the following features:

- Fracture in the neck of femur
- External rotation of the femur with the lesser trochanter appearing more prominent Displacement of the greater trochanter
- Break in th[illegible]eam
- Break in [illegible]'s line

Extra-capsular (inter-trochanteric) fracture is more common than intra-capsular.

- Most common complication of Extra-capsular fracture of neck of femur of neck is mal union.
- In inter-trochanteric fractures, there is usually gross deformity and pronounced lateral rotation.

In Intra-capsular (neck of femur fracture)

- Most common complication is avascular necrosis > non-union.

Q. A 16 year old male sustained injury to his right hand while riding bicycle. His flexor tendon must be repaired. For this the graft must be taken from.

A. Plantaris
B. Palmaris longus
C. Extensor digitorum
D. Extensor indicis

Answer: D

Solution

- It arises from the distal third of the dorsal part of the body of ulna and from the interosseous membrane. It runs through the fourth tendon compartment together with the extensor digitorum, from where it projects into the dorsal aponeurosis of the index finger.
- The extensor indicis extends the index finger, and by its continued action assists in extending (dorsiflexion) the wrist and the midcarpal joints.
- For the flexor tendon the graft is usually taken from the extensor indicis

LEARNING OBJECTIVES

UNIT 8: JOINT DISORDERS

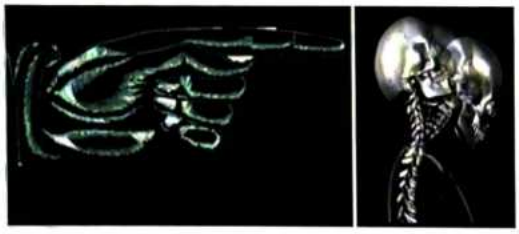
- **Joint Disorders**
  - Rheumatoid arthritis
  - Pathogenesis of RA
  - Ankylosing spondylitis
  - Osteoarthritis
  - Patellar clunk syndrome
  - Classification criteria for RA
  - Deformities of RA
  - Ankylosing hyperostosis vs Ankylosing spondylitis
  - Psoriatic arthritis with Caspar criteria
  - Acroosteolysis
  - Gout
  - Charcot's joints
  - Hemosiderotic synovitis
  - Synovial chondromatosis
  - Synovial fluid findings

20 JOINT DISORDERS

Rheumatoid arthritis

00:00:50

- Young Female
- Bilateral hand Pain
- Morning stiffness
  age is nor criteria
- Most common area involved is upper cervical Spine (AKA craniovertebral junction)



- Craniovertebral junction involvement: RA > AS > Gout
- C1-C2 anomaly: Spine flexion/extension view

Ankylosing Spondylitis

- Young Male
- Lower back ache: Sacroiliac joint involvement
- Reduced chest inspection
- Hands are spared
- Less common
- Controlled by swimming & cycling

Bone tumors

- More common in males
- GCT and Fibrous dysplasia: More common in females

	Osteoarthritis	Rheumatoid Arthritis	Psoriatic Arthritis (Caspar Criterion)
Involved	• PIP, DIP and 1st CMC (carpometacarpal) joints	• PIP, MCP, Wrist	• DIP, PIP and any joint
Spared	• MCP (Metacarpo - phalangeal), Wrist and Ankle	• DIP joint usually	•

Diseases and joints involved

- Gout - MTP or great toe joint
- Pseudogout - Knee
- RA - Metacarpophalangeal joint
- AS - Sacroiliac joint
- Septic arthritis - Knee
- HIV - Knee

Pathogenesis of RA

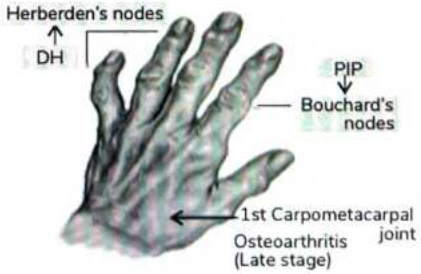
00:08:13

- T cell contribution to bone degradation
  - T cells can activate variety of cell types involved in bone degradation and resorption
  - T cells directly attack the cartilage cells, and they also indirectly stimulate the dendritic cells which release the bone and degradation enzymes
  - It will also stimulate the macrophage and fibroblast like synoviocyte which directly damages the bone and the cartilage
- Systemic response
  - Systemic autoreactivity/ genetics activates the innate immunity which activate the dendritic cells, FLS, and Macrophage
  - Dendritic cells activates the nT cells (naïve T cells) to aT cells (activated T cells)
  - This cause an immune response and cause damage to synovium

Osteoarthritis

00:11:01

- MCP Spared
- Base of thumb (1st metacarpal joint): Characteristic feature DIP > Knee
- DIP involved in Osteoarthritis: Heberden's Nodes
- Pip involvement: Bouchards Nodes



Previous Year's Questions

Q. Involvement of PIP, DIP and I[st] CMC with sparing of Wrist and MCP is seen in? (NEET Jan 2020)

A. RA
B. Osteoarthritis
C. Psoriatic arthropathy
D. Jaccoud arthropathy

Previous Year's Questions

Q. Primary Osteoarthritis affects all except? (FMGE May 2018)

A. Hip joint
B. Knee joint
C. Distal interphalangeal joint
D. Metacarpophalangeal joint

Psoriasis

- Cup & pencil appearance
- Sausage digits
- Opera glass hand, Paravetebral ossification


Cardinal signs of Osteoarthritis

- Narrowing of joint space
- Subchondral sclerosis (age related)
- Marginal osteophytes
- Subchondral cysts

OA involving Knee

- Genu Varum ['O' between legs]
- Medical compartment is involved
- Muscle involved → Quadriceps, specifically vastus medialis
- Specific fiber → Vastus medialis obliques


RA Knee


OA Knee


Tibia vara

Previous Year's Questions

Q. 60-year-old female complaints of pain Bilateral Knee, the pain increases while going up and down the stairs. The X-ray shows Bilateral reduced Joint spaces. Which is the most likely diagnosis? (FMGE Dec 2020)

A. osteoarthritis
B. Rheumatoid arthritis
C. Ankylosing spondylitis
D. Hemophiliac arthropathy

Osteoarthritis Knee Treatment

- Initially - Conservative
  - Physiotherapy + Lifestyle modification + Glucosamine
- If daily activities are affected: Surgery
  - Young Pts: surgery
    → High tibial osteotomy (up to 20_0 deformity)
  - Less than 60 years: correct deformity
  - 60 or more than 60 years: Total knee replacement
- High Tibial Osteotomy: removal of wedge of a bone where the lateral border is bigger than the medial border which is called as lateral based wedge osteotomy.

HTO=HIGH TIBIAL OSTEOTOMY

- Total Knee replacement: replaces the joint surface and it gives good movements, proprioception good and mild

insignificant sensory loss.

Patellar Clunk Syndrome ⏱ 00:15:39

- After Total Knee replacement: Patella makes noise when the knee is flexed
- Fibrotic nodule at the upper end of patella
- Treatment: Arthroscopic debridement

Rheumatoid Arthritis	Osteoarthritis
• Synovitis	• Arthritis
• Osteopenia	• Sclerosis (below the joint)
• Genu Valgum	• Genu Varum

Classification criteria for RA ⏱ 00:17:02

- The 1987 Revised Criteria for Diagnosis of RA

1 Guidelines for classification 4 of 7 criterion are required to classify a patient as having RA Patients with 2 or more criteria are not excluded.

2 Criteria (a-d must be present for at least 6 weeks and b-e must observed by physician.)

a. Morning stiffness, in and around joint lasting 1 hour before maximal improvement.

b. Arthritis of 3 or more joint areas, observed by a physician simultaneously, have soft tissue swelling or joint effusion, not just bony over growth. The 14 possible joint areas involved are right or left proximal interphalangeal joints (MTP).

c. Arthritis of hand joints eg., Wrist, MP or PIP joints

d. Symmetrical arthritis i.e. simultaneous involvement of same joint area on both side of body.

e. Rheumatoid nodules: Subcutaneous nodules over bony prominences, extensor surfaces or juxta articular region. (PATHOGNOMIC)

f. Serum rheumatoid factor

g. Radiological changes: bony erosion or unequivocal bony decalcification, periarticular osteoporosis and narrowing of articular (joint) space.

Previous Year's Questions

Q. A 40-year-old female has pain in small joints of Bilateral hand with morning stiffness. What is the most likely diagnosis? (INICET Nov 2020)

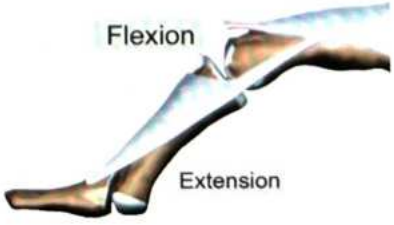
A. AS
B. Reiter's syndrome
C. R.A
D. Lupus Arthritis

Deformities of RA

- Swan Neck Deformity

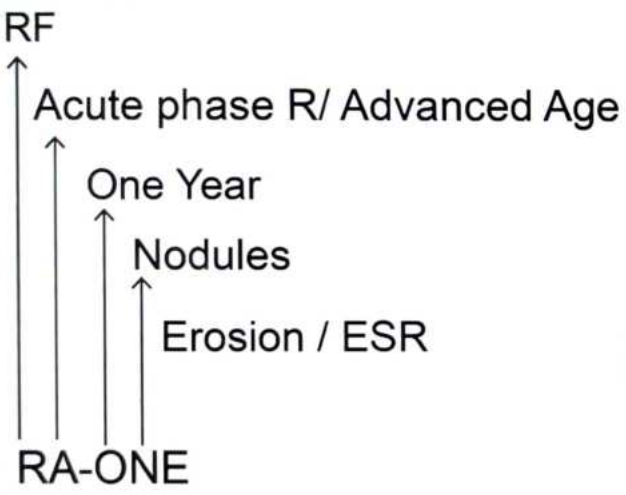
  - Flexion at DIP and hypertension at PIP
  - Flexor insufficiency of PIP
- Boutonniere deformity / Button hole deformity

Bountonniere deformity



- Extensor deficiency at PIP joint
- Hyperextension of DIP & Flexion of PIP
- Deformity of thumb
- Ulnar deviation of fingers

Poor prognostic factors of RA



Previous Year's Questions

Q. A female presents with pain and swelling over multiple peripheral small joints and deformity shown below. What is the likely diagnosis?

(NEET Jan 2020)

A. RA
B. Psoriatic arthropathy
C. Osteoarthritis
D. Scleroderma

Miscellaneous information

- Pencil in cup seen in Psoriatic arthritis

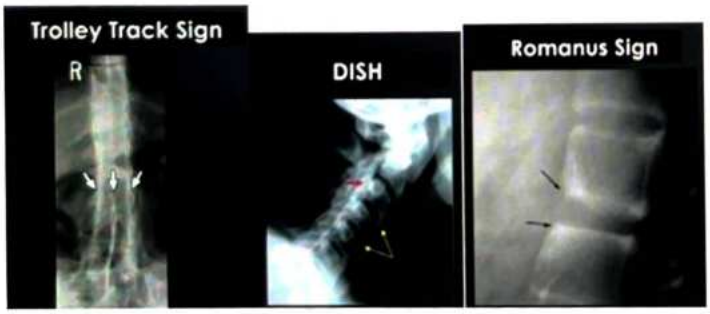
- Acro-osteolysis (terminal phalanges) seen in scleroderma
- Arthritis mutilans: Seen in RA and psoriasis

Ankylosing Spondylitis

- HLA B27 positive in more than 90% cases of AS
- Diagnostic criteria
  - Essential criteria: Definite radiographic sacroiliitis Supporting criteria
  - Inflammatory back pain
  - Limited chest expansion
  - Limited lumbar spine motion in both sagittal and frontal plane (Schober test/Modified Schober test)
- Characteristic features

1. Enthesitis: Inflammation of insertion of tendons and ligaments
2. Axial skeleton disease: 30% only Appendicular (peripheral joints) Disease of root joints
3. 30% causes ANTERIOR UVEITIS
4. MC extra-articular manifestation: Cardiac defects (Enthesitis)

- Radiographic findings
  - Bamboo spine (Bony ankylosis)
  - Squaring of vertebrae
  - Inter-spinous ligament calcification: Dagger Sign
  - Facet calcification of joints + inter spinous ligament: Trolley Track Sign
  - Sclerosed vertebral edges: Romanus Sign



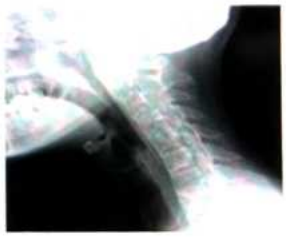
- Test for AS
  - SI joint
    - → Gaenslen test
    - → Patrick/FABER test
    - → Figure of 4
    - → Pump handle test
  - → Side to side compression test
  - Cervical spine: Fleche test

Characteristic	Ankylosing Spondylitis	Ankylosing Hyperostosis
• Joint	• Sacroiliac	• Dorsolumbar
• Age	• Young	• Elderly
• Chest movement	• Marked restriction	• Mild restriction

- Urine turn black on standing + Disc calcification: Alkaptonuria
- Eye involvement in AS
  - KESRA: Kerato-conjunctivitis sicca (KCS)> Episcleritis > Scleritis – RA
  - Anterior uveitis: AS

Previous Year's Questions

Q. A 30-year-old patient has no neck movements and the following X-ray was clicked: (INICET Nov 2020)



A. Ankylosing spondylitis
B. Reiter's syndrome
C. RA
D. Fluorosis

CASPAR Criterion for Psoriatic Arthritis

- To be classified as having PsA, a patient must have inflammatory joint disease (joint, spine, enthesitis) with ≥ 3 of the following 5

1. Evidence of psoriasis (One of these)
   a. Current psoriasis
   b. Personal history
   c. Family history
2. Psoriatic nail dystrophy
3. Negative RF
4. Dactylitis (One of a, b)
   a. Current
   b. History
5. Radiological evidence of juxta-articular new bone formation

Acroosteolysis

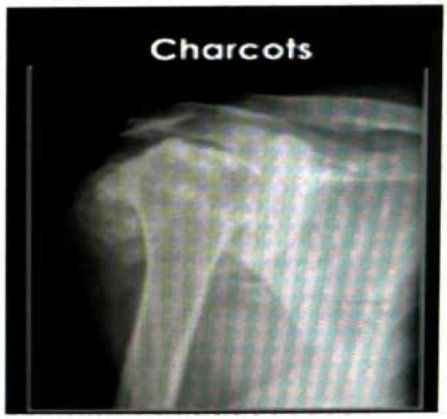
Gout 00:28:56

- Inflamed great toe
- Middle aged businessman (usual history)
- Disc space calcification
- Great Toe: Martels sign (overhanging bone) seen in Alkaptonuria
- Punched out Erosions (Rat bite erosions) with history of great toe pain

Characteristic	Gout	Pseudogout
• Joint	• Great Toe	• Knee
• Crystal • Deposited	• Uric-Acid-negatively birefringent-Needle shaped	• Calcium pyrophosphate-positively birefringent Rhomboid shaped
• Association	• Protein + Alcohol intake	• Hypothyroidism
• X-ray	• Bone and soft tissue erosions	• Chondrocalcinosis (calcification of the cartilage)

Charcots Joints

- Totally destroyed joints
- Neuropathic joints
- Loss of proprioceptor fibers
- Anatomy deranged
- Painless
- Other painless ds: mycetoma
- Indication for Arthrodesis
- MC cause: Diabetes



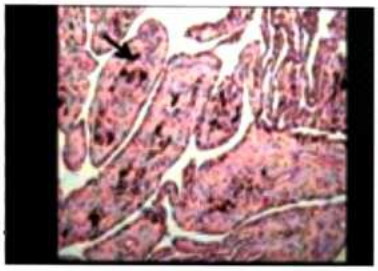
Disease	Joint Involvement
• Diabetes	• Midtarsal (Most common) > tarsometatarsal, metatarsophalangeal and ankle joint > knee and spine
• Tabes dorsalis	• Knee (most common), hip, ankle and lumbar spine
• Leprosy	• Hand and foot joints
• Syringomyelia	• Shoulder (Glenohumeral), elbow, wrist and cervical spine

Hemophilia

- Inflammatory condition
- MC affects knee joints
- In Children: Ankle
- X-ray findings: PENIA
  - Periarticular osteopenia
  - Squaring of patella
  - Epiphyseal enlargement
  - Widened notch
  - Decreased joint space (arthritis)
  - Subarticular cyst
  - Arnold Hilgartner classification

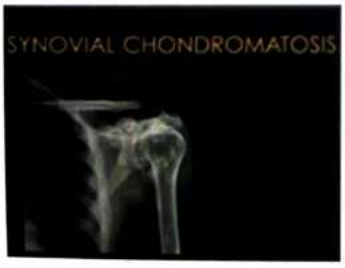
Hemosiderotic Synovitis

- Occurs in chronic intraarticular bleeding. E.g, hemophilia
- Microscopy
  - Fine villous projections may be present
  - Hemosiderin pigment is present
  - No proliferation of mononuclear cells
  - No multinucleated Giant cells

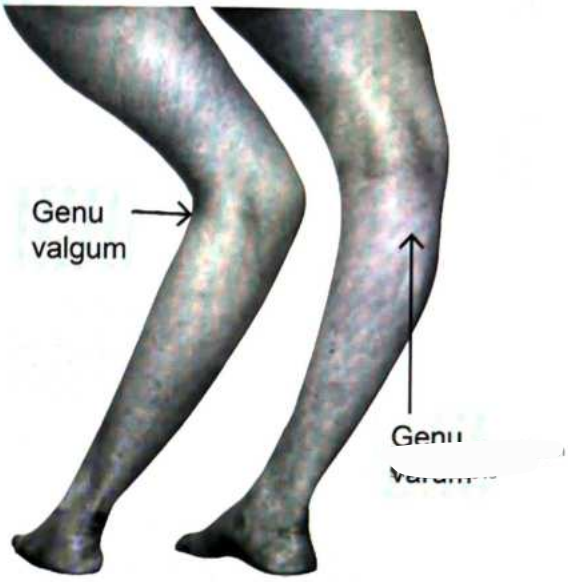


Synovial Chondromatosis 00:33:53

- MCC of multiple loose bodies in a joint
- MC Joint: Knee
- Loose body above, but not at joint because synovium of knee travel beneath patella in suprapatellar area, synovium is continuous with knee cavity.
- MCC of loose bodies: Osteoarthritis (Knee)
- Osteoarthritis → VARUS
- RA → Valgus
- Valgus in one and Varus in other knee: Windswept deformity / Tackle deformity
- Causes: Rickets > RA



Windswept Deformity

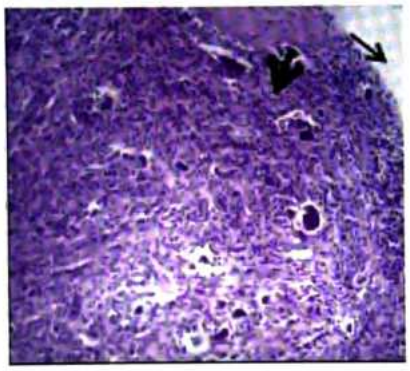


- Synovial fluid finding 00:35:20
  - Viscosity: due to hyaluronic acid
  - Normal synovial fluid is clear, WBC count less than or equal to 200/uL
  - Inflammatory fluid WBC count 2,000 to 50,000/uL and a polymorphonuclear leukocytic predominance.
  - Inflammatory fluid has reduced viscosity & diminished hyaluronic acid.
  - Infections (pyogenic) is purulent, WBC count > 50,000/uL
  - Infections(tuberculosis/granulomatous) WBC count 10,000-20,000/ uL , PMN 60% and presence of lymphocytes, plasma cells and histiocytes
  - Trigger Finger: Constriction around MCP joint called: Stenosing tenosynovitis / Trigger finger

Stenosing tenosynovitis (trigger finger)

Pigmented villonodular synovitis

- Benign lesion of synovium
- Usually occurs in knee joint
- Microscopy
  - Proliferating Hyperplastic synovium with papillary projection
  - Consists of mononuclear cells, Multinucleated Giant cells, foamy cells and Hemosiderin containing Macrophages



PRACTICE QUESTIONS

Q. Case 1 - 60-year-old man with dull inflammatory back pain for last 10 months. He has difficulty in sitting & standing up. X ray shows fixed SI joints, syndesmophytes & perivertebral calcification?

A. Ankylosing spondylitis
B. Rheumatoid arthritis
C. Gout
D. Pseudogout
E. Psoriatic arthritis
F. Reactive arthritis

Ans. A

Q. Case 2: Middle aged male patient with acute onset right knee effusion with pain. He reports that such episodes are recurrent. X rays showed punched out periarticular erosions?

A. Ankylosing spondylitis
B. Rheumatoid arthritis
C. Gout
D. Pseudogout
E. Psoriatic arthritis
F. Reactive arthritis

Ans. C

Q. A patient presents with knee joint pain, on aspiration, in synovial analysis

- WBC raised
- Viscosity unaltered
- No other inflammatory cells

O/E: Swelling around knee joint present. What is the likely possibility?

A. Pseudogout
B. OA
C. RA
D. Tubercular arthritis

Ans. B

Q. Most specific for diagnosing Ankylosing spondylitis?

A. HLA B27
B. B/L sacroilitis
C. Lumbar movements
D. ESR

Ans. B

CLINICAL QUESTIONS

Q. A 60-years-old man with diabetes mellitus presents with painless, swollen right ankle joint. Radiographs of the ankle shows destroyed joint with large number of loose bodies. What is the most probable diagnosis?

A. Charcot's joint
B. Clutton's joint
C. Osteoarthritis
D. Rheumatoid arthritis

Answer: A

Solution

- Patient of diabetes with painless swollen joint is enough for the diagnosis of charcot's joint.
- X-Ray Features
  - Marked destructive changes with periarticular erosions
  - Joint space narrowing
  - Osteophyte formation
  - Subchondral sclerosis
  - Loose bodies.
- The changes simulate osteoarthritis, but the absence of pain is diagnostic. Similarly, it may be difficult to differentiate it from osteomyelitis but joint margins in Charcot's arthropathy are distinct, while in osteomyelitis its blurred. MRI/Bone scan can further help in d/d but CT scan is not useful.

Q. A 42-year-old male with frequent attacks of joint pain, underwent an X-ray showing soft tissue swelling as shown in the image below. What is the likely diagnosis?

A. Gout
B. Parathyroid adenoma
C. Psoriasis
D. RA

Answer: A

Solution

- Tophi appear as characteristic punched out cysts or deep erosions with over hanging bony edges -Martel's or G' sign.

Gout

- Sometimes only feature is acute pain and tenderness. hyperuricemia is not diagnostic and is often seen in normal middle-aged men.
- During acute attack X-rays show only soft tissue swelling.
- Chronic gout may result in joint space narrowing and secondary OA.

Q. A 39-year-old female patient with known history of Rheumatoid arthritis comes OPD for follow up, An Xray was done showing Juxta -articular osteopenia. Which of the following findings you won't see in the X- ray of this patient?

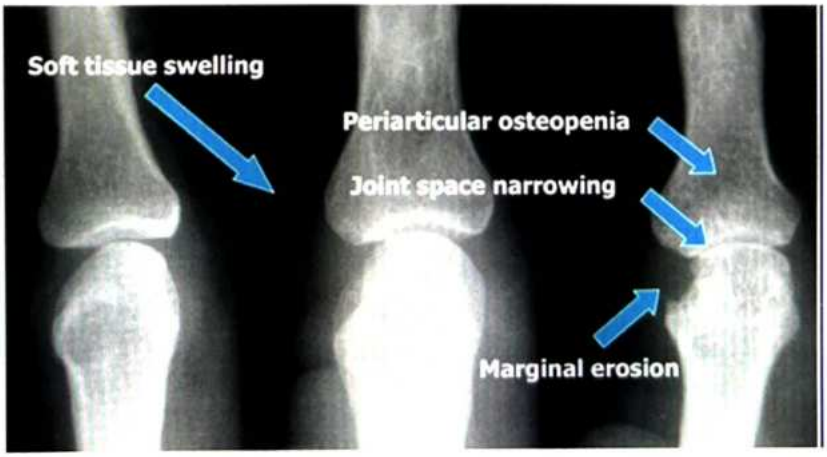
A. Reduced joint space
B. Soft tissue shadow
C. Periarticular bone formation
D. Subchondral cyst

Answer: C

Solution

Radiological features of Rheumatoid arthritis

- Evidence of soft tissue swelling and joint effusion
- Symmetrical involvement
- Juxta-articular osteopenia (within weeks)
- Loss of articular cartilage and bone erosions (after months)
- Narrowing of joint space
- Articular destruction and joint deformity, e.g., subluxation of atlantoaxial and cervical joints
- Lack of hypertrophic bone changes (sclerosis or osteophyte)



Deformities of RA

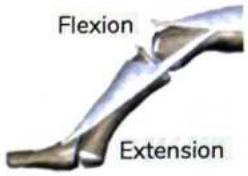
- Swan Neck Deformity → Flexion at DIP and hypertension at PIP, Flexor insufficiency of PIP
- Boutonniere deformity / Buttonhole deformity → Extensor deficiency at PIP joint, Hypertension of DIP & Flexion of PIP
- Z deformity of thumb →Ulnar deviation of fingers

Swan Neck Deformity

Z deformity of thumb

Ulnar deviation of fingers

Buttonhole deformity



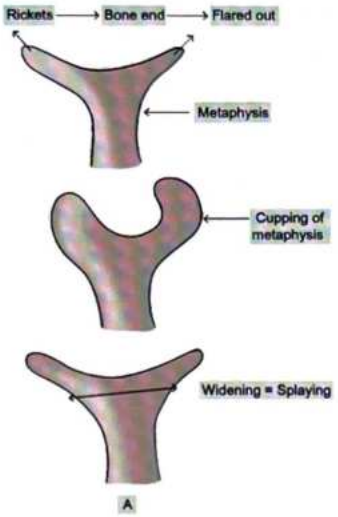
LEARNING OBJECTIVES

UNIT 9: METABOLIC DISORDERS

- **Metabolic disorder 1**
  - Rickets
  - Osteomalacia
  - Scurvy
  - Umbauzanon
  - Congenital disorders

- **Metabolic disorder 2**
  - Hyperparathyroidism
  - Achondroplasia
  - Cleidocranial disorder
  - Osteoclast defects
  - Osteopetrosis
  - Paget's disease
  - Osteoporosis
  - Fibromyalgia
  - Osteogenesisimperfecta
  - Melorheostosis
  - Osteopathisstriata
  - Renal Osteodystrophy
  - Pectus excavatum
  - Table of Calcium, PTH,Po4, ALP in Rickets, Renal osteodystrophy, Osteoporosis, Primaryhyper parathyroid, Paget's

21 METABOLIC DISORDERS-1



- ALP in children = 3-5 (Adult)
- Phosphate in child = Adult + 1 mg / Dl
- Image of Wrist = rickets
- Image of Knee = scurvy, Rickets
- To differentiate
  - Cupping, splaying, and Flaring: Rickets
  - White line of Frankel + Wimberger ring sign: Scurvy

Rickets 00:02:40

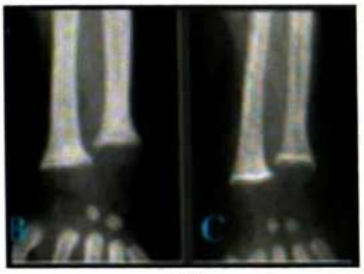
- Mineralization defect
- Generalized muscle weakness
- Widening knees / wrist
- Rachitic Rosary(B): Prominent Non- tender and round costochondral junction
- Harrison's groove: Sub costal sulcus d/t pull of diaphragm Genu valgum / varum(C)
- Coxa vara: Reduced neck shaft angle of femur.
- Enamel defect (tooth)
- Cupping, splaying, flaring (D)
- Osteotomy correction done only once healing takes place
- White line of frankel (E): Healing rickets (F)

B

(C)

(D)

(E)



(F)

Previous Year's Questions

Q. Child with widening of bone has this X-ray. What is the etiology? (FMGE Dec 2020)

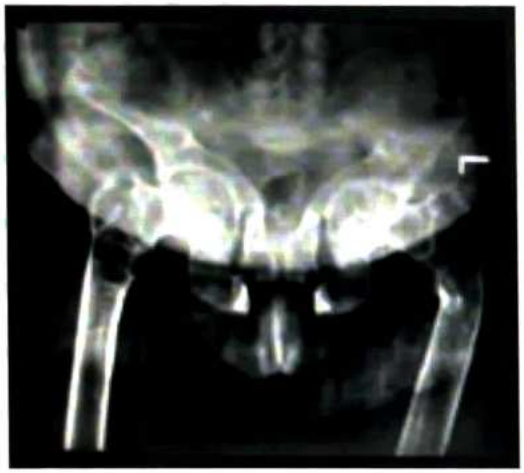
A. Scurvy
B. Rickets
C. Gout
D. Salter Harris type 2 injury

Hypophosphatemic Rickets

- X-Linked dominant
- PHEX gene mutation
- Normal Ca, PTH, Vit D
- ↑ ALP
- ↑Incidence of skeletal deformities.

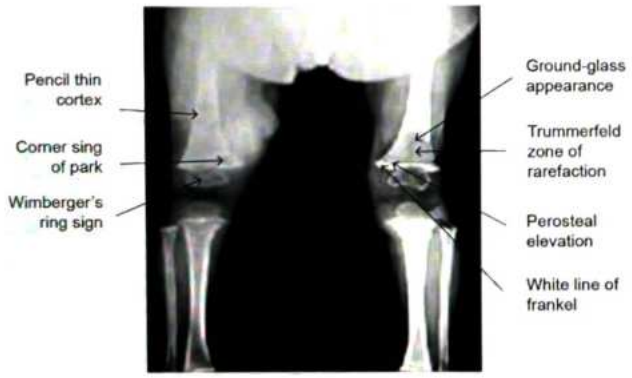
Osteomalacia 00:06:08

- Osteon = bone; malacia = Softening
- Adult counterpart of Rickets
- Tetracycline labelling is used to calculate turnover
- Osteoid/ Osteon > 1
- Biopsy gold standard
- Triradiate pelvis
- Gold standard Investigation: Biopsy



- Otto pelvis due to protrusion acetabuli

Scurvy 00:07:05



- Occur in knees of children
- Sharp and tender rosary
- Disease due to lack of vit c (Ascorbic acid)
- Findings
  - Wimberger ring sing: Sclerotic margin of epiphysis (↑)
  - Wimberger corner sign: Metaphyseal defect in congenital syphilis

scurvy

  - White line of Frankel: classical of scurvy

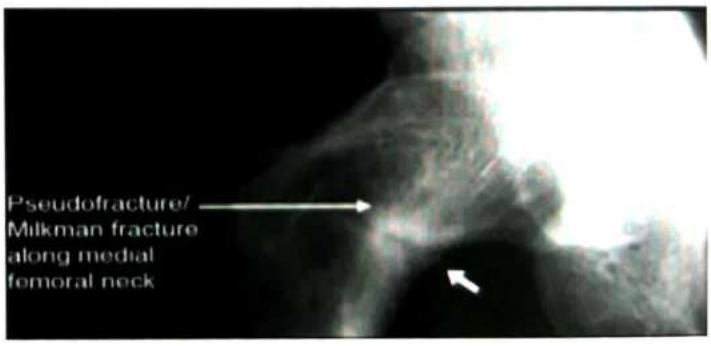
X-Ray Epiphysis	Scurvy	Rickets
• White line of frankel Sclerotic margins	• Sclerosed Always White	• Normal If +nt→ healing rickets Wide(A)

Important Information

- Wimberger ring sing → Scurvy → Sclerotic margin of epiphysis
- Wimberger corner sign → Congenital syphilis → Metaphyseal defect
- White line of frankel → Scurvy, Healing Rickets, Lead poisoning, Methotrexate therapy.

Umbauzanon 00:08:02

- Found in bone softening disorders such as
  i. Osteomalacia > Rickets
  ii. Hyper PTH
  iii. Neurofibromatosis
- Lesions found in N.O.F and Pubic Rami
  ...ation of cortex due to arterial pulsation Known as Pseudo-fracture./ Milkman fracture./ Losers Zone



- Treatment: Treat the primary cause, Rest

Congenital Rubella 00:08:53

- Celery Stalk appearance
- Also seen in chronic degeneration of ACL

CLINICAL QUESTIONS

Q. Wrist X-ray is given below. What is the probable diagnosis?

A. Rickets
B. Colles fracture
C. Scaphoid fracture
D. Osteoporosis

Answer: A

Solution

Fig. X-ray wrist—rickets

Fig. Rickets knee

Radiographic findings

- The characteristic feature of rickets are thickening and widening of growth plate (physis). Indistinct and hazy metaphysis that is abnormally wide (splaying) with cupping or flaring (Brush like appearance).
- Bowing of diaphysis, with thinning of cortices.
- Looser's zone in 20%.
- Persistent hypocalcemia may cause secondary hyperparathyroidism.

- **Note**: Lower limb deformities appear when the child starts to walk. Hence, bowing of legs will be less commonly seen in infants.
- Looser's zone: Also known as cortical infractions, Milkman lines or pseudo fractures, are wide, transverse lucencies with sclerotic borders traversing partway through a bone, usually perpendicular to the involved cortex, and are associated most frequently with osteomalacia and rickets.

Q. A 1-year-old male child has been brought to OPD. His radiograph of the hand shows the following features Cupping, fraying, and splaying of ulnar and radius distal metaphysis. Also, in metacarpals metaphysis. The following statement is wrong about lab values of the given patient.

A. Hypocalcemia
B. Normal ALP
C. Elevated levels of Parathyroid Hormone
D. $\downarrow PO_4^{3}$

Answer: A

Solution

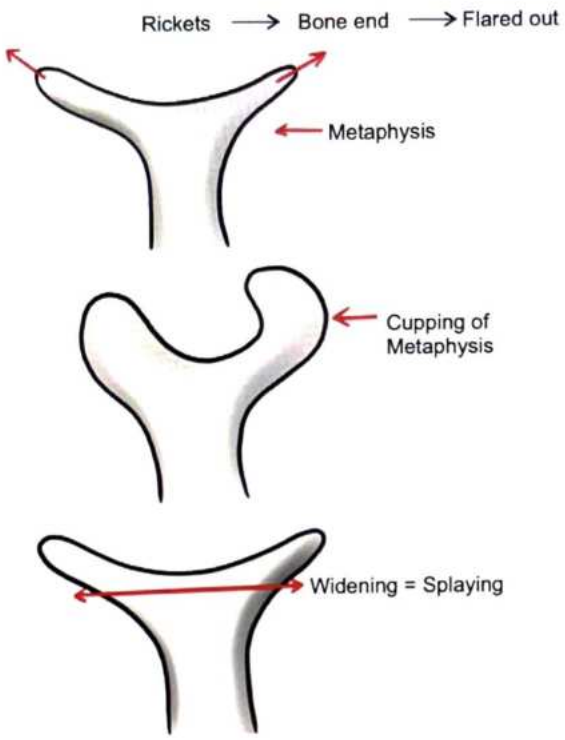
- Cupping, fraying, and splaying of ulnar and radius distal metaphysis is one of the classical features of Rickets.
- In rickets ALP will be raised not normal

Hypophosphatemic Rickets

- X-Linked dominant
- PHEX gene mutation
- Normal/↓ Ca,Vit D
- Normal/↑ PTH
- ↑ ALP
- ↑Incidence of skeletal deformities
- Low levels of phosphate.

	Calcium	Phosphate	ALP	PTH
Osteoporosis	• Normal	• Normal	• Normal	• Normal
Rickets/osteomalacia	• N or low	• Low	• High	• High
Primary hyperparathyroidism	• High	• Low	• High	• High
Paget's disease	• Normal	• Normal	• High	• Normal

- Widening of the metaphyseal ends is known as splaying. It occurs because of the accumulation of non-mineralized osteoid at the metaphyseal ends.
- Defective mineralization of osteoid also results in fraying and cupping.
- Fraying is the worn-out appearance of the metaphyseal margins.
- Cupping is the concave appearance of the metaphysis. Bowing is seen in the diaphysis of the long bones affected by rickets.


Rickets → Bone end → Flared out
Metaphysis
Cupping of Metaphysis
Widening = Splaying

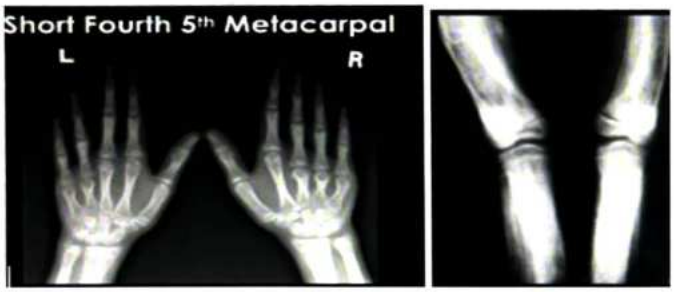
(A)

22 METABOLIC DISORDERS-2

Hyperparathyroidism

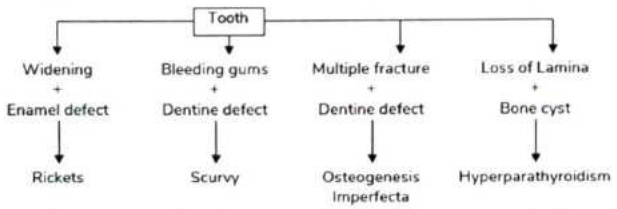
00:00:18

- Sub periosteal Resorption
- Osteitis Fibrosa Cystica
- Rotting fence post appearance
- Brown tumor
- Salt pepper skull
- Loss of lamina dura
- AVN rarely.



Lamina dura pathology

Normal lamina dura | Loss of lamina dura



Previous Year's Questions

Q. Elderly female presents with pain and swelling in the thigh. X-ray shows multiple lytic lesion in distal femur with no periosteal reaction. Aspirate from the swelling shows homogenous serosanguinous fluid with RBC's. Which investigation can confirm diagnosis? (AIIMS Nov 2019)

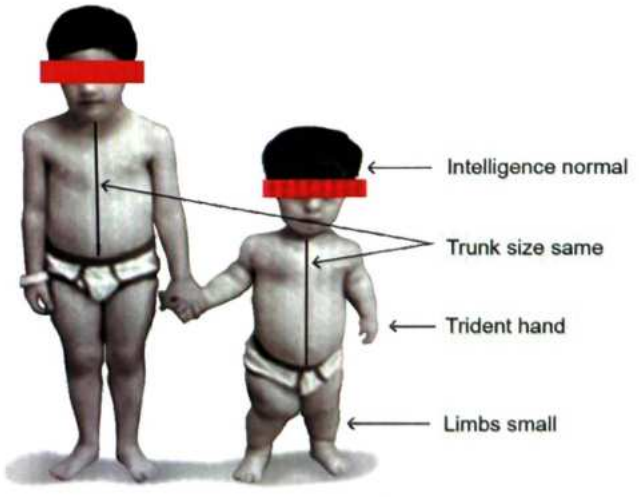
A. S. Calcium levels
B. S. PTH level
C. MRI
D. CD1a IHC

Achondroplasia

00:03:14

- Enchondral ossification defect
- Normal intelligence
- Limb dwarfism
- Trident hand or starfish hand
- Champagne glass pelvis [Width>depth]
- Bullet nose vertebra
- Limb dwarfism
- Causes: Due to FGFR & mutation leading enchondral ossification defect

Trident hand | Starfish hand | Bullet nose Vertebra



Short fourth metacarpal

- Turners syndrome
- Pseudohypoparathyroidism

Cleidocranial disorder

- AD
- Intramembranous ossification defect
- Absent clavicle: Shoulders meet in midline
- Squashed / flat face
- Delayed dentition
- Scoliosis and coxa vara
- Deformities in spine or reduced neck shaft angle

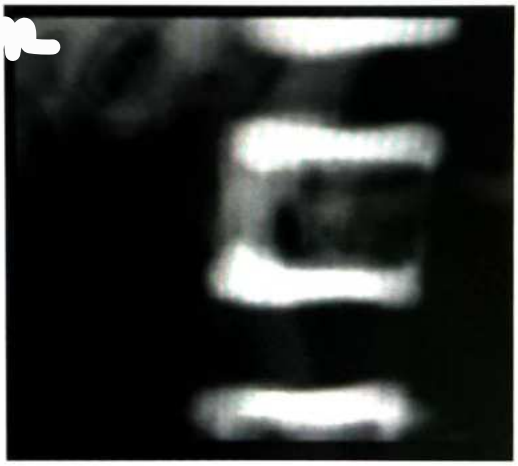
Osteoclast Defects 00:13:57

- Osteopetrosis > Paget's (Multifactorial)

Osteopetrosis

- CA II proton pumps defect genetically –Bone resorption
- Known as Marble bone ds.
- Functional deficiency of Osteoclasts
- Pancytopenia/ Anemia/ Infections
  - Pancytopenia due to absent bone marrow
  - Anemia: secondary hematopoiesis
  - Infection: Osteomyelitis of mandible
- Hepatosplenomegaly
- Blindness: 2nd CN Compression
- Deafness: 8th CN Compression
- M/c compressed CN: 7th CN (Facial)
- Delayed bone healing but few studies claim normal healing.
- T/t: Bone marrow Transplant (I/v)

- Bone within a bone appearance (Also in Sickle cell Anemia)
- Rugger jersey spine (Renal Osteodystrophy)



- Erlen Mayer flask deformity also seen in Gaucher's

>Osteopetrosis.

Previous Year's Questions

Q. Albers Schonberg disease is?

(FMGE Dec 2018)

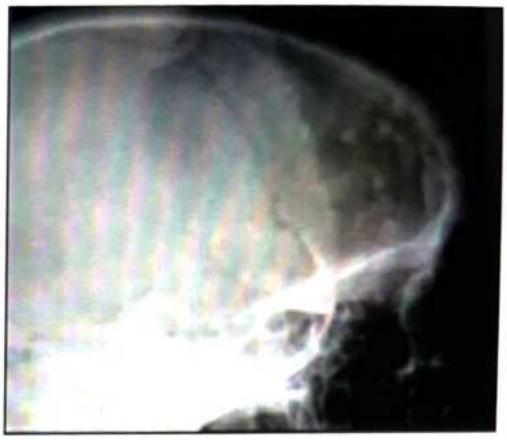
A. Paget
B. Osteogenesis imperfecta
C. Osteoporosis
D. Osteopetrosis

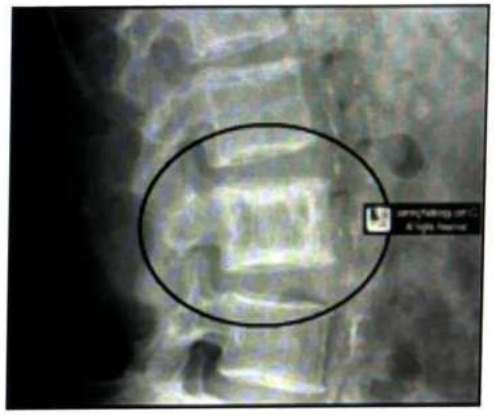
Paget's Disease

00:16:11

- Osteitis Deformans
- ↑ Bone formation
- ↑ Bone Resorption
- Osteoclast defect → larger, irregular
- Excessive Disorganized bone turnover
- Age > 50 yr., Males (6th decade onwards)
- Pelvis commonly affected
- M/c symptom pain
- Normal Ca+2 and P
- ↑ALP
- Diagnostic histological Feature → Cement lines→ Mosaic pattern (or) Marble pattern (A)
- Ivory vertebra; picture frame vertebra / Cotton wool skull (↑ head/ hat size)
- Osteosarcoma (1%)
- Blade of Grass/ flame appearance: Brim Sign
- Doc: Bisphosphonates

- Calcitonin Good for pain control





- Picture frame vertebra

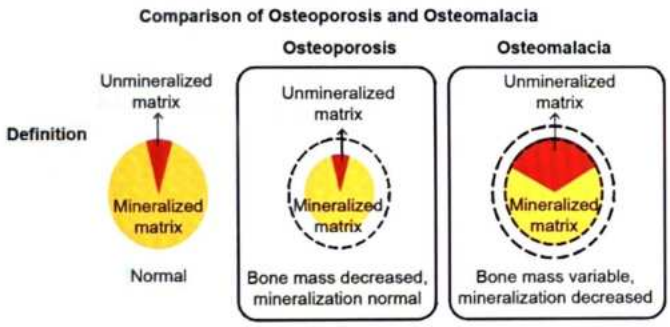
- Blade of grass or flame appearance

- Increasing hat size

- Brim sign

Important Information

- Rim Sign Chronic Osteomyelitis.
- Brim Sign Paget's disease
- Ring Sign Scapho-Lunate dislocation
- Wimberger Ring Sign Scurry
- O' Ring Sign chondroma



Osteoporosis

- Normal Ca, P and ALP
- ↓Bone mineral density measured by DEXA scan.
- T Score
  - +1 to -1 = Normal
  - -1 to -2.5 = Osteopenia
  - <- 2.5 = Osteoporosis
- Severe Osteoporosis: Osteoporosis with fracture Vertebra > fracture Hip > Colles fracture
- In Hemiplegic patient: Humerus has max loss of bone mineral
- Treatment
  - Estrogen: (-) Rank L
  - Bisphosphonates: (-) osteoclast but increase hip fracture after prolonged use.
  - Calcitonin: (-) Osteoclast
  - Low dose PTH (20µg/dL) (Teriparatide): (+) Osteoblasts.
- Drugs
  - ↑Formation: Fluoride, PTH
  - ↓ Resorption: -Bisphosphonates, calcitonin, Denosumab, and estrogen
  - Strontium acts on both the pathways
- X-Ray findings
  - Codfish vertebrae (Osteoporosis > Osteomalacia)

Previous Year's Questions

Q. An old lady complains of chronic bad pain since few months. X-ray shown below. What is probable diagnosis? (NEET Jan 2020)

A. Osteoporosis
B. Spondylolysis
C. Spondylolisthesis
D. Osteopetrosis

Fibromyalgia 00:23:12

- Diagnosis of exclusion
- Chronic pain > 3 months
- Neuropsychiatric features Fatigue/ Mood disorders
- M: F= 1:9
- All test are normal

Previous Year's Questions

Q. Which of the following is used for diagnosis of osteoporosis? (INICET Nov 2020)

a. Dexa Scan
b. Bone Scan
c. quantitative CT
d. Serum Biochemistry
e. X-ray

A. a, b, c
B. b, c
C. c, d, e
D. a, c, d, e

Previous Year's Questions

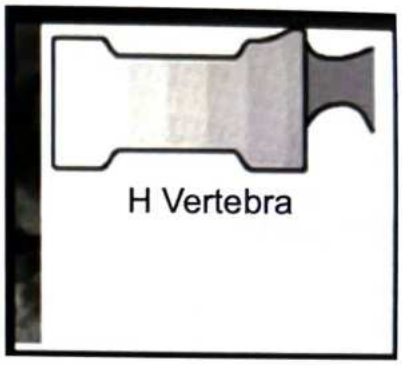
Q. Which of the following increase bone formation in osteoporosis? (INICET Nov 2020)

A. Teriparatide
B. Bisphosphonates
C. Calcitonin
D. Denozumab

- Treatment
  - Exercise
  - Analgesic + Antidepressants
  - Duloxetine/ Milnacipran/ Amitriptyline
  - Sedative Analgesics: Gabapentin / Pregabalin

Osteogenesis imperfecta

- Defect in Type 1 collagen formation
- AD
- Osteopenia causing repeated propensity of fracture
- Fracture heals at a normal rate
- MC involved: Femur (LL)
- Mc cause of multiple fractures at birth
- Hyperlaxity, DDH
- Blue Sclera
- Deafness
- Dentinogenesis imperfecta
- Sillence classification
- Pathological fracture: Bailey Dubow rods (adjust nail length with growth)
- Treatment: Gene therapy



Previous Year's Questions

Q. Patient has history of multiple fracture with blue sclera. What is the most likely diagnosis? (FMGE Dec 2020)

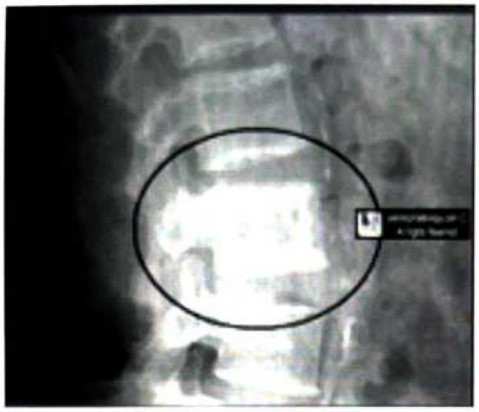
A. Osteogenesis Imperfecta
B. Rickets
C. Scurvy
D. Paget's Disease

Types of Spines

- Rugger Jersey Spine seen in
  - Chronic Renal Failure
  - Osteopetrosis

Rugger Jersey Spine

- Picture frame/ Ivory vertebra: Paget's



- Bullet shaped vertebra: Achondroplasia

- Cod fish vertebra: Osteoporosis

- Bamboo Spine: Ankylosing Spondylitis

Causes of IVORY Vertebra

- **L** – Lymphoma
- **I** - Infections (TB)
- **M** - Medulloblastoma/ Metastases
- **P** - Paget's (M/c)
- **H** - Hemangioma
- **O** - Osteosarcoma/ Osteoblastoma

How to remember

- LIMPHO

Hyperostosis disorders

1. Candle dripping disease/ Melorheostosis 00:26:23

- Sclerosis over the bone
- Looks like dripping of the wax

2. Osteopoikilosis
   - Spotted bone disease
   - Periarticular, symmetrical, and uniform size bony spots
3. Osteopathia striata

- Striations over entire skeleton

Renal osteodystrophy 00:27:27

- Renal Osteodystrophy: Bony changes are combination of Rickets + Hyperparathyroidism + Osteoporosis + Osteosclerosis.
- Renal osteodystrophy is more common in CRF. It is driven by presence of secondary hyperparathyroidism.
- Pathophysiology begins with damaged glomerulus's inability to excrete phosphorus.
- Hyperphosphatemia shuts down the production of vit D thus causing decreased calcium absorption from small intestine.
- Hypocalcaemia triggers release of PTH which enables the demineralization of bone to increase serum calcium level.
- Osteosclerosis when present, is most common at the base of the skull and in vertebra causing horizontal stripped Rugger Jersey appearance.

RENAL OSTEODYSTROPHY (CONTD)

- Rugger Jersey vertebrae' appears like sandwiches. with osteo- sclerosis adjacent to the end plates but relative radiolucency in the middle of vertebrae. It is seen in renal osteodystrophy and osteopetrosis. In patients of renal osteodystrophy.
- Rugger Jersey appearance is due to hyperparathyroidism and osteosclerosis.
- Renal abnormalities precede the bony changes by several years. Children are stunted and myopathy is common.
- Epiphysiolysis (displacement of epiphysis) may be seen. Low calcium and high phosphate is seen treatment is high dose of vit D (5,00,000 IU daily), in resistant cases small doses of 1.25 DHCC may be effective.

Pectus Excavatum 00:31:04

- Inward Sternum Associated with
- Prematurity
- Congenital heart disease
- Poland syndrome
- Marfan's syndrome
- Noonan syndrome
- Homocystinuria
- Decreased pulmonary functions
- Mitral valve prolapse

Table – Calcium, Phosphorus, PTH relations in diseases 00:31:34

Refer Table 22.1

- Paget's disease usually has normal calcium and phosphorous. Prolonged immobilization for fractures can cause hypercalcemia

PRACTICE QUESTIONS

Q. Which drug is used as a first line management for postmenopausal female with osteoporosis?

A. Bisphosphonates
B. Raloxifene
C. Estrogen
D. Combined OC pills

Ans. A

Q. What is the likely diagnosis of image shown below?

A. Coxa magna
B. Coxa vara
C. Coxa valga
D. Coxa sultans

Ans. B

- Coxa vara: Decrease neck shaft angle of femur

Q. Paget's disease commonly develops in which age group?

A. 1st decade
B. 3rd decade
C. 5th decade
D. 7th decade

Ans. D

- Paget's disease commonly develops in 60 years age group

Table 22.1

Lab Findings in Rickets	Calcium (Usually N↓)	Phosphorus (Usually ↓)	PTH (Usually ↑)	ALP (Usually ↑)	25 (OH)D	1,25 $(OH)_2D$
Vit D deficiency	N↓	↓	↑	↑	↓	↓N↑
VDOR Type I	N↓	↓	↑	↑	N	↓
VDOR Type II	N↓	N↓	↑	↑	N	↑↑
CRF	N↓	↑	↑	↑	N	↓
Dietary P deficiency	N	↓	N	↑	N	↓
XLH-Hypophosphatemia Rickets	N	↓	N	↑	N	↑
ADHR-Hypophosphatemia Rickets	N	↓	N	↑	N	↓
Fanconi syndrome (Proximal RTA)	N	↓	N	↑	N	↓
Dietary Ca deficiency	N↓	↓	↑	↑	N	↑

CLINICAL QUESTIONS

Q. A 65-year-old male patient presents to OPD with a complaint of decreased hearin· ·ıich skeletal survey was done to rule out possibility of Malignancy. The x ray skull of the patient shows cotton wool skull appearance. What is your diagnosis

A. Multiple myeloma
B. Paget's disease
C. Thalassemia
D. Epiphyseal dysplasia

Answer: B

Solution

- The given clinical scenario and cotton wool skull appearance on radiograph are suggestive of Paget's disease.
- Increased bone formation in Paget's disease may lead to the narrowing of the foramina of the skull. This causes compression of the cranial nerves which may lead to deafness, as seen in this patient.
- Deafness due to the narrowing of cranial nerve foramina is also seen in osteopetrosis.
- It can be differentiated from Paget's disease by the absence of lytic lesions of the bone.
- Paget's disease of the bone increases the risk of osteosarcoma (most common), fibrosarcoma, chondrosarcoma, and sarcoma of myeloid and mesenchymal elements.

Other Complications:

- Risk of fractures due to decreased strength of bone
- Osteoarthritis
- Bony overgrowth leading to spinal stenosis and nerve compression
- High output cardiac failure due to the increased blood flow to skeletal bones
- Hypercalcemia may be seen in prolonged immobilization
- Cranial nerve-2nd, 5th, 7th, 8th palsy is seen.
- Deafness due to nerve compression > otosclerosis.

Other features:

- An initial osteolytic phase involves prominent bone resorption and marked hypervascularization. Radiographically, this manifests as an advancing lytic wedge, or blade of grass or Flame shaped lesion.
- The second phase is a period of very active bone formation and resorption that replaces normal lamellar bone with haphazard (woven) bone.
- In the final sclerotic phase, bone resorption declines progressively and leads to a hard, dense, less vascular pagetic or mosaic bone, which represents the so-called burned-out phase of Paget's disease.

Q. A 55-year-old woman complains of back pain, low mood, and fatigue she was found to have renal stones and hypercalcemia. A radiograph of the patient is given below. What is the most probable diagnosis of the given condition?

A. Rickets
B. Osteomalacia
C. Deficiency of vitamin C
D. Hyperparathyroidism

Answer: D

Solution

- The radiograph showing Loss of lamina dura (i.e., thin cortical bone of tooth socket surrounding teeth is seen as thin white line, is resorbed). which confirms the diagnosis of hyperparathyroidism
- Hyperparathyroidism presents with the classical findings of bones, stones, abdominal groans, and psychiatric overtones which occur because of hypercalcemia.
- Dental findings of other options
  - Osteomalacia- no tooth abnormality,
  - Rickets- enamel defect,
  - Deficiency of vitamin C- bleeding gums + dentine defects

Radiological Features of Hyperparathyroidism

- Subperiosteal resorption of terminal tufts of phalanges, lateral end of clavicle and symphysis pubis.
- Loss of lamina dura (i.e. thin cortical bone of tooth socket surrounding teeth is seen as thin white line, is resorbed).

- Brown Tumor: Non-aggressive lytic lesion in the second middle phalanx.

- Salt and Pepper appearance of skull

- **Treatment:** Direct parenteral supplementation of calcium.

Q. 5 days old newborn baby was admitted to the hospital in agonal state, pale mucosa, acute respiratory failure. The child's mother did not have prenatal follow-up and reported non-existence of disease in the family. X ray of the child is given below. Which of the following is not true about the given condition?

A. Blue sclera
B. Multiple fractures
C. Cataract
D. Hearing loss

Answer: C

Solution

- The given radiograph shows bowing of long bones due to multiple transverse fractures in femur, humerus right 3rd, 4th and 6th posterior ribs.
- Most common cause of fracture in childhood is Osteogenesis imperfecta.
- Cataract is not seen in Osteogenesis Imperfecta
- Osteogenesis Imperfecta
  - Bone fragility (brittle "wormian" bone)
  - short stature
  - Scoliosis
  - Tooth defects (dentinogenesis imperfecta)
  - Hearing defects
  - Blue sclerae in types I and II
  - Ligamentous laxity
  - Basilar invagination is common in more severe clinical phenotypes.
- Fractures are common- Compression fractures of vertebrae (Codfish vertebrae)
- Pathology: defect in type I collagen (COL1A2 gene)
- Histologic findings: increased diameters of haversian canals and osteocyte lacunae, increased numbers of cells,
- Replicated cement lines, which result in the thin cortices seen on radiographs

Classification

Type	Inheritance	Sclerae	Features
1A,1B	AD	Blue	Onset at preschool age (tarda); hearing loss; involvement of teeth (type IA only)
II	AR	Blue	Lethal; concertina femur, beaded ribs
III	AR	Normal	Fractures at birth, progressively short stature IVA, IVB AD Normal
IVA, IVB	AD	Normal	Milder form; normal hearing, involvement of teeth (type IVA only)

- Four types have been identified

Treatment

- Fracture management
- Bracing
- Bisphosphonates

LEARNING OBJECTIVES

Unit 10: SPORTS INJURY & NEUROMUSCULAR DISORDER

- **Amputation & Sports Injury**
  - MESS
  - Amputation
  - Principles of amputation
  - Methods of closure: Myodesis, Myoplasty
  - Amputation in children
  - Re implantation of limb
  - Arthroscopy with different portals
  - Shoulder join
  - Arthroscopy
  - Knee joint
  - ACL tests
  - Tests for PCL, Posterior drawer test, Godfrey sag test
  - Insall - Salvatiratio
  - O Donohue triad
  - Menisci
  - Bounce home test

- **Neuro muscular disorders**
  - Flexor tendon injuries
  - Postero lateral intervertebral disc
  - Myotomes
  - Dermatomes of lower limb
  - Treatment of discprolapse
  - Parsinterarticularis
  - Spondylosis
  - Spondylolisthesis
  - Prayersign
  - Ledder hose sign
  - Trigger finger, Game keeper's thump, Tennis elbow
  - Dequervain's tenosynovitis
  - Haglund'sdeformity
  - Dupuytren's contracture
  - Mallet finger, Jersey finger, Bowler's thumb
  - Halluxvalgus
  - Rotator cuff syndrome
  - Frozen shoulder
  - Osteochondritis dissecans
  - Variants of osteochondritis
  - Avascularnecrosis
  - Ganglion
  - Baker's cyst

23 AMPUTATIONS & SPORTS INJURY

Mangled Extremity severity score (MESS) 00:00:35

- Tells about survival of a limb after crush injury Includes 4 parameters
  - **S - S**hock
  - **I - I**schemia
  - **V - V**elocity of Trauma
  - **A - A**ge of the patient
- Total score = 11
- ≥ 7 limb cannot survive, requires amputation

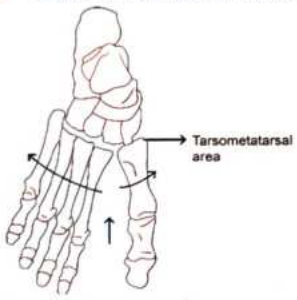
Amputation 00:01:29

- Overall, Most Common Cause in the World: Peripheral vascular disease
- Most Common Cause in India: Road Traffic accidents (RTA)

Important types of amputation

1. Chopart's Amputation
   - Inter-tarsal amputation

2. Lisfranc's Amputation
   - Tarso-metatarsal area.



3. Symes amputation
   - Through the ankle 0.6 cm above the talar dome

Amputation neuroma

- Occurs due to amputation of a limb
- Treatment: Excision (surgery) & control the pain
- Pain can be controlled by

1. TENS (Transcutaneous electrical nerve stimulation): Inhibits pain gate pathway
2. IFT (Interferential therapy): Uses same principle
3. Ultra-sonic therapy

- Pain management: TENS > IFT > US

Principles of amputation 00:03:14

- Understand the cause of the condition demanding amputation
- Decide the level of the amputation
- Decide the desired length of the stump
- Arteries to be ligated, veins to be coagulated (both should not be ligated together – avoid AV-fistula)
- Nerves should be pulled out and a cut to be done at a very high level to prevent neuroma coming on to the stem
- Bone ends should be rounded
- Muscles usually are divided at least 5 cm distal to the intended bone resection
- Ideal stump is requiring for optimal outcome.
- Ideal amputation stump

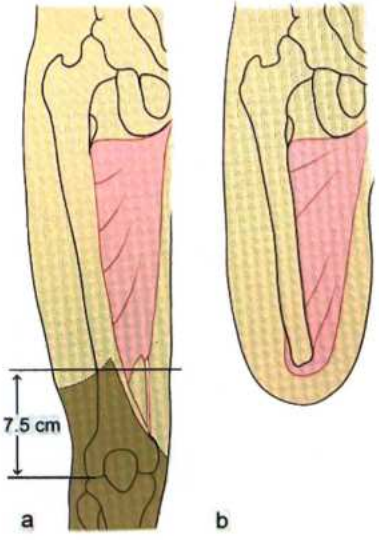
1. Non tender
2. Well healed
3. Non adherent
4. Non bullous
5. Skin at end of stump mobile sensate skin
6. Properly constructed to allow satisfactory fitting of prosthesis

Level of amputation 00:04:30

- Cardinal rule: Preserve all possible length consistent with good coverage of stump
- Type of amputation traditional length of stump
  - Above knee: 23 cm (9 inches)
  - Below knee: 14 cm (5.5 inches)
  - Below elbow: 18 cm (7 inches)
  - Above elbow: 20 cm (8 inches)

Methods of closure 00:05:30

Myodesis / myoplasty



- Muscles are stabilized by myodesis (suturing muscle or tendon to bone) or by myoplasty (suturing muscle to the periosteum or the fascia of opposing musculature).
- If possible, myodesis should be performed to provide a stronger insertion, help maximize strength, and minimize atrophy
- Myodesed muscles continue to counter-balance their antagonists, preventing contractures and maximizing residual limb function.
- Myodesis may be contraindicated, however, in severe ischemia because of the increased risk of wound breakdown.

Amputation in children 00:06:34

- Krajbich summarized the general principles of childhood amputation surgery as follows:

1. Preserve length
2. Preserve important growth plates
3. Perform disarticulation rather than trans-osseous amputation whenever possible,
4. Preserve the knee joint whenever possible
5. Stabilize and normalize the proximal portion of the limb
6. Be prepared to deal with issues in addition to limb deficiency in children with other clinically important conditions.

Reimplantation of limbs 00:07:34

- **B - Bone** "Bone is repaired first"
- **E - Extensor tendon**
- **F - Flexor tendon**
- **A - Arteries**
- **N - Nerves**
- **V - Veins**
- **S - Skin coverage** " Skin is preserved first but repaired last"

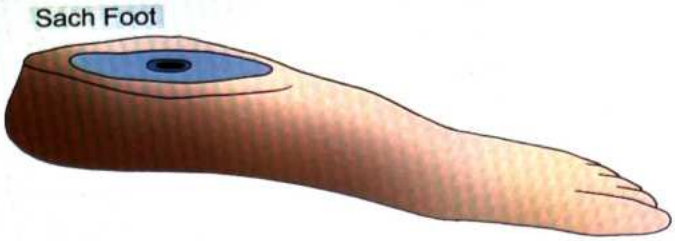
How to remember

- BE FAN VS

Prosthesis

- To replace amputated foot

1. SACH (Solid Ankle Cushion Heel) Foot: Western lifestyle foot



2. Jaipur Foot: Indian foot/ natural looking foot; created by Dr. P.K. Sethi

Prosthesis	SACH foot	Jaipur foot
• Appearance	• Does not look normal • Requires shoe	• Looks normal • Can walk barefoot
• Keel	• Long Keel restricting movements	• Small keel allowing all movements
• Ankle movements	• Not present • Squatting not possible	• Present • Squatting possible • (sit on ground)
• Inversion / Eversion (subtalar joint movements)	• Not present • Hence difficult to walk on uneven grounds	• Present • So can walk on uneven grounds
• Cost	• High	• Low

Re-implantation of amputated digit

- **B - Bone** "Bone is repaired first"
- **E - Extensor tendon**
- **F - Flexor tendon**
- **A - Arteries**
- **N - Nerves**
- **V - Veins**
- **S - Skin coverage** "Skin is preserved first but repaired last"

How to re

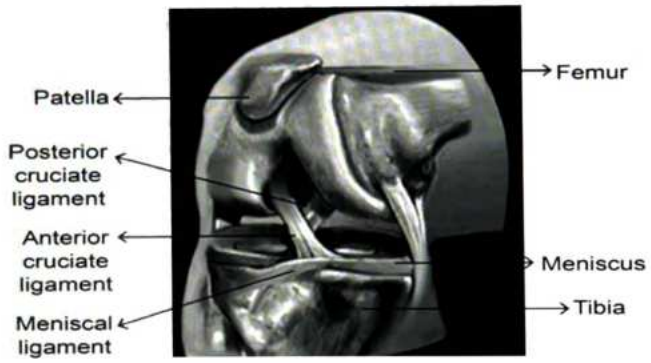
- BE FAN VS

Arthroscopy with different portals 00:10:23

- Knee arthroscopy

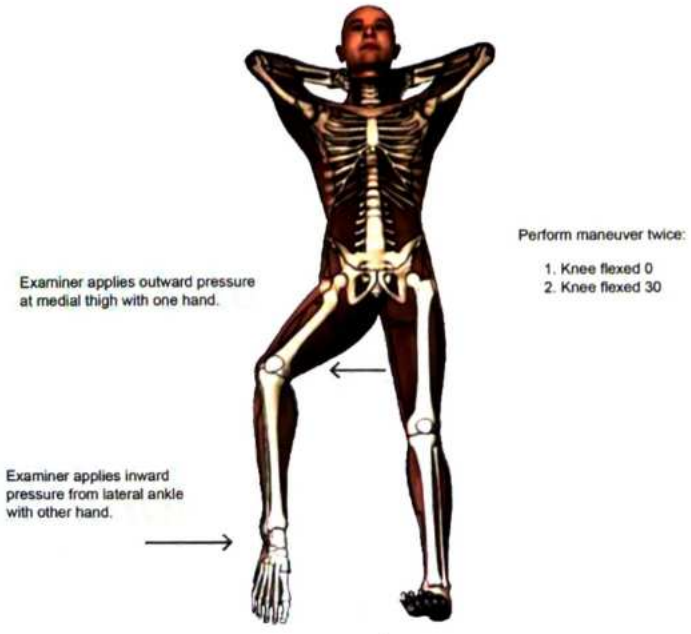
Refer Diagrame 1.1

Knee joint

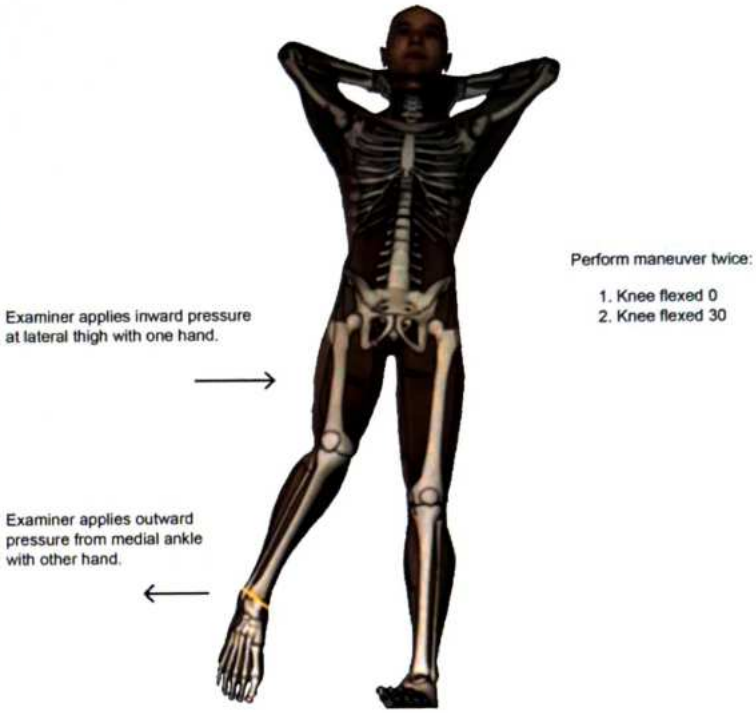


- Lateral Collateral Ligament → Varus force
- Medial Collateral Ligament → Valgus force
- Medical & lateral menisci → Torsion & rotation
- Torsion - happens only when the knee is flexed
- In extension, knee is locked
- Anterior Cruciate Ligament: Torsion + Valgus (Found inside the joint + goes Medially)
- Posterior cruciate ligament: Posterior force

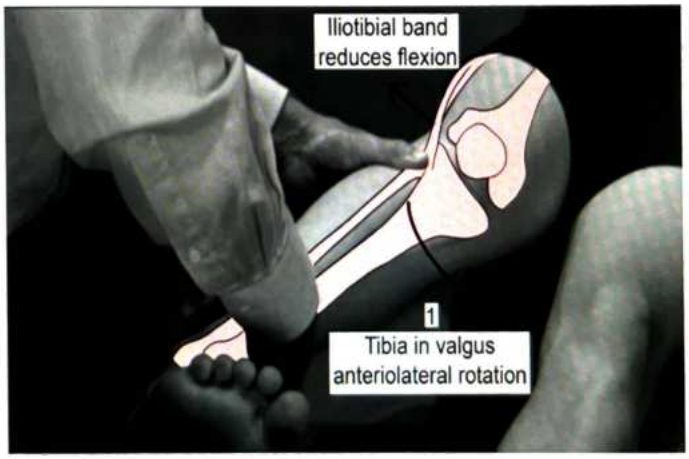
Varus Stress Test



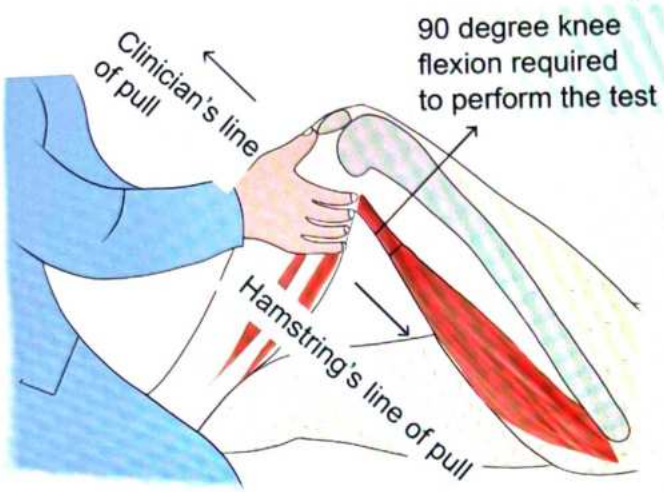
Valgus Stress Test



- Pivot shift test: test for ACL

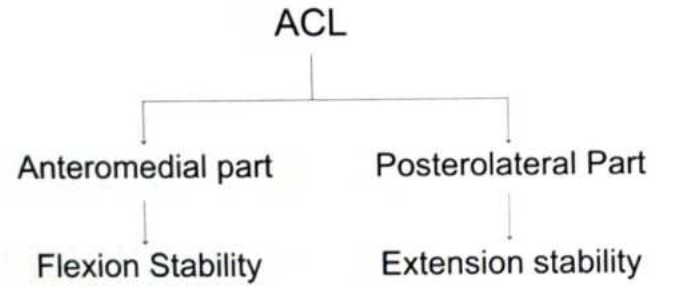


- PCL restricts External rotation: Dial test
- ACL restricts hyperextension and IR: Pivot shift test
- Other tests for Anterior Cruciate Ligament



- Anterior drawer test: Knee 90. flexed, then pulled anteriorly, ACL restricts the pull
- Lachman test: Bend knee at 20 flexion, best test for ACL

- New test for ACL: Lelli test



Tests for PCL 00:17:13

1. Posterior drawer test

- Hip flexed to 45 degree and knee flexed to 90 degrees, hamstrings are relaxed. Thumbs of both the hands placed over tibial tuberosity and the fingers of both hands posteriorly around the proximal tibia push the tibia behind. The amount of translation is visualized and felt.
- Affected - > the anterior step is lost, and the tibia is found sagging behind the femur in flexion as comparable to the opposite side

2. Godfreys Test

- Hip is placed on 90 degrees of flexion along with the 90-degree knee flexion. Here the foot is resting on the examiners hand
- The tibia is seen sagging posteriorly in a PCL deficient knee.

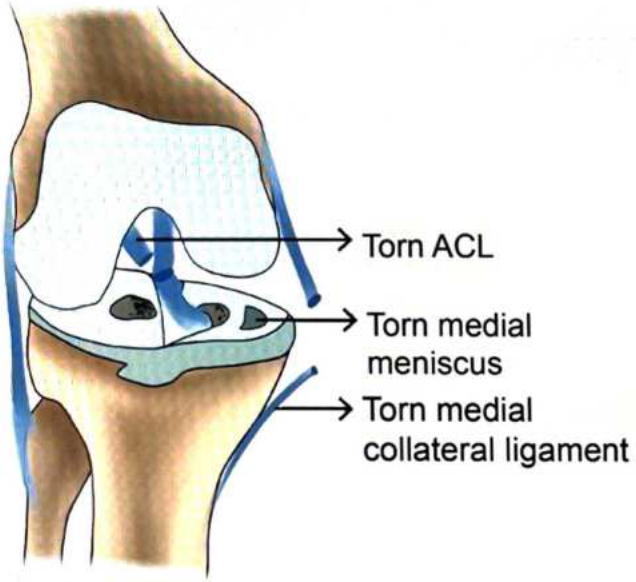
Previous Year's Questions

Q. All are true about PCL except? (AIIMS Nov 2020)
A. It's extra synovial structure
B. Primary restrain for post dislocation of Knee joint
C. Primary restrain for internal rotation around knee joint.
D. Attached to medial femoral condyle

INSALL SALVATTI RATIO

- A – is the length of the patella tendon
- B – is the length of the patella
- The index is calculated as A/B
- If it is more than 1.2 it indicates a patella Alta and if less than 0.8 then patella Baja

O' Donoghue triad 00:20:27



- 3 structures are damaged – dangerous

1. **M** - **M**edial collateral ligament
2. **A** - **A**nterior cruciate ligament
3. **M** - **M**edial meniscus

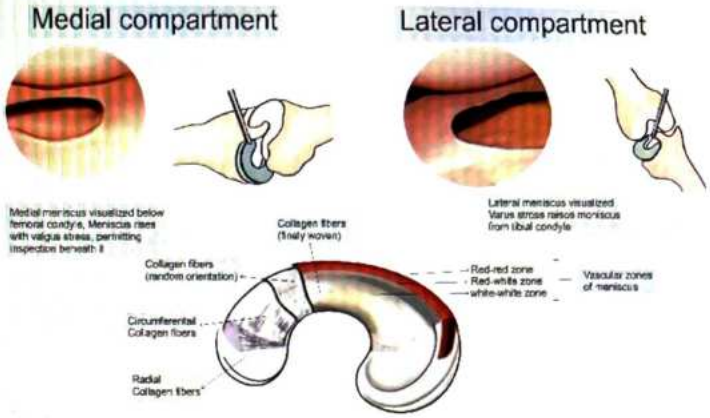
- Test to differentiate cervical spine strain (muscle) & sprain (ligament)

McMurray test (Rotational test)

- Can hear tear
- Receives blood supply from Periphery.
- So Peripheral 1/3rd is vascular. Hence it can be repaired
- Inner 2/3rd → excised if damaged
- Tests for menisci
  - **M**- **M**C Murray
  - **A** - **A**pley grinding test
  - **T** - **T**hessaly
  - **E** - **E**ge's test

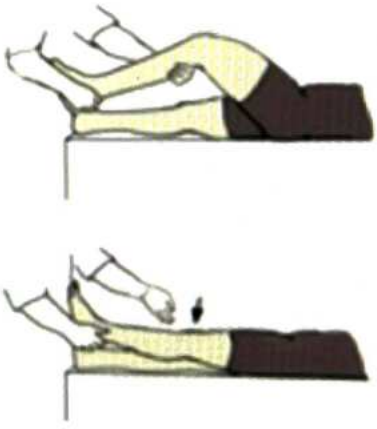
How to remember

- MATE



- Bucket handle tear of medial meniscus

Bounce home test



- When knee is Flexed and then suddenly extended, there is a feel.
- Feel on Knee extension
  - Hard: If bone rubs on bone
  - Normal Firm If cartilage rubs
  - Rubbery: Torn ACL or menisci is present-abnormal

- Empty feel is never felt
- There will always be a feel

Previous Year's Questions

Q. Best results after meniscal repair is seen in repair of? (AIIMS June 2020)

A. Red zone
B. White zone
C. Gray zone
D. Red white zone

- **M** - Anterior Horn of **M**edial Meniscus (Most Anterior)
- **C** - Anterior **C**ruciate ligament
- **L** - Anterior horn of **L**ateral Meniscus
- **L** - Posterior horn of **L**ateral meniscus
- **M** - Posterior horn of **M**edial meniscus
- **C** - Posterior **C**ruciate ligament (Most posterior)

How to remember

- MCL-LMC

Structure of knee anterior to posterior

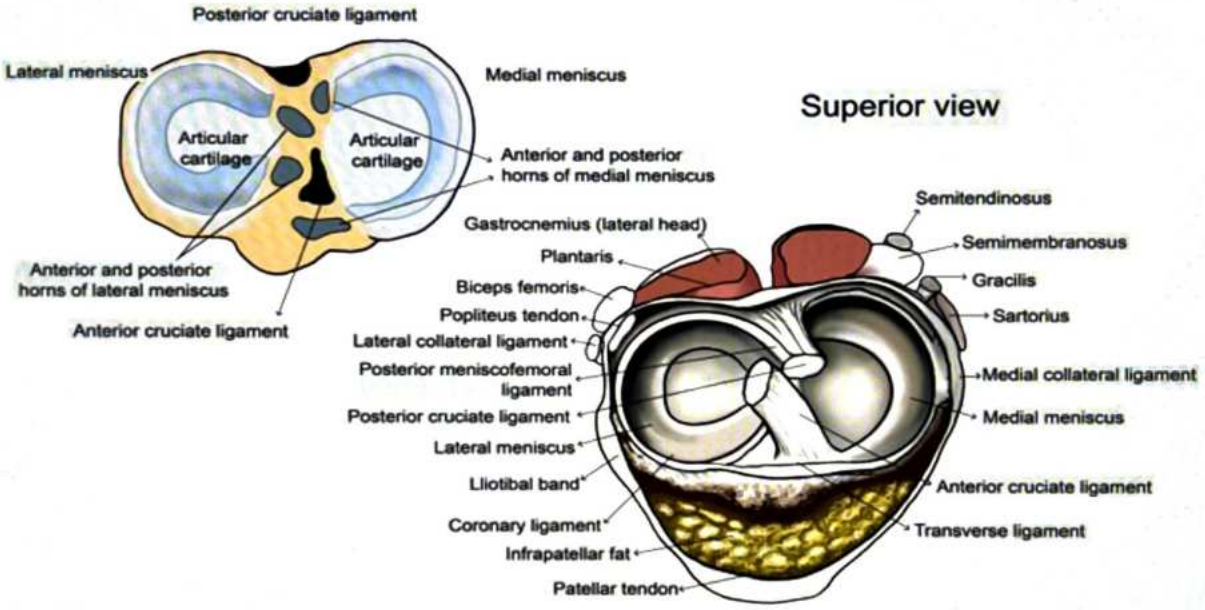


figure 23.1

Arthroscope:
1. 4 mm diameter
2. 30 degree

Portals of Knee Arthrscopy

Anterolateral portal
- Most common approach
- 1 cm above joint line and 1 cm lateral to patellar tendon
- Universally see all structure except
  - I PCL
  - II Anterior part lateral meniscus
  - III Posterior horn medial meniscus

Anteromedial portal
- Additional viewing of lateral compartment
- Instrumentation

Superolateral portal
- Patello femoral articulation and excision of medial pilcae

Posteromedial portal
- Repair of posterior horn meniscal tears
- Removal of posterior loose bodies

Gillquist portal (Trans Patellar portal)

CLINICAL QUESTIONS

Q. A 38-year-old Lorry driver was driving for a long distance decided to take a nap, parked his vehicle on the side of the road and was sleeping under the lorry. Unfortunately, another lorry driver who was driving under the influence of alcohol lost control and hit this lorry on the backside. The patient was brought to the ER after 2 hours of the incident. Proximal limb amputation is planned for this patient. What is the permissible ischemia time for this patient?

A. 4 hours
B. 6 hours
C. 8 hours
D. 12 hours

Answer: B

Solution

- Irreversible necrotic changes begin in muscles after 6 hours of ischemia (warm ischemia time), it is preferable to begin the replantation of parts with good muscular bulk (viz. parts proximal to palms and foot) within this time.
- With cooling (to 4°C), this time may be extended to 12 hours (cold ischemia time).

Sequence of reimplantation (Mnemonic: BEFANVS)

- **B**- **B**one (first to be implanted)
- **E**- **E**xtensor tendon
- **F**- **F**lexor tendon
- **A**- **A**rteries
- **N**- **N**erves
- **V**- **V**eins
- **S**- **S**kin (preserved first implanted last)

Q. A 48-year-old chronic smoker who underwent foot amputation for peripheral vascular disease has come for follow up, you're the Orthopaedic intern on the OPD. He is asking about prothesis and his lifestyle after rehab. The following movements are true about sach foot prosthesis except

A. Solid ankle cushion heel
B. inversion/ eversion not possible
C. Squatting is easy
D. Does not look like a normal foot

Answer: C

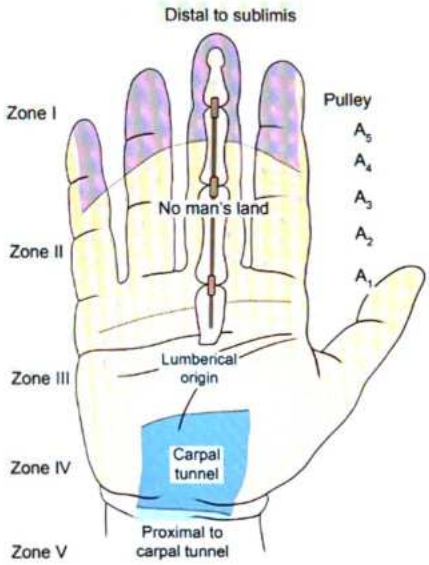
Solution

- In SACH foot there are no ankle movements. Hence squatting is not possible.

Prosthesis	Sach foot (Western) (Solid ankle cushion heel)	Jaipur foot By Dr. P k Sethi
Appearance	• Does not look normal Requires shoe	• Looks normal Can walk barefoot
Keel	• Long Keel restricting movements	• Small keel allowing all movements
Ankle movements	• Not present Squatting not possible	• Present Squatting possible (sit on ground)
Inversion / Eversion (subtalar joint movements)	• Not present Hence difficult to walk on uneven grounds	• Present so can walk on uneven grounds
Cost	• High	• Low

24 NEUROMUSCULAR DISORDERS -1

Flexor tendon injuries



- Flexor tendons are derived into 5 zones base on their level.
  - Zone I - FDP
  - Zone II - FDS called as "No man's land" (as surgeries done in Zone II causes poor result)
  - Zone III - Lumbricals
  - Zone IV - carpel tunnel
  - Zone V - Forearm

PIVD: POSTEROLATERAL (PROLAPSED INTERVERTEBRAL DISC) 00:01:19

- Prolapse is More common in posterolateral than central.
- Clinical presentation: Lower back ache radiating to Lower Limb aka sciatica
- IOC: MRI (T2) weighted.
- M/C site of Relapse L4 -L5 > L5-S1 (as lumbar is usually dehydrated)
- Lower nerve root compressed: L5 (M/C)
- In cervical spine C5 C6 > C6 C7

Previous Year's Questions

Q. 30-year female has backache going to right lower limb. The following is the MRI picture. Which is the most common nerve root involved?

(FMGE Aug 2020)

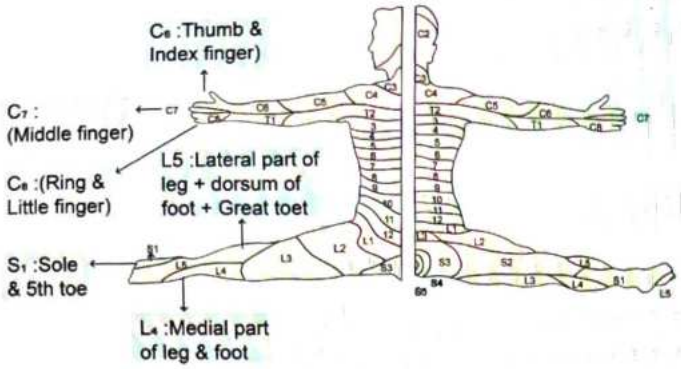
A. L3
B. L4
C. L5
D. SI

MYOTOMES 00:03:14

- C5 - Shoulder abduction + elbow flexion
- C6 - wrist extension
- C7 - elbow extension
- C8 - finger flexion
- T1 - intrinsic muscle of hand I2 - hip flexion
- L3 - knee extension
- L4 -ankle dorsiflexion
- L5 - extensor hallucis longus
- S1 - flexor hallucis longus

Dermatomes of lower limb 00:04:12

- L4 - Medial border of leg + foot
- L5 - Lateral border of leg, dorsum of foot & great toe all around
- S1 - Sole of little toe all round



Yellow flag sign

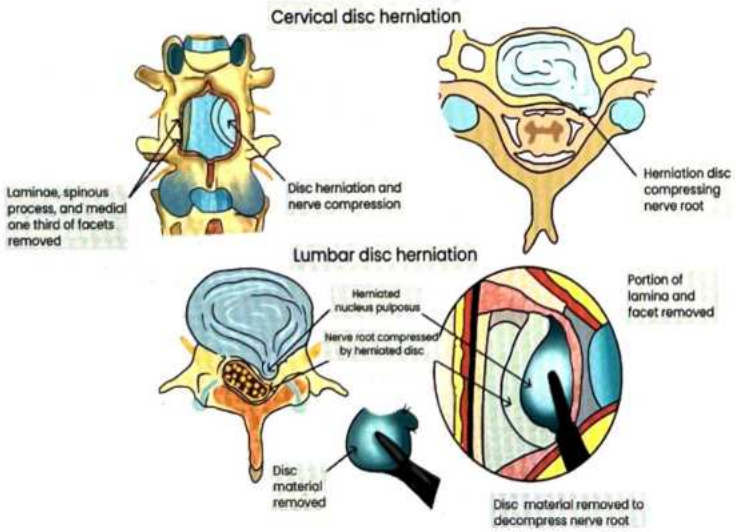
- Indicates Psychosocial factors as a reason for pain

Red flag sign

- Indicates serious spinal pathology
- Signs Includes
  - Bladder or bowel dysfunction
  - History of carcinoma
  - Progressive neurological defects
  - Steroids > 4 weeks

Treatment of disc prolapse

- Plan A
  - Rest + NSAIDS + Physiotherapy (TENS)
  - Local steroids
  - Surgical decompression
    - → Laminotomy
    - → Laminectomy
    - → Hemilaminectomy



Lumber canal stenosis syndrome

- Narrowing of lumbar canal < 10 mm: Neurogenic claudication
- Narrowing can be due to thickening of tissues like ligamentum flavum & fibrosis all around.
- Treatment: Laminectomy / Laminoplasty

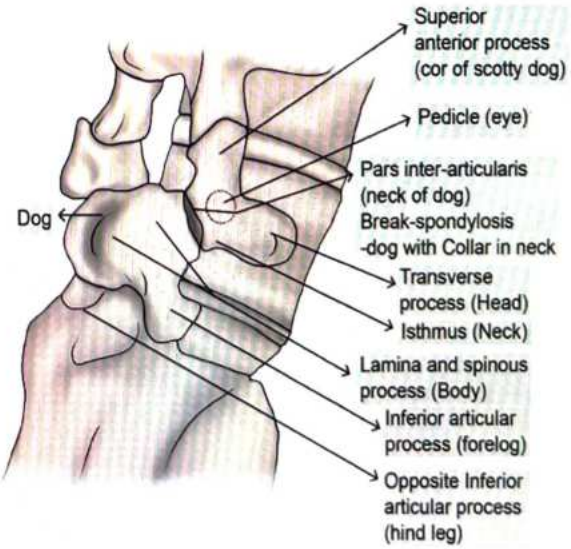
Hoovers sign ⏱ 00:06:30

- Maneuver aimed to separate organic from non-organic paresis of leg.
- Relies on the principle of synergistic contraction.
- Normal: Hip flexion on right side; heel pressure felt on left side.
- Paralyzed right leg: Paralyzed right side, can't flex but effort present

Malingering

- Not able to lift right leg, No pressure at left heel.
- Waddell test can also be done to detect malingering.

Pars interarticularis

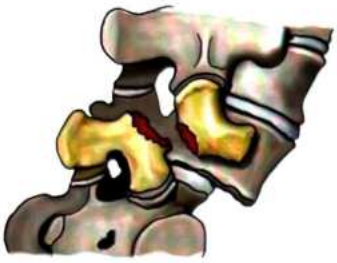


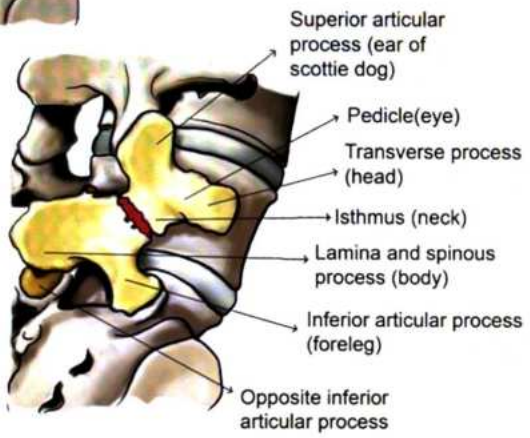
- Lumbar vertebrae in oblique view radiograph gives Scottish dog appearance

Spondylolysis

- Fracture of vertebra of level L5 in pars interarticularis (neck) gives dog with collar in neck / broken neck / elongated neck appearance.

Spondylolithesis

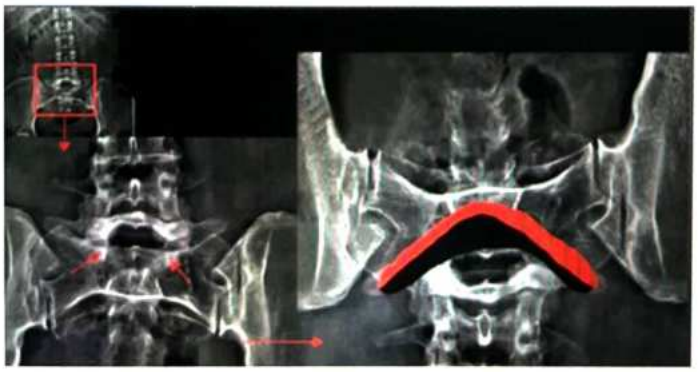




- M/C at the level of L5 -S1.
- Separation of fractured pars interarticularis gives beheaded Scottish terrier sign appearance

Important Information

- Spondylolisthesis on AP view in "Inverted Napoleon hat" appearance.



- Inverted Napoleon hat sign
- Seen in end stage of Spondylolithesis

Prayer sign 00:08:37

- It is a clinical test in which the patient is not able to approximate both the palmar surfaces of the hand and fingers
- This is seen in early onset diabetes mellitus
- This indicates higher chances of early complication affecting minor and major vessels.

LEDDERHOSE disease

- Associated with Dupuy... contracture
- Has plantar fibromatosis
- Also associated with frozen shoulder
- So one can look for the hand and the feet in a case of frozen shoulder.

Trigger Finger 00:09:57

- Stenosing tenosynovitis of the flexor leading to trapping at the entrance to its fibrous digital sheath (mainly A1 pulley) at the level of metacarpophalangeal joint
- Local trauma/unaccustomed activity/rheumatoid arthritis (RAV / diabetes mellitus/gout.

- Commonest is ring and middle fingers
- Patient frequently notes catching/locking/triggering of affected finger after forceful flexion.
- In some instances, the opposite hand must be used to passively bring the finger into extension.
- Patient notices that finger clicks as he or she bends it; when the hand is unclenched the affected finger remains bend at the proximal interphalangeal joint, but with further effort it suddenly straightens with a snap.
- Triggering is more pronounced in morning than later in day. A tender nodule can be felt in front of metacarpophalangeal joint.

Treatment

- Injection Of methyl prednisolone into the tendon sheath.
- Surgical release of Al pulley. A2 pulley must be spared to preserve effective digital flexion.
- In patients of RA, the entire annular pulley system should be preserved to prevent further ulnar drift of fingers.
- These patients are treated by teno-synovectomy and excision of one slip of flexor digitorum superficialis.
- In children it is worth waiting until the child is a year Old, as spontaneous recovery often occurs.

Game Keeper's Thumb 00:12:23

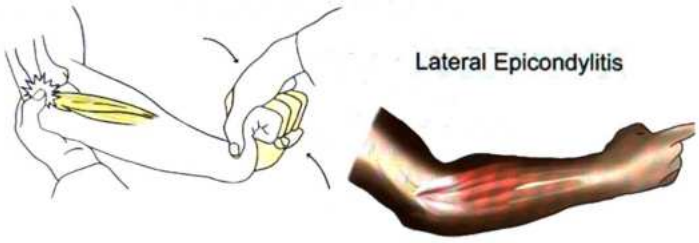
- AKA Skiers' thumb
- M/C Injury of Metacarpophalangeal joint
- Ulnar collateral ligament tear due to forced radial deviation.
- Injury most commonly involves the phalangeal insertion of Ulnar Collateral ligament.
- Tx:
  - Cast application
  - Surgery is done when fibers of adductors policies interfere with healing of ligaments known as Steners lesion

Previous Year's Questions

Q. Patient had injury to thumb causing thumb abduction. Which of following can happen?
(FMGE Dec 2018)

A. Game Keeper's thumb
B. Bohler's thumb
C. Kaplan injury
D. Mallet finger

Tennis Elbow

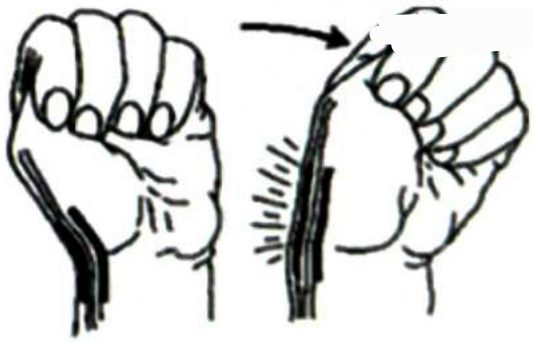


- AKA lateral epicondylitis
- Inflammation of common extensor origin: ECRB > ECRL
- Tx: Cozen Test: Wrist dorsiflexion resisted by causing pain

Important Information

- Tennis Elbow: Lateral Epicondylitis
- Golfers Elbow: Medial Epicondylitis
- Students Elbow: Olecranon Bursitis
- House Maids' Knee: Prepatellar Bursitis
  Clergyman's Knee: Infrapatellar Bursitis

Dequervain's Tenosynovitis

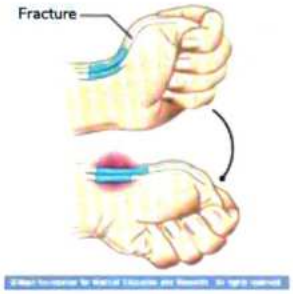


- Inflammation of abductor pollicis longus / extensor pollicis brevis. (both muscles enter 1st extensor compartment of wrist)
- Finkelstein test is done for diagnosis
- Treatment for all the above conditions

- Plan A: Rest + NSAID's → Steroids → Surgery

Previous Year's Questions

Q. Which tendon are involved in the test show below?
(NEET Jan 2020)

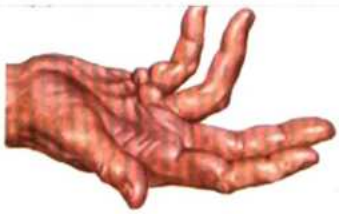


A. EPL and EPB
B. APL and EPB
C. APL and APB
D. APL and EPL

Haglund's Deformity

- Prominent calcaneal tuberosity + an overlying bursitis
- Treatment
  - Plan A: Rest + NSAID's → Steroids → Surgery

Dupuytren's contracture

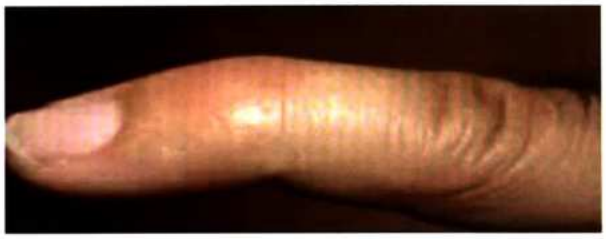


- Contracture of Palmar aponeurosis: Flexion Deformity
- Joint involved: MCP > PIP > DIP
- Ring Finger > Little Finger
- Treatment
  - Wait & watch
  - If > 30 0 deformity at MCP or > 15 0 at PIP – then subtotal fasciectomy is done.
  - Collagenase has also been used which was taken from Clostridial.

Important Information

- **These patients usually always has history of DM / alcoholism**

Mallet finger



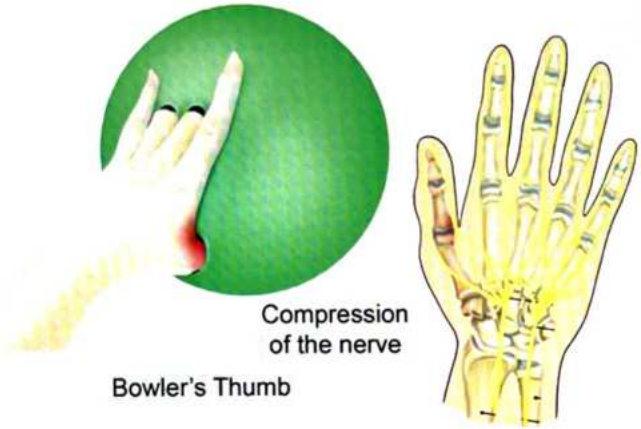
- Avulsion of extensor tendon from distal phalanx
- AKA baseball finger
- Treatment: Mallet splint → 6-8 weeks

Jersey finger

- Avulsion of FDP from distal phalanx
- Treatment: Operative since it is in Zone I

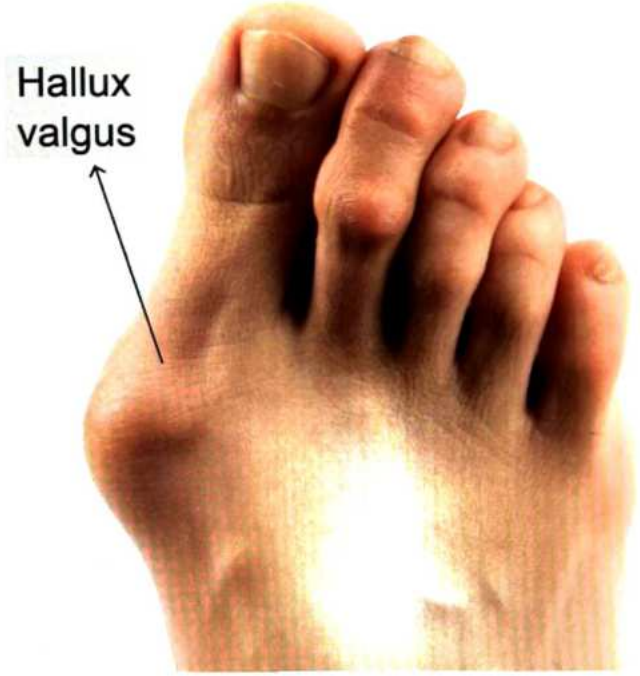
Bowler's thumb

- Perineural fibrosis during bowling of ulnar digital nerve of thumb.
- Treatment: Plan A



Hallux Valgus

- Lateral deviation of great toe.
- Bilateral involvement is also noted
- Treatment
  - Keller's Surgery
  - Arthrodesis
  - Arthroplasty



Rotator cuff syndrome 00:18:27

- Includes
  - Subacute tendonitis (Painful arc syndrome – Pain on abducton between 60° -120°)
  - Chronic tendonitis (Impingement syndrome – Neers test is used)
  - Rotator cuff tears
- Treatment
  - Physiotherapy + NSAIDS.
  - Local injection of steroids.
  - Surgery if required for impingement syndrome or rotator cuff tears (especially in young individuals).

Previous Year's Questions

Q. Abduction of shoulder must not include is?
(INICET Nov 2020)

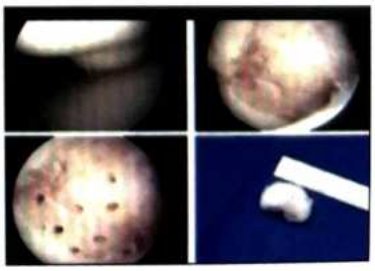
A. Serratus anterior
B. Deltoid
C. Trapezius
D. P. major

Frozen shoulder

- AKA adhesive capsulitis.
- It is a feature of DM patients & they usually have night pain.
- It is characterized by adherence of capsule to each other causing limitation of internal rotation and abduction.
- Gradually all movements lost.
- Treatment: Plan A

Osteochondritis Dissecans

- Osteochondritis dissecans (OCD) is a condition that develops in joints, most often in children and adolescents.
- It occurs when a small segment of bone begins to separate from its surrounding region due to a lack of blood supply.
- As a result, the small piece of bone and the cartilage covering it begin to crack and loosen.
- Treatment
  - Microfracture technique is done
  - Multiple hole are made in the underlying bone which will regenerate the Cartilage



Osteochondritis Dissecans

Important Information

- Other Varieties of Osteochondritis
  - Keinbock - Lunate
  - Kohler - Navicular
  - Freiberg - 2nd Metatarsal Head
  - Iselin - 5th metatarsal Base
  - Severs - Calcaneum
  - Panners - Capitulum
  - Perthes - Femur epiphysis
  - Osgood schatter's - Tibial tuberosity
  - Sinding Larson's - Lower pole of patella

Important Information

Q. Kohler's disease is due to osteonecrosis of? (JIPMER 2017)

A. Calcaneus
B. Tarsal bone
C. Talus
D. Humerus - Capitulum

Previous Year's Questions

Q. Which of the following is/are true Kienbock disease? (PGI 2017)

A. osteochondritis of scaphoid bone
B. Osteochondritis of lunate bone
C. Painful flexion and extension of wrist
D. Passive dorsi flexion of middle finger produces pain
E. Positive ulnar variance is a predisposing factor

Previous Year's Questions

Q. A body builder taking steroids presented with hip pain and is unable to squat. On MRI, femoral articular surface is disrupted and there is crescent sign seen an radiograph. What is diagnosis? (AIIMS Nov 2017)

A. AVN
B. Osteochondroma
C. TB hip
D. Fracture neck of femur

Variants of Osteochondritis

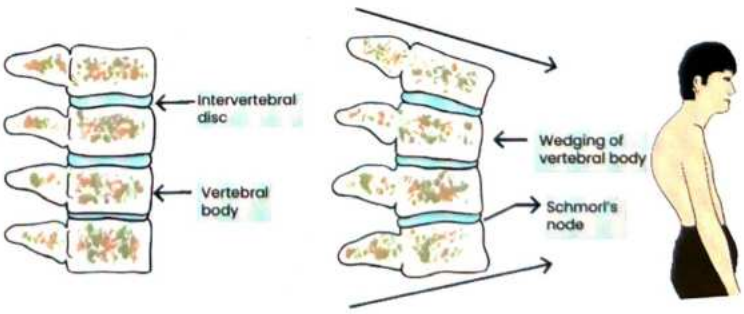
1. Keinbock

- Lunate
- Ds of young
- Pain: Base of 3rd MC
- Very painful on wrist dorsiflexion
- Treatment: Arthrodesis / arthroplasty

2. Kohler disease

- Osteochondritis of navicular

3. Scheurman's disease



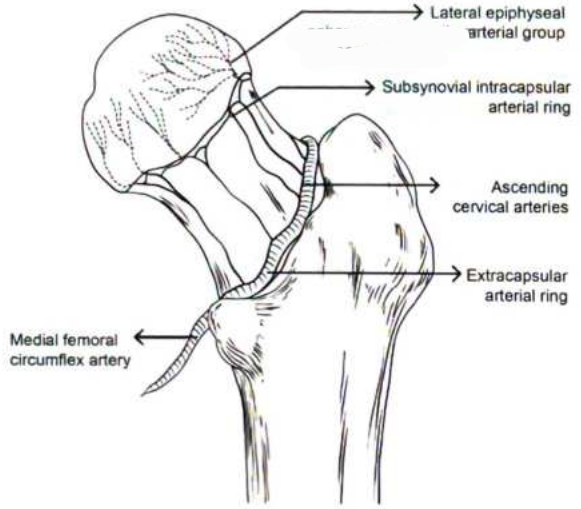
- Osteochondritis of Spine

Avascular Necrosis

⏱ 00:21:25

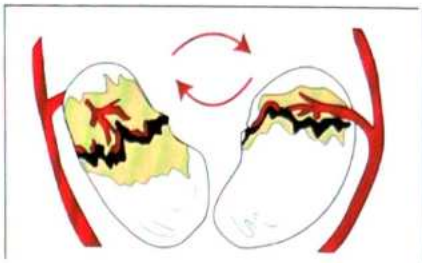
- Death of bone due to poor blood Supply

	Most Common Site	Cause
1.	Head of femur	Neck of femur & Posterior dislocation of hip
2.	Proximal pole of scaphoid	Fracture through waist of scaphoid
3.	Body of talus	Fracture of Neck of talus
4.	Proximal pole of lunate	Dislocation
5.	Capitulum	
6.	Distal femoral condyles	
7.	Humeral head	



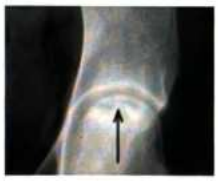
- Blood supply: Profunda femoris which is from middle circumflex femoral Artery, a branch of lateral epiphyseal artery. The arteries are easily compressed causing AVN.
- MC cause of AVN: idiopathic "Chandelier's disease"

- Scaphoid
  - Scaphoid has retrograded blood supply which is from distal to proximal pole.
  - During fracture, there is poor blood supply to the proximal pole as the fracture is usually at the waist of the scaphoid leading to AVN of proximal pole.



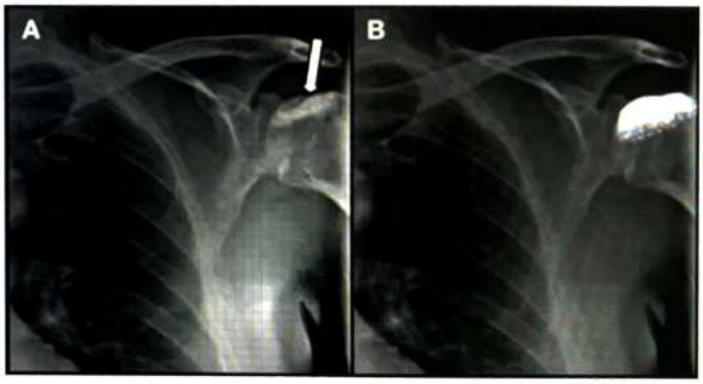
- Femur AVN
  - Affects anterolateral aspect of femoral head o IOC - MRI

- Sectoral Sign: reduction in IR and Abduction



- Crescent sign on X-ray –on femoral joint surface

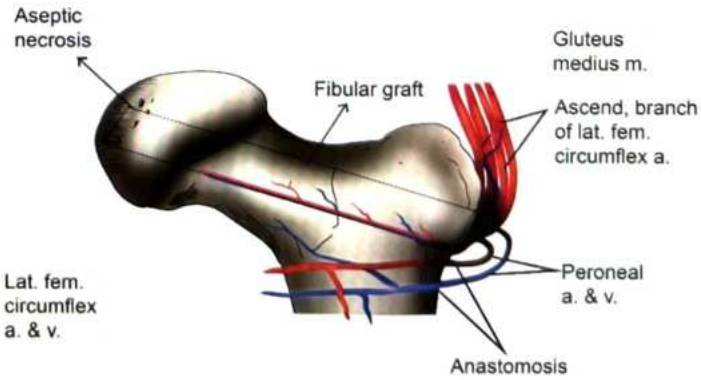
- Double line sign on MRI



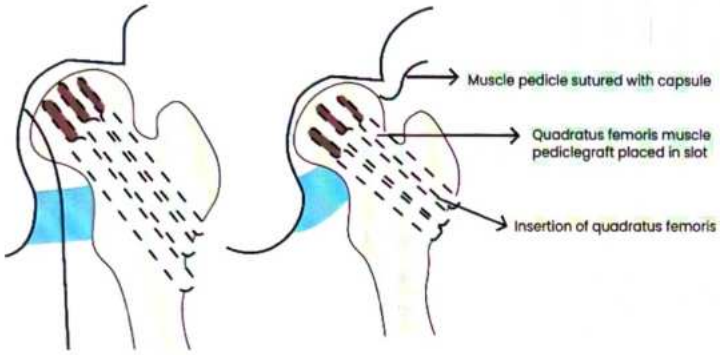
- Image shows snowcap sign: AVN of Humoral head

Treatment of AVN

1. Core decompression (↓ pressure) + Fibular graft (↑ vascularity)



2. Muscle pedicle graft
   i. "Meyer's graft": In AVN of femur; Quadratus femoris muscle is used
   ii. Joshi's graft: Tensor fascia Lata muscle used.



3. Total hip replacement: Currently used

Ganglion 00:24:08

- MC swelling of hand & wrist
- Cystic structure
- No synovial living
- Found in dorsal wrist – scapholunate
- Treatment: Plan A

Baker's cyst

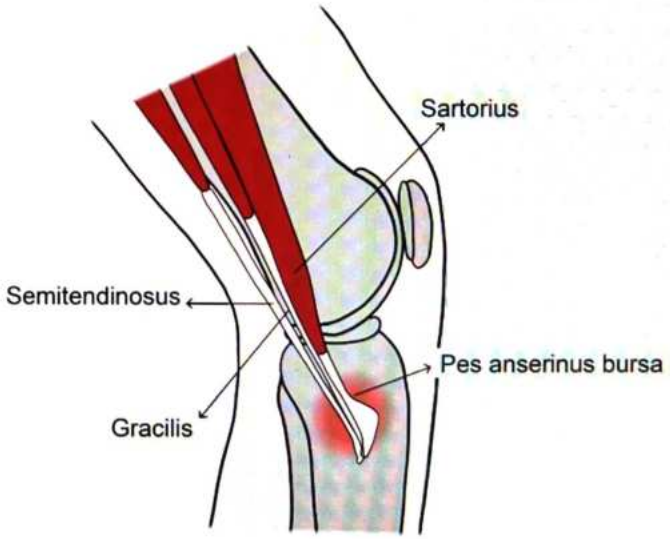
- Semi-membranous
- At medial head of gastrocnemius-compress popliteal artery
- Pressure diverticulum may arise
- Prominent on extension
- Causes associated with it: OA / RA / Pigmented villo nodular synovitis / medial meniscus injury
- Treatment: Excision if symptomatic

Compound Palmar Ganglion

- Compound palmar ganglion is chronic inflammation of common sheath of flexor tendon both above and below flexor retinaculum causing hourglass swelling.
- RA and tuberculosis are the commonest cause.

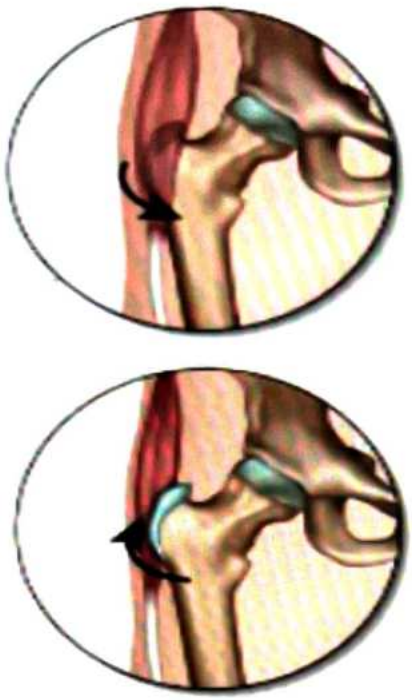
Snapping Knee Syndrome

- KNEE: Snapping of tendons at the posteromedial corner of the knee when knee goes into extension from flexion. Tendons of pes anserinus (Semitendinosus and Gracilis) are involved.
- Gluteus maximus and surgical procedures,



Snapping hip syndrome

- Dancer's hip or coxa saltans is a clinical condition characterized by a palpable or audible snapping sensation that is heard during of the hip joint.
- This is most commonly an overuse phenomenon, but may be brought on by trauma, including intramuscular injection into the gluteus maximus and surgical procedures.



FICAT AND ARLET STAGING: AVN femoral head

00:27:34

Stage 0

- Preclinical and pre-radiographic: "Silent hip"

Stage I

- Earliest clinical manifestation: Pain with limited movement of hip joint
- Radiographs are normal patchy osteoporosis in comparison with the opposite side

Stage II

- Clinical signs persist, or worsen
- Radiographs show changes in the trabecular pattern of the femoral head
- Sclerosis and lucency or even a mixed image

Stage III

- X-ray shows significant arthritis: Pathognomonic imaging features
  - Crescent line: Due toa subchondral fracture
  - Out of round appearance: Segmental flattening of the femoral head
  - Joint space is preserved or even increased

Stage IV

- Terminal phase
- Hip movement is progressively diminished until only a small range of flexion remains
- X-ray shows significant arthritis

Refer Diagram 24.1

PRACTICE QUESTIONS

Q. X ray sign of ACL injury is?

A. Segond fracture
B. Malgaigne fracture
C. Maisonneuve fracture
D. Straddle fracture

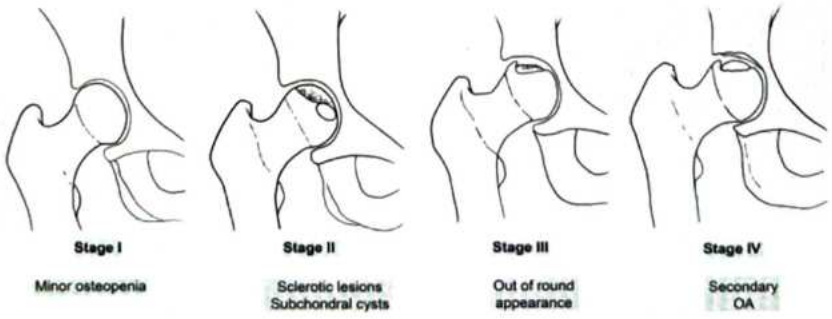
Ans. A

Q. AVN can occur at all expect?

A. Femur neck
B. Body of talus
C. Proximal scaphoid
D. None

Ans. A (Femur head)

Diagram 24.1



CLINICAL QUESTIONS

Q. De - Quervain's tenosynovitis involves?

A. Abductor pollicis longus and Extensor pollicis brevis
B. Adductor pollicis longus and flexor pollicis brevis
C. Flexor hallusis longus
D. None of the above

Answer: A

Solution

- Ans. is 'A' i.e., Abductor pollicis longus and Extensor pollicis brevis
- De-Quervain's tenosynovitis is characterized by pain over the styloid process of the radius. It is a palpable thickening in the course of the abductor pollicis longus and extensor pollicis brevis tendons.
- De Quervain's tendinosis can be triggered by several factors, including:
  - Overuse
  - A direct blow to the thumb.
  - Repetitive grasping.
  - Inflammatory conditions including arthritis
- The main symptom is pain on using the hand, especially when movement tenses the abductor pollicis longus and extensors brevis tendons (as in lifting a saucepan or a teapot).
- The thickened fibrous sheath is usually palpable as firm nodule.
- Passive adduction of the wrist or thumb causes the patient to wince with pain.
- Finkelstein's test is used to diagnose De-Quervain's tenosynovitis.

LEARNING OBJECTIVES

Unit 11: PEDIATRIC ORTHOPEDICS

Pediatric orthopedics-1

- Hip, Developmental dysplasia
- Different Tests
- X-rayfindings, Shenton's arch, Higenreinerline, Prekinsline
- Risk factors for DDH
- Management of DDH
- Perthes disease
- Slipped capital femoral epiphysis

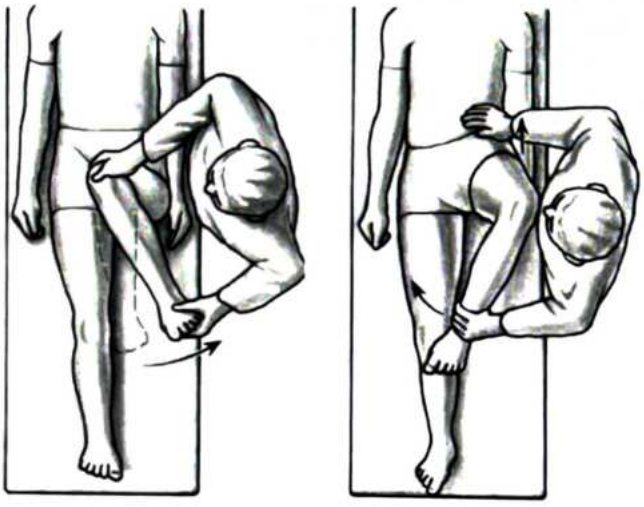
Pediatric orthopedics -2

- Duchene Muscular dystrophy
- Congenital Muscular torticollis
- Kippel-Feil syndrome
- Classical triad
- Sprengel's deformity
- Poland syndrome
- Blount's disease
- Rocker bottom foot
- Pesplanus
- Clubfoot/ Congenital talipes equino varus
- Management
- Treatment of CTEV
- Battered baby syndrome
- Types of pediatric injuries
- Congenital pseudo arthrosistibia
- Crawford classification
- Radial hemimelia
- Madelung deformity
- Polio

25 PEDIATRIC ORTHOPEDICS-1

Introduction 00:00:13

- Altered shape of femoral head-Limitation of abduction & internal rotation

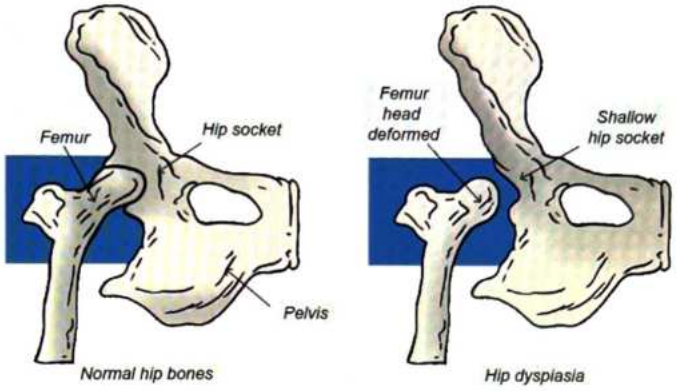


- Normal axis: clavicle
- In internal rotation & abduction when you flex the knee, the Knee goes towards the clavicle: Normal Axis
- If hip is destroyed, knee goes towards axilla
- Axis deviation Investigation of Choice: MRI
- Treatment of Choice - Maintain the hip reduced (do Abduction of hip)
- Internal rotation: leg goes out, hip goes in
- External Rotation: Leg goes in, hip goes out

Disease	M: F	Bilateral
1. Development dysplasia of Hip / CDH	1:6	20%
2. Perthes Disease (4-8y)	3:1	20%
3. Slipped capital femoral epiphysis (11-20y)	3:1	40%

Development Dysplasia of Hip 00:03:10

- Epiphysis of femur small Acetabulum flat / shallow

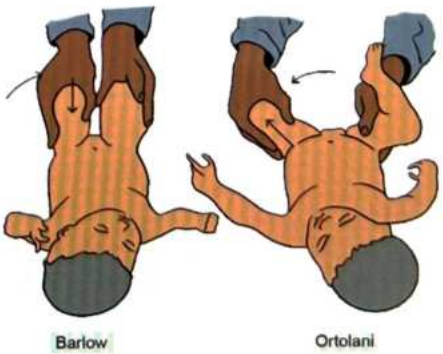


- X-ray Findings

- Shallow / flat acetabulum
- Head goes up K/a Supero-lateral dislocation
- Central edge angle: center of epiphysis forms on angle with Perkins line
- IOC: MRI
- In DDH, femoral artery pulsations are not felt Vascular sign of Narath positive

Different Tests

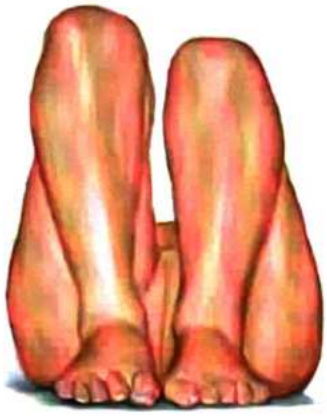
1. Ortolani maneuver



- Reduction of hip by abduction

2. Barlow maneuver
- Dislocation of hip by adduction

3. Allis or Galeazzi test

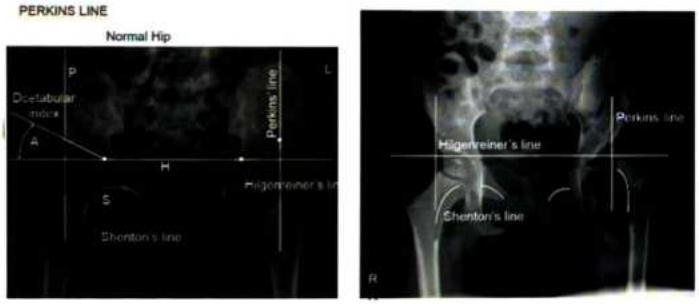


- For superolateral dislocation
- Knee of normal side is higher than the knee of affected side

4. Klisic's Test
- For measurement of DDH for bilateral Allis test disease

X-ray findings 00:05:35

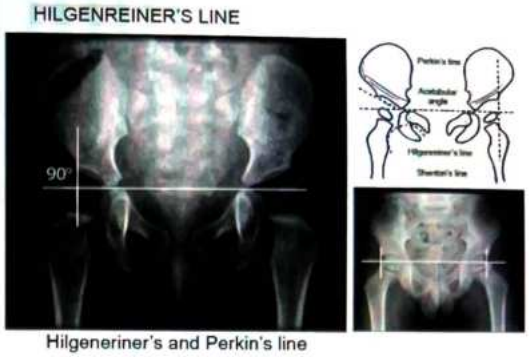
1. Perkins line



- Vertical line at the edge of acetabulum
- In normal hip, the epiphysis is inner to Perkin's line & lower to Hilgenreiner's line
- In DDH, the epiphysis is upper to Hilgenereiners line & outer to Perkins's line
- Acetabular Index: The slope of acetabulum with the horizontal line
- In DDH, acetabulum index keeps on increasing as the disease worsens / progresses

2. Shenton's arch
- An arch over the proximal femur & pubic rami
- In DDH, senton's arch is broken

3. Hilgenreiner's line



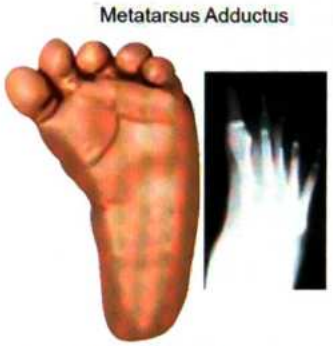
Hilgeneriner's and Perkin's line

- Horizontal line to triradiate cartilage

4. Acetabular index
- Vertical/ shallow acetabulum
- Increases in DDH

USG in DDH
- Screening tool
- Alpha angle decreases
- Beta angle increases in DDH
- In DDH
  - Acetabular index: Increases
  - Central edge angle: Decreases

Risk factors for DDH
- Oligo hydramnios
- Metatarsus adducts (medial deviation of metatarsals)
- Congenital muscular torticollis (Cock- robin appearance)
- Talipes calcaneovalgus (Heel prominent) > CTEV (clubfoot)
- Family history
- Breech presentation
- Females
- First born child
- Left side is more commonly affected
- Twin pregnancy is not a risk factor



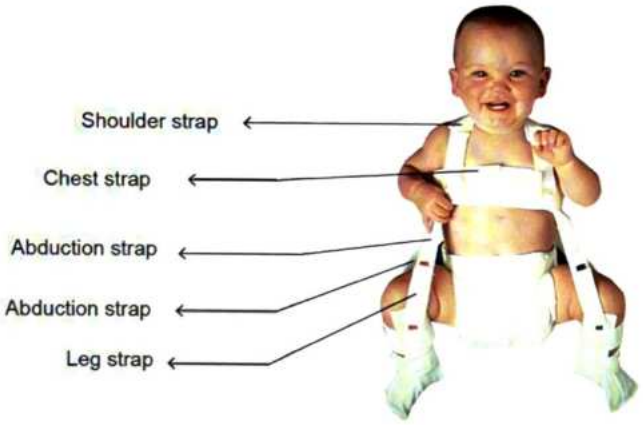
View of sole and radiograph show medial deviation of forefoot

- A strong association exists between congenital dysplasia of the hip and other musculoskeletal abnormalities such as Congen[illegible], Metatarsus adductus and Talipes calcaneo-valgus

- The most common IV position places the left hip of the fetus against the maternal sacrum. This could partially explain the increased incidence of DDH in the left hip.
- Ligamentous laxity as a contributing factor in congenital dysplasia of Hip. Increased incidence of DDH → Swaddle infants with hip in extension;
- Flexion & abduction prevents DDH
- Hence DDH is uncommon in India.

PAVLIK HARNESS

Pavlik harness



Previous Year's Questions

Q. The following brace is used for which condition?

(FMGE Aug 2020)

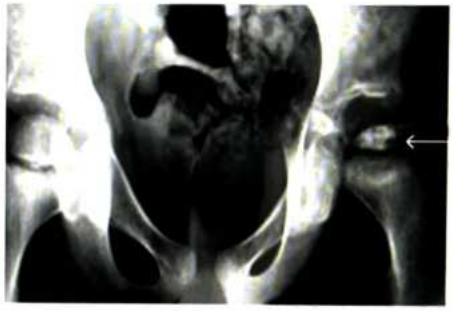
A. Perthes disease
B. Slipped capital femoral epiphysis
C. Congenital coxa vara
D. DDH

Management

- Maintain abduction by using
  1. Pavlik harness
  2. Von Rosen splint
  3. Bachelors cast
- Up to 6 months: Closed reduction (maintain abduction)
- 6 months to 18 months: Open reduction
- 18 months to 3 years: femoral correction
- > 3 years: femoral and pelvic correction

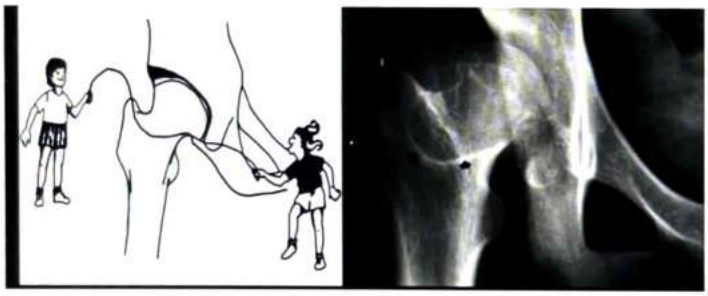
Perthes Disease 00:10:09

PERTHES DISEASE

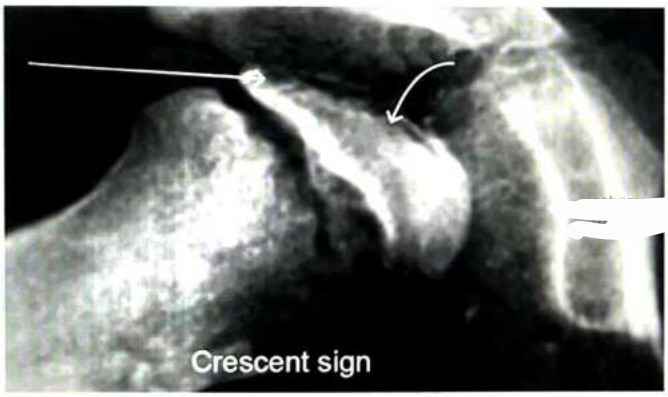


- Avascular necrosis of femoral epiphysis
- 4-8 years of age
- Self – resolving
- More common in male
- Initial x-ray in normal in Perthes IOC: MRI
- Management: Broom stick cast
- Aim: Maintain abduction
- Head will migrate superolateral
- Signs
  - Gage's sign: Refraction in the lateral part of the epiphysis and subjacent metaphysis

- Sagging rope sign



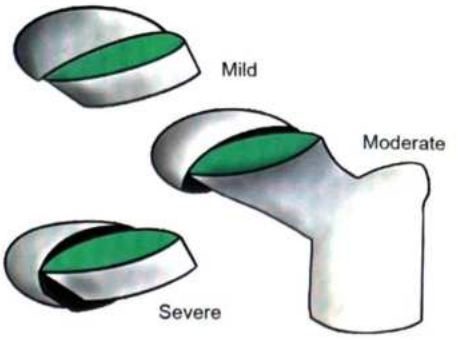
- Crescent sign



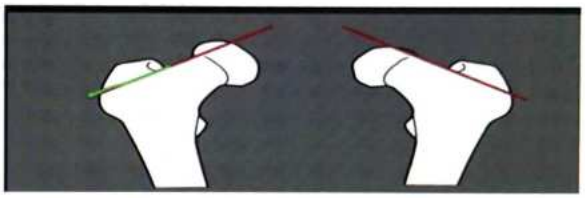
- Treatment: maintain the head abducted

Slipped Capital Femoral Epiphysis (SCFE) 00:11:35

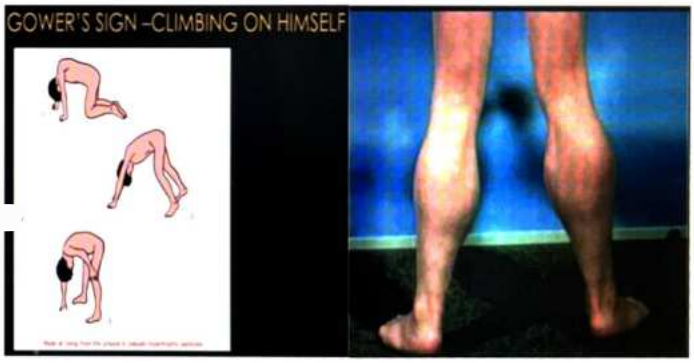
- Age: 11-20 Years
- Misnomer: "Metaphysis slip", not slipped epiphysis
- Cause: Endocrinopathies (Hypothyroidism) and Growth spurt
- IOC: MRI
- Along with IR + abduction, flexion is restricted
- AP X- ray of pelvis



- Klein's line: Line over the neck, it must have a part of epiphysis above it



- Trethowan's sign: When epiphysis goes down, then there is nothing above the line
- Management: Fixation
- Pseudohypertrophy of calf: seen when proximal muscles are week
- Gower's sign: Patient uses his own body to climb up as there is proximal muscle weakness.



CLINICAL QUESTIONS

Q. A 7-year-old young boy had fracture of lateral condyle of femur. He developed malunion as the fracture was not reduced anatomically. Malunion will produce:

A. Genu valgum
B. Genu varum
C. Genu recurvatum
D. Dislocation of knee

Answer: A

Solution

- Malunion in C/O Injury to lateral femoral condyle -Genu valgum
- Malunion in C/O Injury to medial femoral condyle -Genu varum.
- It is hyperextension of the knee joint- Genu Recurvatum
- Malunion can't produce dislocation of knee joint.
- Genu varum is physiologic in neonates and infants and reaches its peak between 6 to 12 months.
- During normal growth the tibiofemoral angle reaches zero between 18 to 24 months, after which it turns into a physiologic genu valgus, finally reaching the adult configuration by the age of 6 to 7 years.

Causes of Genu Valgum:

- Bilateral genu valgum
  - Physiologic (between 3 - 7 years)
  - Renal osteodystrophy (renal rickets)
  - Skeletal dysplasia
    - → Spondyloepiphyseal dysplasia
    - → Chondroectodermal dysplasia
- Unilateral genu valgum
  - Physeal injury from trauma, infection, or vascular insult
  - Proximal metaphyseal tibia fra[illegible]
  - Benign tumors
    - → Fibrous dysplasia
    - → Osteochondromas

Causes of Genu varum in children:

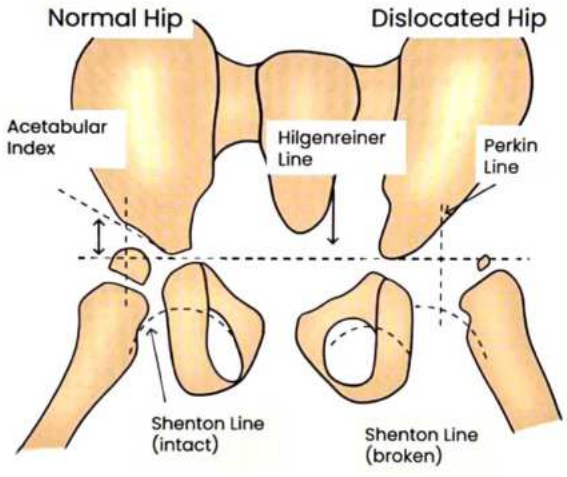
- Physiologic (infants and neonates)
- Rickets (vitamin D deficiency or refractory, caused by hypophosphatemia)
- Bone dysplasia (e.g., Achondroplasia)
- Asymmetric arrested growth of the medial distal femur and proximal tibia (e.g., osteomyelitis, fracture, tumor)
- Blount disease (tibia vara)
- Prior trauma

Q. This image signifies which of the following lines used in studying hip anatomy?

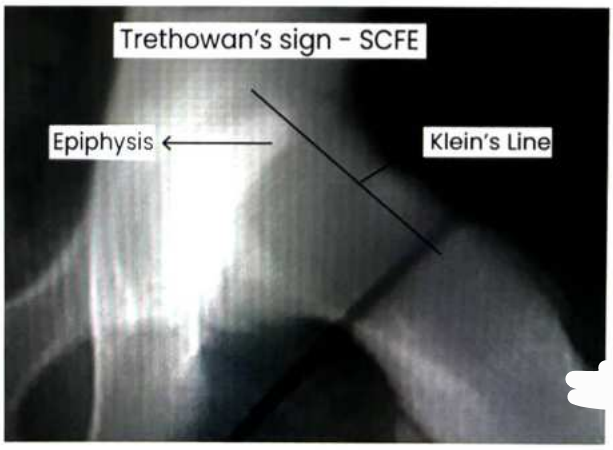
A. Hilgenreiner's line
B. Shenton's line
C. Perkin's line
D. Klein's line

Answer: B

Solution



- This arc is Shenton's line- disrupted in all subtrochanteric pathologies and DDH.
- The Klein line is a line along the superior aspect of the femoral neck that normally is intersected by the epiphysis.
- Trethowan sign is when Klein's line does not intersect the lateral part of the superior femoral epiphysis on an AP view of pelvis.



26 PEDIATRICS ORTHOPEDICS 2

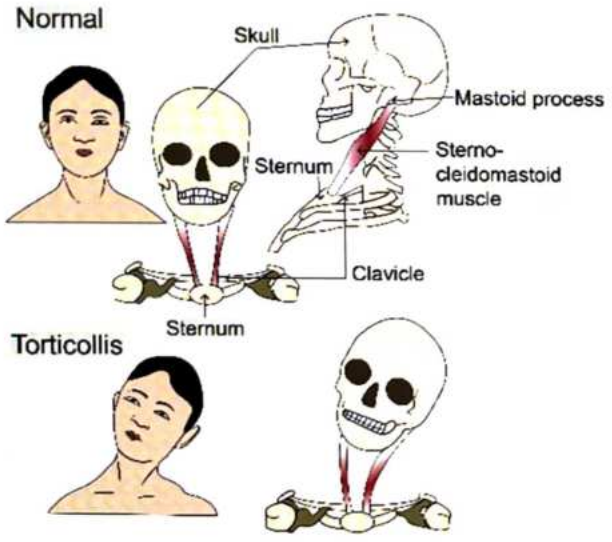
Duchene Muscular Dystrophy

⏱ 00:00:18

- X-linked recessive (Xp 21)
- Defect in Dystrophin gene (Largest gene in human)
- Swollen calf Pseudohypertrophy of calf (Fibrous fatty deposit)
- Average age of presentation is 4 years (occurs in < 5 years of age)
- Proximal muscle weakness is seen
- Pseudohypertrophy of calf & tongue is seen
- Gower's sign: Patient uses his own body to climb up as there is proximal muscle weakness.
- Definitive diagnosis is by muscle biopsy and genetic studies
- M/c nerve involved is sural nerve

Congenital muscular torticollis

⏱ 00:00:49



- Sternocleidomastoid muscle is affected
- AKA wry neck (or) twisted neck
- Associated with breech delivery, shoulder dystocia, birth injury and SCM ischemia / tumor (like compartment syndrome)
- Associated with metatarsus adductus, DDH, CTEV (cock-robin appearance)
- Knot can be detected in the body of SCM in first 3 months of life
- It can disappear spontaneously (90% by 1 year)
- There may be asymmetrical development of face (Plagiocephaly)
- Treatment: surgery
  - Optimum age to operate: 1-4 years
  - < 1 year: disappears
  - 4 years: Plagiocephaly

Klippel-Feil syndrome

- Posterior hair line very low
- Short neck
- Decreased movements
- It is associated with congenital osseous fusion of the cervical spine, involving one or more vertebra.

- Classical triad
  Short web neck (prominence of Trapezius)

- Most common associated disease: Scoliosis (60%)
- Associated disease: Sprengel's deformity (50%)

Previous Year's Questions

Q. The spot diagnosis is?

(FMGE Dec 2020)

A. Scoliosis
B. Disc prolapses
C. Klippel feil syndrome
D. Torticollis

Poland syndrome

- Congenital variations COMMONEST in pectoralis
- Agenesis associated with other anomalies: Poland syndrome.
- Clinical features: Flattened chest wall. With hypoplastic ribs, an elevated nipple and may present with unilateral hyper radiolucency of the lung on a roentgenogram.
- Can have a dextrocardia if left side involved
- Abnormalities in limbs also have been reported
- Diagnosis is Often established on ultrasound and is mainly based on the absence of a muscle belly or tendon.

Blount's Disease 00:03:19

- Characterized by
  - Varus (Tibia> genu)
  - Genu recurvatum (Hyperextension of knee)
  - Internal torsion of tibia
- Sudden deviation of tibia due to posteromedial defect occurring metaphysis – diaphysis junction.

Important Information

- Lower end of femur and tibia goes medially: Genu varum
- Only the tibia goes medially: Tibia varum

	Blount's	Physiological bowing
Side	60% bilateral	100% bilateral
Progress	Progresses	Resolves
Treatment	Tx required	Observation

- Tx of Blount's Disease: High tibial oste…… upper end of tibia)

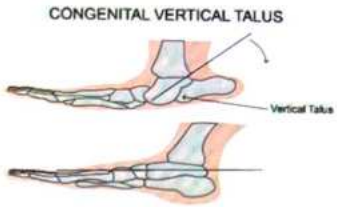
Rocker bottom foot 00:04:34

- Convexity of sole Cause

1. Due to incorrect correction of CTEV
2. Vertical talus

- Normally talus is horizontal

Convex sole like rocker bottom



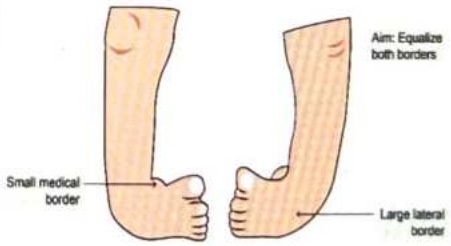
PES PLANUS (FLATFOOT)

- In normal foot, the arch is formed with heel as the center. The arch is due to medial longitudinal arch.
- Flat foot refers to obliterated / lost medial longitudinal arch
- Types (Jacks test)

1. Flexible
   - Arch disappears on non-weight bearing (arch disappears when placed on ground & comes back when foot is lifted off)
   - Mgt → conservative
2. Rigid
   - Flat on both ground & when lifted
   - Due to congenital vertical talus (or) RA (or) infection or tarsal coalition (AD – talocalcaneal and calcaneo navicular) or tibialis posterior dysfunction
   - They often require surgical intervention,

Club foot / Congenital Talipes Equino Varus(CTEV)

Normal Club foot



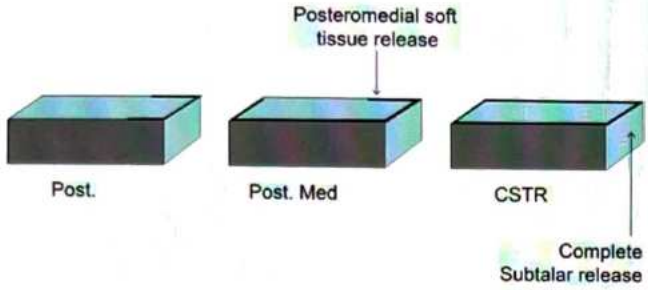
- Combination of 4 deformities

1. **C** - Cavus (↑arch)
2. **A** - Adduction (medial deviation of fore foot &mid-point)
3. **V** - Varus (inversion at sub-talar joint)
4. **E** - Equinus (Plantar flexion at ankle)

How to remember

- CAVE

- Order of correction
  - Cavus → Adduction → varus → Equinus
  - If not corrected correctly, leads to rocker – bottom foot



Management

1. Kite's method
- At birth: Manipulation by mother for 1st 2 weeks
- At 2 weeks old: cast application
- Order of correction: C-A-V-E (calcaneo-cuboid area) One at a time
- The deformity is corrected in 6-9 months

2. Ignacio V ponsetti's method
- At birth: apply cast (includes manipulation also)
- Change cast every 7 days
- As collagen fibers recontract on day 8 as change cast before that.
- Order of correction → C-AV-E
- Adduction& Varus can be corrected together Push Head of talus laterally (kite's error → calcaneo-cuboid)
- The deformity is corrected in 6-8 weeks

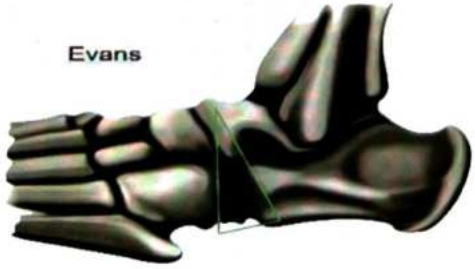
At Birth

- Manipulation and cast
- Upto 1 year of age same treatment
- Above knee cast
- Weekly changed

Treatment

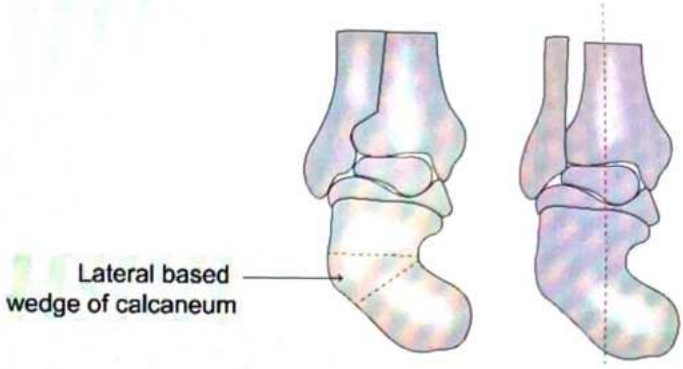
1. Birth up to 1 yr.
- Manipulation (Head of talus) + cast
- Tendo Achilles tenotomy (at end to correct Equinus)

2. 1-3 years = STR (PMSTR – Turcos)
3. 3 years = STR + Bony wedge
4. 3-5 years of age



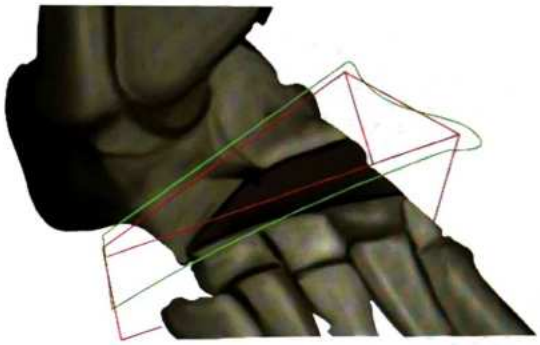
- Evan's procedure + STR
- Evan's: Calcaneo-cuboid wedge

5. 5-8 years of age



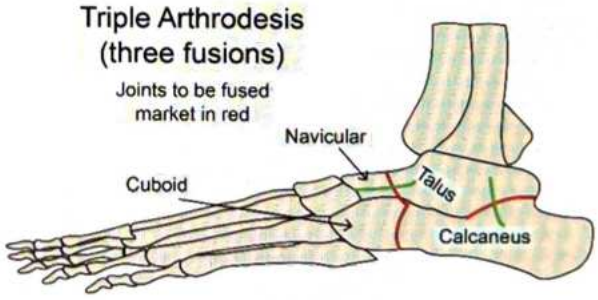
- Evan's Procedure + STR + Dwyer's calcaneal osteotomy (to correct heel Varus in > 5 years of age)

6. 8-10 years of age



- Wedge tarsectomy
- Wedge is taken out from multiple

7. Beyond 10 years of age → Triple arthrodesis (fusion of three joints)
- Talonavicular - most difficult to fuse
  a. Talocalcaneal
  b. Calcaneocuboid



Previous Year's Questions

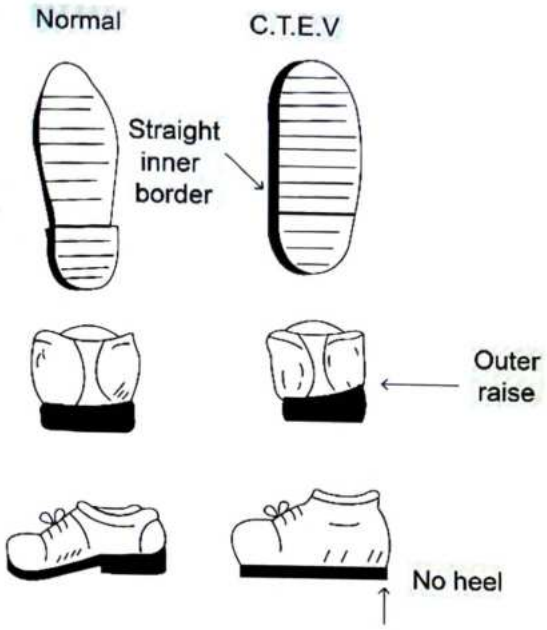
Q. The triad of triple arthrodesis include all except?

(FMGE Nov 2017)

A. Calcaneo cuboid joint
B. Talonavicular joint
C. Tibio-talar joint
D. Subtalar joint

Important Information

- Treatment for CTEV:
  - At birth - cast
  - 1-3 years - PMSTR (Turcos)
  - 3-5 years - STR + Evan's procedure
  - 5-8 years - STR + Evan's + Dwyer's
  - 8-10 years - Wedge tarsectomy
  - >10 years - Triple arthrodesis



Previous Year's Questions

Q. Evaluate following statements with respect to CTEV?

a. 50% cases are males and are bilateral
b. Rare foot is adducted and supinated
c. With ponseti technique, correction upto 90%
d. Equinus should be corrected first

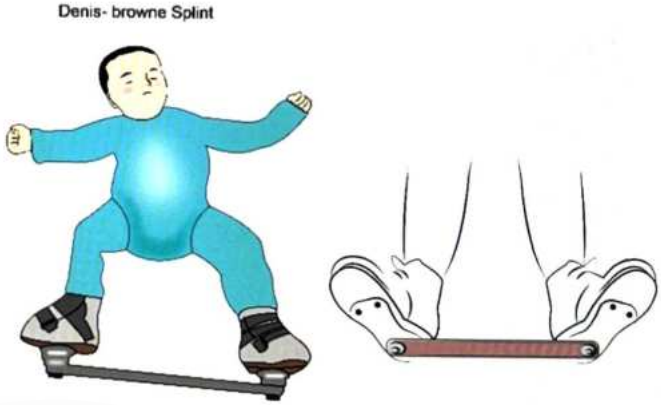
(AIIMS Nov 2019)

Options

A. a, b, c are correct
B. a and c
C. b and d are correct
D. a, b, c, d are correct

Dennis Brown splint

- Applied 23 & half – 24 hours a day & Bilateral side



CTEV Shoes

- By Thomas
- Straight medial border → for Cavus & adduction
- Outer raise → for Varus
- No heel → for Equinus
- Given up to 7 years of age

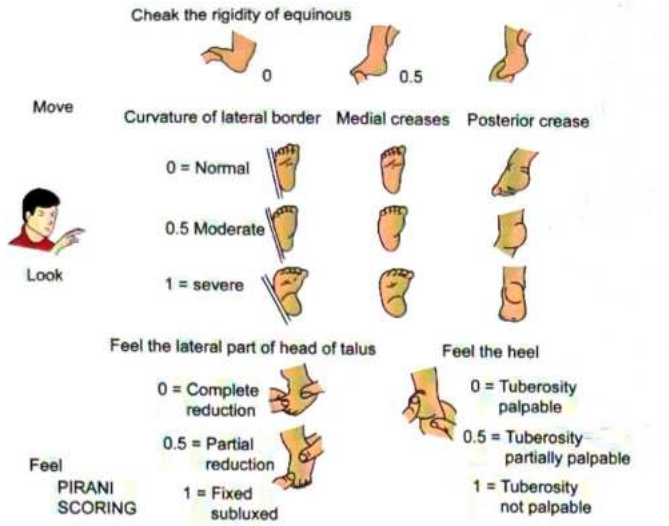
Short great toe/Sole Crease
Hyperextended great toe/Heel crease
Others (AMC, NF, Spina Bifida)
Rigid feet
Tight heel
SHORT CALF

Important Information

- <1 year old → only splint
- >1-year-old → splint at night and CTEV shoes at day

- AMC → Arthrogryposis multiplex congenita NF → Neurofibromatosis

Pirani scoring for CTEV 00:13:26



Hindfoot contracture (HFCS)	Points	Midfoot contracture (MFCS)	Points
a. Posterior orease 0.0.5 or 1.0 points		a. Posterior crease 0.0.5 or 1.0 points	
b. Empty heel: o.0.5 or 1.0 points		b. Medial crease 0.0.5 or 1.0 points	
c Rigid equinus 0.0.5 or 1.o points		c. Lateral head of talus 0.0.5 or 1.0 points	
HFCS sub-total	MFCS sub-total	Total Score (HFCS and MFCS)	

Parameters

1. Equinus
2. Lateral part of head of talus
3. Heel
4. Curvature of lateral border
5. Medial crease
6. Posterior crease

Pirani scoring

- **T** -Talar head
- **H** - Heel
- **E** – Equinus
- **L** - Lateral curvature
- **M** - Medial crease
- **P** - Posterior crease

How to remember

- THE LMP

Battered baby syndrome 00:14:15

- AKA Infantile whiplash syndrome
- Child is manipulated by guardian / parents
- Injury in metaphysis

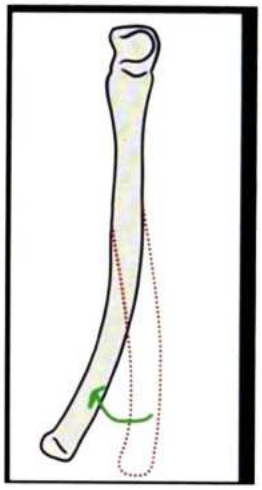
1. At corner: chip fracture
2. Metaphyseal bucket handle fracture
3. In femur: Fractures are spiral
4. Sub-epiphyseal micro-fractures are seen on MRI
5. Nobbing fractures are seen in the ribs
6. X-ray of specific parts required → skeletal survey; Babygram are not done

Types of pediatric Injuries 00:15:12

1. Torus fracture

- Buckling of cortex at metaphyseo-diaphyseal junction
- Torus- bend seem at the bottom of a pillar

2. Plastic deformation



- Bend without a break

3. Green stick fracture

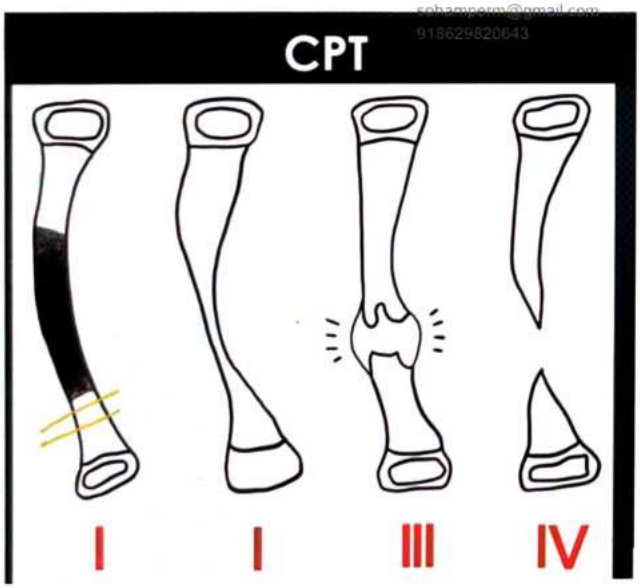
- Single cortical breech

Congenital pseudo arthrosis tibia

00:15:38

- Arthrosis is between 2 bones and has hyaline cartilage and synovial fluid
- If these are not present, then its Pseudo arthrosis
- Occurs due to non-union, failed surgery or congenital deformities
- Cause: Idiopathic
- Associated with neurofibromatosis
- Leads to anterolateral defect of tibia

Crawford classification of Congenital pseudo arthrosis tibia



- Type I: Anterolateral bowing of tibia
- Type II
  - Antero lateral bowing
  - Increased cortical thickness
  - Narrow medullary canal
  - Tubular defect
- Type III: Cystic lesion
- Type IV: Presence of cyst, fracture or frank pseudo arthrosis
- Treatment: Bone graft + stabilization by Ilizarov

Radial hemimelia

- Radial club hand
- Deficiency of radial bone and thumb (40% of hand)
- Hand deviated to radial side Associated conditions
  1. Hold Oram syndrome
  2. VACTERL

Fibular Hemimelia

- Fibula absent

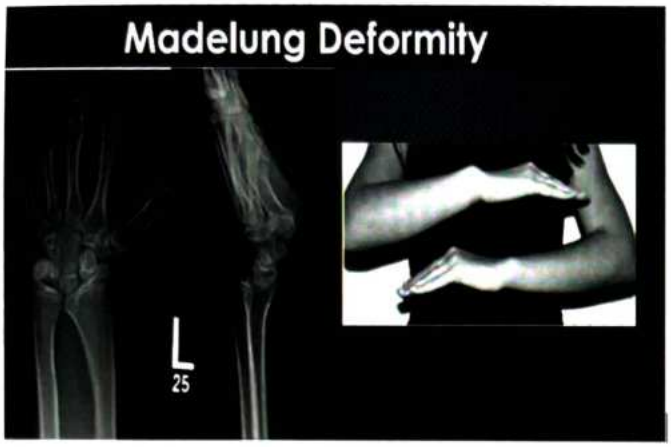
Tibial Hemimelia

- Absent Tibia

Posteromedial Bowing

- Self resolving

Madelung deformity 00:19:51



- Defect in the palmar and ulnar aspect of lower radius Prominent ulnar head
- 50% are bilateral
- More common in female
- Associated with turner syndrome
- Has excellent functions

Polio

- Involves lower limb > upper limb
- Most common muscle to be affected → Quadriceps femoris (Partial)
- "Hand-knee gait"
- Most common completely paralyzed muscle →Tibialis anterior In upper limb → Deltoid
- Hand muscles (very rare): Opponens pollicis
- Acute Fatality is due to involvement of respiratory muscles

PRACTICE QUESTIONS

Q. Which of the following is true about Poland syndrome? (Multiple options)

A. Absence of deltoid
B. Absence of teres major
C. Radial bone abnormal
D. Webbed finger
E. Hypoplastic nipple

Ans. C, D, E

Q. Management of DDH, sequence of surgery:

a. Capsulotomy
b. Femoral osteotomy
c. Acetabulum identification by ligament (true acetabulum)
d. Place head in acetabulum

Options:

A. a → c → d → b
B. b → a → c → d
C. c → b → a → d
D. a → c → b → d

Ans. D

CLINICAL QUESTIONS

Q. A 2-year-old baby presented to you with Rocker bottom foot. Which of the following may lead to this condition?

A. Overtreatment of CTEV
B. Malunited fracture calcaneum
C. Horizontal talus
D. Neural tube defect

Answer: A

Solution

Rocker bottom foot

- The feet of all new-borns appear flat because the postural tone of the intrinsic muscles has not yet developed; but in some, the foot is not only flat but also its under surface is convex (rocker-bottom foot).
- Such a foot may be in severe valgus. This is due to a congenital anomaly where the talus lies in a vertical position rather than the normal horizontal.

Causes of Rocker Bottom foot

1. Congenital vertical talus
2. Overcorrection of CTEV
3. Improper correction of CTEV, i.e., forceful correction of equines by dorsiflexion before correction of adduction, varus and inversion.
4. Edward's syndrome, Escobar syndrome, Apert's syndrome.
   Congenital vertical talus may be associated with arthrogryposis, Prune belly syndrome, neurofibromatosis, and spinal muscular dystrophy

Q. A term baby was via normal vaginal delivery. Congenital hip dysplasia was suspected, so the Ortolani test is performed. It is considered to be positive when the examiner hears which of the following finding?

A. Clunk of entry on abduction and flexion of hip
B. Clunk of entry on extension and adduction of hip
C. Click of exit on abduction and flexion of hip
D. Click of exit on extension and adduction of hip

Answer: A

Solution

Clinical tests for CDH/DDH

a. Ortolani's test

- This test is like the second part of Barlow's test.
- The hips and knees are held in a flexed position and gradually abducted.
- A 'click of entrance' will be felt as the femoral head slips into the acetabulum from the position of dislocation

b. Barlow's test

- Part 1: Infant is in supine position with hip and knee in 90° of flexion, The hip is slowly adducted & pushed to dislocate the hip and one can hear a clunk of exit of femoral head out of the acetabulum.
- Part 2: Now the hip is gently abducted and pulled to reduce the hip. This will cause a 'clunk' indicating the reduction of hip. It is obvious that part 1 can be done only dislocate hip; but not in already dislocated hip as the head is already out of the acetabulum.

PREP NUGGETS

Prep Nuggets

Bones	Years to orsify
Capitulum	.....
Radial head	.....
Internal epicondyle	.....
Trachea	.....
Olecranon	.....
External epicondyle	.....

Prep Nuggets

Infections	Causative agents
Sickle cell anaemia	.....
.....	Pseudomonas
Open injuries	.....
Human bite	.....
.....	Pasteurella

Prep Nuggets

Eumycetoma	Actinmycetoma
.....	Bacterial cause
Multiple draining sinus over foot	.....

Prep Nuggets

Origin	.....
Age of presentation	.....
Bone	.....
Present like	.....

Prep Nuggets

Test	Nerve involved
Card test	.....
.....	Axially nerve
Pointing index	.....

Prep Nuggets

Intracapsular fracture	Extracapsular fracture
Age: 60 y	.....
.....	More common
Less pain	.....
.....	Extra rotation > 45