Orthopaedics

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Surgical Talk, 279-360

I Fractures

1 Describing an XR

1. Date, patient details, part of body
2. Quality: Must be 2 views at 90° (orthogonal): AP & lateral usually. Should include joint above & below. Entire bone should be present. *If not, ask for another XR.*
3. Red dot: something abnormal
4. Type of fracture
5. Displacement

2 Classification

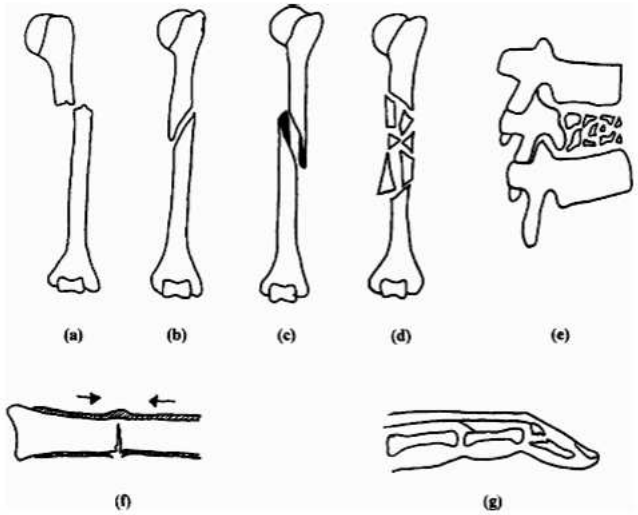

Figure 1. *Types of fracture*: (a) transverse (b) oblique (c) spiral (d) comminuted (e) crush (f) greenstick (g) avulsion

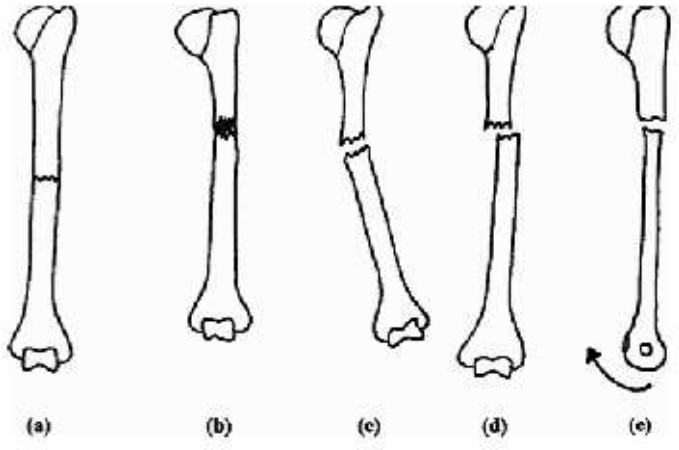

Figure 2. *Displacement*: (a) Undisplaced (b) Impacted (c) Angulated (d) Lat displacement (e) Rotation

Skin contact. Open (communicates w skin), vs closed

Line. Transverse, oblique, spiral, multifragmentary (or comminuted), avulsion (bony fragment torn off by tendon/ligament), compression (or crush, cancellous bone crumpled), stress fractures (repeated stresses cause bone to fatigue, e.g. athletes), greenstick (one side pliable doesn't break), pathological (weakened by disease. Not usually used for osteoporosis cos that would be too obvious)

Displacement. Impaction (driven in to each other), angulation (described in degrees), dislocation (complete loss of congruity), subluxation (partial loss of contact). Describing: always mention the distant fragment in relation to proximal

3 Healing

Stages.

1. Bleeding
2. Inflammatory reaction
3. Proliferation of cells
4. Consolidation in to callus
5. Stronger lamellar bone
6. Remodels: over y's

Time. Age, general health, method of restriction

Adults — Upper: 6w. Lower: 12w

Children — Halve the time

4 Management

For any fracture: Hx & Ex (including neurovascular of limb), ABC, 2° survey, analgesia, then Resuscitation, reduction, restriction, rehabilitation.

Resuscitation. Life threatening injuries first (ABC). "In life threatening injuries - save life, save limb, and stabilize fracture." If active bleeding, this comes under circulation: apply sterile pressure dressing, external splintage or external fixation. Asses the neurovascular status, skin, soft tissues. Exclude dislocation by examining joints on either side of fracture.

Open fx — Theatre within 6h. Gross contamination removed. Abx. Tetanus booster. Cover in antiseptic dressing. Immobilize w splint (Manipulation under sedation may be needed). *Examination under anesthesia & debridement*: wash out, debride. May need skin graft.

Reduction. Not all need reduction (e.g. rib fx). Alignment is more important than opposition (cos can't heal if not aligned). Methods

1. Manipulation
2. Traction: skin (adhesive tape), skeletal (pin through bone)
3. Open: in displaced intra-articular fx (Open Reduction and Internal Fixation - ORIF), or failure of above

Restriction.

1. Conservative
   a. Non-rigid: slings, elastic supports
   b. Plaster: due to risk of compartment syndrome a back slab is used for first 24-48h
   c. Functional bracing: shafts supported in segments joined by hinges. Most widely used for femoral/tibial
   d. Continuous traction: e.g. collar & cuff, gallows
2. Surgical
   a. External fixator: pins. Useful in open fractures cos open inadvisable due to risk of infx. Educate about hygiene of pin sites
   b. Internal fixation: pins, plates, screws, intramedullary nails. Usually permanent. Multiply injured patients involving lower extremity.

Rehabilitation. POSSET

5 Complications

General.

Any tissue damage — Haemorrhage & shock, fat embolism, RDS, infx, muscle damage, rhabdomyolysis

Prolonged bed rest — Chest infection, UTI, pressure sores, muscle wasting, DVT, PE

Cx of anaesthesia — Anaphylaxis, damage to teeth, aspiration

Specific to fracture.

Immediate —

1. Haemorrhage
2. Visceral damage
3. Neurological: stretching of nerve over bony edge. Seddon classification neuroparxia, axonotmesis, neurotmesis. Axillary palsy (dislocation of shoulder), radial palsy (fx of shaft of humerus), ulnar palsy (elbow dislocation), sciatic palsy (dislocated hip), common peroneal palsy (fx neck of filbula or knee dislocation)

Early —

1. Compartment syndrome: Swelling → ↑P in fascial compartment → ↓capillary blood flow → ischaemia. 6h irreversible changes → Volkman's ischaemic contracture (claw hand). Sx: pain out of proportion to clinical, paraesthesia, tight feeling, PAIN ON PASSIVE STRETCHING. Warm, erythematous (cf. to ischaemic limb). Often lower limb, forearm. Rx: elevate, split cast, consider removing plaster, fasciotomy may be needed.
2. Infection

Late —

1. Union problems: **Delayed union** (takes longer to heal than should). **Nonunion** (not joined. If no Δ after several months). Poor blood supply, ↑shearing forces, infection, interposition of tissue. *Hypertrophic non-union*: rounded, dense, sclerotic ends. *Atrophic non-union*: osteopenic (↓blood supply). Prevention: stability, bone-grafting (iliac crest, or substitute e.g. demineralised bone matrix, bone morphogenic proteins). **Malunion**: imperfect position, may be unsightly or have ↓function.
2. Avascular necrosis: death due to ↓blood supply. Femur, scaphoid, talus. Becomes soft, deformed causing pain, stiffness & OA. XR: may take time to develop. Sclerosis.
3. Sudek's atrophy (complex regional pain syndrome type I, or reflex sympathetic dystrophy): Persistent pain, swelling, redness, sweating, due to abn SNS response. Usually weeks after injury. Colles. Usually self-limiting.
4. Myositis ossificans (post-traumatic ossification): calcification following injury/surgery. Restricted, painful movement. Elbow.
5. Joint stiffness
6. Growth disturbance:

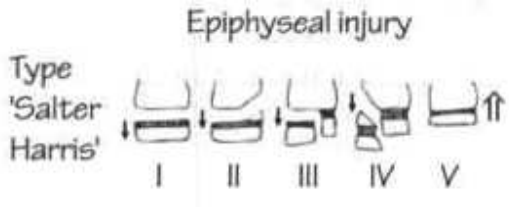

Figure 3. Salter Harris for children. I do well, V badly.

6 Specific Fractures

6.1 Neck of Femur

RF. Elderly ♀, osteoporosis, FH, low muscle mass, steroids, dietary (↓vit D, ↓Ca), ↓exercise, tobacco, alcohol

Claim to Fame. ↑Mortality that cannot be entirely explained by ↑comorbidity in the group.

Clinical. Fall, cannot get up afterward. Externally rotated, shortened (Caused by pull of iliopsoas which attaches to lesser trochanter).

Fractures affecting healing.

1. Premorbid mobility: stick, stairs
2. Mini mental score
3. Premorbid independence: clean, cook
4. Comorbidity

Ix. XR, MRI/bone scan (may be helpful if XR normal)

Pre-op. Analgesia, IV fluids, infx

Classification. Blood supply is from vessels along neck (& a bit via shaft, & medullary - which is broken). Therefore if intra-capsular (medial to intertrochanteric line) then blood supply compromised → AVN

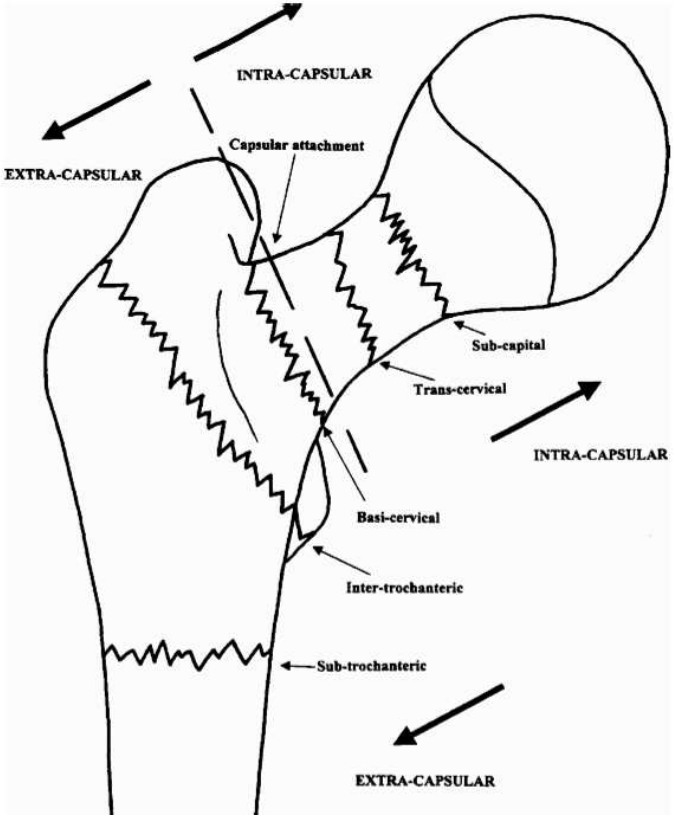

Figure 4. Note: on XR Stenton's line should be unbroken

Intracapsular.

Classification —

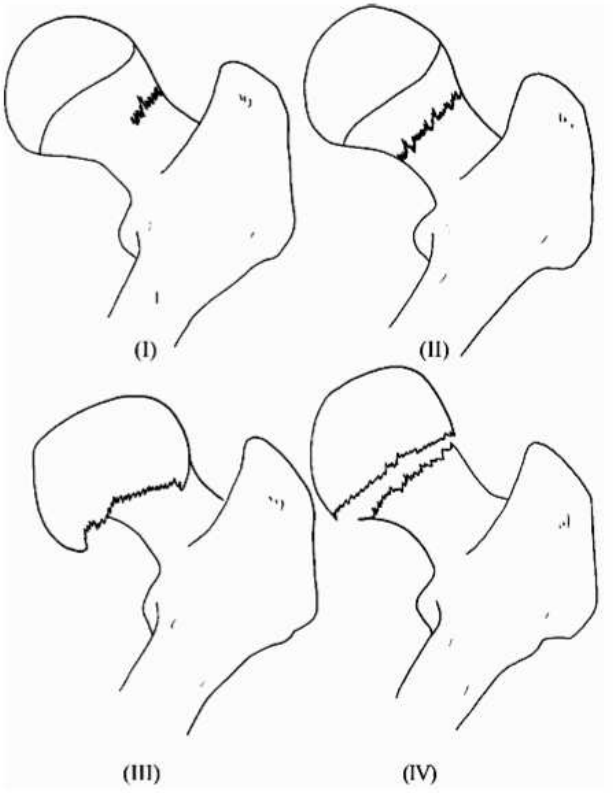

Figure 5. Gardens classification. "1, 2 plate & screw, 3, 4 Austin-Moore"

Undisplaced (I, II) — Often impacted, would unite if left alone. Rx: Screw through neck.

Displaced (III, IV) — Won't unite without reduction → AVN. *Elderly*: hemiarthroplasty. Austin-Moore is uncemented. *Young*: reduction & internal fixation (screw).

Extracapsular. Rx: dynamic hip screw: the screw can slide along the plate to accomadate collapse (quite likely)

Prevention.

1. Vit D, Ca
2. Bisphosphonates
3. Hip protectors

4. Calcitonin

Prognosis. 20% die in next year. 50% lose indpendence

6.2 Radius & Ulnar Shaft

Monteggia. Fx of ulna shaft w dislocation of radial head.

Galleazzi. Fx of radial shaft w dislocation of distal radioulnar joint

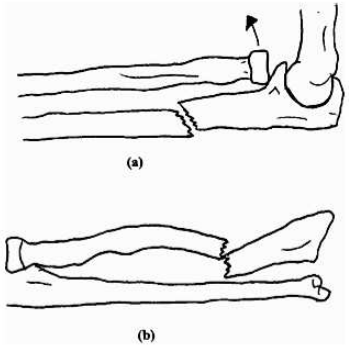

Figure 6. (a) Monteggia (b) Galeazzi

6.3 Distal Radius: Colles

Clinical. "Dinner fork." Elderly fall on to outstretched osteoporotic hand. Extra-articular fx of distal radius (within 1.5in of joint) w dorsal displacement & radial shift.

Nerves nearby. Median, radial.

Rx. Reduce. Leave wrist in slightly flexed, ulnar deviation, forearm fully protonated. Colles plaster is elbow → metarcarpophalyngeal. Ideally above elbow (prevent supination), but this leads to shoulder stiffness. Back slab for first few days. 5-6 w plaster.

Cx.

1. Malunion
2. Median nerve problems
3. Frozen shoulder: immobilisation
4. Tendon rupture: EPL
5. (Sudek's atrophy)
6. Carpal tunnel

6.4 Smith's (Reverse Colles)

Clinical. Fall on wrist in flexion. Volar, displaced anteriorly.

Rx. Above elbow cast. Wrist extended, protonated.

6.5 Barton's

Clinical. Fx dislocation where distal radial fracture is oblique & extends into wrist joint.

6.6 Scaphoid

Clinical. Tenderness in anatomical snuffbox. **Ix.** XR normal until 10d after. Bone scan.

Rx. Scaphoid plaster for 6w: includes IPJ of thumb (beer glass holding position). If not healed then ORIF, external fixator, or K-wires.

Cx. AVN, cos vessels enter bone distally, median nerve damage

6.7 Supracondylar

Epi. Children

Clinical. Fall on to outstretched hand. Swollen elbow, semi-flexed. distal displaces backwards.

Cx. Sharp edge of proximal humerus may compress/injure brachial A, compartment syndrome

Rx. Ensure °neurovascular damage. *Not displaced*: flex arm to stabilise. Collar & cuff or backslab. 3w. *Displaced*: urgent MUA. K-wires + Collar & cuff. *Suspected brachial A damage*: angiogram ± exploration.

7 Miscellaneous

Bennets — Fx base of thumb extending into 1st meta-carpal

Potts — Fx of ankles

Potts disease — TB of spine

Pagets — ↑ALP, normal Ca/LFTs. Deafness, pathological fx, local pain, nerve compression

II Other Common Disease/Injury

8 Dislocated Shoulder

Clinical. 95% anterior dislocations due to direct trauma or falling on to the hand, humerus driven forward tearing capsule. Sev pain, square-appearing shoulder, arm supported by other hand.

Ix. AP & trans-scapular.

Rx. Reduction under sedation. Sling 4w. Physiotherapy.

Cx.

1. Axillary nerve lesion (egg-shaped skin over deltoid insertion)
2. Often glenoid labrum pulled off ("Bankart lesion").
3. Recurrent instability: due to defect ("Hill-sach's lesion") of humerul head impacting against ant glenoid. More likely if younger. TUBS (Traumatic Unilateral Dislocations with a Bankart lesion often require Surgery). AMBRI (Atraumatic Multidirectional Bilateral shoulder dislocation best treated by Rehabilitation but occasionally should be considered for an Inferior capsular shift)

Posterior dislocation. Due to direct trauma. "Light bulb sign": due to int rotation, hence the greater trochanter not seen.

9 Femoral & Tibial Fx

Rx. Resus first cos blood loss can be great. *Femoral*: traction splint. *Tibial*: padded board or long leg splint. Young: Surgery.

Cx. Compartment syndrome.

10 Knee Injuries

Epi. Sportsmen

Structures. Collateral, meniscal, anterior cruciate

Hx. *Swelled up immediately*: haemarthrosis (fracture, patalle dislocation, rupture of ligaments). *Next day*: effusion (meniscal tear). Cardinal knee signs: PAIN, LOCKING (mechanical obstruction e.g. meniscus), SWELLING, GIVING WAY (instability e.g. torn ACL). Meniscal tear: locking, effusion, joint line tenderness.

Ix. XR: lipohaemarthrosis (fluid level, fat/blood).

Rx. RICE: Rest, Ice-packs, Compression, Elevation

Arthroscopy — Re-examine knee under anaesthesia before: ↓tone makes easier. Menisci preserved if possible (→ OA). *Outer 3rd*: has blood supply, repaired using sutures. *Inner 3rd*: trimmed cos irreparable,

Ruptured ACL — Leads to instability. Rehabilitation: strengthens quads to ↑stability. Operative: tendon or artificial graft. Can run 3m after surgery, contact sports 6m

Osteochondral injuries — Hyaline cartilage covers synovial joints. Avascular, doesn't heal. If lesion in to bone (so bleeding occurs) some repair occurs. can simulate *surgically*. Can use *autologous chodrocytes*.

11 Osteoarthritis

Path. Progressive loss of articular cartilage. Thickened, sclerotic, cysts (due to microfractures), osteophytes. Capsular fibrosis: stiff joint.

Classification. 1^o or 2^o (e.g. fracture, rheumatoid)

Hx. Weight bearing joints: hip, knee. Although all joints possible.

Pain — Aggravated by exercise, relieved by rest. Progressive. May occur at night.

Stiffness — After long periods of rest (hence in mornings).

Deformity — Due to muscular spasm, capsular & ligamentous contracture, & distortion of joint surfaces.

Ask about ADLs.

Ex. Restriction of movement, crepitus, flexion deformities. Heberden's nodes (DIP), Bouchard's nodes (PIPJs)

Ix. XR: narrowing of joint space, osteophytes, subchondral sclerosis, subchondral bone cysts, previous disorders (e.g. old fx), structural damage

Rx.

Conservative — Analgesia, weight loss, periods of rest, walking sticks, physiotherapy.

Medical — Steroids (not for hips), LAs, glucosamine

Surgical —

1. Arthroscopic washout: trim cartilage, wash out debris
2. Osteotomy: shifting weight-bearing areas
3. Arthrodesis: last resort for joints where not too disabling (e.g. toes)
4. Arthroplasty: hip, knee most popular

12 Important Operations

12.1 Total Hip Replacement

Components. Polyethylene cup (acetabulum), ceramic or metal head (articulates)

Rehab. 1/2 days after: leg exercises → weight bearing. Usual stay: 1w.

Lasts. 10y

Cx.

1. Dislocation: 3%. Avoid squatting, sitting on low chairs, abducting hip
2. DVT: 50%. Prevent: Heparin, mobilization. TED stockings.
3. Deep infection: 1-2%. Revision needed.
4. Nerve damage: sciatic nerve stretched during procedure → foot drop. Sup gluteal nerve → trendelenburg gait (weak abductors)
5. Leg length discrepancy

12.2 Hip Resurfacing

Def. Only the damaged articular surfaces are replaced: cap of femoral replaced by metal cover.

⊕ . ↓Bone resection, better anatomy, ↓risk dislocation

12.3 Total Knee Replacement

Lasts. 10-20y

Components. 2 metal prostheses w intervening polyethylene articular disc btw distal femur & tibial plateau. Can use only unicompartmental prosthesis if only 1 side damaged.

Cx. DVT (50-75% of TKRs!), PE (1%), infection (2-3%)

13 Rheumatoid Arthritis Rx

Prevention & rx of inflammatory synovitis. Advise, exercise, joint protection, DMARDS (gold, penecillamine, immunosuppressants (methotrexate, pyrimidine synthesis inhibitors, anti-TNF))

Prevention of joint destruction. Rest during exacerbations, physio, rehab. Tendon rupture might need repair

Joint reconstruction. Replacement of hip, knee, shoulder, MCPJs. Treat the sx not the Xr. Arthrodesis, osteotomy, synovectomy

14 Avascular Necrosis

Def. Disruption of arterial inflow, or blockage of venous outflow (as in infiltrative disorders blocking venous sinusoids e.g. Gaucher's disease)

Causes.

1. Fx/dislocation (femoral, humerus, scaphoid, lunate, talus)
2. Sickle cell: clumping of rbcs leads to ↓capillary blood
3. Decompression sickness (Caisson)
4. Gaucher's disease
5. Drug induced (esp STEROIDS)
6. Idiopathic
7. Infx, vasculitis

Clinical. Pain, stiffness

Xr. ↑Density. Bone scans: ↑uptake.

Idiopathic AVN (osteochondritis). Patchy AVN of bone. Adolescents. Not inflammatory, cause unknown except for these subgroups:

Traction apophysitis — Pulling forces of a tendon may damage the apophysis. Osgood-Schlatter disease: knee pain in adolescents, self-limiting, waxes/wanes. Conservative: stopping sports.

Osteochondritis Dissecans — Bone may fall off due to repeated minor stress. Most commonly knee, w pain, swelling, limitation of movement. Rx: wait a& see → surgery

III The Back

15 Acute prolapse

Sev pain in back, buttock, spine. Herniation of L4/5 compresses L5 causing ↑reflexes, ↓power, sensory loss on outer leg +dorsum foot.

L5/S1 compresses S1 causing weak plantar flexion, eversion, senory loss lat foot

Cauda Equina syndrome — Compression of the cauda equina below the level of L2. It may result from any space occupying lesion in the spinal canal, for example, a large central disc protrusion at L4/5.

i. Urinary and faecal incontinence,
ii. Sensory numbness of the buttocks and the backs of the thighs
iii. Lower motor neurone weakness (the precise features of which depend upon the level at which the cauda equina is compressed. Commonly, the foot becomes flail with loss of dorsiflexion of the foot (L4) and toes (L4,5), and of eversion and plantarflexion (S1).)
iv. Absent ankle jerks bilaterally

16 Anatomy

MRI.

T1 —

T2 — Fluids (H_2O) are white

Anatomy of the spine. Body, pedicle (inner), lamina (outer), transverse process, spinous process, spinal canal, articular processes

IV Bone Tumours

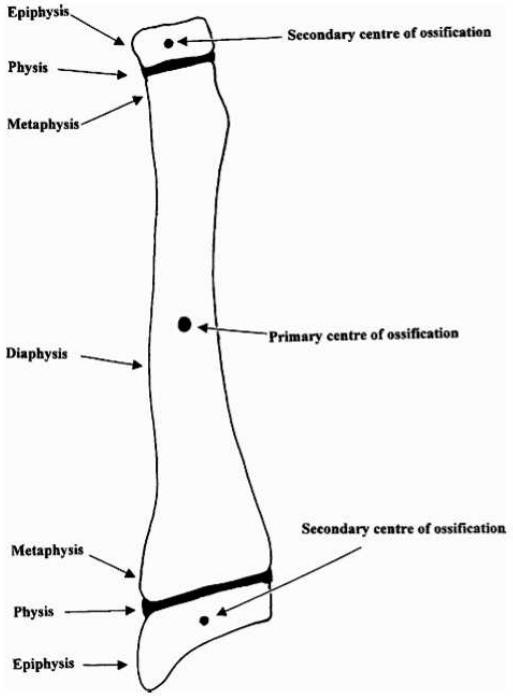

Figure 7. Development of bones. Bone laid down into metaphysis.

Epi. All are incredibly rare. $2^o \gg 1^o$s. 1^os must be rx in a specialist centre.

Terminology.

-oma — Benign. **-sarcoma** — Malignant. **Osteoid** — Bone derived

Chondroma — Cartilage derived. **Fibroma** — Fibrous tissue derived

Clinical. Pain (esp night), swelling, rapid growth, tenderness, warmth

Red Flags. Night pain, <20 or >55, hx of cancer, weight loss, anorexia

Xr Δs may have. Cortical destruction, periosteal reaction (fuzzy line outdise cortex, indication irritation of periosteum), diffuse zone of transition (btw lesion & bone)

Ix. CXR, bone scan, CT, MRI, ESR, ↑ALP, biopsy.

17 Primary

17.1 Benign

Aneurysmal Bone cysts. Expansile (hence name). < 30y, pain. Multiple fluid levels on MRI.

Bone cysts. Most proximal humerus/femur, young patients. Asx, can cause fx ("fallen fragment sign" of bone into cyst)

Chondroma. Single.multiple. Maffuci's syndrome: multiple & associated w soft tissue haemangiomas. Most often phalanges, can affect other long bones.

Fibrous cortical defect. Common (incidental in 20% children). Spontaneously regress. Non-painful.

Fibrous dysplasia. Bits of bone replaced by fibrous tissue. Monostatic (localised) or polyostotic (generalised). Can cause fractures. McCune-Albright syndrome: polyostotic fibrous dysplasia w cafe au lait spots & (♀) precocious puberty

Giant Cell tumour. Osteoclastomas. Young adults always after fusion of growth plate. Around knee.

Osteochondroma. Commonest tumours of bone. Cartilage capped exostoses that continue to grow as bone grows. Bony lump. XR: abn outgrowth. Excised if symptomatic.

Osteoid osteoma. < 30y. SR: small radiolucent area surrounded by dense sclerosis. Hot spots on bone scan. Sx: pain responding to aspirin.

17.2 Malignant

See intro for sx.

Osteosarcomas.

Epi — ♂>♀, adolescents.

Path — Usually knee, proximal humerus. Occur in metaphysis. Locally invasive to blood.

Xr — Metaphyseal, translucent, destructive lesion. "Codman's triangle": triangle of new bone in angle where periosteum separates from shaft.

Rx — Chemo, resection

Ewing's Sarcoma.

Epi — Rare, young.

Path — Bone marrow.

Xr — "Onion skin" due to several layers of periosteal new bone around a destructive lesion

Rx — Chemo, resection

Chondrosarcoma.

Epi — Middle aged/elderly.

Path — Pelvis, end of long boes.

Xr — Expanding, radiolucent lesion, flecks of calcification

Rx — Excision, amputation

18 Secondary

Aetiology. "Bone Tumours are Rarely Bony Primaries": Breast, Thyroid, Renal, Bronchus, Prostate.

Where. Axial skeleton (spine, pelvis, ribs, proximal ends of bones)

Rx. Fixate: tend not to heal.

V Infection

Aetiology. Staph Aureus, occasionally Strep or Coliforms. Via haematogenous or following trauma/infx

Sx. Pain, fever, hx of sore throat. Limb painful to move, tender, localised inflammation.

Ix.

1. Pyrexial? Tachycardic?
2. XR: Normal at first, then develops periosteal reaction.
3. Bone scan: will show ↑ activity
4. Bloods: culture + sensitivity, WCC (neutrophilic?), ESR, CRP
5. Abx (6w, DON'T GIVE BEFORE GETTING SAMPLE FOR SENSITIVITY), rest, analgesia

19 Acute Septic Arthritis

Clinical. Large joints. Unwell, fever, rigors. Painful, inflamed, swollen, stiff.

ΔΔ. Rheumatoid, gout, pseudogout

Ix.

1. XR: may be normal initially
2. Aspiration: M&C
3. Bloods: FBC, ESR, CRP, culture

Rx. Clinical suspicion. Joint washout under GA & IV abx

VI Peripheral Nerve Injuries

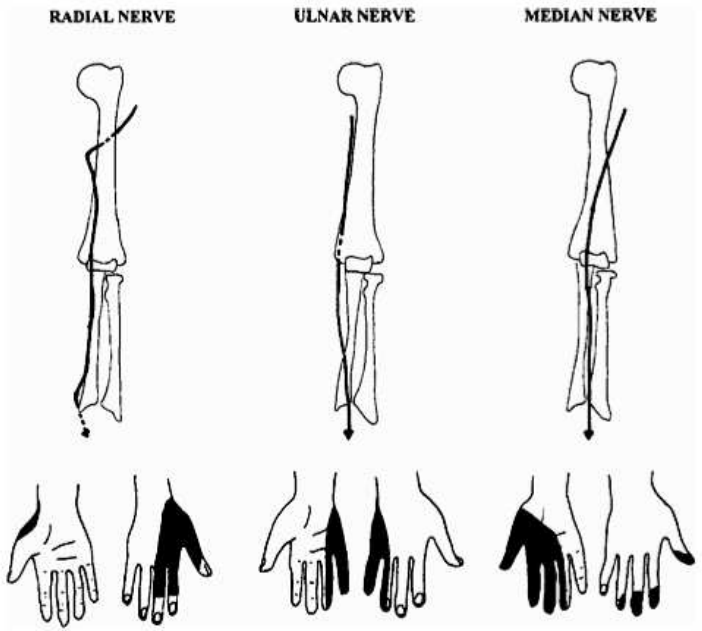

Figure 8. Sensation & nerve pathway

Brachial Plexus.

Upper (Erb's palsy) — C5/C6. "Waiter's tip" (internal rotation)

Lower (Klumpke paralysis) — C8/T1

Radial. Often following fx humerus (travels in radial groove) & "Saturday night palsy." Wrist drop, loss of sensation.

Ulnar. "Claw like hand" cos of unopposed action of extensors & FDP. Test: ask pt to grip piece of paper btw thumb & proximal phalanx of index finger. In ulnar nerve lesion they cheat & flex the DIPJ. Sensation loss.

Carpal tunnel. Median (C6C7C8T1). LOAF (Lumbricals, Opponens pollicis, Abductor, Flexor pollicis brevis). Flexors of forearm. SNS (loss of blanching of skin). Compressed under flexor retinaculum. Pregnancy, RA, hypothyroidism, acromegaly, trauma. Sx: Pain, paraesthesia, typically worse @ night, relieved by shaking hands. Tinel's (tap over wrist). ΔΔ Cervical rib, cervical spondylosis. Rx: conservative (splints, injections), surgical (division of flexor retinaculum)

Dupuytren's contracture. Fibrosis & thickening of the palmar fascia. Commoner in ♂, middle age, alcohol, drugs (e.g. phenytoin), cirrhosis, DM. Can be bilateral, can affect feet. ΔΔ Skin contracture

Ganglion. Cystic mucoid degeneration of the joint capsule, most commonly dorsum of wrist. Painless. Can excise.

VII The Limping Child

Age (years)	*Diagnosis*	*Rough Incidence*
0 (birth)	Congenital dislocation (CDH)	1 in 1000
0–5	Infections	
5–10	Perthes' disease (Legg–Cálve–Perthes)	1 in 10,000
10–15	Slipped femoral epiphyses	1 in 100,000
Adults	Avascular necrosis, rheumatoid arthritis and osteoarthritis	

Table 1.

20 Congenital Dislocation

Def. Congenitally determined developmental deformation of the hip. Femur can be completely or partially displaced.

Clinical.

Otorlani's — Hip/knees flexed to 90°, thighs grasped, hips abducted, pressure to **relocate** into hip

Barlow's — Abduction: P applied in line of femur to **dislocate**.

Ix. USS.

Rx.

Closed reduction — Double nappies. Pavlik harness.

Open reduction — If remains dislocated

Cx if missed. Abn gait, limb shortening, ext rotation of foot, Trendelenburg.

21 Perthe's

Path. Type of osteochondritis: AVM of femoral head.

Clinical. ♂, 4-10y, painful limp that become painless. All movements painful

Ix.

1. XR initially normal → increased density of the epiphysis → flattens & fragments
2. Bone scan

Rx. Bed rest, operative.

22 Slipped Capital/Upper Femoral Epiphysis

Epi. Fat/sexually underdeveloped or tall & thin.

Clinical. Can be acute: groin pain, short leg, ext rotated, all movements painful. Or chronic.

Rx. Acute: surgery to reduce & pin back epiphysis.

Cx. Chodrolysis (articular cartilage breaks down)

23 Irritable Hip

Clinical. Diagnosis of exclusion. Limp, pain in hip.

Ix. Aspirate to rule out septic arthritis.