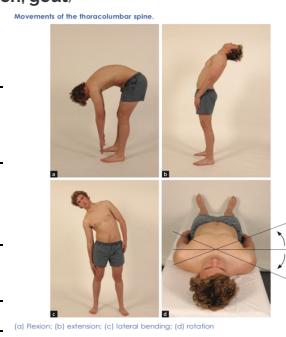


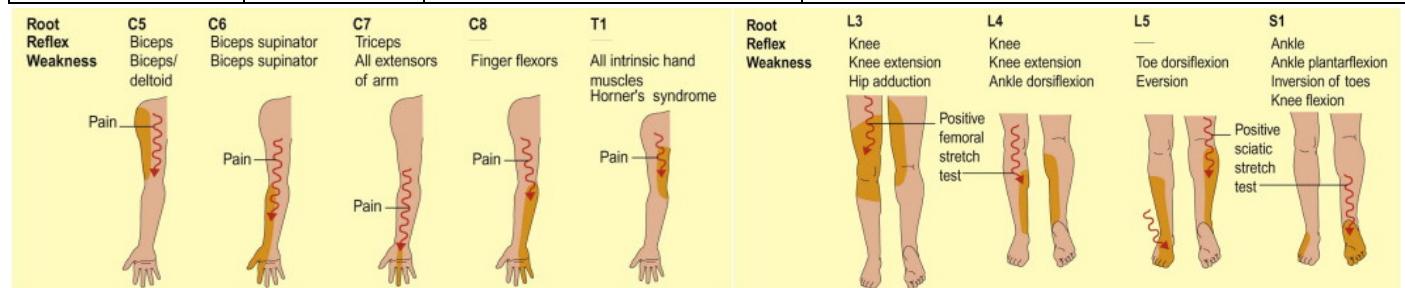
ORTHOPAEDICS

SPINE EXAM

Today I examined Mr Smith, a 32-year-old male. On general inspection, the patient appeared comfortable at rest, with no stigmata of musculoskeletal disease. There were no objects or medical equipment around the bed of relevance. "Assessment of the spine revealed normal alignment, with no tenderness on palpation. The range of movement of the cervical, thoracic and lumbar spine was normal." "In summary, these findings are consistent with a normal examination of the spine." "For completeness, I would like to perform the following further neurovascular exams and review available images."

General inspection	<ul style="list-style-type: none"> Responsive Vital signs Mobility aids Exposure upper body (maintain privacy) → weight (body habitus) → risk factor for osteoarthritis 			
Assess gait	<ul style="list-style-type: none"> Observe gait [walk normal – tip-toes (S1) – heel (L5)] → ASSESS symmetry, smoothness, discomfort, ability to turn quickly? <ul style="list-style-type: none"> foot drop – neurological [common fibular nerve entrapment] stiff and slow – rheumatological [inflammation slows down motion] PARKINSONS' antalgic gait → Sciatica pain 			
Inspection [SWEAT]	Anterior <ul style="list-style-type: none"> Scars (joint replacement) & Bruising Cachexia Erythema skin (active arthritis or infection) Asymmetry of shoulder girdle (e.g. dislocation) Rash (psoriasis) Abnormalities in feet/hands (e.g. clawing, high/low arch profile, presence of hallux valgus, dactylysis) 	Lateral (begin here) Deformity <ul style="list-style-type: none"> Cervical lordosis Thoracic kyphosis Lumbar lordosis foot arches 	Posterior: <ul style="list-style-type: none"> SWEAT Popliteal swelling (baker's cyst – fluid filled sac behind the knee) Spinal & iliac crest alignment Scoliosis (Equal level of iliac crests) → leaning forward emphasizes this Abnormal tuft of hair (lumbar) = spina bifida 	
Cervical spine (patient prone supported by pillow)	Movement (active) "pain on motion = joint or periarticular problem" <ul style="list-style-type: none"> Flexion (chin tuck – C1 → ~80°) Extension (looking up → ~50°) Lateral flexion (tilt head to side (Ear to shoulder) → ~45°) Rotation (look left and right → ~80°) → check eyelashes (more eyelashes seen = reduced ROM) Special tests (Spurling's test) <ul style="list-style-type: none"> Spurling test: PATIENT rotates head and extends towards affected side worsens symptoms → apply force downwards to reproduce nerve root symptoms Feel <ul style="list-style-type: none"> skin warmth → cool joint (not inflammatory), warm joint (active synovitis, infection, gout) tenderness and uneven spacing between C1-C7 spinous processes <ul style="list-style-type: none"> when patient sitting down when patient is prone with chest supported by pillow 			
Thoraco-lumbar spine (standing → lying)	Movement (Active) & Special tests <ul style="list-style-type: none"> Flexion (Bend down to touch toes) Extension (lean backwards) → 10-20° Lateral flexion (lumbar) → (right hand reach down right leg) Special tests (Schober's test) <ul style="list-style-type: none"> Identify PSIS on either SIDE Mark 5cm below and 10cm above PSIS Lumbar flexion → distance > 20cm (ank spondylitis) Special tests (Quadrant test) <ul style="list-style-type: none"> Rotate spine + lean backwards Apply pressure down on shoulders Movement (active #2) <ul style="list-style-type: none"> Sit down on bed → cross arms → Rotation (thoracic) → 10-20° Feel (prone) <ul style="list-style-type: none"> skin warmth → cool joint (not inflammatory), warm joint (active synovitis, infection, gout) Apply pressure on: tenderness → fibromyalgia <ul style="list-style-type: none"> Posterior spinous processes OR renal angle tenderness (pyelonephritis) paravertebral muscles [Use thumb] Feel (supine) <ul style="list-style-type: none"> Straight leg raise → lift leg to 80-90° [Pain in posterior thigh or buttock = sciatica pain] Sacroiliac test: Faber's test → stabilize pelvis + knee acts as lever <ul style="list-style-type: none"> Back pain = lumbar back pain Anterior pain = Hip issue Other <ul style="list-style-type: none"> Power tests [bring thigh up → and down → bend your knee → extend knee] Knee reflexes [patella tap] NEUROVASCULAR STATUS 			
Requests/ Tests	<ul style="list-style-type: none"> Rheumatological suspicion (ESR/CRP, ANA – anti-nuclear antibody) <ul style="list-style-type: none"> proceed for anti-CCP, HLA-B27 (for sero-negative spondyloarthropathies) FBC/ALT (nephropathy → e.g. methotrexate induces liver enzyme activity) MRI (identify possible joint inflammation especially for AS) DXA scan → check for osteoporosis to reduce fracture risk → high risk of mortality, immobility 			

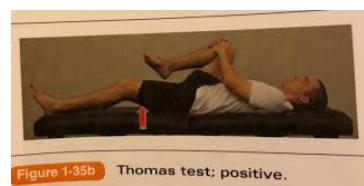
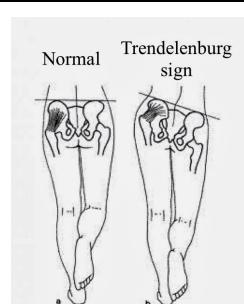
Herniation level:	Nerve root	Dermatome (sensation loss)	Movement lost
• L3/4 = 5%	L4	Medial shin	Knee extension, ankle DF
• L4/5 = 50%	L5	Top of foot	Toe DF, Foot eversion
• L5/S1 = 45%	S1	Back of foot	Knee flexion, ankle PF, Toe inversion
• Deep peroneal	L4-S1	Lateral ½ big toe & medial ½ 2 nd toe	Anterior leg muscles = DF (EHL, EDL), Inversion (Ant. Tib)
• Superficial peroneal	L5-S2	Dorsal foot	Lateral leg muscles (FB, FL) = Eversion
• Tibial	L4-S3	Plantar foot	Posterior leg muscles = Ankle PF (tip-toe on one foot – GC, soleus)



Hip Examination

Watching you walk, looking at your hip joints, feeling your hip joint and then checking the movements of hip joints

Key Hx Points	<ul style="list-style-type: none"> True hip pain = anterior groin pain radiating to knee Trochanteric bursitis/gluteus medius tendinitis or tear = pain over greater trochanter [sprinter athletes] Psoas bursitis or tendon slipping of gluteus maximus = clicking or snapping from hip region Functional impairment = pain and difficult walking and climbing stairs, and sitting down and standing up Fever, weight loss = septic arthritis (staph, gonococcal), or malignancy Signs of hypermobility, arachnodactyl 		
	<ul style="list-style-type: none"> Limping = antalgic gait (painful on one side) Samba dance = weak muscles Mobility aids (walking stick) 		
Exam	GAIT		<ul style="list-style-type: none"> Limping = antalgic gait (painful on one side) Samba dance = weak muscles Mobility aids (walking stick)
	Special tests [Trendelenburg]		<ol style="list-style-type: none"> Place hand on iliac crest on either side + patient stands on one leg for 30 seconds and flex other leg Notice which hand moves up or down In older patients, do from anterior and hold out your hand (if they require a lot of support = +ve test) Normally → iliac crest on side of foot off the ground will rise up (may rise up more if strong abductors) <p>Positive Trendelenburg sign = non-weight bearing hip sags & does not rise when standing on one leg</p> <ul style="list-style-type: none"> proximal myopathy of standing leg causing weak hip abduction (i.e. gluteus medius/minimus) on contralateral hip → may indicate significant hip arthritis R hip pathology = stand on R hip, L hip lowers/drops due to pain and weak abductors and shortened femoral neck
	LOOK @ HIP [SWEAT]		<ul style="list-style-type: none"> Patient supine Front: Scars, Quadriceps wasting (posterior), erythema, asymmetry One leg shorter → femur fracture?
	FEEL HIP [anterior, lateral] "Don't forget the bump!"		<ul style="list-style-type: none"> Temperature (hot = inflammation/infection?, cold = peripheral vascular disease) Locate ASIS + pubic symphysis <ul style="list-style-type: none"> Feel for Joint tenderness (at midpoint of inguinal ligament) Roll over → Locate PSIS (depression in back) Palpate greater trochanter → Tenderness = trochanteric bursitis (DON'T FORGET THE BUMP)
	Move HIP (active → passive)	General	<ul style="list-style-type: none"> Abduction (50°) & Adduction (45°) → patient spread legs out and in [You help!] Flexion (120°) → active then passive Internal (away from body) and external (towards patient) rotation (both knee and hip must be flexed at 90°) [DO LAST] PATIENT PRONE: Extension → hand on sacroiliac joint (30°) <p>Restricted internal rotation, abduction and extension = OA</p>
	ALWAYS LOOK AT THEIR FACE	FABER [Figure 4]	<ul style="list-style-type: none"> Flexion of hip → abduction of hip (spread open legs) → external rotation of hip Push on knee and hip <ul style="list-style-type: none"> Limited ROM = Hip or iliopsoas disease Pain on hip = SI joint disease Pain on knee = hip issue
		FADIR	<ul style="list-style-type: none"> Flexion of hip → adduction of hip → internal rotation of hip Apply inward pressure on acetabulum → pain in acetabulum?
	Measure HIP [Leg length]		<ul style="list-style-type: none"> True leg length: ASIS → medial malleolus → abnormal = hip disease on shorter side [possible neck of femur fracture since quadriceps pulls leg upwards] Apparent length: Umbilicus → Medial malleolus → difference in length = pelvic tilting
	Special tests [Thomas' test]		<p>NEUROVASCULAR STATUS</p> <p>Thomas' test → measure the flexibility of hip flexors (i.e. iliopsoas muscle group, rectus femoris, pectineus, gracilis, tensor fascia latae and sartorius)</p> <ul style="list-style-type: none"> Place hand under patient's spine → flatten any lumbar lordosis Actively flex leg as far as possible (use hands to pull) → contralateral leg should be flat on bed Positive test = unflexed thigh lifts off the bed → loss of hip extension = FIXED hip flexion contracture (muscle spasm)



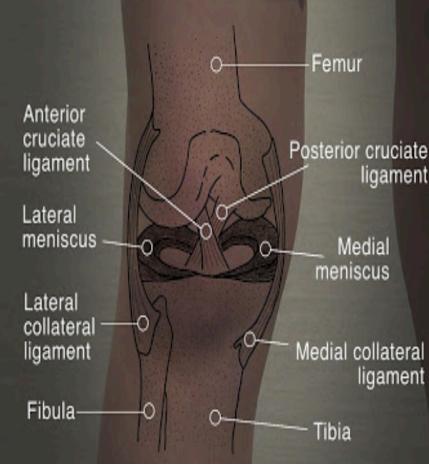
Pathology in L) hip abductors

(a) Flexion; (b) extension; (c) flexion, knee bent; (d) internal rotation; (e) external rotation; (f) abduction

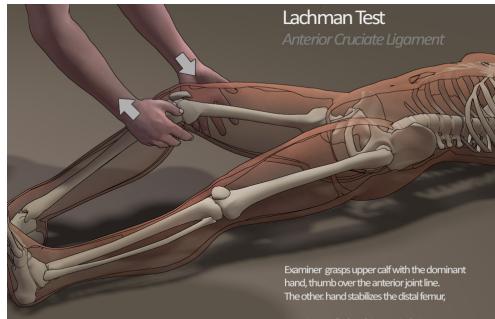
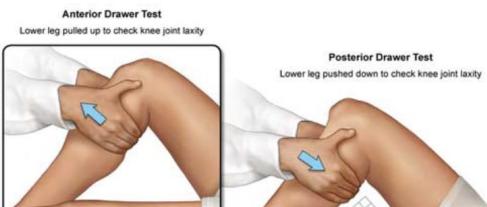
Common conditions affecting the spine and hip

Pathophysiology		RF	Sx	Exam / Ix	Treatment	
Compartment syndrome	<p>Pressure in fascial compartment abnormally elevated restricting blood supply</p> <p>2 types:</p> <ul style="list-style-type: none"> ➤ Acute – assoc. with acute injury ➤ Chronic – aka chronic exertional compartmental syndrome – assoc. with exertion ONLY (no pain when at rest) 	<ul style="list-style-type: none"> • Bone fracture • Crush injury • Recent tight backslabs / plaster of paris 	<ul style="list-style-type: none"> • Pain disproportionate • Paraesthesia • Pale • Pressure high • Paralysis (late sign) <p>Nb: pulseless is not a feature unlike acute limb ischaemia</p>	<ul style="list-style-type: none"> • Needle manometry – measure compartment pressure (measure before and after exertion – especially for chronic compartment syndrome) 	Orthopaedic emergency <ul style="list-style-type: none"> ➤ Remove external dressing / casts ➤ Elevating leg to heart level ➤ Avoid HypoTN ➤ Fasciotomy +/- debride tissue necrosis (wound left open and covered with dressing) 	
Osteomyelitis	<p>Inflammation of bone and bone marrow (due to bacterial infection)</p> <ul style="list-style-type: none"> ➤ Haemogenous osteomyelitis – pathogen carried through blood and seeded in bone (most common method of infection) 	<ul style="list-style-type: none"> • Open # • Prosthetic joints (1%) • DM • PAD • IVDU • Immunosupp. 	<ul style="list-style-type: none"> • Fever • Pain • Tenderness • Erythema • Swelling 	<p>x-ray (may not show any osteopenia or bone damage)</p> <ul style="list-style-type: none"> ➤ MRI (best) ➤ FBC, EUC, ESR ➤ 2x blood culture ➤ Bone cultures 	Orthopaedic + ID referral <ul style="list-style-type: none"> ➤ Surgical debridement ➤ ABx – 6x week fluclo +/– rifampicin for first 2 weeks Vancomycin (MRSA) Clindamycin (if penicillin allergy) Chronic osteomyelitis (3/12 ABx) 	
Sarcoma (rare)	<p>Bone sarcoma</p> <ul style="list-style-type: none"> ➤ Osteosarcoma (most common) ➤ Chondrosarcoma ➤ Ewing sarcoma (children, teens) <p>Soft tissue sarcoma</p> <ul style="list-style-type: none"> ➤ Rhabdomyosarcoma ➤ Leiomyosarcoma ➤ Liposarcoma ➤ Synovial sarcoma ➤ Angiosarcoma ➤ Kaposi's sarcoma (HHV8 – HIV) 	<p>FHx:</p> <ul style="list-style-type: none"> ➤ Li fraumelli 	<ul style="list-style-type: none"> • Soft tissue lump • Persistent bone pain (nocturnal waking) • UWL, fevers, NS 	<ul style="list-style-type: none"> • XR • USS • CT/MR – check for mets spread! • Biopsy (TNM staging) 	Sarcoma MDT <ul style="list-style-type: none"> ➤ Surgery (preferred Rx) ➤ Radiotherapy ➤ Chemotherapy ➤ Palliative care 	
Back pain and sciatica	<p>Causes of sciatica (L4-S3)</p> <ul style="list-style-type: none"> ➤ Herniated disc (LEADING CAUSE) ➤ Spondylolisthesis (anterior displacement of vertebra) ➤ Spinal stenosis ➤ Nb: bilateral sciatica = cauda equina 	<p>DDx of acute back pain:</p> <ul style="list-style-type: none"> • Most back pain 90% =non-specific • Spinal fracture (e.g., major trauma) • Cauda equina (LMN lesion) (e.g., saddle anaesthesia, urinary retention, incontinence or bilateral FND, reduced anal tone and reflexes) • Spinal stenosis (e.g., intermittent neurogenic claudication) • Ankylosing spondylitis (e.g., age under 40, gradual onset, morning stiffness or night-time pain) • Spinal infection (e.g., fever or a history of IV drug use) 	<p>MOST do not imaging or tests</p> <ul style="list-style-type: none"> • FBC, CRP (inflammatory?) • ABPI and CT angio to exclude peripheral arterial disease (if intermittent claudication Sx present) <p>Imaging only if specific cause or serious cause (e.g. cauda equina, epidural abscess)</p>	<ul style="list-style-type: none"> • Self-Mx, education, • keeping active and losing wt • Physiotherapy, group exercise (tai-chi), CBT • NSAID, codeine, and benzos • Amitriptyline • Duloxetine <p>Specialist management for chronic sciatica:</p> <ul style="list-style-type: none"> ➤ epidural steroid injections ➤ RF ablation ➤ Surgical discectomy (faster recovery but same healing as time as conservative Mx) 		
Cauda equina syndrome	<p>Main causes of cauda equina:</p> <ul style="list-style-type: none"> ➤ secondary mets common from [PORTABLE] – Prostate, Renal, Thyroid, Breast, Lung ➤ Herniated disc ➤ Abscess (infection) ➤ Spondylolisthesis 				<p>Neurosurgical referral</p> <ul style="list-style-type: none"> ➤ Emergency MRI scan ➤ Lumbar decompression surgery ➤ If metastatic spinal cord compression ➔ High-dose steroids of- reduce swelling and compression <p>Refer to neurosurgeon</p> <ul style="list-style-type: none"> • General = PA, wt loss, analgesia, PT and decompression surgery • Laminectomy (remove part of lamina to widen stenosis) 	
Spinal stenosis	<p>Narrowing of spinal canal – 3 main types</p> <ul style="list-style-type: none"> ➤ Central stenosis → pseudoclaudication (buttock pain and leg weakness) BUT normal peripheral pulses unlike PAD ➤ Lateral stenosis → sciatica ➤ Foraminal stenosis → sciatica 	<p>Causes of stenosis:</p> <ul style="list-style-type: none"> ➤ Congenital ➤ Degenerative changes (facet joint changes, bone spurs, disc disease) ➤ Herniated discs ➤ Thickened PLL, or ligamentum flava ➤ Spinal # ➤ Spondylolisthesis ➤ Tumours 	<p>RF</p> <ul style="list-style-type: none"> • OP • Advanced age <p>Falls risk</p> <ul style="list-style-type: none"> • Anaemia • Electrolyte • HF, arrhythmia • MI, Stroke • Parkinson's • URTI, UTI 	<p>Sx</p> <ul style="list-style-type: none"> • Groin/ hip pain radiating to knee • Cannot wt bear • Shortened abducted and ER leg <p>Avascular necrosis (medial and lateral circumflex arteries)</p>	<p>Exam / Ix</p> <ul style="list-style-type: none"> • XR (AP and lateral) :shenton's line disrupted on AP "usu. continuous line from medial border of femoral neck to inferior border of superior pubic ramus • MRI/CT (if negative XR but suspected #) 	<p>Treatment</p> <ul style="list-style-type: none"> • Treat reversible cause for falls • Analgesia • VTE prophylaxis - clexane • Pre-op assessment (bloods, ECG) • Orthogeriatrics input • ERAS – early wt bearing post-op (assistance w/ PT)
Hip Fracture	<p></p> <p>30 day mortality rate (5-10%)</p> <p>Aim surgery within 48hrs</p> <ul style="list-style-type: none"> ➤ Undisplaced < 60 → cannulated screws (internal fixation) ➤ Displaced > 60 (grade 3 and 4) ➔ THR, hemiarthroplasty (since BV compromise) ➤ Intertrochanteric → dynamic or sliding hip screw ➤ Subtrochanteric → IM nail into proximal femur shaft 	<p>Intra-capsular</p> <ul style="list-style-type: none"> ➤ Undisplaced < 60 → cannulated screws (internal fixation) ➤ Displaced > 60 (grade 3 and 4) ➔ THR, hemiarthroplasty (since BV compromise) <p>Extra-capsular</p> <ul style="list-style-type: none"> ➤ Intertrochanteric → dynamic or sliding hip screw ➤ Subtrochanteric → IM nail into proximal femur shaft 	<p>Falls risk</p> <ul style="list-style-type: none"> • Anaemia • Electrolyte • HF, arrhythmia • MI, Stroke • Parkinson's • URTI, UTI 	<p>None:</p> <ul style="list-style-type: none"> • Only sensory sx - paraesthesia, hair loss, cold sensation • Worse on movement (esp. hip extension) • Better at rest • NO motor sx 	<p>Conservative</p> <ul style="list-style-type: none"> • Rest + looser clothing (no tight belts) • Weight loss • Physiotherapy <p>Medical</p> <ul style="list-style-type: none"> ➤ Analgesia (Panadol, NSAIDs) ➤ Neuropathic analgesia (amitriptyline, gabapentin, duloxetine) ➤ Local steroid injections <p>Surgical</p> <ul style="list-style-type: none"> ➤ Decompression ➤ Transection (cut) ➤ Resection (remove) 	
Meralgia Paresthetica	<p>Compression of lateral cutaneous femoral nerve – L1-3 nerve roots (mononeuropathy)</p> <p></p>					
Trochanteric bursitis	<p>Inflammation of bursa over greater trochanter on outer hip "greater trochanteric pain syndrome"</p>		<ul style="list-style-type: none"> • Friction from repetitive movements • Trauma • RA • Infection 	<ul style="list-style-type: none"> • Localised warm painful hot joint • Swelling (inflamed bursa) • Worse on lying on side 	<p>Any pain with following tests = bursitis</p> <ul style="list-style-type: none"> • +ve trendelenberg • Resisted adduction • Resisted IR • Resisted ER <p>Explain that it may take at least 6 months to recover</p>	

Knee Examination (COMPLEX HINGE JOINT)

Hx	<ul style="list-style-type: none"> Pain: localised (mechanical trauma), diffuse (inflammatory disease) → Stiffness: gradual (OA) Locking: cannot reach full extension (mechanical issue = torn meniscus or loose body) → ALSO affects flexion Swelling: sudden after injury (haemarthroses) but also arthritis and synovitis Deformity: arthritis Unstable: ruptured ligaments 	
General	<ul style="list-style-type: none"> Adequate exposure (remove socks and shoes) Difficulty undressing? 	
Gait	Inspect foot wear and walking aids	
LOOK Anterior posterior	<ul style="list-style-type: none"> General (sweat): Scars, Quadriceps Wasting (Esp. Vastus Medius → OA?), Erythema, Asymmetry Lateral: Knee Flexion, Foot Arches, Toe Deformity Posterior: Iliac Crest Alignment, Gluteal Muscle Bulk, Popliteal Swelling & Hindfoot Abnormalities Varus Thrust = Bowing Of Knee During Gait "Where Is My Horse?" (OA) Valgus Thrust = Knocked Knees = arthritis Patella Height (sit on end of bed) 	
FEEL	<p><u>Tell me if there is any pain?</u></p> <ol style="list-style-type: none"> Joint Temp Palpate (flex at 30°): tibial tuberosity → patella tendon → around patella → medial/lateral joint lines (meniscal cyst) → popliteal fossa (Baker's cyst, DVT, popliteal entrapment syndrome) Effusion check: <ol style="list-style-type: none"> Swipe sign: bulge = small effusion Patellar tap = compress suprapatellar pouch → confirm large effusions (PUSH HARD) Quadriceps circumference (20cm above tibial tuberosity) 	<p>Testing for patellar effusion.</p>  <p>(a) Testing knee flexion—Let me bend your knee!; (b) testing the collateral ligaments; (c) testing the cruciate ligaments</p>
MOVE (active then passive)	<ul style="list-style-type: none"> Flexion (135°) + Extension (5°) <ul style="list-style-type: none"> rest hand on joint lines of knee cap Passive movement → (hear for crepitus = normal) <ul style="list-style-type: none"> Passive knee flexion Passive knee hyperextension (>10° = abnormal) NEUROVASCULAR STATUS 	
Special test "Extra tests"	<ol style="list-style-type: none"> Medial and lateral collateral ligaments <ol style="list-style-type: none"> Flex leg at 15° → hold behind knee and move leg laterally/medially Anterior (towards you - PCL)/Posterior (away from you - ACL) drawer test <ol style="list-style-type: none"> Place fingers on medial and lateral tibia Lachman's test → check for ACL injury or tear <ol style="list-style-type: none"> Flex leg to 30° Hold lower leg with one hand & thigh on the other Hand on thigh → Pull tibia forward on femur while other hand stabilises femur McMurray's test: (test for lateral meniscal tear) <ol style="list-style-type: none"> Patient flexes → hold joint lines + hold bottom of patient's ankle and: <ul style="list-style-type: none"> i. IR tibia (turn foot inwards) → apply varus pressure to knee = lateral meniscus ii. ER tibia (turn foot outwards) → apply valgus pressure to knee = medial meniscus +ve sign = popping sensation followed by inability to extend knee CHECK FOR ANY CREPITUS (OA, patella maltracking) Apley's grinding test (test for meniscal damage) <ol style="list-style-type: none"> Patient prone → flex knee to 90° → hold knee while twisting and pushing down via tibia (i.e. IR + ER of tibia w/ downward pressure) Apprehension test → lift knee up and repeat (put more pressure on meniscus) 	

Anterior and Posterior Drawer Tests



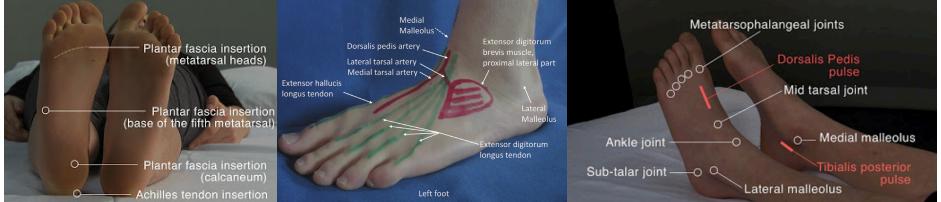
SPECIAL TESTS

- Valgus – MCL
- Varus = LCL

Assess for laxity (>6-8 mm shift). Compare to laxity with the opposite knee.

ANKLE AND FEET Examination

Today I examined Mr Smith, a 32-year-old male. On general inspection, the patient appeared comfortable at rest, with no peripheral stigmata of musculoskeletal disease. There were no objects or medical equipment around the bed. Assessment of the **lower limbs** revealed an unremarkable **gait** and **hip/ankle joint appearance**. The **range of movement** of both hip/ankle/foot joints was also normal with no evidence of **pelvic tilt or fixed flexion deformity of the hip/foot deformity**. In summary, these findings are consistent with a **normal hip (ankle and foot) joint examination**. For completeness, I would like to perform the following **Neurovascular exam (no need for X-ray/MRI)**

Hx	<ul style="list-style-type: none"> Pain: only when wearing shoes OR specific area <ul style="list-style-type: none"> Ask: sports that require twisting of foot (e.g. netball, football), Hx of RA, Severe pain = gout or after vigorous exercise (likely stress fracture) Excess Alcohol or seafood intake = gout Swelling: bilateral (inflammation), over medial aspect of 1st metatarsal head at bunion (aging or RA) Paraesthesia: cold feet (not diabetes) BUT if cyanosis or ulceration (diabetes) 														
	<p>Gait</p> <ul style="list-style-type: none"> Adequate exposure (socks & shoes off) walking aids (INSPECT FOOTWEAR) <ul style="list-style-type: none"> Ask to walk on tippy toes → Inability = possible posterior leg muscle, achilles tendon or tibial nerve entrapment (S1) Walk on heel → possible weakness of anterior leg compartment (L5) Antalgic gait = gait in response to pain Stiff knee gait = when flexed knee or weak quadriceps Flexed Knee Gait - short stride without heel strike & toe off Varus thrust = Bowing of knee during gait Valgus thrust = sudden onset of valgus as limb accepts weight 														
	<p>LOOK (all sides)</p> <ul style="list-style-type: none"> General: SWEAT, toe deformities (e.g. hallux valgus, clawing, toe crowding in RA), ulcers, Raynauds, rash, callus, Bunions Nail changes (PSA) = psoriasis, ingrown nail, pitting? Anterior: symmetry, # of toes, sausage digits (dactylitis -PSA) On side: Transverse Foot arches - If flattened (RA) Posterior: Achilles tendon, symmetry, scars, swelling, RA nodules 														
Exam	<p><i>Let me know of any pain before checking joints</i></p> <ol style="list-style-type: none"> Temperature & Pulse (Dorsalis pedis & posterior tibial) MTP → IP → MT Inspect for tinea in between toes! Tarsal → ankle → medial/lateral malleoli → subtalar → calcaneus → distal fibula Plantar fascia insertion (metatarsal heads → base of 5th metatarsal → calcaneum) Metatarsal squeeze across whole foot (Morton's neuroma) <p>*capillary refill time (for diabetes and neuro)</p> <table border="1" data-bbox="377 1163 1462 1495"> <thead> <tr> <th data-bbox="377 1163 759 1197"><u>Location</u></th><th data-bbox="759 1163 1462 1197"><u>Pathology</u></th></tr> </thead> <tbody> <tr> <td data-bbox="377 1197 759 1230">Tender posterior medial malleolus</td><td data-bbox="759 1197 1462 1230">suspected ankle fracture</td></tr> <tr> <td data-bbox="377 1230 759 1282">Tenderness/Pain Between 3rd and 4th metatarsals</td><td data-bbox="759 1230 1462 1282">Morton's neuroma = nerve entrapment and swelling of digital nerve between toes = pain and numbness</td></tr> <tr> <td data-bbox="377 1282 759 1316">Tender Inferior aspect of heel</td><td data-bbox="759 1282 1462 1316">Plantar fasciitis → seronegative spondyloarthropathies</td></tr> <tr> <td data-bbox="377 1316 759 1349">Tender/stiff interphalangeal joint</td><td data-bbox="759 1316 1462 1349">seronegative spondyloarthropathies</td></tr> <tr> <td data-bbox="377 1349 759 1401">Tender MTP joint</td><td data-bbox="759 1349 1462 1401">Early RA NB: Extremely Tender 1st MTP joint = possible acute gout!</td></tr> <tr> <td data-bbox="377 1401 759 1495">Tender Achilles tendon + RA nodules</td><td data-bbox="759 1401 1462 1495">Achilles tendinitis</td></tr> </tbody> </table> 	<u>Location</u>	<u>Pathology</u>	Tender posterior medial malleolus	suspected ankle fracture	Tenderness/Pain Between 3rd and 4th metatarsals	Morton's neuroma = nerve entrapment and swelling of digital nerve between toes = pain and numbness	Tender Inferior aspect of heel	Plantar fasciitis → seronegative spondyloarthropathies	Tender/stiff interphalangeal joint	seronegative spondyloarthropathies	Tender MTP joint	Early RA NB: Extremely Tender 1 st MTP joint = possible acute gout!	Tender Achilles tendon + RA nodules	Achilles tendinitis
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<p>Move (mostly active)</p> <ul style="list-style-type: none"> Dorsiflexion (20°) and plantarflexion (50°) – “bring feet up as if pointing towards your head” “push your feet down like pressing down on pedal” Inversion (35°) / eversion (15°) of subtalar and mid-tarsal (pain and limited ROM) <ol style="list-style-type: none"> “Try to touch the soles of your feet together.” “Try to angle the soles of your feet outwards as far as you are able to.” Flexion/Extension of Hallux and toes <ol style="list-style-type: none"> “curl up your toes as tight as you can” “Extend toes back towards your head” <p>Special tests</p> <ul style="list-style-type: none"> Simmond's test (is Achilles tendon intact?) = squeeze calf (no movement of foot = Achilles tendon rupture) <ul style="list-style-type: none"> Knee on bed and stand up straight Inspect also: soles of feet, dry/cracked heels, tinea (i.e. scaly skin +/- red) Palpate for calcaneum & Achilles Tendon insertion Talar tilt / anterior drawer test – lateral ankle ligaments (anterior talofibular and calcaneofibular ligaments) NEUROVASCULAR STATUS 															

Common conditions affecting the knee and ankle

	Pathophysiology	Risk factors	Common Symptoms	Exam / Ix	Treatment
Meniscal tear	<p><i>Meniscal damage - Trauma due to forceful twisting or hyper-flexing of the knee joint</i></p> <ul style="list-style-type: none"> • Unhappy Triad = ACL, MCL + medial meniscus 	<ul style="list-style-type: none"> • netballer's injury" • athletes • standing from seated 	<ul style="list-style-type: none"> • A "pop" • RAPID onset swelling • <i>Instability (cannot weight bear)- knee giving way</i> • Locking/clicking sound esp. ascending stairs 	<ul style="list-style-type: none"> • Tender swollen joint line + reduced ROM • McMurray test • Apley grind test • MRI (confirm Dx) • Arthroscopy (gold standard to dx tear) 	<ul style="list-style-type: none"> • 1st line = RICE + NSAID • Physio (before and after surgery-) • Arthroscopic surgery <ul style="list-style-type: none"> ○ Repair meniscus ○ Resect affected meniscus portion
ACL / PCL tear rupture	<ul style="list-style-type: none"> • ACL – normally stops tibia moving in front of femur (lateral intercondylar notch → anterior intercondylar area of tibia) • PCL – normally stops tibia moving posterior to femur (medial intercondylar notch → to posterior intercondylar area of tibia) 	<ul style="list-style-type: none"> • <i>Trauma due to high friction surfaces + high intensity movements</i> • netballer's injury" 	<ul style="list-style-type: none"> • A "pop" • RAPID onset swelling • <i>Instability (cannot weight bear)</i> 	<ul style="list-style-type: none"> • Positive Lachman test (knee flexed at 20°) • Positive Ant. drawer test • MRI (confirm Dx) • Arthroscopy (gold standard to dx tear) 	<ul style="list-style-type: none"> • 1st line = NSAID • Crutches and knee braces • Physio (before and after surgery-) • Arthroscopic surgery (ligament reconstruction – for young active adults) – new ligament created from graft of tendon: <ul style="list-style-type: none"> ○ Hamstring tendon ○ Quadriceps tendon ○ Bone-patellar tendon bone
Baker's cyst and rupture	<ul style="list-style-type: none"> • Degenerative knee joint changes • <i>Rupture produces fluid leaking down into your calf</i> • DDx: DVT, abscess, ganglion cyst, lipoma, popliteal artery aneurysm, varicose veins, tumours 	<ul style="list-style-type: none"> • Meniscal tears (main cause) • OA • Knee injury • RA 	<ul style="list-style-type: none"> • <i>Pressure sensation or fullness</i> • <i>Palpable lump, swelling</i> • <i>Oedema - if cyst compress veins</i> <p>If ruptured</p> <ul style="list-style-type: none"> • Pain, swelling, redness 	<ul style="list-style-type: none"> • Foucher's sign = lump gets smaller when knee flexed from full extension • USS = confirm Dx and rule out DVT • MRI = for surgery plan 	<p>Asymptomatic = no Rx</p> <p>Symptomatic</p> <ul style="list-style-type: none"> • Activity mod. (PT) • Analgesia (NSAID) • USS-guided aspiration • Steroid injections • Surgery – arthroscopy to treat underlying issue (e.g. meniscal tear) – difficult to excise cyst
Osteoarthritis	<ul style="list-style-type: none"> • <i>Degenerative change</i> • <i>Wear and tear</i> • <i>Previous injury/trauma</i> 	<ul style="list-style-type: none"> • FHx • <i>Repetitive injury or trauma</i> 	<ul style="list-style-type: none"> • Asymmetrical Knee pain (worse on exercise) • Stiffness (< 30 mins) → worse after immobile • Elderly (>60) • Hx of injury 	<ul style="list-style-type: none"> • <i>Effusion</i> • <i>Higher BMI</i> • <i>Quadriceps wasting (esp. vastus medius)</i> • <i>Crepitus</i> • <i>Heberden and Bouchard's nodes</i> 	<ul style="list-style-type: none"> • Weight loss (5% makes big difference) • NSAIDs • DO NOT REST FOR OA or tendinopathy → Hydrotherapy • Denosumab?
Patellofemoral syndrome "Housemaid's" syndrome	<ul style="list-style-type: none"> • <i>cartilage under the MEDIAL kneecap is damaged due to injury or overuse.</i> • <i>Involves patella, iliotibial tract, ligament laxity</i> 	<ul style="list-style-type: none"> • <i>injury or overuse.</i> • DDx: Patellar maltracking 	<ul style="list-style-type: none"> • <i>Assymetricla Pain</i> • <i>Muscle weakness</i> • <i>Stiffness</i> • <i>Antalgic gait</i> 	<p>Frontal knee pain → exacerbated upon kneeling</p>	<ul style="list-style-type: none"> • Brace • Rest • Ice packs
Osgood–Schlatter's disease	<p><i>Inflamed tibial tuberosity where patellar ligament inserts (secondary to multiple minor avulsion fractures)</i></p> <ul style="list-style-type: none"> • Once resolved – hard non-tender bony lump over tibial tuberosity 	<ul style="list-style-type: none"> • 10-15yo males 	<ul style="list-style-type: none"> • Unilateral knee pain • Visible hard tender lump • Worse on activity 	None	<ul style="list-style-type: none"> • RICE – reduce PA • PT = strength joint and function • Analgesia (NSAID) • Surgery ONLY if complete avulsion fracture
Achilles tendinopathy	<p>2 types:</p> <ul style="list-style-type: none"> • Insertion tendinopathy (within 2cm of insertion) • Mid-portion tendinopathy (2-6cm above insertion) 	<ul style="list-style-type: none"> • Sports (basketball, track athletes) • Quinolone Abx (within 48hrs) • DM • HC • INFLAMMATION 	<ul style="list-style-type: none"> • Pain or ache in achilles tendon • Stiff • Tender • Swelling • Nodularity on palpation 	<p>None</p> <p>Positive Simmond's test</p>	<ul style="list-style-type: none"> • RICE – minimise rest • Analgesia (NSAID) • PT and orthotics (insloes) • Extracorporeal shock wave therapy • Surgery – remove nodules and alter tendon <p>NO steroid injection = ↑ rupture risk</p>
Achilles tendon rupture	<p><i>Sudden onset rupture of Achilles tendon (lost connection between gastrocnemius/soleus with calcaneus/heel)</i></p>	<ul style="list-style-type: none"> • Sports (basketball, track athletes) • Quinolone Abx (within 48hrs) • Systemic steroids • Advanced age • FHx • Existing tendinopathy 	<ul style="list-style-type: none"> • Sudden onset Achilles pain • Snapping sound and sensation 	<p>Positive Simmond's test</p> <p>Confirm on USS</p>	<p>Urgent ortho referral (same-day)</p> <ul style="list-style-type: none"> • RICE • Analgesia (NSAID) • Non-surgical = specialist boot to immobilise ankle with full plantarflexion in 1st boot then moving towards neutral (6-12 wk with high risk of recurrence) • Surgical = surgically reattaches Achilles followed by specialist boot (long rehab process)
Plantar fasciitis	<p>Inflamed plantar fascia (attached to calcaneous)</p> <ul style="list-style-type: none"> • Can lead to ruptured plantar fascia or fat pad atrophy 	<ul style="list-style-type: none"> • Worse w/ pressure (prolonged walk/stand) 	<ul style="list-style-type: none"> • Gradual onset pain on heel plantar aspect • 	<ul style="list-style-type: none"> • Tenderness on palpation 	<ul style="list-style-type: none"> • RICE • Analgesia (NSAID) • PT • Steroid injections
Fat pad atrophy	<p>Atrophy of fat pad over heel of foot</p>	<ul style="list-style-type: none"> • age, • inflammation or repetitive activity 	<ul style="list-style-type: none"> • Similar to plantar fasciitis 	<p>USS – reduced fat pad thickness</p>	<ul style="list-style-type: none"> • Analgesia • Weight loss • Comfort shoes (custom insoles)
Morton's neuroma	<p>Nerve dysfn in intermetatarsal space usu. 3rd and 4th metatarsal</p>	<ul style="list-style-type: none"> • High heels • Narrow shoes 	<ul style="list-style-type: none"> • Pain at front of foot • Lump sensation in shoes • Paraesthesia in distal toes 	<ul style="list-style-type: none"> • Analgesia (NSAID) • PT • Mulder's sign = painful click when rubbing either side of foot w/ 2 hands • USS/MRI to confirm 	<ul style="list-style-type: none"> • Activity mod (no high heels) • Analgesia (NSAID) • PT, insoles • Wt loss • RF ablation or excision of neuroma
Bunions (Hallux Valgus)	<p>Bony lump due to deformed MTP at base of big toe – inflamed and enlarged</p>	<ul style="list-style-type: none"> • OA 	<ul style="list-style-type: none"> • Painful while walking (esp. tight shoes) 	<p>Wt bearing XR</p>	<ul style="list-style-type: none"> • Wide comfortable shoes • Analgesia • Surgery (definitive Rx)
Gout	<p>Crystal arthropathy where elevated uric acid levels</p>	<ul style="list-style-type: none"> • Gout RF 	<ul style="list-style-type: none"> • Common cause of pain and swelling in MTP 	<p>Joint fluid aspiration + polarised microscopy</p> <ul style="list-style-type: none"> • Aim to exclude septic 	<ul style="list-style-type: none"> • Restrict purine rich food, EtOH • 1st LINE = NSAID • 2nd line = colchicine • 3rd line = Steroid injections • start allopurinol ONLY after acute attack settled

LIGAMENT INJURIES

Avoid US, MRI, X-ray [false Dx – freaks patient out to seek surgical Rx]

KNEE LIGAMENT INJURIES		ANKLE LIGAMENT INJURIES																																				
Ottawa rules (X-ray indication)	<p>Knee x-ray indications: Ottawa knee rules (acute)</p> <ul style="list-style-type: none"> • Age ≥ 55 years • Isolated patella tenderness • Tenderness at head of fibula • Inability to flex knee 90° • Inability to bear weight (4 steps) immediately after injury and in emergency department <p>➤ Traumatic knee injury (e.g. twisting, ACL, MCL, meniscus, LCL injuries)</p> <p>➤ <u>Swelling makes it difficult to exam (may need to wait 1 wk)</u></p>	<p>Lateral view</p> <p>Medial view</p> <p>A Posterior edge or tip of lateral malleolus → 6 cm B Posterior edge or tip of medial malleolus → 6 cm C Base of 5th metatarsal D Navicular</p> <p>An ankle x ray series is required only if there is any pain in malleolar zone and any of these findings: • Bone tenderness at A • Bone tenderness at B • Inability to bear weight both immediately and in emergency department</p> <p>A foot x ray series is required only if there is any pain in midfoot zone and any of these findings: • Bone tenderness at C • Bone tenderness at D • Inability to bear weight both immediately and in emergency department</p>																																				
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General Mx	<p>Crutches + analgesia + education</p> <p>➤ NSAID PO tds for 7 days</p> <p>➤ RICE – early mobilise, ice (20min 4x day), compress bandage, elevate for 24 hrs</p> <p>➤ Gradual weight bearing (2mins 2x/day for a mth) – while brushing teeth?</p> <p>➤ Physio esp. if not improving in 1-2 wks</p>																																					
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		<p>DDx for ligament injury:</p> <ul style="list-style-type: none"> ➤ ### ➤ Septic arthritis ➤ Inflammatory arthritis – RA, SpA (reactive) ➤ Juvenile arthritis (still's disease) <p>Mx considerations:</p> <ul style="list-style-type: none"> ➤ Use paracetamol + Avoid NSAIDs if: <ul style="list-style-type: none"> ○ PUD, gastric ulcer HX ○ Asthma (flare up via leukotriene pathway) ○ Pregnancy ➤ Caution w/: <ul style="list-style-type: none"> ○ CCF/HTN/ILD ○ CKD ○ Aspirin + anti-coagulant usage ○ Triple whammy (ACEi + NSAID + Diuretics) 																																				

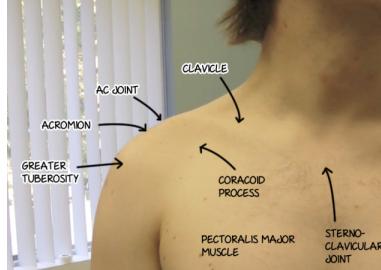
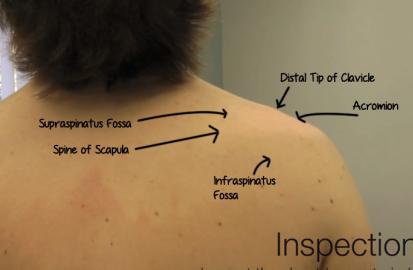
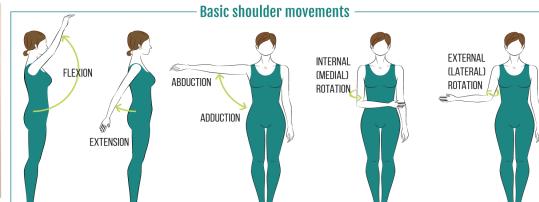
SHOULDER Examination (synovial ball-socket = very mobile & unstable)

"Today I examined Mrs Smith, a 32-year-old female. On general inspection, the patient appeared comfortable at rest, with no stigmata of musculoskeletal disease. There were no objects or medical equipment around the bed of relevance."

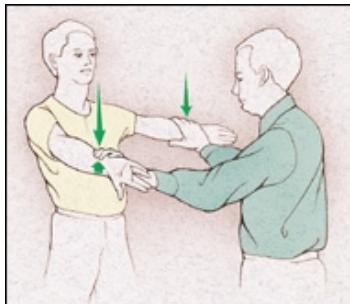
"Assessment of the **upper limbs** revealed a normal **shoulder joint appearance**, with no tenderness on **palpation**. He had a full range of **passive and active movements** in both shoulder joints was normal. In summary, these findings are consistent with a **normal shoulder joint examination**. To complete the examination, I would also examine the **elbow** and the **cervical spine** as well as a neurovascular status of both upper limbs."

General:

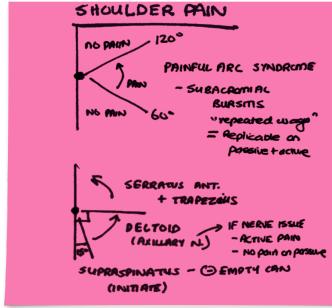
1. Limited ROM + >70 years old + with abnormal X-ray (e.g. osteophytes) → **osteoarthritis**
2. Limited ROM + young + normal X-ray → **adhesive capsulitis**
3. **UNSTABLE movements** → **rotator cuff muscles**: supraspinatus, infraspinatus, teres minor and subscapularis
4. **Young patients** = tendinitis and impingement
5. **Rare** = fracture dislocation

Hx	<ul style="list-style-type: none"> • Pain → most common → felt over front and lateral part of joint radiating to insertion of deltoid <ul style="list-style-type: none"> ◦ If pain over top shoulder → acromioclavicular joint or base of neck • Instability = dislocation "shoulder jumping out of socket" • Loss of function or reduced ROM → cannot reach back!
	<div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> <p>General</p> <ul style="list-style-type: none"> • Consent: looking at shoulder, feeling shoulder joint and assess movement of shoulder joint • Do you have any pain at the moment? • Adequate exposure No T-shirt </div> <div style="width: 70%;"> <ul style="list-style-type: none"> • LOOK <p>Anterior Lateral posterior</p> <ul style="list-style-type: none"> • General (anterior): scars, swelling/bruising, wasting, erythema, asymmetry <ul style="list-style-type: none"> ◦ Popeye deformity: Static anterosuperior migration of humeral head (massive RC tear) ◦ Muscle wasting: deltoid (shoulder issue) • General (lateral): scars, supraspinous and infraspinous fossa • General (posterior): scoliosis, Muscle wasting: trapezius (c-spine issue), deltoid (shoulder issue), supraspinatus, infraspinatus, <ul style="list-style-type: none"> ◦ Press both hands against wall → Deformity (winged scapula) → long-thoracic nerve injury (serratus anterior (C5-C7)) </div> </div>
Exam	<div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> <p>FEEL</p> <div style="border: 1px solid black; padding: 5px; text-align: center;"> MOST COMMON SHOULDER DISLOCATION IS ANTERIOR (DUE TO TRAUMA) </div> </div> <div style="width: 70%;"> <p><u>Tell me of any pain when I feel the shoulder joint?</u></p> <ul style="list-style-type: none"> • Temp • Palpate (back): c-spine + border/spine of scapula • Palpate (both sides): sternoclavicular joint → clavicle → GHJ (2cm below acromium + push hard!) → acromioclavicular joint → coracoid process → biceps groove → head of humerus → greater tuberosity of humerus • Extra: acromioclavicular joint <ul style="list-style-type: none"> ◦ cross chest adduction <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  <p>AC JOINT ACROMION CLAVICLE CORACOID PROCESS PECTORALIS MAJOR MUSCLE STERNO-CLAVICULAR JOINT</p> </div> <div style="text-align: center;">  <p>Supraspinatus Fossa Spine of Scapula Infraspinatus Fossa Distal Tip of Clavicle Acromion</p> </div> </div> <p style="text-align: right;">Inspection Inspect the shoulder posteriorly</p> </div> </div>
	<div style="display: flex; justify-content: space-between;"> <div style="width: 60%;"> <p>MOVE (active then passive)</p> <ul style="list-style-type: none"> • Bring arms out above head and back down as far as possible behind you → c <ul style="list-style-type: none"> ◦ Flexion (~180°) → ANTERIOR DELTOID, PEC MAJOR, CORACOBRACHIALIS ◦ Extension (~65°) → Latissimus Dorsi ◦ Scapula Rhythm smooth? → Checks deltoid, supraspinatus and rotator cuff muscles • NB: for hitching or use of other muscle • Bring arms out to side and up to top and bring them down and across your body → SUBACROMIAL BURSITIS <ul style="list-style-type: none"> ◦ Abduction tests (~90°) ◦ Adduction (~50°) • painful arc test = Supraspinatus = shoulder impingement syndrome Asymmetry in movement and note pain at which angle <div style="display: flex; justify-content: space-around; margin-top: 10px;">   </div> </div> <div style="width: 40%;"> <p>Tuck elbows in → move forearm away from you and across body</p> <ul style="list-style-type: none"> • External rotation (~65°) → infraspinatus • Internal rotation (~90°) → subscapularis <p>With both hands reach up back as far up as you can</p> <ul style="list-style-type: none"> • Internal rotation (~90°) <p>Both hand behind head and push elbows back (like an arrest)</p> <ul style="list-style-type: none"> • External rotation (~65°) • Abduction tests (~90°) <p>Spurling's test → tilt head back + look to affected side <ul style="list-style-type: none"> ◦ If pain = c-spine pathology → MRI spine </p> </div> </div>
	<p>Neurovascular exam</p> <ul style="list-style-type: none"> • Spinal Accessory Nerve (Trapezius), Suprascapular Nerve (Supra & Infraspinatus), Axillary Nerve (Deltoid) • Long Thoracic Nerve (Serratus Anterior -C5-7) → cannot retract scapula • Dorsal Scapular Nerve (Rhomboids) Injury → asymmetry (one side will be close to scapula than other)

<p>Special test (rotator cuff exam)</p>	<p>1. (Gerber's lift off test - IR against resistance)</p>	<ul style="list-style-type: none"> • Subscapularis rupture or tendonitis • Subscapular nerve lesion 	<ul style="list-style-type: none"> • back of hand on lower back (lift-off actively and against resistance) • Belly test (actively push inwards against resistance) • Bear hug (pull my hand towards your shoulder) • XS ER power
	<p>2. Empty can test "Jobe test"</p>	<ul style="list-style-type: none"> • Supraspinatus rupture or tendonitis 	<ul style="list-style-type: none"> • 90 deg shoulder flexion + 30 deg abduction + IR with thumb to ground • Resistance against pushing arm down
	<p>3. Hawkin's test</p>	<ul style="list-style-type: none"> • Subacromial bursitis • RC tear / tendinitis 	<ul style="list-style-type: none"> • Flex shoulder and elbow at 90 deg then internally rotate • Pain = + sign
	<p>4. Neer's sign</p>	<ul style="list-style-type: none"> • Subacromial bursitis / impingement 	<ul style="list-style-type: none"> • Passive shoulder flexion with arm internally rotated (thumb to floor)
	<p>5. ER against resistance at 0 deg abduction</p>	<ul style="list-style-type: none"> • Infraspinatus tear • Teres minor tear 	<ul style="list-style-type: none"> • Elbow flexed at 90 deg → slight abduction • Passive ER of arm to maximum → push against my hand • Hornblower → arms drop down = massive rotator cuff tear (irreversible) teres minor
	<p>6. Supination against resistance</p>	<ul style="list-style-type: none"> • Biceps tendon 	<ul style="list-style-type: none"> • Supination against resistance
	<p>7. Apley scratch test or scarf test</p>	<ul style="list-style-type: none"> • Adhesive capsulitis • AC joint arthritis 	<ul style="list-style-type: none"> • Reach begin shoulder to medial scapula on other side • Ask to reach across chest to opposite shoulder
	<p>8. Apprehension test</p>	<ul style="list-style-type: none"> • Shoulder instability (previous anterior dislocation or sublux) 	<ul style="list-style-type: none"> • Supine patient → shoulder abducted to 90 degrees and elbow flexed at 90 degrees • Shoulder slowly ER → patient feels scared it will dislocated (NO pain)



Empty can test "supraspinatus"



Painful arc syndrome "subacromial bursitis"



Gerber's lift off test "subscapularis"



External Rotation "infraspinatus"

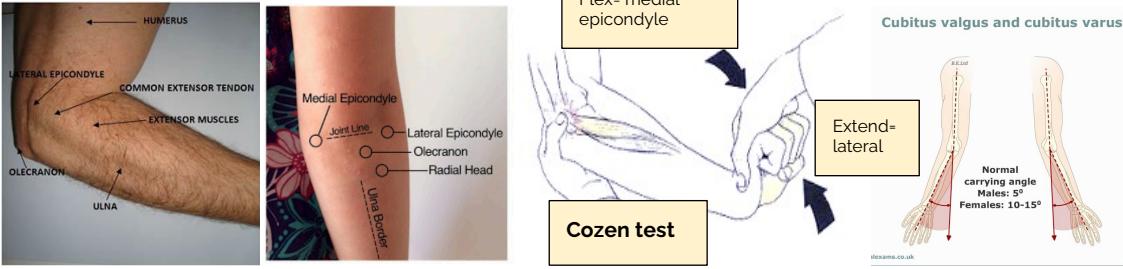
Adhesive capsulitis = "Frozen Shoulder"		Rotator cuff tears	Shoulder dislocations						
PP	Inflammation and fibrosis in joint capsule leads to adhesions (scar tissue) → bind to capsule and tighten around joint to reduce ROM	Injury to rotator cuff tendons (partial or fully)	Head of humerus (ball) comes out of glenoid cavity (socket)						
Cause	<p>2 types:</p> <ul style="list-style-type: none"> ➢ Primary (idiopathic) ➢ Secondary (trauma, surgery, immobilisation) 	<p>2 types</p> <ul style="list-style-type: none"> ➢ RC tear (FOOSH, avulsion injury) ➢ RC arthropathy due to Degenerative changes with age (>70yo) 	<ul style="list-style-type: none"> ➢ Subluxation = partial dislocation (naturally pops back in) ➢ 90% are anterior dislocations (FOOSH) ➢ Post. dislocations = electric shocks /seizures 						
RF	<ul style="list-style-type: none"> ➢ Middle age ➢ Diabetes 	<ul style="list-style-type: none"> ➢ Overhead activities (e.g. construction work, playing tennis) 							
DDx	<p>If no preceding trauma, consider:</p> <ul style="list-style-type: none"> ➢ Supraspinatus tendinopathy ➢ Acromioclavicular joint arthritis ➢ Glenohumeral joint arthritis <p>If preceding trauma, consider</p> <ul style="list-style-type: none"> ➢ Shoulder dislocation ➢ Fractures (proximal humerus, clavicle) ➢ Rotator cuff tear 	<table border="1"> <thead> <tr> <th>RC tear</th> <th>RC arthropathy</th> </tr> </thead> <tbody> <tr> <td>Acute injury</td> <td>Degenerative</td> </tr> <tr> <td> <ul style="list-style-type: none"> • Wider CSA > 38 • Lateral acromium • Upward tilting glenoid </td><td> <ul style="list-style-type: none"> • Narrower CSA < 31 • Shorter acromium • Downward tilting glenoid </td> </tr> </tbody> </table> <p>'DDx: Supraspinatus tendinitis, Shoulder impingement syndrome (SIS)</p>	RC tear	RC arthropathy	Acute injury	Degenerative	<ul style="list-style-type: none"> • Wider CSA > 38 • Lateral acromium • Upward tilting glenoid 	<ul style="list-style-type: none"> • Narrower CSA < 31 • Shorter acromium • Downward tilting glenoid 	<p>Complications:</p> <ul style="list-style-type: none"> ➢ Bankart lesion = tears to anterior labrum (repeated subluxation/dislocations) ➢ Hill-sachs lesions = compression fracture on posterolateral part of humerus head ➢ Erb's palsy (axially nerve damage) = C5, C6 → deltoid and teres minor weakness and major patch sensation loss ➢ Fractures – humeral head, greater tuberosity, acromion, clavicle
RC tear	RC arthropathy								
Acute injury	Degenerative								
<ul style="list-style-type: none"> • Wider CSA > 38 • Lateral acromium • Upward tilting glenoid 	<ul style="list-style-type: none"> • Narrower CSA < 31 • Shorter acromium • Downward tilting glenoid 								
Sx	<p>3 main phases (lasting 6/12 each)</p> <ol style="list-style-type: none"> 1. Painful phase = shoulder pain worse at night 2. Stiff phase = stiffness in both active and passive movement (ER most affected) 3. Thawing phase = gradual improvement 	<ul style="list-style-type: none"> ➢ Shoulder pain ➢ Weakness and pain specific to RC tendon (SITS) ➢ Difficulty sleep – pain lying on affect side ➢ "Painful arc syndrome" 	<ul style="list-style-type: none"> ➢ Hold affected arm against side of body ➢ Flattened deltoid + bulging head of humerus ➢ Assess: neurovascular status (pulses, CRT,– Erb's palsy w/ major patch sensation loss) ➢ Apprehension test = 						
Ix	<p>XR = normal (but helps to exclude OA)</p> <p>USS, CT or MRI = thickened jt capsule</p>	<p>XR = normal (but helps to exclude OA)</p> <p>USS or MRI = for diagnosis</p>	<p>XR (confirm dislocation and exclude fractures)</p> <p>MRI +/- arthroscopy = assess shoulder damage e.g. Bankart and Hill-sachs lesions</p>						
Rx	<p>Self-resolves over 1-3 years</p> <ul style="list-style-type: none"> ➢ Rest, ➢ NSAIDs, ➢ PT + Activity mod – continue arm use without pain ➢ IA steroid injections <p>If resistant to above</p> <ul style="list-style-type: none"> ➢ Manipulation under anaesthesia (stretch capsule to improve ROM) ➢ Arthroscopy (remove adhesions) 	<p>Conservative Mx (for degenerative RC tears)</p> <ul style="list-style-type: none"> ➢ Rest, NSAIDs, ➢ PT + Activity mod – arm use without pain <p>If acute or full thickness tears or when PT fails</p> <ul style="list-style-type: none"> ➢ Arthroscopic RC repair (tendon reattached to bone in keyhole surgery) ➢ Reverse TSR (for massive RCT w/ arthritis but intact deltoid) <p>Nb: irreparable tear if:</p> <ul style="list-style-type: none"> ➢ fat infiltration into muscle ➢ ER lag sign, Hornblower sign 	<p>Conservative Mx (for degenerative RC tears)</p> <ul style="list-style-type: none"> ➢ Analgesia (NSAID) ➢ Broad arm sling (support arm) ➢ Closed reduction of shoulder (after # excluded) ➢ Post-reduction XR ➢ Immobilisation after shoulder relocation <p>To reduce risk of recurrent (20% risk)</p> <ul style="list-style-type: none"> ➢ PT = improve function of shoulder ➢ Shoulder stabilisation surgeries – remove Bankart and Hill-sachs lesions OR tighten shoulder capsule ➢ Beware prolonged recovery period (>3/12) 						

ELBOW Examination

Assessment of Elbow (synovial hinge)

"Today I examined Mrs Smith, a 32-year-old female. On general inspection, the patient appeared comfortable at rest, with no stigmata of musculoskeletal disease. There were no objects or medical equipment around the bed of relevance."

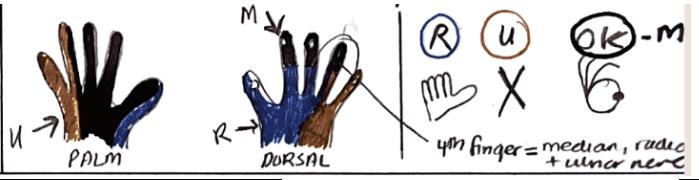
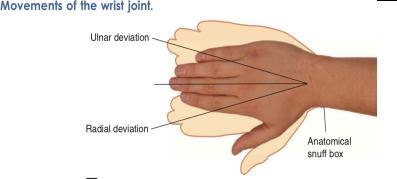
"Assessment of the **upper limbs** revealed a normal **elbow joint appearance**, with no tenderness on **palpation**. The **passive and active movements** in both elbow joints was normal. "In summary, these findings are consistent with a **normal elbow joint examination**. To complete the examination, I would also examine the shoulder and wrist joint as well as a neurovascular exam."

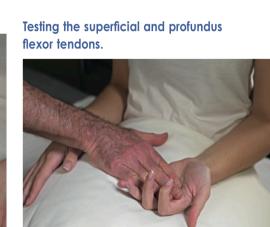
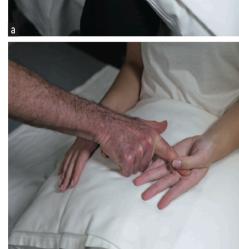
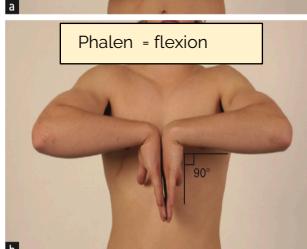
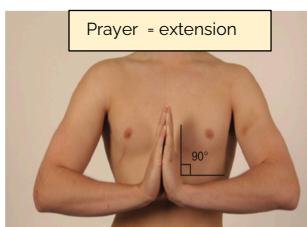
General	<ul style="list-style-type: none"> Adequate exposure -- expose shoulder and wrist Difficulty undressing? 											
LOOK [MUST be in anatomical position]	<ul style="list-style-type: none"> General (anterior): scars, swelling, erythema, bruising <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%; text-align: center;">Anterior</td> <td style="width: 33%; text-align: center;">Lateral</td> <td style="width: 33%; text-align: center;">Posterior</td> </tr> <tr> <td> <ul style="list-style-type: none"> Carrying angle ($F > M \approx 7-12^\circ$) \rightarrow cubitus valgus/ varus deformity NB: make sure both arms in line despite fixed flexion deformity Olecranon swelling (bursitis) \rightarrow if bilateral olecranon swelling (joint effusion) </td> <td> <ul style="list-style-type: none"> fixed flexion deformity swelling </td> <td> skin changes: <ul style="list-style-type: none"> rheumatoid nodules/psoriatic plaques (behind elbow) gouty tophi. </td> </tr> </table>			Anterior	Lateral	Posterior	<ul style="list-style-type: none"> Carrying angle ($F > M \approx 7-12^\circ$) \rightarrow cubitus valgus/ varus deformity NB: make sure both arms in line despite fixed flexion deformity Olecranon swelling (bursitis) \rightarrow if bilateral olecranon swelling (joint effusion) 	<ul style="list-style-type: none"> fixed flexion deformity swelling 	skin changes: <ul style="list-style-type: none"> rheumatoid nodules/psoriatic plaques (behind elbow) gouty tophi. 			
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FEEL	<p><i>Tell me if there is any pain?</i></p> <ul style="list-style-type: none"> Temp (olecranon fossa) + Radial Pulse Palpate (lateral): lateral epicondyle + common extensor origin \rightarrow Radial head Palpate (posterior): olecranon \rightarrow triceps insertion Palpate (medial): medial epicondyle + common flexor origin \rightarrow medial collateral ligament (45°) \rightarrow cubital tunnel (subluxing ulnar nerve + tinnels) Palpate (anterior): biceps tendon while elbow flexed (hook) 											
MOVE / POWER (active then passive)	<ul style="list-style-type: none"> Elbow flexion (145°)/extension (0°) \rightarrow boxer arms Supination (90°)/pronation (85°) \rightarrow have elbow flexed and thumbs pointing up BEFORE testing \rightarrow shake hands (push against) Assess passively to determine any crepitus 											
Impingement	<ul style="list-style-type: none"> Anterior Impingement \rightarrow coronoid osteophyte Posterior Impingement \rightarrow olecranon osteophyte 											
Special test "instability"	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%; text-align: center;">Static Valgus Stress Test (MCL)</td> <td style="width: 33%; text-align: center;">Moving Valgus Stress (MCL)</td> <td style="width: 33%; text-align: center;">Static Varus Stress Test (LCL)</td> </tr> <tr> <td>Shoulder Abduction with Full ER & Supinated Forearm + elbow at 25°</td> <td>Shoulder Abduction with Full ER & Supinated Forearm \rightarrow Full Flexion & Extension + Valgus force</td> <td>IR Shoulder and Pronate Forearm + elbow at 25°</td> </tr> <tr> <td>Look for Apprehension/Pain in Mid-Arc - Diff Dx includes RC OA and Lateral OCD</td> <td></td> <td></td> </tr> </table>			Static Valgus Stress Test (MCL)	Moving Valgus Stress (MCL)	Static Varus Stress Test (LCL)	Shoulder Abduction with Full ER & Supinated Forearm + elbow at 25°	Shoulder Abduction with Full ER & Supinated Forearm \rightarrow Full Flexion & Extension + Valgus force	IR Shoulder and Pronate Forearm + elbow at 25°	Look for Apprehension/Pain in Mid-Arc - Diff Dx includes RC OA and Lateral OCD		
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Look for Apprehension/Pain in Mid-Arc - Diff Dx includes RC OA and Lateral OCD												
Special test "extra tests for joint problems"	<p>Cozen's test \rightarrow 'active wrist extension against extension' to check for tennis elbow or lateral epicondylitis</p> <ul style="list-style-type: none"> Flexion \rightarrow make a fist wrist flexion against resistance \rightarrow positive test = pain on medial epicondyle \rightarrow common flexor wrist extension against resistance \rightarrow positive test = pain on lateral epicondyle \rightarrow common extensor 											
Neurovascular Exam	<ul style="list-style-type: none"> Median nerve \rightarrow tunnel's test (i.e. pressure over carpal tunnel of behind olecranon) \rightarrow cubital tunnel Ulnar Nerve \rightarrow Spread Fingers Apart And In Together [trauma = \rightarrow paraesthesia, numbness or limited strength] \rightarrow RING AND PINKY Anterior Interosseous Nerve (Median) \rightarrow Make Circle Between Thumb And Index Finger (i.e. thumb opposition) Posterior Interosseous Nerve (Radial) \rightarrow Spiderman's Web 											

Common conditions affecting the elbow

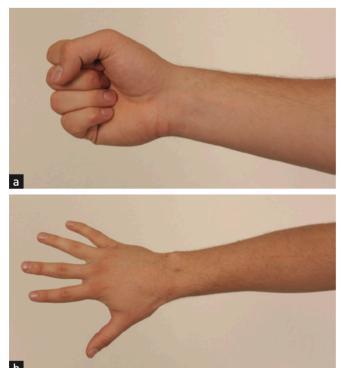
	PP	Sx	Exam / Ix	Rx
Elbow epicondylitis (medial)	<ul style="list-style-type: none"> golfer's or painter's elbow Overuse/degenerative 	<ul style="list-style-type: none"> Pain Weak grip (cannot shake hands) 	<ul style="list-style-type: none"> Pain at common flexor origin of medial epicondyle Wrist Flexion against resistance \rightarrow exacerbates pain of medial epicondylitis 	<ul style="list-style-type: none"> RICE, + activity mod Analgesia (NSAID) Physiotherapy. Orthotics (elbow braces or straps) Steroid injections
Elbow epicondylitis (lateral)	<ul style="list-style-type: none"> 'tennis elbow' Overuse/degenerative 		<ul style="list-style-type: none"> Pain at common extensor origin of lateral epicondyle Wrist Extension against resistance (Mill's and Cozen's test) \rightarrow exacerbates pain of lateral epicondylitis 	
Olecranon Bursitis "students' elbow"	Bursa Inflammation due to: <ul style="list-style-type: none"> mechanical strain / friction (Studying too hard) Trauma Inflammation (RA,gout) Infection (septic bursitis) 	<ul style="list-style-type: none"> Swollen, warm, tender fluid filled joint Septic = fever, very painful, signs of sepsis 	<ul style="list-style-type: none"> Tenderness at the tip of the elbow exposed to mechanical stress Joint aspiration (if infection suspected) before ABx <ul style="list-style-type: none"> M/C/S and crystal inspection Pus = infection, (if straw coloured = less likely) blood = trauma, infection, inflammation milky = gout, pseudogout 	Signs of septic arthritis <ul style="list-style-type: none"> Fluid aspiration ABx - flucloxacillin (clarithro = 2nd line) Admit to hospital (VBG, culture, IV ABx, IVF)
Pulled elbow (paediatrics)	<ul style="list-style-type: none"> Age: 1 - 4 years old Proximal radioulnar joint Radius pulled out of annular ligament 	<ul style="list-style-type: none"> Pain on elbow use 	<ul style="list-style-type: none"> extended elbow with pronated forearm NO bending of affected elbow no swelling, deformity or bruising of elbow or wrist 	Controversial <ul style="list-style-type: none"> PRP injections Extracorporeal shockwave therapy

HAND/WRIST Examination

General	<ul style="list-style-type: none"> Adequate exposure (roll up to shoulder) Difficulty undressing? What is your dominant hand? 										
LOOK Dorsal Palmar	Palmar Hand [SWEAT]	Dorsal Hand [SWEAT]									
	<ul style="list-style-type: none"> Scars Wasting (thenar, hypothenar, intrinsic muscles) Erythema/Palmar crease pallor Asymmetry Psoriasis – check behind the elbow Dupuytren's contracture (palmar thickening) 	<ul style="list-style-type: none"> Rheumatoid Nodules, Gouty tophi OA = Bouchard's nodes (PIP), Heberden's nodes (DIP) RA = Z-deformity of thumb: hyperextension of IP joint and fixed flexion and subluxation of MCP RA = swan neck: hyperextension of PIP + fixed flexion at DIP (tendon shortening) RA = boutonniere "Buttonhole" deformity: fixed flexion of PIP and extension of DIP RA = ulna deviation PsA = Dactylitis - Sausage shaped phalanges PsA = Nail pitting/ onycholysis (spoon-shaped) 									
	 <p>Ulnar deviation + Z deformity</p>	 <p>Swan Neck deformity (DIP)</p>	 <p>Boutonniere deformity of PIP & DIP</p>	 <p>Bouchard's nodes (PIP) Heberden's nodes (DIP)</p>	 <p>Dactylitis</p>						
FEEL I grab a pillow!!	<ol style="list-style-type: none"> Warmth? (septic or inflammatory arthritis) radial and ulna pulses Muscle atrophy (LMN lesions = median/ulnar nerve → scalloping in thenar (median)/hypothenar eminence) Thickened palm (Dupuytren's contracture) Joints (Wrist, CMC, MCP, PIP, DIP), ulna styloid, radial styloid, anatomical snuffbox = tenderness (scaphoid fracture) 			<p>Sensation) + R U OK? (radial, ulna AND median nerve distribution)</p> <ul style="list-style-type: none"> Use cotton wool and ask to close eyes 							
MOVE (active then passive)	Wrist <ul style="list-style-type: none"> F/E (dive, prayer) → MCP + IP (make fist and open and close) ulna deviation/radial deviation. 										
	Finger <ul style="list-style-type: none"> F/E → check FDS (PIP) and FDP (DIP) OR grasp fingers test Abd (ant. Interosseus - median) → splay fingers and don't let me push them together Ad (post. Interosseus - ulnar) → tissue paper 										
	Thumb <ul style="list-style-type: none"> F/E (make a 4 – say hi!) Abd (APB → Median → Supinate palm + Point thumbs to ceiling and don't let me push them down) opposition 										
	Function <ul style="list-style-type: none"> power grip (opening jar) pincer grip (pick up small item) do up a button 										
	<p>*Flexion = Median/ Ulnar, Extension = Radial nerve,</p>					<p>(a) Ulnar and radial deviation; (b) dorsal and palmar flexion</p>					
Special test "Extra tests"	<ul style="list-style-type: none"> Tinel's sign "tapping a tin" [median nerve]: gentle percussion over carpal tunnel with extended Phalen's test [carpal tunnel syndrome]: Prolonged (60 s) passive wrist flexion <ul style="list-style-type: none"> Positive Phalen's sign = tingling sensation in median nerve + numbness and weakness Finkelstein's test [De Quervain's tendonitis]: patient's thumb tucked into their fist → turn wrist into full ulnar deviation <ul style="list-style-type: none"> Positive Finkelstein's sign = Sharp pain in tendon sheath Ask to check feet <ul style="list-style-type: none"> Gouty tophi, toe crowding (RA) Eyes (uveitis) and CV + RESP Exam 										



Screening metacarpalphalangeal and interphalangeal movements.



(a) Active wrist extension; (b) active wrist flexion

(a) Extension; (b) abduction; (c) adduction; (d) opposition

(a) Flexor profundus; (b) flexor superficialis

NERVE PATHOLOGIES

Wrist extensors	Wrist flexors	Finger extensors	Thumb extensors
FDS - extrinsic	FDP - extrinsic	FPL - extrinsic	
Intrinsic	Palmar/ dorsal Interossei muscles	Lumbricals	
PIP test - FDS tendon [median]	DIP test - FDP tendon [median - AIN]	FDS + FDP	
FDP [flexible joint?]	Ulnar Nerve [denervates lumbricals with no MCP extension]	Volkmann's ischaemic contracture [causes compartment syndrome]	
Wrist drop	Unable to straighten fingers	Loss thumb opposition	Inability to reach around large objects
RADIAL nerve (C5-T1)	MEDIAN nerve (C6-T1) ➤ Anterior interosseous nerve	ULNAR nerve (C8, T1) ➤ Loss of thumb adductor (flex IP joint via FPL to compensate)	17

COMMON conditions affecting the Hand and Wrist

	PP/ ASSOC.	RISK FACTORS	SX	IX	MANAGEMENT	
Repetitive strain injury	Umbrella term for soft tissue irritation, microtrauma or strain due to repetitive activity	<ul style="list-style-type: none"> Poor posture Assembly line worker Scrolling smartphone, power tool vibration 	<ul style="list-style-type: none"> Replicable Pain, ache, cramp, numbness of joint 	<ul style="list-style-type: none"> XR – check for OA USS – RA?, RC tear? Bloods- CRP, RF 	<ul style="list-style-type: none"> RICE Analgesia PT Steroid injections 	
Carpal tunnel syndrome 	Compression of median nerve <ul style="list-style-type: none"> Unilateral (trauma) Bilateral (systemic) 	<ul style="list-style-type: none"> Repetitive strain RA Diabetes Acromegaly Hypothyroid Pregnancy Obesity 	<ul style="list-style-type: none"> Pain/ numb / paraesthesia in median dermatome (thumb, index and lateral half of ring finger) "pinky unaffected" Weakness to APB, OP, FPB (thenar muscles) Wake up at night No fine finger movement 	<ul style="list-style-type: none"> Tinel's sign: Phalen's test Nerve conduction studies (confirm Dx) 	<ul style="list-style-type: none"> Rest + activity mod (shake hands to warm up) Wrist splints Steroid injections Surgery (open vs endoscopic) – release flexor retinaculum pressure 	
Dupuytren's contracture 	Thickened palmar fascia causing fixed flexion contractures and reduced ROM > unknown MoA	<ul style="list-style-type: none"> Age FHx (aut. dom.) Male Smoking + EtOH Epilepsy T1DM Manual labour (jackhammers) 	<ul style="list-style-type: none"> Asymptomatic Hard nodules on palm Ring finger most affected (index least likely) 	<ul style="list-style-type: none"> Table top test – cannot flatten hand on table 	<p>Conservative (watch and wait)</p> <p>If symptomatic → surgery:</p> <ol style="list-style-type: none"> 1. Needle fasciotomy – divide and loosen cord causing contracture 2. Dermofasciotomy – removing abnormal fascia and skin (may need skin graft) 	
De Quervain's tenosynovitis "mummy's thumb"	Swelling and inflamed tendon sheaths (APL and EPB)	Repetitive strain injury 	<ul style="list-style-type: none"> APL – abduct thumb, wrist (insert 1st MCP of thumb) EPB – abduct thumb, wrist (insert proximal phalanx) Pain and paraesthesia 	<ul style="list-style-type: none"> Finkelstein's test (Eichhoff's test) 	<ul style="list-style-type: none"> Rest Activity mod (PT) Analgesia Splints (restrict movement) steroid injection surgery (last line = release pressure from extensor retinaculum) 	
Trigger finger	<ul style="list-style-type: none"> Tender palpable nodule along 1st annular pulley at MCP joint Nodules gets stuck at pulley when extended from flexed position 	<ul style="list-style-type: none"> 40-50s Women T1DM > T2DM 	<ul style="list-style-type: none"> Painful tender around MCP palmar surface Stiff movement Crepitus Fixed flexion Improved during day 	Clinical diagnosis	<ul style="list-style-type: none"> Rest + activity mod (shake hands to warm up) Wrist splints Steroid injections Surgery (release A1 pulley) 	
Ganglion cyst	Sacs of synovial fluid from tendon sheath or joints (usu. in wrist or fingers)	None	<ul style="list-style-type: none"> Ranges in size (0.5-5cm) Transilluminates Well-circumscribed 	<ul style="list-style-type: none"> XR – normal bones USS – exc. crystal arthropathies 	<p>Conservative (watch and wait)</p> <p>If symptomatic → surgery:</p> <ul style="list-style-type: none"> Needle aspiration (high rate of recurrence) Surgical excision (low recurrence rate but infection and scarring risk) 	
Osteoarthritis (inc. CMC jt) 	<ul style="list-style-type: none"> Athletes Household cleaners Builders/manual workers 	Progressive degeneration of articular cartilage in synovial CMC joints of through wear and tear	<ul style="list-style-type: none"> Painful ache Thickened joint Loss of space Tenderness 	<ul style="list-style-type: none"> Positive grind test – pain on loading Cannot pinch or grip Osteophytes Joint space narrowing 	<ul style="list-style-type: none"> WEIGHT LOSS Weight bearing exercise NSAID w/ PPI IA steroid injections Joint replacement – if severe impacts on ADLs 	
Other	Mallet finger 	Fixed DIP joint flexion while extensor tendon contracted (cannot fully extend)	Skier's thumb 	<ul style="list-style-type: none"> Forced lateral stress to thumb MCP joint Cannot grasp objects 	FDP rupture "jersey finger" 	<ul style="list-style-type: none"> Closed rupture of FDP Tendon – FDP maximally contracted Full passive DIP flexion

Fractures Description

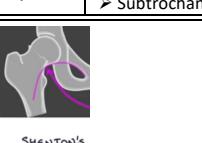
Steps		Description	
Description		Who (correct pt), what (correct limb), when (time), why and where	
Type		Complete (all the way through bone) <ul style="list-style-type: none"> Transverse = straight across bone Oblique = oblique line across bone Spiral = corkscrew Comminuted → 2 fracture parts Salter harris = fracture of growth plate 	
Location		Diaphysis VS metaphysis VS epiphysis + bone involved	
Displacement		Angulation (dorsal/volar) VS translation VS rotation VS distraction / impaction (w/ reference to proximal)	
Other		Jt involvement Is jt surface involved or fracture extends into joint Another fracture? Check other sites – X-ray ABOVE and BELOW fracture Bone lesion Pathological fracture e.g. MM, mets	
Example		<ul style="list-style-type: none"> Transverse fracture of mid-to-distal third of right tibia. No significant angulation BUT translation Spiral fracture of distal 1/3rd of left tibia. Mild varus angulation, lateral translation and angulation. Fracture does not extend to jt surface. Buckle fracture of left distal radius w/ no significant displacement 	

Fracture Healing



Aim = promote healing	1. Adequate BV supply	Blood flow substantially increases at fracture site (peaks after 2 wks)	What factors delay bone healing? <ul style="list-style-type: none"> Advanced age Reduced mobility (no load) Smoking & EtOH Meds (e.g. steroids, quinolones, RT, chemo, bisphosphonates, NSAIDs) Anaemia + diet + osteomalacia <ul style="list-style-type: none"> Vit D, Ca, Fe deficiency DM Immunocompromise (HIV) Gastric bypass (poor Ca absorption)
	2. Adequate mech. Stability	<ul style="list-style-type: none"> early stability promotes revascularisation loading promotes greater callus formation in 1st mth 	
Mechanism	Inflammation	<ol style="list-style-type: none"> Haematoma induced coagulation cascade creates platelet rich injury site → cytokines released Vasodilatation + recruitment of WCC → increased blood flow 	What factors delay bone healing? <ul style="list-style-type: none"> Advanced age Reduced mobility (no load) Smoking & EtOH Meds (e.g. steroids, quinolones, RT, chemo, bisphosphonates, NSAIDs) Anaemia + diet + osteomalacia <ul style="list-style-type: none"> Vit D, Ca, Fe deficiency DM Immunocompromise (HIV) Gastric bypass (poor Ca absorption)
	Repair	<ol style="list-style-type: none"> VEGF → Neoangiogenesis (+++ osseous blood supply) Primary soft callus forms within 6 weeks → fibrocartilage matrix 	
	Remodelling (longest time)	<ol style="list-style-type: none"> woven bone → mineralisation of matrix → lamellar bone → Wolff's law (stress + strain) Full fracture healing within 12 weeks Adults and lower limb bones 2x longer to heal 	
Primary vs Secondary Healing	PRIMARY (direct) BONE HEALING		SECONDARY (indirect – callus)
	Indication	Little Strain is < 2% [i.e. need strong stability]	Some strain 2%-10% [i.e. relative stability] Fractures that are not rigidly fixed
	Repair time	Months to year	<ul style="list-style-type: none"> Fairly rapid - weeks
	Process	Creeping Substitution = cutting cones OR haversian system <i>Healing fracture by forming numerous 2^o osteons either through:</i> <ol style="list-style-type: none"> Contact healing (direct contact) Gap healing (partially fill w/ woven bone that remodeled into lamellar) 	Endochondral ossification <ul style="list-style-type: none"> Larger gaps = filled with fibrous tissue before undergoing secondary ossification
	Rx	<ul style="list-style-type: none"> Dynamic Compression Plating <ul style="list-style-type: none"> +++ stability, minimal strain = 1^o healing 	<ul style="list-style-type: none"> Bracing & Cast Immobilisation External Fixation & bridge plating - ORIF Intramedullary (IM) Nailing

FRACTURE TYPES (RESUS → REDUCE → RETAIN → REHAB)

FOREARM		DISTAL RADIUS		NOF		TIBIA		ANKLE/FOOT																
Cause	Falls (mainly)	Most common fracture of upper extremity (fall from height, MVA or sports injury, OLD LADY)		<ul style="list-style-type: none"> OP, bisphosphonate, denosumab usage Poste-meno, smoking, 		<ul style="list-style-type: none"> Falls (mainly), direct blow, sports related RF: Diabetes, HIV, smoking 		<ul style="list-style-type: none"> Axial vs rotational loading RF: high BMI, fragile women 																
Types	<ul style="list-style-type: none"> Monetggia (ulna #) Galeazzi (radius #) Gru__some Murder 		<ul style="list-style-type: none"> Colles - FOOSH = distal radius # w/ dorsal angulation Smith's = distal radius # w/ volar angulation Barton's = intra-articular distal radius # 		Shortened, ER and abducted leg <ul style="list-style-type: none"> Intra-capsular Extra-capsular 		Isolated malleolar – 60% Bimalleolar – 25%, trimalleolar – 5-10% Open # – 2%																	
Non-Op	<ol style="list-style-type: none"> Reduction + casting Functional brace Early mobilisation 		<ul style="list-style-type: none"> All displaced fracture = closed reduction Cast immobilisation – if minimally displaced 		40% return to own home > Vit D, Ca, bisphosphonates, denosumab																			
Rx Goals	<ol style="list-style-type: none"> Stop pain Restore anatomy (e.g. length/curvature/rotation of bone) and integrity of interosseous space +++ Stabilise + ROM. Maintain normal neurovascular function Prevent infection 																							
Reduce	<table border="1"> <tr><td>Oblique/ spiral</td><td>Lag screw</td></tr> <tr><td>Transverse</td><td>Compression plate</td></tr> <tr><td>Comminuted</td><td>Interfragmentary screws</td></tr> <tr><td>Monetggia</td><td>Compression plate</td></tr> <tr><td>Galeazzi</td><td>K wires</td></tr> </table>		Oblique/ spiral	Lag screw	Transverse	Compression plate	Comminuted	Interfragmentary screws	Monetggia	Compression plate	Galeazzi	K wires	External fixation w/ plates + pins > ORIF – dorsal or volar plating, fragment specific plating		<table border="1"> <tr><td>Intra-capsular</td><td> <ul style="list-style-type: none"> Undisplaced < 60 → cannulated screws Displaced > 60 (grade 3 and 4) → THR </td></tr> <tr><td>Extra-capsular</td><td> <ul style="list-style-type: none"> Intertrochanteric → dynamic hip screw Subtrochanteric → IM nail </td></tr> </table>		Intra-capsular	<ul style="list-style-type: none"> Undisplaced < 60 → cannulated screws Displaced > 60 (grade 3 and 4) → THR 	Extra-capsular	<ul style="list-style-type: none"> Intertrochanteric → dynamic hip screw Subtrochanteric → IM nail 	Femur/tibial shaft IM nail Open/closed # External fixation Compartment syndrome External fixation		Weber B & C (disrupted syndesmosis) <ul style="list-style-type: none"> LM = Lag screw + neutral plate MM = cancellous screw FIBULA = Syndesmotic stabilisation Open # <ul style="list-style-type: none"> IV ABx + tetanue Irrigate + debride ORIF 	
Oblique/ spiral	Lag screw																							
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Retain (non-op)	<table border="1"> <tr><td>Clavicle</td><td>Broad arm sling</td></tr> <tr><td>Proximal + mid humerus</td><td>Collar and cuff sling</td></tr> <tr><td>Distal humerus</td><td>Collar and cuff + elbow backslab</td></tr> </table>		Clavicle	Broad arm sling	Proximal + mid humerus	Collar and cuff sling	Distal humerus	Collar and cuff + elbow backslab	<table border="1"> <tr><td>Colles #</td><td>Closed manipulation under haematoma block (aspirate + give 10mL xylocaine) ➤ backslab</td></tr> <tr><td>Scaphoid</td><td>Future splint or thumb spica</td></tr> </table>		Colles #	Closed manipulation under haematoma block (aspirate + give 10mL xylocaine) ➤ backslab	Scaphoid	Future splint or thumb spica					Lateral malleolus (weber A) Below knee cast or aircast boot or stirrup brace					
Clavicle	Broad arm sling																							
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Rehab	<table border="1"> <tr><td>Physio</td><td>Non-weight bearing</td></tr> <tr><td></td><td>➤ Legs do not touch floor ➤ ≈ 6wks for unstable # and after plate fixation</td></tr> </table>		Physio	Non-weight bearing		➤ Legs do not touch floor ➤ ≈ 6wks for unstable # and after plate fixation	→ Toe-touch weight bearing Toes touch floor to balance BUT not supported by any weight		→ Partial weight bearing < 50% of body weight		→ Weight bear As tolerated		→ Full weight bearing After intramedullary nails, external fixations, jt replacements											
Physio	Non-weight bearing																							
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Comp.			<table border="1"> <tr><td>General</td><td>Specific</td></tr> </table>		General	Specific	Specific ED																	
General	Specific																							
Immediate Haemorrhage, arterial damage,		tendon/ligament or neurovascular damage,		Fat embolus																				
Early (few wks) Wound infection – skin edge necrosis ➤ chest infection, ➤ VTE,		➤ prosthesis infection ➤ anatomical loss of position/fixation,		Compartment Syndrome (urgent fasciotomy) → compartment pressure within 30mmHg of DBP ➤ 6 P's → pain, palpable swelling, paraesthesia (early), paralysis and absent peripheral pulse (late) ➤ Irreversible muscle and nerve damage → AKI (PCT necrosis) + poikilothermia																				
Late (mths-years) Neuropathic pain		➤ Malunion (incorrect union) ➤ Non-Union (cannot heal) – failure to unite after 6/12 with no signs of callus/healing for 3 consecutive mths ○ E.g. <i>hypertrophic, oligotrophic, atrophic</i> ➤ Delayed Union – failure to unite within 6/12 but may unite soon ➤ OA,		Avascular Necrosis (retrograde blood supply) 1) scaphoid, → radial artery 2) head of femur → medial and lateral circumflex artery (more common in intracapsular NOF #) 3) neck of talus																				

General work up:
➤ FBC, EUC, LFT
➤ COAGS, Group + save
➤ ECG
➤ CXR + X-ray Imaging – AP/PA/Lateral of jt
General plan:
• ABCDE – O2, BP, IVF /hydration
• 3-point contact necessary to maintain close reduction
Analgesia (before repair)
• Haematoma block (aspirate haematoma + inject 10mL xylocaine)
• Bier's block = double tourniquet proximal + Venous system filled with local anaesthetic

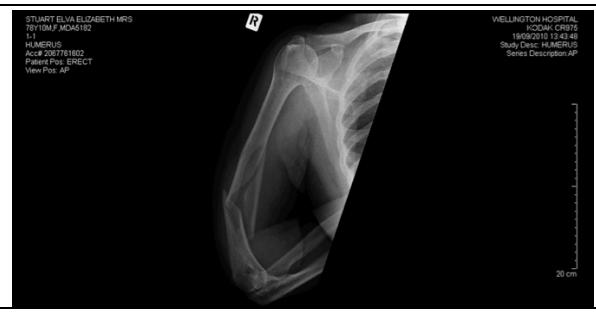
Simple fracture work up:

No fracture	RICE
Fracture ONLY	Cast immobilise
Fracture + Dislocated	Reduce + Splint
Compound #	ED surgery
ACUTE #	splint or backslab (allow for swelling)
1wk post-injury	full circumferential cast (better immobilization)

External fixation	<ul style="list-style-type: none"> Contaminated open wounds or #, soft tissue injury
Internal fixation	<ul style="list-style-type: none"> Comminuted/displaced #, intra-articular # IM Nail – long bone # IM K-wire – temp. fixation for 4 wks (small bones) Extramedullary (plates screws) bridge <i>communite</i> #, compress <i>simple/transverse/oblique/spiral</i> #, support areas of thin cortex or tension side of #
Conservative Immobilise	<ol style="list-style-type: none"> Splints/backslabs (non-circumferential) – plaster/fibreglass Allows for swelling and protect bony prominence Casts (circumferential) – plaster/fibreglass Brace (support but allow ROM) Sustained traction e.g. collar & cuff, buddy strap, traction splint

Post-op considerations	Rx # cause
1. Swelling → RICE → early mobilisation	1. OP, fall, cancer
2. Smoking cessation → faster wound healing	2. delirium (hypoxia, infection, drugs,
3. Analgesia → avoid NSAIDs	3. Hypoxia – stroke, STEMI, DVT/PE
4. VTE prophylaxis	4. Dehydration, AKI
5. ABx prophylaxis → open #	

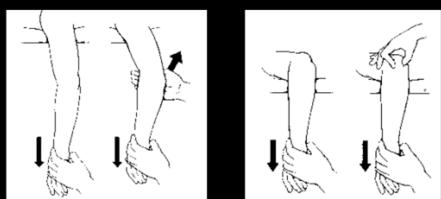
Case 1		Case 2		Case 3		Case 4	
Case	<ul style="list-style-type: none"> IA 25 yo male Fit/Healthy Non-smoker Unemployed Direct Blow to Left Lower Limb whilst Playing Rugby 	<ul style="list-style-type: none"> JA 67 yo female Out on the town drinking Getting out of a taxi and felt like she rolled her ankle. Pain and unable to weight bear on the left ankle. BG – Under investigation for palpitations 		<ul style="list-style-type: none"> IS 45 yo female Slipped on tiled kitchen floor whilst wearing stockings 		<ul style="list-style-type: none"> TM, 19 yo male in High speed MVA Head Injury → SDH, SAH, DAI GCS 3, intubated and sedated Multiple stable spinal injuries Bilateral pulmonary contusions Splenic laceration (minor) – treated non-operatively 	
O/E	<ul style="list-style-type: none"> Immediate pain/Swelling/ Mild deformity NV Intact Comfortable Obvious Contusion - No Skin break – Swollen – Tender No marked Deformity 	<ul style="list-style-type: none"> Painful swollen left leg above the ankle - tender to palpate distal tibia. Tender around the proximal fibula. Neurovascular intact. Nil other points of bony tenderness. 		<ul style="list-style-type: none"> Lower leg deformed Approx. 1.5cm wound over anteromedial aspect of lower leg Spike of bone exposed, wound clean Calf compartments soft, non tender Distal neurovascular status normal Wound washed out with 1L of normal saline, betadine 		<ul style="list-style-type: none"> Left leg – large open wound antero-medially Bone protruding through skin 3cm Elliptical wound 3cm x 9cm No obvious contamination Neurovascular intact 	
X-Ray							
	<p>Treated with an IM nail</p> <p>□ Discharged 3/7 following injury without immediate complication and awaiting follow-up</p>				<p>Leg deformity corrected and AK backslab applied</p> <ul style="list-style-type: none"> IM nail + primary closure Wound check 3/7 later in theatre Edges debrided, thoroughly irrigated and closed Discharged day 12 post injury + Review 6/52 Progress to weightbearing, awaiting 12/52 follow-up 		

	
<p>Mrs Stuart R humerus erect X-ray taken 13:43 showing a spiral fracture in mid to distal 1/3rd humerus diaphysis with butterfly fragment and displacement and posterior angulation concerned with radial nerve damage.</p>	<p>Salter harris type 2 (left) and salter harris type 3 (right) → triplane fracture (overall salter harris type 4 as both epiphysis and metaphysis involved)</p>

CLASSIFICATION SYSTEMS + MX

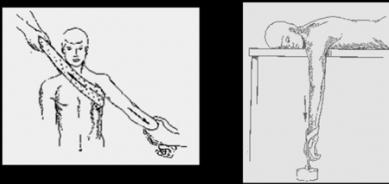
Common Closed Reductions

- **Elbow Dislocation** - traction, flexion, and direct manual push



Common Closed Reductions

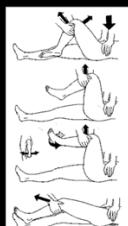
- **Shoulder Dislocation** - relaxation, traction, gentle rotation if necessary



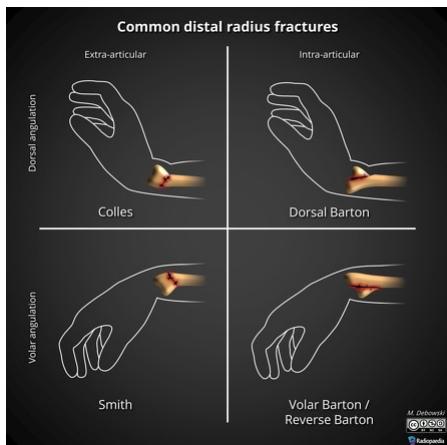
Common Closed Reductions

Hip Dislocation

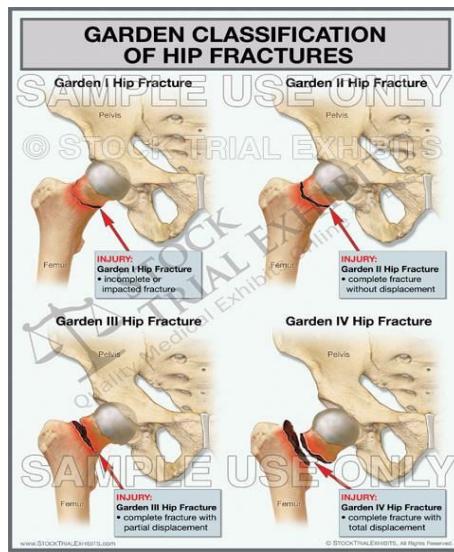
- Relaxation, flexion, traction, and rotation
- Gentle and atraumatic



Relocation should be palpable and permit significantly improved ROM. This often requires very deep sedation.

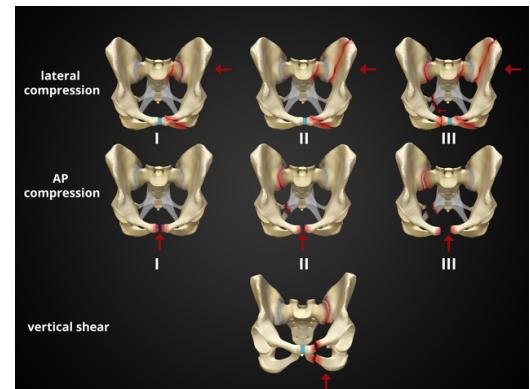


- **Smith (fall on flexed wrist)** = ORIF
- **Barton** (dorsiflexed wrist + pronated forearm – **shearing injury**) = ORIF + buttress plate
- **Chauffeur's (Radial styloid)** = ORIF



Garden classification is used for intra-capsular neck of femur fractures:

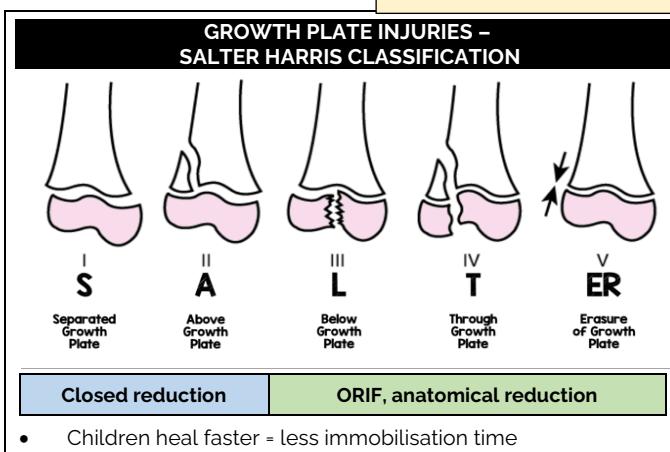
- **Grade I** – incomplete fracture and **non-displaced**
- **Grade II** – complete fracture and **non-displaced**
- **Grade III** – partial **displacement** (trabeculae are at an angle)
- **Grade IV** – full **displacement** (trabeculae are parallel)



Pelvic Fractures (Young and Burgess classification)

- AP compression (pubic diastasis)
- Lateral compression (pubic rami)
- Vertical shear

NOTE: Pelvis is a ring → hence, If pubic rami fractures → also sacral fracture

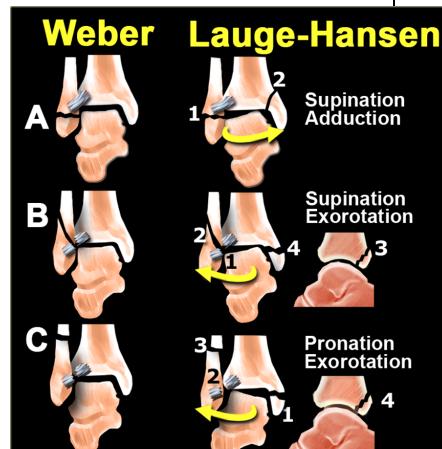
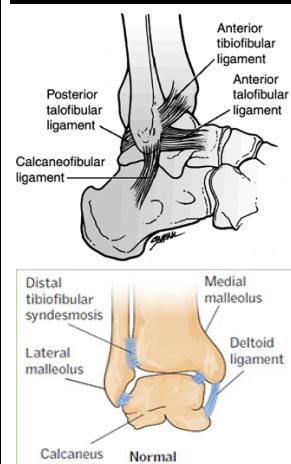


Closed reduction

ORIF, anatomical reduction

- Children heal faster = less immobilisation time
- Restore length, alignment and rotation where possible

Ankle fracture Classification



Management of growth plate fractures:

- **Type 1 and 2** (most common) – **DOES NOT** disrupt **epiphyseal zone and synovial region (good)** → only need closed reduction, immobilisation
- **Type 3 and 4 (unstable)** → disrupt proliferative site → leading to angular growth → needs anatomic reduction, ORIF

Management of ankle fractures:

- **Weber A** – benign fracture (avulsion injury = self-heal)
- **Weber B** = spiral configuration (begins at tibiotalar jt line) = any displacement or talar shift in the jt (i.e. widening it space) → surgery
- **Weber C** = rips through both ligaments (twisting) → surgery

*ankle fractures → instability of ankle

Weber C → drunk women @ 3AM and non-weight bearing

Gustillo Classification for open fractures

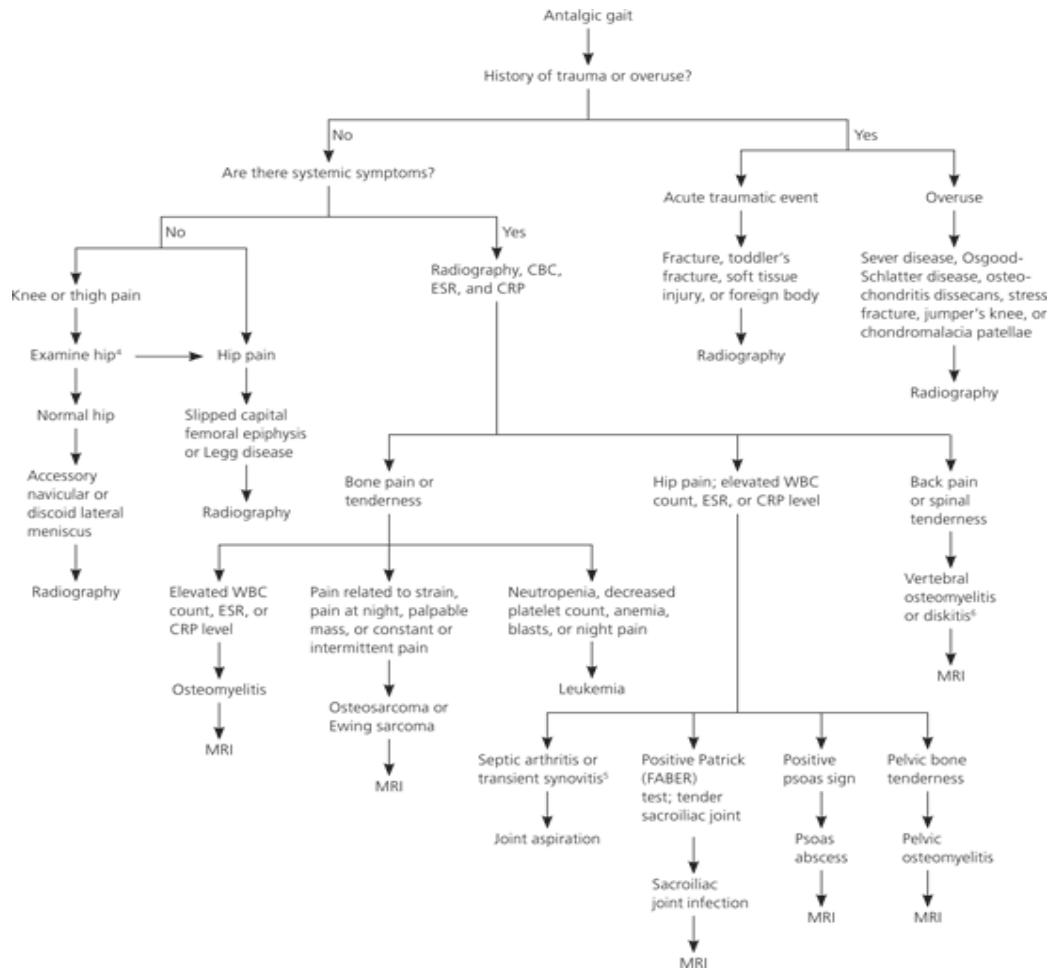
	I	II	III-A	III-B [high velocity]	III-C (vascular)
Energy	Low	Moderate	High	High	High
Wound Size	≤ 1 cm	1-10 cm	usually >10 cm	usually >10 cm	usually > 10 cm
Soft Tissue Damage	Minimal	Moderate	Extensive	Extensive	Extensive
Contamination	Clean	Moderate contamination	Extensive	Extensive	Extensive
Infection rate	0-2%	2-7%	7%	10-50%	25-50%
Fracture Pattern	Simple fx pattern with minimal comminution	Moderate comminution	Severe comminution or segmental fractures	Severe comminution or segmental fractures	Severe comminution or segmental fractures
Periosteal Stripping	No	No	Yes	Yes	Yes
Skin Coverage	Local coverage	Local coverage	Local coverage	Requires free tissue flap or rotational flap coverage	Typically requires flap coverage
Neurovascular Injury	Normal	Normal	Normal	Normal	Exposed fracture with arterial damage that requires repair [Any vascular compromise even if appears Grade 1 is automatically a grade IIIc]
Antibiotics	1 st generation cephalosporin (e.g. cefazolin)	Add gentamycin (aminoglycoside)	1st generation cephalosporin = gram +ve coverage Add gentamycin (aminoglycoside - gram -ve coverage) Penicillin (if heavily contaminated or concerned of farm injury)		

NB:

- Most **accurate way** to grade open fractures is by intra-operative examination after washout
- **Grade III** - Automatically if MVA, farm injury (contamination), Gunshot Wound, Segmental Fracture.
- ***Tetanus booster not up to date (in last 5 years) → very high risk of complications

Hypertrophic	Oligotrophic	Atrophic
<ul style="list-style-type: none"> • Good vascular supply but inadequate stability (>10% strain) • Viable bone ends • Large callous without bridging bone with fibrocartilage in between <ul style="list-style-type: none"> ○ Elephant foot (lot of callous) ○ Horse hood (moderate callous) • Managed with ORIF (open reduction internal fixation) 	<ul style="list-style-type: none"> • Good stability but inadequate Blood supply • No callous • Viable bone ends • Managed with internal fixation may need bone graft 	<ul style="list-style-type: none"> • Inadequate stability and Blood supply • Loss of viable bone ends = pencilled • Rx: rigid internal fixation and bone graft (autologous iliac crest - osteoconductive)
Infected non-union <small>[low healing rate if not removed]</small>		Pseudoarthrosis
<ul style="list-style-type: none"> • Often assoc. with pseudoarthrosis • Staging essential • Need for full debridement, ABs and vacuum dressing • Beware of sig. bone and soft tissue loss 		<ul style="list-style-type: none"> • Non-union with fluid-filled cavity (assoc. with infection) • "New joint" at fracture site + peanilles motion • Rx: = excise pseudoarthrosis → rigid fixation/compression and bone graft

DDx for antalgic gait



ELECTIVE JOINT REPLACEMENT

Indication	Types	Main types of joint replacement		
For joint pain that fails previous Mx (analgesia, steroid PT)	<ul style="list-style-type: none"> Total joint replacement – replacing both articular surfaces of the joint Hemiarthroplasty – replacing half of the joint (e.g., the head of the femur in the hip joint) Partial joint resurfacing – replacing part of the joint surfaces (e.g., only the medial joint surfaces of the knee) 	Total Hip Replacement <i>lateral incision over the outer aspect of the hip</i>	Total Knee Replacement <i>vertical, anterior incision</i> on anterior knee + patella rotated out of the way	Total Shoulder Replacement anterior incision along deltoid
<ul style="list-style-type: none"> OA Fractures Septic arthritis Osteonecrosis Bone tumours RA 		<ul style="list-style-type: none"> head of the femur removed metal or ceramic replacement (ball + shaft, acetabulum and spacer) uncemented (for tighter fit) or cemented stem shafts 	<ul style="list-style-type: none"> Articular surfaces of femur and tibia are removed. 2x new metal surfaces and spacer 	<ul style="list-style-type: none"> head of humerus removed metal or ceramic replacement (ball + shaft, glenoid and spacer) <p>Nb: reverse TSR → sphere in glenoid with cup at head of humerus</p>

Before Surgery

- X-rays +/- CT or MRI scans
- Pre-operative assessment (pre-op)
- Consent for surgery - mark correct limb
- Bloods** (inc. **group + X-match**)
- Med changes** (e.g., stop anticoagulation)
- VTE** assessment
- NBM** before surgery

During Surgery

- GA needed or **spinal anaesthetic** may be used for lower limb surgery.
- Prophylactic ABx** BEFORE procedure to reduce the risk of infection.
- TXA** - minimise blood loss during the procedure.

AFTER Surgery

- Analgesia**
- PT** - to guide when and how to mobilise
- VTE prophylaxis** (LMWH, aspirin, DOAC, stockings)
- 28 days post THR
- 21 days post TKD
- Post-operative XR** (correct location), **FBC** (anaemia)
- Monitoring for complications** (e.g., DVT or infection)

General risks

- Anaesthetic risks
- Pain
- Bleeding
- Infection
- Neurovascular damage
- Joint dislocation or reduced ROM
- VTE
- Fracture during procedure

Specific risks

- Prosthetic infection (very bad!) – 1% of joint replacements – usu. **Staphylococcus aureus**
- Prolonged operative time
- Obesity
- Diabetes

Management of prosthetic infection

- Dx**
 - XR,
 - blood (raised CRP)
 - blood cultures M/C/S
 - joint aspirate M/C/S
- Repeat surgeries** – joint irrigation, debridement or complete replacement
- Prolonged Abx**