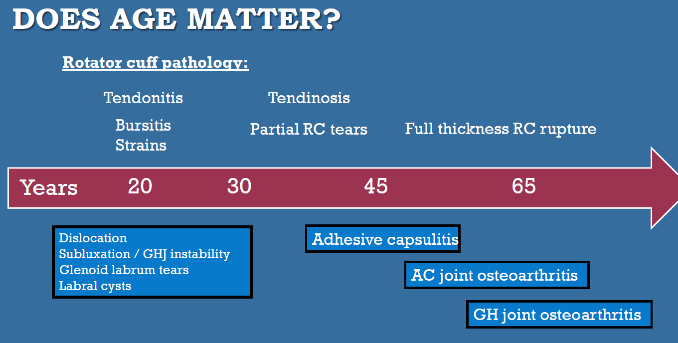
**Final revision MSME 706 (2022)**

**Module 1. Shoulder revision.**

**Differential diagnosis**

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| Common causes of shouder pain | Less common | Not to missed |
| * Rotator cuff: strain, tendinopathy, * GH: dislocation, instability, labral tear, * Referred pain * Clavicle #, * ACJ sprain, * Levator scapulae syndrome * Other muscle tears: Pectoralis major, long head biceps * Brachial plexus: neuropraxia, neuritis . | * Rotator cuff: tear, calcific , tendinopathy * Adhesive capsulitis * Biceps: tendinopathy * Nerve entrapment: Suprascapular, LTN * #: scapula, neck of humerus * Stress # coracoid process | * Bone tumours * Viscera Refererd pain * Thoracic outlet syndrome * Axillary vein thrombosis . |

*Non shoulder DDx:* - thoracic outlet syndrome; Disorders of the aortic arch; Carpal tunnel syndrome; ulnar nerve neuropathy; Brachial plexus injury; cervical spondylosis;; Acute cervical disc herniation; Brachial neuralgia

**Shoulder anatomy**

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| Bone | Joint | Functional space | Ligament /muscle | Rotator cuff | Movement of the shoulder |
| Humerus  Scapula: *glenoid, acromion*  Clavicle | **1.GHJ:**  -ball & socket, synovial, glenoid cover 1/4 HH  -HH: retroverted 20°, upward *inclincation45*°  -inherently unstable: shallow, wide ROM  **Static stabilizer**  1.labrum *(↑concavity, better fit, -ve pressure*),  2.GH lig.inferior portion🡪 anterior stability;  Ant. Midd. Infe portion🡪thicken the capsule  3. CH lig: vertical stability  4. GH capsule: superior portion🡪vertical Sta.  5. -ve intraarticular pressure.  **Dynamic stabilizer**  - Rotator cuff: ant. Sup, post. Stability  - Other muscles: deltoid  2**. ACJ** (Acromial clavicular Joint)  - synovial joint, wedge-shaped articular disc  - lined with fibrocartilage  - **Stabilizer**:  a) *superior, inferior AC ligament* ( avoid *axial rotation, posterior translation*),  b) *capsule* ( *AP stability*),  c) *CC lig* ( vertical)  - ROM: rotation 35°, translation 3.5mm.  3. Sternoclavicular | **Subacromial space**  - clinically important space.  - frequent site of shoulder pain  - **SA bursa**: covers HH anteriorly, superiorly, laterally, sl posteriorly🡪 provides smooth gliding soft tissue surface  Scapulothoracic space  - functionally as a joint but does not have joint structure  - Allowing gliding movements between 2 soft tissue plains  - rarely a source of symptoms | CC: coraco-clavicular  CA: coraco-acromial  CH: coraco-humeral Lig  AC: acromio-clavicular lig  GH lig: glenohuermal lig  -  **Shoulder girdle muscles**  - Deltoid  - Pec major, pec minor  - Serratus anterior  - Trapezius  - Rhomboid major, minor  - levator scapulae  - latissimus dorsi | Supraspinatous  Infraspinatus  Subscapulas  Teres minor  **Function:**  1. **reinforce** ant. Sup. Post aspect of GHJ.  2. **stabilize** HH🡪 draw it in towards glenoid fossa (providing a fixed fulcrum for abduction of the arm about the HH)  **Rotator cuff syndrome**  -SS impingement, tendinitis  -rotator cuff tear  -acute calcific tendinitis  - biceps tendonitis/rupture  **Exam for impingement**  Hawkins-Kennedy  (not specific, but sensitive)  Neer’s test | Flexion 180° (167°F, 171°M) Extension 60°,  ABD 180°,  ER 60°  IR: inferior border of scapula  **Muscle couple to abduction**  **- deltoid + rotator cuff balance important** (*RC tear in elderly 🡪 minimal sx, in young 🡪significant sx*)  - **↓muscle tone**🡪 HH sublux infer  - *Scapulohumeral rhythm*: *complex synchronous coordination GH, and scapulothoracic motion*  1. initial30°: GH  2. From 70°: GH+ Scapulo-thoracic ( scapular rotation) ,  3. GH: ST ratio 2:1  Muscle for ABD:  deltoid, RC, pec Major, biceps.  Muscle for ADD:  Pec major, latissimus dosi. |

**Shoulder test**

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| Condition | Test | Overall impression | Κ (kappa score) | Sensitivity | Specificity | Odd ratio | LHR ( likely hood ratio) |
| Subacromial impingement | Hawkins-Kennedy | Low sen, low spec. (ACJ also +ve) | 0.39 | 0.55-0.8 (high) | 0.29 (poor) |  |  |
|  | Neer test | Low sen. Low spec | 0.4 | 80% ( high) | 0.3-0.6 (poor) |  |  |
|  | Painful arc | Pain at 60-120°abduction, less pain with ER |  | 0.53 | 0.76 |  |  |
|  | Empty can test ( Jabe’s ) |  |  | 0.86 ( high) | 0.14 (poor) |  |  |
|  | Cross-body adduction |  |  |  |  |  |  |
|  | Yocum test |  |  |  |  |  |  |
|  | Resisted ER |  |  |  |  |  |  |
| Rotator cuff tear | Drop arm test |  |  | 0.12 | 0.90 |  | +LHR :2.7 (FTT), 0.6 ( PT) |
|  | External rotation lag |  |  |  |  |  | +LHR: 7.2 |

**Common shoulder pain conditions**

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| Condition | Aetiology | Pathology | History | | Signs | Investigations | Management |
| Frozen shoulder | *Uncertain : +/-trivial trauma*  2-10% population  F>M (70%)  Mean age 40-60y.  Self-resolve after 18m.  40% mild-mod persistent Sx | Definition:  -*Gradual development of global restriction of GHJ (Active & Passive)*.  -due to Fibrovascular inflammation (*active fibroblastic, myofibroblastic proliferation*)  Risk:  *DM, thyroid dz, RC injury*, immobilization, autoimmune ds, RA, stroke, Dupuytren’s, Parkinson’s | 1. May follow trivial trauma  2. Pain: shoulder and arm. Gradual increase. Cant sleep on affected side  3. Global stiffness in all direction: esp. GH ER (anterior GH capsule thickening early stage)  4. Overlapping 3 stages  - Mean duration: 8m (1-36m) (*full resolution 4-10y*)  - Often bilateral 35%  - Classification: idiopathic, primary, secondary.  - Stages: I: freezing, II: frozen, III: Thawning | | ↓active & passive ROM  Slight wasting  DDx:  -Infection  -post-traumatic stiffness  -diffuse stiffness  -reflex sympathetic dystrophy | X ray: normal  exclude other pathology (*osteopenia*)  USS:  Thickened CH Lig ( *high Sen, spec*).  Hypoechoic region with ↑ vascularity in rotator interval  Thick inferior GH capsule  *MRI:*  Reliable, capsular thickening, obliteration of sub-coracoid fat triangle | **Stage I**: analgesia, GHJ CSI, physio, manual therapy  **Stage II:** stretch, exercise, Hydrodilation, MUA (*Manipulation under GA*), arthroscopic release.  \* *Oral steroids improve pain, ROM*  *\* CSI faster pain relief, ROM but similar 24 weeks outcome.* \* *stretches early don’t change course*.  \* NSAIDs no better than placebo  *\* more intense physio🡪 poorer outcome*  \* hydrodilatation: better score at 6 months |
| RC tear | **RC:** SupS, IS, SubS, TM  **Extrinsic:**  Anatomical abnormality  Poor scapular control (↓)  Anterior instability (↑)  Excessive load on RCM  🡪narrow SA, impingement, tendinitis, SA bursitis  **Intrinsic**  Overuse, Overload, aging  🡪intrinsic failure  Genetics, Systemic factors🡪 RC pathology🡪 narrowing of SA space  **Causes**  *Falling*, throwing, lifting, pulling, pitching, swimming, painting, after DL.  *Aging.* | -Partial vs complete  -Bursal surface, articular surface, intratendinous tear.  -*Crescentic*, U-shaped, L-shaped, massive full thickness tear.  *Risk factors (odd ratio)*  - Heavy labour 3.81  - overhead work 3.83  - weight training 2.39  - swimming 1.98  - DM 3.34  - Generalized OA. 2.39 | **Pain** *with overhead activity,*  **Pain at night**  +/- weakness  **Chronic**: assoiated w/ impingement (bursal side)  **Acute**: in throwers (articular side), after dislocation (>40y.o)  *Hx suggesting Full Thickness Tear*  - Recent trauma, severe pain, function impairment  - shoulder girdle muscle wasting  -significant muscle weakness | | Palpation  ROM: active <passive  Power:  Specific test:  **SS**: FF, empty can, drop arm *(+LHR2.7*), External rotation lag sign (*+LHR7.2*)  **IS**: ER, Hornblower,  **Subscap**: IR, lift-off, belly press  *Worse outcome factors*  -large, FTT >1cm2  - sx >1y  - Sig function impairment  - Sig. RC weakness | **USS: confirm tear.**  **X ray**: usually normal  *-may show tendon ca++,*  *- spurs,*  *- humeral head elevation*  *- chronic tendinitis :*  *- rough, overgrowth of acromion*  *-GH OA*  .  **MR** (Gold standard) T2W, contrast shows communication b/w joint & subacormial space  CT (if pacemaker, CI MRI) | **Activity modification**  **NSAIDS**  **PT**: ROM, RC strengthening, scapular stabilization  **SA CSI (**elderly, low demand): 3x 6/52,  **Surgery: (**tear>1cm, >1y, ↓function, weakness significant)  \* **Refer urgently** if tear >1cm or subscapularis tear.  \* **Arthroscopic** repair: *95% pain relief*. Long term good result (*better if w/I 6mon*)  \* **Replacement**: >70y. +/-OA.  \* **Denervation** (intractable torn, co-mobility) |
| Impingement syndrome | Same to above | 1.Repetitive compression or rubbing of RC  2. RC & bursa trapped b/w acromion & Gr tuberosity | 1.Pain w. *overhead activities*. Lifting, etc | | Neers +/- local block  Hawkins  Painful arc  Jobe (empty can)  Yocum’s( *hand on opp shoulder,raise up*)  IRRS test | **X ray:** outlet view (*hooked acromion or spur)*  **MR:** evaluate RC tear . | NSADs  Activity modification  Physio: RC strengthening  SA CSI  SA decompression surgery. |
| Subacromial bursitis | Common shoulder pain.  RF: throwing, repetitive  Causes  -repetitive stress  -acute trauma  - RCT/injury  - inflammatory: RA, | Inflammatory changes of SAB | Pain with overhead activities  Pain at anterolateral part of joint | |  | **X ray:** to exclude other dx  **USS:** anechoic fluid filled structure  Hyperechoic wall, synovial hypertrophy +/- hyperechoid blood  **MRI:** Fluid filled structure btw deltoid and acromion. . T1w hyperintense. T1W hypointense. |  |
| **GH OA** | OA #1 > RA  1° or 2° to  - T**raumatic** (fall, RA, tear, surgery)  - longstanding RC lesions |  | Pain,  Stiffness  Usually elderly | | ↓ROA ,  +/- wasting  Crepitus | X ray: joint narrowing, osteophytes  MR: RC evaluation | NSAIDs  PT  CSI  Hemi vs total shoulder arthrosplasty |
| ACJ OA | Degeneration  Previous trauma,  Overuse (*weight-lifter*)  RC disease |  | Pain  Grinding | | ACJ tenderness  Crossbody adduction(scarf)  AC shear test  Bell Van Riet test  Hawkins |  |  |
| Calcific tendinopathy | Unknown (No trauma)  Ischaemia/ overuse🡪 *fibrocartilaginous metaplasia and deposition of crystals by the chondrocytes*  Affects 30-50y.  F>M  DM, hypothyroidism common | Soft tissue calcium deposits in the tendons of RC  \*calcification is not painful  \*vascular reaction (swelling, tension) in the tendon is painful | Acute or chronic shoulder pain.  Severe pain following overuse within hours.  Night pain.  Subsides after a few days | | Severe pain  Painfu arc 60-120°  Too sore to do any test  May resemble acute infection. | **X ray** ( *gold standard*)  -calcium deposition in SS tendon 1-2cm proximal to insertion.  -Erosion, sclerosis or cyst at cuff insertion site.  **-MRI:** Not necessary, small black signal in the SS , can check RCT. | CSI into SA space  NSAIDs  Needling of the lesion  ***Shockwave***  Needle aspiration and irrigation  Surgery (severe pain>6m) |
| Bicipital tenosynovitis |  |  | Gradual onset anterior shoulder pain  Worse with resisted forearm supination & flexion  Snapping | | Pain at bicept tendon groove  Speed: *resisted shoulder flexion*  Yergason: *resisted supination*  Resisted elbow FL, supination |  | NSAIDs  Physio  CSI to tendon sheath  Tenodesis vs tenotomy |
| Biceps tendon rupture | Usually, older pt  Often degenerative tear  Asso. w *impingement & RC tear* |  | Pain  Deformity | | Popeye arm deformity  Weak supination | X ray: usually normal  MRI: usually not necessary | Physio  Tenodesis ( esp. younger/ active pt) |
| SLAP lesion | Tear of Superior Labrum from Ant. To Post.  **Types:**  - *non-traumatic ( old pt)*  *- avulsion of labrum (#1)*  *- bucket handle tear*  *- extension to LHB* | **Chronic**: with RC tear  **Acute**: FOOSH (shoulder load in flexed abducted position)  7 types based on extend of tear . | Pain  Popping,  **Painful click** on lifting the arm above shoulder  Weakness | | O’Brient’s: *Shoulder 90°FL,10-15° ADD, Pain in SP>PN*  Crank  Painful arc  Kim (inferior labral tear)  Speed’s test  Yergason’s | **X ray**: usually normal  **MRI** (*gold standars*)  **Arthrogram**: most senstive. | \*Few return full function w/o surgery.  Arthroscopic repair (*91% successful*)  Debridement  +/- tenotomy or tenodesis of biceps |
| Scapular instability | 1. Weakness of the serratus anterior (a. neuralgic amyotrophy b.injury to brachial plexus c. direct damage to the LTN; d. fasioscapulohumeral muscle dystrophy ) 2. Injury to the spinal accessory nerve🡪 trapezius weakness | | | | | |  |
| Snapping scapula | Asymptomatic 1/3 of healthy person. | | |  |  | X ray: exclude osteochondroma  CT | Conservative  Surgery if OCD found |

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| Shoulder DL | Mechanism of injury | Clinical features | Imaging | Treatment |
| **Anterior DL**  95% | **FOOSH🡪**  Common in young /athletics  Associated w/ labral tears (<40y).  Rotator cuff tears (>40y)  Associated w/ #  - Bankart lesion  - Hill-Sachs lesion  **Complications**  -RCT tear  -N. A.V injury  -# (humerus, clavicle, scapular)  -Shoulder stiffness,  -unreduced dislocation  -recurrent dislocation | -Pain is severe  -Pt supports arm with opposite hand.  - unable to move arm  -“flattened ” shoulder, no ROM,  *\*MUST check nerve, vessel injury before reduction.*  Apprehension test: | ***AP view***: HH forward, overlapping with glenoid. Head below + medial to the socket.  Bankart lesion: *avulsion glenoid labrum/ tuberosity*  Hill-Sachs lesion: *Posterolateral HH impression #*  ***Lateral view*:** HH out of line with the socket.  West point or axillary view | **Acute Reduction**  -Stimson’s  - Hippocratic method  - Kocher’s method (*risk of nerve, vessel and bone damage, not recommended*)  **Immobilize:**  - Sling for 3wks under 30.y.o.  - Sling 1 wks. If >30y.o ( *prone to stiffness*)  **Physiotherapy:**  **Surgery**  - If recurrent DL, instability  - early labral repair in young patients |
| Posterior DL (<2%) | Rare  Seizure, electric shock  Fall on flexed, adducted arm  Direct blow to front of shoulder  FOOSH. | Often missed  AP X-ray: may be normal.  Arm held in IR locked in position.  Front of shoulder looks flat  Prominent coracoid | AP X-ray: empty glenoid sign *(light bulb)*  **Lateral, axillary view** essential  +/- HH #.  CT | Reduction ASAP  Pulling on arm in adduction  *Complications*  -unreduced dislocation  -Recurrent DL or sublux |
| Inferior DL  (*luxatio Erecta*) | Rare, but Serious consequences  Due to weakness of deltoid muscle | Arm in nearly full abduction/elevation  Soft tissue injury may be severe ( *avulsion of the capsule, surrounding tendon, rupture of muscles, # of glenoid or proxima humerus, damage to brachial plexus and axillary artery*) | X-rays: Humeral shaft in abducted position . head below the glenoid | Prolonged exercise program  Viewed with great caution.  Surgery |
| Subluxation GHJ |  |  |  | Surgical stabilsation |

Neurological exam

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| Level | Motor | Sensory | Reflex |
| C5 | Deltoid/biceps | Upper arm | Biceps |
| C6 | Wrist extension | Thumb | Brachioradialis |
| C7 | Wrist extension/finger extension | Middle finger | Triceps |
| C8 | Finger grip | 5th finger | Non |
| T1 | Hand intrinsic | Medial elbow | None |

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|  | Ulnar N (C7-T1) | Median N (C5/6-T1) | Radial N (C5-T1) |
| Muscles | FCU, FDP;  FPB(deep), all interosseous, 3rd 4th lumbrical, Adductor pollicis | APB, OP, FPB (superficial), 1st& 2nd lumbrical;  Forearm flexor (*apart from FCU FDP*) | Anconeus, mobile wad ( BR, ECRL)  PIN: ECRB, All posterior compartment: |
| Branches | 1) dorsal cutaneous 2) palmar cutaneous 3) deep motor 4) superficial sensory branches | 1)AIN, 2)Palmar cutaneous, 3)Motor recurrent, | 1)Superficial Br, 2) Deep br, 3) PIN |
| Sensory | Ulnar border 4th finger, small finger | Palm of hand, volar 3.5 finger, Dorsal distal 3.5 fingers | Post. Forearm, dorsal wrist (4th compartment) |
| Motor | Wrist flexion, ulnar deviation; finger adduction, thumb adduction, 4th 5th PIP extension, MCP flexion (lumbrical) | Thumb abd, flexion, opposition, 2nd 3rd PIP extension, MCP flexion | Finger, wrist extension, thumb abduction, extension. |
| Specific test | Ulnar claws, Fromen’s, Wartenburg, finger abduction, claw hand | Ape hand |  |

**Module 2. Elbow revision**

**Elbow anatomy**

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| Bone | Joints | Biomechanics | Ligaments | Muscles | Others |
| **Radius**：  - head, neck, tuberosity  **Ulna**: olecranon, coronoid process, tuberosity  **Humerus**  - Capitellum  - trochlear  - Med/ Lat. Epicondyle  - Olecranon fossa(后)  - coronoid fossa ( 前) | 3 joints  - UH (ulnohumeral)  - RC (*radiocapitellar*)  - PRU (*proximal radioulnar*)  **ROM**  flexion/extension 0-150°, Supin./pronation 80 / 80°  **Functional ROM**  Flexion: 30-130° supination/rotation 50/50° | **Carrying angle** (vulgus):   * 5-10° (M), 10-15° (F) * ***trochlea Valgus*** *: 6°* * *anterior tilt: 30°* * *IR: 5°*   Stabilizer:  **1° static:** UHJ, MCL, LCL  **2° static:** RCJ, Capsule, common flexor and extensor  **Dynamic**: any muscle cross the elbow (*anconeus, triceps, brachialis, biceps*)  **Force across the elbow**  F. on forearm x 3= F at elbow J.  **Instability**  **PL rotatory**: injury to LCL  **PM rotatory**: LUCL (*Lateral pivot shift*)  **Valgus:** MCL *( valgus laxity*) | **MCL** (Medial collateral/ulnar)  - **Anterior** bundle (*Most important*)  - Posterior Bundle  - Transverse bundle  **LCL** (lateral collateral/ Radia)  - **LUCL** (*lateral ulnar collateral*)  *(🡪 posterolateral rotatory IS*)  - LCL  - Accessory collateral ligament  - Annular ligaments  **Other structures**  - Fat pads  - Olecranon bursa  - Ligament of struthers  (*supracondylar process-M. epicondyle*)  - Arcade of Struthers  (*IM septum- triceps*)  - Leash of Henry (*branches of recurrent radial artery*) | **Superficial extensor**  *anconeus,* ***ECU, EDM, EDC***  Mobile ward: *BR, ECRL,* ***ECRB***  **Deep Extensor**  Supinator, APL, EPB, EPL, EIP (*Extensor indicis proprius*)  **Common extensor tendon (4)**  ECRB, EDC, EDM, ECU  **Superficial flexor**:  PT (*Pronator teres*), FCR, PL, FCU, FDS  **Deep flexors**  FDP, FPL, PQ (*pronator quadratus*)  Common flexor tendon origin (5)  PT, FCR, PL, FDS, FCU | elbow ossification  CRITOE  Capitellum 1y  Radial head 3Y  Int, epicondyle 5y  Trocheal 7y  Olecranon 9 y  Ext epicondyle 11Y  **Cubital tunnel**  R: Osborne’s ligament  F: MCL  P: Medial head Triceps  A: Medial epicondyle  L: Olecranon  **Radial tunnel**: 5cm long tunnel, begins as radial N courses past the Radiocapitellar joint.  Roof: brachioradialis  Medial: Biceps, brachialis  Lateral: ECRB, ECRL, BR  Distal: arcade of Frohse |

**Paeds elbow injury**

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| Supracondylar # | Very common  Most extension type | FOOSH fall  Pain  Will not move arm  Deformity | Swelling +/- deformity  Common: AIN > radial N  Volkman’s contracture: clawing  \* Must check Neurovascular  Ok—AIN N.  Scissors—Ulnar N.  Star—Radial N  **Pulse** | **X ray**: elbow series, lateral  Anterior humeral line: 1/3 capitellum center not in front.  Fat pad sign.  Gartland classification  -I: nondisplaced  -II: partially displaced  -III: displaced | **Grade I**: above elbow back slab/cast  **Grade II:** Flex elbow >90deg,  **Grade III**: Splint, refer for OT  *closed reduction& percutaneous pinning*.  If pulseless/unperfused: Urgent surgery |
| Medial epicondyle # | Avulsion # | With common flexor ward | Ulnar nerve damage: scissors |  | OT If displacement >5mm |
| Lateral condyle fracture | Lateral condyle pulled or pushed off |  |  |  | Often surgery  ( *intraarticular #*) |
| Radial head # |  | FOOSH fall |  | X ray: valgus, hyperextension | OT if >30° valgus deformity |
| Monteggia | MUF: ulnar #+ radial head DL |  |  |  | Surgery |
| Pulled elbow | Most common injury to the elbow in young children  < 5y.o common | Due to forced axial traction of extended elbow on a resisting child🡪 Subluxation of the annular ligament🡪 Radial head dislocation | -Pain in elbow  -30-40° elbow flexion + sl pronation  -Unable to extend or supinate the elbow |  | Hyperpronation  Supination + flexion |
| Elbow dislocation | Rare in young ( <3y) | Post. DL: Fall on ext. elbow  Ant. DL: fall on flex. elbow |  |  |  |
| Little league elbow | Medial epicondyle stress #  MCL strains  Flexor ward strains | Repetitive valgus loading to elbow (thrower) |  |  | Most settle with rest, activity modification |
| Osteochondritis dissecans  Panners disease | OCD  Most common on capitellum  10 y. | Cause unknonw  ? repetitive microtrauma  Lateral compressive forces ( common in gymnasts) |  |  | Most settle with activity modification  OT if loose fragment, ORIF |
| Forearm fracture  (FOOSH fall) | Treat aggressively in adult( Joint)  Within 2 years of growth completion: ORIF (girl 12y. Boy 14y) | | Ulnar #if >50%displacement>10deg angulation 🡪ORIF | Galleazi #: MUA🡪 ORIF |  |

**Common elbow conditions in adults**

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| Condition | Aetiology/ | Pathology | Symptoms | Sign | Investigations | Treatment |
| Lateral epicondylitis  (Tennis elbow) | Repetitive stress 🡪 ECRB and EDC (*all deep to ECRL*)  +/- PIN compression (5%)  Most common cause of elbow Pain  1-3% adults annually  Common 35-50y  Dominant arm  M=F | **Histology:**  Angio-fibroblastic hyperplasia  (Not inflammatory)  - *Neovascularization*  *- infiltration by mucopolysaccharide*  *- disordered collagen scaffold*  *- bone formation*  *- angiofibroblastic proliferation* | Pain at lateral elbow  DDx:  -Radial tunnel syndrome: *pressure on RT and SN/PN forearm🡪pain*  -Radiohumeral joint syndrome  - C-spine RL  - OA RCJ  - posterolateral instability  - Triceps tendonitis  - Occult fracture | **Pain**  -Lateral epicondyle pain (ECRB)  -passive wrist flexion  **Mill’s sign**: *Resisted wrist extension with forearm pronated, elbow flexed*  **Maudsley’s test**: *resisted 3rd finger extension*  **Chair test:** *worse In pronation> supination* | **X ray:** *usually normal*  *+/- calcification in extensor muscle mass*.  **MRI:**  -ECRB tendon thickening, oedema, tendon degeneration 90% cases  **USS:**  *ECRB tendon thickened, hypoechoic;*  *variable sensitivity, specificity.* | **Activity modification**  **NSAIDs**  **Physical therapy**: effective 91% at 52w  **Injection**: (CSI *good for short term pain, do not improve long term outcome;*  **Bracing**: reduce tension (*cock-up wrist splint, counterforce brace*)  **Acupuncture**  \**no evidence of botox, autologous blood, PRP,* ESWT ( shockwave)  **Surgery:** not common.  - Sx >6-12 mon. night pain,  - CI: inadequate conservative  - Open/arthroscopy: debride, decorticate,  (94%-97%successful rate) |
| Medial epicondylitis  (Golfer’s) | Repetitive stress🡪 Pronator teres, FCR origin  Less common (ratio 1:6 compared with lateral)  10-20% lateral epicondylitis  Common 4th-5th decades  Dominant arm 75%  M=F | Angiofibroblastic hyperplasia  (due to microtrauma, degeneration)  Sports:  -valgus stress  -overhead throwing ( *Golfers, bowlers, weight lifters, racket sports, labour*)  Occupation  -doing repetitive forceful grip, manual handling of load>20kg, constant vibratory forces at elbow. | Pain :  *Anterior and distal to medial epicondyle over origins pronator teres, FCR.*  -Worse with gripping,  - palpation,  - resisted wrist flexion,  - pronation  -overhead throwing,  -early acceleration for thrower.  Flexion contracture | -Tenderness to palpation  -Resisted wrist flexion and forearm pronation🡪 pain  - flexion contracture in chronic case  -  DDx  Cubital tunnel syndrome  Fracture  MCL injury:(*distal medial epicondyle, valgus stress, milkman test*)  Triceps tendonitis  Ulnar neuritis: tinel, | **X ray**: usually normal  **MRI**: may show rupture of flexor-pronator origin  **USS**: may show thickened and hypechoic area and tear | More aggressive ( risk of contracture )  Activity modification: refrain 6-12m  Icing  NSAIDx 1-2 wks  **Physio:**  -*Flexor-pronator strengthening stretching*  - eccentric contraction avoided initially  -night splinting and supportive orthoses  **Needling:** 🡪 tendon trephination🡪bleeding, tendon healing.  **CSI** *peritendinous, synovial tissue NOT the TENDON itself*  *\*Shockwaves, PRO no evidence*  **Surgery** (4-6 months. More aggressive) |
| Cubital tunnel syndrome | 2nd commonest compressive neuropathy  Ulnar nerve compression at elbow  Diagram  Description automatically generated | **Compression site**  --Osbornes fascia (Common)  - 2 heads of FCU  - Arcade of Struthers  - Medial triceps  - Medial epicondyle  - elbow valgus  - Osteophytes  - Ganglions  **Cubital tunnel**  R: Osborne’s ligament  F: MCL  P: Medial head Triceps  A: Medial epicondyle  L: Olecranon | **Tingling/numbness** in ulnar distribution  **Weakness**: wrist flexion, ulnar deviation (FCU), weak pinch (thumb adduction)  **Vague forearm pain +/- elbow pain** | **Paraesthesia** : 4th 5th finger  **Weakness:**  **-↓**wrist flexion (FCU),  -finger add (interosseous),  - 4th 5th PIP ext, MCP flexion,  - grip strength (lumbricals 3& 4),  - thumb add (Add pollicis),  **Muscle wasting**: *1st web space, intrinsic (interosseous*)  **Ulnar claw hand** (*wasting of intrinsic, 4th 5th PIP flexion, MCP extension,*)  **Wartenburg sign**: lost little finger Add  **Fromen’s sign**: Weak thumb add. (*recruit FPL*)  **Tinels**: tapping on CT  **Elbow flexion test**: flex elbow  **Modified Tinel’s**: flex elbow + palpation | **X ray**: look for abnormal medial epicondyle  **EMG**: confirm diagnosis  (*negative does not r/o*)  **DDx**;  C8  - weak triceps (*no other muscle weakness of hand*)  - numbness ring, little finger  T1  - numbness forearm  - weakness finger abduction,  - wasting thenar eminence (median)  **Combined Med +ulnar**  Undistinguishable | Activity modification  NSAIDs  Night extension splints / rolled towel  Surgery (*if fail conservative Mx, persistent neurology*)  - Ulnar nerve transposition |
| Radial tunnel /PIN entrapment | Diagram  Description automatically generated | **Compression site**  - Leash of Henry  - ECRB  - Arcade of Frohse  - Distal edge for supinator  - Interosseous membrane  - Between APL & EPL  **Anatomy**: 5cm long tunnel, begins as radial N courses past the Radiocapitellar joint.  Roof: brachioradialis  Medial: Biceps, brachialis  Lateral: ECRB, ECRL, BR  Distal: arcade of Frohse | 1.**Deep dull ache** at *dorsal proximal radial* aspect of forearm  2.mild or no motor or sensory loss  **PIN entrapment**  *Painless (or minimal)*  Fingers and thumb drop  Drift of hand radially  **NCV**: diagnostic  MRI: muscle atrophy, denervation  **Wartenberg’s syndrome**  -compression of superficial radial nerve at wrist  - Sensory sx only (numbness/pain) | 1)Pain with compression on radial tunnel with forearm pronation/ supination  2)Passive resisted extension of middle finger  3) supination against resistance | *Difficult diagnosis*    **X ray**: evaluate RCJ.  **MRI**: evaluate for masses  **EMG:** usually normal in radial tunnel syndrome, but confirms diagnosis & locations in PIN  Diagnostic block. | NSAIDs  Activity modification  Physio: nerve gliding, USS. Heat/cold  Steroids injection  \**avoid using counterforce or tennis elbow braces*  Surgical decompression.  (*unless weakness: uncommon*) |
| Pronator syndrome  (Median N) |  | Compression of Median nerve at   1. Ligament of Struthers 2. Pronator teres 3. Lacertus fibrosis (*bicipital aponeurosis*) 4. FDS aponeurosis/ arch | **Numbness**  **Tingling**  +/- weakness of thenar M  **Pain** in wrist, forearm  DDx: CTS  - no nocturnal sx  - -ve Tinel at wrist  - -ve Phalens  - EMG:  - numbness at palmar triangle. | Decreased palm sensation  **Symptoms triggered** by  : pronator teres, lacertus fibrosus, arch of FDS pressure.  **Pain triggered by**  - resisted pronation (*PT* test)  - resisted elbow flexion (*lacertus fibrosis*)  -resisted PIP flexion (*FDS test*)  **Difference to CTS**  No nocturnal sx  Tinels -ve at wrist, +ve proximal forearm  Phalens -ve  Numbness at thenar | EMG: delayed at forearm  *(-ve does not rule out*) | Activity modification  NSAIDS  Splinting  Surgery |
| AIN syndrome | Rare | Same sites at pronator syndrome | Weakness+/- pain  (No numbness) |  | X ray: usually normal  EMG/NCS: confirm dx | Same to above |

**Module 3. Hand and wrist revision**

**Anatomy of wrist and hand**

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| Bone | Joints | Tendons | Muscle | Movement | Special test |
| **Carpal bones (8) (***held by ligaments, no muscles***)**  Scaphoid, lunate, triquetrum*,* ***pisiform (sesamoid bone)***  Trapezium, trapezoid, capitate, hamate  **Metacarpals (**5)  **Phalanges** (14)  **TFCC** (triangular fibrocartilage complex) | Wrist joint:  CM (carpometacarpal)  Mid-carpal J (btw 2 rows of carpus)  MCP joint  PIP  DIP  Type of grip  - precision grip: pick a pin  -pinch: hold a sheet of paper  -side-ways pinch: key hold  - chunk grip: hammer handle  - hook grip: hold gag handle  -span: hold a glass | **Flexors tendon sheath**  -**annular pulleys (A1-A5):** (A1: MCP; A3:PIP; A5:DIP. *A2.A4 over prox. Middle phalange*)  - Vincular (*系带*)  - cruciate pulleys:  -**Volar plate** (palmar ligament)  **Extensor tendon complex**  1.**Dorsal hood:** *sagittal, oblique, lateral bands*  2.**Extensor tendon**:  *central slip (P2)🡪 base of middle phalanx*  *lateral slip(P3)🡪base of distal phalanx*  *terminal extensor tendon(P3)🡪base of distal phalanx*  3.**conjoined lateral bands**: lateral slip+ lumbrical + interossei (at MCP) | **Extrinsic:**  - Long flexors: FDS, FDP, **FPL**  - **Extensors**: EPL, EPB, APL, EIP, EDC, EDM  **Intrinsic**  - Lumbricals 1&2 (Median):  (*FDP🡪radial lateral band: Ext PIP, FL MCP*)  - Lumbrical 3&4 (Ulnar):  - Interosseous dorsal (ulnar) DAB ( abduction)  - interosseous palmar (ulnar) PAD (adduction)  **Thenar**: **APB,** **FPB** (ulnar—Deep head) **OP**  **Adductor pollicis (ulnar)**  **Hypothenar (ulnar): PB, ADM, FDMB, ODM** | **Wrist**  - Flexion/extension  - supination/pronation  - radial/ulnar deviation  **Fingers**  - Flexion/extension  MCPJ 0-90°  PIPJ 0-110°  DIP 0-90°  -abduction/adduction  **Thumb**:  - add (AP:*ulnar)*  - abduction: APB, APL  - opposition: OP  - flexion: FPB (MCP), **FPL (IP)**  - extension: EPB (MCP), EPL (IP) | 1. Finkelstein’s test: de Quervain  2. Radiocarpal and midcarpal drawer  3. Ulnocarpal stress test :Sharpey’s  4. ECU subluxation  5. DRUJ compression test  6. Watson: SL dissociation  7. Piano key: instable DRUJ  8. **Regan test**: Lunotriquetral lig disruption.  9. **Shuck test**: lunotriquetral ballottement test:  10. Thumb instability test: (1st UCL)  11. **Elson test**: central slip injury |

**Wrist anatomy**

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| **Extensor compartment** | **Carpal tunnel** | **Ulnar tunnel/Guyon’s canal** | TFCC (triangular fibrocartilage complex) | Hand surface landmark: dorsal | Hand surface landmark: volar |
| I: EPB, APL (de Quervain’s)  II: ECRB ECRL  III: EPL  IV: EIP (*ext. indicis proprius*), EDC (*Ext. digitorium Communis*)  V: EDQ/EDM (Ext. digiti minimi)  VI: ECU ( Ext. carpi ulnaris) | Volar concave arch formed by 8 bones  **Roof**: flexor retinaculum  **Floor**: central carpal bones  (Pisiform/hamate—Scaphoid/trapezium)  **Medial wall**: pisiform, hamate  **Lateral wall**: trapezium, scaphoid  9 tendons: 4x FDS, 4x FDP, FPL  1 nerve: Median N | Floor: transvers carpal lig  Roof: volar carpal lig  Medial wall: pisiform  Lateral wall: hook of hamate  Ulnar nerve  Ulnar artery  \*usually ganglion causing issues | Distal ulnar- ulnar proximal carpal row (*triquetrium*); Sigmoid notch (radius)- base of ulnar styloid  **Blood supply**: ulnar A. AIA (10-25%)  **Triangular fibrocartilage**:  - **Central disc**: *avascular*, *aneural*. Resist compress  - **Dorsal radioulnar** lig. (*tight in pronation*)  - **Palmar radioulnar** lig.(*tight in supination*)  Meniscal homologue: *highly vascular synovial fold*  **ECU** tendon sheath | 1. Thumb CMC 2. ASB 3. Radial styloid 4. Distal radius 5. Lister’s tubercle 6. SLL (scapho-lunate) 7. TFCC 8. Ulnar styloid 9. Ulnar snuffbox | 1.Scaphoid tubercle  2.Radial styloid  3.Radial artery  4.FCR  5. FCU  6.pisiform  7.hamate |

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| Conditions | Aetiology | Pathology | Symptoms | Test | Investigations | Treatment |
| Carpal tunnel syndrome | Most common peripheral neuropathy  **RF:**  Developmental  Trauma:#  Swelling: *ganglion, fibroma, lipoma*  DM, Thyroid ds, pregnancy  RA, obesity,  Manual work | Median nerve compression by *transverse carpal ligament* in the carpal tunnel  🡪inflammatory reaction of N   * Edema, hypoxia * Axial degeneration   Nocturnal sx  - acute wrist flexion of the fetal sleeping position  - altered fluid distribution when lying | Sensory disturbance (*worse at night*)  -numbness  -tingling at finger tips ( radial 3.5 fingers)  -Wrist arm pain: burning, (*may 🡪 shoulder*) .  Motor disturbance  -weakness: pinch,& grip, thumb op  -clumsiness of thumb:  Thenar atrophy | **Sensory loss** (spare palmar triangle: *Palmar cutaneous N*)  **Abductor pollicis brevis test**:  **Muscle wasting**  **Hand elevation test***: hand held above head 2 min*  Carpal compression  Phalen’s test  Reversed Phalen test  Tinel  (above not diagnostic) | **EMG**: confirm diagnosis (*but negative does not rule out)*  **X ray**/ *specialized carpal tunnel view:* usually normal  **Blood test**: ESR, BSL, UA, TSH  DDx:  Pope’s blessing sign (Hand of benediction *proximal medial N lesion*)  Pinch sign: AIN | 1.Activity modification  2. night splints  3.NSAIDx  4.CSI  5.surgery:  (*failed conservative, constant sensory, evidence motor weakness, EMG +ve*)  release of transvers carpal ligament |
| **Guyon’s canal compression** | Ulnar N compression in Guyon’s canal | Trauma ( *hypothernar eminence, repetitive occupational trauma, hypothenar hammer syndrome*)  Abnormal structures: ganglion, abnormal muscle | **Numbness** (5th and half 4th at palmar side only) (If dorsal sensation impaired, cannot be Guyon’s)  **Weakness**: Interossei, ADP  **Impair precision grip**: *due to intrinsic M weakness & little finger sensory dysfunction)* | **Worse Clawing hand:**  \* high ulnar N compression cause - less clawing: *FDP also involved; -*  *-* more loss *of sensation at dorsal ulnar hand*) | **X ray**: look for fracture  **CT**: Evaluate for fracture/malunion  **MR**: useful for masses  **US**: evaluate for thrombosis  **EMG**: confirm diagnosis | Night splints  Avoidance of provoking postures, activities  CSI  Surgical decompression. |
| De Quervain’s | F, 30-50 y.o  Trigger:  Repetitive activity (pinching)  RA, psoriatic arthritis  Other inflammatory synovitides  Pregnancy, postpartum | Tenosynovitis of APL & EPB (***1st dorsal*** *compartment)* | Radial wrist Pain , base of thumb pain  Over the tunnel radiates into forearm.  Weakness: any hand function | Tenderness & crepitus at *1st dorsal compartment*  Finkelstein’s test +ve.  ( *false +ve in basal joint arthrosis*) | **X ray**: usually normal  **MRI:** Thickening of the peritendinous synovium whining the dorsal tunnels | Splint ( *radial gutter light support splint*)  NSAIDs  CSI into sheath  Surgical release |
| Flexor tenosynovitis |  |  | Ulnar wrist pain  +/- popping/grinding | Ten |  |  |
| TFCC tear | Traumatic (class1)  Degenerative (class2)  Only periphery is vascular | FOOSH injury  Twisting injury of forearm. | Pain, clicking,  Instability in distal RUJ ( esp. twisting wrist) | +ve Foveal sign  Ballotmen test ( piano-key sign)  Sharpeys test |  |  |
| RA | Most common  Can affect all joints of the hand/wrist  MCP PIP wrist most common | *Synovitis*  *Ligament stretching*  *Articular cartilage destruction*  *Characteristic joint deformities* | Ulnar drift  Swan neck  Boutonniere deformity  Tendon ruptures: EDC, EDM |  |  |  |
| Psoriatic arthritis | Less common  DIP joints +/- Nail involvement |  | Asymmetrical distribution  **Nail** involvement  Flail fingers  Synovitis🡪 trigger finger. | Arthritis mutilans: devastate small joints | **X ray**: “pencil in cup”appearance  Shortening of the bones |  |
| OA | Elderly  Hx of injury  Common: DIP, 1st CMC | Loss of articular cartilage  Due to **wear** or **posttraumatic** | Pain  Worse with activity | DIP J #1 (Heberden’s nodes)  PIP J #2 (Bouchard’s nodes)  1st CMC joint OA: painful grind, shuck test  Decreased ROM | X ray: joint space loss, osteophytes, sclerosis, subchondral cysts | NSAIDs  Steroids injection  Arthrodesis/fusion  Arthroplasty |
| Dupytrens disease | Associated with Genetics ( AD), DM, EtOH, smoking  Male > 40y.  **4th** >5th>3rd>2nd fingers, | **Contracture** of **palmar fascia**  Myofibroblasts🡪 **thick cords** of Type III collagen🡪 MCP, PIP | Hand mass, | **Nodule** in palm (A1 pulley)  Contracture of MCP or PIP | PE is diagnostic | Early: reassurance  Late (contracture): surgical excision of cords |
| Trigger finger | Associated with DM, RA, age  Congenital form in paeds  1st>3rd> 4th finger | Stenosing tenosynovitis  Tight /**thickened A1 pulley** entraps flexor tendon | Pain snapping, or locking esp in AM | Tender flexor sheath, snapping with flex.ext | PE diagnostic | Splint, occupational Rx  CSI into tendon sheath  A1 pulley release surgery |

**Injury to wrist /hand**

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| Soft tissue | Bone | Bone | Nerve injury |  |
| Wrist sprain | 1. Distal radius # | 1. Scaphoid # | Median N. | Ulnar nerve |
| FOOSH  Ligaments injury  Conservative  If complete rupture (SLL) 🡪 chronic wrist pain | **Colles** #: dorsal angulation, displacement if distal fragment  **Smiths** #: Volar angulation🡪 growth plate involvement in kids  Mx: manipulation, short arm cast 4-6wks.  If comminuted, intraarticular #--> ORIF, bone grating  **Complications**: Malunion, wrist stiffness, pain, weaklness. CTS,  CRPS, rupture EPL. | - young male. FOOSH  - Painful swollen wrist,  - Tender at snuff box,  - x ray: may be normal  -**Mx:** Immobilise wrist in plaster 2wks🡪 rex ray. Or MRI.  **Complications:** delayed/ non-union; avascular necrosis of the proximal pole of scaphoid; chronic wrist pain, stiffness  OA. | Loss of tactile gnosis to toe radial 3.5 digits | Loss of precision grip  ( paralysis of intrinsic muscle) |
|  | Metacarpal phalangeal # | Dislocation | Tendon injury | Nerve damage |
|  | Manipulation, splintage  Correct all angulation, displacement, rotational deformity  If across joints🡪 ORIF ( risk of stiffness) | MCP, IP J common.  Ulnar collateral ligament of thumb ( skiers thumb)🡪 early repair of complete rupture | Long flexor tendon: repair, rehab  Extensor tendon: conservative in splint | Repair. |
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| Spindle-shaped finger: PIPJ swelling | Swan-Neck: **PIP** extend, **DIP** flexed (*FDS insertion/volar plate injury*) | Finger trauma | **Human bite**: wash out, Never suture |
| Sausage finger: digital flexor tenosynovitis | Boutonniere: **PIP** flexion, **DIP** extension (*central slip injury, RA*) | Mallet fingers: distal extensor tendon rupture🡪DIPJ extension splint 6wks🡪 OT | **Crush injury:** elevation, intrinsic plus position, never suture |
| Telescoped shortening of the digits: Psoriatic arthritis | Z-shaped deformity of thumb: MCP flexion, IP extension (EPB) | Jersey finger: forced DIP extension injury🡪 OT | **Dislocation**: MCP, IP common, 1st UCL ( skiers thumb)🡪early repair. |
| Dupuytren’s contracture: thickened & contracture of *palmar aponeurosis.* | 1st EPL rupture: flexed MCP, IP thumb | Gamekeeper’s thumb: MCP UCL rupture.  Partial tear: splint. Full tear: repair. | Flexor Tendon injuries: Long flexor T🡪 repair |
|  | Heberden’s : DIP | Extensor tendons: avulsion/ rupture (Mallet deformity DIP): splint |
|  | Bouchard’s node’: PIP | Nerve injury: clean, repair for young but variable prognosis. |
|  | Mucous cyst: DIP J ganglion cyst | \*\*\* Early active, passive joint mobilization encouraged |

**Module 4. Hip revision**

**Paediatric hip problems (\*\*2018:2)**

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| **Condition** | Aetiology | Pathology/causes | Symptoms | Exam, investigation | **Management** |
| **Dysplasia**  (Developmental Dislocation of the hip  DDH) | \* 1.5-2 /1000 live births.  **Risk factors**:  - Female (7:1)  - First born,  - breech,  - Family history.  - Swaddling.  - high birth weight,  - oligohydramnios,  - With other anomalies  *L>R* | Due to  *- ligamentous laxity,*  *- Muscle underdevelopment*  *- Abnormal shallow slope of acetabular roof*  🡪 dislocation, subluxation or laxity of hip | *Exam: birth, 6mon, 12mon, 18mon*  **Infant:**  - asymmetry  - clicking hip  - difficulty in applying nappy  -asymmetrical skin fold  -asymmetrical leg length  - limping, delayed walking  **Adolescence**:  1. Development of pain in adolescence  2. *Bilateral dislocation*: no asymmetry, but bilateral waddling. Trendelenburg. | \* Clinical exam at birth, 6 weeks , 8-9 months.  **1) Barlow test (***Dislocation* )  **2) Ortolani’s test (***relocation* **)**:  Investigation  -USS: (newborn) <50% FH cover  -x ray > 6m.o. (*after development of the capital epiphysis*):  *- increased acetabular index,*  *- a broken Shenton’s line*  *- false acetabulum*  - *femur lateral to Perkins’ line* | **Aim:** to hold the joint reduced to enable normal development  **<6m**: Pavlik harness  **6-14m**: more difficult. MUA, Open reduction +/- femoral osteotomy  **>14m**: open reduction+ osteotomy |
| **Perthes’ disease (Legg-Calve-Perthes’ Disease)** | **-4-8 years** of age  -M: F=4:1.  -10-20% bilateral.  -8-12% positive FHx.  (Small, active boy, parents smoking etc) | cause unknown  Avascular necrosis of the femoral head (the blood supply to the head of the femur is temporarily disrupted)  **Prognosis factor:**  - Age of onset (*younger, the better*) (<6y)  - Degree of Femoral head involvement (<50% head involvement) | **Sx**: limp, hip or knee pain  **Ix:** - Reduced **Ab**duction, IR  - Antalgic or Trendelenburg gait  - Flexion contracture (stiff hip)  - Limb length discrepancy (late)  **Outcome**:  - short limb,  - ↓Abduction,  - Degenerative arthritis (most by 5th decade)  - Hip arthrodesis or arthroplasty | Stages in Perthes  1. Initial/necrosis: blood supply to the femoral head is disrupted and bone cells die.  2. Fragmentation (over a period of 1-2y)  3. Reossification  4. Healed  Crescent sigh: subchondral collapse/#  X ray  Bone scan  MRI: early necrosis (sensitive) | **Goal:** (*to preserve ROM, keep femoral head contained in acetabulum)*  **Mild:** avoidance of high-impact activity.  - NSAIDs,  - physio: traction  - Petrie Casting and bracing for 4-6 weeks;  **Surgery** (severe cases, >8y.o. non-surgical fails):  - arthrogram,  - tenotomy (to release adductor longus muscle in the groin)  - *osteotomy* (re-alignment of the proximal femur, occasionally, an acetabular procedure to improve femoral head cover)  - followed by a cast for several weeks |
| **Irritable hip**  *(Transient synovitis)* | Diagnosis of exclusion  **Commonest** cause of hip pain( 3-8Y)  M> F.  Insidious onset  Must rule out infection/Perthes | *Aseptic hip effusion* of unknow cause  Can follow viral URTI/ overuse | Hip pain in otherwise healthy child  Transient: 7-10days  Synovitis: discomfort, muscle spasm around hip joint and a limp | Routine blood test; ESR, CRP WCC  Urine  USS of pelvis and hip joints  (may show small effusion) | Bed rest after clinical exam  Usually pain will settle over 48-72hr |
| **S.U.F.E (Slipped upper femoral epiphysis)** | **10-14 y.o.**  **obese** (*mechanical stress)*  **Male** (3:1)  **Hormonal** Hypothyroidism  **Genetic**: autosomal dominant  **Trauma**: causes acute slip | Acute or chronic  Salter I fracture (slip of femoral epiphysis) *through plate of proximal femur*  **Complications**:  - Progressive slip and deformity  - Chondrolysis,  -AVN of femoral head,  -Degenerative OA | - Sudden or gradual onset  - Hip pain (groin, ant. Thigh) pain + limping  - Knee pain (referred pain)  *Adolescent knee pain equals SUFE until proven otherwise*  -Tender over joint capsule  - Sl. **Shortened** leg + ER (external rotation)  - **Restricted IR**, Abduction, Flexion  - Whitman’s sign: *obligatory* external rotation during passive flexion of hip)  - Trendelenburg sign: weakened gluteal muscles | **X ray** (AP, Frog-view. Lateral view)  - Normal x ray first several weeks  - Femoral epiphysis slips  \* Posterior, medial slip of epiphysis  \* Klein’s line: *epiphysis slipped under*  \* AP view: widened/lucent growth plate)  Diagram  Description automatically generated | 1. Immediate referral (Emergency)  2. Crutches, wheelchairs, NWB  3. Urgent surgery (in situ pinning, Fixation of the contralateral epiphysis (*30 % risk of slip in opposite hip*) |

**Other hip issues**

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| **Hip dislocation** | Posterior DL (most common)  Anterior DL ( less common) | 1) High-energy trauma (MVA, dashboard injury)  2) significant fall  *Associated multiple injuries/fractures*  **Post DL**  - *Patella* #  - *PCL* rupture  - # posterior margin of the *acetabulum*  - Femoral head and neck #  - *Sciatic nerve* impairment  **Ante. DL**  - *obturator nerve* injury  Emergency (risk for AVN of femoral head  *Due to disruption of the retinacular capsular blood supply*) | Trauma hisotry  Severe pain ( *esp with motion*)  Cant move hip/thigh  Post DL: ADDucted, fixed IR. Slightly flexed  Ant. DL: ABDucted, fixed ER.  Diagram  Description automatically generated | X ray: AP pelvis, frog lateral | Early reduction essential (< 6hr)  Repeat x ray & neuro exam  Closed reduction +/- ORIF if necessary |
| **Femoral neck fracture** | Common in elderly (*double every 5-7 y. over age 65y*)  Fall (elderly), MVA (young)  Risk factors: *osteoporosis*  High morbidity & complication | Classification  - subcapital # (femoral neck): high risk AVN  - Intertrochanteric #  - Subtrochanteric #:  **Garden type ( 4 type)**  I: incomplete # ; valgus impaction  II: complete #, nondisplaced  III: complete #, partial displacement (varus)  IV: complete #, total displacement  Pauwel biomechanics classification  Pauwels I: <30°  Pauwels II: 30-50°  Pauwels III: >= 50° | History of fall  Pain (*hip +/-knee*) +/- Inability to bear weight/walk  Leg+ Short+ abducted + ER  Diagram  Description automatically generatedPain with rolling /log roll | X ray: AP pelvis, cross-table, lateral  MRI: (if x ray negative) Occult fracture  Diagram  Description automatically generated | **Young** ( high-energy injury)  -urgent reduction  -ORIF (3 parallel screws)  **Elderly**  - early medical evaluation  - types I & II: ORIF ( 3 screws)  - Type III & IV : hemiarthroplasty  - Medically unstable: nonoperative  Intracapsular:  Undisplaced: fixation  Displaced: young: urgent ORIF  Old: replace (THJR vs hemi)  Extracapsular: all fixation. |
| AVN | M> F, 30-40’s 50% bilateral  Trauma  Steroids,  EtOH use  Inflammatory disorders  *Metabolic (Gaucher)*  *Sickle cell*  *Radiotherapy*  *Chemotherapy*  *Decompression*  *Autoimmune*  *Infection* | Necrosis of femoral head due to vascular disruption. | Groin pain, worse with activity  Limited ROM (esp IR & Abd)  Antalgic gait | X ray: AP, lateral,  - Sclerosis +/- collapse ( crescent sign)  - Flat femoral head  - joint narrowing  - early degenerative joint disease.  MRI: most sensitive  Bone scan: | **Not collapsed**: revascularize  **Collapsed:**  - off load affected aera (osteotomy)  Replacement |
| **OA hip** | **-abnormal stress** (subluxation, coxa magna, coxa vara, minor deformities, protrusion)  **- Defective cartilage**, (infection, RA, calcinosis)  -**abnormal bone** (#, necrosis of Femoral head, Paget’s) | Articular cartilage becomes soft, fibrillated;  Underlying bone cyst formation;  Osteophytes at margin of joints  Synovial hypertrophy common  Capsular fibrosis🡪stiffness | -Groin pain +/- knee referred pain  -disturbed sleep  -stiffness after rest  - limp due to shortening  -Trendelenburg sign  - ER, ADD, shortened when lying  - Reduced ROM: IR *(<15°early sigh*), ABD, ET. | Xray: AP pelvic /AP/lateral hip  -decreased joint space  - Subchondral sclerosis  - bone Cysts  - Osteophytes | -NSAIDs. heat  -weight loss  - walking stick (*in opposite hand*)  - physio, activity modification  -**Surgery:**  1) Osteotomy (young)  2) Arthrodesis (young)  3) Total hip arthroplasty |

**Module 5. Knee revision**

**Anatomy of knee**

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|  | Bone | Joint | Kinematics | Ligament | Muscle |
|  | Femur,  Tibia,  fibula,  **Patella:** *largest sesamoid bone*.  Function  - protect articular cartilage  - give support to the knee.  - ↑ mechanical advantage of quads  - disperses compressive force of quads onto the femur  3x BW w/ stairs, 7x BW w/ deep bending  **Meniscus**  -Fibrocartilage discs btw femoral condyles and tibial plateaus.  - **Thick** periphery, **Thin** centrally  - Mainly type 1 collagen in  circumferential fiber *resist compressive stress*  Radial fibres (25%) *resist shear stress*  - **3 layers**: superficial, surface, middle  - Vascular supply: Peripheral 1/3-1/4.  - Vascular source:  Super./ infer. med/lat. geniculate A.  **Medial M**: C-shape, less mobile, tight attached to capsule &tibia (meniscal cysts common)  **Lat. M**: O-shape, mobile, loose attachments. No attachment at popliteal hiatus  Function  - load transmission, shock absorption  - joint congruity and stability  - Joint lubrication  - joint nutrition  - proprioception. | FTJ  3 articulations:  - **Medial** & **lateral** FTJ: hinge joints (*femoral condyles+ tibial plateaus*)  - **PFJ**: sellar joints (*patella, femoral trochlear groove*)  **Capsules**: cover entire joint (lax at 30° FL)  Synovial lining: cover all 3 compartments  Hyaline cartilage: type II  **Menisci:** Medial (C), lateral (O)  **Bursae**: prepatellar, semimembranosus, Baker’s cyst  **Lateral Structure**  ITB, biceps🡪 L. patellofemoral Lig, L patellar retinaculum🡪LCL, fabellofibular Lig,  (*bursa: under biceps, LCL, ITB*)  **Medial structure**  Sartorius, fascia🡪MCL (*superficial*), POL, MPFL, M. patellar retinaculum, SM🡪MCL (*deep*), capsule,  (*bursa: under pes anserinus, SM*)  Proximal Tibiofibularl joint  Q angle: male 14° Female 17°  (*angle from ASIA🡪mid-patella🡪 tibial tubercle*)  **Genu valgum** ( x shaped), **Genu varum** ( O shaped) | Inherently unstable:  1.bone contact PFJ <1/3 patellar surface  2.lack of bony conformity btw tibia, femoral joint surface  3.lateral tibial plateau sl convex in sagittal plane🡪greater laxity lateral TFJ >medial TFJ  **Stabilizer (Static, dynamic)**  **Medial** (S) MCL, POL (*posterior oblique lig*)  (D): SM, VMO, M. gastrocnemius, PES tendon  **Lateral** (S): LCL, ITB, arcuate ligament  (D): popliteus, biceps femoris, L. gastrocnemius  **Patella**r: lateral ridge of trochlear groove of femur is more prominent than medial🡪avoid patellar lateral DL  **ROM limited by**:  **ET**: ACL, PCL, MCL, LCL, Hamstring, gastrocnemius, joint capsule  **FL**: soft tissue, rectus femoris, joint capsule tautness.  **Complex motions**: 6 degrees of motion  - Ext/FL (inc *rolling, gliding*): -5 to 140°  - IR/ER: 10° total (IR in swing🡪unlock; ER in Stance🡪lock)  - Varus/Vagus: 5mm gapping laterally/medially  - AP translation: *within 2mm difference*  - Med/Lat translation: *minimal in normal knee*  - Compression/distraction | **MCL**: 1°static restraint to valgus stress  2°restraint to anterior tibial translation  - Superficial  -Deep:  LCL  **ACL** :  P.M. lateral femoral C. 🡪anterior tibial eminence  PCL  Quadriceps tendon  Patellar tendon  Patelo-femoral ligaments:  - Medial: MPFL  - Lateral: LPFL  Patello-tibial ligaments  - Medial:  - Lateral:  Patello-meniscal ligaments  - Medial  - Lateral  Patellar retinaculum  - Medial  - lateral | **Anterior compartment**  - Tibialis anterior  - EHL  -EDL  -Peroneus tertius  **Lateral compartment**  - Peroneus longus  - Peroneus brevis *(🡪base of 5th metatarsal*)  **Superficial posterior compartment**  - Gastrocnemius  -soleus  - plantaris  **Deep posterior compartment**  - Popliteus  - FHL  - FDL  - TP |

**Knee conditions**

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| Conditions | Aetiology | Mechanism /Pathology | S & S | Physical exam | Investigation | Treatment |
| **Meniscus tear** | Acute: Young, Twisting injury  Chronic: old, degenerative, OA  Medial > Lateral 3:1 (*posterior horn most common*) | Usually traumatic  *Twisting injury* to flexed weight bearing knee  (footballer) | **Pain.** *Usually medial knee, Worse with flexion activities*  **Swelling**: *some hours later.*  +/- catching or **locking** (bucket handle tear)  **Recurrent** sx after trivial twist/strains  **Giving way**  **Post-surgery outcome: future** OA  (Multifactorial: *tear, removal of meniscus, pre-existing varus deformity, cruciate ligament insufficiency*) | Joint line tenderness,  Effusion  McMurray  Apley’s  Thessaly test | **X ray**: usually normal +/- Early OA  **MRI**: sensitive. Double PCL sign for displaced bucket handle tear  **Arthroscopy**  Factors: better healing (post repair)  1.Injury <8wks,  2.pt age < 30y  3. tear length <2.5cm  4. lateral meniscal tear | Small/minimal sx: conservative  (*backslab 3-4wks, crutches, quads exercise*)  Surgery ( *recurrent, persists locking)*  Peripheral tear: repair  Central tears: partial meniscectomy, meniscal transplantation.  Post OP: NSAID, quads strengthening |
| Meniscal degeneration | >45y  No recall of injury |  | Associated with OA or chondrocalcinosis . |  | **Arthroscopy:** horizontal cleavage in medial meniscus; Detachment of the ant. Post horn without obvious tear. | Suture  Meniscectomy |
| Meniscal cyst | Medial > Lateral  Mainly posteromedial  Assoc. Horizontal meniscal tear | Probably traumatic in origin |  | Lump at /sl below joint line |  | Arthroscopy and meniscal debridement |
| **ACL injury** | F> M ( *? proprioception*)  associated with other injuries: meniscal tear, collateral lig. | *Awkward land from a leap*  *Sudden twist* | “**pop”** & **pain** , inability to continue playing  **Swelling** after a few hours (*acute hemarthrosis*)  Recurrent knee **giving-way** (*laxity of lateral knee*)  **Fate of ACL deficient knee**  - instability, poor knee quality of life, meniscal damage | Lachman test +ve (*sensitive*)  Anterior drawer test +ve  **Pivot shift** (*high specificity*) | **X ray**: (*Segond fracture is pathognomic for ACL*)  **MRI:** absent/detached ACL +/- bone bruise  **Arthroceteisis**: hemathrosis | **If stable/low demand pt:**  Activity modification, PT, brace  **If unstable/athletes/ active pt:**  Surgical reconstruction ( grafts: hamstring, allograft) |
| PCL injury | Associated with collateral and/or PL corner injury | \*Anterior ***force on tibia* (**dashboard injury)  \*Sports***hyperextension*** injury | Pain  Posterolateral knee instability ( usually minimal) | Effusion  Posterior drawer  Quadriceps active test  Posterior sag | **X ray:** look for avulsion fracture  **MRI**: confirm diagnosis, evaluate meniscus and articular cartilage | Non-operative: (isolated, esp grade 1& 2 ): brace & PT  Surgical reconstruction (*failed nonop tx. Combined injury, grade 3*) |
| MCL injury | Acco. ACL tear 95%, meniscal tear 5% | ***Valgus force*** (common in football) | Trauma,  Pain*: usually higher than joint line* /*femoral origin*  instability | Tenderness at medial epicondyle along MCL  Valgus stress test (30° FL) | X ray: medial epicondyle avulsion  MRI: confirm diagnosis | Hinged knee brace  PT: ROM, strengthening  Surgery: uncommon  ( unless combined MCL +ACL) |
| **Patella DL** | Girl >boy  Tends to recur  *Risk:*  *- Generalized ligament laxity (MPFL)*  *-underdevelopment lateral femoral condyle*  *- Maldevelopement of patella*  *-increased Q angle*  *-External tibial torsion*  *-primary muscle defects* | 1)May follow trauma: valgus+ IR of femur above fixed tibia  2) underlying *anatomical abnormality*  - shallow femoral trochlear  - small high patella  - generalised ligament laxity  -increased Q-angle | Giving way  Hemarthrosis or effusion  Medial capsular tenderness | Apprehension sigh |  | Usually  Acute: MPFL repair  Recurrent/chronic: physical therapy, brace, patellar realignment surgery. |

**Module 6 Foot and ankle revision**

Foot ankle anatomy

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| Bone | Joints | Biomechanics | **Ligaments** | Compartment of lower **limbs** | Gait phase |
| Calcaneus  Talus  Navicular  Cuboid  Cuneiform (Med. Inter. Lateral)  Metatarsal  Phalanges  Ossicles  Malleoli: medial. Lateral | **Tibiotalar**: dorsi/ plantar 45-70°  **Subtalar**: inver/eversion 6°  **Transverse tarsal J (**Chopart J**)**  - **TNJ**: Talonavicular:  - **CCJ:** calcaneocuboid  **Midfoot joints (***5 bones***)**  -NC (naviculo- cuneiform J)  - IC (Inter-cuneiform joints)  - TM (tarso- metatarsal / Lisfranc) | **Bohler’s angle**: lateral view 20-40°. ( *reflex calcaneal #, collapse of posterior facet*)  Gissane’s critical angle: 95-105° | **Deltoid (Medial):** (4 )  **ATT** (*anterior tibio-talar*)  **TN** ( tibio-navicular):  **TC** ( tibio-calcaneal)  **PTT** (posterior tibio- talar)  **Lateral ligament** (3)  **ATFL** (anterior talo-fibular ) ( *commonly injured*)  **PTFL** (posterior talo-fibular)  CF (calcaneo-fibular)  Syndesmosis  **Achilles:** (soleus, gastrocnemius 🡪 calcaneus) | **Anterior**: TA, EHL, EDL, Peroneus tertius (*deep peroneal nerve*)  **Lateral**: PL, PB (superficial peroneal nerve)  **Superficial posterior**: GN, Soleus, plantaris  **Deep posterior**: PT, FHL, FDL, popliteus (*Tibial nerve*) | Stance phase ( 62%)  - Heel strike (ankle d  - foot flat  - midstance  - Toe off  -preswing  Swing phase (38%)  - toe -off  - mid-swing  - terminal swing |

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| Condition | Aetiology | Symptoms | Signs | Investigations | Treatment |
| Rupture of Achilles tendon  (2018:1) | Middle aged weekend warriors (70%)  Common in the 4th decade  Risk activities (*running, sprinting, jumping*)  Mechanism:  -*sudden Dorsal flexion of PF foot*  *- weakened tendon: aging, DM, gout, tight calf M, obesity*  Achilles tendonitis  - Insertional tendonitis (*pain & thickening at insertion)*  - Retrocalcaneal bursitis+ Haglund’s deformity  - Achilles tendinopathy ( *tendon thickening and inflammation. Pain throughout ROM*) | 1.Sudden popping event  2.Described as a “*kick from behind*” or “a *sudden snap in the calf*”  3.Delayed diagnosis is common. | **Palpable gap in the tendon**  **Weakness of plantar flexion against resistance**  **Thompson test:** no involuntary plantar flexion when calf is squeezed.  **Matles test**: prone, knee flexion 90°, active flexion of knee🡪 No plantar flexion | **X ray:** +/- avulsion at calcaneal insertion site  **USS:** acoustic vacuum at the rupture site with the presence of thick irregular edges.  **MRI**: gap between ruptured end. Altered T2W signal ( normal is low intensity) | Early diagnosis and referral important  **Non-operative** (functional rehab *often advised if presented within 48hrs. or elderly, frail* )  -**Equinus casting**: long leg knee 45° FL, ankle in plantar flexion🡪below knee cast after 4 wks  - **physiotherapy**: improve gait and calf strength  **Surgical repair** if  - presented after 24-48 h,  - re-rupture,  - persistent tendon gapping in PF,  - patient preference,  - avulsion  🡪 ↓re-rupture *2% vs 20%* , but complications ) |
| Ankle fracture | **Very common** in all ages  Usually due to external rotation of pronated foot  1 or 2 malleoli involved | Trauma  Pain  Swelling  +/- inability to bear weight | Effusion  Soft tissue swelling  1 or 2 malleoli tenderness  Proximal fibular tenderness | X ray: ankle trauma serios  Mortise view ( AP +15° IR)  Stress view: syndesmosis injury | Dislocation: reduce immediately  Stable/nondisplaced/avulsion: short leg cast4-6wks  Unstable/displaced: ORIF,  Bimaleolar # / lateral #+medial lig rupture: ORIF. |
| **Talus fracture** | High energy (MVA, fall from height)  Neck # most common🡪 AVN, needs ORIF.  Blood supply:  - 70% covered by cartilage  - No muscular attachments  - Direct *extra-osseous* blood supply  - Artery of tarsal canal supplies most of talar body  - *ANV depends on degree of displacement*    **3 types**  - body #  - neck of talus #  - osteochondral # | Trauma  Pain  Swelling  Inability to weight bear  **Complications** following Neck #  -skin necrosis (if talus is extruded)  -non-union  - aseptic necrosis (blood supply interrupted)  -late osteoarthrosis of the subtalar, TN joints  -unrecognized osteochondral fragments🡪 loose bodies | Oedema,  Tenderness  +/- Deformity  Check pulses | **X ray**: AP, lateral, **Canale** ( neck) & **Broden** ( post. Facet) view  **Hawkin’s sigh**: resorption of subchondral bone (lucency on x ray)🡪 fracture healing  **CT**: to better define # line . | **Neck fracture**: risk of AVN. ( Hawkins classification)  - type I percutaneous pin  - type II-IV: ORIF  Body/head/process #:   * Non-displaced: cast * Displaced: ORIF   Osteochondral fracture   * Large bony piece: repair * Small/cartilaginous: debride, drilling |
| Calcaneus fracture | \*Most common tarsal fracture  **\*High energy**/ axial load ( MVA, High fall)  \*Mostly intraarticular # #--> subtalar joint  **\*Skin** at risk from extensive oedema  \*Rule out **spine injury** in a fall  **\*Poor** outcomes | Trauma, pain, swelling, inability to weight bear  **Classification**  **Essex-Lopresti**   * Joint depression * Tongue type (Emergency)   **Sander**s: per coronal CT   * I-IV: how many fragments/# line * A-C: lateral to medial | Marked oedema & arch swelling  Fracture blisters  Widened heel  Check nerve function and pulses  10% with vertebral injuries  10% contralateral calcaneus # | **X ray:**  **AP**  **Lateral**  **Harris view**:  *Bohler’s angle* <20°;  *Angle of Gissane*: NL 95-105°  Calcaneal shortening and varus  **CT**: better define # lines, displacement, comminution. | Extraarticular:  -nondisplaced: cast 10-12weeks  -displaced: percutaneous pinning  **Intraarticular**  **-nondisplaced :** cast 12 weeks  **-displaced**: ORIF  -Comminuted, low demand/elderly, smoker: closed reduction, cast  - Comminuted, labourer: primary subtalar fusion. |
| Lis Franc #/ dislocation | **Torque** (扭转) of fixed foot or axial load to vertical foot  -can have # or purely ligamentous injury  -“Fleck” sign is avulsion of Lisfranc ligament from 2nd MT base  -easily missed injury  +/- other injury ( tarsal #) | Trauma to planted foot, pain, swelling | Oedema at mid foot  Ecchymosis: **plantar bruising**  (Highly suspicious) | X ray: AP, lateral, oblique  - >2mm btw 2nd MT base and cuneiform  - Weight bear stress views if needed.  - Compared to other side  CT: usually not needed | Nondisplaced (no widening)  \*NWB cast 8wks  \* >2mm needs surgical fixation  Minimally displaced: closed reduction, perc Pinning  Displaced:   * ORIF (screws, K-wires) * External fixation if needed preliminarily. |
| Compartment syndrome | Increased pressure within a fibrosseous compartment 🡪 decrease perfusion.  🡪 irreversible *muscle, neurovascular* damage if left untreated  **\*\***Commonly affects *anterior common*  *-increase in compartment contents*  *-decrease in volume*) | Pain out of proportion to the injury sustained  Post high energy injuries | \***Pain** on passive extension of the ankle and toes (sensitive sign)  \* paraesthesia, paralysis, palpable swelling, peripheral pulses absent (late sign)  \*Presence of pulse does NOT rule out |  | Urgent surgical decompression  --Dual incision technique. |
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Foot and ankle non-traumatic conditions

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| Condition | Aetiology | Symptoms | Examination findings | Investigation | Treatment |
| OA ankle | Usually post traumatic (70%) | Restricted ROM  (*Dorsiflexion first🡪 all range* )  Pain |  | **X ray:** Joint space narrowing, osteophytes, subchondral cysts, subchondral sclerosis  Deformity | Fusion vs arthroplasty |
| Hallux valgus | \* Genetic vs environment  (high heels, pointed shoes, barefoot, Family Hx)  \* F:M= (10:1)  **Pathology:**   1. *Adductor hallucis* over pulls hallux 2. Capsule tight laterally, loose medially 3. Bursal thickening over prominent exostosis about the MTP joint (*bunion*) | **Pain**  *- pressure over the bunion*  *-crowding of the toes*  *-degeneration in the MTP joint*  **valgus deformity**: lateral deviation & pronation of *hallux*, varus *1st MT*  Associated deformities  - Claw toes  - metatarsalgia  - Callosities | Valgus alignment of 1st MTPJ  Pronation of toe  FHL/Sesamoids malaligned  1st ray unstable +/- loss of arch +/- planovalgus  Tight calf: more forefoot load | **X ray**  AP (EB)/Lateral/Oblique  **4 Angles:**  - Hallux valgus (normal <15°)  - intermetatarsal (Normal <9°)  - Interphalangeal (normal <10°)  -DMAA: distal MT articular angle(normal<15°) | **Individualised treatment plan**  (*age, mobility, patient’s preference, other foot pathology*)  1: Modify shoes: wide toe box  2. Orthotics: metatarsal bar, toe spacer  3. Physio: calf stretching  4: Operation: *stabilise 1st ray, balance forefoot, lengthen calf PRN*  Excision of the osteophytes, osteotomy,  arthroplasty,  arthrodesis  Interposition arthroplasty |
| **Metatarsalgia** | Aetiology:  - flexor tendinitis,  - ligament rupture,  - callus (#1)  Due to Dx affecting MTP joint  - Freiberg’s osteochondritis  - Inflammatory/ degenerative conditions  - Increased loading (congenital, post trauma) | Metatarsal head pain  2nd MT most common. |  | X ray  Standing AP/ lateral  Look for short MT. | Metatarsal pads, MT neck supports  Modify shoes  Treat underlying cause  **Surgery:**  - osteotomies ( *realign prominent MT head*)  - Excision of the MT head  - Reorientation of the plantar fat pad. |
| Hallux rigidus | Causes unknown  Probably OA at 1st MTPJ  Often post traumatic | Pain and stiffness at 1st MTPJ  Dorsal MT head osteophyte  (worse pain in toeing off phase) | Tenderness to palpation  Decreased ROM (*especially dorsiflexion*) | X ray: dorsal osteophyte or OA findings at 1st MTP | - NSAID.  - full length rigid orthosis  - Cheilectomy  - fusion |
| Flat foot  (Planovalgus deformity)  Pes plenus  (平足) | 20% population has flat feet  Almost always bilateral  **Acquired**:  - ligamentous laxity  - Tibialis Posterior tendon dysfunction  - Traumatic  - arthritis  - calf tightness | Usually asymptomatic +/- pain with activity  **Pain**:  - medial hindfoot,  - lateral subfibular region  -Mid foot  **Stiffness**: difficult with foot wear  **Instability:** | **Too many toes sign**  Valgus heel  **Pes planus** when weight bearing  Non-WB arch reconstitute  Heel goes into varus on heel rise  - Stand on tip toes: calcaneus turns to varus (*flexible hind feet. Does not need treatment*)  **Pathologic flat feet**  - Deformity/tenderness ( loss of arch)  - inability to heel raise  - Apropulsive gait  - Flexible or fixed | X ray: Weight bearing  Lat: Decreased arch, otherwise normal  AP: +/- subluxation of talar head  Ankle xray: valgus talar tilt  USS: ? Tib post tendonitis  MRI: not generally helpful | Observation. Parental reassurance. Analgesia  Activity modification  Arch support may help:  orthotics  Physiotherapy  **Surgery**: Calcaneum osteotomy .  - indication: persistent pain  - Flexibility is key  - Flexible flat foot: bone realignment, soft tissue re-balancing.  - Stiff foot: fusion. |
| Cavovarus foot | Always pathology ( No normal variation)  Neurological imbalance. |  |  |  |  |
| Plantar fasciitis | **Common cause** of plantar heel pain.  Cause: chronic *traction injury*, repetitive trauma  🡪 microtear 🡪*Perifascial* inflammation of PF *aponeurosis*  F:M=2:1  Related conditions:  *obesity, flat foot, athletes, seronegative spondylorathropathies, RA, gout, SLE* | Pain medial heel  Increased pain with **DF** of toes/foot  Worse pain in the morning  Calf tightness | Medial plantar calcaneus tenderness . | **X ray:** +/- calcaneal bone spur (*commonly asymptomatic*)  **MRI:** thickening of the proximal plantar fascia, Inflammation in plantar aponeurosis; adjacent soft tissue edema, reactive calcaneal marrow edema, fluid-filled fascia; rupture at mid or proximal segments  Bone scan:  USS: | Pain relief  **Stretching/physio**  **Orthotics**: splint, casting, heel cup  Rarely surgical: partial fascia release. |
| Tarsal Tunnel syndrome | Posterior tibial nerve entrapped by  - flexor retinaculum  - space occupying lesion in tunnel | Pain  Numbness/tingling around ankle or plantar side of foot  Worse with walking, standing, running | Heel pain triad: TTS, PF, FF  Swelling around ankle  Tinnel  Worse pain with dorsiflexion, eversion | **EMG/NCS** ( sensory > motor)  **X ray** or **CT** : +/- osseous impingement, posteromedial process # of the talus  **MRI:** SOL | Orthotics  CSI  Surgical release if conservative fails after 3-6 months . |

**Radiology review**

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| Modalities | X ray | USS | CT | MRI | Bone scan |
| Advantages | \**First-line* imaging modality /baseline  \***MSK issues**: *fractures, arthritis, infection, bone tumours*  \* Widely available, low cost  \* Low radiation exposure  \* Easy to monitor treatment or dx progress  Fluoroscopy: Real time x ray  Low radiation  Used in OT | \* **Multiplanar imaging**  \* For **soft tissue** assessment: *tendon, muscle, ligament, nerve, effusion, collection, foreign body, lump,*  \* High resolution  \* Widely available; low cost  \* No ionising radiation/ own side effects  \* Dynamic assessment in real time  \* Colour doppler/power doppler: check vascularity  \* Imaging guided injection, aspiration, biopsy | \* **high spatial resolution** bone imaging  Eg. Occult/complex #, loose body, tumor.  \* CT guided injection, biopsy  \* Widely available  \* Moderate cost | \* Multiplanar cross-sectional  \* *Accurate delineation* of structures: *joint, tendons, tendon sheaths, ligaments, synovial membrane, cartilage*  \* Excellent soft tissue contrast resolution  \* Showing inflammation: soft tissue/bone  \* Good for bone marrow assessment  \*No ionising radiation | \*Osteoblastic map🡪 prediction for pain generators  \*Good for fracture, osteoarthritis, infection, skeletal metastases  \* Can image entire skeleton with one study  \* Sensitivity> specificity |
| Disadvantages | \* low sensitivity  - up to 10% fractures occult  - up to 40% bone destroyed before x ray evidence (infection/tumour) | \* Operator dependent  \* Machine quality dependent  \* Affected by BMI. | \* Moderate radiation  \* Moderate cost | \* high cost  \* variable availability, referral access  \* long waiting lists in public hospital  \* Clostrophobia for some patients  \* **Contraindication**: *pacemaker, some metallic implants, older aneurysm clips, intra-orbital metallic foreign bodies* | \* Imtermediate-high cost  \* variable availability and referral access  \* higher radiation exposure ( *radiophamaceutical + CT*)  \* Time consuming for patient |
|  |  |  |  |  |  |
| Frozen shoulder | Often normal  May show OA, spur, calcified tendon | \* limited ROM: ER , supraspinatus mv  \* thickened Coracohumeral ligament (CHL)  \* thickening of inferior GH capsule  \* echogenic material around the long head of biceps at rotator interval  \* increased vascularity of LHB at rotator interval. |  | T2W  CH lig thickening >4-7mm  Subcoracoid triangle singn  Joint capsule thickening  Abnormal soft tissue thickening at rotator |  |
| Subacromial bursitis | Often normal  to exclude other dx | **USS:** anechoic fluid filled structure  Hyperechoic wall, synovial hypertrophy +/- hyperechoid blood |  | **MRI:** Fluid filled structure btw deltoid and acromion. . T1w hyperintense. T1W hypointense. |  |
| Lateral epicondyle pain | *usually normal*  *+/- calcification in extensor muscle mass*. | *ECRB tendon thickened, hypoechoic;*  *variable sensitivity, specificity.*  Color dpl: tendon hyperemia  Dynamic: delineate instability |  | -ECRB tendon thickening, oedema, tendon degeneration 90% cases |  |
| CMC joint arthropathy |  |  |  |  |  |
| De Quervain’s | usually normal  Soft tissue swelling over radial styloid  Cortical erosion, sclerosis, periosteal reaction. | Diagnostic  Thickening of APL, EPB tendon  Increased fluid at 1st ET compartment  Thickening of overlying retinaculum, synovial sheath.  Peritendinous hperemia. |  | Very sensitive, specific  Tenosynovitis: inc. T2W signal ( fluids in sheath, thickened retinaculum )  Tendinosis: thickened tendon, tendon tear, |  |