Orthopaedics Summary

General management
Haemorrhage control (1.2-1.5L in femur; 0.5-1L in tibia; 500ml in humerus)
Decontamination: if open; irrigation - early surgical debridement
Analgesia, ADT
Antibiotics: fluclox 2g QID; significant soiling/>10cm wound/loss of bone coverage: gent + augmentin
Elevation
Reduction + Immobilisation
Urgent OT if: amputation for life saving; uncontrollable haemorrhage; open #; contaminated; ischaemia >6-8hrs

Increased risk # infection
Contaminated; STI; debridement delay 8hrs; Abx delay 3hrs
Staph aureus, strep pyogenes; C perfringens

Fracture Complications
Acute
Soft tissue: compartment syndrome, skin necrosis, rhabdo
Nerve: neuropraxia or transection
Vascular: contusion or traction, distal ischaemia, haemorrhage
Bone infection, other bone injuries
Visceral complications
Fat Embolism
Iatrogenic: Complications of anaesthesia, manipulation, hospitalisation, medications

Delayed
Union: Non, Slow, Delayed, Malunion
Traumatic epiphyseal arrest
Joint Stiffness, early OA
AVN
Volkmann’s ischaemic contracture
CRPS
Myositis ossificans
Osteomyelitis
Social - Loss of function, mobility, work

Complex Regional Pain Syndrome
Group 1: “Sudeck’s atrophy, reflex sympathetic dystrophy”
Group 2: Injury to major peripheral nerve eg gunshot wound/amputation affecting sciatic n.

Ottawa Ankle Rules
Pain in malleolar area +
1: tender posterior edge or tip lateral malleolus
2: tender posterior edge or tip medial malleolus
3: unable to WB 4 steps immediately and in ED

Ankle # Classification
Potts: Uni/bi/trimalleolar; bi and tri and unstable
Weber: Level of fibular fracture relative to tibiotalar joint
Maisonneuve #: Proximal fibula + medial malleolus (or deltoid ligament rupture); unstable; needs OT
Back Pain Ddx

<30yrs: ank spond, RA, OM, discitis, extradural abscess
>30yrs: bony mets, myeloma, lymphoma, renal/pancreatic disease, aortic aneurysm
>60yrs: OP, Paget’s, OA, spinal stenosis

Red flags
Recent significant trauma; recent mild trauma >60yrs; prolonged steroid use; OP; >70yrs; PMH Ca; recent infection; fever; IVDU; low back pain worse at rest; unexplained weight loss; nocturnal pain, features of SC compression; ?Ca; ?infection; immunosuppression; >6/52 duration

Cauda Equina
Urinary incontinence/retention (most common symptom; 90% sens, 95% spec) residual >200ml
C5 biceps jerk
C6 wrist extension
C7 triceps, pronator teres
C7-8 triceps jerk
L1-2 hip flexion
L3-4 knee extension, knee jerk
L5 great toe and ankle dorsiflexion, heel walking
L5-S1 SLR test, ankle jerk
S1 ankle and toe plantar flexion, ankle eversion, toe walking
S3 hip extension

Clavicle #

Neer classification
I. Middle 1/3 ~ 80%  II. Distal 1/3 ~ 15%  III. Proximal 1/3 ~ 5%

Indications for OT
Open # or Integrity of skin threatened
Severe angulation or complete displacement of mid-shaft
Floating shoulder with displaced clavicular fracture and unstable scapular fracture
Displaced Neer Type II fracture
NV injury
Unable to tolerate closed management - rare- e.g. Parkinson’s, seizures; Unacceptable cosmosis

SCJ dislocation
Posterior dislocation – brachiocephalic/subclavian venous obstruction, tracheal compression, subclavian/brachiocephalic/carotid artery compression

ACJ dislocation
I AC ligament sprain
II AC ligament torn; CC lig sprain; subluxation <1cm; normal CC joint space
III AC and CC ligs torn; >1cm subluxation/>50% widening CC joint
IV As III, but posterior displacement of clavicle
V 200-300% superior displacement
VI Inferior displacement
IV, V & VI = surgery

Scapula #
Associated injuries common - high energy
Skeletal – shoulder disloc, clavicle #, rib #s
Pulmonary – PTX or contusion
Brachial plexus or axillary artery injury
Head/neck injuries
Shoulder Anterior dislocation (95%)
Complications
Rotator cuff inj (esp subscapularis; in 86% if >40yrs)
# Greater tuberosity or humeral neck
Axillary artery and nerve, brachial plexus
Bankart lesion - avulsion ant glenoid labrum, tear anterior capsule, assoc with recurrent dislocations
Hill-Sachs deformity - compression # post-lat humeral head due to abrasion by glenoid
Reverse Hill-Sachs lesion - compression # anteromed humeral head, posterior shoulder dislocation
Recurrent dislocation

Shoulder Relocation
Kochers - pt seated, flex elbow, traction, ext rot
Milch - supine, extend elbow, traction, abduction + ext rot
Stimson - prone, 5-10kg weight on wrist
Scapular rotation - prone or seated, scapular tip medially
Hippocratic - Traction-countertraction - supine, abduct, sheet axilla, traction on abducted arm
Cunningham - seated, arm adducted/downwards, flex elbow, arm on doc’s shoulder, doc’s wrist over patient’s forearm, massage trapezius/deltoid/biceps, patient to hold ‘shoulder blades’ together/sit up
Spaso technique - supine, arm lifted vertically, slight external rotation

Posterior dislocation
Often associated with posterior glenoid and reverse Hill-Sachs deformity
Reduction
Traction with arm at 90 deg abduction and external rotation; or traction to adducted arm and assistant pushes humeral head anteriorly

Luxatio erecta - Inferior dislocation
Complications: significant risk NVI (60% neuro injury, usually axillary)
80% have rotator cuff injury or # proximal humerus

Proximal humerus #
Neer Classification
Displacement = >1cm, Angulation = >45 deg
1 part (no displacement/angulation)
2 part (most common; displacement of 1 element eg fracture of surgical neck or GT or LT)
3 part (displacement of 2 elements; humeral head in contact with glenoid)
4 part (displacement of 3+ elements; dislocations of GH joint)
Complications
Most often axillary nerve related to surgical neck. Also radial or musculocutaneous nn.
Vascular – axillary artery

Humeral shaft #
Complications
Brachial artery injury
Radial nerve injury, Also ulnar and median nerves
Displacement (common due to many muscle attachments)

Supracondylar/transcondylar fractures
Gartland Classification
I - non-displaced
II - displaced but posterior cortex intact
III - completely displaced
Complications
Median, radial & ulnar nerve
Brachial artery
Compartment syndrome
Volkman’s ischaemic contracture: neurovasc compromise 2o missed compartment syndrome
Stiffness: early range of motion may prevent or reduce its severity
Cubitus varus – mainly cosmetic
Post-traumatic arthritis: can result from the initial articular impact
Heterotopic ossification

Medial humeral epicondyle # (appears at 5-6yrs)
3rd most common paeds elbow #
50% assoc with elbow dislocation
Needs OT if >1cm of articular surface, or ulnar nerve involvement

Lateral humeral condyle (appears at 11-12yrs)
Unstable, often also involves all of capitellum and ⅓ of trochlea
Milch I = Salter Harris IV
Milch II = Salter Harris II (into jt/lat part of trochlea), most common
OT if displaced or ulnar nerve involvement

Elbow dislocation
90% postero-lateral

Complications
1/3 # (coronoid process, radial head)
15% medial epicondyle #
Brachial artery, ulnar nerve
“Terrible triad” = dislocation + radial head and coronoid #
Management - traction, correct med/lateral displacement, downward pressure on forearm, flexion with thumbs pushing on olecranon

Epicondylitis (Tendonitis)
Tennis Elbow: Lateral epicondylitis where ext. carpi radialis brevis inserts
Golfer’s Elbow: Medial epicondylitis of CFO. Worse on resisted wrist flexion.

Colles #
Associated ulnar styloid # in 60% - suggests serious disruption of inferior radio-ulnar joint

Complications
Median nerve compression
CRPS (1-4%)
EPL rupture (3%; due interrupted vascular supply; occurs 4-8/52 later)
Compartment syndrome
Triangular fibrocartilage complex inj: radioulnar and radiocarpal instability
Smith’s #
# distal radius, volar displacement and angulation

Barton’s #
Dorsal/volar rim # of distal radius extending intra-articularly unstable as ligamentous injury assoc; ORIF needed

Henderson (Chauffeur’s) #
Radial styloid #
May be assoc with lunate dislocation, scapholunate dissociation, trans-styloid perilunate dislocation, dorsal Barton’s #

Radial head #
Classifcation
I  Displaced <2mm; no mechanical block
II  Displaced <2mm; >30% radial head involvement; maybe mechanical block
III Comminuted
IV  + dislocation

Olecranon #
Classifcation:
I  Displaced <2mm; trt conservatively
II  Displaced but ulnohumeral joint stable; needs OT
III  Displaced and unstable

Nightstick #
Midshaft ulna due to direct blow

Monteggia #
Fracture prox ⅓ ulna with dislocated radial head (anteriorly in 60%)
Complications: interosseous/radial nerve injury; malunion and nonunion; unstable radial head

Galeazzi #
Reverse Monteggia
# midshaft or distal ⅓ radius with dislocated distal radioulnar joint
Complications: instability DRUJ; ulnar nerve and ant intersosseous branch of median nerve

Hume #
Fractured olecranon with radial head dislocated anteriorly
Essex-Lopresti #
Fractured radial head and dislocation of DRUJ

Radiocarpal joint dislocation
Disruption of Gilula’s lines; incr carpal joint spaces >2mm
Lunate dislocation - middle ‘c’ displaced volar - spilled tea cup
Perilunate dislocation - dislocation of carpus dorsally (Lunate still attached to radius) - lateral view capitate dorsal to lunate
Trans-scaphoid perilunate dislocation: distal scaphoid fragment displaces posteriorly with rest of carpals
Scaphoid dislocations: prox pole goes dorsal, distal goes volar
Scaphoid # - 30% prox pole #’s get AVN, nonunion, CRPS
Triquetrum # - 2nd most common carpal #; avulsion or through body; tender dorsum of wrist
Hamate # - Ulnar nerve inj

Bennett’s #
Intra-articular # – dislocation carpo-metacarpal joint of thumb
Management: traction, abduction and pressure over base of thumb
Usually needs K wire fixation

Rolando’s #
3 part # base of thumb (T or Y), intra-articular, uncommon, worse prognosis than Bennett’s, always need ORIF (= comminuted Bennett’s)

Paronychia - Infection between cuticle/lateral nailfold and nail plate - give fluclox; I&D if collection visible
Felon - Infection of distal finger pulp, very painful; I&D if abscess; fluclox

Hand hx: DM, immunosuppression, drugs/allergies, systemic sx, ADT, FB, occupation, handed, Hep B if bite

Radial Nerve
Sensory - dorsal aspect radial two-thirds of hand and thumb
Motor - extension of wrist, thumb, and all finger MCP joints

Ulnar Nerve
Sensory - dorsal and volar sides of medial half of ring finger and entire little finger
Motor - intrinsic muscles of hand: flexion MCPJs, extension IPJs, adduction thumb, wrist flexors

Median Nerve
Sensory - volar aspect of hand and fingers from thumb to radial half of ring finger; dorsal aspect of index, middle, and radial half of ring finger from PIP joint to tip of finger
Motor - thumb opposition

Pelvic Trauma
Complications
Vascular:
Internal iliac arteries intrapelvic - if post ring involvement can lose up to 4-6L blood
Most bleeding is low pressure venous bleeding and bleeding from bone edges
10-15% arterial (from internal iliac)
Shock and death usually due to arterial; if bleeding refractory to resus, likely arterial - angiography

Neural:
Lumbar and sacral plexus
S1-2 nerve roots commonly involved in post element #’s
Impotence in 1/6th sacral #’s

GU:
Bladder or urethral in 16% - If suspect, do retrograde urethrography before placing IDC
High fetal death rate

GI: Rectal injury uncommon

Other: Ruptured diaphragm

Avulsion #
ASIS - sartorius; pain on flexion + abduction
Ischial tuberosity - hamstrings; non-union common; OT needed
AIIS - rectus femoris; can’t flex hip
Post spine - erector spinae
Iliac crest - direct violence
**Acetabular #**
Assoc with sciatic and femoral nerve inj, femoral #, knee inj

**Pelvic # Investigations**
Pelvic inlet view for ant SIJ inj
Pelvic outlet view for sacrum
Judet view for acetabular #
Retrograde urethrogram

**Angiography and embolisation**
If continuing blood loss and other sources excluded even if haemodynamically unstable
Only Cl’ed if needs laparotomy

**Pelvic # Classification**
Single break = stable inj; 2 breaks = unstable with risk of displacement

**Young- Burgess Classification**

**LC (Lat compression)**

*Type I*  
50% - Most common  
Stable (4% bladder rupture)  
# sacrum on side of impact + pubic rami #

*Type II*  
Unstable to int rotation  
36% severe haem, 7% bladder rupture  
# iliac wing near SIJ + pubic rami #

*Type III*  
Unstable (60% severe haem, 20% bladder rupture  
20% urethral inj)

Contralat AP compression (open book #), ipsilat lat compression (LC I/II)

**APC (antpost compression)**

*Type I*  
Symphysis diastasis

*Type II*  
Disruption sacrotuberous/sacrospinous/ant SI ligs, intact post SI ligs; wide SIJ; open book

*Type III*  
Complete disruption hemipelvis, posterior involvement

**VS (vertical shear)**
Significant blood loss (75% severe haem, 15% bladder rupture, 25% urethral rupture)

**NOF #**
F >M if >60y
Leg shortened, adducted, externally rotated if extracapsular #

Asymmetry of Shenton’s line (sup border of obturator foramen and medial aspect of femoral metaphysis)

Angle to neck of shaft normally 135deg

**Classification**

*Garden 1* - Superior cortex buckled/fractured, Inferior cortex intact  
Trabeculae angulated, Non-displaced, stable

*Garden 2* - Complete fracture, Trabeculae interrupted but *not angulated*, Non-displaced, unstable

*Garden 3* - Complete fracture, Abduction & Rotation of head, Displaced

*Garden 4* - Complete fracture, Fully displaced

1-2 have up to 20% AVN
3-4 have worse prognosis than this; 15-35% risk of AVN overall

Garden I-II/all grades in younger patients/extracapsular = internal fixation with dynamic hip screw
Garden III-IV = hemiarthroplasty
Consider THJR in younger patient

**Extracapsular**
Less risk of AVN; 4x more common; non-union rare; OT easier

**Extracapsular - Evans**
I - Single #; Minimal displacement
II - Lesser trochanter #
III - Greater + lesser trochanter # + femoral neck separate
IV - # spirals into femoral shaft

**Greater trochanter #**
Direct trauma (older), or avulsion from contraction of gluteus medius (7-17yrs). If displaced >1cm needs OT

**Lesser trochanter #**
Iliopsoas avulsion. Pain on flexion and int rotation; Ludloff sign (can’t raise foot off ground when seated)

**Hip Dislocation**

**Complications**
10% AVN
50% acetabular/femoral #
Sciatic nerve injury, femoral head #

**Femoral shaft #**

**Winquist classification:**
I - minimal/no comminution
II - comminution of <50% circumference of major # fragments
III - comminution of >50% circumference of major # fragments
IV - all cortical contact lost/circumferential comminution segment of bone

**Supracondylar #**

**Classification (Muller AO)**
A - extra-articular, transverse
B - intra-articular, unicondylar
C - intra-articular, bicondylar - displacement, post angulation, rotation

**Femoral condylar #**
Intercondylar/condylar

**Complications** - Popliteal artery/deep peroneal nerve (1st web space), DVT, fat emboli

**Ottawa knee rules**
Pain in knee + >55yrs
tender head of fibula / patella
active knee flexion <90deg
inability to WB 4 steps immediately and at time of assessment

**Pittsburgh Knee Rules**
**Xray if:** Blunt trauma or fall plus one of:
1. age <12 or >50
2. unable to walk 4 steps in ED
Adults & children; as sensitive & MORE SPECIFIC than Ottawa; Specificity relatively low
Knee dislocation
40% anterior, 33% posterior, 18% lateral
Spontaneous reduction 50% - high index suspicion esp if ant/post drawer positive

Complications
Nerve - common peroneal (foot drop, lateral foot sensation), tibial
Vascular - popliteal artery
Tendons/ligaments
Compartment syndrome
Joint stiffness, instability

ACL injury
Accounts for 70% haemarthroses
Segond #
Tests:
Lachman (85-95% sens, 100% spec; >5mm positive)
Ant drawer (60% sens, 65% spec; >6mm positive)

PCL injury - Tests: Post drawer (55-85% sens)

LCL injury - Complication: peroneal nerve injury

Meniscal injury
Medial meniscus 2x more common
Tests:
McMurray’s test (50% sens)
Apley compression/Grind test (50% sens)

Tibial plateau #
Lateral tibial condyle most common (due to valgus stress; assoc with ACL and MCL inj)
Medial plateau inj assoc with PCL and LCL inj

Classification
I Wedge # of lateral plateau
Depression/displacement <4mm
Usually young patients
II Split fragment from articular surface with depressed areas
Associated with fibular #; ligament inj in 20%
Usually older patients
III Depression without associated wedge #
Usually older patient with OP
IV Wedge # of medial plateau
Associated with medial meniscus injury
Usually older patients (younger if high energy injury)
V Wedge # medial and lateral plateau
VI Bicondylar # and distal oblique shaft #

Management
I and III - usually conservative
II - conservative if <6mm depression and displaced fragment reduced with traction
IV - reduction and internal fixation

Complications
Peroneal nerve inj; popliteal artery inj; ACL, PCL, MCL, LCL inj, DVT, OA
**Tibial shaft #**

**Gustillo classification** (open tibial fractures)
- **I** minimal STI, skin lac < 1 cm
- **II** mod STI; wound 1-5 cm; mod contamination
- **III** segmental #, vascular, wound > 10 cm, highly contaminated
- **IV** total/subtotal amputation

**Tibial plafond (Pilon) #**
As talus is driven into bottom of tibia; high energy mechanism; often comminuted; often assoc with L1 # and compartment syndrome.

**Ottawa Foot Rules**
Pain in midfoot zone plus:
- 1: tender base 5th metatarsal
- 2: tender navicular (medial)

**Ottawa Rules:**
Pros: 100% sens, can be used by RNs, decr XR 30%
Cons: not applicable to children or non-cooperative, distracting inj, potential litigation for missed fracture

**Talar #**

**Hawkin’s classification**
- **I** - non-displaced; 10% AVN
- **II** - displaced; ankle joint OK; 30% AVN
- **III** - displaced; dislocation talus from ankle/subtalar joint; 90% AVN; reduce ASAP

**Calcaneal #**
Complications: other #s - other foot/acetabulum, 10% vertebral, 50% chronic pain, subtalar joint instability, early OA, compartment syndrome
Bohler’s angle: post tuberosity to highest midpoint/ant tuberosity to midpoint; normal 20-40deg

**Lisfranc #/dislocation**
Tarso-metatarsal joint. Lisfranc ligament runs lateral base medial cuneiform to medial base 2nd MT
AP: Medial border 2nd MT lines with medial border middle cuneiform
**Oblique**: Med + lat border 3rd MT lines with med + lat border lat cuneiform
Med border 4th MT lines with med border of cuboid
Complications: dorsalis pedis compression/laceration, RSD, compartment syndrome

**Base 5th Metatarsal #**
Jones # - intra-articular transverse # base 5th MT, 35-50% non-union
OT if > 30% articular surface or > 2 mm displacement

**Pulled elbow**
Subluxation of radial head.

*Supination/flexion technique*: hold arm with thumb on radial head - supinate and flex arm
*Hyperpronation method*: hold elbow - hyperpronate forearm with other hand; 95% success rate

**Salter Harris injuries**
- **I:** Separate: through epiphysis; diagnosis clinical
- **II:** Above: through epiphysis and metaphysis; most common
- **III:** Low: intra-articular # into epiphysis.
- **IV:** Thru: intra-articular # into epiphysis and metaphysis
- **V:** Rammed: crush/axial loading to epiphysis - prognosis poor
Paediatric elbow

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<td>Radial head</td>
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<td>Int epicondyle</td>
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<td>Trochlea</td>
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<tr>
<td>Lat epicondyle</td>
<td>11-12 years</td>
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Paediatric elbow XR interpretation

1. **Ant humeral line**: bisects capitellum in middle ⅓ on lateral; Angle between line through centre of capitellum and ant humeral line should be 30-45 deg
2. **Radio-capitellar line**: abnormal in lat condyle, radial neck, Monteggia, elbow dislocation
3. **Baumann angle**: angle between physeal line of lat condyle of humerus and line perpendicular to long axis of humeral shaft = 8-28 deg; supracondylar #
4. **Bowing of anterior fat pad**
5. **Any posterior fat pad**

Supracondylar fracture humerus

Significantly displaced # surgical emergency (brachial artery, median/radial/ulnar nerve; Volkmann's contracture); compartment syndrome

Elbow dislocation: neuro inj in 10%; post most common; ulnar/median nerve inj

?NAI

Clavicular # <2yrs
Mid-humerus # in small children
Femoral shaft # if not yet walking
Metaphyseal # (bucket handle/corner #)
Rib #, esp posterior ribs
Non-parietal skull #
Scapular #
Sternal #

Osteomyelitis

More common in neonates, SCD, open #, chronic ulcers
Usually long bones in young; axial skeleton in adults
Direct spread in children, haematogenous in adults
Staph aureus most common cause (80%)

**Neonate (<4/12)**: staph aureus, enterobacter, grp A+B strep

**Children and adults**: staph aureus, grp A strep, Hib, enterobacter

**Adults**: also gonorrhoea (usual cause in healthy adult), E coli

**Bloods**: incr ESR/CRT in 90%; blood cultures +ve in 50%; WCC not sens

<5yrs: fluclox 25-50mg/kg QID + cefotaxime 25-50mg/kg TDS or ceftriaxone 50mg/kg OD

>5yrs: fluclox 25-50mg/kg QID

Adults: fluclox 2g IV QID for 2-4/52 (6/52 if chronic) (+ cefotaxime 2g TDS if ?G-ve). If MRSA: vanc

Paget's Disease of the Bone

Increased bone turnover in focal areas, 2 phases: lytic, sclerotic
Commonest in pelvis, lumbar spine, long bones, skull
Commonly asymptomatic & discovered by elevated serum ALP or XR