Trauma & Orthopaedic Surgery for the Intercollegiate MRCS
Ages of Trauma & Orthopaedics

• Age of Amputation – 19th Century
• Age of Reconstruction – 20th Century
• Age of Regeneration – 21st Century
Pathophysiology of fracture healing

• Bone anatomy and biomechanics
• Fracture patterns
• Bone healing and blood supply
• Influence of implants
What is the structure of bone?
Bone structure

Four levels:

• Chemical – molecular
• Electron microscope – lamellae
• Microscopic – Haversian systems
• Macroscopic – compact and cancellous
Microscopy

• Cortical bone
  – also “compact” and “lamellar” bone

• Cancellous bone
  – spongy bone, woven bone.
Microscopy

Haversian systems:

- Lamellae interleaved with osteocytes in lacunae

- Central canal with Blood vessel and lymphatics
Bone dynamics

- Osteoblasts: mesenchymal, specialised adjacent to periosteum and endosteal areas
- Osteoclasts: multinucleated giant cells, from bone marrow
- Osteocytes: derived from osteoblasts, interlacunral connections, and entombed by their neighbours
Blood supply

- Blood vessels - nutrient artery
- Endosteal
- Periosteal
- Venous drainage
Bone Strength

Compression

Shear/tension

250 kg
How do bones fracture?
DESCRIBING THE FRACTURE

• Mechanism of injury
  – Traumatic
  – Pathological
  – Stress
  – Pathological sieve
DESCRIBING THE FRACTURE

• Anatomical site (bone and location in bone)

• Configuration Displacement
  – three planes of angulation
  – translation
  – shortening

• Articular involvement/epiphyseal injuries
  – fracture involving joint
  – dislocation
  – ligamentous avulsion

• Soft tissue injury
MINIMALLY DISPLACED DISTAL RADIUS FRACTURE
MULTIFRAGMENTARY PROXIMAL-THIRD FEMORAL FRACTURE WITH SIGNIFICANT DISPLACEMENT

OPEN?
N/V INJURY?
Fracture mechanics

- Spiral: Torsion Low energy
Fracture mechanics

- Transverse: bending load
Fracture mechanics

Oblique

or transverse with butterfly:
Compression + bend
Fracture mechanics

Comminuted:

High energy: combination

• implosion
• compression,
• Bending
• Torsion
How do fractures heal?
Fracture healing

Why do fractures unite?

Because the bone is broken!
Healing cascade: indirect healing

- **Inflammation 0 – 5 days**
  - Haematoma
  - Necrotic material
  - Phagocytosis

- **Repair: 5 – 42 days**
  - Granulation tissue
  - Acid environment
  - Periosteum – osteogenic cells
  - Cortical osteoclasis

- **Remodelling**
  - years
Cytokine release

- Inflammatory mediators
- Fibroblastic growth factor stimulates angiogenesis
- TGF β initiates chondroblast/osteoblast migration
- TGF β stimulates enchondral ossification
Healing cascade

Late repair:

• Fibrous tissue replaced by cartilage

• Endochondral ossification

• Periosteal healing » membranous ossification
Healing cascade

Regeneration & remodelling
- Replacement of callus (woven bone with lamellar bone)
- Continued osteoclasia
- Mechanical strain

(Wolff 1892)
What is the difference between direct and indirect bone healing?
Indirect healing – healing by Callus

- Unstable
- Callus stabilises #
- Direct healing between cortices
Robert Danis 1880 - 1962

- Plaque co-aptateur, 1949
- Primary (direct) bone union “soudure autogène”
- No callus
Direct bone healing – the response to rigid fixation

- Temporary acceleration of Haversian remodelling

- Only occurs in absolute stability of the fracture

- Does not involve callus formation

- Requires good blood supply
Direct bone healing

Appositional healing
- No gap
- Osteons traverse #

Gap healing
- Accurate apposition impossible
- Vessels/mesenchymal cells
- Lamellar bone
Effect of implants on bone biology

**Absolute stability:**
Plates
- Early reconstitution of macrocirculation
- Plate footprint
- Periosteal stripping
- Titanium vv SS.
Effect of implants on bone biology

Relative stability:
IM nails

- Reaming & blood supply
- Periosteal reversal
- Thermal necrosis
Effect of implants on bone biology

Relative stability:
External fixation

- Pin configuration & rigidity of construct
- Bone and thermal necrosis
- Infection
What are the aims of fracture treatment?
AIMS OF FRACTURE TREATMENT

• Restore the patient to optimal functional state

• Prevent fracture and soft-tissue complications

• Get the fracture to heal, and in a position which will produce optimal functional recovery

• Rehabilitate the patient as early as possible
What factors effect fracture healing?
FACTORS AFFECTING FRACTURE HEALING

• The energy transfer of the injury

• The tissue response
  – Two bone ends in opposition or compressed
  – Micro-movement or no movement
  – Blood Supply (scaphoid, talus, femoral and humeral head)
  – Nerve Supply
  – No infection

• The patient
  – smoking

• The method of treatment
LOW ENERGY INJURY
HIGH-ENERGY INJURY
How do you manage a polytrauma patient?
MANAGEMENT OF THE INJURED PATIENT

• Life saving measures
  – Diagnose and treat life threatening injuries
  – Emergency orthopaedic involvement
    • Life saving
    • Limb saving
    • Complication saving
  – Emergency orthopaedic management (Day 1)
  – Monitoring of fracture (Days to weeks)
  – Rehabilitation + treatment of complications (weeks to months)
LIFE SAVING MEASURES

A - Airway and cervical spine immobilisation

B - Breathing

C - Circulation (treatment and diagnosis of cause)

D - Disability (head injury)

E - Exposure (musculo-skeletal injury)
EMERGENCY ORTHOPAEDIC MANAGEMENT

• Life saving measures
  – Reducing a pelvic fracture in haemodynamically unstable patient
  – Applying pressure to reduce haemorrhage from open fracture

• Complication saving
  – Early and complete diagnosis of the extent of injuries
  – Diagnosing and treating soft-tissue injuries
Pelvis Fracture and Ex-Fix
Why is treating the soft tissues so important, how do you classify soft tissue injury?
DIAGNOSING THE SOFT TISSUE INJURY

• Open fractures, degloving injuries and ischaemic necrosis
• Muscles
  – Crush and compartment syndromes
• Blood vessels
  – Vasospasm and arterial laceration
• Nerves
  – Neurapraxias, axonotmesis, neurotmesis
• Ligaments
  – Joint instability and dislocation
Soft Tissue Injuries

*Open*

I  Clean, <1 cm
   *Simple #*

II Clean, >1 cm
   *Simple #*

III Extensive
   *High energy #*

*Gustilo & Anderson, 1976*
Soft Tissue Injuries

Open

I  Clean, <1 cm
    Simple #

II Clean, >1 cm
    Simple #

III Extensive
    High energy #

Gustilo & Anderson, 1976
Soft Tissue Injuries

Open

I  Clean, <1 cm
Simple #

II Clean, >1 cm
Simple #

III Extensive
High energy #

Gustilo & Anderson, 1976
Soft Tissue Injuries

Open

**IIIa** Soft tissue cover

**IIIb** Soft tissue loss periosteal strip

**IIIc** Vascular injury -repair

Gustilo, Mendoza & Williams, 1984
Soft Tissue Injuries

Open

IIIa Soft tissue cover

IIIb Soft tissue loss
periosteal strip

IIIc Vascular injury
-repair

Gustilo, Mendoza & Williams, 1984
Soft Tissue Injuries

Open

IIIa Soft tissue cover

IIIb Soft tissue loss periosteal strip

IIIc Vascular injury repair

Gustilo, Mendoza & Williams, 1984
TREATING THE SOFT TISSUE INJURY

• All severe soft tissue injuries require urgent treatment
  – Open fractures, Vascular injuries, Nerve injuries, Compartment syndromes, Fracture/dislocations
  – After the treatment of the soft tissue injury the fracture requires rigid fixation
  – A severe soft-tissue injury will delay fracture healing
DIAGNOSING THE BONE INJURY

• Clinical assessment
  – History - Co-morbidities
  – Exposure/systematic examination

• “First-aid” reduction

• Splintage and analgesia

• Radiographs
  – Two planes including joints above and below area of injury
How do you treat fractures?
TREATING THE FRACTURE

• REDUCE, HOLD, REHABILITATE

• Does the fracture require reduction?
  – Is it displaced?
  – Does it need to be reduced? (e.g. clavicle, ribs, Metatarsals)

• How accurate a reduction do we need?
  – alignment without angulation (closed reduction - e.g. wrist)
  – anatomic (open reduction - e.g. adult forearm)
TREATING THE FRACTURE

• How are we going to hold the reduction?
  • Semi-rigid (Plaster)
  • Rigid (Internal fixation)

• What treatment plan will we follow?
  • When can the patient load the injured limb?
  • When can the patient be allowed to move the joints?
  • How long will we have to immobilise the fracture for?
DIFFERENT TYPES OF RIGID FRACTURE FIXATION
# TREATING THE FRACTURE

<table>
<thead>
<tr>
<th></th>
<th>Operative</th>
<th>Non-optve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rehabilitation</td>
<td>Rapid</td>
<td>Slow</td>
</tr>
<tr>
<td>Risk of joint stiffness</td>
<td>Low</td>
<td>Present</td>
</tr>
<tr>
<td>Risk of malunion</td>
<td>Low</td>
<td>Present</td>
</tr>
<tr>
<td>Risk of non-union</td>
<td>Present</td>
<td>Present</td>
</tr>
<tr>
<td>Speed of healing</td>
<td>Slow?</td>
<td>Rapid</td>
</tr>
<tr>
<td>Risk of infection</td>
<td>Present</td>
<td>Low</td>
</tr>
<tr>
<td>Cost</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>
What are the indications for the operative treatment of fractures?
INDICATIONS FOR OPERATIVE TREATMENT

• General trend toward operative treatment last 30 yrs
  • Improved implants and antibiotic prophylaxis,
  • Use of closed and minimally invasive methods

• Current absolute indications:-
  • Polytrauma  Displaced intra-articular fractures
  • Open #'s  #’s with vascular injury or compartment syndrome,
    Pathological #’s  Non-unions

• Current relative indications:-
  • Loss of position with closed method, Poor functional result
    with non-anatomical reduction, Displaced fractures with poor blood
    supply, Economic and medical indications
When is a fracture healed?

• Clinically
  
<table>
<thead>
<tr>
<th></th>
<th>Upper limb</th>
<th>Lower limb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult</td>
<td>6-8 weeks</td>
<td>12-16 weeks</td>
</tr>
<tr>
<td>Child</td>
<td>3-4 weeks</td>
<td>6-8 weeks</td>
</tr>
</tbody>
</table>

• Radiologically
  • Bridging callus formation
  • Remodelling

• Biomechanically
REHABILITATION

• Restoring the patient as close to pre-injury functional level as possible
  – May not be possible with:-
    • Severe fractures or other injuries
    • Frail, elderly patients

• Approach needs to be:-
  – Pragmatic with realistic targets
  – Multidisciplinary
    • Physiotherapist, Occupational therapist, District nurse, GP, Social worker
What are the complications of fractures?
# COMPLICATIONS OF FRACTURES

<table>
<thead>
<tr>
<th></th>
<th>Early</th>
<th>Late</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General</strong></td>
<td>Other injuries</td>
<td>Chest infection</td>
</tr>
<tr>
<td></td>
<td>PE</td>
<td>UTI</td>
</tr>
<tr>
<td></td>
<td>FES/ARDS</td>
<td>Bed sores</td>
</tr>
<tr>
<td><strong>Bone</strong></td>
<td>Infection</td>
<td>Non-union</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Malunion</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AVN</td>
</tr>
<tr>
<td><strong>Soft-tissues</strong></td>
<td>Plaster sores/WI</td>
<td>Tendon rupture</td>
</tr>
<tr>
<td></td>
<td>N/V injury</td>
<td>Nerve compression</td>
</tr>
<tr>
<td></td>
<td>Compartment syn.</td>
<td>Volkmann contracture</td>
</tr>
</tbody>
</table>
What is the definition of compartment syndrome, how do you treat it?
Increased Pressure

in a

closed tissue compartment

resulting in

local ischaemia
Compartment Syndrome

Head injury
Ventilated
Drugs / alcohol

Must consider pressure monitoring
Compartment Syndrome

Treatment

Dressings / cast bivalved

Elevate - level with heart

Fasciotomy
Fasciotomy

Emergency

All compartments

Open

Debridement
What is the general principle of treatment of ........ fracture?
Classification of Clavicle Fractures

- **Group I: Middle third**
  - Most common (80% of clavicle fractures)
- **Group II: Distal third**
  - 10-15% of clavicle injuries
- **Group III: Medial third**
  - Least common (approx. 5%)
  - Vascular injury
Clavicle Treatment Options

- Nonoperative
  - Sling
  - Brace

- Surgical
  - Plate Fixation
  - Screw or Pin Fixation
Clavicle Nonoperative Treatment

• “Standard of Care” for most clavicle fractures.
• Continued questions about the need to wear a specialized brace.
Definite Indications for Surgical Treatment of Clavicle Fractures

- Open fractures
- Associated neurovascular injury
Shoulder Dislocations

- Classified by:
  - Direction
  - Etiology
  - Involuntary vs voluntary
Anterior Shoulder Dislocation

- Most common
- Up to 20-40% neurologic injury (axillary, brachial plexus)
- Axillary x-ray or CT to assess for head impaction or Hill Sachs lesion
- May be associated with greater tuberosity fracture
Posterior Shoulder Dislocation

- Associated with seizures or electrical shock
- Commonly missed on X-ray
- Light bulb sign
- High incidence of associated lesser tuberosity fracture

Example of a posterior dislocation
Shoulder Dislocations - Etiology

- **Traumatic**
  - Usually unidirectional

- **Atraumatic**
  - Often associated with multidirectional instability, psychiatric problems if voluntary
Shoulder Dislocations - Treatment

• Immediate reduction
  – Many techniques
  – Adequate sedation
  – Control scapula

• Immobilization
  – Controversial re: position and duration
Humeral Fractures

- 98% treated conservatively in a hanging cast
- Better outcome with plates than IM nails
Fractures of humerus (conservative & operative)
Radial & ulnar shaft fractures

- anatomic # reduction
- Forearm as a joint
- stable fracture reduction
- early return of motion

- If ORIF Leave metalwork in-situ
Olecranon Fractures
Olecranon Tension Band Wire

Vertical split in triceps tendon

Bury end of K-wire deep to tendon

Pass Tension band wire deep to tendon with angio-catheter
Supracondylar Elbow Fracture

- Vascular injury
- Volkmann's Contracture
- Varus Deformity
Scaphoid: Middle Third Fracture
Scaphoid Treatment Options - Acute Injuries

• Nonoperative
  – Short vs. long-arm cast
  – Thumb spica vs. standard cast

• Operative
  – Percutaneous pin or screw fixation
  – ORIF
Hand Fractures

- Physical examination reveals swelling, deformity.
- Assess all musculotendinous units that traverse the injured area.
- Standard x-rays: AP, lateral, oblique.
- Be sure to assess malrotation by asking patient to make a fist
- Optimum treatment determined by severity of bone and soft tissue injury.
- Most fractures can be treated by immobilization or protective splinting
Normal alignment and rotational deformity

Beware Finger Malrotation – doesn't remodel poorly tolerated
Nonoperative Treatment

• Brief immobilization in intrinsic plus position
• Early movement
• Protective splints or “buddy-taping”
Edinburgh position of immobilisation

Decision to mobilise hand should be on clinical rather than radiological grounds
Interlocking Femoral IM Nails

- 98% union with Statically Locked Rod
Tibial shaft fractures
Hip Dislocations

• Urgent reduction, closed
• Careful assessment of congruity of reduction
• CT scan to rule out intraarticular fragments
• Open reduction for failure to reduce closed, incomplete reduction with interposed bone or soft tissue
How do classify hip fractures, how do you treat?
Fracture types

• Intracapsular – involving the femoral neck.
• Extracapsular – involving the intertrochanteric or pertrochanteric region.
• Subtrochanteric – involving the proximal femoral diaphysis.
Gardens Classification

INTRACAPSULAR FRACTURES

Undisplaced

Displaced
Undisplaced fractures

Internal fixation will result in 10% failure rate

Safe and simple to fix: percutaneous or minimally invasive
Displaced fractures

- 30% fixation failure/loss of reduction
- Avascular necrosis
- Non-union
Hemiarthropasty

Frail
Elderly
Cemented
Better than ORIF?
Arthroplasty—complications

- Dislocation
- Infection
- Acetabular erosion
Trochanteric Fractures Classification

- Stable, 2 part
- Unstable 3 - 4 part
- Reversed obliquity/subtrochanteric.
Modern hip nailing systems

- DHS
Tibial Plateau: Schatzker

I

II

III
Tibial Plateau: Schatzker

IV

V

VI
Tibial plateau fractures

- Variety of techniques
- Anatomical restoration of joint plus External fixation or plate
How do you assess function of the hand?
Function of the hand: motor

• Grasp
• Pinch
  • tip pressure
  • pulp pressure
  • lateral pressure
• Hook
Function of hand: sensory

- stereognosis (position, size, shape, etc.)
- Pinprick
- light touch
Rapid assessment of hand function

- space and stability
- open and close
- pinch and touch
What is a ganglia?
Ganglion

cystic swelling in the neighborhood of tendon or joint
Ganglion site

• 60-70% dorsal wrist ganglion (scapholunate joint)

• 18 -20% volar ganglion

• 10 - 20% in the flexor sheath
Ganglion treatment

• conservative

• surgical
What is carpal tunnel syndrome?
Carpal Tunnel Syndrome (CTS)

• The entrapment of the median nerve at the fibro osseous tunnel of the carpus
CTS Aetiology

Decrease in the size of the canal

- osteoarthritis
- trauma
- acromegaly
CTS Aetiology

increase in the size of its contents

• pregnancy
• rheumatoid arthritis
• alcoholism
• tumour
• idiopathic
CTS Clinical Picture

- patients in their 40s
- female > male
- pain (nocturnal)
- numbness
- clumsiness
CTS signs

- wasting of thenar eminence
- numbness
- weakness
- Tinel sign
- Phalen sign
CTS Treatment

• non operative
  – Splint
  – Steroid injection?

• surgical decompression
  – open
What is DeQuervain’s Disease?
DeQuervain's Disease

Stenosing tenovaginitis of the first dorsal extensor compartment
DeQuervain’s treatment

- non operative
  - rest
  - steroid injection
  - anti-inflammatory

- operative
What is trigger finger?
Trigger Fingers

Stenosing tenovaginitis of the flexor tendon sheath (A1 pulley)
Trigger Finger aetiology

- congenital (thumb)
  - often not recognised until toddlers
  - 30% resolve spontaneously

- acquired (middle aged)
  - idiopathic
  - traumatic
  - diabetes
  - rheumatoid
Trigger Finger treatment

- non operative
  - steroid injection

- operative
  - release of A1 pulley
What is Dupuytren’s Disease
Dupuytren’s Contracture

nodular hypertrophy and contracture of the palmar fascia
Dupuytren’s Contracture

aetiology

• genetic
• geographical
• smoking
• alcohol
• epilepsy
Dupuytren’s Contracture clinical

- middle aged
- male 10 x female
- nodular thickening in the palm
- contracture of the ring and little finger
- MCPJ and/or IPJ not DIPJ
Dupuytren’s Contracture treatment

Surgery if:-

- rapidly progressive contracture
- inconvenience

- fasciotomy
- fasciectomy
- amputation
What common foot disorders are there?
Foot Disorders

• deformities
• arthritis
• pain
Deformities Pes Planus

- physiological
- congenital (vertical talus)
- joint hypermobility
- paralytic
- compensatory
- spasmodic (peroneal muscle spasm)
Pes Planus Peroneal muscle spasm

- tarsal coalition
- infection
- inflammatory arthritis
- fractures
Deformities
Pes Cavus

• idiopathic

• neurological abnormality eg
  – spinal dysraphism
  – peroneal muscular atrophy
  – Friedrich’s ataxia
Deformities Hallux Valgus

- female > male
- adolescent (familial)
- middle aged
Hallux Valgus symptoms

• deformity

• pain
  • bunion
  • metatarsalgia
  • MT-P OA
  • hammer toe
Hallux Valgus treatment

• Soft tissue balancing
• distal osteotomy
• proximal osteotomy
• excision
• fusion
Deformities
Lesser toes

- curly toes
- claw toes (neurological)
- hammer toes
- mallet toes
- overlapping
Lesser toe deformities treatment

- modify footwear
- tendon release / transfer
- excision
- arthrodesis
Osteoarthritis Hallux Rigidus

• male > female
• repeated trauma
• loss of dorsiflexion
Hallux Rigidus treatment

- rocker sole
- dorsal cheilectomy
- extension osteotomy
- arthrodesis
- excision
- replacement
Rheumatoid arthritis hindfoot

- Ankle pain and swelling
  - tenosynovitis
  - ankle or sub-talar joint

- Ankle and tarsal joint erosion and deformity
Rheumatoid arthritis
forefoot

- hallux valgus
- claw toes
- MT-P dislocation

[Image of X-ray showing forefoot abnormalities]
What are the causes of foot pain?
Foot pain

- Mechanical pressure
  - foot-shoe mismatch
- joint inflammation
- bone lesion
- peripheral vascular disease
- muscle strain
Heel pain

• Sever’s disease
• heel bumps
• peritendonitis
• plantar fasciitis
  – idiopathic
  – ankylosing spondylitis
  – Reiter’s disease
  – gonorrhoea
Midfoot pain

- Köhler’s disease
- tarsal boss
- osteoarthritis
- tarsal tunnel syndrome
Forefoot pain

- hallux valgus
- hammer toe
- Freiberg’s disease
- stress fracture
- Morton’s neuroma
What are the common types of arthritis?
Types of Arthritis

- Rheumatoid arthritis (RA)
- Osteoarthritis (OA)
- Sero-negative arthritis
- Ankylosing spondylitis
- Reiter’s disease
- Crystal arthropathies
Rheumatoid Arthritis

- affects 3% population
- female > male (3:1)
- 80% RF
- 30% ANF
- HLA DR4 (chr 6)
What is the pathology of rheumatoid arthritis?
Rheumatoid Arthritis Pathology

- **Synovitis**
  chronic infl, synovial hypertrophy, effusion

- **Destruction**
  proteolytic enzymes, pannus

- **Deformity**
  articular destruction, capsular stretching, tendon rupture
Rheumatoid Arthritis
extra-articular

- nodules
- tendon sheath
- vasculitis
- myopathy and neuropathy
- reticulo-endothelial system
- visceral - lungs, heart, kidneys, brain, GI
Rheumatoid Arthritis early symptoms

- myopathy, tiredness, weight loss, malaise
- proximal finger joints
- wrists, feet, knees, shoulders
- start up pain
- tendon crepitus
Rheumatoid Arthritis early joint changes
Rheumatoid Arthritis
late symptoms

- joint destruction
- pain
- deformity
- instability
Rheumatoid Arthritis
advanced joint changes
What are the x-ray changes of rheumatoid arthritis?
Rheumatoid Arthritis
X-ray findings

- joint space narrowing
- peri-articular osteopenia
- erosions
Rheumatoid Arthritis treatment

- stop synovitis
- prevent deformity
- reconstruct
- rehabilitate
Rheumatoid Arthritis prognosis

- 10% improve
- 60% intermittent, slowly worsening
- 20% severe joint erosion, multiple surgery
- 10% completely disabled
What is osteoarthritis? What is its pathology?
Osteoarthritis

A chronic joint disorder in which there is progressive softening and disintegration of articular cartilage accompanied by new growth of cartilage and bone at the joint margins (osteophytes) and capsular fibrosis
Osteoarthritis classification

- Primary or idiopathic

- Secondary - infection
  - dysplasia
  - Perthes’
  - SUFE
  - trauma
  - AVN
Osteoarthritis - aetiology

- Genetic
- metabolic
- hormonal
- mechanical
- ageing
Osteoarthritis mechanism 1

Disparity between:-

stress applied to articular cartilage
and
strength of articular cartilage
Osteoarthritis mechanism 2

Increased stress (F/A)

- increased load eg BW or activity
- decreased area eg varus knee or dysplastic hip
Osteoarthritis mechanism 3

Weak cartilage

- age
- stiff eg ochronosis
- soft eg inflammation
- abnormal bony support eg AVN
Osteoarthritis X-ray changes

- joint space narrowing
- subchondral sclerosis
- osteophytes
- cysts
Osteoarthritis X-ray changes
Arthritis symptoms

- pain
- swelling
- stiffness
- deformity
- instability
- loss of function
What is the treatment of osteoarthritis?
Arthritis non-surgical treatment

- analgesia
- disease modifying drugs (RA)
- altered activity
- walking aids
- physiotherapy
Arthritis surgical treatment

- arthroscopy
- osteotomy
- arthrodesis
- excision arthroplasty
- replacement arthroplasty
Joint Replacement indications

- Disabling pain
- Functional limitations
Joint Replacement history - pain

- Site
  - radiation
  - limiting activity
  - disturbing sleep
  - analgesics
Joint Replacement

history - function

- Walking distance
- walking aids
- low chairs
- foot care
- stairs
Joint Replacement examination

- gait
- limb alignment
- range of movement
- stability
- peripheral circulation
- skin condition
Joint Replacement investigation

- **X-ray** - alignment
  - deformity
  - previous fractures and implants
  - AVN
  - osteophytes
  - bone loss

- **CT, MRI, bone scan** - rarely
What is an ideal result from a joint replacement?
Joint Replacement - ideal

- painless joint
- full range of movement
- stable
- permanent
Joint Replacement

hip complications

- dislocation - 1%
- loosening >90% 10y survival
- DVT / PE
- infection - 1%
- Death
Joint Replacement
knee complications

- limited ROM
- patellar instability 3-5%
- loosening > 90% 10y survival
- DVT / PE
- infection - 2%
What is ankylosing spondylitis?
Ankylosing Spondylitis

- 0.2% of population
- mainly affects spine and SI joints
- male > female
- HLA B27 in 90%
- synovitis
- enthesopathy
Ankylosing Spondylitis
hips and knees

- flexion deformities
- arthritis with large osteophytes
- ankylosis
Ankylosing Spondylitis
X-ray changes

- joint space narrowing
- large osteophytes
- heterotopic bone
- ankylosis
How do you examine the spine?
Examination of Spine

SYMPTOMS

• Pain
• Sciatica
• Stiffness
• Deformity
• Numbness or paraesthesia
• Urinary symptoms
Cutaneous distribution of nerve roots

The cutaneous and motor distribution of the nerve roots supplying the skin and muscles of the lower limbs.
Muscle Power Testing
MRC Scale

0    Total paralysis
1    Barely detectable contracture
2    Not enough to act against gravity
3    Strong enough to act against gravity
4    Still stronger but less than normal
5    Full power
HIP FLEX.
L.2.3.

HIP EXT.
L.4.5.
KNEE EXT.
L.3.4.

KNEE FLEX
L.5.
ANKLE EXT.
L.4.5.

FLEX.
S.I.
What is low back pain?
Low back pain

Lifetime incidence ranges from 60-80%
Most cases resolve spontaneously
  – Simple back pain (non specific low back pain)
  – Nerve root pain
  – Possible serious spinal pathology
Simple back pain

- Presentation 20 - 50 years
- Lumbosacral, buttocks and thigh
- “Mechanical” pain
- Patient well
- Specialist referral not required
Treatment for acute low back pain

• Vast majority improve within 2 months
• Symptomatic Rx with Aspirin/NSAIDs
• Bed rest should be limited to 1-2 days
• ? Corsets, TENS, Traction
• Exercise - Stretching & range of motion active
Chronic low back pain

- Pain that persists after 3 months
- < 5% of patients with L.B.P develop Ch.L.B.P
- Multiple factors
  - Disc, facet joints, annulus fibrosis, ligaments
- Psychosocial factors
- Surgery is rarely helpful
- Functional restoration programme
Acute disc prolapse

• Uncommon in very young and the very old
• Nerve root pain follows the dermatome of the involved nerve
• Pain is generally worse in the leg than in the back
• Exacerbation of leg pain by straining, sneezing or coughing
• Localised neurological signs
Cauda Equina Syndrome

- Large midline disc prolapse
- Compresses several nerve roots
- Sphincter disturbance
- Saddle anaesthesia
- Prompt surgical intervention
Treatment acute disc prolapse

Conservative

- Bed rest for 48-72 hours
- NSAIDs
- Epidural steroids?
- 85% relief rate

Surgical treatment

- 5% of patients ultimately require surgery
- More rapid relief but the ultimate end point is the same regardless of treatment
Spinal Stenosis

• Commonest cause of neurologic leg pain in older patients
• Symptoms
• Neurogenic claudication - Vascular claudication
• Treatment ? decompress
What are red flags to indicate serious spinal pathology?
Red flags for possible serious spinal pathology

- Presentation under age 20 or onset over 55
- Thoracic pain
- Past hx of carcinoma, steroids
- Unwell, weight loss
- Widespread neurology
- Structural deformity
- Abnormal blood parameters
- Night pain
Do you know any forms of spinal deformity?
Spondylolisthesis

• Forward slippage of one vertebral body on another

• Causes
  – Congenital
  – Isthmic
  – Traumatic
  – Pathologic
  – Degenerative

• Treatment
Spinal Deformity

Deformity may occur in either coronal or sagittal plane

Scoliosis - Lateral curvature of the spine
  - Structural
  - Nonstructural

Kyphosis - Sagittal plane deformity in the thoracic or thoracolumbar spine
Scoliosis - Cobb angle
Adolescent idiopathic scoliosis

Structural scoliosis presenting at or about the onset of puberty and before maturity
80 % of cases of idiopathic scoliosis
Mostly (90%) in girls
Predictors of progression
  very young age
  marked curvature
  Risser sign
Neuromuscular scoliosis

Causes

- Poliomyelitis
- Cerebral palsy
- Syringomyelia
- Friedrich’s ataxia
- Muscular dystrophies

Typical paralytic curve is long, convex towards the side with weaker muscles
What are the common metastatic bone tumours?
Metastatic bone tumours

- The most common condition associated with pathologic fractures is osteoporosis.
- Prostate cancer, combined with breast cancer, contributes to 80% of all skeletal metastasis.
- Lung cancer has a relatively aggressive course and a short survival after bone metastasis.
- Consider thyroid, kidney.
What primary bone tumours do you know?
Primary bone tumours

• **Multiple Myeloma**, the most common primary bone cancer, is a malignant tumour of bone marrow. Most cases are seen in patients aged 50 to 70 years old. Any bone can be involved.

• **Osteosarcoma** is the second most common bone cancer. It occurs in two or three new people per million people each year. Most cases occur in teenagers. Most tumours occur around the knee. Other common locations include the hip and shoulder.

• **Ewing's sarcoma** most commonly occurs between age 5 and 20. The most common locations are the upper and lower leg, pelvis, upper arm and ribs.

• **Chondrosarcoma** occurs most commonly in patients 40 to 70 years of age. Most cases occur around the hip and pelvis or shoulder.
Osteomyelitis

• Infection of skin and other soft tissue can lead to infection of bones (osteomyelitis) and joints (septic arthritis).
• Risks with HIV, rheumatoid arthritis, diabetes mellitus, haemophilia or sickle cell anaemia
• MRI
• Debridement/drainage/antibiotics
What limb amputations are there?
Amputations

- Minor amputations are amputations where only a toe or part of the foot is removed.
  - A ray amputation is a particular form of minor amputation where a toe and part of the corresponding metatarsal bone is removed
- Major amputations are amputations where part of the limb is removed.
  - Symes amputation – through ankle
  - Gritti-Stokes amputation – through knee
  - AKA/BKA
- Prosthetics – replaces part of limb
- Orthotics – shoe inserts
- PAM aid – pneumatic inflatable prosthesis
Clinical General Principles:

• As a general principle in examining the musculo-skeletal system we **LOOK, MOVE and FEEL**

• When assessing the range of joint motion remember that zero is the neutral or anatomical position i.e. full extension

• *In the new exam you will get at least one hip or a knee*
The hip: Likely pathology for exam

- Osteoarthritis
- Rheumatoid arthritis
- Infection
- Adult sequelae of paediatric disease
  - Perthe's
  - CDH
The knee: Likely pathology

- Osteo/rheumatoid arthritis
- Meniscal tear
- Ligamentous disruptions particularly ACL
- Infection
Shoulders: Likely pathology for the exam:

- Subacromial impingement
- Recurrent dislocation
- Acromio-clavicular dislocation
- Gleno-humeral osteoarthritis
- Rheumatoid arthritis
- Frozen shoulder
- Infection
- Brachial-plexus injury
The elbow: Likely pathology in the exam:

- Trauma
- Infection
- Olecranon bursitis
- Osteo and rheumatoid arthritis
The wrist: Likely pathology in exam:

- Trauma – old dinner fork deformity
- Osteoarthritis – old scaphoid fracture
- Rheumatoid arthritis – synovitis +/- ulnar head subluxation – the piano key sign
- Ganglia
- De-Quervain’s stenosing tenovaginitis
The hand: Likely pathology in exam

- Carpal tunnel syndrome
- Dupuytren’s disease
- Osteo/rheumatoid arthritis
- Ganglia
- Trigger finger
Foot and ankle: Likely pathology for exam

- Osteo/rheumatoid arthritis
- Ligamentous laxity with instability
- Ganglia
- Hallux rigidus
- Hallux valgus
- Hammer toes
- Diabetic complications
- Ingrowing toe nail
The spine: Likely pathology for exam

- Mechanical back pain
- Prolapsed intra-vertebral disc
- Infection
The End