LOWER LIMB FRACTURE

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HIP FRACTURES

- Acetabular trabeculae
- Principal (medial) compressive trabeculae
- Secondary (lateral) compressive trabeculae
- Principal tensile trabeculae
- Ward triangle

Garden I fracture
Garden II fracture
Garden III fracture
Garden IV fracture
FEMORAL HEAD BLOOD SUPPLY

• Extracapsular vessels have 2 regional anastomoses
  • TROCHANTERIC anastomosis (Crock Ring)
    • Centred on trochanteric fossa [think in terms of piriformis]
      • Ascending branch of MFCA posteriorly
      • Ascending branch of LFCA anteriorly
      • Descending branch of superior gluteal artery
      • Ascending branch of inferior gluteal artery
  • CRUCIATE anastomosis
    • Centred on lesser trochanter
      • Transverse branches of MFCA + LFCA
      • Ascending branch 1st perforator
      • Descending branch of inferior gluteal artery
89 FEMALE FALL AT HOME
90 M
• Bimodal
• Bilateral have 25% mortality
• 5-10% have ipsilateral femoral neck fracture
MANAGEMENT

• Analgesia
• NV obs
• Traction (skin or skeletal)
• Group and hold
• Definitive treatment is an IM nail
COMPLICATIONS

- FAT EMBOLISM SYNDROM
- VTE (THROMBOEMBOLISM)
- RESPIRATORY (ARDS)
- COMPARTMENT SYNDROME
- NON-UNION / DELAYED UNION / MALUNION
- HARDWARE FAILURE (USUALLY DUE TO NON-UNION)
- INFECTION
- HO
- NERVE INJURY (usually PUDENDAL NERVE from traction)
FAT EMBOLISM SYNDROME

- This is a condition characterised by a triad of features:
- Respiratory Distress
- Cutaneous Changes (Petechiae)
- Mental State Changes (Confusion)
- This occurs 24-72 hours after initial injury in patients with long bone fractures.
- Fatal in 15% of patients.
- Treatment is SUPPORTIVE THERAPY.
- Prevention is early STABILISATION (within 24 hours).
DISTAL FEMUR FRACTURE

- Bi modal distribution
- May be perprosthetic
- Usually needs CT scan if suspected intra-articular
KNEE DISLOCATION

- Orthopaedic Emergency
- Vascular injury is limb threatening due to tethering of popliteal artery
- Associated in 32-45% of all dislocation
- 25% associated with neurological (CPN) injury
- Multi ligament knee injury (>2 Ligaments)
ASSOCIATED INJURIES

- FRACTURES (60%)
- VASCULAR INJURY (50%)
- NEUROLOGICAL INJURY (25%)
- EXTENSOR MECHANISM INJURY
- MENSICAL INJURY
- CHONDRAL INJURY
MANAGEMENT

• Contact ortho and vascular
• Urgent closed reduction
  • Assess vascular status post reduction
  • Stabilise in POP or splint or ex fix
  • Immobilise in 20-30 degrees of flexion
  • ABI
  • CT Angio
ABI

- 100% sensitivity and specificity and PPV for significant arterial injury when ABI <0.9
- technique = Doppler probe on either DP or TP with injured lower limb SBP c/w ipsilateral non injured arm SBP
- Normal ABI should be >0.9
- ABI <0.9 is abnormal and indicates arterial injury.
- ABI <0.45 is critical ischaemia.
- Any abnormality requires urgent ANGIOGRAM.

$$\text{ABI} = \frac{\text{Doppler systolic arterial pressure in injured limb (ankle)}}{\text{Doppler systolic arterial pressure in uninjured limb (brachial)}}$$
EMERGENCY SURGERY

• Indicated in patients with:
  • Vascular Injury
  • Open Dislocations
  • Irreducible Dislocations
  • Compartment Syndrome

• EXTERNAL FIXATION is done first and then VASCULAR INJURY REPAIR/SAPHENOUS VEIN GRAFT by VASCULAR SURGEON

• If a vascular repair / graft is required, FASCIOTOMIES of the leg are required.

• Open dislocation should be treated with reduction and wound debridement.

• Compartment syndrome requires urgent fasciotomies
TIBIAL PLATEAU FRACTURES

• 8% of fractures in the elderly

• Mechanism
  • Axial force +/- varus and valgus force

• Associated Injuries
  • 50% associated with meniscal tears
  • 30% ligamentous injuries
  • Peroneal nerve injuries from neuropraxia
  • Arterial injuries not from trisection but intimal stretching (present as thrombosis)
Fig. 4 The Schatzker classification of tibial plateau fractures. Type I is a wedge (split) fracture of the lateral tibial plateau. Type II is a split-depression fracture of the lateral plateau. Type III is a pure central-depression fracture of the lateral plateau without an associated split. Type IV is a fracture of the medial tibial plateau, usually involving the entire condyle. Type V is a bicondylar fracture, which typically consists of split fractures of both the medial and lateral plateaus without articular depression. Type VI is a tibial plateau fracture with an associated proximal shaft fracture.
MANAGEMENT

- Analgesia
- Zimmer splint
- NV obs
  - ABI if Schatzker 4 or above
    - If < 90 then CT angio
    - May need external fixator
- Monitor for compartments syndrome
  - High risk for compartments syndrome
- CT scan on tibial plateau fractures.
INDICATIONS FOR SURGERY

• OPEN FRACTURES
• MULTITRAUMA
• DISPLACED FRACTURES
• ARTICULAR GAP > 3-5MM
• CONDYLAR WIDENING > 5MM
• VARUS / VALGUS INSTABILITY
• ALL MEDIAL (TYPE 4)
• ALL BICONDYLAR (TYPE 5 & 6)
OPEN FRACTURES
GRADE I

- WOUND < 1CM
- Clean Wound
- Low Energy Injury
- Mild Soft Tissue Injury
GRADE 2

- WOUND > 1CM & < 10CM
- Moderate Contamination
- Low or High Energy Injury
- Moderate Soft Tissue Injury (Without Extensive Flaps)
GRADE 3

- WOUND > 10CM
- Highly Contaminated
- High Energy Injury
- Severe Soft Tissue Injury
- Includes All Segmental Fractures & GSW

- GRADE 3A: ADEQUATE SOFT TISSUE COVER
- GRADE 3B: INADEQUATE SOFT TISSUE COVER (NEED FLAP/GRAFT)
- GRADE 3C: ARTERIAL INJURY
PRINCIPLES OF OPEN FRACTURE MANAGEMENT

- Tetanus prophylaxis
- Antibiotics
  - Grade 1 and 2 cephalosporin
  - Grade 3 cephalosporin and aminoglycoside
- Wound debridement and irrigation
  - +/- delayed primary closure.
- Fracture stabilisation
- Coverage
TIBIAL SHAFT FRACTURE

- Common in young patients
- Usually high energy
- Association
  - Compartments syndrome
  - Open fracture
  - Extension into plateau or plafond
TIBIAL PLAFOND FRACTURE

- High energy injuries and treatment dictated by soft tissue status.
- Young and middle aged adults.
- Axial compression
MANAGEMENT

• Initial management is for soft tissue
  • External fixator for 10-14/7
  • Span/scan/plan

• Definitive treatment
  • ORIF and bone graft
COMPARTMENTS SYNDROME

• Circulation of tissues within a closed osteo-fascial space are compromised by increased pressure within that space

• Prerequisite is volume restricting envelope
  • fascia & skin
  • POP
  • dressings
COMPARTMENTS SYNDROME

• Aetiology
  • 1. Increased contents
    • Bleeding / edema
      • fracture
      • osteotomies
      • crush injuries
      • post - ischaemic swelling
  • 2. Decreased size
    • Tight casts & dressings
    • Tight closure of fascial defects
    • Fracture reduction
COMPARTMENTS SYNDROME

- Increased local tissue pressure increases pressure within intracompartmental veins
  - local AV gradient is reduced
  - causes decreased local perfusion secondary to Starling Forces

- Metabolic tissues demands not met
  - loss of tissue function & viability
  - distal pulses remain as ICP < SBP
  - digit capillary refill remains as venous return extracompartmenta
COMPARTMENTS SYNDROME

- P's
  - Pain (most important)
  - Paraesthesia (often early)
  - Palpation (swollen and tense)
  - Passive stretch
  - Paresis (proximal nerve injury or guarding)
  - Pulseless (late sign)
COMPARTMENTS SYNDROME

• Clinical Diagnosis
  • Tense compartment and pain +++
  • Pressure measurement
    • Patient is unresponsive
    • Uncoperative
    • Underlying peripheral nerve defect.
COMPARTMENTS SYNDROME

• Management
  • Prevention
    • Remove tight dressings
    • Split plasters
  • Early fasciotomy < 8 hours

• Complications
  • Ischemic muscles fibrosis and contractions
  • Deformity and stiffness
  • Nerve damage and variable numbness
ANKLE FRACTURE

- **Danis-Weber Classification**
- Type A – at the level of the plafond or distal to it, transverse fracture, syndesmotic ligaments intact
- Type B – at the level of the distal tibiofibular joint, it starts at the plafond and travels proximally, variable disruption of the syndesmosis
- Type C – proximal to the distal tibiofibular, complete disruption of the syndesmosis (all 3 ligaments)
MECHANISM
MANAGEMENT

- Webber A – Non operative
- Weight bearing films for isolated webber B
  - Look for talar shift
- Webber C – Operaerative
- Medial Mal fracture – operate.
MANAGEMENT CONTINUED

- Webber A – WBAT in cam boot review 2/52 with an x-ray
- Webber B – nil talar shift WBAT in cam boot. X-ray at 2/52 and boot 6/52 total
- Webber C – Operate will need syndesmotic screw
MAISONNEUVE FRACTURE
CALCANEAL FRACTURE

• Mechanism is fall on heel with axial load
• Can be intra-articular (compression) or extra-articular (avulsion)
• Associated
  • 10% lumbar spine
  • 10% Contralateral clac
ANGLES

Normal Bohler Angle

Decreased Bohler Angle

Böhler's angle

Crucial angle of Gissane
MANAGEMENT

• CT all calc fractures

• UNDISPLACED fractures are treated NON-OPERATIVELY.
  • These patients are immobilised in POP for 6-12 WEEKS NWB.

• DISPLACED fractures required SURGERY with ORIF.
  • (The exceptions are elderly and multiple comorbidities patients)
5th METATARSAL FRACTURE
• Zone 1 – tuberosity avulsion fractures
  • Fracture or the lateral aspect of the tuberosity, extending proximally into the MT joint

• Zone 2 (Jones) – # at the metaphyseal-diaphyseal junction
  • Begins in the lateral distal part of the tuberosity and extends obliquely into the base of the 4th and 5th MT articulation
  • always an acute injury
  • Injury described by Jones

• Zone 3 (Mrach) – stress fracture of the proximal 1.5cm of the shaft
  • Distal to the fourth and fifth metatarsal base articulation
  • Not acute with prodromal symptoms or
  • Radiological signs of repetitive stress injury
MANAGEMENT

• Type 1 – WBAT in cam boot for 4-6/52
• Type 2/3 – Backslab then full fiberglass for 6 weeks
• Surgical fixation
  • Displaced
  • Symptomatic nonunion
  • Athlete
  • Articular