

Early complications

Local:

- Vascular injury causing haemorrhage, internal or external
- Visceral injury causing damage to structures such as brain, lung or bladder
- Damage to surrounding tissue, nerves or skin
- Haemarthrosis
- Compartment syndrome (or Volkmann's ischaemia)
- Wound infection, more common for open fractures

Systemic:

- Fat embolism
- Shock
- Thromboembolism (pulmonary or venous)
- Exacerbation of underlying diseases such as diabetes or CAD
- Pneumonia

Compartment syndromes

- Fractures of the limbs can cause severe ischaemia by damage to a major artery or by increasing the osteofascial compartment pressure by swelling due to bleeding or oedema.
- ↓capillary flow → muscle ischaemia. → more oedema → more pressure → ↓capillary flow.
- Thus rapid pressure build-up, leading to muscle and nerve necrosis.
- Compartment syndromes can also result from crush injuries (falling debris or simple compression if patient unconscious for length of time) or an over-tight cast.
- Any compartment, but tibia shaft # & forearm # greatest risk. Esp if age < 35y.

Presentation

- Signs of ischaemia (5 P's: Pain, Paraesthesia, Pallor, Paralysis, Pulselessness) - but diagnosis should be made before all these features are present. The presence of a pulse does not exclude the diagnosis.
- Signs of raised intracompartmental pressure:
 - Swollen arm or leg
 - Tender muscle - calf or forearm pain on passive extension of digits
 - Pain out of proportion to injury
 - Redness, mottling and blisters
- Watch for signs of renal failure (low-output uraemia with acidosis)

When uncertain, measure intracompartmental pressure directly.

Management

- Remove/relieve external pressures
- Prompt decompression of threatened compartments by open fasciotomy
- Debride any muscle necrosis
- Treat hypovolaemic shock and oliguria urgently
- Renal dialysis may be necessary

Complications

- Acute renal failure secondary to rhabdomyolysis
- DIC
- Volkmann's contracture (where infarcted muscle is replaced by inelastic fibrous tissue)

Fat embolism

This is a relatively uncommon disorder that occurs in the first few days following trauma with a mortality rate of 10-20%. Various theories: Fat drops from bone marrow following #, coalesce and form emboli in pulmonary capillary beds and brain, with a 2° inflammatory cascade and platelet aggregation. Alternative theory suggests that FFAs are released as chylomicrons following hormonal changes due to trauma or sepsis. Also seen following severe burns, CPR, bone marrow transplant and liposuction.

Risk factors

- Closed fractures
- Multiple fractures
- Pulmonary contusion
- Long bone/pelvis/rib fractures

Presentation

- Sudden onset dyspnoea
- Hypoxia
- Fever
- Confusion, coma, convulsions
- Transient red-brown petechial rash affecting upper body, especially axilla

Management

- Supportive treatment
- Corticosteroid drugs (used in treatment, more controversial in prevention)
- Surgical stabilisation of fracture

Late Complications

Local:

- Delayed Union
- Non-union
- Malunion
- Joint stiffness
- Contractures
- Myositis ossificans
- Avascular necrosis
- Algodystrophy (or Sudeck's atrophy)
- Osteomyelitis
- Growth disturbance or deformity

Systemic:

- Gangrene, tetanus, septicaemia
- Fear of mobilising
- Osteoarthritis

Problems with bone healing (non-union, delayed union and malunion)

Non-union = no signs of healing after >3-6 months (depending upon # site). Non-union is one endpoint of delayed union. 1% of all #, but 19% in lower leg #. Malunion occurs when the bone fragments join in an unsatisfactory position, usually due to insufficient reduction.

Causes of delayed union include:

- Severe soft tissue damage
- Inadequate blood supply
- Infection
- Insufficient splintage
- Excessive traction

For non-union: as above plus bone separation & interposition of periosteum, muscle or cartilage

Presentation

- Pain at fracture site
- Non-use of extremity
- Tenderness and swelling
- Joint stiffness (prolonged >3 months)
- Movement around the fracture site (pseudarthrosis)

X-ray

- Absence of callous (remodelled bone) or lack of progressive change in the callous
- Closed medullary cavities suggest non-union.
- May look avascular (known as atrophic non-union) or have excessive bone formation on either side of the gap (known as hypertrophic non-union).

Management

Early weight bearing and casting may be helpful. Surgical treatments include:

- Debridement to establish a healthy infection-free vascularity at fracture site
- Internal fixation to reducing and stabilize fracture.
- Bone grafting to stimulate new callous formation.

Myositis ossificans

Calcifications and bony masses develop within muscle and can occur as a complication of fractures, esp humeral supracondylar #s. Presents with pain, tenderness, focal swelling, and joint/muscle contractions. Avoid excessive physio, rest joint until pain subsides, NSAIDs may be helpful and consider excision after the lesion has stabilized (usually 6-24mo).

Algodystrophy

Sudeck's atrophy is a form of reflex sympathetic dystrophy (or complex regional pain syndrome type 1), usually hand or foot generally following trauma, esp fractures. Continuous, burning pain with initial local swelling, warmth and redness which → to pallor and atrophy. Movement↓↓.

Treatment is usually multi-pronged:

- Rehab - physio & occupational therapy to ↓sensitivity & gradually ↑exercise tolerance.
- Psychological therapy
- Pain management - often difficult. Approaches used are neuropathic pain medications (e.g. amitriptyline, gabapentin, opioids), steroids, calcitonin, IV bisphosphonates and regional blocks.

Iatrogenic complications

Casts: Pressure ulcers, thermal burns, thrombophlebitis. Prolonged cast immobilisation, or 'cast disease' → circulatory disturbances, inflammation, osteoporosis, chronic oedema, soft-tissue atrophy, and joint stiffness. Good physiotherapy should avoid these problems.

Traction: Muscle wasting and weakness, pressure ulcers, pneumonia/UTIs, permanent footdrop contractures, peroneal nerve palsy, pin tract infection, thromboembolism

External fixation: Pin tract infection, pin loosening or breakage, interference with movement of joint, neurovascular damage due to pin placement, misalignment due to poor placement of the fixator