

# COMPLICATIONS OF FRACTURE HEALING

---

Jasmeet Jhaj

Trauma & Orthopaedics Registrar

Great Western Hospital, Swindon



- Know the common complications of fracture healing
  - Nonunion, malunion, delayed union
- Common risk factors
  - Smoking, diabetes..
- Identify and counsel patients who are at risk



IT'S GOING  
**TIBIA**  
GOOD DAY

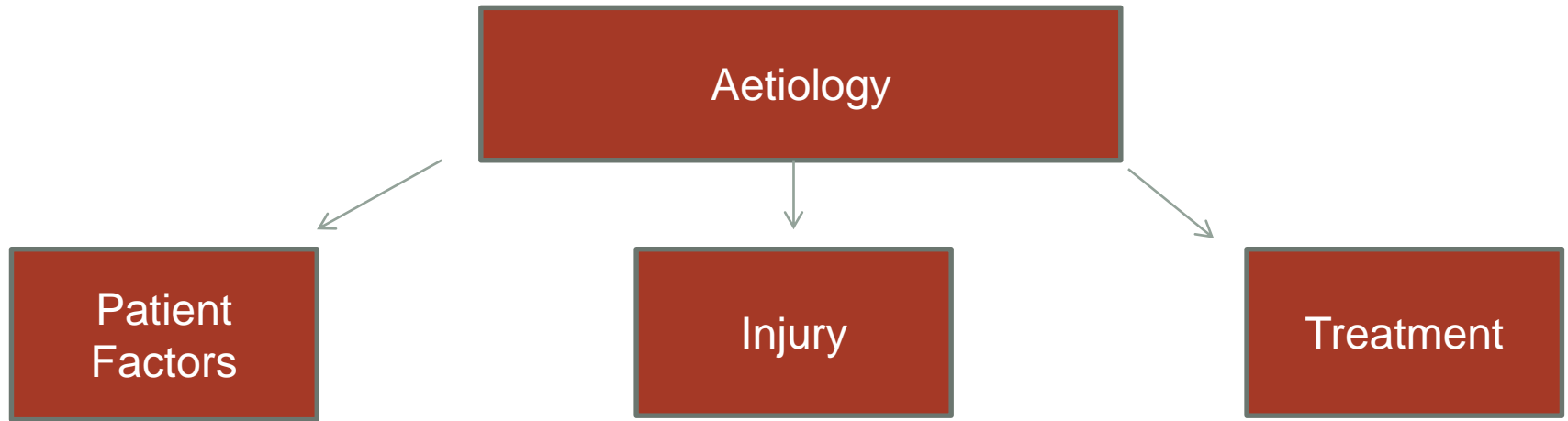
- Most fractures will heal well without complications
- However some fracture will develop early or late complications
- We need to pick up on these patients with risk factors for developing complications
- Fracture-healing complications can lead to pain and functional impairment.

The risk of complications varies with

- Type of fracture & complexity
- Fracture site
- Quality of the management
- Patient-specific risk factors such as age and comorbidities
- Post-fracture activities such as air travel and immobility.

# Average Healing Times

- Phalanges: 3 weeks
- Metacarpals: 4-6 weeks
- Distal radius: 4-6 weeks
- Lower arm: 8-10 weeks
- Humerus: 6-8 weeks
- Femoral neck: 12 weeks
- Femoral shaft: 12 weeks
- Tibia: 10 weeks



- Age & Activity
- Nutrition
- Smoking
- Diabetes & other metabolic disorders
- Immunocompromised
- Medications

- **Blood supply**
- Open Fractures
- Soft tissue injury
- Infection
- Pathological fractures
- Osteoporosis
- Location
- Bone loss and comminution
- Intra-articular fractures
- Fracture blisters

- Distraction of fracture
- Inadequate stability
- Surgical approach

Normal fracture healing can be disrupted in many ways:

- **Non-union (71%)**

Fracture healing does not occur in 6-9 months

- **Mal-union (18%)**

Healing in malalignment

- **Delayed union (11%)**

Fracture takes twice as long to heal

# Non-union

## 1. Hypertrophic

- Abundant callus, adequate vascularity
- predominantly fibrocartilage in gap
- inadequate immobilisation
- 92-95% non-infected non-unions tibia & fibula

## 2. Oligotrophic

- no callous on x-ray
- vascularity on bone scan

## 3. Atrophic

- pencilling of bone ends
- no vascularity on bone scan
- fibrous or cartilage interposition
- needs osteoinduction + stabilisation
- debride non-union / rigid fixation / compress / bone graft

## 4. Pseudarthrosis

- non-union with fluid-filled cavity
- synovial-like membrane & pseudocapsule formation
- new joint at fracture site
- usually painless motion
- needs excision of pseudoarthrosis / rigid fixation / compression / bone graft





# Patient Factors in detail..

## **Age and Activity**

- Fractures heal more efficiently in children than in adults
- Less osteoblastic activity as we age
- Diseases and medications
- Disuse osteopenia

# Nutrition

## **Vit D and Calcium**

In one study 84% of patients with non-union had metabolic diseases & 66% of these patients had Vit D deficiency

## **Protein Malnourishment**

Reduced fracture callus strength

# Diabetes

- Affects the repair and remodelling of bone
- Decreased fracture callus strength
- Inadequate insulin production leads to reduced production of collagen by osteoblasts
- Fracture healing takes **1.6x longer** in diabetic patients versus non-diabetic patients

# Smoking

- Nicotine is the main culprit!
- Inhibits growth of new blood vessels as bone is remodelled
- Decreases rate of fracture healing
- Increase risk of nonunion
- Decreased strength of fracture callus
- Smokers can take ~70% longer to heal open tibial shaft fractures versus non-smokers

# Medications

## **NSAIDS**

- Prolonged healing time because of COX enzyme inhibition

## **Corticosteroids**

- Some studies suggest a 6.5% higher rate of nonunion in proximal femoral fractures

## **Quinolones**

toxic to chondrocytes and diminishes fracture repair

## **Bisphosphonates**

- long term usage may be associated with atypical subtrochanteric/femoral shaft fractures



# Fracture Blisters

- Uncommon but can alter/delay the management
- Occur in areas where skin adheres tightly to bone  
(ankle, wrist, elbow, foot)
- Resemble secondary degree burns
- Clear or haemorrhagic

## Management

Silver sulfadiazine cream  
(Falamazine)



# Treatment options

## Non-surgical approaches:

- Casting and stabilisation of the fracture
- Bone stimulation. This delivers pulsed ultrasonic or electromagnetic waves to stimulate new bone formation.
- Medical treatments such as teriparatide have also been used to promote fracture healing, particularly in patients with osteoporosis

## Surgical approaches:

- Debridement to establish a healthy infection-free vascularity at the fracture site
- Bone grafting to stimulate new callus formation
- Internal fixation to reduce and stabilise the fracture





# Questions..?

