

# ORTHOPAEDICS



FOR PRIMARY  
HEALTH CARE



**LION**  
LEARNING INNOVATION VIA  
ORTHOPAEDIC NETWORKS

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# Basic fracture principles

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## Learning objectives

1. Define and classify fractures.
2. Recognise fracture patterns.
3. Clinically examine a fracture.
4. Outline the basic principles of fracture management.

## What is a fracture?

A fracture is an 'incomplete or complete break in the continuity of a bone'.

However, this definition does not account for accompanying soft tissue injury.

The degree of soft tissue injury dictates fracture management and the degree of fracture healing. Therefore, a better definition would be that a fracture is 'an open or closed soft tissue injury of varying severity, accompanied by a break in the continuity of the adjacent underlying bone'.

## Basic fracture classification

Fractures may either be 'open' or 'closed'.

In open fractures, there is a break in the continuity of the skin overlying the fracture. In closed fractures, there is no communication between the fracture and the atmosphere.

## Other definitions

- **Pathological fracture:** Fracture which occurs in diseased bone. The disease weakens the bone e.g.

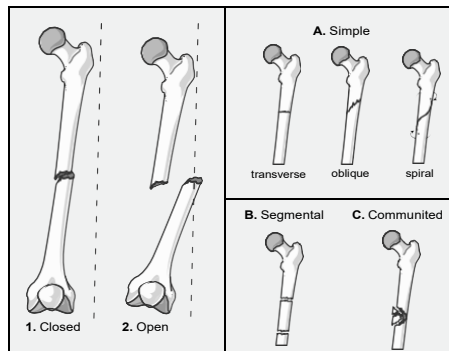
metastatic cancer or osteomyelitis.

- **Stress fracture:** Fracture in normal bone that is subjected to repetitive loads or stress.

## Fracture patterns

### Complete fractures

1. **Simple:** A single fracture line. The fracture line may be transverse, oblique, sagittal or spiral.
2. **Segmental:**  $\geq 2$  fracture lines, creating a tubular segment of the shaft.
3. **Complex/comminuted:** Multiple fracture fragments with no lateral or longitudinal stability.



## Incomplete fractures

1. **Greenstick:** On bending this leads to an incomplete break of the bone.
2. **Buckle:** A stable compression fracture.

## Describing fractures

When describing a fracture, one should comment on the following:

1. **Soft tissue involvement:** open (grading) vs closed
2. **Position:** metaphysis vs diaphysis; proximal vs distal
3. The **injury/fracture** itself: the extent (complete vs incomplete) and the fracture pattern itself
4. **Location:** the bone involved
5. **Displacement:** length, angulation, rotation, apposition
6. Is there **growth plate** (Salter-Harris) or **articular involvement**?
7. **Neurovascular status:** sensation and distal pulses

## Diagnosis of fractures

The primary survey of the patient should always take precedence to the examination of a fractured bone, unless torrential bleeding from the fracture site is suspected.

As with all clinical examinations you must start with history (how, when and what), followed by examination (look, feel, and move) and then special investigations.

1. **History:** How did the injury happen? When did it happen? What has been done so far in terms of management/treatment? Note the pain, patient's

activities of daily living and relevant history (medical, surgical or social).

2. **Examination:**
  - **Note vital signs**
  - **Look:** skin – wounds, bleeding, colour; soft tissue swelling, bone – deformity/alignment
  - **Feel:** deformity, swelling, tenderness and distal pulses
  - **Move:** active movement, passive movement, abnormal range of motion/location
3. **Special investigations:** X-rays apply the Rule of Twos: 2 views, 2 joints, 2 limbs, 2 opinions, 2 occasions (see 'Approach to orthopaedic X-rays').
4. **Severity**

## Fracture management

Basic principles for management priority is **life > limb > fracture**.

Generally, a fracture may require surgical intervention or non-surgical intervention. Non-surgical management involves closed reduction with immobilisation (cast or splint). Management is dependent on the fracture's stability and displacement. Surgical management can include:

- Open reduction which remains the gold standard for most intra-articular fractures.
- External fixation with pins and bars which is often used in fractures with high infection risk (open fractures) or in staged management of multiple injured patients to avoid long operating times.

Examples:

- A. Percutaneous pin fixation (e.g. elbow fractures in children)
- B. Intramedullary (i.e. femoral nail) or extramedullary devices (e.g. plate fixation in forearm fractures)

**Indications** for surgical management:

- Failed nonoperative management (malunions or nonunions)
- Unstable open fractures (II–III)
- Displaced intra-articular fractures
- Salter-Harris III–V
- Multiple fractures involving pelvis femur or spine

**Contra-indications** for surgical management:

- Poor soft tissue quality affecting fracture or surgical approach, e.g. infection, excessive swelling, burns.
- Amputation is considered to be better for the patient and limb.
- Surgery or anaesthesia is contraindicated due to patient's medical history.

## Key takeaways

1. Fractures may either be open or closed.
2. Soft tissue injuries dictate fracture management and healing

## References

1. Lloyd-Jones, G. 2019. Introduction to trauma X-ray. Available from [https://www.radiologymasterclass.co.uk/tutorials/musculoskeletal/trauma/trauma\\_x-ray\\_page1](https://www.radiologymasterclass.co.uk/tutorials/musculoskeletal/trauma/trauma_x-ray_page1)
2. Buckley, R. 2018. General principles

of fracture care treatment and management. Available from: <https://emedicine.medscape.com/article/1270717-treatment>

### **Modified images:**

Fractures. Available from: <https://smart.servier.com/>

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## ABOUT THE BOOK

Informed by experts: Most patients with orthopaedic pathology in low to middle-income countries are treated by non-specialists. This book was based on a modified Delphi consensus study\* with experts from Africa, Europe, and North America to provide guidance to these health care workers. Knowledge topics, skills, and cases concerning orthopaedic trauma and infection were prioritised. Acute primary care for fractures and dislocations ranked high.

Furthermore, the diagnosis and the treatment of conditions not requiring specialist referral were prioritised.

\* Held et al. Topics, Skills, and Cases for an Undergraduate Musculoskeletal Curriculum in Southern Africa: A Consensus from Local and International Experts. JBJS. 2020 Feb 5;102(3):e10.

## THE LION

The Learning Innovation via Orthopaedic Network (LION) aims to improve learning and teaching in orthopaedics in Southern Africa and around the world. These authors have contributed the individual chapters and are mostly orthopaedic surgeons and trainees in Southern Africa who have experience with local orthopaedic pathology and treatment modalities but also in medical education of undergraduate students and primary care physicians. To centre this book around our students, iterative rounds of revising and updating the individual chapters are ongoing, to eliminate expert blind spots and create transformation of knowledge.

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The information in this book is meant to supplement, not replace, Orthopaedic primary care training. The authors, editor and publisher advise readers to take full responsibility for their safety and know their limits. Before practicing the skills described in this book, be sure that your equipment is well maintained, and do not take risks beyond your level of experience, aptitude, training, and comfort level.

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