

# ORTHOPAEDICS

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# Complications of fractures

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## Learning objectives

- Be able to identify the immediate and delayed complications associated with fractures.
- Understand the importance of history-taking and examination in identifying fracture-related complications.
- Understand the risk factors for complications of fractures.
- Be able to identify the different management options (surgical and non-surgical) for the various complications of fractures.

## Introduction

Fractures are a relatively common injury that patients present with. It is important to be able to recognise complications arising from fractures as these can significantly impact a patient's recovery. Through a thorough history-taking and examination during check-ups, it is possible to identify complications and implement a management plan to prevent any long-term sequelae.

## Complications of fractures

### Immediate complications

#### **Compartment syndrome:**

Compartment syndrome occurs when there is increased pressure within a limb muscle compartment from swelling or bleeding around the fractured bone. Increased pressure impairs circulation and leads to tissue hypoxia. This condition is painful and needs urgent treatment to prevent irreversible tissue damage.

**Soft tissue injury:** Local injury to the tissues around the fracture site.

#### **Nerve or blood vessel damage:**

Fractures can cause damage to peripheral nerves or blood vessels, leading to sensory or motor function loss, or impaired blood flow.



**Figure 1:** Acute compartment syndrome

## Delayed complications

**Malunion:** Malunion happens when the bone fragments heal in a malaligned position. This can lead to functional impairment, deformity and chronic pain.

**Delayed or non-union:** Fractures can take longer than usual to heal or not heal properly at all, causing delayed or non-union. Soft tissue injury such as open fractures, poor blood supply, infection or insufficient immobilisation are potential causes.

**Fracture-related infection:** Infection can occur in open fractures or following surgery. Osteomyelitis is an infection of the bone.

**Osteoarthritis:** This is a long-term complication of fractures (especially intra-articular fractures) that impacts physical ability and can lead to chronic pain.

**Deep vein thrombosis (DVT):** This potential complication is due to immobilisation following fractures. The risk is higher in spinal, pelvic and leg fractures and can potentially lead to a pulmonary embolism.

**Fat embolism syndrome:** This is a risk, especially in long bone fractures. Fat droplets from the bone marrow may enter the bloodstream. These droplets can affect the lung, brain and other organs; for example, causing respiratory distress.

### Joint stiffness and contractures

**Muscle atrophy:** This can occur when a fractured limb is immobilised for a long period of time, causing muscle wasting and weakness.



**Figure 2:** Fracture malunion

## Clinical findings

### History

A comprehensive history should be taken of the fracture and how it occurred to identify potential complications. Information about the mechanism of injury, time since the injury and patient's past medical conditions can help assess the severity of the fracture, the healing process and recognise risk factors for impaired fracture healing.

### Risk factors

**Age:** Older patients generally have lower bone density, putting them at a higher risk of fractures. They may also have more complications during the healing process.

### Type and location of the fracture:

**Open** fractures and fractures near joints have a higher risk of complications compared to other fractures.

**Severity of the fracture:** Complex fractures or fractures that are severely displaced may take longer to heal and have a higher rate of complications compared to closed fractures.

**Osteoporosis:** Osteoporosis causes decreased bone density, which increases the risk of fractures and causes difficulties in fracture fixation.

**Poor nutrition:** Deficiencies of nutrients like protein and vitamin D can also impair bone healing and lead to complications.

**Smoking and alcohol consumption:** This can increase the risk of delayed or non-union, infections and other complications.

**Delayed treatment:** Untreated fractures can cause further damage to local soft tissues that would otherwise be preventable. Late presentation therefore increases the risk of complications.

**Underlying medical conditions:** Diabetes, peripheral vascular disease or autoimmune disorders can negatively impact the body's healing process and increases the risk of complications.

**Medications:** Corticosteroids and other medications negatively impact bone health, slowing the healing process.

**Non-compliance with treatment:** Not wearing casts, not attending follow-up appointments or not going to physiotherapy can slow the healing process and lead to complications such as contractures.

## Examination

It is important to follow up with a patient after a fracture to check that they are healing well and that no complications have occurred. The following features indicate that there is a potential complication with the healing process:

- Severe pain that is worse than what would be expected during the healing process.
- Swelling or bruising around the fracture site that is severe or rapidly

increasing. This could indicate infection or impaired healing.

- Deformity.
- Limited range of motion compared to the other unaffected limb.
- Skin changes – red and hot to the touch.
- Open wounds or pus near the fracture could indicate infection.
- Fever that is unexplained could indicate a systemic infection.
- Delayed healing.
- Crepitus could suggest malalignment or non-union. This is caused by bone ends rubbing against each other.
- Sepsis symptoms such as tachycardia, hypotension and confusion.

## Special investigations

### Imaging

**X-rays** are often used initially and provide useful information about the fracture pattern and alignment.

**Computed tomography (CT)** scans are valuable for when assessing complex fractures and intra-articular involvement.

**Magnetic resonance imaging (MRI)** is useful for identifying soft tissue injuries, ligamentous involvement and occult fractures.

## Management

### Immediate complications

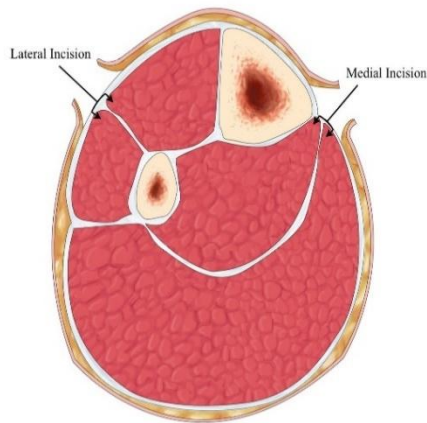
#### Non-surgical

Rest, ice, compression and elevation (RICE) can be used to manage soft tissue injuries and help to reduce inflammation.

Any suspected nerve damage or blood vessels injuries should be investigated, monitored closely or urgently referred depending on severity.

## Surgical

For compartment syndrome in the early stages, the immediate treatment involves a fasciotomy, which is a surgical technique to reduce pressure within the affected compartment, allowing for restoration of adequate blood flow and tissue perfusion.



**Figure 3:** Fasciotomy (Source: [Cone & Inaba](#), CC BY-NC)

In cases of severe blood vessel or nerve damage, surgical intervention should be done to restore blood flow and function to the affected area.

## Delayed complications

### Non-surgical

Non-surgical management of a DVT is preventative and includes compression stockings, anticoagulants and early mobilisation of the patient.

Physiotherapy can help to prevent joint stiffness and contractures through stretching and range of motion exercises.

Physiotherapy can also help to prevent and treat muscle atrophy of the affected limb.



**Figure 4:** Skin traction to immobilise a hip fracture to limit movement at fracture site, decreasing pain and preventing complications

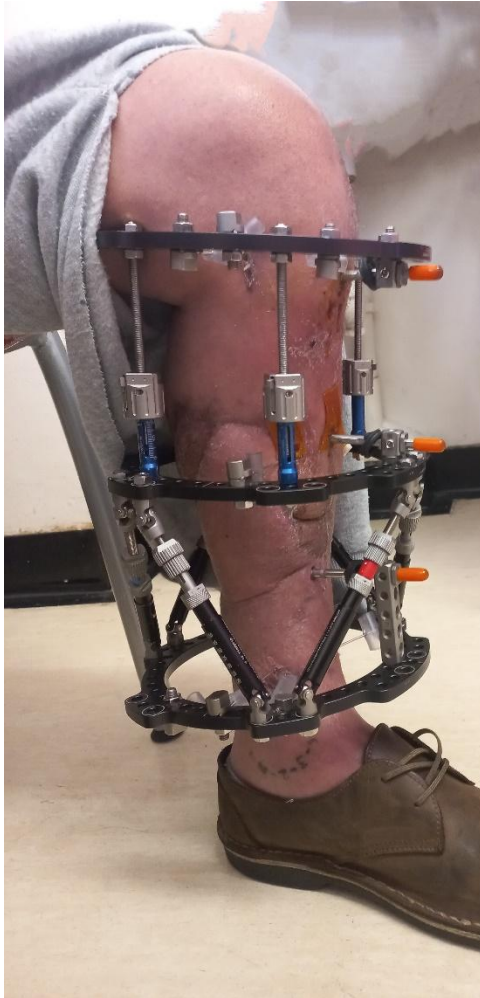
## Surgical

Surgical treatment can prevent complications. For instance, in the cases of AO (Arbeitsgemeinschaft für Osteosynthesefragen) type B or C fractures of the distal radius, operative fixation as opposed to conservative treatment can decrease the risk of complications of fractures, such as malunion, articular incongruity and osteoarthritis.

Corrective surgery is necessary to treat malunion; for example, osteotomy with the use of internal or external fixation devices. Surgical intervention is also required in most cases of fracture-related infection and non-union.

For fracture-related infections and osteomyelitis, the treatment always involves surgery (debridement of devitalised tissue) and systemic antibiotics.

In severe cases where a DVT leads to a pulmonary embolism, emergency surgery may be necessary.



**Figure 5:** External fixation device

## Key takeaways

- Fracture-related complications can significantly impact patient outcomes and can lead to functional impairment, deformity and potentially life-threatening conditions.
- History and clinical examination are essential for diagnosis and can help in identifying potential complications early on.
- There are a variety of complications of fractures, such as compartment syndrome, soft tissue injuries, malunion and non-union, and all have slightly different presentations.
- There are many risk factors for complications of fractures, so identifying these factors can help guide preventative measures.
- Management options vary based on the type and severity of the fracture and associated complications, and range between surgical and non-surgical options.
- Differential diagnosis helps rule out other conditions with similar presentations, such as degenerative joint disease.

# Assessment

1. A 35-year-old man sustains a fracture in his forearm and undergoes conservative treatment involving immobilisation with a cast. After six weeks, he complains of weakness and wasting of muscles in the affected arm. What is the most likely complication he is experiencing?

- A. Compartment syndrome
- B. Muscular atrophy
- C. Delayed or non-union
- D. Fat embolism syndrome

The answer is (B). These symptoms of weakness and muscle wasting are consistent with muscular atrophy.

2. A 42-year-old woman sustains a closed fracture in her tibia following a fall. She complains of increasing pain and swelling in the affected leg. Upon examination, there is limited range of motion. The neurological examination is normal. What complication is the most likely cause of her symptoms?

- A. Joint stiffness and contractures
- B. Nerve or blood vessel damage
- C. Osteomyelitis
- D. Compartment syndrome

The answer is (D).

3. A 28-year-old male sustains a fracture in his femur after a motorcycle accident. He is treated with surgical intervention involving open reduction and internal fixation (ORIF). Two days after surgery, he develops sudden onset respiratory distress. What is the most likely complication he is experiencing?

- A. Fat embolism syndrome
- B. Infection
- C. Delayed or non-union
- D. DVT

The answer is (A). Symptoms of sudden onset respiratory distress following a femur fracture and ORIF are indicative of fat embolism syndrome.

4. A 50-year-old man sustains a fracture in his wrist due to a fall. After the fracture has healed, he notices that the bone fragments have not aligned correctly, leading to limited functionality and chronic pain. What complication is he likely experiencing?

- A. Malunion
- B. Compartment syndrome
- C. Delayed or non-union
- D. Joint stiffness and contractures

The answer is (A).

5. A 32-year-old woman sustains an open fracture in her arm during a car accident. She undergoes surgery to clean the wound and fixate the fracture. A few days after the surgery, she develops signs of infection at the surgical site, with redness, warmth and pus discharge. What complication is she likely experiencing?

- A. Osteomyelitis
- B. Compartment syndrome
- C. Fat embolism syndrome
- D. Infection

The answer is (A).

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## ABOUT THE BOOK

This is the second volume of the *Orthopaedics for Primary Health Care* textbook edited by Michael Held, first published in 2021.

Most patients with orthopaedic pathology in low- and middle-income countries are tested by non-specialists. This book was based on a Delphi consensus study\* with experts from Africa, Europe and North America to identify topics, skills and cases concerning orthopaedic trauma and infection that need to be prioritised in order to provide guidance to these health care workers.

The aim of this book is to be student-centred.

\*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.



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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 experience, aptitude, training or comfort level.

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