

# Introduction to Fractures

Traumatology  
RHS 231  
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Lecture 3

# Definitions

- A **fracture** is an interruption in the continuity of bone
- Fracture = Break
- Fracture: mechanical damage produced in a bone

# Definitions

- **Trauma** may cause injury to nerves, muscle, blood vessels, ligaments, and / or bone
- The severity of an injury is greatly influenced by the violence of the impact (e.g., car accident versus tripping over a carpet)

# Classifications of fractures

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graph TD; A[Classifications of fractures] --> B[Simple & Compound]; A --> C[Open & Closed]; A --> D[Shape]
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Simple &  
Compound

Open &  
Closed

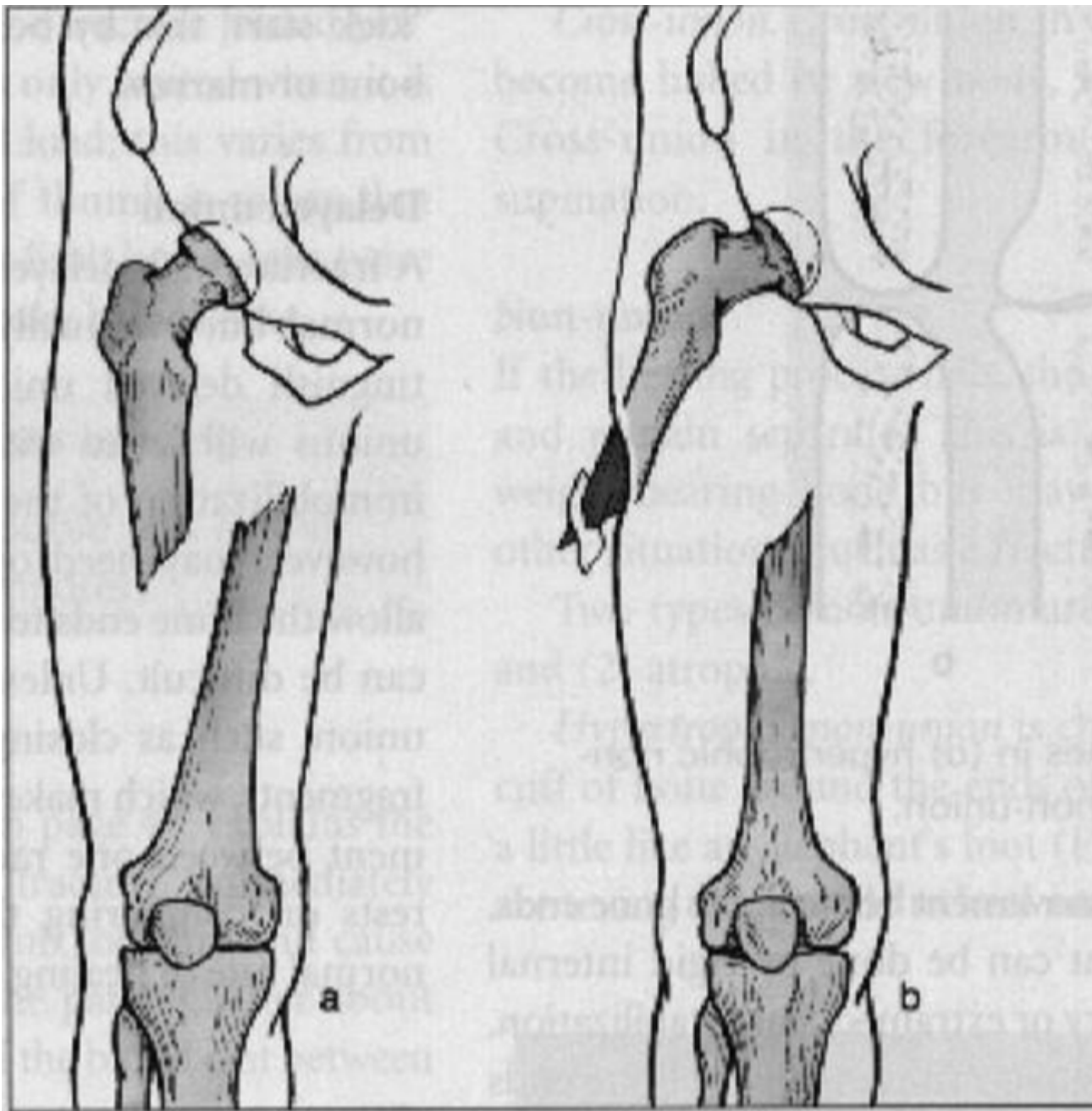
Shape

# Simple versus Compound

- Ancient classification of the **old** military surgeons:
  - **Simple** fractures: intact skin
  - **Compound** fractures: open wound & soft tissue damage

# Open versus Closed

- **Closed** fracture: when there is no communication between the fracture and the outside environment
- **Open** fracture: when the skin has been penetrated by a bone fragment from inside (compound)



**Close fracture**

**Open fracture**

# Classification based on shape

- **Transverse** fractures:
  - The result of a direct blow (***sideway bending***)
  - The square shape of the bone ends helps the fracture to stay aligned
  
- **Oblique** fractures:
  - Rare
  - May be confused with spiral fractures (radiological artefact?)



# Fractures



***Greenstick fracture***



***Partial (fissured) fracture***



***Comminuted fracture***



***Transverse fracture***



***Oblique fracture***




***Spiral fracture***

# Classification based on shape

- **Spiral fractures:**

- The most common fracture in long bones

- Caused by an excessive ***twisting*** movement about the long axis of the bone

- Example: a sharp twist to the leg with the foot stuck in a wheel  spiral fracture of the tibia

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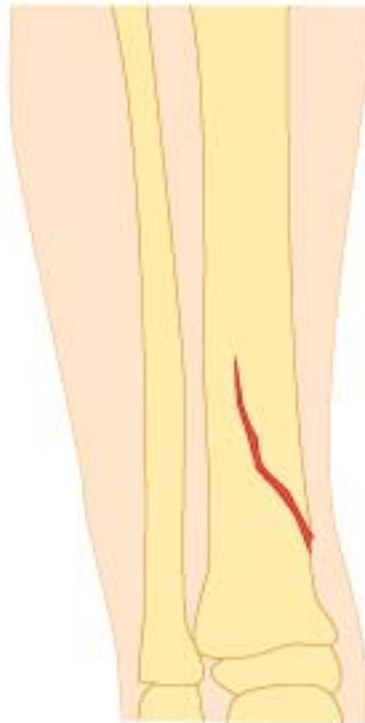
**Fracture Type****Illustration**

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**SPIRAL**

Ragged break occurs when excessive twisting forces are applied to a bone

Common sports fracture



# TYPES OF FRACTURE

## DIRECT OR INDIRECT TRAUMA



Abduction or  
Adduction Force



Transverse  
Fracture

REDUCE BY ADDUCTION OR ABDUCTION

This illustrates a transverse fracture due to a transverse force



Twisting Force



Oblique or  
Spiral Fracture

**REDUCE BY TWISTING**

# Classification based on shape

- **Spiral fractures:**

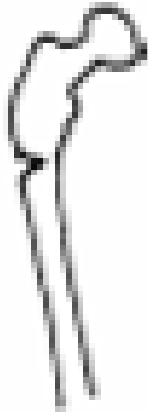
- The fragments are more difficult to balance against each other than the square ends of the transverse fracture
- Bone spikes may damage blood vessels, nerves, or skin
- Bone spikes may break off to produce triangular fragments known as “***butterfly fragments***”

# Classification based on shape

- **Greenstick fractures:**
  - Bone breaks incompletely: only one side of the shaft splints and the other side bends (one side breaks and the other side remains intact)
  - Similar to the way a green twig breaks
  - Common in children (because their bones are more flexible than adults)
  - First the cortex “*buckles*”, and if the force continues, the cortex will break under tension

# Common fractures in children

## Greenstick fractures



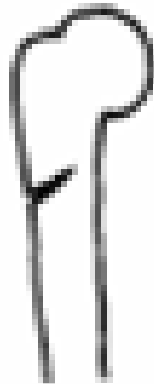
Femur



Tibia



Radius  
and ulna



Humerus



Clavicle



## Fracture Type

## Illustration

### **EPIPHYSEAL**

Epiphyseal plate tears, separating epiphysis from diaphysis

Tends to occur where cartilage cells are dying and calcification of the matrix is occurring



### **GREENSTICK**

Bone breaks incompletely, much in the way a green twig breaks. Only one side of the shaft splits, the other side bends.

Common in children, whose bones have relatively more organic matrix and are more flexible than those of adults



# Classification based on shape

- **Epiphyseal fracture:**
  - May cause severe deformity if the bone grows only on one side of the plate
  - “Harris & Salter” described 5 patterns of injury:

# Salter-Harris classification

## Type I



- Complete separation
- No fracture
- Easy reduction
- Good prognosis

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- 1) A separation along the epiphyseal line (epiphyseal slip only)

## Type II



- Commonest type
- Older children
- Easy reduction
- Good prognosis in most cases

2) Separation of the epiphysis with a triangular fragment of the shaft attached to it



### Type III

- Reduction and Kirschner wire fixation
- Prognosis usually poor – same as type IV

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3) Fracture of the epiphysis, with part of it attached to the shaft

## Type IV



- Intra-articular open reduction and fixation
- Prognosis poor unless perfect reduction

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4) A fracture line passing through both the epiphysis and the shaft

## Type V

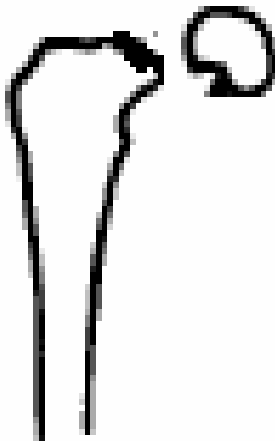


- Crushing injuries
- Diagnosis difficult
- Prognosis poor

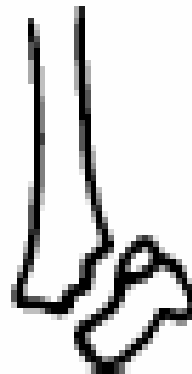
5) A crushing injury:

difficult to recognize at the time of the injury  
(clinically or radiologically)

## Epiphyseal injuries



Femur



Tibia



Radius



# Classification based on shape

- **Comminuted** fracture:
  - Caused by direct trauma
  - When the bone is splintered into a number of fragments
  - More common in the elderly whose bones are brittle
  - Exact anatomical reconstruction is difficult
  - Not to be confused with “compound” fractures

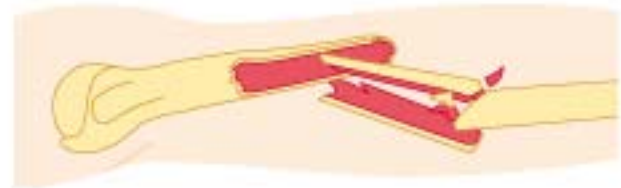
# Classification based on shape

- **Crush** (compression) fractures:
  - Caused by longitudinal forces
  - When the cancellous bone is squashed or crushed
  - Difficult to treat because there are no fragments left to manipulate back into place
  - Mainly in lumbar vertebrae, calcaneum
  - Common in osteoporosis (porous bone)

**Table 6.1****Common Types of Fractures****Fracture Type****Illustration****COMMINUTED**

Bone fragments into 3 or more pieces

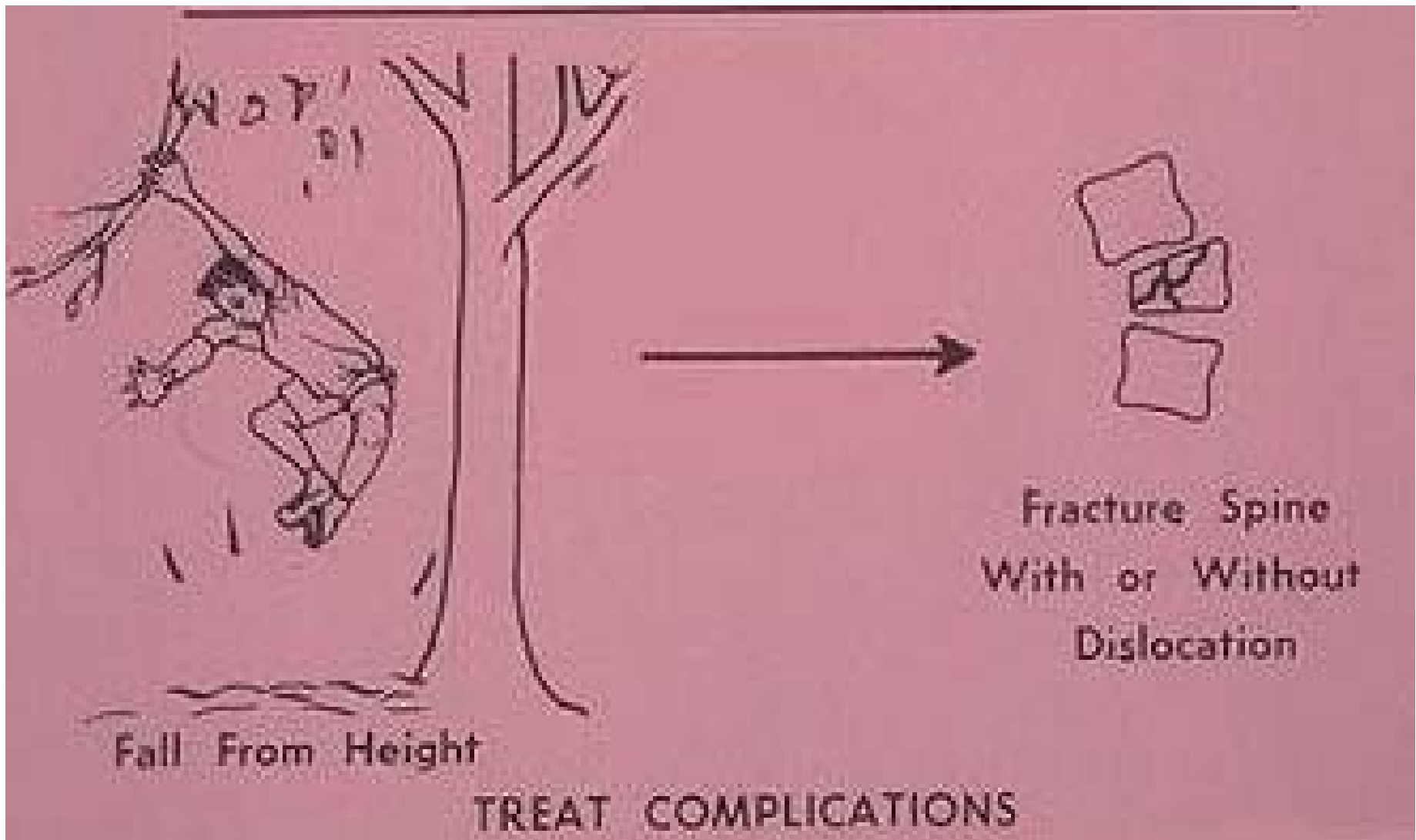
Particularly common in the aged, whose bones are more brittle

**COMPRESSION**

Bone is crushed

Common in porous bones (i.e. osteoporotic bones) subjected to extreme trauma, as in a fall





Fall From Height

Fracture Spine  
With or Without  
Dislocation

**TREAT COMPLICATIONS**

# FRACTURES DUE TO FALLS FROM A HEIGHT



FRACTURE  
SPINE



CENTRAL  
DISLOCATION  
OF HIP



FRACTURE  
CALCANEUS



## Direct trauma



Bumper



Comminuted -  
often compound



Fallen  
calcaneus



Crush  
fracture

**Table 6.1**

**Common Types of Fractures**

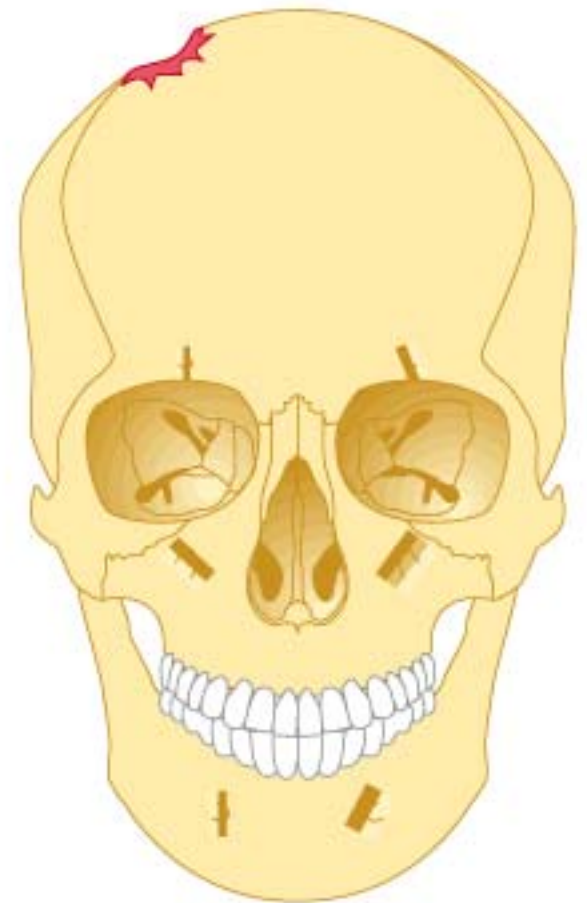
Fracture Type

Illustration

**DEPRESSED**

Broken bone portion is pressed inward

Typical of skull fracture



# Mechanism of injury

- **Direct trauma:**
  - May cause different fracture patterns depending on the angle of the force
  - Example: road traffic accident; weight falling on the body



# Mechanism of injury

- **Indirect trauma:**

- More common

- Usually a twisting injury

- Example: clavicle fracture due to falling on an outstretched arm; tibial fractures during skiing or soccer (when the weight of the body rotates on a fixed foot)

# Mechanism of injury

- **Fatigue fractures:**

- Caused by repeated *minor trauma*
- Repeated small bending stresses can break the bone
- Common in athletes
- Example: 2<sup>nd</sup> metatarsal in young people who walk excessive distances; tibia of long distance runners

# Mechanism of injury

- **Pathological fractures:**

- Occur through abnormally weak bones
- Occur as the result of a disease that affects the composition of the bone itself, making it liable to fracture due to a trivial injury
- Example: tumours; osteoporotic bones; Paget's disease

# Clinical features of fractures (signs & symptoms)

- Pain:
  - May be immediate from the local inflammatory reaction and trauma
  - Tenderness around the site of the fracture

# Clinical features of fractures (signs & symptoms)

- Deformity:
  - Can be seen or felt when there is a displacement of the bone fragments
  - Example: “dinner fork deformity” following Colles fracture of the distal radius

# Clinical features of fractures (signs & symptoms)

- Abnormal movement:
  - Due to movement of the bone ends at the fracture site
  - There may be grating between the bone ends, known as “***crepitus***”
- Impairment or loss of function:
  - Vary according to the severity of the fracture

# Clinical features of fractures (signs & symptoms)

- Oedema (swelling at the fracture site):
  - Localized immediately after the injury
  - Becomes more extensive with time
  - Reduced by elevation & isometric contractions
- Muscle spasm:
  - Attempt by the body to stop things from moving
  - May cause displacement or over-riding of bone ends (traction may be needed)



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## **Ape hand deformity**

A median nerve palsy due to a wound on the palmar aspect of the wrist, resulted in wasting and paralysis of the thenar muscles



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## Claw hand deformity

The typical appearance of an ulnar nerve palsy with partial clawing of the 4th and 5th fingers.



A **wrist drop** due to a **radial nerve palsy**. In this case it was a so called ***crutch palsy*** due to crutches which were too long for the patient causing pressure in his axillae with resulting paralysis. Other common causes of radial nerve palsy are a ***fracture of the mid shaft of the humerus*** and ***Saturday night palsy***.