



**ORTHOPAEDICS  
INTERNATIONAL**  
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## Nailing - History and Indications

# 16<sup>th</sup> Century



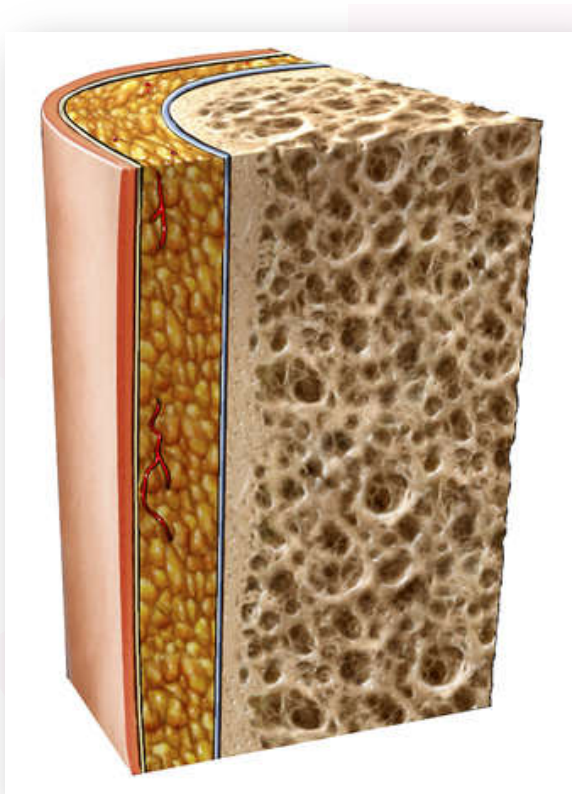
During the 16<sup>th</sup> Century anthropologist Bernardino de Sahagun, on expedition through Mexico, witnessed Aztecs placing wooden sticks into medullary canals to treat long bone fractures

# 1850



During the mid 1800s, surgeons began using ivory inserted into the canal which in time was found to reabsorb into human bone

# 1917



In 1917 the use of autogenous bone (allograft – patients own bone) was reported by Hogland of the United States. A piece of cortical bone was cut out and used to span fracture sites.



# World War One



During World War One an English Surgeon, Hey Groves, reported use of metal rods in the treatment of gunshot wounds. The infection rate however was appalling.

# 1931



During 1931 Smith-Petersen reported the success of stainless steel nails for the treatment of Neck of Femur fractures

# 1930s



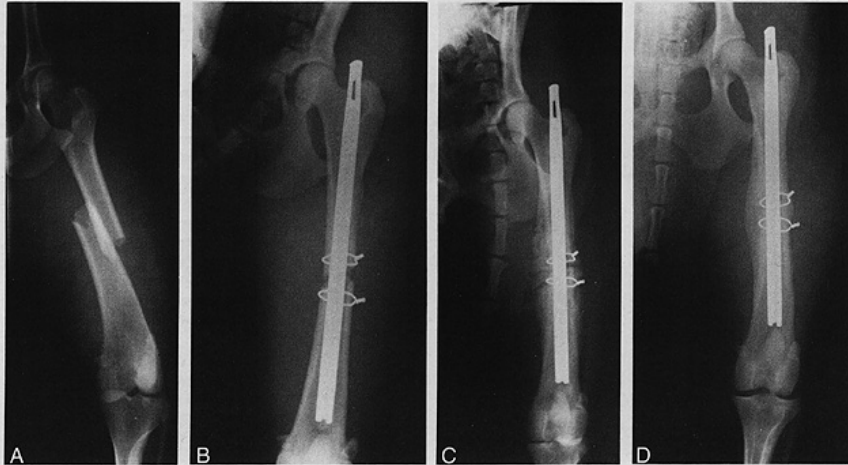
Rush pins and Steinmann pins were used in the 1930's  
Bent to shape and inserted in the canal

# 1930s



Gerhard Künzschner  
pioneered  
intramedullary  
nailing after  
developing the  
Smith Petersen nail  
technique for use in  
diaphyseal  
fractures

# 1939



**FIG. 29-11** (A) Cranial-caudal radiograph demonstrates a transverse, middiaphyseal femoral fracture in a 1-year-old mixed breed dog. (B) Radiograph demonstrates the fracture following reduction and fixation using a Küntscher nail and two wires. (C) Radiograph 6 weeks following fixation; (D) 12 weeks following fixation.

Testing on cadavers and animals resulted in a V-shaped stainless steel nail that was inserted antegrade. This was first used in 1939

# Time magazine - March 12<sup>th</sup> 1939

At England General Hospital in Atlantic City last week was a wounded soldier with a strangely mended femur (thighbone). The man had been treated by the Germans, his captors.

When the broken bone failed to heal, after weeks of conventional treatment, the soldier was operated on. He was mystified to find that his only new wound was a 2½-inch incision above the hipbone. Two days later, the German surgeons told him to move his leg; a few days after that, they told him to walk. He did. He has walked ever since.

After his exchange, U.S. Army doctors X-rayed the soldier's leg. They were amazed at what they saw: a half-inch metal rod of some kind had been rammed down the thighbone through the marrow for three-quarters of the bone's length, thus supplying a permanent, internal splint.



# World War Two



While there was some interest in the use of Küntscher's technique in Europe during World War II, his method was essentially unknown in the US

# 1947



By 1947, 105 cases using the V-shaped nail had been performed by Küntscher. He then moved onto a cloverleaf design

# 1950s

Two important  
techniques developed

**Intramedullary  
reamers**

**Interlocking  
screws**



# 1960s



Trochanteric nails  
first introduced

Zickel Nail c1967

# 1960s



Development of  
radiological image  
intensifier  
allowing closed  
techniques

# 1970s



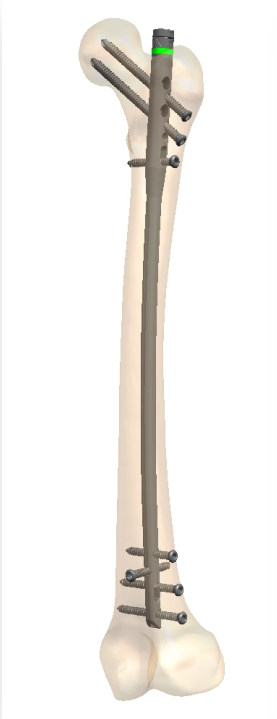
Dominant nails used were  
AO and Grosse-Kempff

Closed technique developed

Slotted cloverleaf design



# 1980s and 1990s



Titanium implants introduced

Immediate mobilisation study  
for trochanteric nails

1988 Gamma Nail introduced

First retrograde nailing

# Current day technology



# What influences surgeon decision



Patient age

Mechanism of injury

Fracture pattern/ location

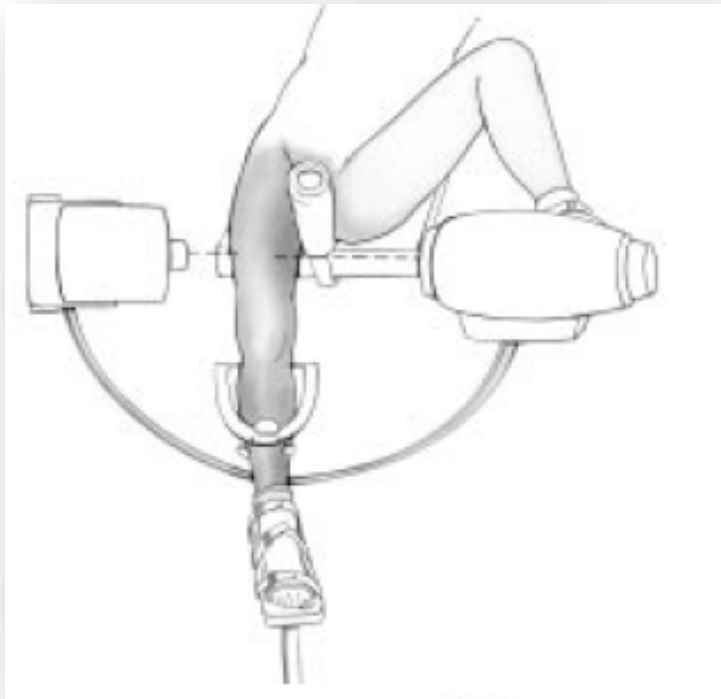
Other injuries

Surgeon preference

# Patient positioning



# Patient positioning - femur

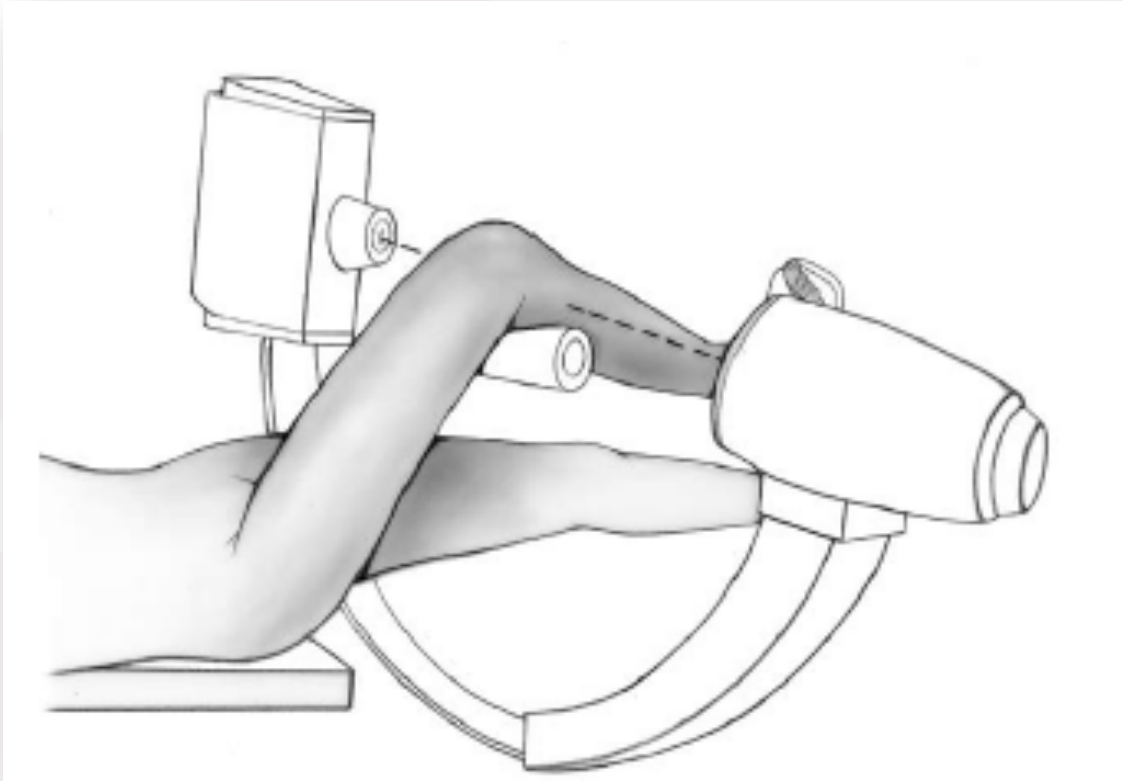


## Supine

Facilitates fracture reduction and rotational alignment of femur.

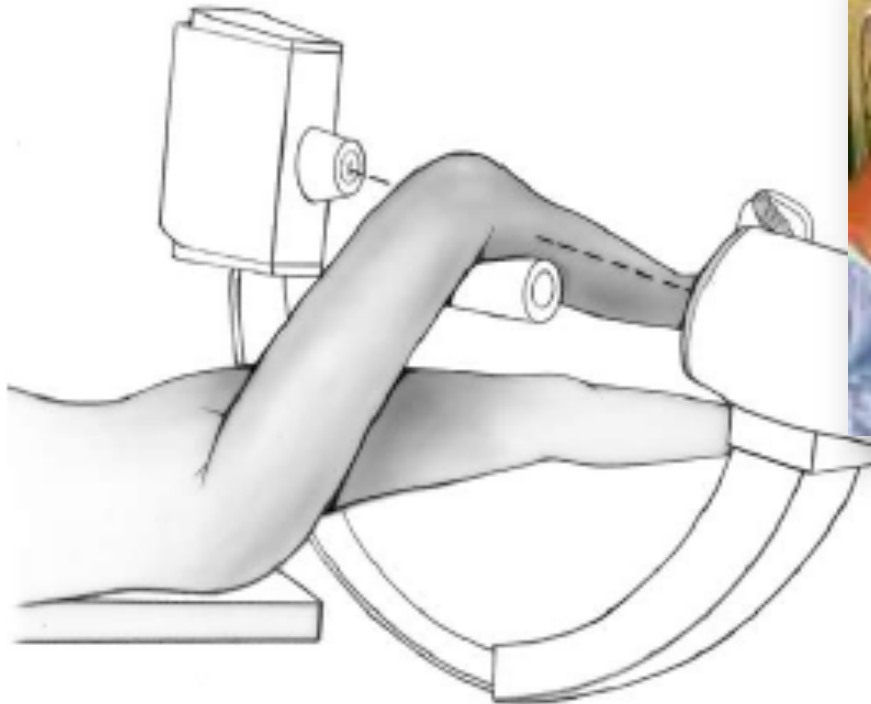
Check C-arm access

# Patient positioning - retrograde

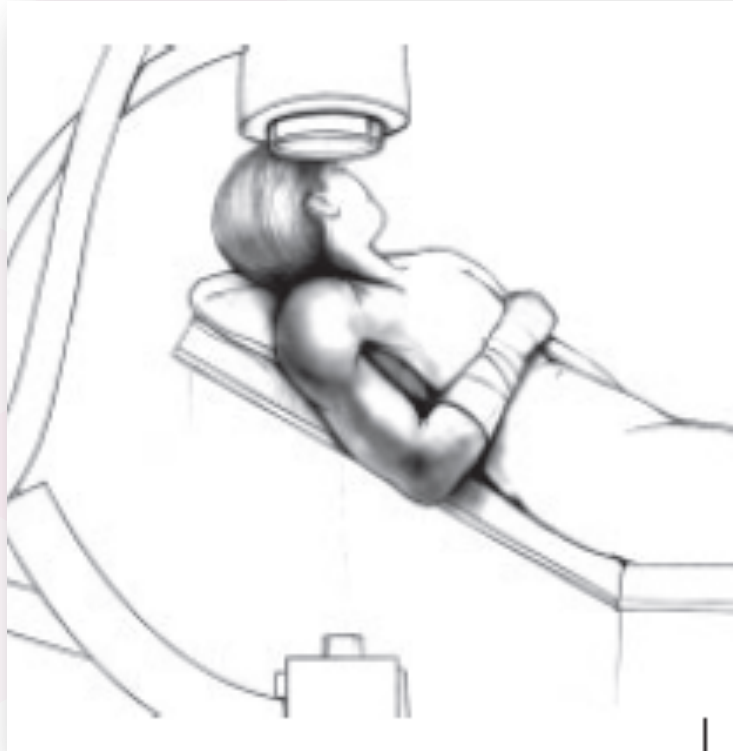




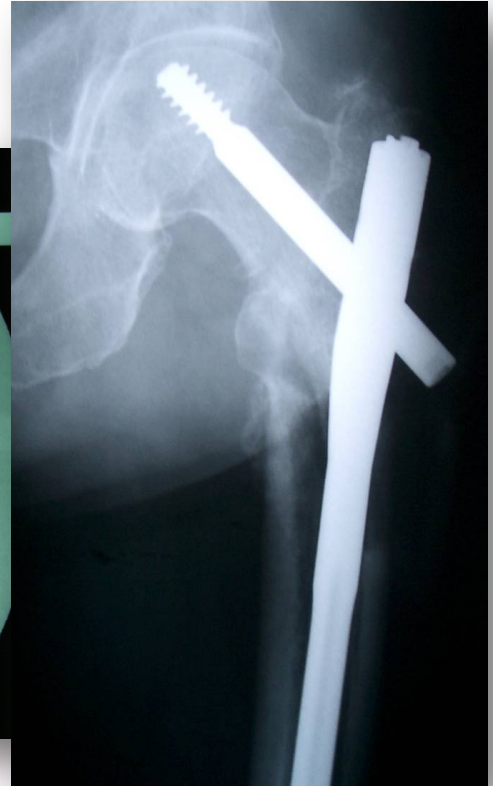
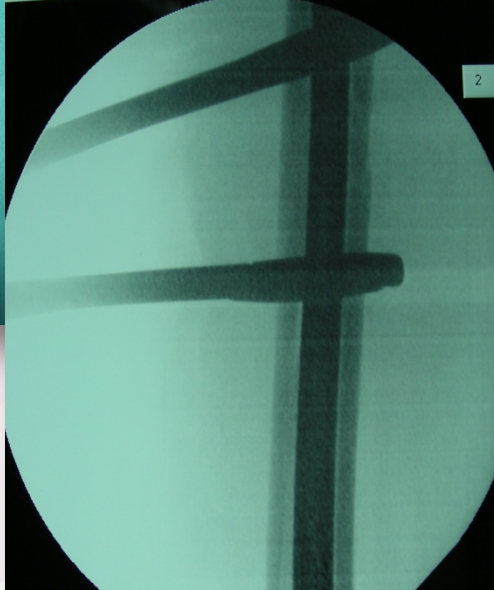
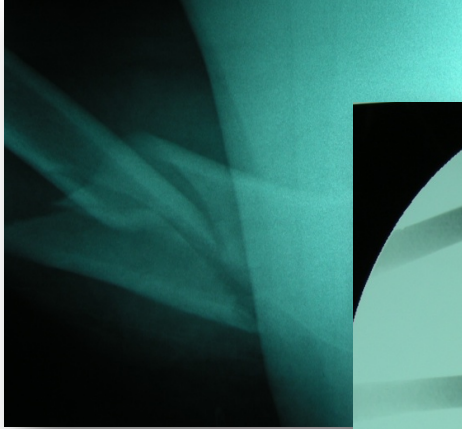
# Patient positioning - tibia



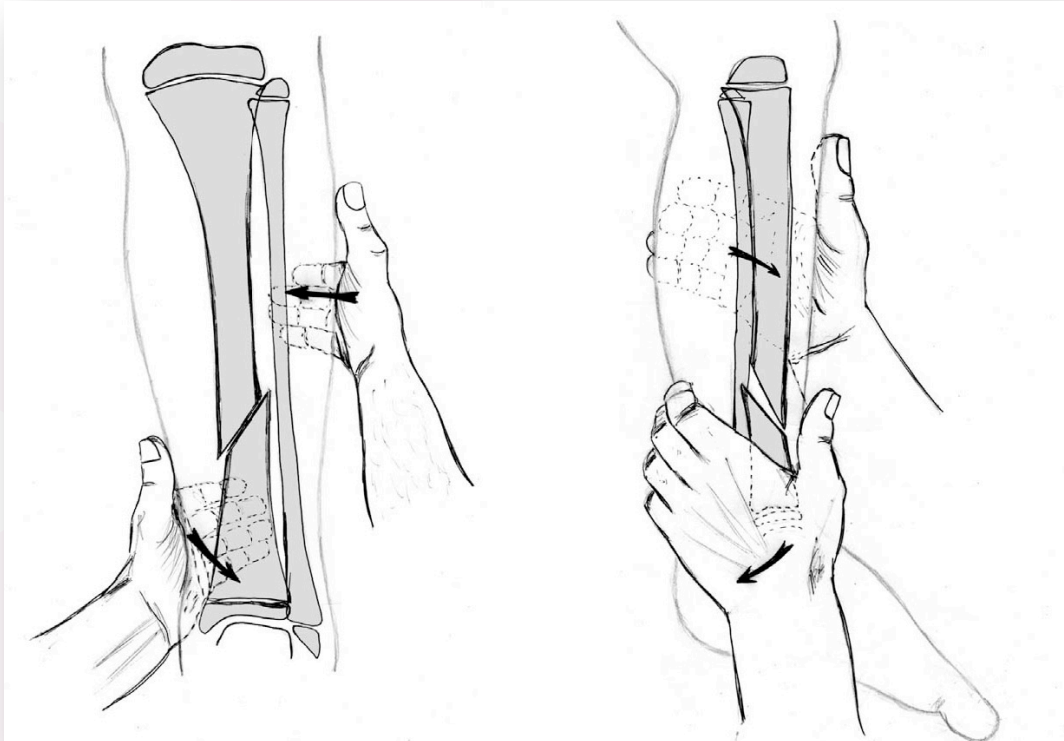
# Patient positioning - humerus



# Fracture reduction



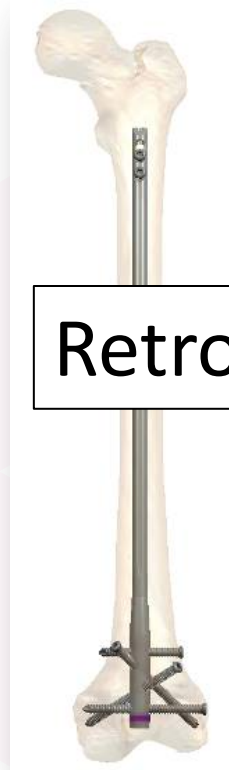
# Fracture reduction



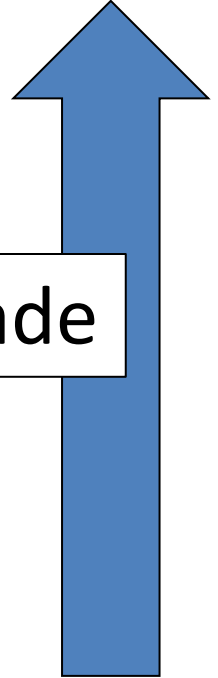
# Nail insertion



Antegrade



Retrograde



# Fracture indications





# Fracture indications



## **Complete Fracture**

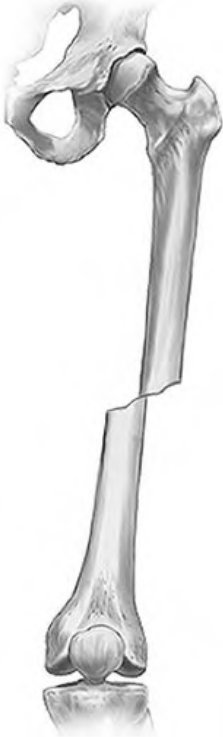
Fracture has  
penetrated both  
cortices of the bone

## **Incomplete Fracture**

Fracture penetrates  
only one side of the  
cortical wall



# Fracture indications



## **Displaced Fracture**

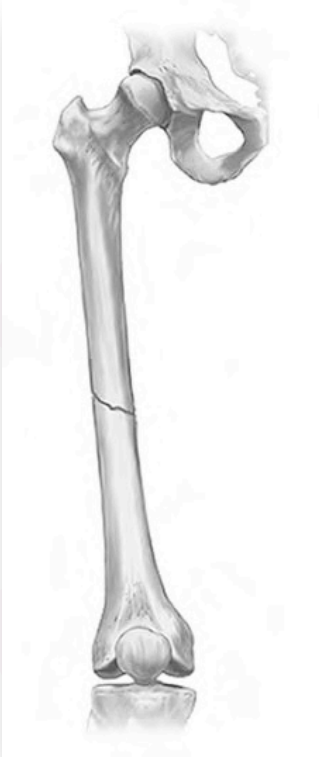
No longer aligned

## **Non-Displaced Fracture**

Bone segments are still in alignment



# Fracture indications

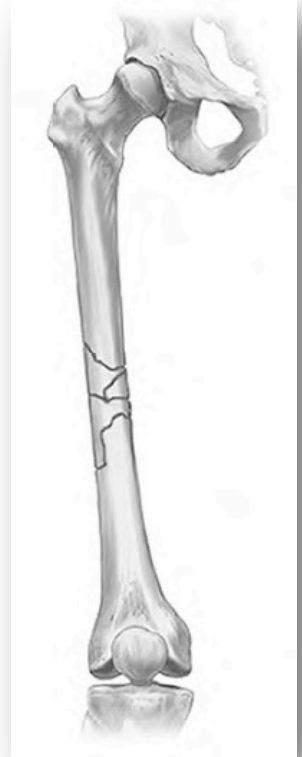


## **Simple Fracture**

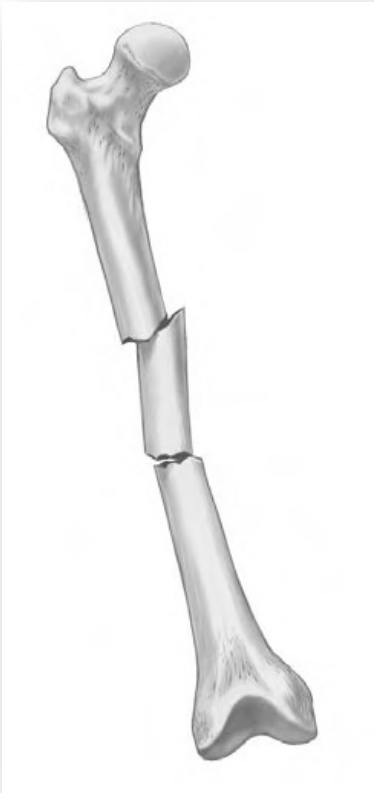
Closed fracture with a single fracture line and only two fracture fragments

## **Comminuted Fracture**

Bone is broken into multiple pieces



# Fracture indications

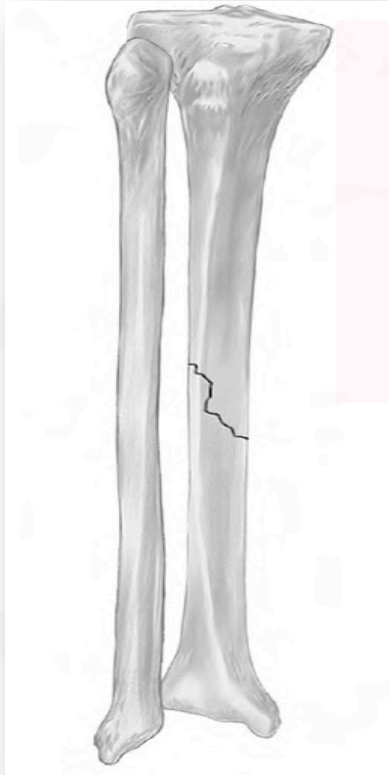


**Segmental Fracture**  
Fracture at two levels  
of the same bone

**Butterfly Fracture**  
Fracture lines meet



# Fracture indications



## **Oblique Fracture**

Fracture  $> 30^\circ$  to the long axis of the bone

## **Transverse Fracture**

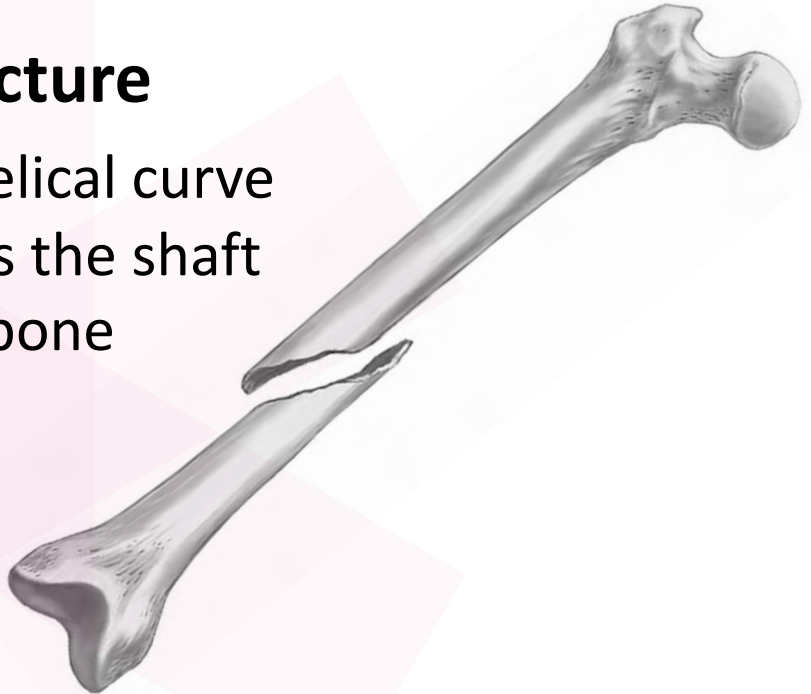
Straight fracture line, nearly perpendicular to the long axis of the bone



# Fracture indications

## Spiral Fracture

Line creates a helical curve  
that encircles the shaft  
of the bone



# Patient positioning - tibia

## Supracondylar Fracture

Any fracture just above the condyles

## Subcapital Fracture

Fracture close to the femoral head



# Patient positioning - tibia

## **Intertrochanteric fracture**

Fractures between the greater and lesser trochanters

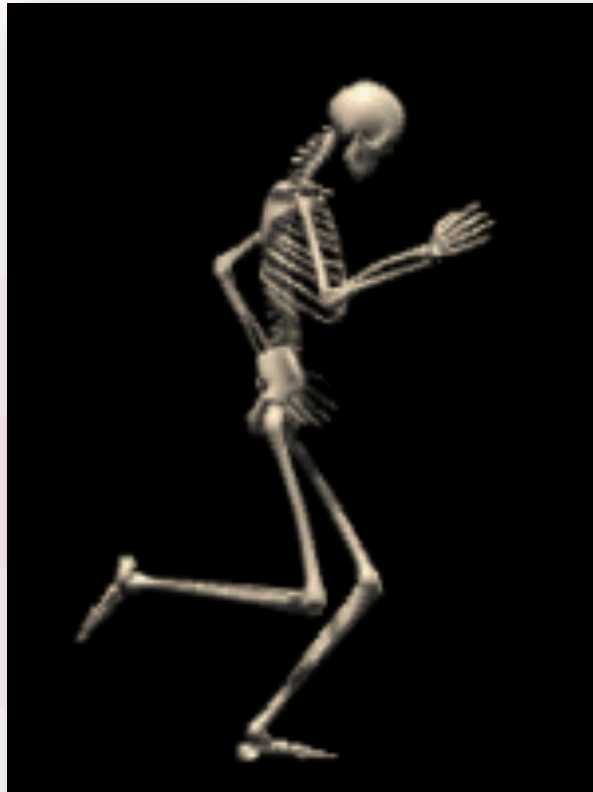
## **Subtrochanteric fracture**

Fractures below the lesser trochanter

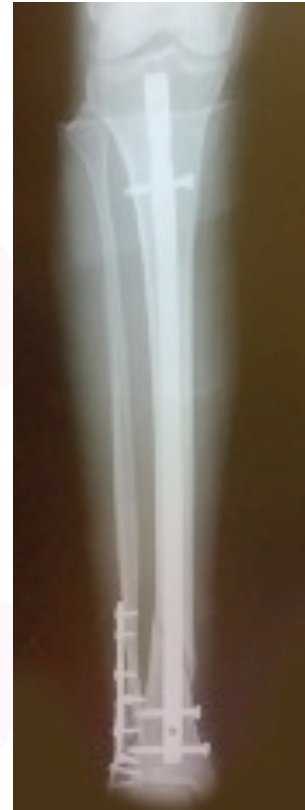
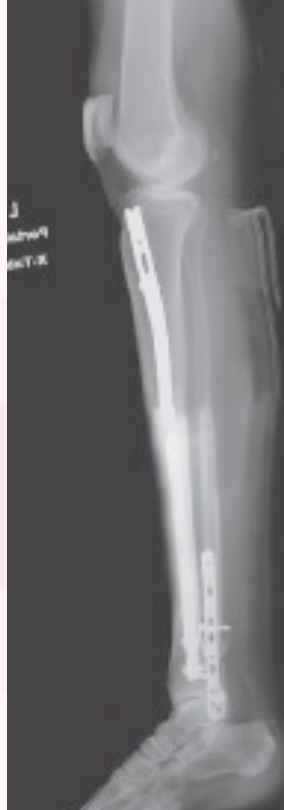




# X-ray discussion



# X-ray one



# X-ray two



# X-ray three



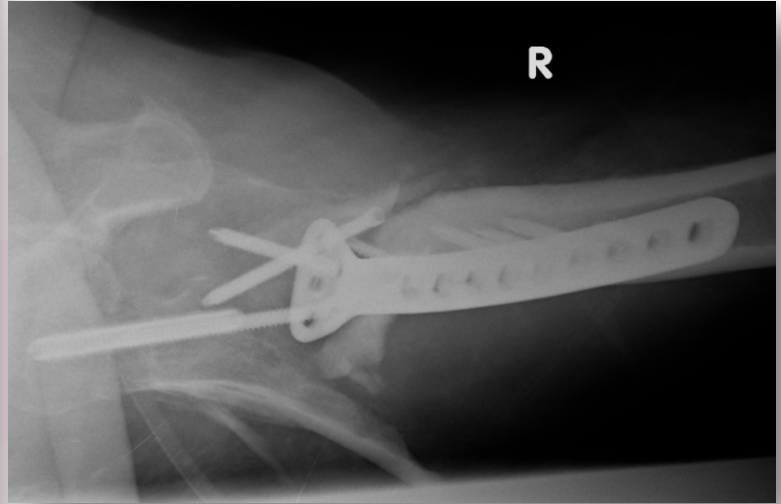
# X-ray three



# X-ray four



# X-ray five





# X-ray five





# Thank you



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