

# Soft tissue injuries

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Norbert Wiegand

# Soft tissues:

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- Skin
  - Subcutis
  - Muscle
  - Ligament
  - tendon
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# Soft tissue injuries

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- Without fracture
  - With fracture
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# Skin injuries

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- wounds
  - burn
  - chemical injuries
  - contusion
  - necrosis
-

# Treatment of skin contusion and necrosis

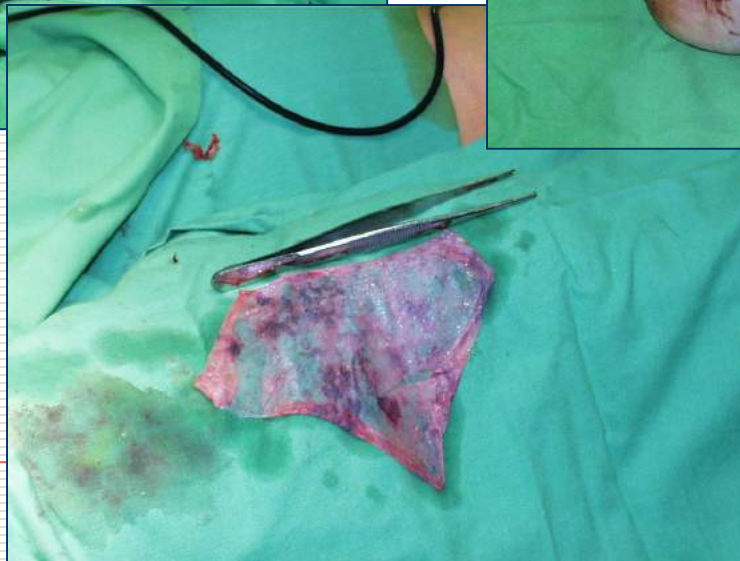
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- Vitality
- Surgical treatment
  - Necrectomy
  - Grafting
    - Skin
    - Flaps
      - Island
      - Bridge
      - Microsurgical



# Hematoma: bullectomy, skin grafting

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# Subcutis injuries

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- Contusion
- Hematoma
- Decollement
- Necrosis



# Treatment of subcutis injuries

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## Hematoma

- Fresh: suction
- Not fresh: open evacuation

## Decollement

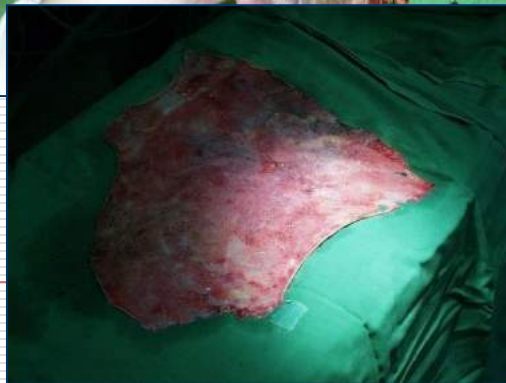
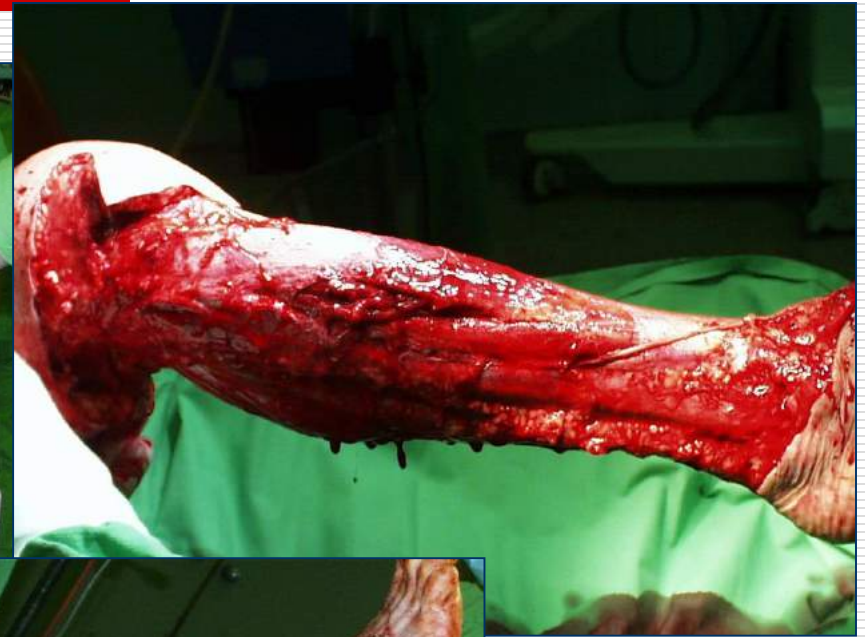
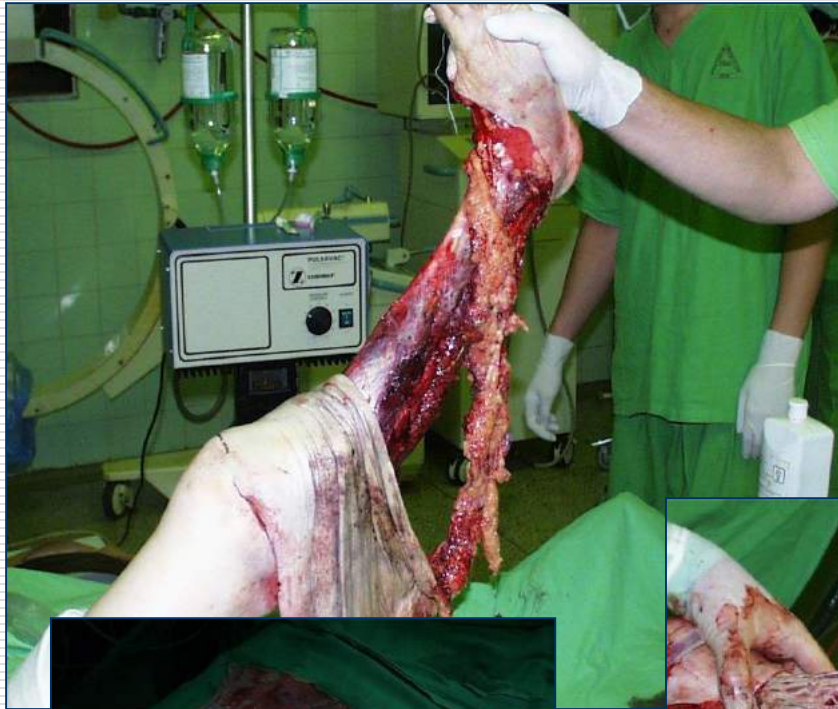
- Surgical evacuation, drainage 4-5 days

## Necrosis

- Surgical necrectomy, skin grafting
-



# Complex soft tissue injury without fracture



# Fascia injuries

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- Contusion
  - Rupture
  - Necrosis
-

# Treatment of fascia injuries

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- Rupture
  - Suture rare, only if it causes problems
- Necrosis
  - necrectomy



# Muscle injuries

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- Contusion
  - Strain
  - Tear /rupture/
    - partial
    - complete
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# Diagnostic of muscle injuries

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- Physical examination
  - Functional tests
  - Ultrasonography
  - MR
-

# Treatment of muscle injuries

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## Conservative

### ■ Functional

Contusion

Strain

### ■ Immobilization

Partial tear

## Operative: suture, reinsertion

### ■ Complete tear

### ■ **Compartment sy.**

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# Most common muscle injuries

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- Upper extr.:
    - Rotator cuff
      - Subscapularis
      - Infra- et supraspinatus
    - Biceps
    - Triceps
  - Lower extr.:
    - Suralis
    - Quadriceps
    - Adductors
    - Tibialis anterior
-

# Tear of Pectoralis major

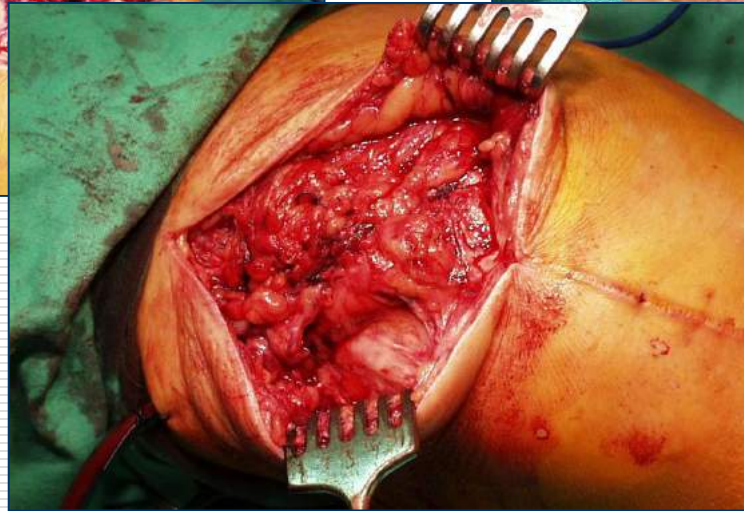
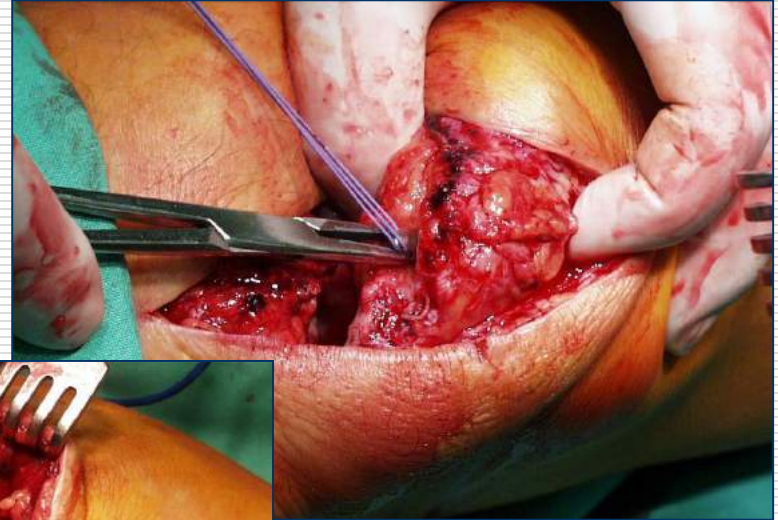
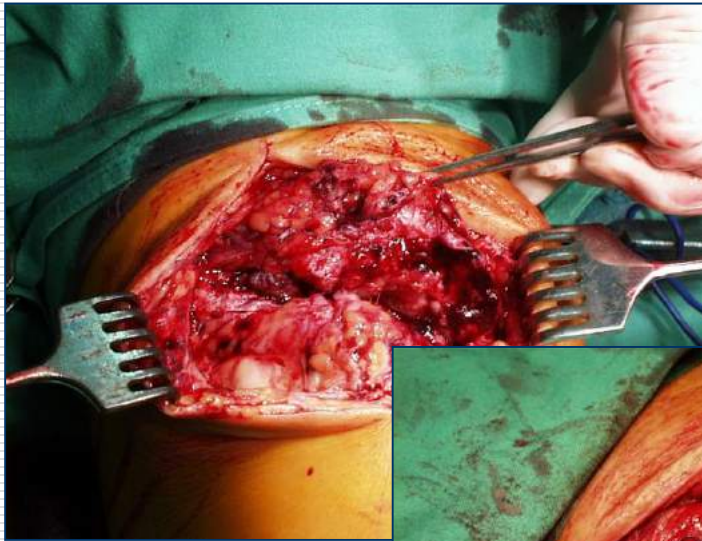
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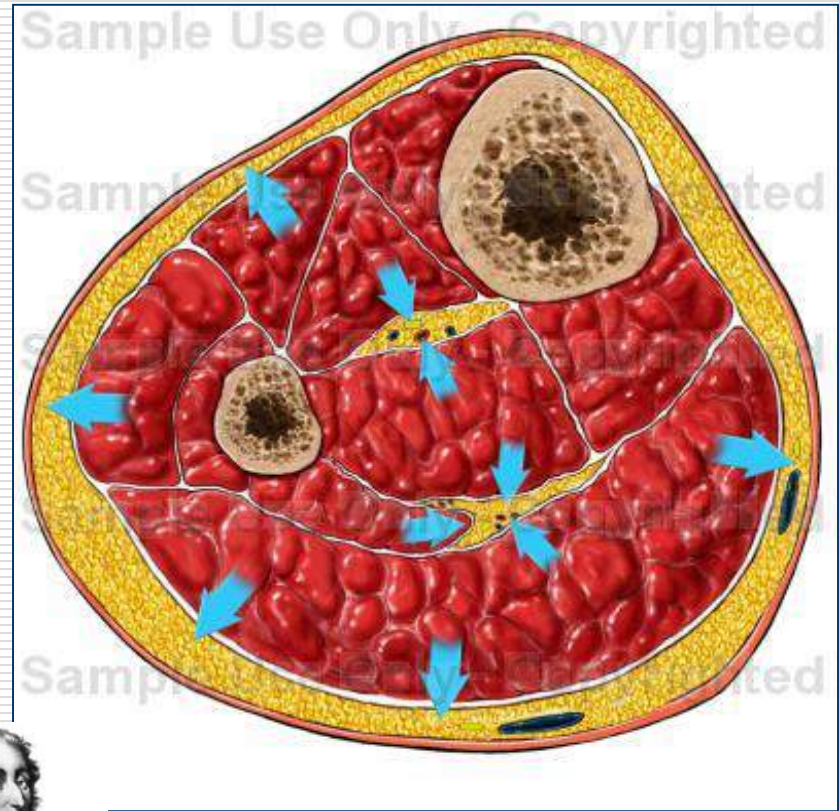
# Reinsertion of the Quadriceps muscle to the patella

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# Definition of Compartment syndrome

- In a closed anatomical place the pressure of the tissues is higher than the perfusion pressure in the vessels.
- It can generate a serious irreversible changes.



Pascal

# Causes of compartment syndrome

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- long bones fracture
  - damage of circulation
  - muscle injuries
  - burn
  - Etc.: extravasation
-

# Effects of compartment syndrome

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- Tissue necrosis
  - Irreversible changes
  - Nephropathy
  - Death
-

# Pathophysiology

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- **Normal oxygen pressure in cells:  
5-7 Hgmm**
  - **Capillary perfusion pressure  
(CPP):  
25 Hgmm**
  - **Interstitial pressure: 4-6 Hgmm**
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# Critical pressure in the anatomical compartment

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**30 Hgmm!**

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# Localization

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- Lower extremity**
  - Upper extremity**
    - Abdomen**
    - Other**
-

# Compartment sy. Different localisations

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# Diagnosis

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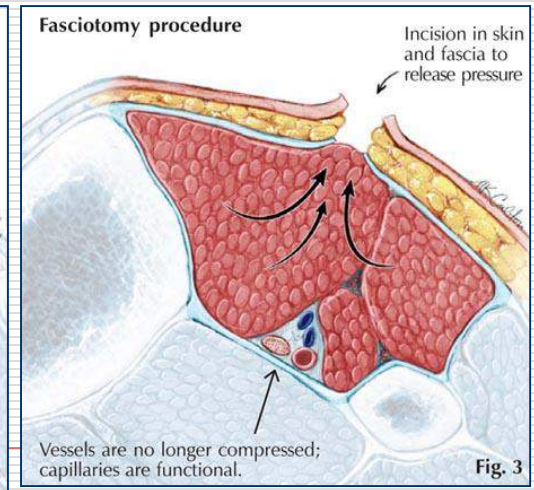
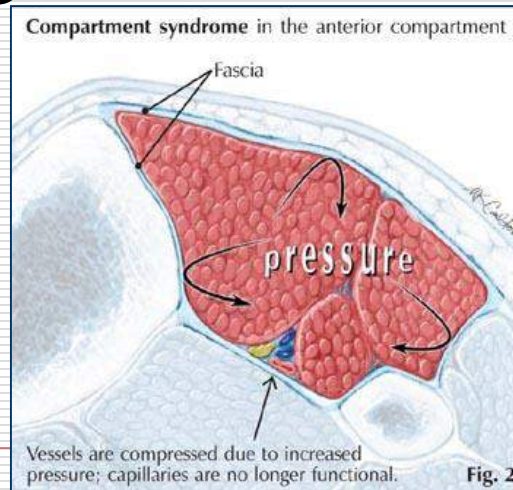
- Pain
- Pulse
- Neurological deficit
- Measurement of tissue pressure



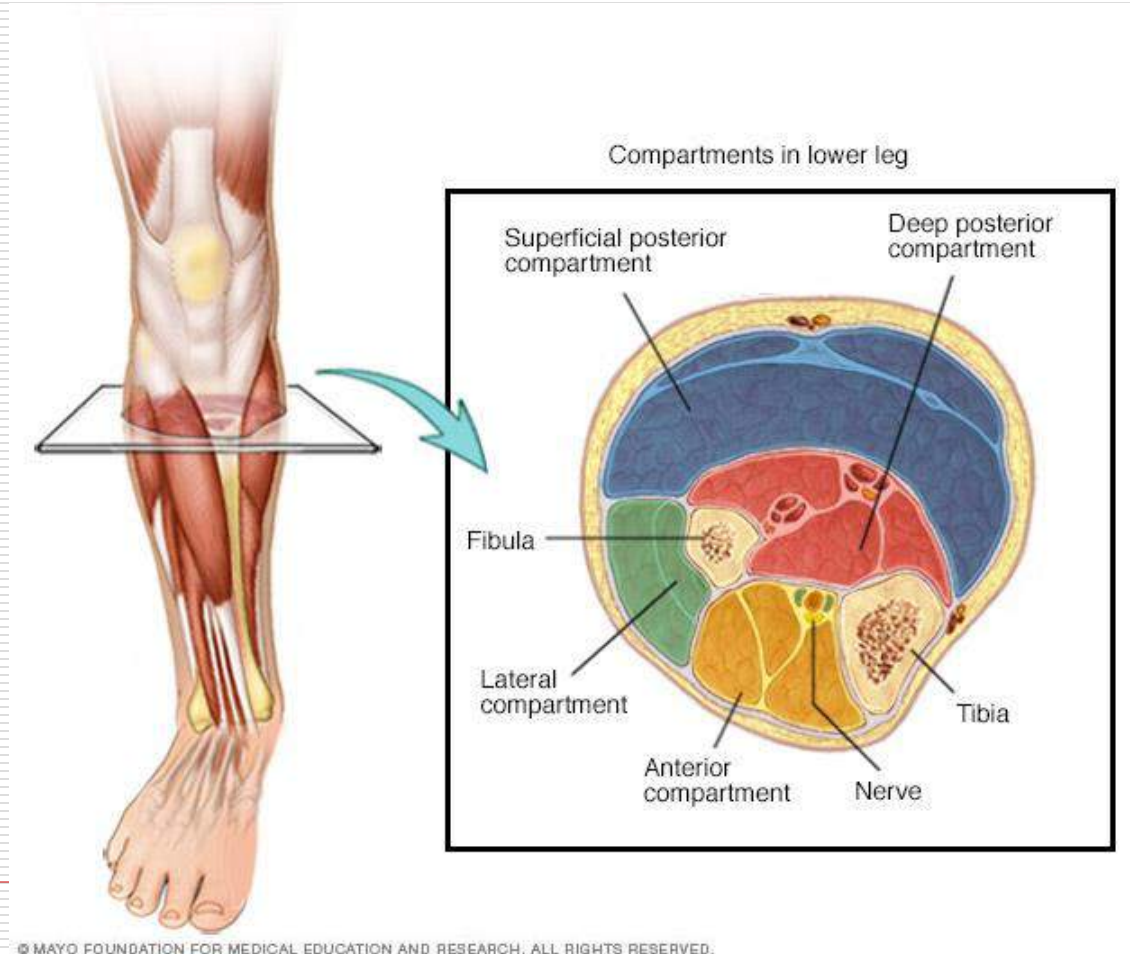
# Therapy

□ **urgent fasciotomy**

□ **within 6 hours!!!**



# Four compartments in leg



# Compartment sy.: fasciotomy, secunder suture

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# Vacuum assisted closure (VAC)

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# Tendon injuries ( muscle-tendon-bone)

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- Steps of the elongation:
    - 1. initial strain, longitudinal orientation of the fibers
    - 2. elastic strain - reversible
    - 3. plastic strain – irreversible
    - 4. tears
      - partial
      - complete
-

# Diagnostic of tendon injuries

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- Physical examination
  - Functional tests
  - Ultrasonography
  - MR
-

# Treatment of tendon injuries

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- Conservative
    - Strain
    - Partial tear
  - Surgical: suture, reinsertion, replacement
    - Complete tear
-

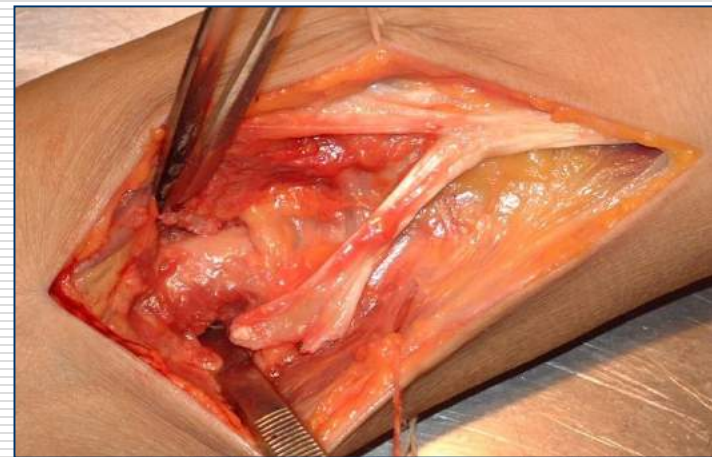


# Frequent tendon ruptures

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## □ Upper extremity

- Biceps long head
- Biceps distal
- Rotator cuff
- Finger extensor and flexor

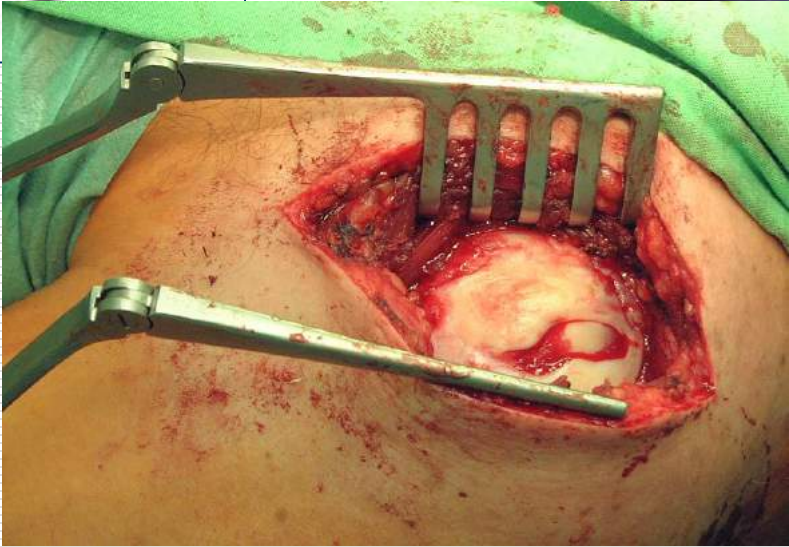
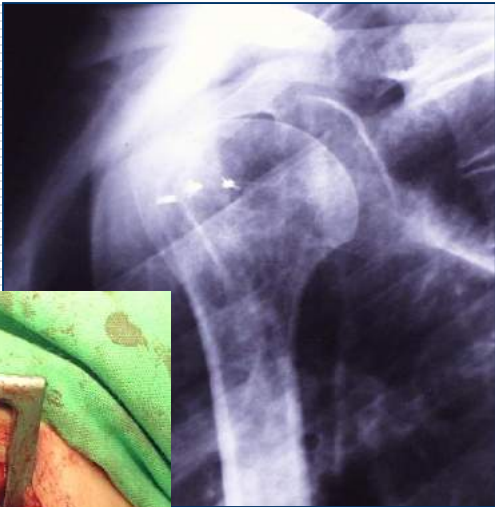
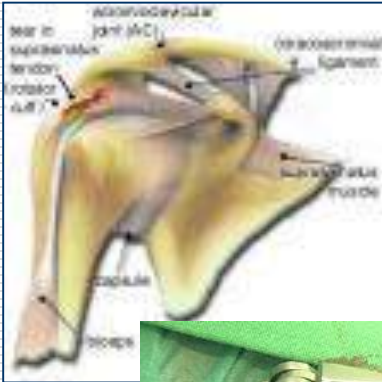


## □ Lower extremity

- Achilles
  - Tibialis anterior
  - Ligamentum patellae
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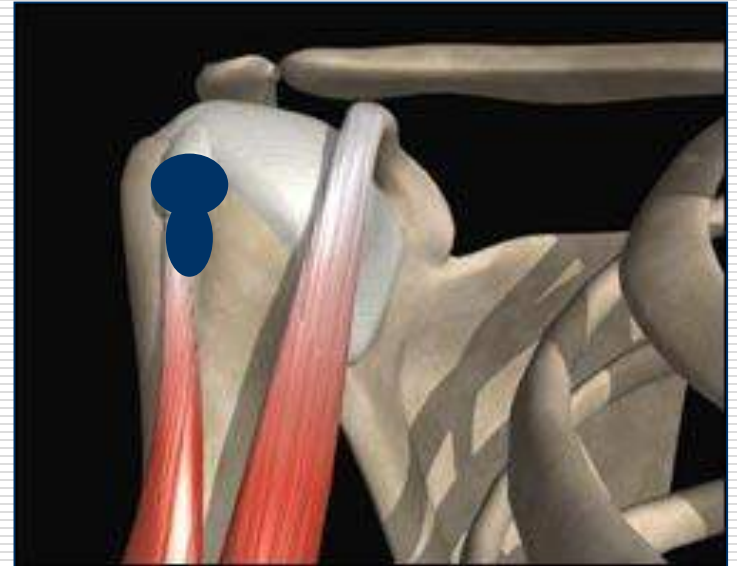
# Treatment of rotator cuff tear: reinsertion with bone anchor

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# Tear of Biceps long head: keyhole tenodesis

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# Distal biceps tendons tear, reinsertion with anchor

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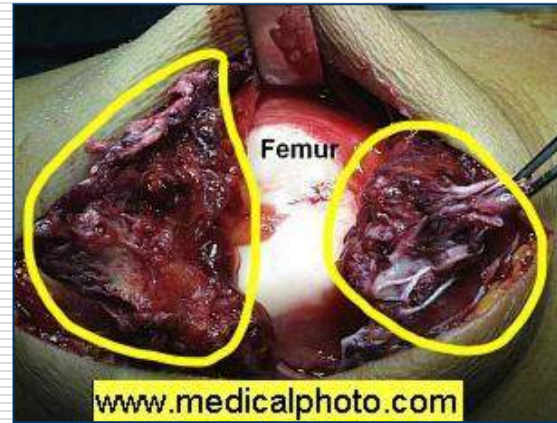
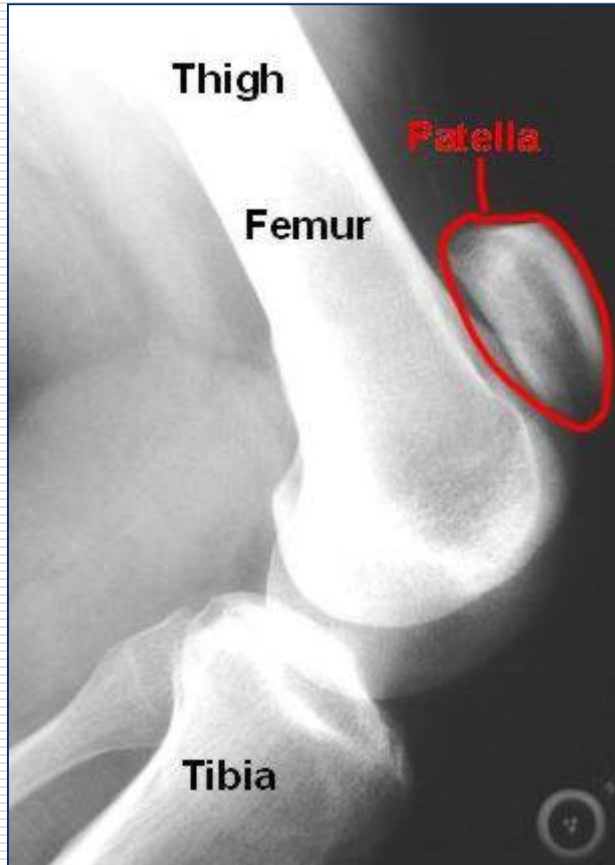
# Tear of the long fingers extensor tendon

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# Tear of patellar ligament

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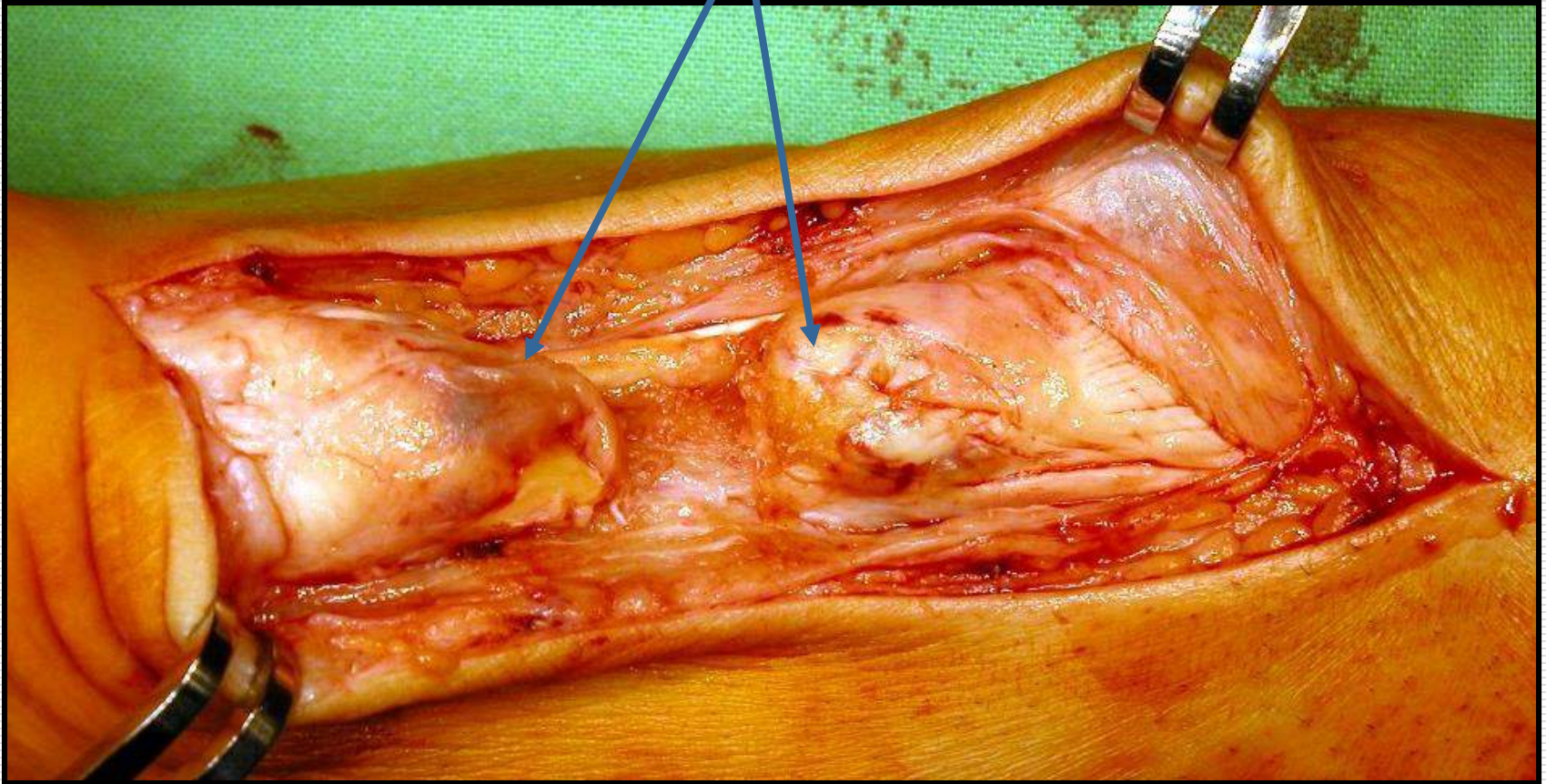
# Tear of Achilles tendon

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# Neglected tear of Achilles tendon

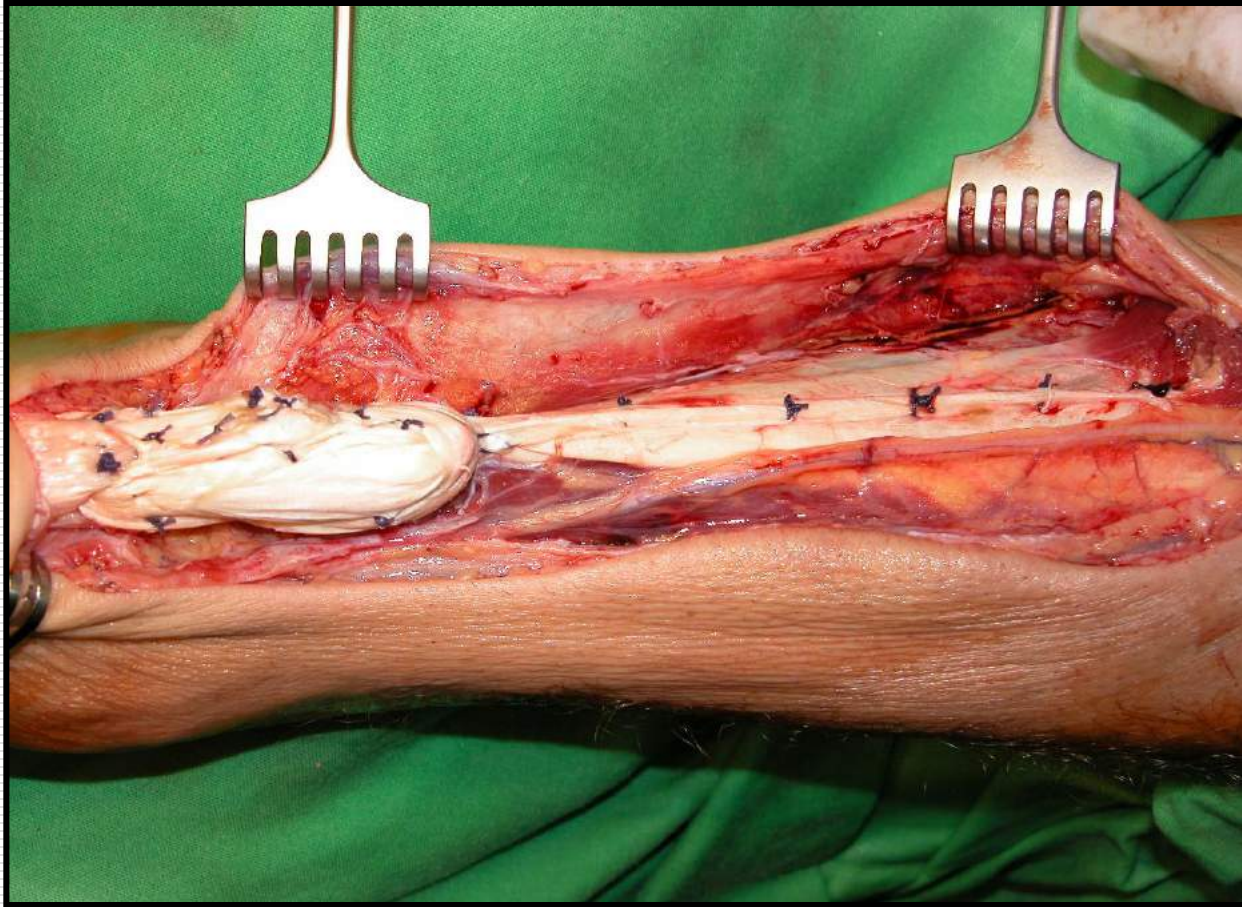
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# Treatment with folded back flap

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# Closed paratenon

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# Injuries of the joints

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# Contusion

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- Def.: Direct force, soft tissues are affected, no deformity
  - Dg.:
    - Physical examination: pain, swelling, hematoma, lost of function
    - US, X-ray, CT, MR
  - Th.:
    - conservative
-

# Sprain - distorsion

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- Def.: Indirect force, the bones are shifted for a moment, they return to its original position.
    - No tear of ligaments or joint capsule
  - Dg.:
    - Physical examination: pain, swelling, hematoma, lost of function, hemarthrosis
    - US, X-ray, CT, MR
  - Th.:
    - conservative
-

# Ligament injuries

( bone-ligament-bone )

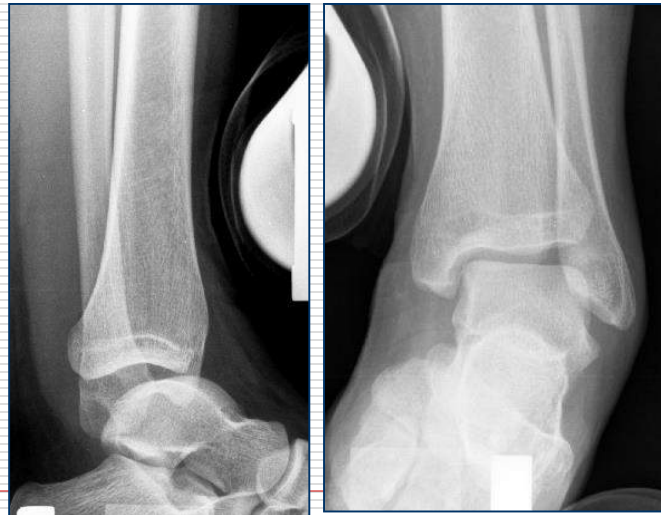
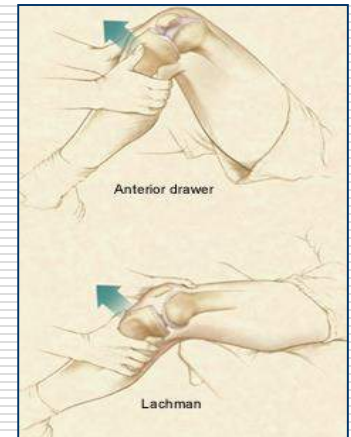
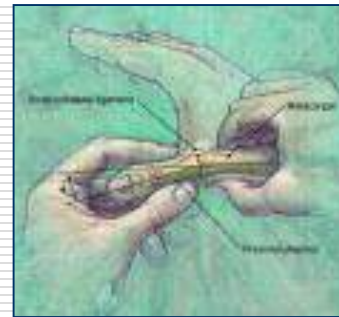
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- Contusion
  - Strain
  - Tear
    - Fast force
    - overstretch!
    - partial
    - complete
  - Bony abruption
    - Slow force
    - No overstretching
-

# Diagnosics of ligament injuries

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- ❑ Phys. examination
- ❑ Abnormal movement
- ❑ Stress X-ray
- ❑ US
- ❑ MR



# Therapy of ligament injuries

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- Conservative
  - Functional
    - Contusion
    - Strain
  - Immobilization
    - Partial tear
    - Complete tear
      - Without instability
- Surgical: suture, reinsertion, replacement
  - Complete tear
    - With instability





# Common ligament ruptures

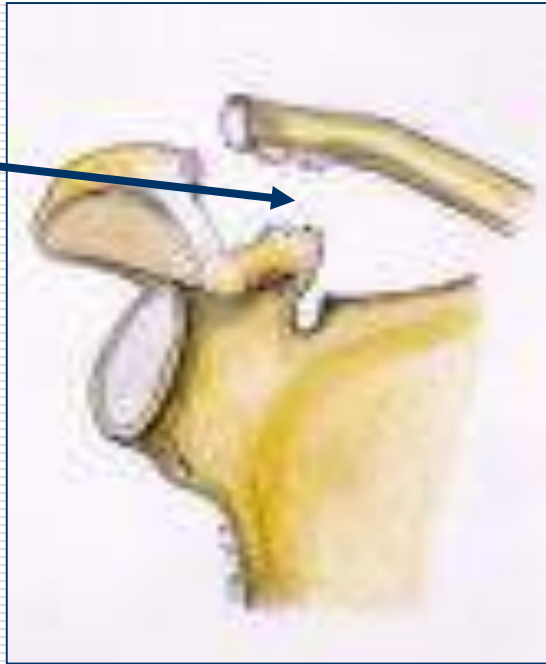
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- Upper extremity
    - Acromioclavicular
    - Bankart lesion
    - I.MP ulnar collateral
    - Elbow ulnar collateral
    - Elbow radial collateral
  - Lower extremity
    - Talofibularis anterior-posterior
    - Calcaneofibular
    - Knee
      - Medial collateral
      - Lateral collateral
      - Anterior crutiate
      - Posterior crutiate
-

# Acromioclavicularis dislocation

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Lig.coraco-  
claviculare



**Tossy I-II:**

**Conservative th:**

**Gilchrist  
bandage**

**Tossy III**

**Operative th:  
cerclage, pin**

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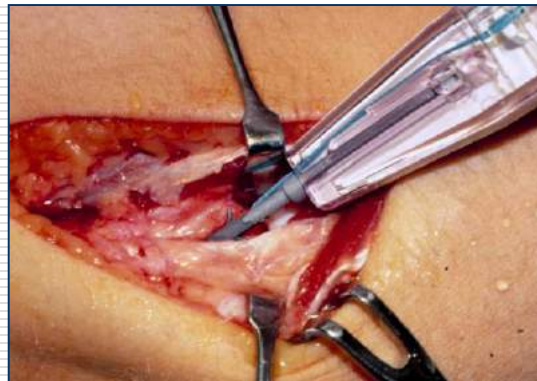
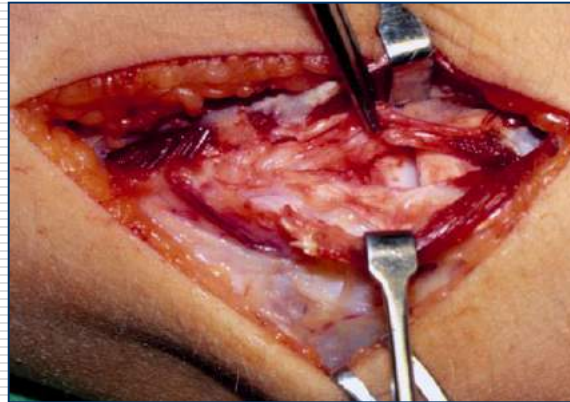
# Acromioclavicular lesion

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# Radial instability of the elbow, collateral ligament reinsertion with anchor

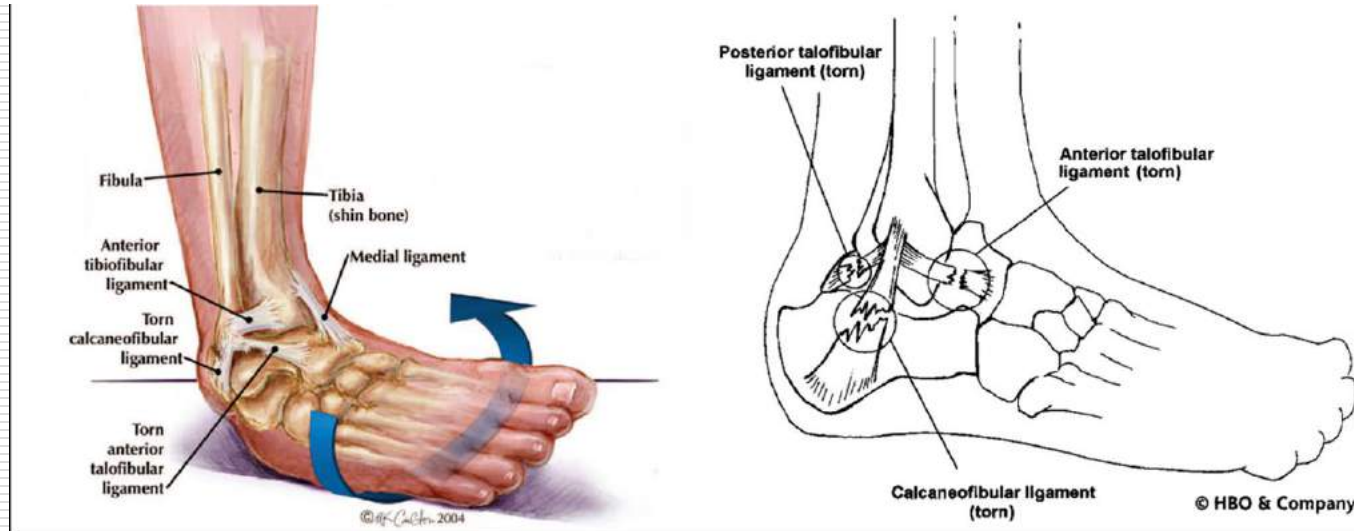
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# Rupture of the lateral malleolar ligaments

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**Treatment: 1 week plaster cast + 5 weeks brace (Aircast)**

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# Stress X-ray of the ankle joint

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# Injuries of the knee

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The knee is the most common injured joint

Motions:

flexion-extension  
rotation

Stability:

ligaments, joint capsule,  
meniscus, muscles





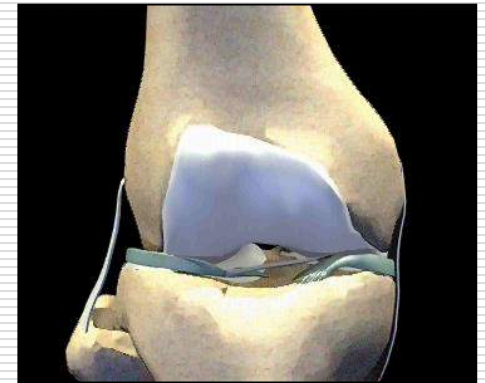
# Medialis collateral (MCL):

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medialis femur condyle – medialis tibia condyle

Function:

valgus stress stabilisation



# lateral collateral ligament tear of the knee

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# Cruciate ligaments

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## Anterior(ACL):

- \*posterolat. femur – anteromed. tibia

- \*tight in extension

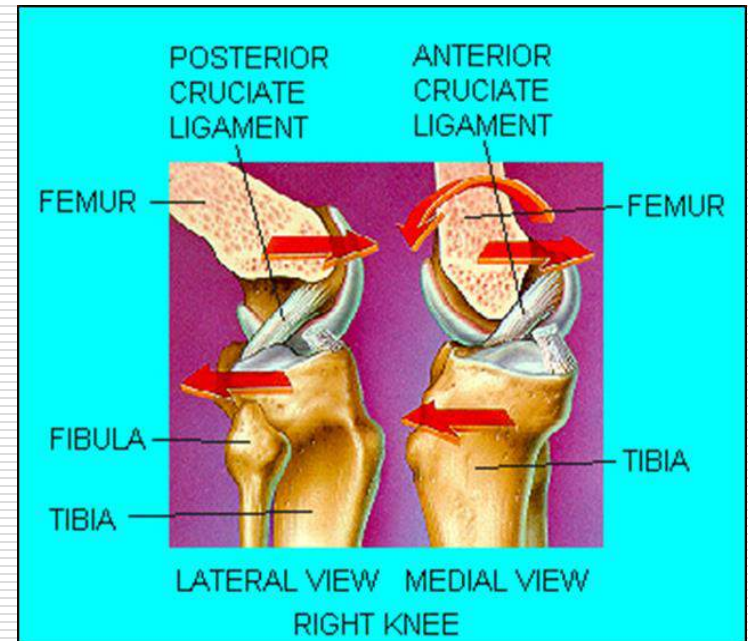
## Posterior (PCL):

- \*primary stabilization

- \*stronger than ACL!

- \*anteromed. Femur – posterolat. Tibia

- \*tight in flexion



# Stability tests I.

## Valgus test:

In extension and 30 degree flexion  
+: medial laxity

ACL, MCL, posteromedial capsule  
injuries



## Varus test:

In extension and 30 degree flexion  
+: lateral laxity

ACL, LCL, posterolateral capsule  
injuries



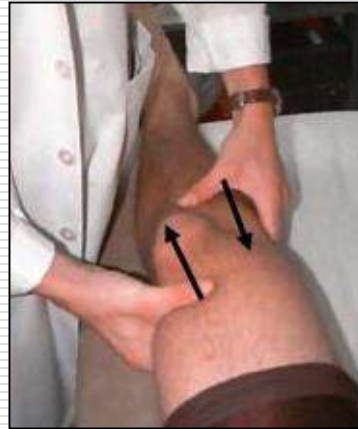
# Stability tests II.

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Lachman test:

20-30 degree flexion  
+: anterior translation  
of the tibia

ACL rupture



Anterior – posterior drawer test:

90 degree flexion

The hamstring tendons have to be  
loose!

+: anterior or posterior translation  
of the tibia

ACL - PCL rupture





# ACL sérülés

Mechanism of injury:

Rotation

Inner rotation of the tibia valgus stress of the knee

Hyperextension

Direct trauma, landing

Symptoms:

Cracking

Haemarthros

Instability

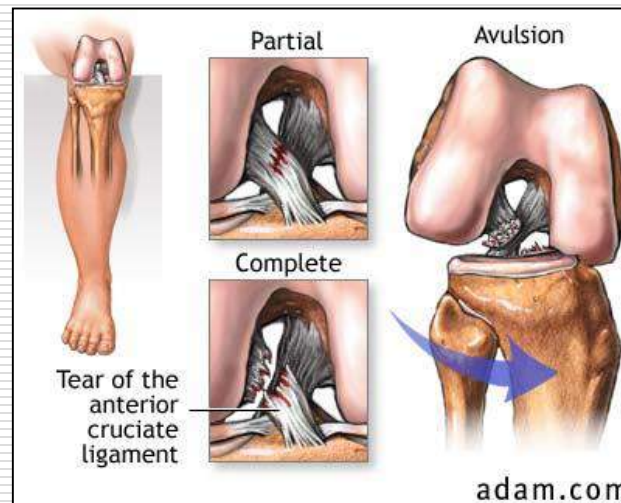
+ Lachmann and anterior drawer test

Dg:

Physical exam.

Ultrasonography

MR



# ACL rupture: surgical therapy

first operation: 1917

USA: 200 000 / év

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## Indikáció:

Fiatal sérült  
Magas fizikai aktivitás  
Instabilitás  
Társsérülés

## Kezelés:

Varrat + augmentatio  
Reinsertio  
Graft



Autograft: Patella ín (BTB), Hamstring (Semit.+Gracilis),  
Quadriceps ín

Allograft: BTB, Achilles, Hamstring, ACL, IT köteg

Xenograft: szarvasmarha

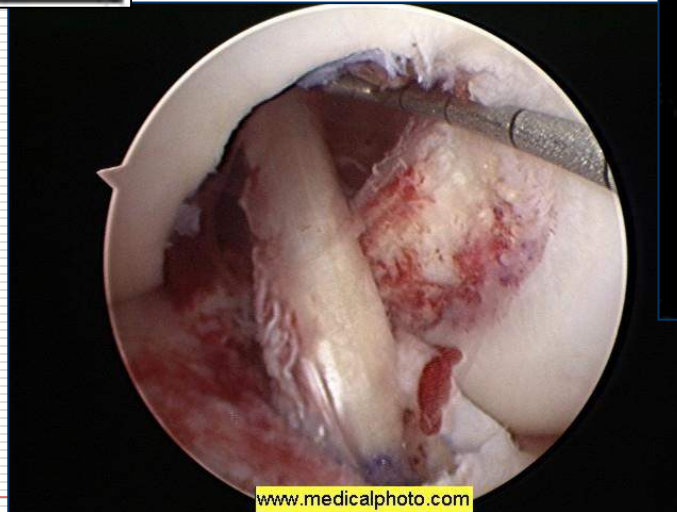
Szintetikus graft

Tissue engineering graft: jövő

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# ACL replacement with BTB graft

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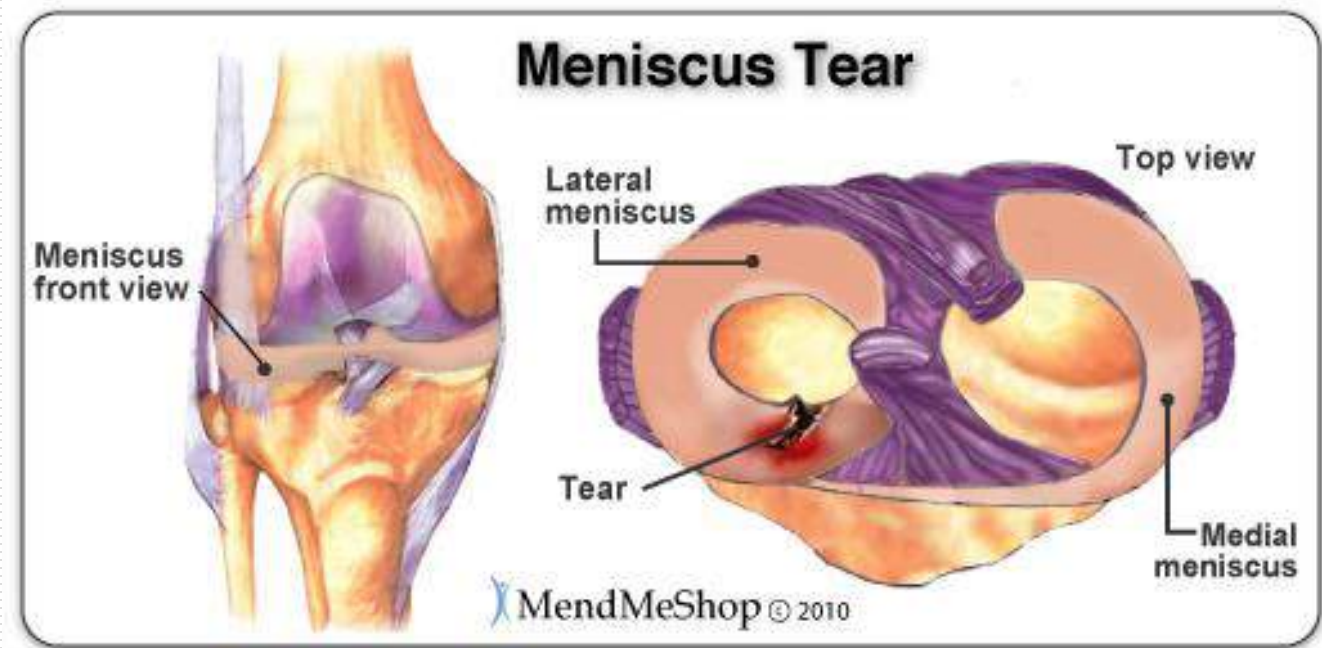
# PCL tear of the knee

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# Meniscus

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# Meniscus tear:

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Mechanism:

rotation of the femur on fixed tibia

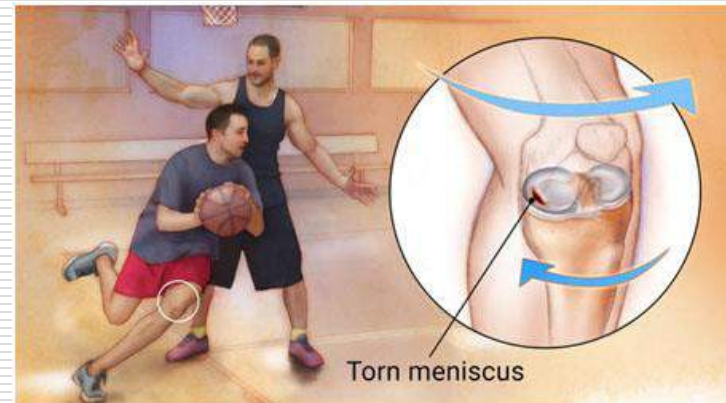
Symptoms:

pain

hydrops

haemarthros (red zone)

locked knee



# Diagnosics of meniscus tear I:

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Physical exam.

Steimann test:

flexed knee,  
tibia rotation

Böhler test:

extended knee  
tibia ab- and adduction

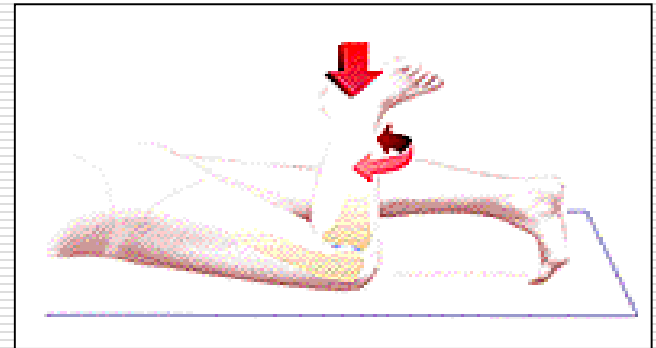
Appley test:

prone position  
90 degree flexed knee  
compression and rotation of  
the tibia

McMurray test:

supine position  
90 degree flexion of the hip  
and knee  
rotation of the tibia

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# DiagnosticsII:

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Ultrasonography  
MR



Arthroscopy



# Types of meniscus tears:

Vertical



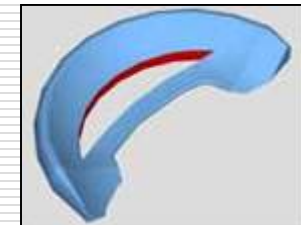
Radial

Complete

Incomplete



Bucket handle



# Types of meniscus tears:

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Medial posterior part



Lateral posterior part  
incomplete



Lateral posterior  
complete



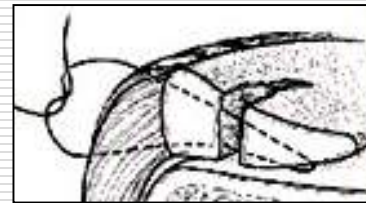
# Therapy of meniscus tears:

~~Arthrotomy~~

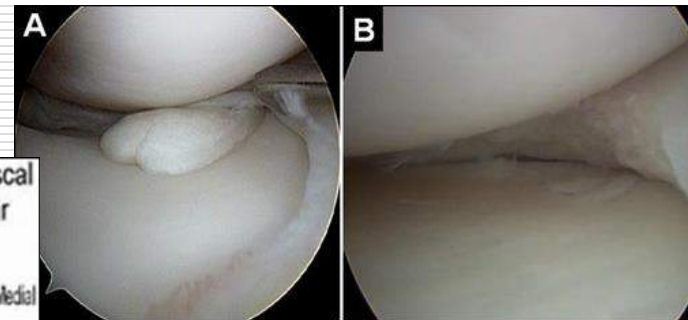
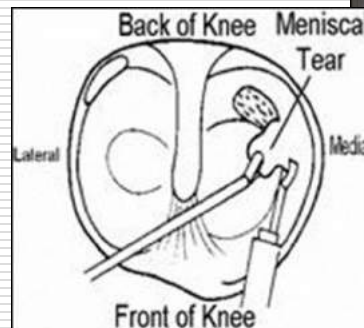
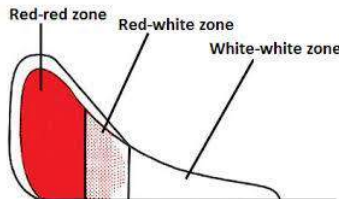
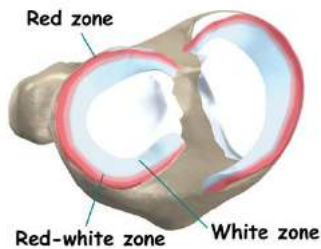
Arthroscopia

Suture

Resection



partial  
complete





# Dislocation - luxation

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- Def.: the bones are shifted permanently and fixed in a new abnormal position.
    - Tear of the ligaments and capsules
  - Dg.:
    - Physical examination: pain, loss of function, abnormal position, deformity, **elastic rigidity**
    - US, X-ray, CT, MR
  - Th.: reposition
    - Conservative
    - Surgical: open, irreparable
-

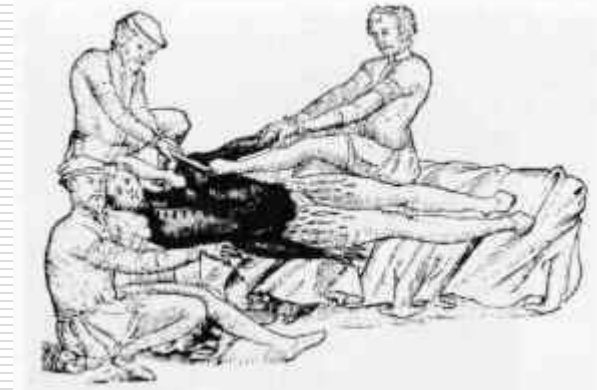
# Dislocation of the shoulder

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# Reposition of the shoulder

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# Dislocation of the elbow

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# Dislocations of the knee:

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□ posterior



□ anterior



□ torsional



# Open dislocation of the talocrural joint with fracture: fix.ex. + plate

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# Thank you for your attention

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