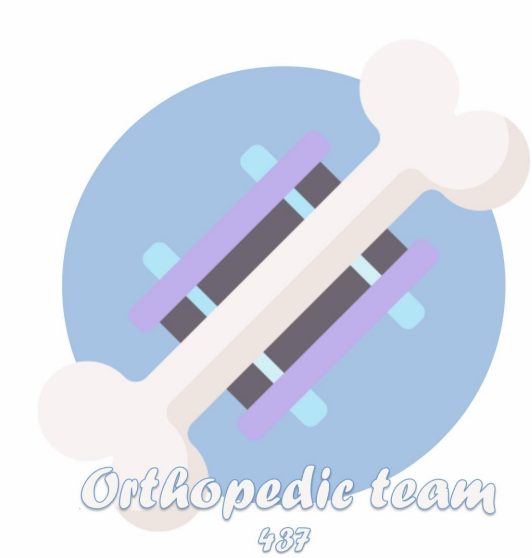
SPORTS & SOFT TISSUE INJURIES



Lecture objectives:

1. Specify the symptoms, signs and potential immediate complications of common sport and soft tissues injuries involving muscles, tendons, and ligaments for commonly injured joints; like shoulder, knee, and ankle.
2. Outline the assessment and appropriate investigation and immediate and long-term management of patients with muscles, tendons, ligaments and meniscal injuries.
3. Demonstrate knowledge of non-operative and operative measurements and to know the most common non-operative and operative used for sport/soft tissue injuries and their indications.

Done by: Tareq AlAlwan, Yazeed AlDossare, Khalid AlMutairi, Renad AlMogren
Team Leader: Tareq AlAlwan, Elham Alami
Revised by: Sondos AlHawamdeh
References: Doctor's slides + Team 436 + Toronto notes

INTRODUCTION

Soft Tissues Injuries Include

- **Muscle**
  - Muscle Strain
  - Muscle Contusion
  - Muscle Laceration
  - Delayed Onset Soreness
- **Tendon**
  - Overused tendinopathies
  - Tendon Rapture
- **Knee**
  - Ligament
    - AC
    - PC
    - MC
    - LC
  - Dislocation
  - Meniscus
- **Shoulder**
  - Will be in separate lecture
- **Ankle**
  - Ankle sprain

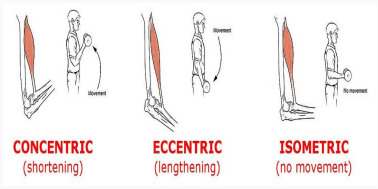
★ Initial Management: of any soft tissue injury

R	I	C	E
Rest	**Ice**	**Compression**	**Elevation**
It can help in detecting the real side of injury, controlling the damage prevent further damage. 	It can help in pain and swelling relief and prevent further damage. It's golden period is: first 72 hours, after that it's useless 	It can help in swelling relief, controlling the damage and prevent further damage. 	Have to be above heart level 

MUSCLE INJURIES

- The muscles most at risk are those in which the origin and the insertion **cross two joints**. For Example: Quadriceps and Hamstrings muscles are usually injured because they cross two joints: Hip and knee.
- Frequently injured muscles act in an eccentric fashion (i.e., lengthening as they contract). What happens in this type of situation is that the athlete, for example, tries to suddenly contract the quadriceps, which functions as a knee extensor, while the knee is flexed leading to quadriceps stretching which causes it to get injured. Or hamstring contraction while the knee is extending.

EXTRA



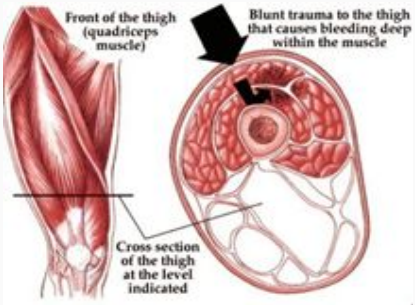
❖ Four types of muscle injuries:

1- Muscle Strain: شد عضلي/تمزق عضلي if it's in the ligament we call it sprain.

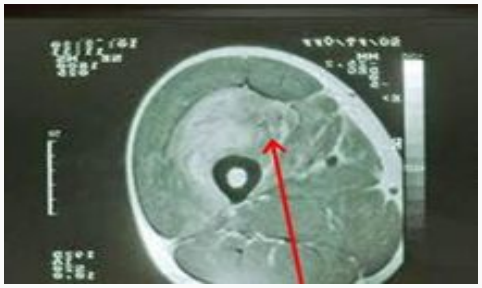
- The most **common** muscle injury suffered in sports.
- How it's happened? overuse, or improper use of a muscle result in → muscle overstretched (muscle strain) → could lead to muscle tear.
- Immediate pain associated with diminished function
- Both complete and incomplete muscle tears can occur by passive stretch of an activated muscle.
- Muscle tears also typically occur at or near to the myotendinous junction (the connection between muscle and tendon).
- Treatment:
  - RICE
  - NSAID
  - early Physical therapy

2- Muscle Contusion: كدمة عضلية

- Caused by a non-penetrating blunt injury (direct blow) to the muscle resulting in hematoma and inflammation.
- Quadriceps and Brachialis muscles are **common involved regions.**
- Clinical features:
  - Pain with active and passive motion +/- swelling.
  - Decreased range of motion of joints spanned by the injured muscles. For example, if the quadriceps is affected, the passive knee flexion will be painful.
  - Occasionally a permanent palpable mass.
- **Treatment:**
  - **Short** period of immobilization, compression, ice, elevation
  - Followed by **early** mobilization and Physiotherapy
  - NSAID



There is inflammation and bleeding inside the muscle



This is MRI, an axial cut at the level of the thigh shows contusion, the white area (arrow) is hematoma.

3- Muscle Laceration: تمزق العضلات

- Muscle cut by sharp object.
- Treatment: I&D (irrigation & debridement) followed by suture repair of the fascia, if possible.

4- Delayed Onset Soreness: الآلام العضلية الآجلة/ ألم العضلات المتأخر

- Structural muscle injury leads to progressive edema formation and resultant increased intramuscular pressure.
- Is primarily associated with eccentric loading type exercise. e.g. going downhill/uphill or using the stairs. تسوي نشاط فوق المجهود المعتاد
- Clinical features: muscular pain that occurs 1-3 days after vigorous exercise.
- Treatment:
  - It's self-limited and **will resolve in a few days** so there is no need to do anything
  - NSAID

★ Complications of muscle injuries:

1) **Scar formation and muscle weakness:** mainly due to laceration. How the scar formed inside the muscle? The space between ruptured muscle fibers fills with blood which clots and gradually converted into connective tissue, which converted into scar tissue. This leaves the muscle with areas of varying elasticity. In some cases, this scar tissue may need surgical excision. Scars will lead to muscle weakness
2) **Compartment syndrome:** Mainly due to contusion
   - At the level of the muscle fibers, capillary bleeding and edema can lead to hematoma formation and can cause compartment syndrome in areas in which the volume is limited by the fascial envelope.
   - Patients with Bleeding disorders is at high risk
   -

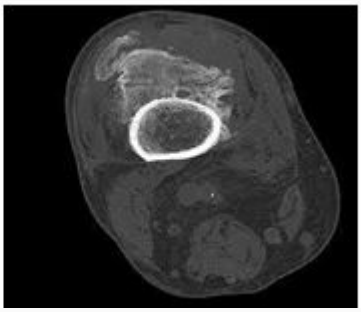
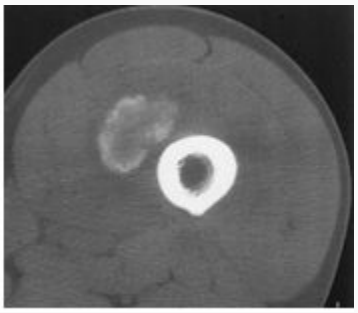
Let's revise the pathophysiology of compartment syndrome: Swelling, injury, hematoma → Increased interstitial compartment pressure obstruction of capillary perfusion → Direct transfer of oxygenated blood from arterial to venous system without oxygenation of the tissues→ Ischemia and necrosis of the compartment structures. In general, all the types of compartment syndrome:

- Acute (fracture or soft tissue injury) medical emergency
- Chronic (activity related) reversible once the exercise stop

3) **Myositis Ossificans:** AKA heterotopic calcification

- **What is it?** Bone formation (calcification) within muscle secondary to blunt trauma. It's bone formation outside the bone, if it's formed in the muscle we call it myositis ossificans.
- Clinical features:
  - Early:
    - Pain, swelling and decreased ROM
    - Erythema, warmth, induration, tenderness
  - Late: painless swelling with decreased ROM. The most common presentation, they forget the trauma or injury and come to you with swelling so good history is very important.
- This sometimes mimics osteogenic sarcoma on radiographs and biopsy. You should take a good history because it can be mixed up with with osteogenic sarcoma, which is the biggest problem here. How to differentiate between them? history of trauma.
- Increased ESR and serum alkaline phosphatase
- Myositis ossificans becomes apparent approximately 2 to 4 weeks' post-injury.
- **Treatment:** if you sure it's a myositis ossificans the treatment will be conservative unless there is a significant ossification and causing significant functional limitation of the involved muscle.



This is X-Ray of myositis ossificans. When you see this picture you might think it's a tumor, so if you get confused or you're not sure, you need to do biopsy.

OVERUSE TENDON INJURIES

إصابات الأوتار الإجهادية

- What are the functions of tendon? To transfer force from muscle to bone to produce joint motion.
- Type of injuries:
  - **Overused tendinopathies.** We don't call it tendonitis anymore because it's not a true inflammation, it's a degenerative process, so we call it tendinosis or tendinopathies.
  - **Tendon rupture**. It's a traumatic tear usually. It's very important to remember that overused tendinopathies are degenerative processes, there is no inflammation or tears while tendon rupture is a tear. Since tendinopathies are a degenerative process we can treat it conservatively but in rupture we have to repair the tear, so it's always surgical management in tendon rupture and there is no conservative treatment.

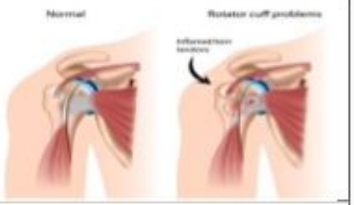
1- Overused Tendinopathies:

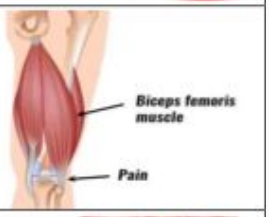
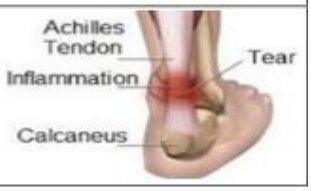
- **Osteotendinous junction** is the most common site of overuse tendon injury. Why? Tendons are relatively hypovascular proximal to the tendon insertion. This hypo-vascularity may predispose the tendon to hypoxic tendon degeneration and has been implicated in the etiology of tendinopathies.
- Tendinopathy NOT tendonitis.

Most common Diagnoses and Locations of Chronic Tendinopathies

This is an **important** table, the doctor said that we have to know the symptoms and **site** for each.

All the pictures and symptoms in this table are **extra**

Diagnosis	Symptoms	Location
Rotator cuff Tendinopathy إصابة الكفة المدورة	- Pain and swelling in the front of your shoulder. - Pain triggered by raising or lowering your arm. - A clicking sound when raising your arm. - Stiffness.	Supraspinatus tendon insertion 
Lateral epicondylosis (tennis elbow) Because of the overuse for arm extensor will lead to tear in tendon مرفق لاعب التنس أو التهاب لقيمة العضد الوحشية	- Tenderness on the outside of the elbow. - Morning stiffness of the elbow with persistent aching. - Soreness of the forearm muscles. - Elbow pain is worse when grasping or holding an object	Common wrist extensor tendon origin mainly involved extensor carpi radialis brevis (ECRB) 

Medial epicondylosis (golfer's elbow) مرفق لاعب الغولف أو التهاب اللقيمة الأنسية للعضد	- Pain when flexing the wrist toward the forearm. - Pain that extends from the inside of the elbow through the wrist to the pinky. - A weak grip. - Pain when shaking hands.	Common wrist flexor tendon origin	
Hamstring Tendinopathy التهاب في العضلة المأبضية/ عضلة الفخذ الخلفية	- Pain in or close to the knee joint that radiates up the thigh and possibly into the hip or pelvis & gets worse with activity, especially repetitive motions. - Swelling in or around the knee or thigh.	Hamstring tendon origin	
Quadriceps Tendinopathy التهاب في عضلة الفخذ رباعية الرؤوس	- Swelling around the quad tendon. - Sensitivity to touch. - Warmth or burning pain in the affected area. - Stiffness in the knee in the early morning	Quadriceps tendon insertion	
Patellar Tendinopathy (jumper's knee) التهاب الوتر الرضفي/وتر الصابونة	- Pain around your patellar tendon. - Swelling. - Pain with jumping, running, or walking, bending or straightening your leg. - Tenderness behind the lower part of your kneecap.	Patellar tendon origin	
De Quervain's disease متلازمة دي كورفان	- Pain & swelling near the base of your thumb. - Difficulty moving your thumb and wrist when you're doing something that involves grasping or pinching. - A "sticking" sensation in your thumb when moving it	Sheath/pulley of abductor pollicis longus	
Achilles Tendinopathy وتر العرقوب	- Increasing pain, usually at the back of your leg or heel. - Stiffness in the tendon. - Swelling & tenderness at the back of your ankle. - Crepitus when you move your ankle.	Sheath, midsubstance, or calcaneal insertion	

★ Treatment:

- **Goal**: reduce pain and return function.
- Mainly is **conservative** Rx:
- Rest
- Ice (Cryotherapy)
- Physiotherapy (stretching and eccentric strengthening)
- Analgesics
- Corticosteroids injection don't give it on the tendon, you should inject around it because it can cause weakness and rupture of the tendon except tennis elbow
- Orthotics and braces
- Other modalities: U/S, ESWT (extracorporeal shockwave therapy), iontophoresis, phonophoresis
- Surgical treatment: very rarely
    - Failed conservative treatment (at least 3-6 months)
    - Excision of abnormal tendon tissue and performance of longitudinal tenotomies to release areas of scarring and fibrosis.

2- Tendon Rupture:

- Knee extensor mechanism: Quadriceps tendon, and Patellar tendon
- Achilles tendon (more common than patellar tendon)
- Partial vs complete

تمزق وتر الرضفة/ وتر العضلة الرباعية Patellar/Quadriceps tendon rupture

Predisposing factors	**Steroid,** Chronic disease, Tendinopathy
Age	- Patellar **< 40 usually in young** - Quadriceps **> 40** That's why if you examined randomly people with patellar pain you'll find: + 40: pain above patella - 40: pain below patella
Location	At the tendon attachment to the patella. Quadriceps tendon rupture  
Physical examination	- Tenderness at the site of the injury, hematoma, and a palpable defect in the tendon. - Unable to extend the knee against resistance or to perform a straight-leg raise. How to differentiate between them clinically? The most significnt sign is extension lack. Patient is unable to do **active** extension and if you can do it passively it's full passive.
X-ray	How to differentiate between them in x-ray? - Patella-alta > Patellar tendon rupture - Patella-infera > Quadriceps tendon rupture You don't need MRI for diagnosis, but u may use it to exclude other injuries or to determine how will u reconstruct in the surgical treatment. Notice here the patella is above its normal position which indicate patellar tendon rupture patella-alta. while in patella baja it will be lower than its normal place. 
Treatment	Usually Surgical (always) as we said before in rapture the management is surgical only. 

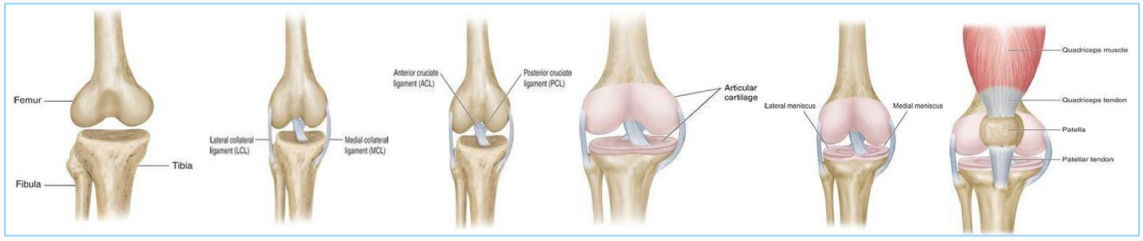
Common scenario: 20 y boy came to ER with inability to rise his right lower limb *knee extension*. **What is your DDx?** knee ligament tear, fracture of patella, quadriceps or patellar tendon rupture, femoral nerve injury or psychology

تمزق وتر العرقوب/أخيل Achilles Tendon Rupture

Occurrence	Most ruptures (75%) occur during sporting activities. common
History	- The patient reports a "pop" or the sensation of being kicked in the heel during the injury. ليش البيشنت يحسون او حتى يسمعون بوب لما يتقطع التندن؟ لأن الاكيليس تندون من اقوى التندنز الي بالجسم قوي جدا فيتطلب طاقه قويه جدا جدا عشان تقطعه فلما يتقطع الطاقة المتجمعة هناك بتطلع فجأة فنسمع الصوت The stored energy will be released suddenly, creating what the patient perceives as a pop. - Weakness and difficulty walking.
Physical examination	Increased resting dorsiflexion with the knees flexed, a palpable gap, weak plantar flexion, and an abnormal Thompson test (**lack of plantar flexion when squeezing the calf**).  في هذه الصورة الخلل يمين المريض Negative test positive test
Diagnosis	Diagnosis is clinical, but MRI or ultrasound can confirm.
Treatment	Usually surgical. (always) as we said before in rapture the management is surgical only, if we treat it conservatively there will be permanent weakness

KNEE INJURIES

Knee Anatomy: extra pics, but the doctor said that we have to know the anatomy. Check the pics from L -> R

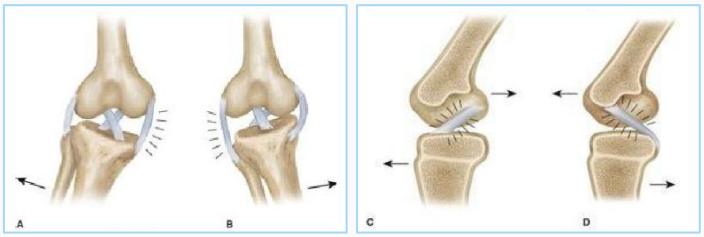


- Joint stability: bone stability + soft tissue
- Dynamic stabilizer: Tendons/Muscles
- Static stabilizer: Ligaments ± meniscus

} Complex synergy leading to a FUNCTIONAL and STABLE joint

Dr.: Anatomy related to basic science SHOULD be read by the students!

The functions of the knee ligaments: extra pics



A. The medial collateral ligament (MCL) prevents valgus deformities.
B. The lateral collateral ligament prevents varus deformities.
C. The anterior cruciate ligament prevents anterior tibial translation over the femur.
D. The posterior cruciate ligament prevents posterior tibial translation over the femur.

★ Types of Knee injuries:

1. Ligaments injuries (ACL, MCL, LCL, PCL)
2. Knee Dislocation red flag
3. Menisci

1. Ligaments injuries:

The role of the knee cruciate and collateral ligaments is to stabilize the joint. These structures connect the bones in a way that allows normal motion (flexion and extension) but resists the forces that create abnormal motion (hyperextension; varus/valgus; anteroposterior translation and rotation).

Common signs & symptoms:

- Some patients will offer that they felt, or even heard, a "pop" when the ligament was injured. Knee ligaments are very strong structures. They can store a tremendous amount of energy before failing. If the load is big enough to fail the ligament, then the ligament will rupture, and that stored energy is released suddenly, creating what the patient perceives as a pop.
- Many patients present a long time after injury with symptoms of instability. In these patients, the pain and swelling from the initial injury have resolved, but, because the ligament did not heal, they are prone to intermittent episodes of instability.
- Ligaments are more vascular than meniscal tissue, and patients with ligament injuries tend to develop effusions within an hour of their injury. In patients with meniscus tears, effusions usually develop much more slowly.

ACL injury إصابة الرباط الصليبي الأمامي	
Mechanism of injury	• Noncontact بدون إلتحام (about 70% of ACL): Cutting or Pivoting sport such as basketball, football, Soccer. بالرياضات اللي تتطلب تغيير الاتجاه بشكل سريع إذا مثلاً اللاعب أصيب بـ non-contact يقول غيروني لأنه يفقد الـ proprioception، فوقتها راح يبدا يحس بدوخة و يصير ما يقدر يمشي. لكن بعد نص ساعه يبدا جسمه يطور طريقة ثانية للإحساس فيقول رجعوني العب. صح راح يكون يعرج لكن يقدر يمشي وأفضل من بعد الإصابة مباشرةً لأن وقتها ما كان يقدر يمشي بتاتاً. عشان كذا بعد ما نسوي له repair نحطه على splint لمدة ست أسابيع على ما يصير لها revascularization و بعدها عاد يبدا يرجع الـ proprioception شوي شوي. • Contact = think about associated medial collateral ligaments (MCL) injury • Sports-Related (80%) o 70% of patient will hear a "POP" sound. Very loud! o Female: 2-4x > Male. if both female and male are active, but in Saudi Arabia it is less than in males. Why it's more common in females abroad? Because: 1. Outside, women play more sports more than men, while here men are 4 times more. 2. Their notch (the place where the ACL & PCL cross -between the 2 condyles) is narrower than the males, so any over activities makes the ACL more prone to injury. 3. The pre period hormones change so they develop laxity. 4. The way they have it: they always jump with valgus so there is stress on ACL.
Symptoms	In acute phase the patient will present with pain, swelling, instability but in chronic phase only instability and it's usually not because of ACL injury! but because of associated injuries like meniscus tear. o Instability "giving way episodes" ركبتي "تخوني" أو مو ثابته o Swelling (Hemarthrosis) is noted within a 1-2 days of the injury. And a "pop" sound. o Pain if associated with meniscus tear. After acute injury we will have pain because of meniscus injury, or bone contusion so the tibia will sublux interiorly. In case of femur it subluxed in the middle.
Physical examination:	o The patient needs to be relaxed and comfortable. o Must be compared with those of the normal knee. o A moderate to severe effusion is usually present in the acute cases. o **ROM:** in acute injury the range of motion may limited by: Pain, Effusion, Hamstring spasm, ACL stump impingement قطع الرباط الممزق تتكدس بالمفصل وتعيق حركته, or Meniscal pathology. o **Special tests:** - Lachman's test. The most sensitive test. - Anterior Drawer test (ADT). - Pivot shift test: is pathognomonic for ACL injury (best in the chronic setting). You don't need to know how to perform this test
Investigation	History and examination are usually enough and diagnostic but sometimes we need to some investigations to check if we suspecting something but not to diagnose. o X ray, We do x-ray if we suspecting a fracture otherwise the x-ray will be normal. o MRI, MRI is the most important if we are not sure from the history or examination or if we want to double check because it will show me is the rapture complete or partial and if there is any other injury o In the skeletally mature patient, the femoral insertion or midsubstance is usually the site of disruption. o In the skeletally immature patient, the tibial attachment may be avulsed with or without a piece of bone.

Investigation

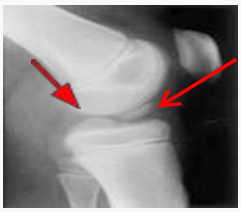
X-ray — ACL can't be seen on X-Ray, but some findings can suggest ACL injury.

Segond fracture

Pathognomonic for ACL injury. There is avulsion of anterolateral capsule attachment & its sign of ACL

Tibial spine avulsion

Here we see growth plate still opens = immature skeleton so this is a pediatric pt.. In pediatric the ligament is stronger than adult so there will be avulsion without piece of bone usually.

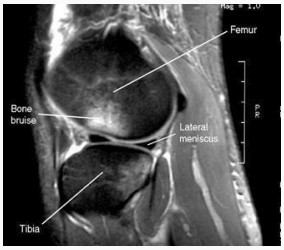


MRI

NORMAL ACL

Torn ACL

Bone Bruise



Injuries Associated With ACL Disruption:

o Injuries of the **ACL rarely occur in isolation.** The effects of other injuries, including:

- Other ligament sprains (MCL). Contact injury = MCL
- Meniscal tears = pain (40% -30%)
- Articular cartilage injuries chondral injuries
- Bone bruises causes pain and "pop" sound, there is subluxation of tibia over femur esp. on the lateral aspect leading to impingement of the posterolateral part of the tibia against the middle part of the lateral femoral condyle.

o Complicate the treatment and eventual outcomes of ACL disruptions.

Treatment

WHEN ACL IS TORN IT DOES NOT HEAL! why not repair? the difference is in repair we repair the same ligament while in reconstruction we change it to new one, so we do reconstruction because the studied shows that the healing in repair is very poor.

Summary of the treatment:

★ **Surgical (ACL reconstruction)** عملية استبناء/بناء الرباط أو وضع بديل له:

1. **Young, athletic and active patient.**
2. **Middle age not having arthritis:**
   - If there is instability during daily activity.
   - If there is **NO** instability and the patient is active and want to play sports.

★ **Conservative:**

1. **Middle age not having arthritis:**
   - If there is **NO** instability and the patient will not play sports.
2. **Old or osteoarthritis patient.**

To come to the point, patient who are old or not willing to participate in any kind of sports, or asymptomatic or no instability, treat them conservatively; this is only exception.

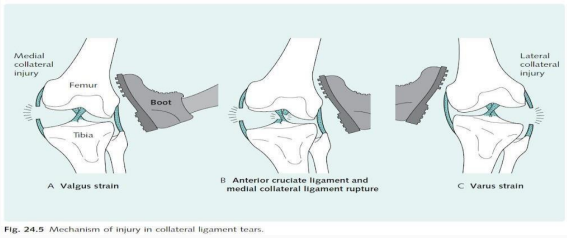
Treatment	**Nonsurgical treatment:** • Appropriate for asymptomatic patients with partial injuries to the ACL. • Patients who are older or less physically active may elect to modify their activities and proceed with nonsurgical treatment. • Nonsurgical treatment involves rehabilitation to strengthen hamstrings and quadriceps, as well as proprioceptive training. • Activity modification is also an important part of nonsurgical management, as patients who avoid cutting and pivoting sports are at lower risk for knee instability. • ACL sports braces have not been shown to prevent abnormal anterior tibial translation. **Surgical treatment:** In summary: Surgery needed if unstable during activities or someone who use his legs for living even if he didn't reach instability stage. • Athletes with ACL injuries rarely return to cutting and pivoting sports (e. basketball, football, soccer) without first undergoing surgery. • For individuals who wish to return to such sports, surgery is generally recommended to avoid instability and secondary meniscal and/or articular cartilage damage. • Individuals who work in occupations that may involve physical combat, such as police officers, or risk, such as firefighters, should have ACL reconstruction before returning to work. • Most patients can function well and perform activities of daily living (ADLs) without instability after a complete ACL injury. However, some have difficulty performing even simple ADLs because of ACL deficiency related instability, and they may require surgery. • Young patients.

PCL injury الرباط المتصالب الخلفي	
PCL function	The PCL is the primary restraint to posterior tibial translation in the intact knee
Mechanism of injury:	o A direct blow to the proximal aspect of the tibia is the most common cause of PCL injury. o Dashboard injury: اللي يركب قدام بالسيارة لما يصير في تسارع بعده فرملة تروح ركبته تضرب بدرج السيارة فتدخل داخل خصوصًا اللي جالس ٩٠ درجة فتقطع o In athletes: a fall onto the flexed knee with the foot in plantar flexion, which places a posterior force on the tibia and leads to rupture of the PCL. 
Complication:	○ PCL insufficiency significantly increased the risk of developing medial femoral condyle and patellar cartilage degeneration over time.
Treatment:	o **Non operative** they do healing without surgical intervention, it won't affect our performance. Mainly non-operative unless there is combined ligament injury. o **Surgical** if combined ligament injury, rarely because it's hard to get there, it doesn't cause frank instability, if it does, we do surgery. if the extensive physiotherapy doesn't succeed we do surgery

MCL injury إصابة الرباط الجانبي الأنسي

Anatomy	The main function of this complex is to resist valgus and external rotation loads.
Occurrence	The tibial MCL is the Most coMMonly injured ligament of the knee.
MOI	Usually result from **contact** injury like a direct blow to the lateral aspect of the knee.
Associated injuries	o Concomitant ligamentous injuries (95% are **ACL**) o Concurrent **meniscal injuries** have been noted in up to 5% of isolated medial ligamentous injuries
Physical examinations	o Valgus stress test should be performed with the knee at 0° and 30° of flexion: ➔ Laxity at 30°: isolated MCL ➔ Laxity at both 0° and 30°: concurrent injury to the posteromedial capsule and/or cruciate ligaments. o Rule out associated injuries (ACL and M. Meniscus) 
Investigation	o Is a **clinical** diagnosis and most of the time does not need further investigation. o If the injury is severe or suspecting associated injuries (e.g. significant knee effusion) then the **MRI** will be modality of choice. o **X Ray:** to rule out fracture (lateral tibia plateau fracture)
Treatment	**Conservative Rx:** - Is the **mainstay** of treatment for the isolated MCL injuries - Crutches, RICE, and anti-inflammatory/pain medication - No brace is usually required for partial tear - A knee brace is recommended for complete tear. **Surgical Rx:** Very rarely if failed conservative Rx + complete tear (Grade 3) + associated with other ligaments (Combined) injury. When I have ACL and MCL I will treat ACL surgical and MCL conservative.

LCL injury رباط الركبة الجانبي الخارجي

LCL Function	The LCL is the primary restraint to varus stress at 5° and 25° of knee flexion.
Occurrence	Less commonly injuries than MCL
Mechanism Of Injury	**Varus strain:** Injuries to the lateral ligament of the knee most frequently result from injury motor vehicle accidents and athletic injuries.  Fig. 24.5 Mechanism of injury in collateral ligament tears.
Treatment	• Isolated injury: **non operative** • Combined injury: **surgical**

2. Knee Dislocation ACUTE EMERGENCY!

- Multiligament knee injuries are usually caused by high-energy trauma and are often considered knee dislocations. A lot of cases come late to the ER after spontaneous reduction.

أقل حاجة عنده ثلاث لقمنت راحت: انتيريور، بوستيريور، وواحد من الكولاترلز. ليه؟ لأن بالدسلوكيشن يا انت رايح ميديال أو رايح لاترال

- Less frequently, low-energy trauma or ultra-low-velocity trauma in obese patients can also result in this injury pattern.

- A bicruciate (ACL+PCL) injury or a multiligament knee injury involving three or more ligaments should be considered a spontaneously reduced knee dislocation.

Important consideration Neurovascular status:

- A knee dislocation should be considered a limb-threatening injury, and careful monitoring of vascular status after the injury is imperative.

- Popliteal artery (estimated at 32%) or peroneal nerve injury (20% to 40%) also can occur. Look for pulse and perfusion sign: color, temperature, capillary refill time (exam question)

- Vascular examination is **critical** in an acutely dislocated knee:
    - Pulse and ankle-brachial index (ABI) should be carefully assessed. An ABI of less than 0.90, and most certainly less than 0.80, should be considered abnormal.
    - If there is any concern about an abnormal vascular examination, there should be a low threshold for ordering an angiogram.
    - If pulses are still abnormal or absent following reduction of the dislocation, immediate vascular surgery consultation with intraoperative exploration should be the next step in management.
    - A vascular injury in a knee dislocation is a limb-threatening injury and needs to be corrected within 6 to 8 hours the golden period. If not corrected, amputation may be required.

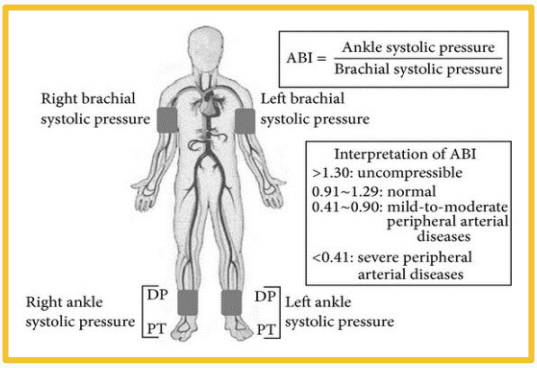
- Neurologic examination is also critical, as peroneal nerve injury can occur with multifilament injuries, particularly in concomitant lateral/posterolateral corner injuries.

★ Management:

NEED EMERGENT REDUCTION

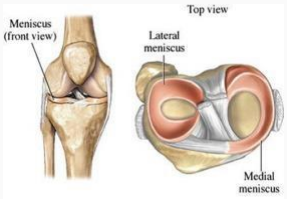
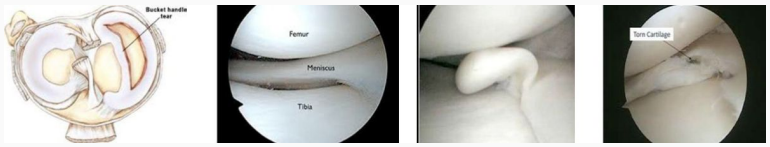
Emergent closed reduction and splinting or bracing should be performed immediately. Post reduction radiographs should be taken to confirm knee reduction. What are the steps of reduction in ER?

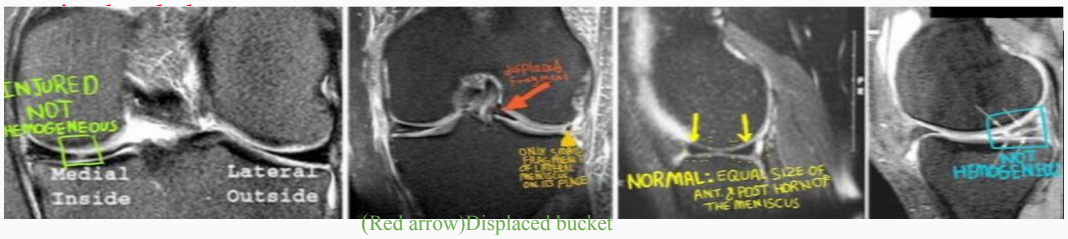
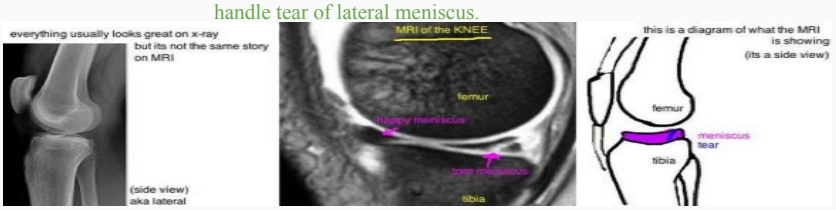
1. Analgesia
2. Reduce joint
3. Immobilization
4. Neurovascular assessment before reduction and after
5. Vascular ABI
6. X-ray
7. Call OR



Extra pic but important

3. Menisci Injuries:

Menisci Injuries تمزق الغضروف الهلالي	
Meniscus anatomy Dr.: Anatomy related to basic science SHOULD be read by the students!	o The menisci are crescent-shaped, with a triangular appearance on cross-section. o The lateral meniscus covers 84% of the condyle surface; it is 12 to 13 mm wide and 3 to 5 mm thick. o The medial meniscus is wider in diameter than the lateral meniscus; it covers 64% of the condyle surface and is 10 mm wide and 3 to 5 mm thick. 
Meniscus function	o The meniscus provides stability, absorbs shock, increases articular congruity, aids in lubrication, prevents synovial impingement, and limits extremes flexion/extension. o The **most important function** of the meniscus **is load-sharing** across the knee joint, which it accomplishes by increasing contact area and decreasing contact stress.
Epidemiology of meniscus injuries	o Meniscus injuries are among the most common injuries seen in orthopaedic practices. o Arthroscopic partial meniscectomy is one of the most common orthopaedic procedures.  Bucket handle tear Normal Mechanical block Torn (rupture) cartilage
Incidence	o Meniscal tears are unusual in patients younger than age 10 years. o Most meniscus tears in **adolescents** and young adults occur with a twisting injury or with a change in direction. In young patients, the meniscus is tough and durable, and it is hard for a person under the age of 25 to tear their meniscus without some element of knee trauma. Usually, this is a weight-bearing, twisting injury. o **Middle-aged** and **older** adults can sustain meniscus tears from **squatting** or falling. As we age, the meniscus cartilage becomes more fragile (degenerative), and it is possible to tear the meniscus cartilage by simply squatting.
History	o With an acute meniscal tear, an effusion may develop slowly several hours after injury. This differs from an anterior cruciate ligament (ACL) injury, where swelling develops rapidly within the first few hours. o Patients with meniscal injuries localize pain to the joint line or posterior knee and describe mechanical symptoms of locking or catching. نسأل المريض هل ركبته تخونه o Chronic meniscal tears demonstrate intermittent effusions with mechanical symptoms
Physical examination	o Small joint **effusions** and **joint line tenderness** with palpation are **common findings** with meniscus tears, palpation with patient has osteoarthritis isn't useful. Joint line tenderness is a most **sensitive** sign. o Manipulative maneuvers, including the McMurray and Apley tests, may produce a palpable or audible click with localized tenderness, but they are not specific for meniscal pathology. o Range of motion is typically normal, but longitudinal bucket-handle tears may **block** full **extension** of the knee joint.

Imaging	• Standard knee radiographs should be obtained for evaluating for: Bone injuries or abnormalities, Osteoarthritis, x ray we can't see anything regards of meniscus but to see possible arthritis. • **MRI** remains the noninvasive diagnostic **procedure of choice for confirming**  (Red arrow)Displaced bucket handle tear of lateral meniscus. 

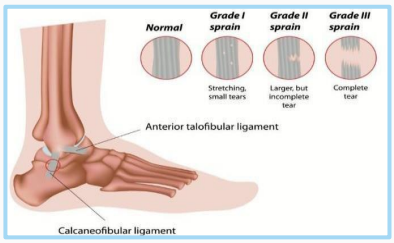
Differential diagnosis	• Differential diagnosis Prior to MRI, several large studies demonstrated accuracy of the clinical diagnosis of meniscus tears to be 70% to 75%.
	• The differential for meniscus tears includes intra-articular and extra-articular diagnoses:
	  ○ **Intra-articular:** possibilities include: osteochondritis dissecans, medial patella plica, patellofemoral pain syndromes, loose bodies, pigmented villonodular synovitis, inflammatory arthropathies, and osteonecrosis.
	  ○ **Extra-articular:** possibilities include: collateral ligament injuries, slipped capital femoral epiphysis, bone or soft-tissue tumors, osteomyelitis, synovial cyst, pes or medial collateral ligament bursitis, injury, reflex sympathetic dystrophy, lumbar radiculopathy, iliotibial band friction, and stress fracture.

Nonsurgical Management	**Nonsurgical:** if no mechanical symptoms • Not all meniscus tears cause symptoms, and many symptomatic tears become asymptomatic. • All degenerative meniscus tear. • **Nonsurgical management include:** ice, NSAIDs, or physical therapy for range of motion and general strengthening of the lower extremities. they respond well **Surgical indications:** no need for surgery unless it disturbs his life his daily activities not his hobbies or there is pain or mechanical block • Failure of conservative treatment • Locked knee blocking or displaced bucket handle tear • Concomitant ACL surgery. We do meniscectomy with ACL reconstruction. **Type of surgical intervention:** • Repair first choice, but if the tear is at an avascular zone we might have to do meniscectomy • Excision (Arthroscopic partial/subtotal/ or total meniscectomy) in the past they used to do partial meniscectomy but now we avoid this procedure because it increases the risk of osteoarthritis.

ANKLE SPRAIN التواء الكاحل

★ Characteristics:

- Ankle sprain is a common sports related injury. more than ACL
- Lateral sprains accounting for 85% of all such injuries.
- We have something called anterior fibular ligament which is more common to be injured than the ACL. Especially in female but they can live with it to the point that the stress start to develop upon the bones so she can't handle it anymore.
- Females more common because of laxity and high heeled shoes.



★ Classification of Acute Lateral Ankle Sprains:

Grade	Description
I	**Mild** injury to the lateral ligamentous complex. No frank ligamentous disruption is present. Mild swelling, little or no ecchymosis on the lateral aspect of the ankle, and no or mild restriction of active ROM. Difficulty with full weight bearing is sometimes seen. No laxity on examination.
II	**Moderate** injury and partial tear to the lateral ligamentous complex. Restricted ROM with localized swelling, ecchymosis, hemorrhage, and tenderness of the anterolateral aspect of the ankle. Abnormal laxity may be mild or absent. May be indistinguishable from a grade III injury in the acute setting.
III	**Complete** disruption of the lateral ligamentous complex. Diffuse, swelling,tenderness and ecchymosis on the lateral side of the ankle and heel. ++ instability

★ Presentation:

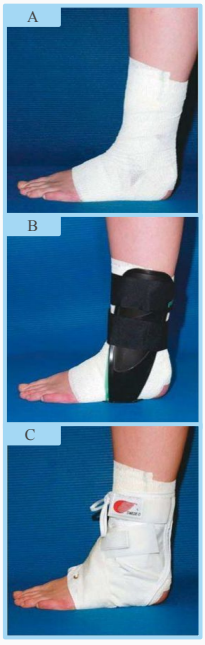
- **History:**
  - History suggestive of inversion injury
- **Physical examination:** Localized tenderness, swelling, and ecchymosis over the lateral ankle.
- **Special tests:**
  - The anterior drawer test may demonstrate anterior talar subluxation.
  - The talar tilt stress test may demonstrate positive tilt to inversion stress.

★ Treatment:

Non-surgical management:

Start with Conservative; consists of 4 (RICE-proper shoes - brace - physiotherapy)

- Initial treatment consists of RICE. + short period of immobilization (10 days) followed by early physiotherapy.
- Early weight bearing and use of a protective brace during functional activities facilitates recovery better than non–weight bearing or immobilization.
- Functional instability may result and should be treated with a course of physical therapy and proprioceptive training.
- Residual mechanical instability may be managed effectively with bracing or taping.
- Patients may return to unrestricted activity when cutting, running, and hopping on the affected leg are no longer painful.
- 90% of acute ankle sprains resolve with RICE and early functional rehabilitation.



Surgical management: Surgery is a reasonable option when an adequate trial of nonsurgical treatment fails to control symptoms for grade III.

Quadriceps/Patellar Tendon Rupture

Mechanism
- sudden forceful contraction of quadriceps during an attempt to stop
- more common in obese patients and those with pre-existing degenerative changes in tendon
  - DM, SLE, RA, steroid use, renal failure on dialysis

Clinical Features
- inability to extend knee or weight-bear
- possible audible "pop"
- patella in lower or higher position with palpable gap above or below patella, respectively
- may have an effusion

Patella alta = high riding patella
Patella baja (infera) = low riding patella

Investigations
- ask patient to perform straight leg raise (unable to with complete rupture)
- knee X-ray to rule out patellar fracture, MRI to distinguish between complete and partial tears
- lateral view: patella alta with patella tendon rupture, patella baja (infera) with quadriceps tendon rupture

Treatment
- non-operative
  - indication: incomplete tears with preserved extension of knee
  - immobilization in brace
- operative
  - indication: complete ruptures with loss of extensor mechanism
- early surgical repair: better outcomes compared with delayed repair (>6 wk post-injury)
- delayed repair complicated by quadriceps contracture, patella migration, and adhesions

Knee

Evaluation of Knee

Common Complaints
- locking, instability, and swelling
  - torn meniscus/loose body in joint
- pseudo-locking: limited ROM without mechanical block
  - effusion, muscle spasm after injury, arthritis
- painful, audible clicking
  - torn meniscus
- giving way: instability
  - cruciate ligament or meniscal tear, patellar dislocation

Special Tests of the Knee
- **anterior and posterior drawer tests (Figure 40)**
  - demonstrates torn ACL and PCL, respectively
  - knee flexed at 90°, foot immobilized, hamstrings released
  - if able to sublux tibia anteriorly (anterior drawer test), then ACL may be torn
  - if able to sublux tibia posteriorly (posterior drawer test), then PCL may be torn
  - anterior drawer test for ACL: 3.8 positive likelihood ratio, 0.30 negative likelihood ratio
- **Lachman test**
  - demonstrates torn ACL
  - hold knee in 10-20° flexion, stabilizing the femur
  - try to sublux tibia anteriorly on femur
  - similar to anterior drawer test, more reliable due to less muscular stabilization
  - for ACL: 25.0 positive likelihood ratio, 0.1 negative likelihood ratio
- **pivot shift sign**
  - demonstrates torn ACL
  - start with the knee in extension
  - internally rotate foot, slowly flex knee while palpating and applying a valgus force
  - if incompetent ACL, tibia will sublux anteriorly on femur at start of maneuver. During flexion, the tibia will reduce and externally rotate about the femur (the "pivot")
  - reverse pivot shift (start in flexion, externally rotate, apply valgus and extend knee) suggests torn PCL
  - composite assessment for ACL: 25.0 positive likelihood ratio, 0.04 negative likelihood ratio
  - composite assessment for PCL: 21.0 positive likelihood ratio, 0.05 negative likelihood ratio
- **posterior sag sign**
  - demonstrates torn PCL
  - may give a false positive anterior draw sign
  - flex knees and hips to 90°, hold ankles and knees
  - view from the lateral aspect
  - if one tibia sags posteriorly compared to the other, its PCL is torn
- **collateral ligament stress test**
  - palpate ligament for "opening" of joint space while testing
  - with knee in full extension, apply valgus force to test MCL, apply varus force to test LCL
  - repeat tests with knee in 20° flexion to relax joint capsule
  - opening in 20° flexion due to MCL damage only
  - opening in 20° of flexion and full extension is due to MCL, cruciate, and joint capsule damage
- **tests for meniscal tear**
  - **joint line tenderness**
    - joint line pain when palpated
    - palpate one side at a time and watch patient's eyes
    - for meniscal tear: 0.9 positive likelihood ratio, 1.1 negative likelihood ratio

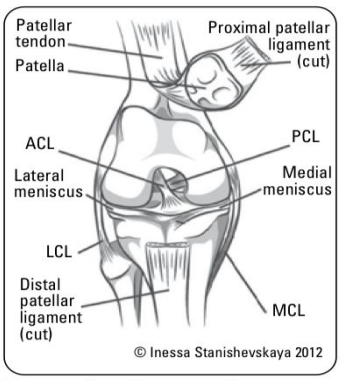


Figure 39. Knee ligament and anatomy

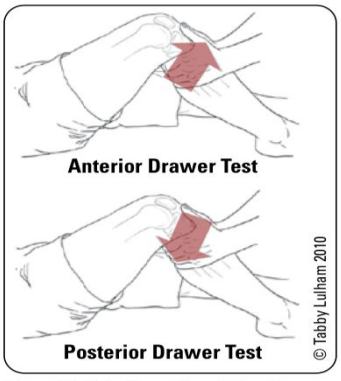


Figure 40. Anterior and posterior drawer test

6 Degrees of Freedom of the Knee
- Flexion and extension
- External and internal rotation
- Varus and valgus angulation
- Anterior and posterior glide
- Medial and lateral shift
- Compression and distraction

On physical exam of the knee, do not forget to evaluate the hip

- **crouch compression test**
  - joint line pain when squatting (anterior pain suggests patellofemoral pathology)
- **McMurray's test**
  - with knee in flexion, palpate joint line for painful pop or click
  - lateral meniscus tear exam: internally rotate foot, varus stress, and extend knee
  - medial meniscus tear exam: externally rotate foot, valgus stress, and extend knee
  - for meniscal tear: 1.3 positive likelihood ratio, 0.8 negative likelihood ratio
- **Thessaly test**
  - patient stands flat footed on one leg while the examiner provides his or her hands for balance. The patient then flexes the knee to 20° and rotates the femur on the tibia medially and laterally three times while maintaining the 20° flexion
  - positive for a meniscal tear if the patient experiences medial or lateral joint line discomfort
  - for medial meniscus: 29.67 positive likelihood ratio, 0.11 negative likelihood ratio
  - for lateral meniscus: 23.0 positive likelihood ratio, 0.083 negative likelihood ratio
  - composite assessment for meniscal tears: 2.7 positive likelihood ratio, 0.4 negative likelihood ratio

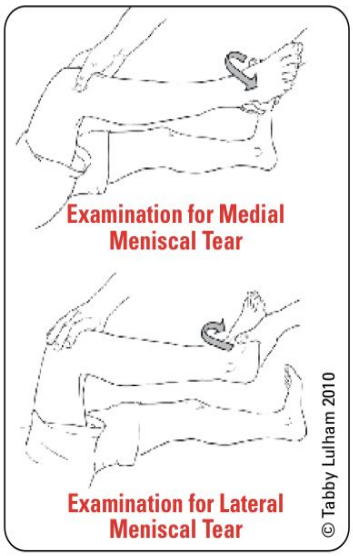


Figure 41. McMurray test

X-Rays
- AP standing, lateral
- skyline: tangential view with knees flexed at 45° to see patellofemoral joint
- 3-foot standing view: useful in evaluating leg length and varus/valgus alignment
- Ottawa Knee Rules (see Emergency Medicine, ER16)

Dislocated Knee

Mechanism
- high energy trauma
- by definition, caused by tears of multiple ligaments

Clinical Features
- classified by relation of tibia with respect to femur
  - anterior, posterior, lateral, medial, rotary
- knee instability
- effusion
- pain
- ischemic limb
- Schenck classification

Schenck Classification
Type 1: Single ligament injury (ACL or PCL)
Type 2: Injury to ACL and PCL
Type 3: Injury to ACL, PCL and either MCL or LCL
Type 4: Injury to ACL, PCL, MCL, LCL
Type 5: Multiligamentous injury with periarticular fracture

Investigations
- X-ray: AP, lateral, and skyline views of the knee
  - associated radiographic findings include tibial plateau fracture dislocations, proximal fibular fractures, and avulsion of fibular head
- Assessment of NVS:
  - ABI (abnormal if <0.9)
  - arteriogram or CT angiogram if abnormal vascular exam (such as abnormal pedal pulses)
  - assessment of peroneal nerve, tibial artery, and ligamentous injuries

Treatment
- urgent closed reduction
  - complicated by interposed soft tissue
- assessment of peroneal nerve, tibial artery, and ligamentous injuries
- emergent operative repair if vascular injury, open fracture or dislocation, irreducible dislocation, compartment syndrome
- knee immobilization x 6-8 wk

Specific Complications
- high incidence of associated injuries
- popliteal artery tear
- peroneal nerve injury
- capsular tear
- chronic: instability, stiffness, post-traumatic arthritis

Cruciate Ligament Tears

- ACL tear much more common than PCL tear

Table 22. Comparison of ACL and PCL Injuries

	Anterior Cruciate Ligament	Posterior Cruciate Ligament
Anatomy	From medial wall of lateral femoral condyle to the anteromedial and posterolateral intercondyloid eminence of the tibial plateau	Lateral wall of medial femoral condyle to posterior intercondyloid eminence of the tibial plateau
Mechanism	Sudden deceleration Hyperextension and internal rotation of tibia on femur (i.e. "plant and turn")	Sudden posterior displacement of tibia when knee is flexed or hyperextended (e.g. dashboard MVC injury)
History	Audible "pop" Immediate swelling Knee "giving way" Inability to continue activity	Audible "pop" Immediate swelling Pain with push off Cannot descend stairs
Physical	Effusion (hemarthrosis) Posterolateral joint line tenderness Positive anterior drawer Positive Lachmann Pivot shift Test for MCL, meniscal injuries	Effusion (hemarthrosis) Anteromedial joint line tenderness Positive posterior drawer Reverse pivot shift Other ligamentous, bony injuries
Treatment	Stable knee with minimal functional impairment: immobilization 2-4 wk with early ROM and strengthening High demand lifestyle: ligament reconstruction	Unstable knee or young person/high-demand lifestyle: ligament reconstruction

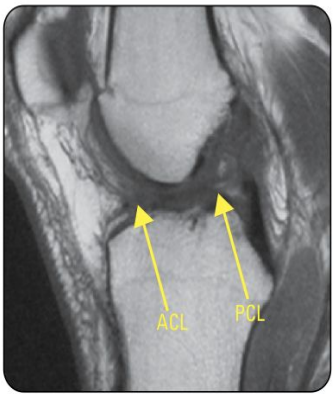


Figure 42. T1 MRI of torn ACL and PCL

Collateral Ligament Tears

Mechanism

- valgus force to knee = MCL tear
- varus force to knee = LCL tear

Clinical Features

- swelling/effusion
- tenderness above and below joint line medially (MCL) or laterally (LCL)
- joint laxity with varus or valgus force to knee
  - laxity with endpoint suggests partial tear
  - laxity with no endpoint suggests a complete tear
- test for other injuries (e.g. O'Donoghue's unhappy triad), common peroneal nerve injury

O'Donoghue's Unhappy Triad
- ACL rupture
- MCL rupture
- Meniscal damage (medial and/or lateral)

Investigations

- X-ray: AP and lateral views of the knee; MRI

Treatment

- non-operative
  - partial tear: immobilization x 2-4 wk with early ROM and strengthening
  - complete tear: immobilization at 30° flexion
- operative
  - indication: multiple ligamentous injuries
  - surgical repair of ligaments

Partial ligamentous tears are much more painful than complete ligamentous tears

Anterior cruciate ligament injury is more common than posterior injury.

- There is severe knee swelling and pain.
- With the knee flexed 90°, the leg can be pulled anteriorly, like a drawer being opened (anterior drawer test).
- A similar finding can be elicited with the knee flexed at 20° by grasping the thigh with one hand, and pulling the leg with the other (Lachman test).

Posterior cruciate ligament injury produces the opposite findings. MRI is diagnostic. Sedentary patients may be treated with immobilization and rehabilitation, whereas athletes require arthroscopic reconstruction.

18. A college student is tackled while playing football, and he develops severe knee swelling and pain. On physical examination with the knee flexed at 90°, the leg can be pulled anteriorly, like a drawer being opened. A similar finding can be elicited with the knee fixed at 20° by grasping the thigh with one hand, and pulling the leg with the other.

This is a lesion of the anterior cruciate ligament, shown by the anterior drawer test and the Lachman test. Further definition of the extent of internal knee injuries can be done with MRI.

Meniscal Tears

- medial tear much more common than lateral tear

Mechanism

- twisting force on knee when it is partially flexed (e.g. stepping down and turning)
- requires moderate trauma in young person, but only mild trauma in elderly due to degeneration

Clinical Features

- immediate pain, difficulty weight-bearing, instability, and clicking
- increased pain with squatting and/or twisting
- effusion (hemarthrosis) with insidious onset (24-48 h after injury)
- joint line tenderness medially or laterally
- locking of knee (if portion of meniscus mechanically obstructing extension)

Investigations

- MRI, arthroscopy

Treatment

- non-operative
  - indication: not locked
  - ROM and strengthening (NSAIDs)
- operative
  - indication: locked (i.e. patient cannot fully extend knee, due to mechanical block) or failed non-operative treatment
  - arthroscopic repair/partial meniscectomy

Meniscal repair is done if tear is peripheral with good vascular supply, is a longitudinal tear and 1-4 cm in length
Partial meniscectomy is done with tears not amenable to repair (complex, degenerative, radial)

Tissue Sources for ACL Reconstruction

- Hamstring
- Middle 1/3 patellar tendon (bone-patellar-bone)
- Allograft (e.g. cadaver)

Ankle Ligamentous Injuries

- see Figure 47 for ankle ligaments

Medial Ligament Complex (deltoid ligament)

- eversion injury
- usually avulses medial or posterior malleolus and strains syndesmosis

Lateral Ligament Complex
(anterior talofibular, calcaneofibular, posterior talofibular)

- inversion injury, >90% of all ankle sprains
- ATF most commonly and severely injured if ankle is plantarflexed
- swelling and tenderness anterior to lateral malleolus
- ++ ecchymosis
- positive ankle anterior drawer
- may have significant medial talar tilt on inversion stress X-ray

Treatment

- non-operative
  - microscopic tear (Grade I)
    - rest, ice, compression, elevation
  - macroscopic tear (Grade II)
    - strap ankle in dorsiflexion and eversion x 4-6 wk
    - physiotherapy: strengthening and proprioceptive retraining
  - complete tear (Grade III)
    - below knee walking cast x 4-6 wk
    - physiotherapy: strengthening and proprioceptive retraining
    - surgical intervention may be required if chronic symptomatic instability develops

Figure 46. Ring principle of the ankle and Danis-Weber classification

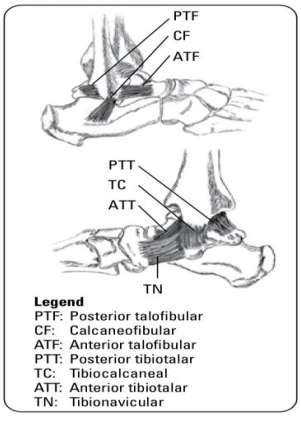


Figure 47. Ankle ligament complexes

With a history of significant trauma from axial loading of lower limb, always consider spinal injuries, femoral neck, tibial plateau, and talar/calcaneal fractures

MCQS

CLICK HERE

1) A 20 years old male twisted his leg while playing soccer, he complains of intermittent acute pain and locking. Clinically there is positive Lachman's test and tenderness over the lateral joint line. What is the most appropriate management of this case? (There was an arthroscopic picture of the knee ACL and meniscus)
   a) Lateral meniscectomy.
   b) Lateral meniscectomy with ACL reconstruction.
   c) Medial meniscectomy with ACL reconstruction.
   d) Medial meniscectomy.

2) A young patient presented after ankle twisting injury. An MRI was done and the diagnosis of Anterior talofibular ligament tear was confirmed. What is the appropriate management?
   a) Back slap cast in nature position of the ankle
   b) Casting in the eversion position
   c) Immediate surgery
   d) Delayed surgery

3) 50-year-old lady came to the OPD clinic with a history of right knee pain. The pain is increasing when she climbs the stairs. She does not have a history of twisting injury. On examination she has pain on valgus stress test, she also reported a tenderness on the medial side of her knee. She has a full range of motion and no other abnormalities. X-ray was done for her knee and shown below. What is the most likely diagnosis?

   a) Degenerative Osteoarthritis
   b) Medial Collateral ligament tear
   c) Meniscal tear

4) Young man was playing handball twisted his ankle and fall. An X-ray was done for him. What is the next step?
   a) Ankle stress X-ray
   b) CT scan of the ankle
   c) MRI of the ankle
   d) X-ray joint above and joint below

5) A 27 years old athlete kicked on the back of left calf followed by severe sharp pain, MRI showed isolated injury of the structure pointed below. (similar picture) Most likely finding on examination is ?

   a) Reduce rest dorsiflexion
   b) Prop f
   c) Palpable gap
   d) Positive Thomas test

6) A young man sustained a severe left ankle twisting injury while playing basketball. He is unable to stand on his painful ankle and presented to ER. O\E as shown with also tenderness of both the medial and lateral sides of the ankle, and skin is intact. What is the ideal next step in investigating his injury ?

A. AP\Lateral\Mortise view of the ankle
B. CT scan of the ankle
C. MRI of the ankle
D. Stress XR view of the ankle

7) An 18 year old young man presented to the orthopedic OPD with a H\O twisting injury to his left knee 10 days ago. He reported that his knee is (locked) since the injury. O\E: left knee medial side tenderness and ROM from 15o to full flexion. MRI showed a tear of the medial meniscus. Which of the following is the most appropriate treatment ?
A. Manipulation under anesthesia
B. Physiotherapy
C. Steroid injection
D. Urgent Arthroscopy

8) A 28 year old lady was involved in massive RTA at 10:00 PM. She sustained right knee injury. The right leg was pale, cold, and pulseless. The knee leg was re-aligned but distal pulses are weak. What should be done next ?

A. Ask for CT angiogram and consult vascular surgery at early morning
B. Check ankle and brachial pressures and calculate the ankle brachial index
C. Check ankle pressure every 2-hours overnight and consult vascular surgery in the morning
D. Check lower limb pulses every 2-hours overnight and consult vascular surgery in the morning

9) Which of the following is the most common predisposing factor for the injury showing in X-ray:

A. Post arthroscopy
B. Prolong casting
C. Regular exercises
D. Steroid injection

10) A 35 years old man C/O severe knee pain for 2 hours sustaining a non-contact twist while playing soccer. O/E showed massive effusion in the knee with ecchymosis. What's the most important initial investigation?
A. MRI
B. Plain XR
C. Stress view
D. US

Answers:

1.	A
2.	B
3.	B
4.	C
5.	C
6.	A
7.	D
8.	C
9.	D
10.	B