



Sport and Soft Tissue Injuries

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Objectives:

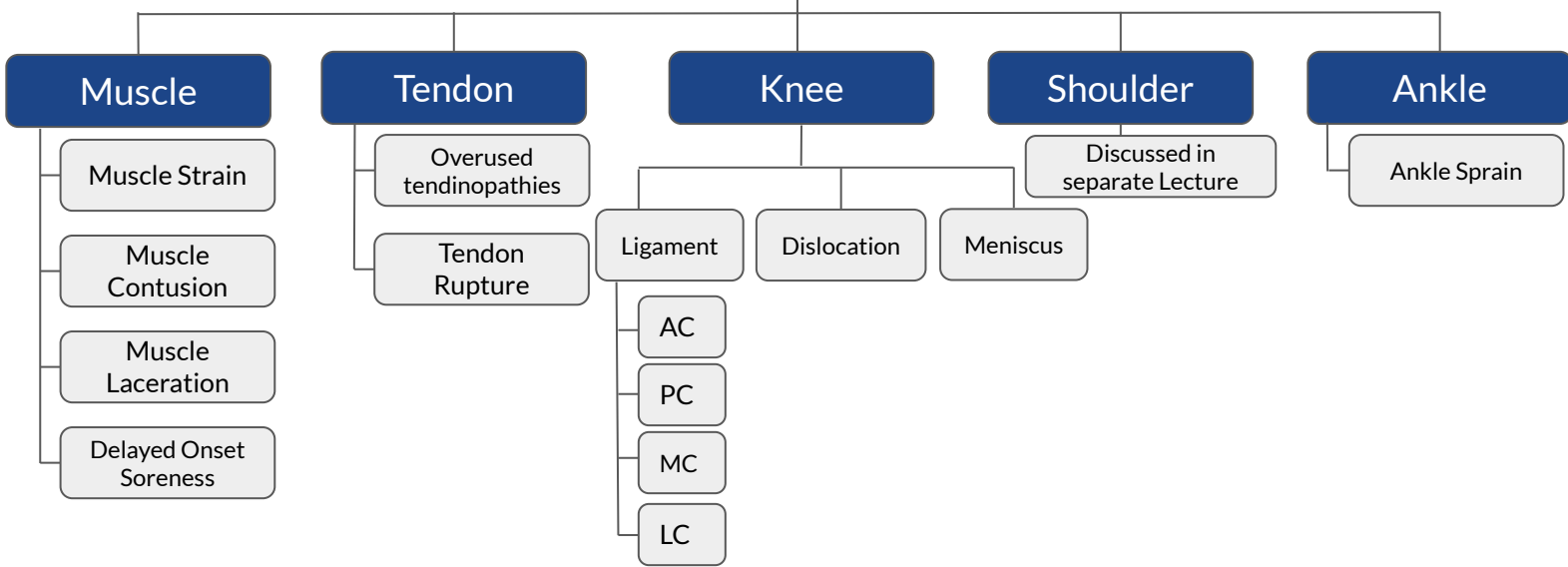
- Specify the symptoms, signs and potential immediate complications of common sport and soft tissues injuries involving muscles, tendons, and ligaments for commonly injured joints; like shoulder, knee, and ankle.
- Outline the assessment and appropriate investigation and to outline the immediate and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

Color Index:

Original text | **Doctor's notes** | Text book
Important | **Golden notes** | Extra

Introduction :

Soft Tissue Injuries Include :



❖ Initial Management :

Rest

It can help in detecting the real side of injury, controlling the damage prevent further damage



Ice

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

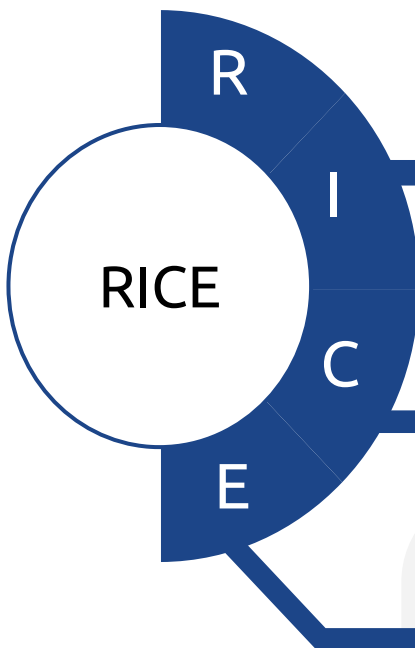
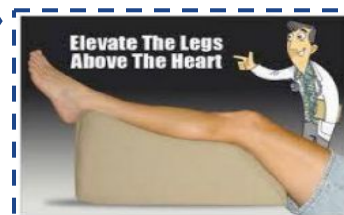


Compression

It can help in swelling relief, controlling the damage and prevent further damage.



Elevation



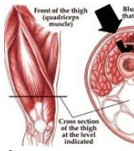
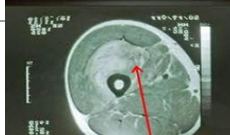
Muscle Injuries:

- The muscles most at risk are those in which the **origin and the insertion cross two joints**
- Frequently injured muscles act in an **eccentric fashion** (i.e., lengthening as they contract).

Muscle Strain¹

Characteristics	<ul style="list-style-type: none"> • The most common muscle injury suffered in sports. • How does it happen? 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. (Trying to stretch a contracted muscle by force) • Muscle tears also typically occur at or near to the myotendinous junction (the connection between muscle and tendon).
Treatment	<ul style="list-style-type: none"> • RICE • NSAIDs • Physical Therapy

Muscle Contusion

Characteristics	<ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> ○ Pain with active and passive motion +/- swelling. ○ Decreased range of motion of joints spanned by the injured muscles. ○ Occasionally a permanent palpable mass. 	
Treatment	<ul style="list-style-type: none"> • Short period of immobilization • Followed by early mobilization and Physiotherapy • NSAID 	

Muscle Laceration

Mechanism	<ul style="list-style-type: none"> • Caused by a direct injury to the muscle by a sharp object.
Treatment	<ul style="list-style-type: none"> • I&D (irrigation & debridement) followed by suture repair of the fascia, if possible.

Delayed Onset Soreness

Characteristics	<ul style="list-style-type: none"> • Structural muscle injury leads to progressive edema formation and resultant increased intramuscular pressure. • Is primarily associated with eccentric loading type exercise. • Clinical features: muscular pain that occurs 1-3 days after vigorous exercise.
Treatment	<ul style="list-style-type: none"> • It's self-limited and will resolve in a few days • NSAIDs

1- Strain is used instead of "tear"

Complications of muscle injuries :

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

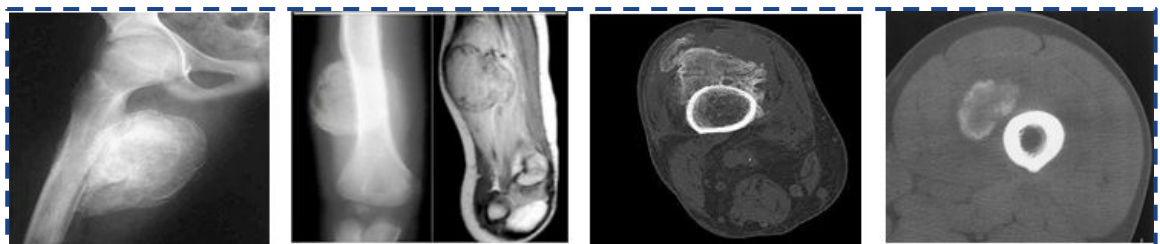
Compartment syndrome

- 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**

(Ex: Hemophilic patient that suffers muscle contusion)

Myositis Ossificans (AKA heterotopic calcification)

- **What is it?** Bone formation (calcification) within muscle secondary to blunt trauma (Muscle contusions).
- Clinical features :
 - Early:
 - Pain, swelling and decreased ROM
 - Erythema, warmth, induration, tenderness
 - Late:
 - Painless swelling with decreased ROM.
- **This sometimes mimics osteogenic sarcoma on radiographs and biopsy. Which is why a good history is essential, as many patients forget to mention that they suffered some sort of trauma earlier.**
- Increased ESR and serum alkaline phosphatase
- Myositis ossificans becomes apparent approximately 2 to 4 weeks post-injury.



Fill this empty space with your imagination...

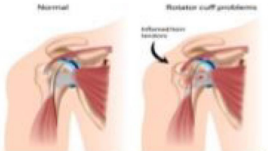







Overuse Tendon Injuries:

- What are the functions of tendon? To transfer force from muscle to bone to produce joint motion.
- Type of injuries:
 - **Overuse tendinopathies.**
 - **Tendon rupture.** It's a traumatic tear usually.

❖ Overuse 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

Diagnosis	Symptoms	Location
Rotator cuff Tendinopathy	<ul style="list-style-type: none"> • 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 	
Lateral epicondylitis (tennis elbow) (because of the overuse of arm extensor will lead to tear in tendon)	<ul style="list-style-type: none"> • 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 epicondylitis (golfer's elbow)	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Pain in or close to the knee joint that radiates up the thigh and possibly into the hip or pelvis & gets with activity, especially repetitive motions. • Swelling in or around the knee or thigh 	Hamstring tendon origin 
Quadriceps Tendinopathy	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • Pain around your patellar tendon. • Swelling • Pain with jumping, running, walking bending or straightening your leg • Tenderness behind the lower part of your kneecap 	Patellar tendon origin 
De Quarvain's disease	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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** :

Rest	Ice (Cryotherapy)
Physiotherapy (stretching and eccentric strengthening)	Analgesics
Corticosteroids injections <small>Injected in the sheath, not the tendon itself to prevent weakness and tendon rupture</small>	Orthotics and braces
Other modalities: U/S, ESWT (extracorporeal shockwave therapy), iontophoresis, phonophoresis	<ul style="list-style-type: none"> • Surgical treatment: very rarely <ul style="list-style-type: none"> ○ 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.

❖ Tendon Rupture :

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

Patellar/Quadriceps tendon rupture

Predisposing factors	Steroid use , Chronic disease, Tendinopathy
Age	<ul style="list-style-type: none"> • Patellar < 40 usually in young • Quadriceps > 40 <p>That's why if you examined randomly people with patellar pain you'll find</p> <ul style="list-style-type: none"> - >40 Pain above Patella - <40 Pain below Patella
Location	At the tendon attachment to the patella
Physical Examination	<ul style="list-style-type: none"> • 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 . <p>How to differentiate between them clinically ? The most significant sign is extension lack . Patient is unable to do active extension and if you can do it passively it can be fully extended.</p>
X-ray	<p>How to differentiate between them in X-ray ?</p> <ul style="list-style-type: none"> • Patella-alta > Patellar tendon rupture (Patella goes up) • Patella-infer(Baja) > Quadriceps tendon rupture (Patella goes down) <p>You don't need MRI for diagnosis, but you may use it to exclude other injuries or to determine how you will reconstruct in the surgical treatment . Sometimes the Patella is above its normal position which indicate patellar tendon rupture patella-alta. While in patella baja it will deviate below its normal position.</p>
Treatment	Treatment in tendon repair is usually surgical (Open repair).

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

Achilles Tendon Rupture

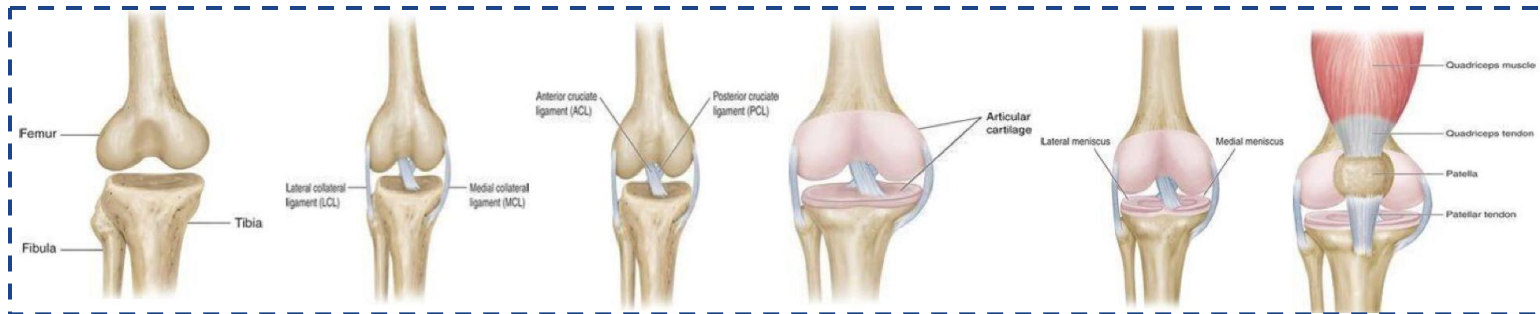
Occurrence	Most common rupture (75%) during sporting activities.
History	<ul style="list-style-type: none"> The patient reports a “pop” or the sensation of being kicked in the heel during the injury. <p>The stored energy will be released suddenly, creating what the patient perceives as a pop.</p> <ul style="list-style-type: none"> 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).
Diagnosis	Diagnosis is clinical , but MRI or ultrasound can confirm
Treatment	Usually surgical (always) as we said before in tendon rupture the management is surgical only. Conservative treatment is not recommended as it usually leads to chronic weakness.

Water break, stay hydrated :)



Knee Injuries:

❖ Knee Anatomy:

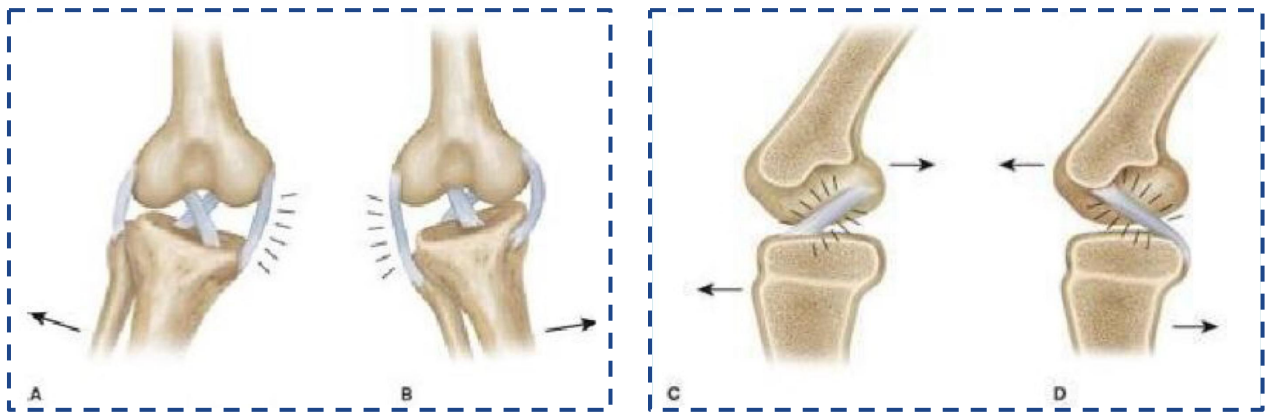


- Joint stability: bone stability + soft tissue
- Dynamic Stabilizer: Tendon/Muscles
- Static Stabilizer: Ligaments ± meniscus



Complex Synergy leading to a Functional and Stable joint.

❖ Functions of The Knee ligaments:



- The medial collateral ligament (MCL) prevents valgus deformities.
- The lateral collateral ligament prevents varus deformities.
- The anterior cruciate ligament prevents anterior tibial translation over the femur.
- 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

Knee Injuries:

1. Ligaments Injuries:

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, causing the tibia to swing back hitting the femur 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 has been 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.

Anterior Cruciate Ligament (ACL) injury إصابة الرباط الصليبي الأمامي

Mechanism of Injury	<ul style="list-style-type: none"> • About 70% of ACL injuries are caused without contact, by cutting or pivoting. Sport such as Basketball, football, Soccer. الرياضات التي تتطلب تغيير الاتجاه بشكل سريع. • Contact = associated with Medial collateral ligaments (MCL) injury. • Sports-Related (80%) <ul style="list-style-type: none"> - 70% of patient will hear a “POP” sound. Very loud! - 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: <ol style="list-style-type: none"> 1. Outside, women play 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	<p>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 or cartilage damage.</p> <ul style="list-style-type: none"> • Instability “giving way episodes” ركبتي “تخوني” أو مو ثابتة • Swelling (Hemarthrosis) is noted within a 1-2 day of the injury. And a “pop” sound. • Pain if associated with Meniscus tear or cartilage damage. After acute injury we will have pain because of meniscus injury, or bone contusion so the tibia will sublux anteriorly. In case of femur it subluxed in the middle.
Physical Examination	<ul style="list-style-type: none"> • The patient needs to be relaxed and comfortable. • Must be compared with those of the normal knee. • A moderate to severe effusion is usually present in the acute cases. • 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. • Special tests: <ol style="list-style-type: none"> 1. Lachman's test. (the most sensitive test) 2. Anterior Drawer test (ADT) 3. Pivot shift test: is pathognomonic for ACL injury (best in Chronic settings).

Knee Injuries:

1. Ligaments Injuries Continued:

Anterior Cruciate Ligament (ACL) injury إصابة الرباط الصليبي الأمامي

X-ray

Segond Fracture

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



Tibial spine avulsion

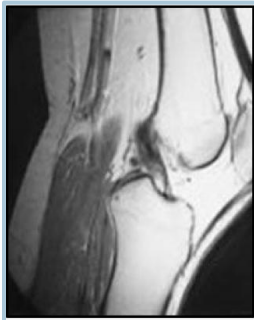
Here we see growth plate still opens = immature skeleton so this is a pediatric pt.. In pediatric the ligament is stronger than adult so there will be avulsion without piece of bone usually.



Investigations¹

MRI

Normal ACL



Torn ACL



Bone Bruise²



Injuries Associated with ACL disruption

- Injuries of the **ACL rarely occur in isolation**. The effects of other injuries, including:
 1. **Other ligament sprains (MCL). Contact injury = MCL**
 2. **Meniscal tears = pain (40% -30%)**
 3. **Articular cartilage injuries (chondral injuries)**
 4. **Bone bruises causes pain and “pop” sound, there is subluxation of tibia over femur especially on the lateral aspect leading to impingement of the posterolateral part of the tibia against the middle part of the lateral femoral condyle.**
- **Complicate the treatment and eventual outcomes of ACL disruptions.**

1- ACL is mainly diagnosed by H&E, you don't really need any investigations mostly.

2- The POP sound heard in ACL tear is caused by the impact between the tibial and femoral condyles, this contact may lead to bone contusions “Bruises”, which can cause pain for some time.

Knee Injuries:

1. Ligaments Injuries Continued:

Anterior Cruciate Ligament (ACL) injury إصابة الرباط الصليبي الأمامي

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.

1. 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

2. Surgical Treatment:

- 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.
- In summary: Surgery needed if unstable during activities or someone who use his legs for living even if he didn't reach instability stage.

❖ Summary of the treatment:

★ **Surgical (ACL reconstruction)** عملية 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

Knee Injuries:

Posterior Cruciate Ligament (PCL) injury إصابة الرباط الصليبي الخلفي

PCL Function	<ul style="list-style-type: none"> The PCL is the primary restraint to posterior tibial translation in the intact knee
Mechanism of Injury (MOI)	<ul style="list-style-type: none"> A direct blow to the proximal aspect of the tibia is the most common cause of PCL injury. Dashboard injury: التي يركب قدام السيارة لما يصير فيه تسارع بعده فرامل تروح ركبته تضرب بدرج السيارة فتدخل داخل خصوصا اللي جالس 90 درجة وينقطع الرباط 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.
Complications	<ul style="list-style-type: none"> PCL insufficiency significantly increased the risk of developing medial femoral condyle and patellar cartilage degeneration over time.
Treatment	<ol style="list-style-type: none"> Non operative: They do healing without surgical intervention, it won't affect our performance. Mainly non-operative unless there is combined ligament injury. 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



Medial Collateral Ligament (MCL) injury إصابة الرباط الجانبي الأنسي

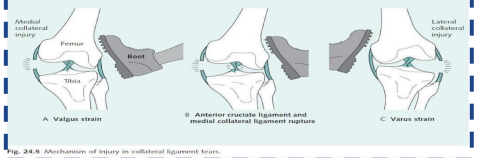
Anatomy	<ul style="list-style-type: none"> The main function of this complex is to resist valgus and external rotation loads.
Occurrence	<ul style="list-style-type: none"> The tibial MCL is the Most coMMOnly injured ligament of the knee.
MOI	<ul style="list-style-type: none"> Usually result from contact injury like a direct blow to the lateral aspect of the knee
Associated Injuries	<ul style="list-style-type: none"> Concomitant ligamentous injuries (95% are ACL) Concurrent meniscal injuries have been noted in up to 5% of isolated medial ligamentous injuries
Physical Examination	<ul style="list-style-type: none"> Valgus stress test should be performed with the knee at 0° and 30° of flexion: <ul style="list-style-type: none"> → Laxity at 30° : isolated MCL → Laxity at both 0° and 30°: concurrent injury to the Posteromedial Capsule and/or cruciate ligament Rule out associated injuries (ACL and Medial Meniscus)
Investigations	<ul style="list-style-type: none"> It Is a clinical diagnosis and most of the time does not need further investigation. If the injury is severe or suspecting associated injuries (e.g. significant knee effusion) then the MRI will be modality of choice. X Ray: to rule out fracture (lateral tibial plateau fracture)
Treatment	<ul style="list-style-type: none"> ❖ Conservative Rx: Is the mainstay of treatment for the isolated MCL injuries <ul style="list-style-type: none"> - 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.



Knee Injuries:

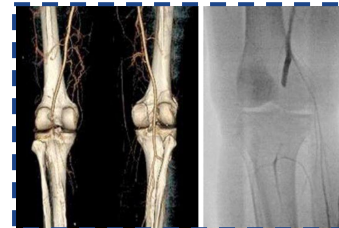
1. Ligaments Injuries Continued:

Lateral Collateral Ligament (LCL) injury إصابة الرباط الجانبي الخارجي

LCL Function	<ul style="list-style-type: none"> The LCL is the primary restraint to varus stress at 5° and 25° of knee flexion.
Occurrence	<ul style="list-style-type: none"> Less commonly injuries than MCL
Mechanism of Injury	<ul style="list-style-type: none"> Varus strain: Injuries to the lateral ligament of the knee most frequently result from injury motor vehicle accidents and athletic injuries. 
Treatment	<ul style="list-style-type: none"> Isolated injury: non operative Combined injury: surgical

2. Knee Dislocation: **ACUTE EMERGENCY!**

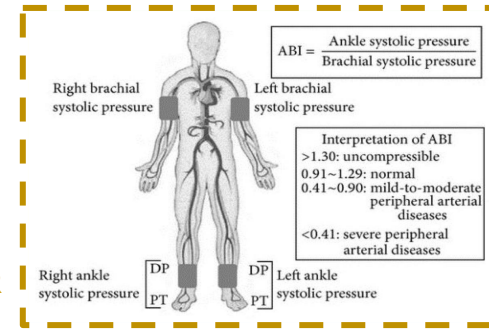
- Multiligament knee injuries** are usually caused by high-energy trauma and are often considered knee dislocations. A lot of cases come late to the ER after spontaneous reduction. At least 3 ligaments are injured: ACL, PCL, and one of the collateral ligaments, why? Because the dislocation is either laterally or medially.
- 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.**
- 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.



Knee Injuries:

2. Knee Dislocation Continued:

- ★ **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?**
- **Analgesia → Reduce joint → Immobilization → Neurovascular assessment before reduction and after → Vascular ABI → X-ray → Call OR**



Extra pic but **important**

3. Menisci Injuries:

Menisci Injuries تمزق الغضروف الهلالي

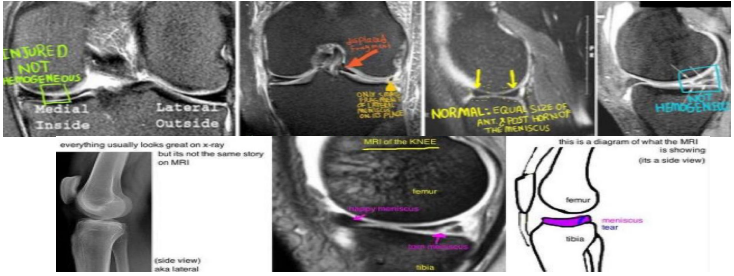
<p>Meniscus Anatomy</p>	<ul style="list-style-type: none"> • The menisci are crescent-shaped, with a triangular appearance On cross-section. • The lateral meniscus covers 84% of the condyle surface; it is 12 to 13 mm wide and 3 to 5 mm thick. • The medial meniscus is wider in diameter than the lateral meniscus; it covers 64% of the condyle surface and is 10 mm wide and 3 to 5 mm thick. 	
<p>Meniscus Function</p>	<ul style="list-style-type: none"> • The meniscus provides stability, absorbs shock, increases articular congruity, aids in lubrication, prevents synovial impingement, and limits extremes flexion/extension. • The most important function of the meniscus is load-sharing across the knee joint, which it accomplishes by increasing contact area and decreasing contact stress¹. 	
<p>Epidemiology of Meniscus injuries</p>	<ul style="list-style-type: none"> • Meniscus injuries are among the most common injuries seen in orthopaedic practices. • Arthroscopic partial meniscectomy is one of the most common orthopaedic procedures 	
<p>Incidence</p>	<ul style="list-style-type: none"> • Meniscal tears are unusual in patients younger than age 10 years. • 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. • 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. 	
<p>History</p>	<ul style="list-style-type: none"> • 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. • 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؟ • Chronic meniscal tears demonstrate intermittent effusions with mechanical symptoms 	

1- Which is why meniscectomy is often associated with early Osteoarthritis.

Knee Injuries:




3. Menisci Injuries Continued:

تمزق الغضروف الهلالي Menisci Injuries

Physical Examination	<ul style="list-style-type: none"> 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. Manipulative maneuvers, including the McMurray and Apley tests, may produce a palpable audible click with localized tenderness, but they are not specific for meniscal pathology. Range of motion is typically normal, but longitudinal bucket-handle tears may block full extension of the knee joint.
Imaging	<ul style="list-style-type: none"> 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 meniscal pathology. 
Differential Diagnosis	<ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> 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.
Non-surgical Management	<ul style="list-style-type: none"> ❖ Nonsurgical: if no mechanical symptoms <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> 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

Ankle Sprain التواء الكاحل

<p>Characteristics</p>	<ul style="list-style-type: none"> • 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. 	
<p>Classification of Acute Lateral Ankle Sprains</p>	<ul style="list-style-type: none"> • Grade 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. • Grade 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. • Grade III: Complete disruption of the lateral ligamentous complex. Diffuse, swelling, tenderness and ecchymosis on the lateral side of the ankle and heel. ++ instability 	
<p>Presentation</p>	<ul style="list-style-type: none"> • History: History suggestive of inversion injury • Physical examination: Localized tenderness, swelling, and ecchymosis over the lateral ankle. • Special tests: <ol style="list-style-type: none"> 1. The anterior drawer test may demonstrate anterior talar subluxation. 2. The talar tilt stress test may demonstrate positive tilt to inversion stress 	
<p>Treatment</p>	<ul style="list-style-type: none"> ❖ 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 training¹. • 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. 	

1- Proprioceptive training is important as proprioception is often affected in ankle injuries.

TORONTO NOTES

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

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



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

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

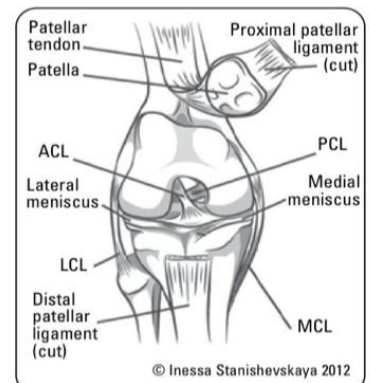


Figure 39. Knee ligament and anatomy

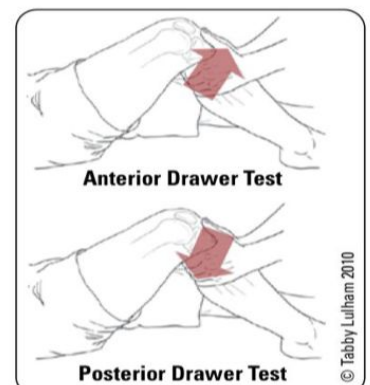


Figure 40. Anterior and posterior drawer test



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

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](#))

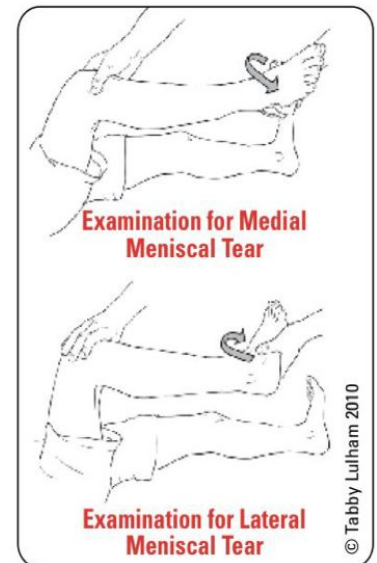


Figure 41. McMurray test

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

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



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

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

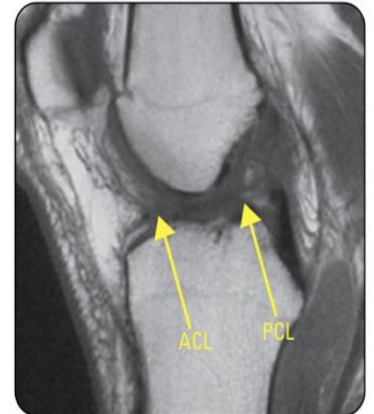


Figure 42. T1 MRI of torn ACL and PCL

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

Investigations

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



O'Donoghue's Unhappy Triad

- ACL rupture
- MCL rupture
- Meniscal damage (medial and/or lateral)

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

Kaplan notes

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 flexed 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

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



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)

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

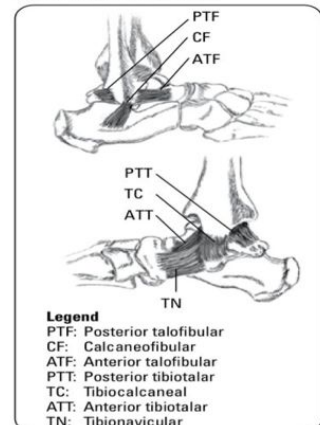


Figure 47. Ankle ligament complexes



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

Quiz

MCQ

Q1: 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 150 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

Q2: 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 X-ray
- C. US
- D. Nuclear Medicine Studies

Q3: A 30 years old man came to the ER with pain and swelling of the knee after Dashboard injury, what is the most common injury in this case?

- A. ACL injury
- B. MCL injury
- C. PCL injury
- D. Meniscal injury

Q4: A 21 years old came to the ER due to Knee dislocation, there was multiligament injury involving ACL, PCL, MCL, after checking NV examination there was no distal pulse, what is the most likely injured artery and injured nerve respectively in this case?

- A. Popliteal Vein, Peroneal Nerve injuries.
- B. Popliteal Artery, Sciatic Nerve Injuries
- C. Popliteal Artery, Peroneal Nerve Injuries.
- D. Popliteal Artery, Vagus nerve Injuries :)

SAQs

Q1: A 29 years old patient came to the ER with this deformity, he was seen by trauma team before, ATLS activated, and now the patient is stable (ABCD stable), he has only This isolated deformity, write top 6 steps to manage this Patient

STEPWISE

1. Check NV examination 2. Analgesia 3. Emergent Close reduction
4. Immobilization 5. Reassess NV Examination And
Compartment syndrome. 6. X-ray and Call Ortho

Q2: Write 3 physical assessment regarding his distal vascular status.

1. Distal pulses 2. Perfusion signs (Color, temperature, Capillary refill)
3. Ankle-Brachial Index



Answers

Q1	Q2	Q3	Q4
D	B	C	C

THANK YOU

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