EVALUATION AND MANAGEMENT OF KNEE PAIN

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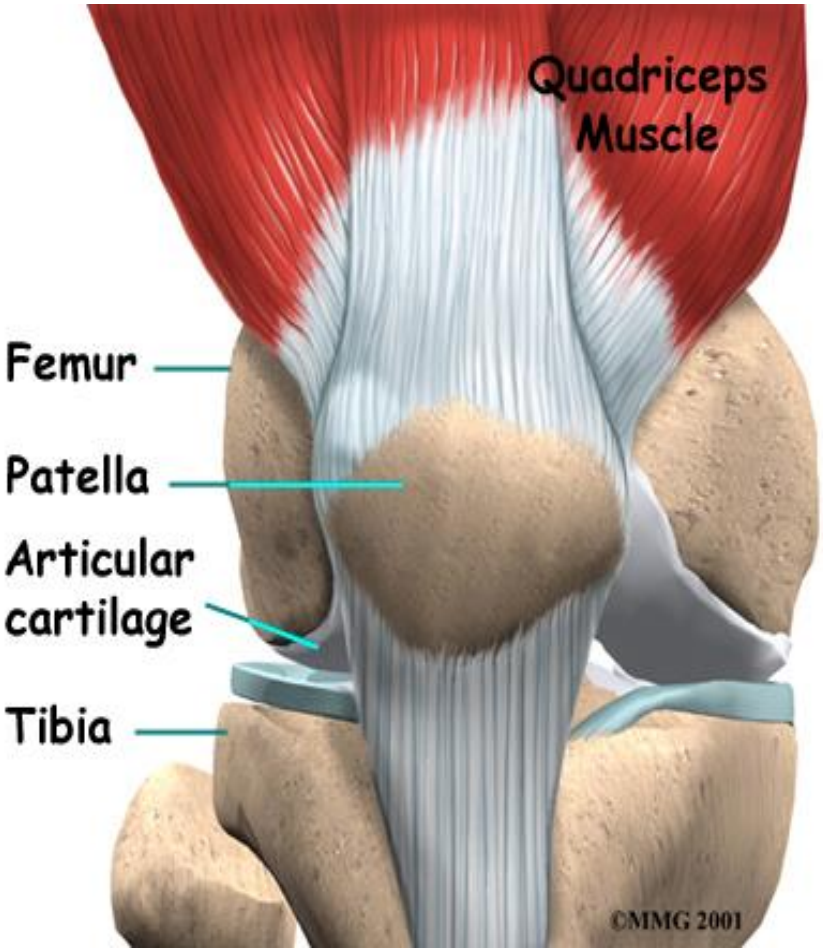
Disclosure

- None

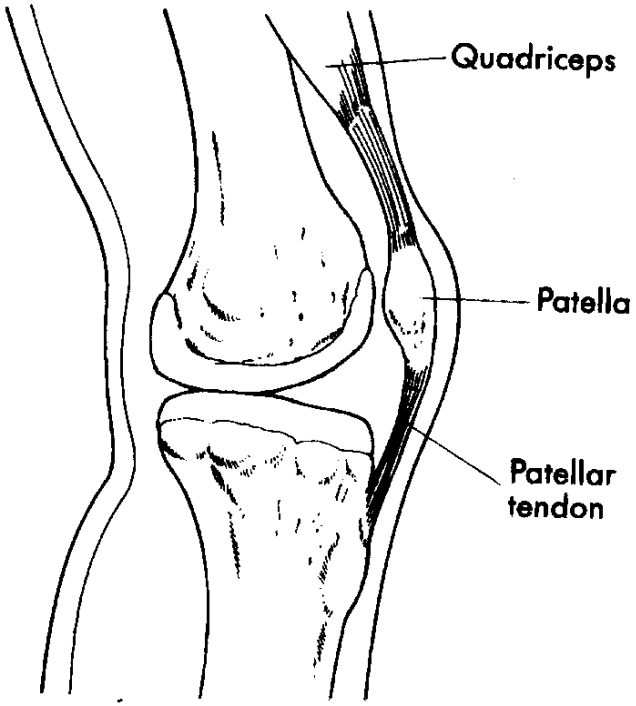
Overview

- Anatomy / Ultrasound Anatomy
- Differential Diagnosis
- Common Causes for Knee Pain
- Treatment Options



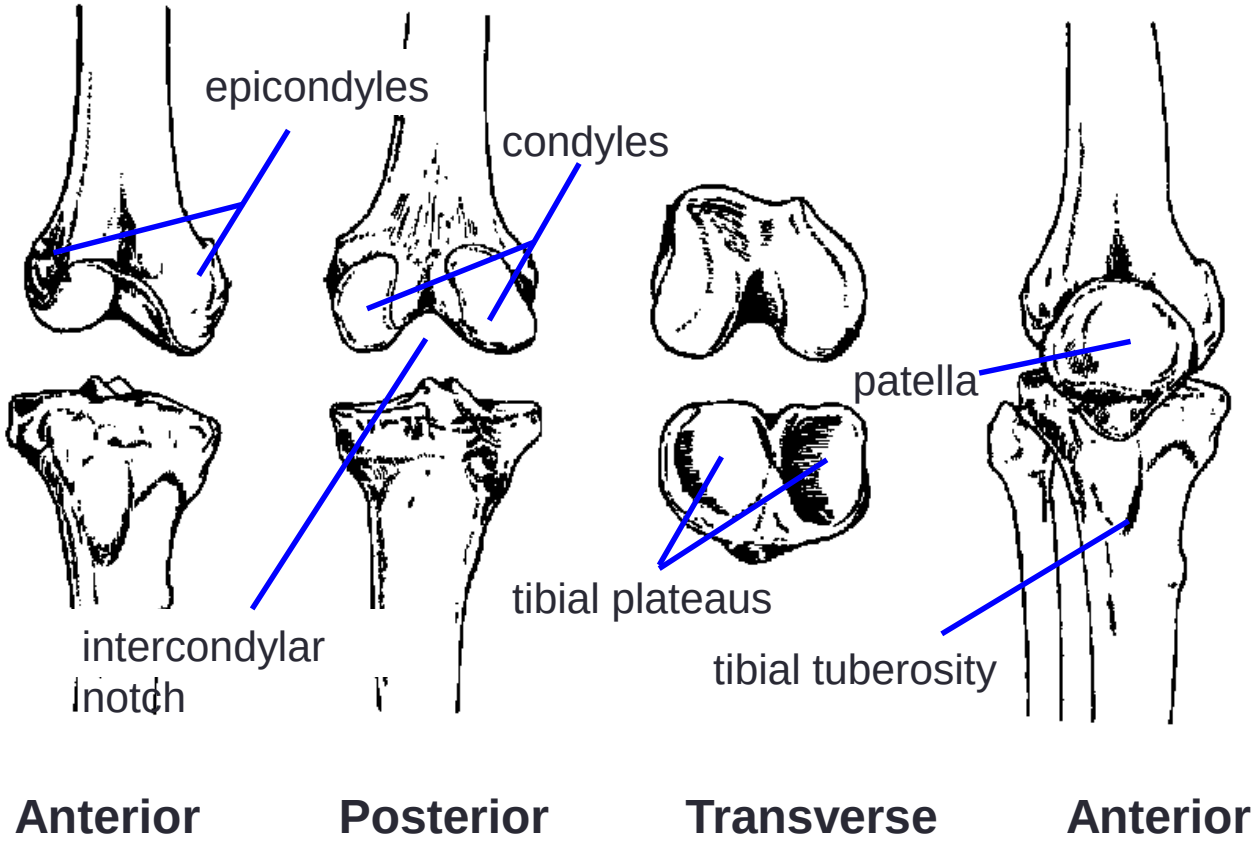
Anatomy

- 2 joints within the articular capsule
  - Tibio-femoral
  - Patello-femoral



Anatomy

- Condyloid Variety
- Hinge Joint
  - Flexion/ Extension is primary motion
  - Some rotation with flexed knee
- Synovial Joint

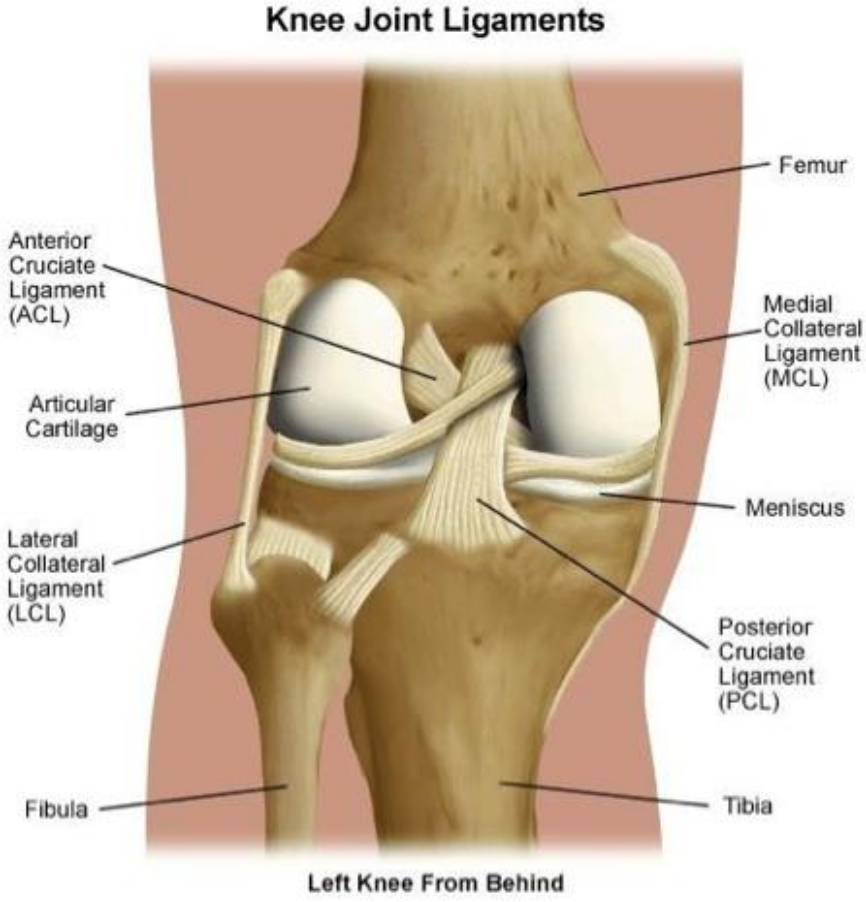


Anatomy - Bones

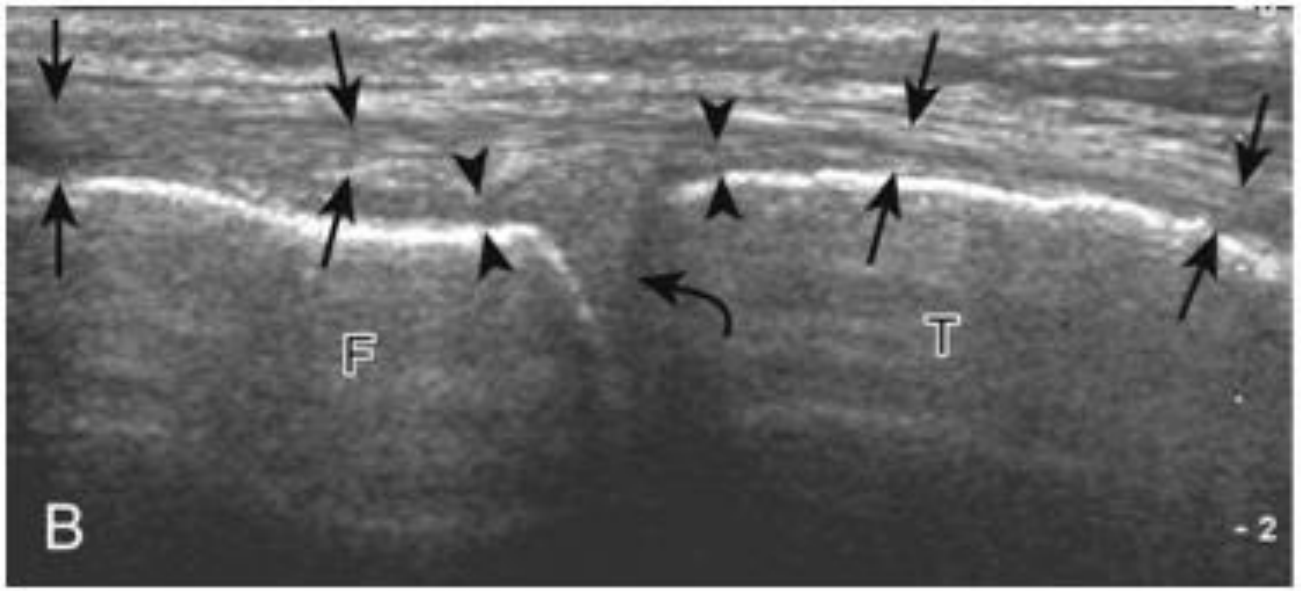
- Comprised of 4 bones:

Anatomy - Ligaments

- 7 ligaments
  - Anterior cruciate ligament (ACL)
  - Posterior cruciate ligament (PCL)
  - Medial collateral ligament (MCL)
  - Lateral collateral ligament (LCL)
  - Arcuate popliteal ligament
  - Oblique popliteal ligament
  - Patellar tendon/ligament

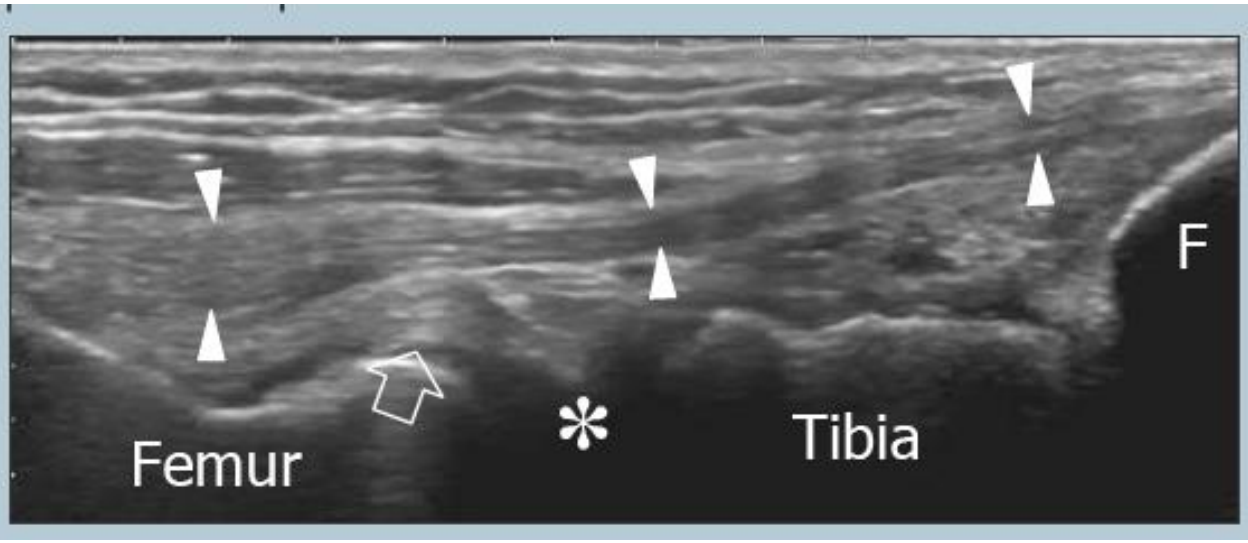


Medial Collateral Ligament



A, Coronal imaging at the medial joint line shows **(B)** the superficial *(arrows)* and deep *(arrowheads)* layers of the medial collateral ligament (*curved arrow*, body of medial meniscus). F, femur; T, tibia.

Lateral Collateral Ligament

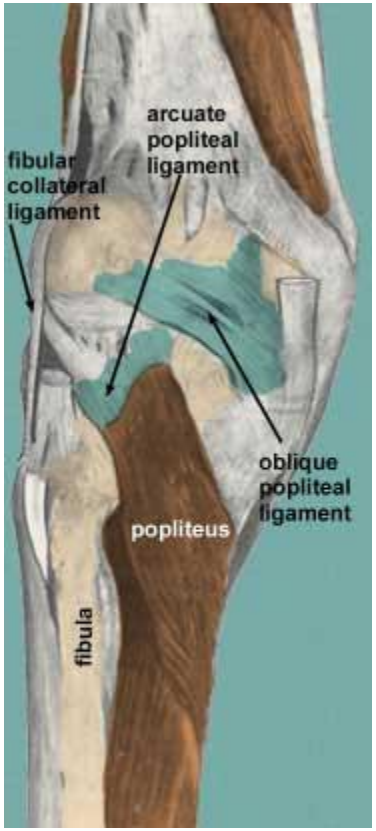


Legend: arrow, popliteal tendon; arrowheads, lateral collateral ligament; asterisk, lateral meniscus; F, fibular head

Anatomy - Ligaments

- ACL
  - Prevents anterior translation of tibia
  - Injured in twist/bend injuries
- PCL
  - Prevents posterior translation of tibia
  - Injury uncommon unless direct trauma to ligament
- MCL
  - Protects medial side of knee from a lateral force (valgus)
- LCL
  - Protects lateral side of knee from medial force (varus)

Anatomy - Ligaments

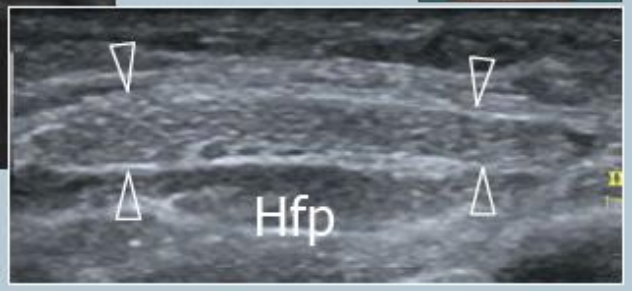


- Arcuate Popliteal
- Oblique Popliteal
- Patellar Tendon/lig.

- Posterolateral knee support – often injured with PCL/popliteus tendon
- Supports the back of the capsule
- Keeps patellar in position for condyles and assist in bending

Patellar Tendon

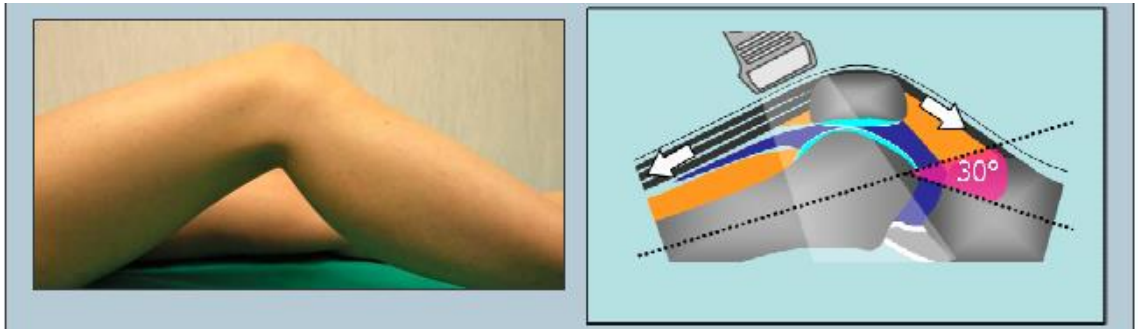
With patient's positioning described at point-1, examine the patellar tendon from its cranial origin down to its distal insertion using long- and short-axis planes. Because the lower pole of the patella has a V-shaped appearance, one should be aware that the tendon inserts not only on the apex but also along the inferolateral and inferomedial edges of the bone. Short-axis US images over the proximal patellar tendon should be also performed because tendinopathy may occur out of the midline.

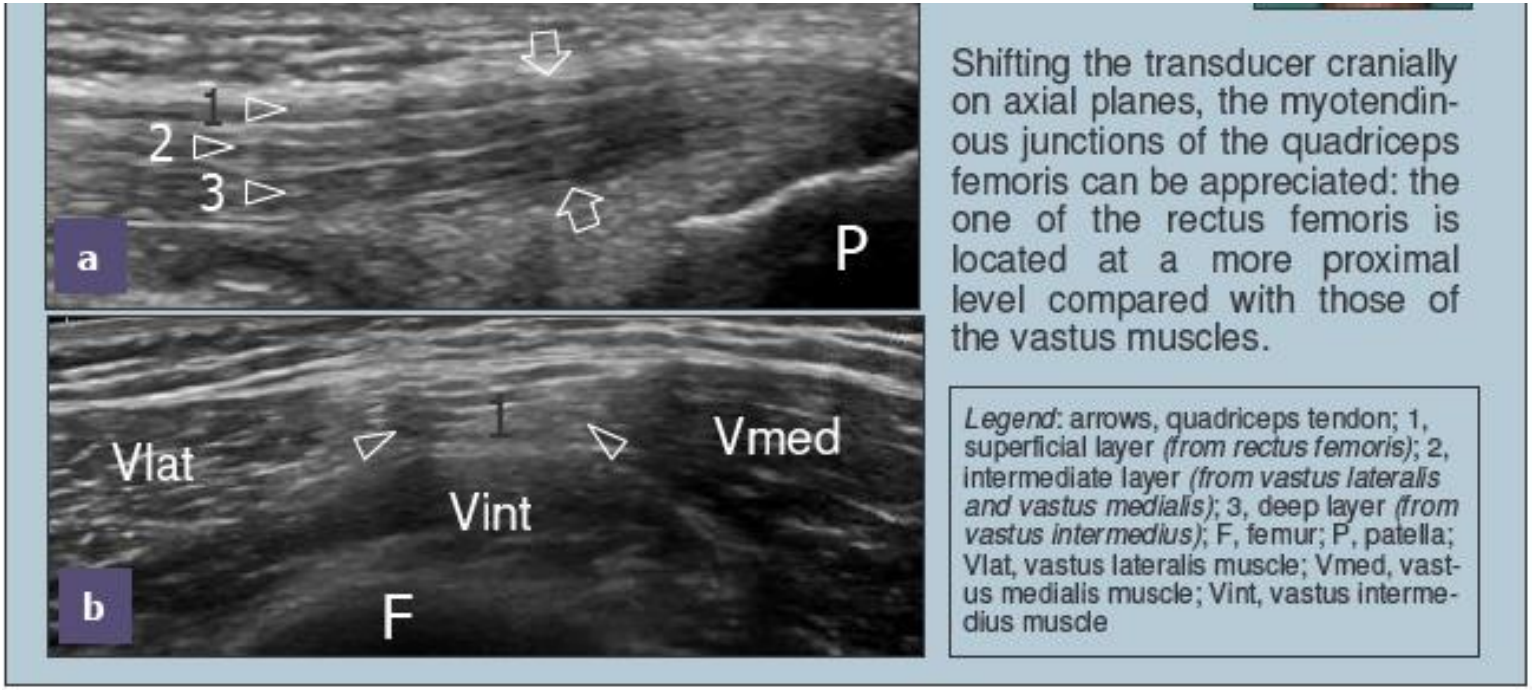


Legend: arrowheads, patellar tendon; arrow, deep infrapatellar bursa; Hfp, Hoffa fat pad; P, patella

Deep to the patellar tendon, look at the intracapsular Hoffa fat pad and check the deep infrapatellar bursa between the distal patellar tendon and the anterior aspect of the tibial epiphysis. Mild distension of the bursa appears as a small triangular hypoechoic area and should be regarded as normal. Normally, the superficial infrapatellar bursa is not visible.

Quadriceps Tendon



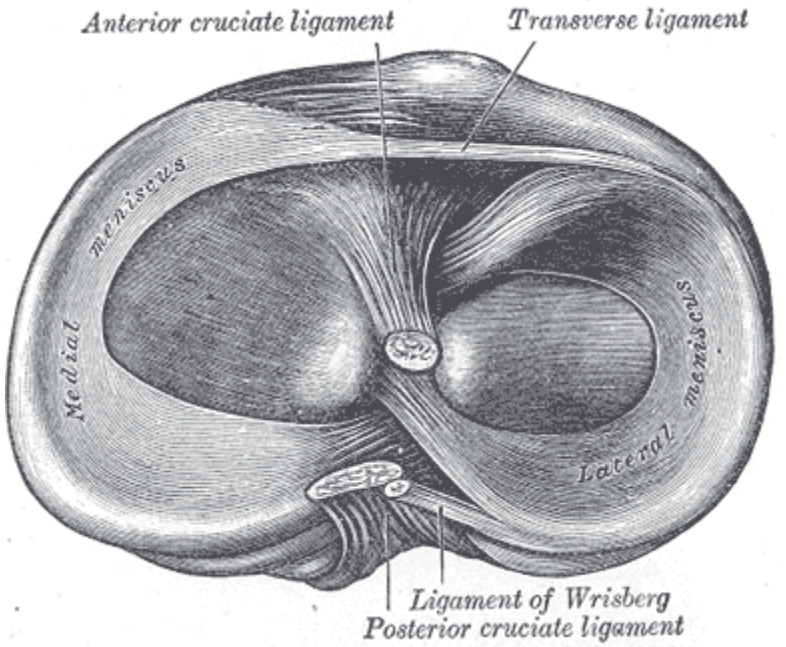


Shifting the transducer cranially on axial planes, the myotendinous junctions of the quadriceps femoris can be appreciated: the one of the rectus femoris is located at a more proximal level compared with those of the vastus muscles.

Legend: arrows, quadriceps tendon; 1, superficial layer *(from rectus femoris)*; 2, intermediate layer *(from vastus lateralis and vastus medialis)*; 3, deep layer *(from vastus intermedius)*; F, femur; P, patella; Vlat, vastus lateralis muscle; Vmed, vastus medialis muscle; Vint, vastus intermedius muscle

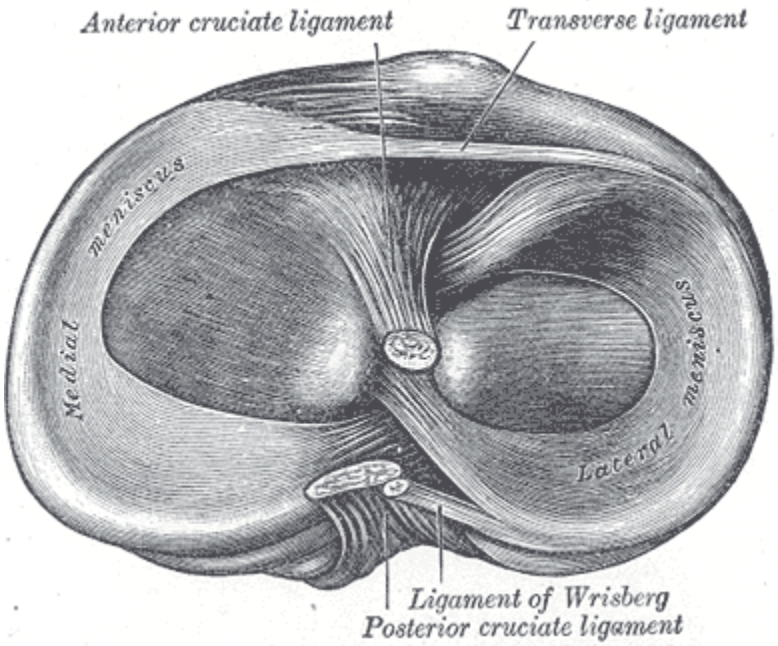
Menisci

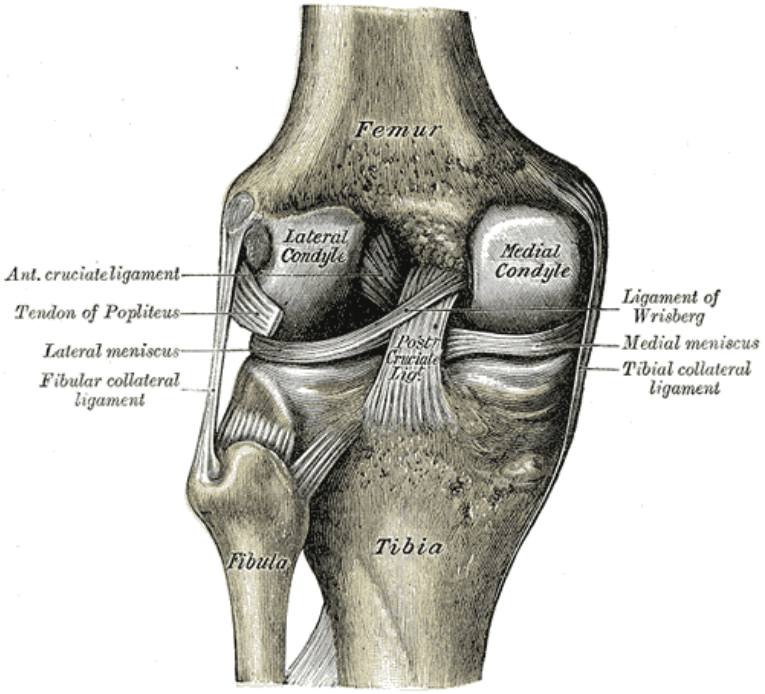
- Medial and Lateral meniscus
  - Fibrocartilage attached to tibial plateau
  - Deepens tibial socket - stability
  - Shock absorption
  - Injured with rotation
  - Injured with forceful bending
  - Medial meniscus is more commonly affected in injury than lateral meniscus



Menisci

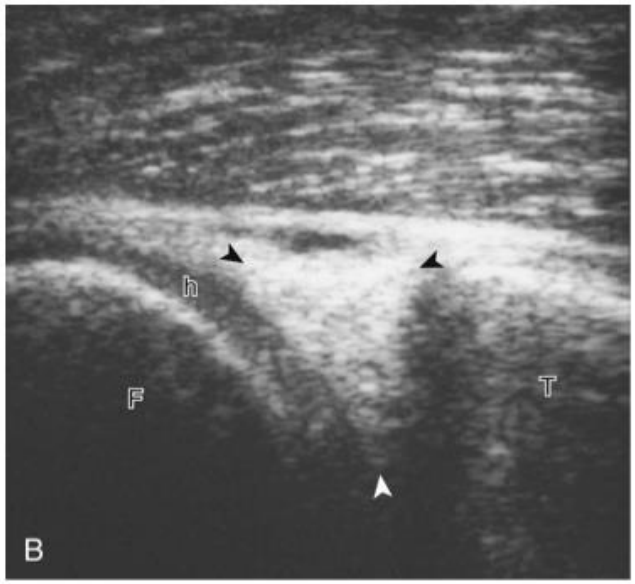
- Medial
  - C shaped – thicker posteriorly than anteriorly
  - Thicker in periphery and thinner along inner margin
  - Vascular outer 1/3; Avascular inner 2/3
- Lateral
  - O shaped – equal thickness throughout
  - Thicker in periphery and thinner along inner margin
  - Vascular outer 1/3; Avascular inner 2/3



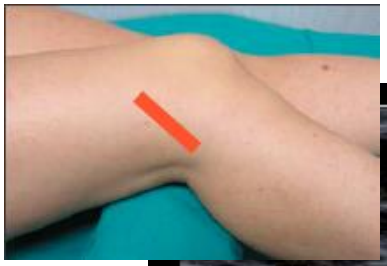


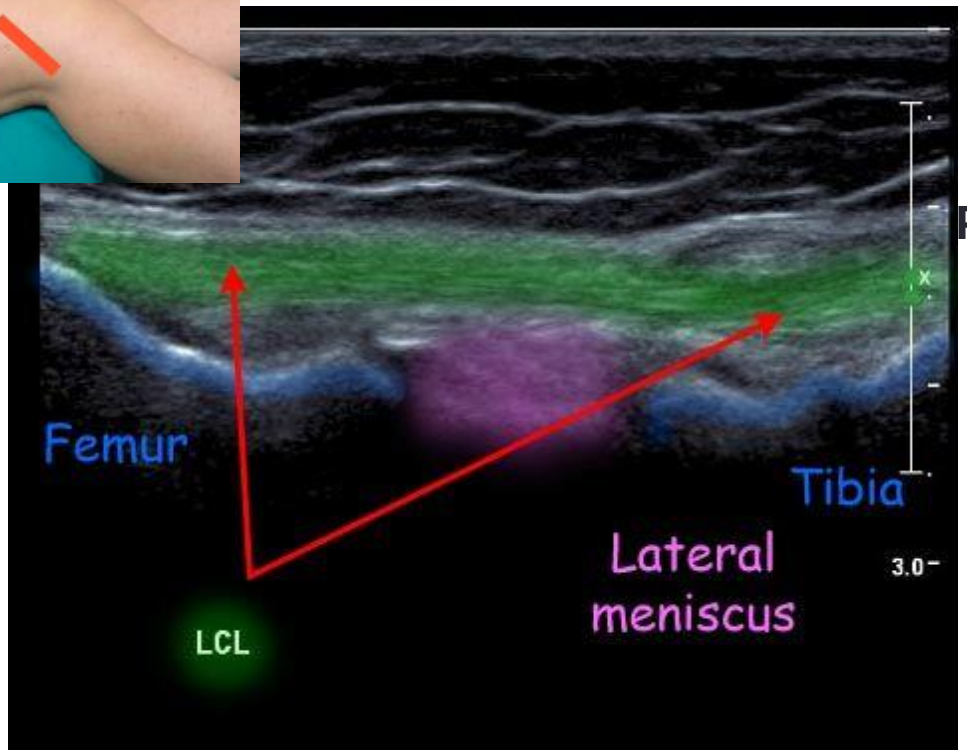
Medial Meniscus

Posterior horn of medial meniscus

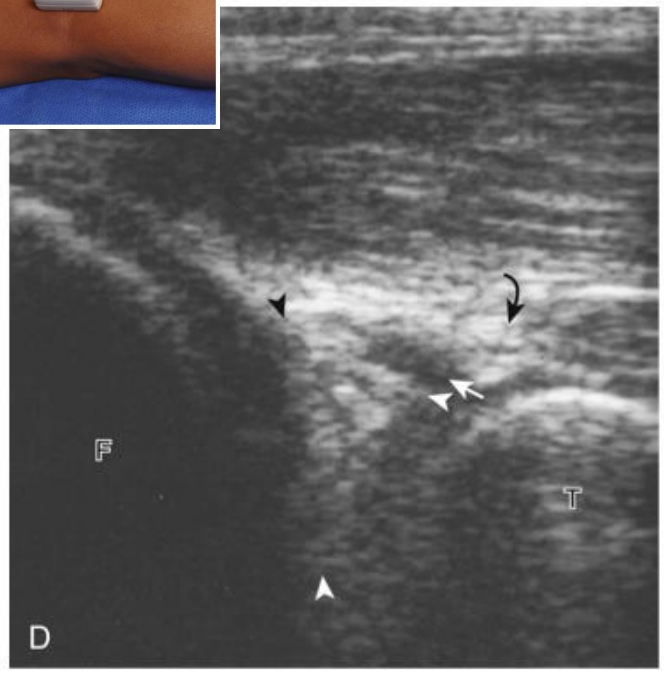


Lateral meniscus





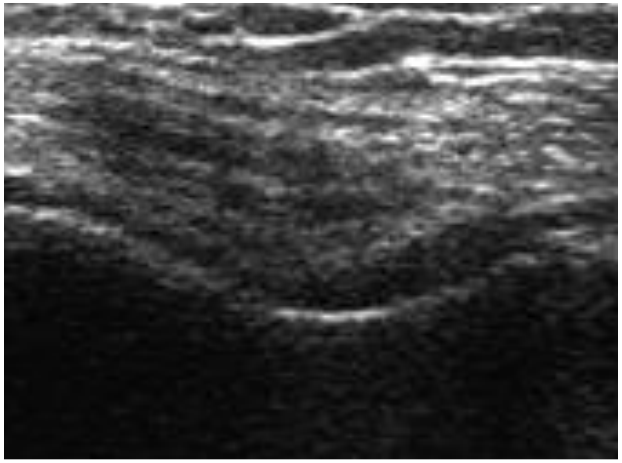
Posterior horn of Lateral meniscus



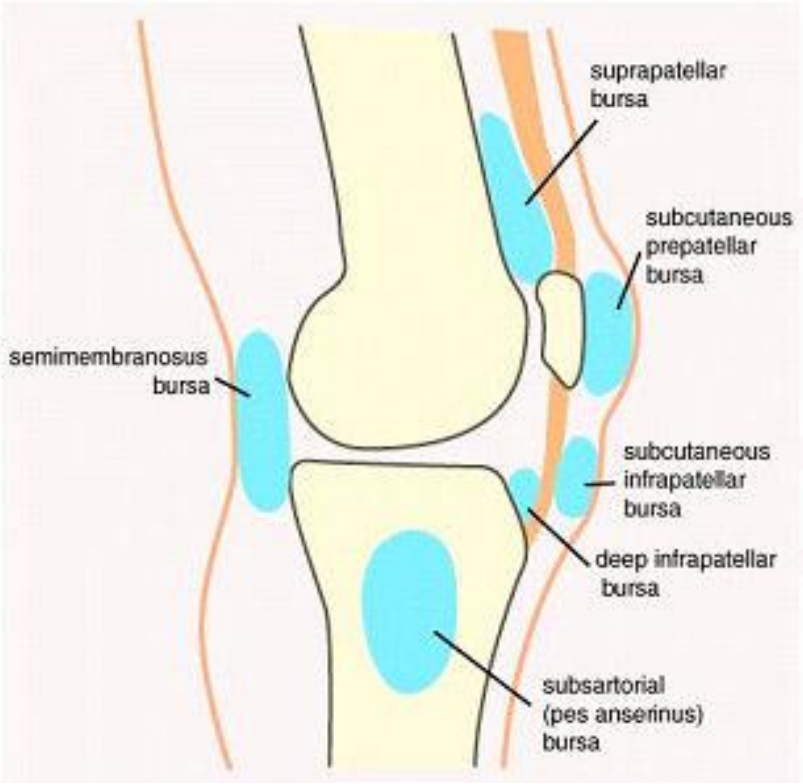
Femoral articular cartilage (Hyaline)

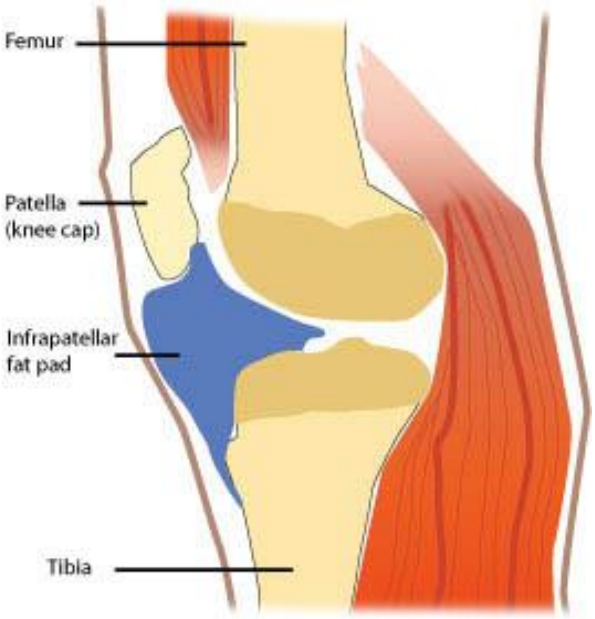
With full knee flexion, the femoral V-shaped trochlea and the overlying articular cartilage are examined on axial planes. In this position, the quadriceps tendon is pushed anteriorly by the femoral trochlea and assumes a curved course over it.

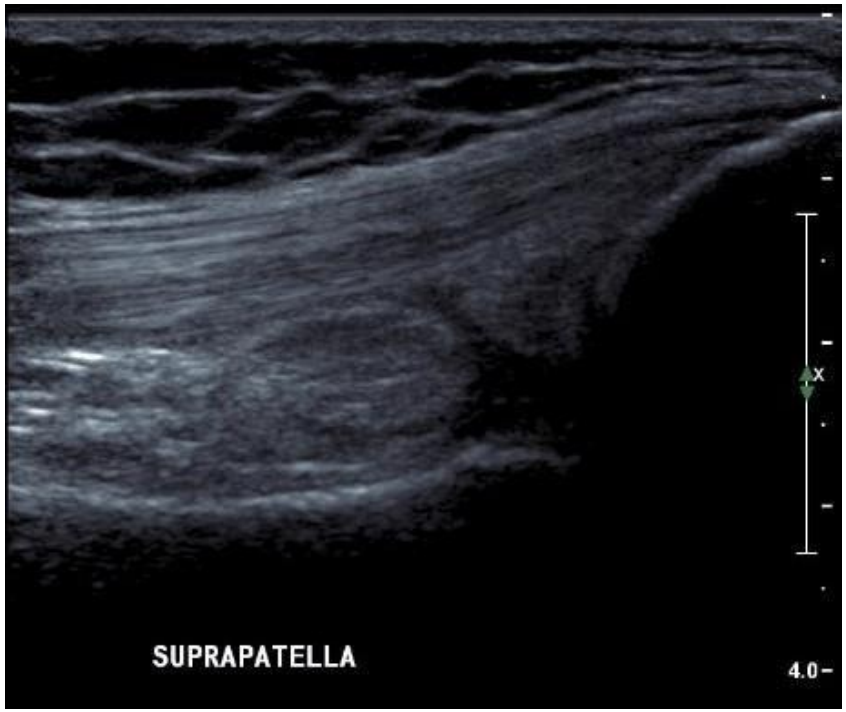
Legend: arrows, articular cartilage of the trochlea; qt, quadriceps tendon

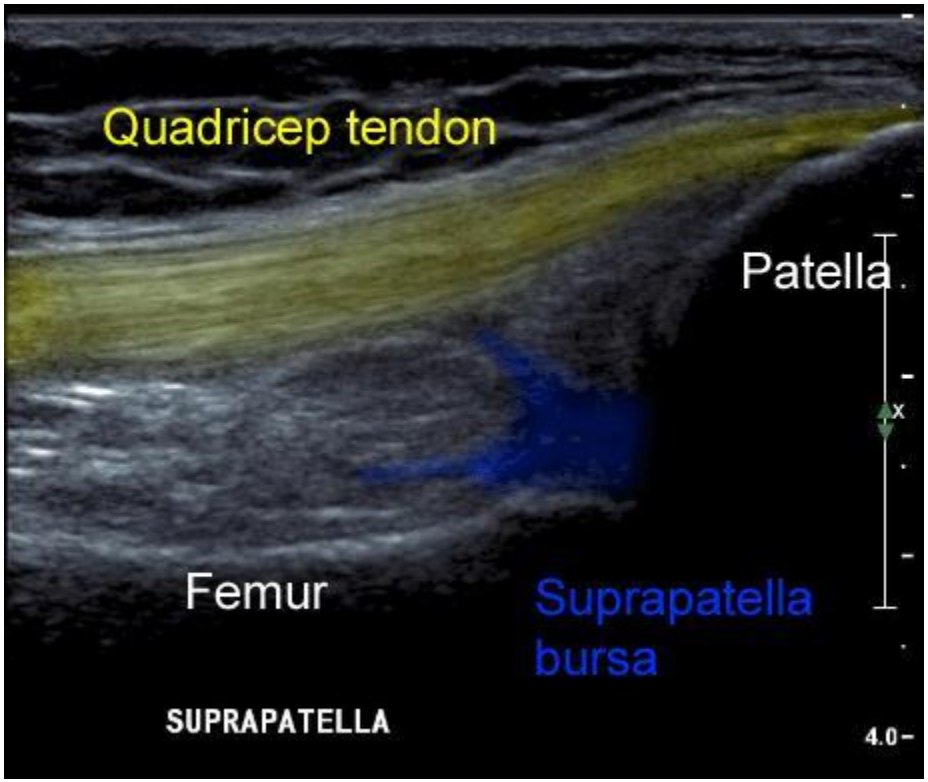


Bursa

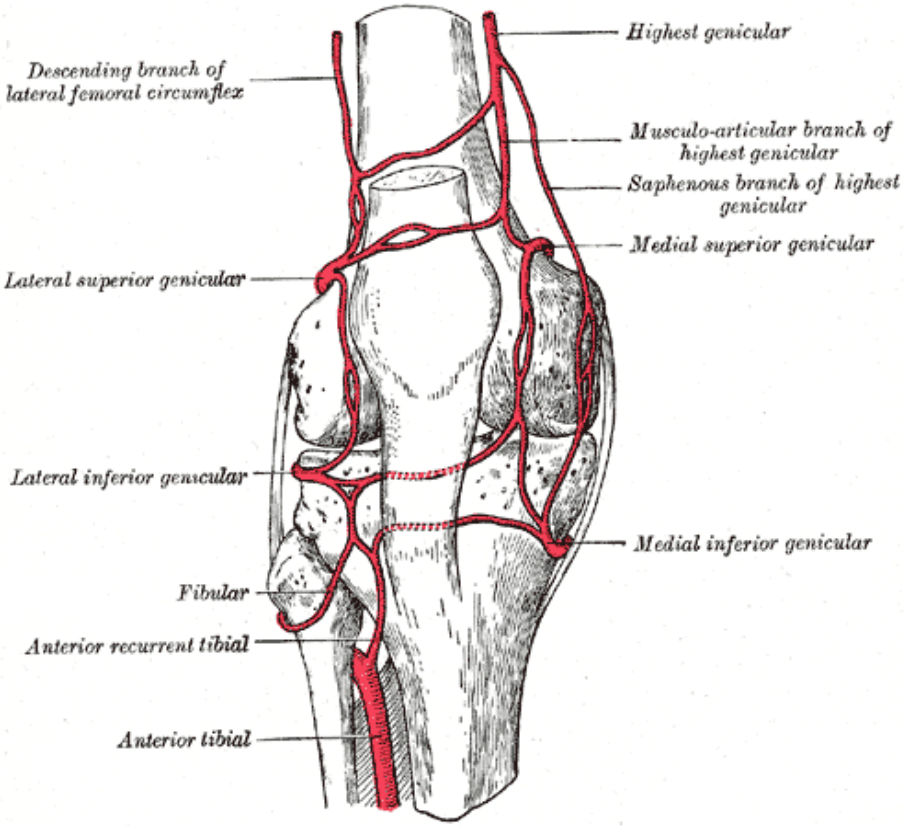

suprapatellar bursa
subcutaneous prepatellar bursa
semimembranosus bursa
subcutaneous infrapatellar bursa
deep infrapatellar bursa
subsartorial (pes anserinus) bursa


Femur
Patella (knee cap)
Infrapatellar fat pad
Tibia


SUPRAPATELLA
4.0


Quadricep tendon
Patella
Femur
Suprapatella
bursa
SUPRAPATELLA
4.0

Anatomy – Blood Supply

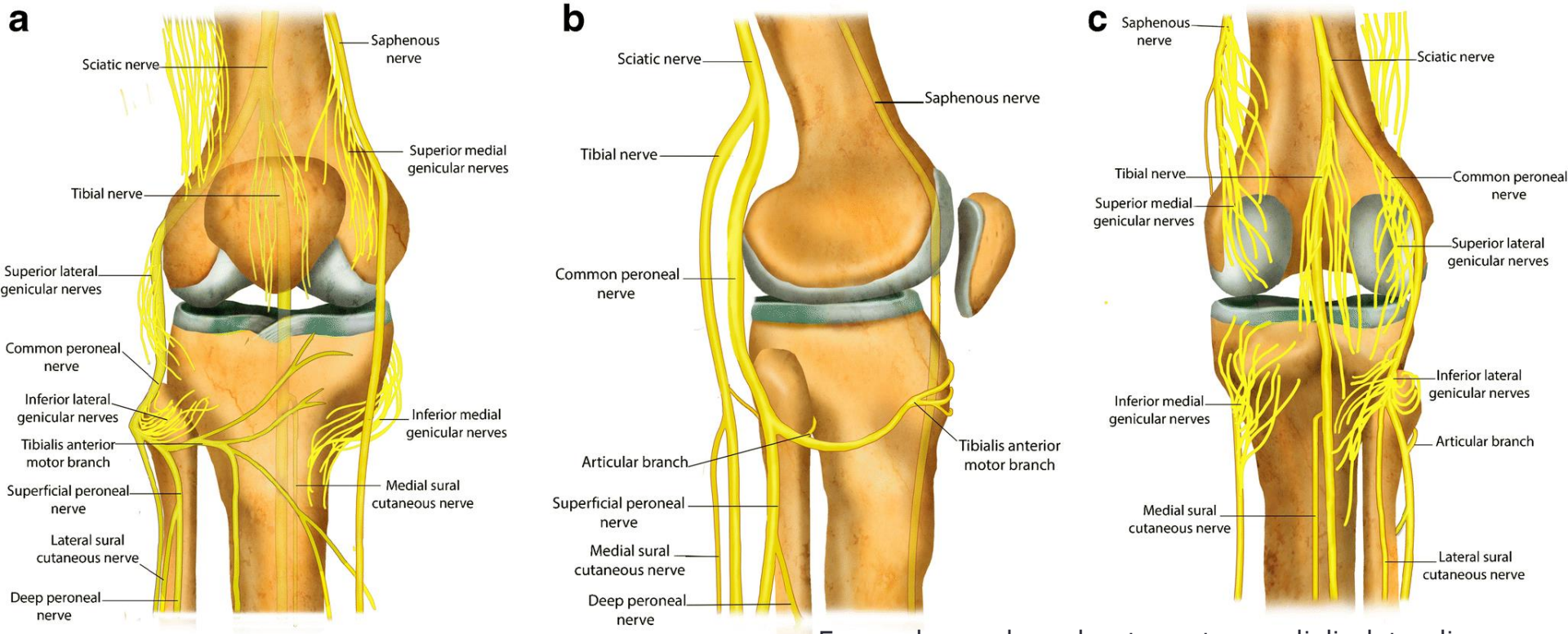


Femoral and Popliteal Arteries supply knee

- 1. Superior medial genicular artery
- 2. Superior lateral genicular artery
- 3. Inferior medial genicular artery
- 4. Inferior lateral genicular artery
- 5. Descending genicular artery (highest genicular artery)
- 6. Recurrent branch of anterior tibial artery

The medial genicular arteries penetrate the knee joint

Anatomy – Nerve Supply



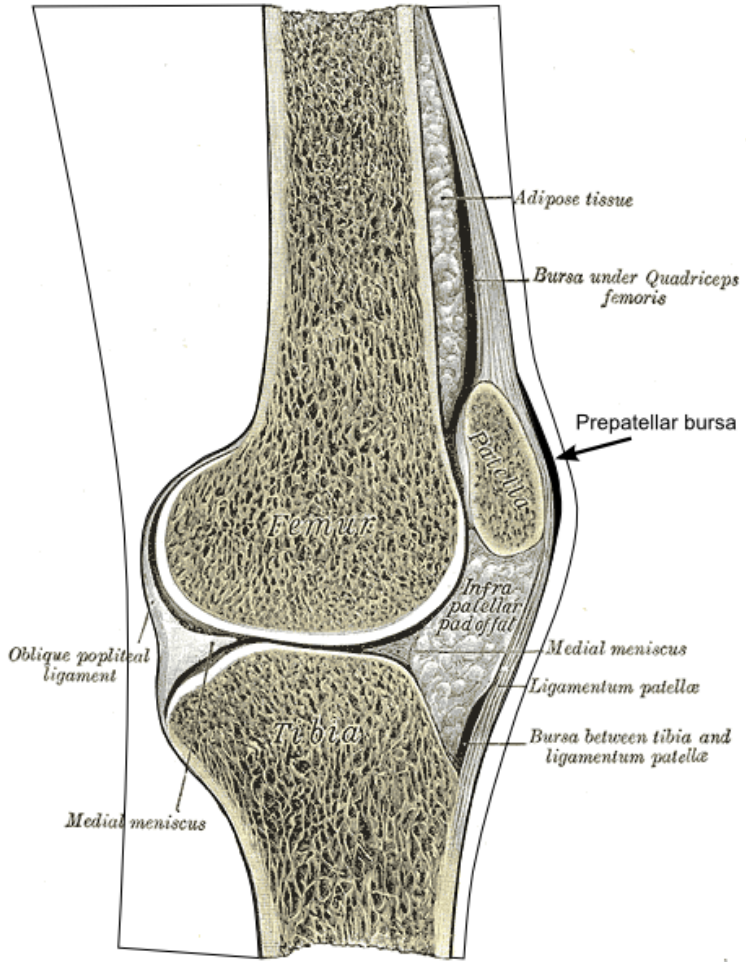
- Superior medial genicular nerve (Tibial n.)
- Superior lateral genicular nerve (Common peroneal n.)
- Inferior medial genicular nerve (Tibial n.)
- Inferior lateral genicular nerve (Common peroneal n.)
- Middle genicular nerve (Tibial n.)
- Recurrent genicular nerve (Common peroneal n.)
- Femoral nerve branches to vastus medialis, lateralis, intermedius
- Obturator nerve (posterior knee)
- Saphenous nerve (femoral nerve)

Differential Diagnosis of Knee Pain

- OA
- RA
- Ligament injury
  - ACL
  - PCL
  - MCL
  - LCL
- Meniscal injury
- Patellofemoral syndrome
- Fracture
- Bursitis
  - Pes anserine bursitis
- Tendonitis
- Enthesopathy
  - Osgood-Schlatter disease
  - Sinding–Larsen–Johansson syndrome
- Gout
- Infection
- Plica syndrome

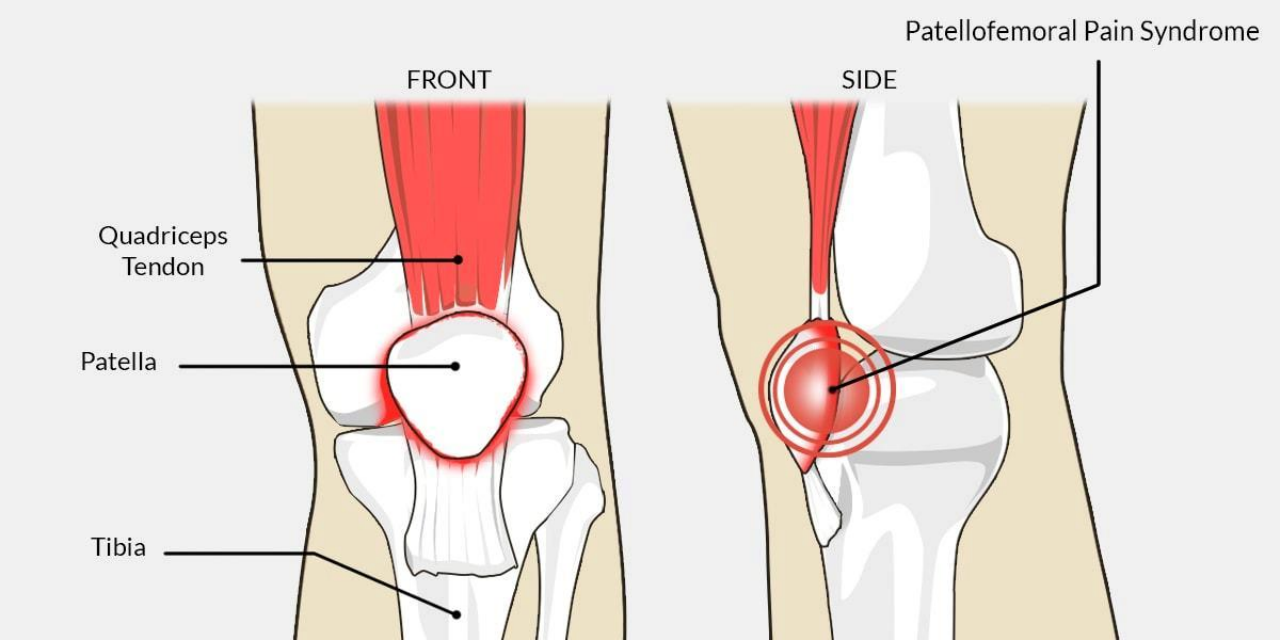
Anterior Knee Pain

- What are common causes of anterior knee pain?
  - Patellofemoral syndrome
  - Patellar tendinitis
  - Patellar instability
  - Prepatellar Bursitis
  - Quadriceps tendinitis / rupture tear



Patellofemoral Syndrome

- A very common cause of anterior knee pain
- Seen most commonly in young active females



Patellofemoral Syndrome

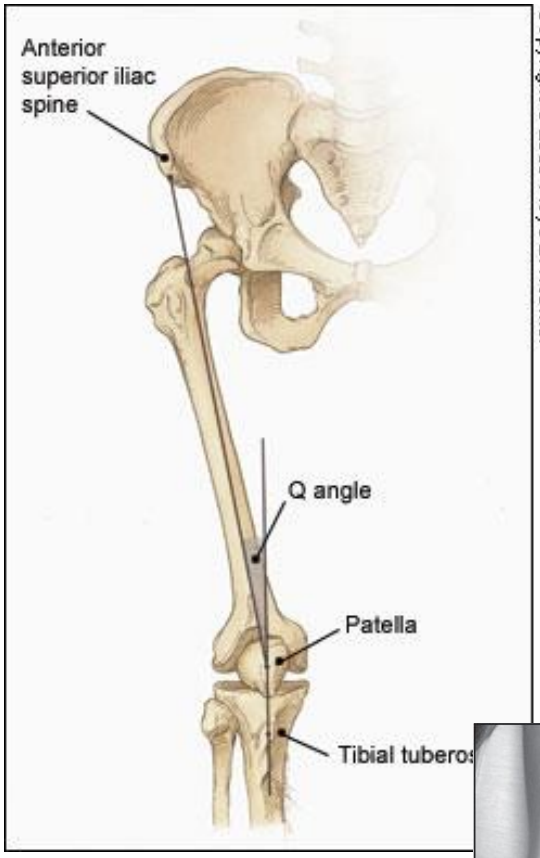
- Common causes of anterior patellofemoral pain:
  - Overuse syndromes
    - Primarily in runners
  - Mal-tracking of the patella in the patellofemoral groove
    - Often due to asymmetric quadriceps development
  - Degeneration of the patella
    - Osteoarthritis
    - Chondromalacia patellae
  - Anatomic variation
    - Increased Q angle in women
    - Past subluxation

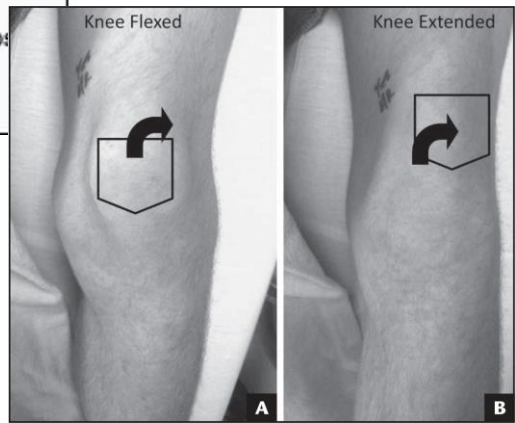
Patellofemoral Syndrome

- Symptoms
  - Pain around or beneath patella
  - Patella pain with squatting and going down stairs
  - "Theatre sign"
    - Pain with prolonged sitting
  - Giving out (due to pain, not instability)
  - Gradually progressive, esp. with activity

Patellofemoral Syndrome

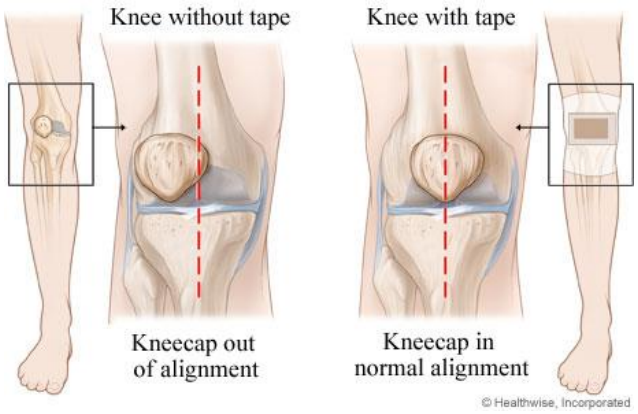
- Physical Exam
  - Tender medial or lateral patella
  - Crepitus on ROM
  - Abnormal patellar alignment
  - Pain with squat-stand
  - Typically no knee effusion noted
  - Excessive pronation
  - Increased Q angle
  - J sign





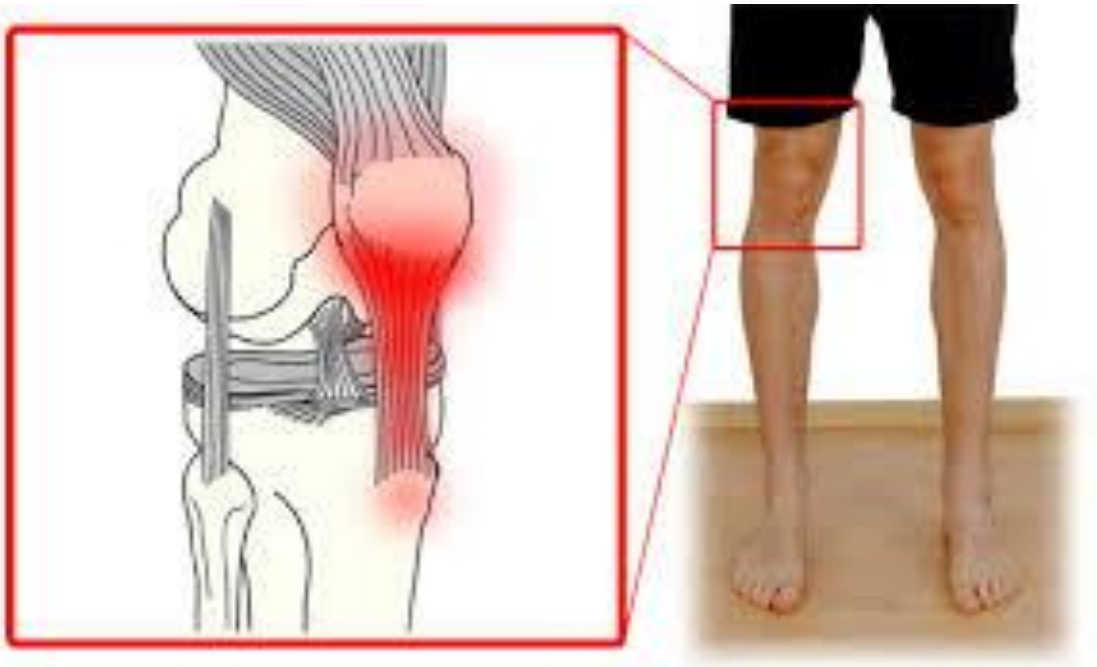
Patellofemoral Syndrome

- Treatments
  - NSAIDS
  - Physical therapy
    - Strengthen quads, especially the vastus medialis, with terminal knee extensions, or one-quarter squats
    - Hamstring stretching
  - Limit weight on flexed knees
  - Good shoes for overpronators
  - Patella stabilizing brace
  - McConnell taping



Patellar Tendinitis

- Often seen in jumpers (ex basketball, volleyball players)
- Microtears at tendon insertion at distal pole



Patellar Tendinitis

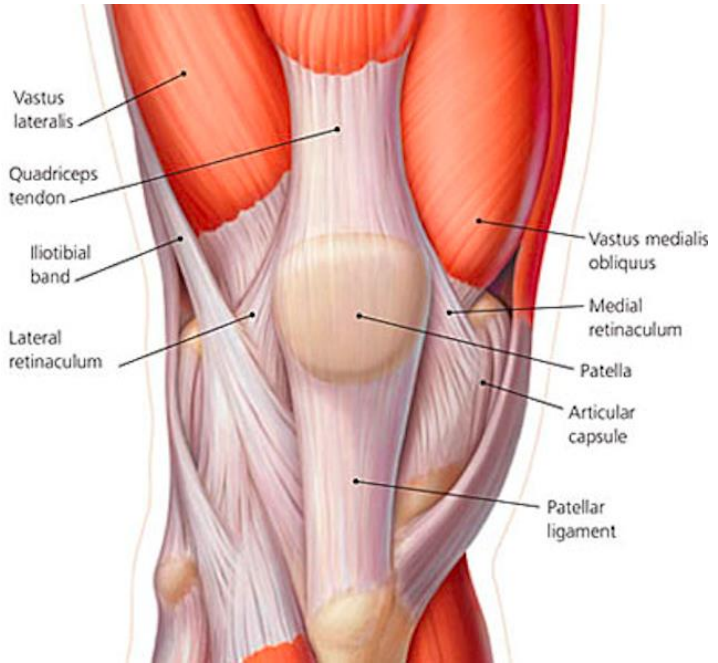
- Common causes:
  - Repetitive overloading of extensor mechanism of the knee
  - Tight quadriceps and hamstrings
    - Causes strain patellar tendon
  - Muscular imbalance

Patellar Tendinitis

- Symptoms
  - Pain with activity especially climbing stairs or rising from a chair
- Signs:
  - Pain upon palpation patellar inferior pole
- Treatment:
  - NSAIDs
  - Patellar tendon strap
  - Physical therapy
  - Prolotherapy
  - Rarely requiring surgical debridement of patellar tendon

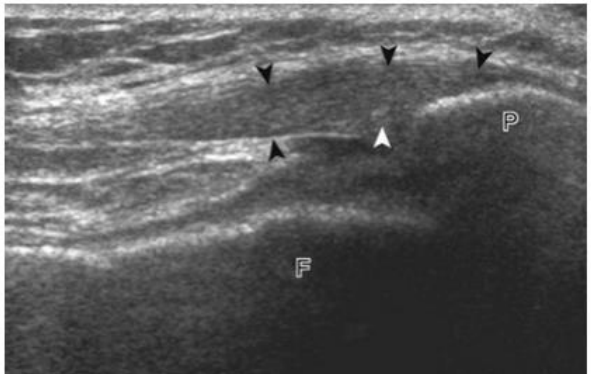
Quadriceps tendon pain

- Quadriceps tendinitis or tear
- Usually from eccentric contraction or indirect trauma
- Usually >40yo
- Rupture often at the musculotendinous junction



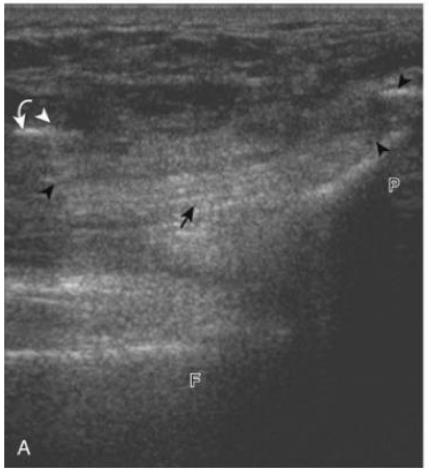
Quadriceps tendon pain

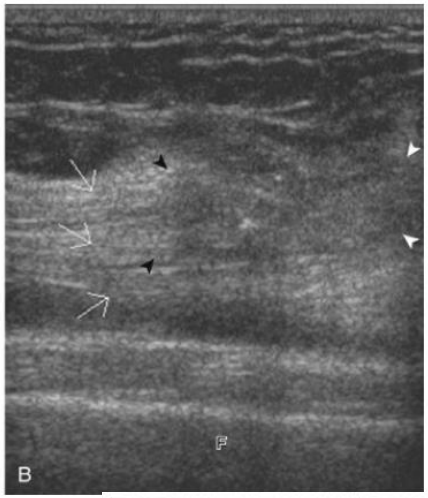
- Symptoms
  - Pain the quadriceps tendon
  - Difficulty ambulating
- Signs
  - Effusion
  - Tenderness on quadriceps tendon
  - Pain with resisted knee extension
  - If rupture, palpable defect above patella and inability to maintain straight leg raise



Quadriceps tendinosis.

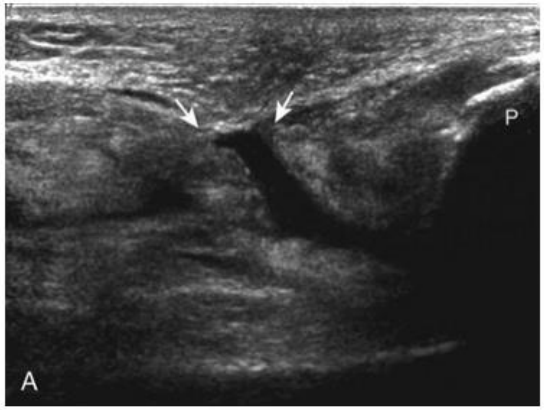
Ultrasound image long axis to the quadriceps tendon shows **hypoechoic thickening of the distal quadriceps tendon** (arrowheads) **without disruption of tendon fibers**. F, femur; P, patella.



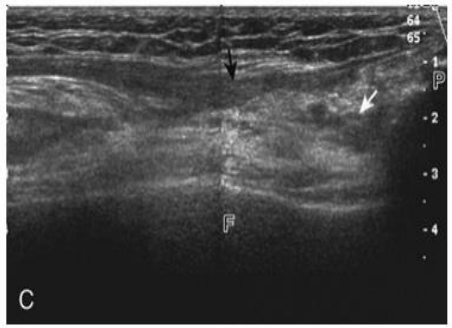


Quadriceps partial-thickness tear.

Ultrasound image long axis to the quadriceps tendon shows (A) **absence of the superficial aspect of the quadriceps tendon (arrowheads) with an intact deep layer (arrow**). Note **echogenic avulsion bone fragment** (curved arrow). Ultrasound image proximal to A shows (B) full-thickness tears of the superficial layer (rectus femoris) and middle layer (vastus medialis and intermedius) (arrowheads) with an intact deep layer (vastus intermedius) (white arrows indicate three layers of quadriceps tendon). F, femur; P, patella.



Quadriceps full-thickness tears.



Ultrasound images (A to C) long axis to the quadriceps tendon from three patients show **complete disruption of the quadriceps tendon** (arrows). Note superior patellar pole bone avulsion (curved arrow) in B. F, femur; P, patella.

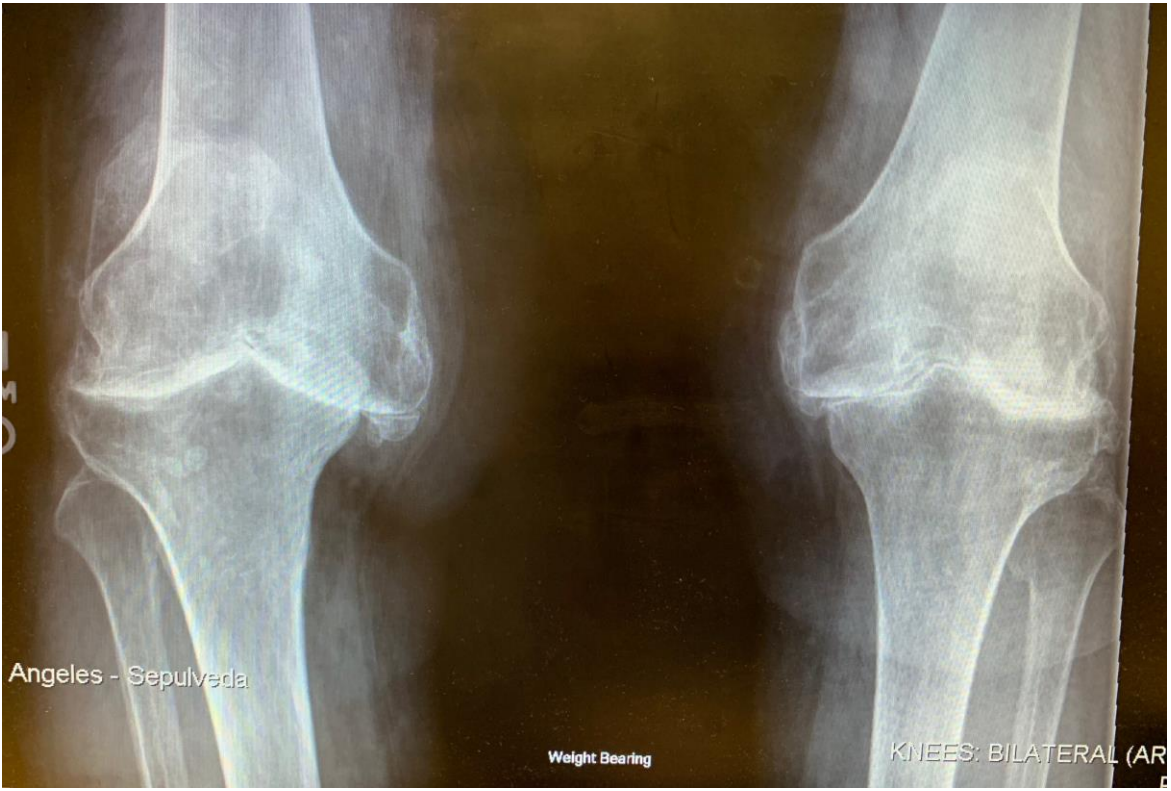
Quadriceps tendon pain

- X-ray of Tendon rupture
  - Patella baja

Quadriceps tendon pain

- Treatment
  - NSAIDs
  - Physical Therapy
  - Prolotherapy
  - If rupture, surgical repair

Osteoarthritis



Knee Osteoarthritis

- Osteoarthritis is a progressive disease that results in the degeneration of joint
- Osteoarthritis is the most common disease of the joints, affecting over 30 million Americans alone.
- In a population over age 45, about half of all knee pain complaints can be diagnosed as osteoarthritis.
- Risk factors for knee OA:
  - Obesity (BMI > 30)
  - Occupational
  - Prolonged kneeling
  - Prior traumatic injury

Kellgren and Lawrence Radiographic Criteria for Assessment of OA*

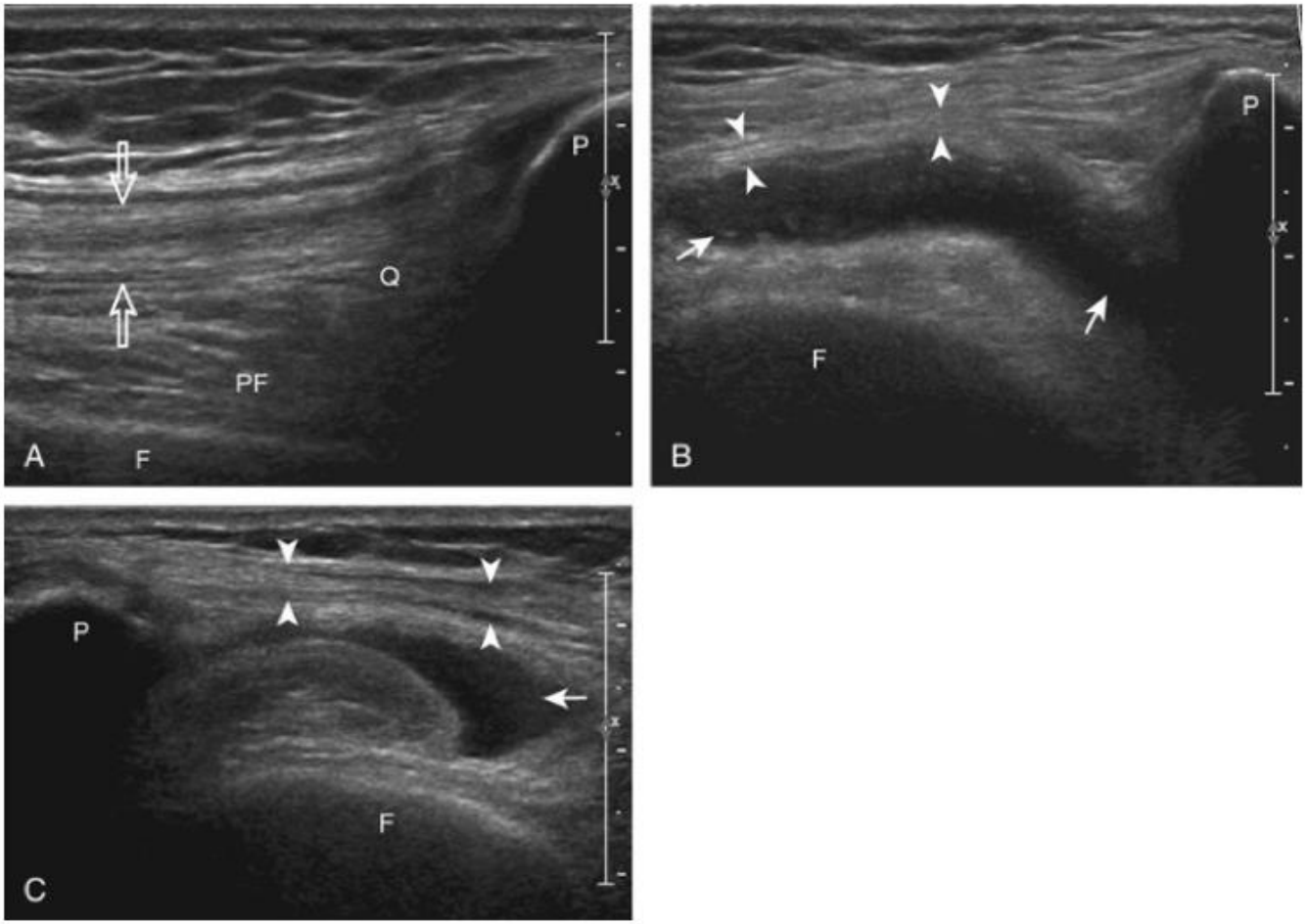
Radiographic grade	0	I	II	III	IV
Classification	Normal	Doubtful	Mild	Moderate	Severe
Description	No features of OA	Minute osteophyte; doubtful significance	Definite osteophyte; normal joint space	Moderate joint-space reduction	Joint space greatly reduced; subchondral sclerosis

Cooper C et al. In: Brandt KD, Doherty M, Lohmander LS, eds. Osteoarthritis. Oxford, NY: Oxford University Press, 1998:237-249.

*Radiography does not reliably correlate with symptoms.

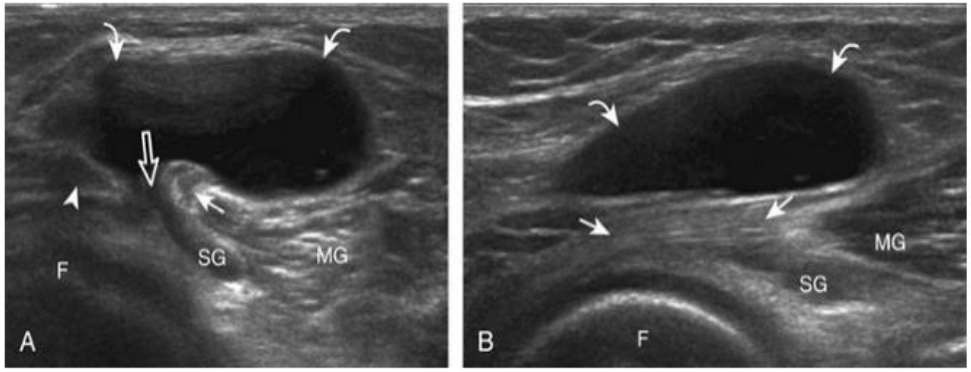
Knee OA

Joint effusion: knee extension.



Knee OA

- Baker's cyst



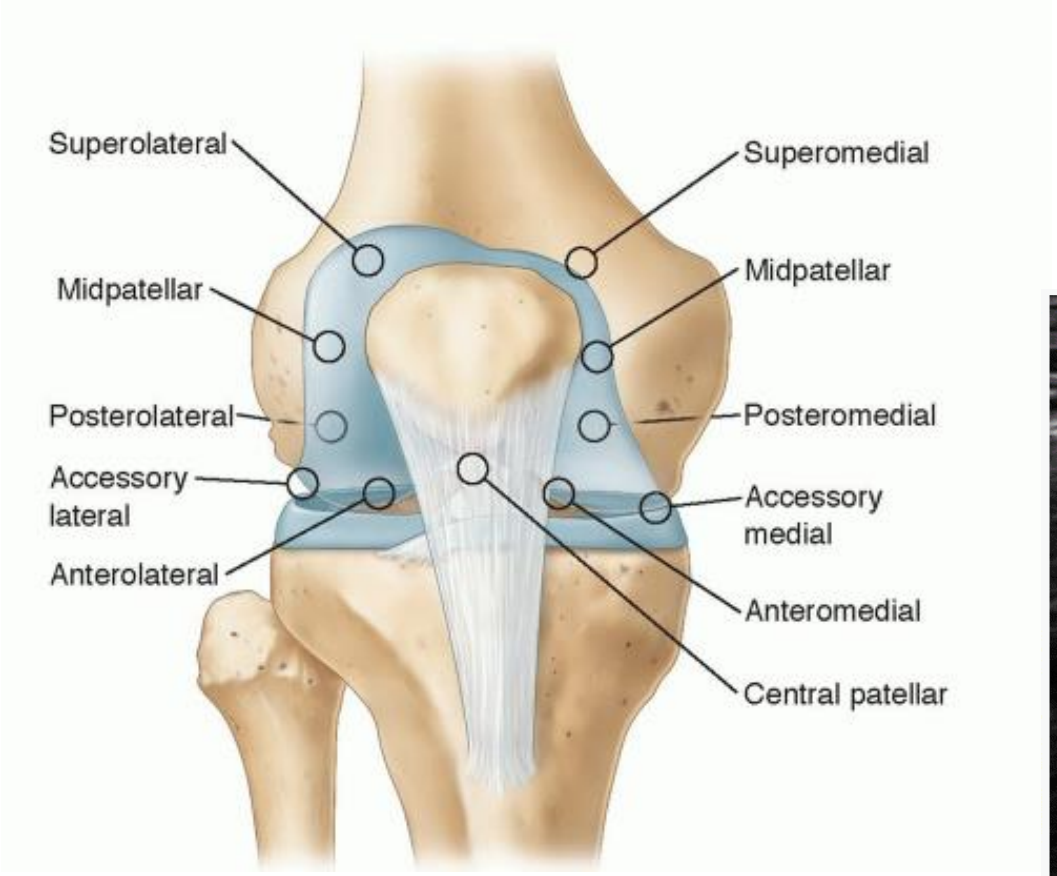
Ultrasound images transverse (A) and sagittal (B) over the **posterior medial knee** show predominantly **anechoic distention of the semimembranosus-medial gastrocnemius bursa** (curved arrows). Note the **communication to the knee joint** (open arrow) between the **semimembranosus tendon** (arrowhead) and the **medial head of the gastrocnemius tendon** (arrows) and muscle (MG) via the subgastrocnemius bursa (SG). F, medial femoral condyle.

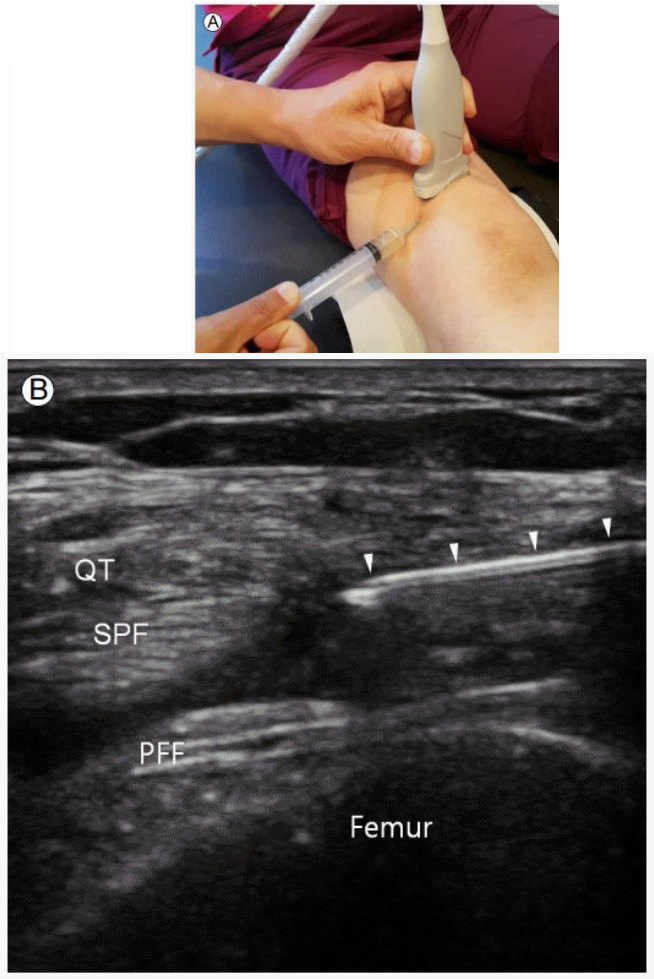
- Distention of semimembranosus-medial gastrocnemius bursa
- Etiology:
  - commonly distended with joint fluid through communication with knee joint
- This communication (present in 50% >50yo) due to degenerative weakness of capsule and increased intra-articular pressure

Treatment of Knee OA

- Activity modification
- Weight loss
- Progressive walking program
- Physical therapy
  - Knee (quads) strengthening exercises
  - Aquatic therapy
- Knee brace
- Shoe orthotic
  - Lateral shoe wedge for medial knee OA
- Tylenol and NSAIDS (consider Cox-2's > 65 yrs)
- Opioids
- Glucosamine
- Chondroitin
- Intra-articular steroids
- Viscosupplementation
- Prolotherapy
- Platelet-rich plasma
- Acupuncture
- Tai chi/Qigong

Treatment of Knee OA





Transverse suprapatellar anterior scan of the knee. The needle (arrowheads) is introduced through the superolateral portal of the knee into the suprapatellar recess. QT, quadriceps femoris tendons; SPF, suprapatellar fat pad; PFF, prefemoral fat pad.

The Most Accurate Approach for Intra-Articular Needle Placement in the Knee Joint: A Systematic Review

Job Hermans, MSc, MD,* Sita M.A. Bierma-Zeinstra, PhD,*,† Pieter K. Bos, PhD, MD,* Jan A.N. Verhaar, PhD, MD,* and Max Reijman, PhD*

Introduction: Intra-articular needle placement in the knee joint, such as injection or aspirations, are commonly used for therapeutic, diagnostic, and research purposes. Although several approaches can be used to establish an intra-articular injection or aspiration of the knee joint, the accuracy differs per approach.

Objective: To summarize the evidence concerning the accuracy of different approaches for intra-articular needle placements in the knee. Additionally, to assess whether the accuracy of different approaches is related to factors such as underlying disease, severity of underlying disease, approach-related factors, and/or the rate of local reactions.

Methods: The literature was systemically reviewed until July 2010. Risk of bias of the included studies was assessed by the QUADAS tool. Study characteristics were extracted; accuracy results were pooled per approach.

Results: Nine studies were included. The superolateral approach with the leg in extension was studied most (230 injections) and resulted in the highest pooled accuracy of 91% (95% CI 84-99%). The lateral midpatellar approach, the anterolateral approach, and the anteromedial approach resulted in the lowest pooled accuracy rates, 85% (95% CI 68-100%), 67% (95% CI 43-91%) and 72% (95% CI 65-78%), respectively.

Conclusions: The superolateral approach was investigated most and resulted in the highest pooled accuracy rate of 91% (95% CI 84-99%). Nevertheless, this approach still results in a substantial amount of extra-articular needle placements. Guidance of intra-articular needle placements by imaging techniques may enhance the accuracy. The costs and extra time associated with these techniques should be taken into consideration.

 Semin Arthritis Rheum 41:106-115

Viscosupplementation

- Intraarticular injection of hyaluronic acid
  - Rutjes (2012) in a meta-analysis of 89 trials (12667 patients) concluded that in patients with knee osteoarthritis, viscosupplementation is associated with a small and clinically irrelevant benefit and an increased risk for serious adverse events.
  - American Academy of Orthopedic Surgeons (2013)
    - Cannot recommend using hyaluronic acid for patients with symptomatic osteoarthritis of the knee.
    - This conclusion was a strong recommendation
    - Metaanalysis of studies that failed to show a clinically significant benefit from viscosupplementation.

Assessment of clinical practice guideline methodology for the treatment of knee osteoarthritis with intra-articular hyaluronic acid☆

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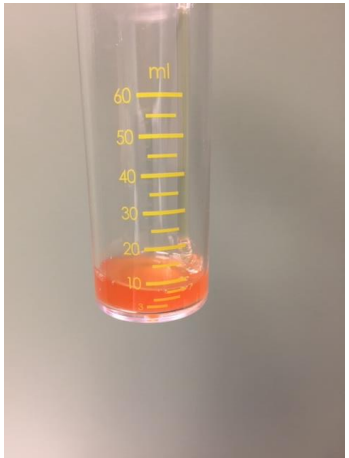
Seminars in Arthritis and Rheumatism 45 (2015) 132–139

Knee OA guideline details

Association	Year	Country		Recommendation	Members	Brief mission statement
Osteoarthritis Research Society International (OARSI)	2014	USA	?	Uncertain—varying quality of evidence and conflicting results	1151 Members distributed globally	Prevention and treatment of osteoarthritis through the promotion and presentation of research, education, and the worldwide dissemination of new knowledge
National Institute for Health and Care Excellence (NICE)	2014	UK	x	Do not recommend—uncertainty and varying quality throughout evidence. Hyaluronic acid is deemed to not be cost-effective	N/A, does not provide membership	Improve outcomes for people using the NHS and other public health and social care services
Veterans Affairs/ Department of Defense (VA/DoD)	2014	USA	?	Uncertain–insufficient evidence available; however, IA-HA may be considered if other treatment options are unsuccessful	N/A, does not provide membership	N/A, no applicable mission statement
American Academy of Orthopaedic Surgeons (AAOS)	2013	USA	x	Do not recommend—based on a lack of IA-HA efficacy, not potential harm. High variability in the quality of current evidence noted.	38,000 Orthopedic surgeons 86.5% US and 13.5% international	Serving (orthopedics) to provide the highest quality musculoskeletal care
American College of Rheumatology (ACR)	2012	USA	✔	No recommendation made regarding the use of IA-HA for initial knee OA management; however, IA-HA is recommended for patients ≥75 that have not had satisfactory clinical response to acetaminophen	9317 Members	Advancing rheumatology
American Academy of Family Physicians (AAFP)	2012	USA	✔	Recommended as a consideration for severe knee OA cases when other treatment options have been unsuccessful	115,900 Family physicians from USA	To improve the health of patients, families, and communities by serving the needs of members with professionalism and creativity
Royal Australian College of General Practitioners (RACGP)	2009	Australia	✔	Grade C recommendation—there is some evidence to suggest that IA-HA is of some benefit for OA of the knee	26,000 Members > 22,000 GPs	To improve the health and well-being of all people in Australia by supporting GPs, general practice registrars, and medical students
National Collaborating Centre for Chronic Conditions (NCC-CC)	2008	UK	x	Do not recommend—Highly variable evidence regarding IA-HA efficacy, deemed not cost-effective	A department of the Royal College of Physicians, which has 29,472 members	A collaborative, multiprofessional center undertaking commissions to develop clinical guidance for the NHS in England and Wales
Agency for Healthcare Research and Quality (AHRQ)	2008	USA	?	Uncertain—due to variability in trial quality and unclear significance	N/A, does not provide membership	To produce evidence to make healthcare safer, higher quality, more accessible, equitable, and affordable
European League Against Rheumatism (EULAR)	2003	France	?	No recommendation made regarding the use of IA-HA for initial knee OA management; however, acknowledgement of potential efficacy	19 Healthcare organizations from various countries within Europe	To stimulate, promote, and support the research, prevention, treatment, and rehabilitation of rheumatic diseases

Platelet Rich Plasma (PRP)

- Blood plasma enriched with platelets
- Concentrated source of autologous platelets
  - PRP contains several different growth factors and other cytokines that stimulate healing of bone and soft tissue
- In-vitro studies have shown PRP increases hyaluronan synthase-2 expression and decreases expression of matrix metalloproteinase-13
  - Stimulating in vivo HA formation and decreasing cartilage metabolism



Efficacy of Intra-articular Platelet-Rich Plasma Injections in Knee Osteoarthritis: A Systematic Review

Carlos J. Meheux, M.D., Patrick C. McCulloch, M.D., David M. Lintner, M.D., Kevin E. Varner, M.D., and Joshua D. Harris, M.D.

Arthroscopy: The Journal of Arthroscopic and Related Surgery, Vol 32, No 3 (March), 2016: pp 495-505

Purpose: To determine (1) whether platelet-rich plasma (PRP) injection significantly improves validated patient-reported outcomes in patients with symptomatic knee osteoarthritis (OA) at 6 and 12 months postinjection, (2) differences in outcomes between PRP and corticosteroid injections or viscosupplementation or placebo injections at 6 and 12 months postinjection, and (3) similarities and differences in outcomes based on the PRP formulations used in the analyzed studies. **Methods:** PubMed, Cochrane Central Register of Controlled Trials, SCOPUS, and Sport Discus were searched for English-language, level I evidence, human in vivo studies on the treatment of symptomatic knee OA with intra-articular PRP compared with other options, with a minimum of 6 months of follow-up. A quality assessment of all articles was performed using the Modified Coleman Methodology Score (average, 83.3/100), and outcomes were analyzed using 2-proportion *z*-tests. **Results:** Six articles (739 patients, 817 knees, 39% males, mean age of 59.9 years, with 38 weeks average follow-up) were analyzed. All studies met minimal clinical important difference criteria and showed significant improvements in statistical and clinical outcomes, including pain, physical function, and stiffness, with PRP. All but one study showed significant differences in clinical outcomes between PRP and hyaluronic acid (HA) or PRP and placebo in pain and function. Average pretreatment Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) scores were 52.36 and 52.05 for the PRP and HA groups, respectively ($P = .420$). Mean post-treatment WOMAC scores for PRP were significantly better than for HA at 3 to 6 months (28.5 and 43.4, respectively; $P = .0008$) and at 6 to 12 months (22.8 and 38.1, respectively; $P = .0062$). None of the included studies used corticosteroids. **Conclusions:** In patients with symptomatic knee OA, PRP injection results in significant clinical improvements up to 12 months postinjection. Clinical outcomes and WOMAC scores are significantly better after PRP versus HA at 3 to 12 months postinjection. There is limited evidence for comparing leukocyte-rich versus leukocyte-poor PRP or PRP versus steroids in this study. **Level of Evidence:** Level I, systematic review of Level I studies.

Platelet-Rich Plasma Versus Hyaluronic Acid Injections for the Treatment of Knee Osteoarthritis

Results at 5 Years of a Double-Blind, Randomized Controlled Trial

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Investigation performed at the Orthopaedic Rizzoli Institute, Bologna, Italy

Background: Platelet-rich plasma (PRP) injections have been proposed as a new conservative option for knee degeneration to provide symptomatic relief and delay surgical intervention. Although the current literature provides some evidence on the benefits of this technique compared with viscosupplementation, no studies have been performed to compare their long-term effects.

Purpose: To compare the long-term clinical outcomes provided by intra-articular injections of either PRP or hyaluronic acid (HA) to treat knee degenerative disease.

Study Design: Randomized controlled trial; Level of evidence, 1.

Methods: Patients with a history of chronic symptomatic knee degenerative changes and osteoarthritis (Kellgren-Lawrence grade 0-3) were enrolled: 192 patients were randomized to undergo 3 blinded weekly intra-articular injections of either PRP or HA. Patients were prospectively evaluated before the injection and then at 2, 6, 12, and 24 months and a mean of 64.3 months (SD, 7.8 months) of follow-up. Evaluation was based on International Knee Documentation Committee (IKDC) subjective (main outcome), EuroQol visual analog scale, and Tegner scores; 167 patients reached the final evaluation.

Results: Both treatments were effective in improving knee functional status and symptoms over time: Mean ± SD IKDC subjective score improved significantly for both PRP and HA groups ($P < .0005$) and remained stable over time up to 24 months (from 53.3 ± 14.3 to 67.3 ± 18.1 and from 50.3 ± 13.2 to 62.1 ± 20.8 for PRP and HA groups, respectively). At final evaluation, a significant IKDC reduction was observed in both treatment groups, with the PRP group still presenting significantly higher values compared with baseline: PRP 60.5 ± 19.0 ($P < .001$ vs baseline), HA 55.7 ± 18.8 (not significant vs baseline). A comparative analysis showed no significant intergroup difference in any of the clinical scores at any follow-up point. The median duration of patient subjective perception of symptomatic relief was 9 months for HA and 12 months for PRP (not significant). The only significant difference was observed in the rate of reintervention at 24 months, which was significantly lower in the PRP group (22.6% vs 37.1%, $P = .036$).

Conclusion: Both treatments were effective in improving knee functional status and symptoms over time. PRP did not provide an overall superior clinical improvement compared with HA in terms of either symptomatic-functional improvement at different follow-up points or effect duration.

The American Journal of Sports Medicine
2019;47(2):347–354
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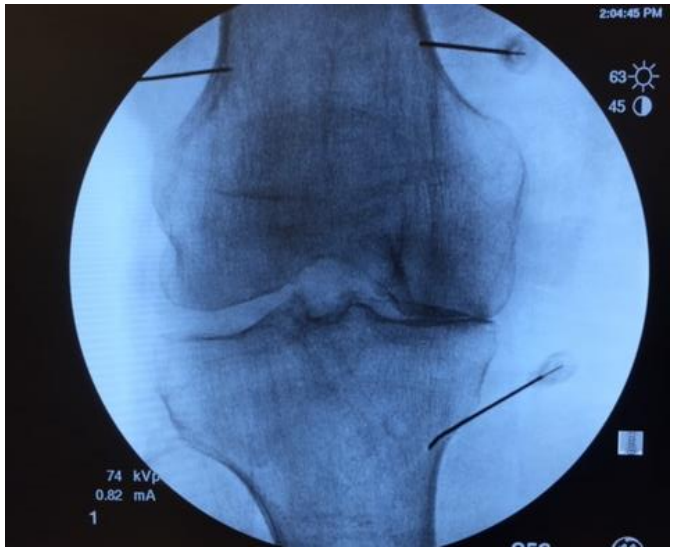
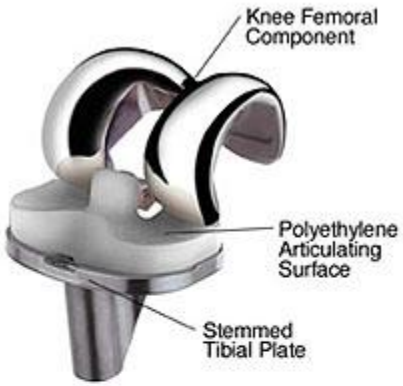
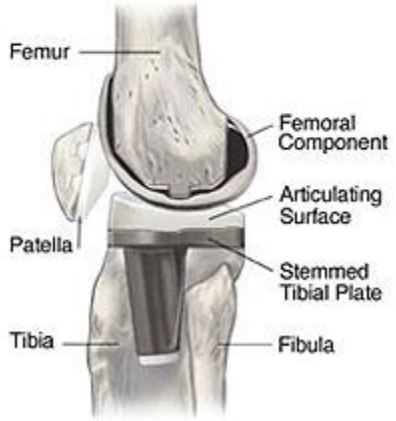
Genicular nerve RFA

- Genicular nerves are articular sensory nerve branches to the knee
- May be alternative to patients who are not surgical candidate or persistent pain after TKA
- Anterior knee pain
- RFA of the superolateral, superomedial, and inferomedial genicular nerves after successful blocks
- May add middle genicular nerve



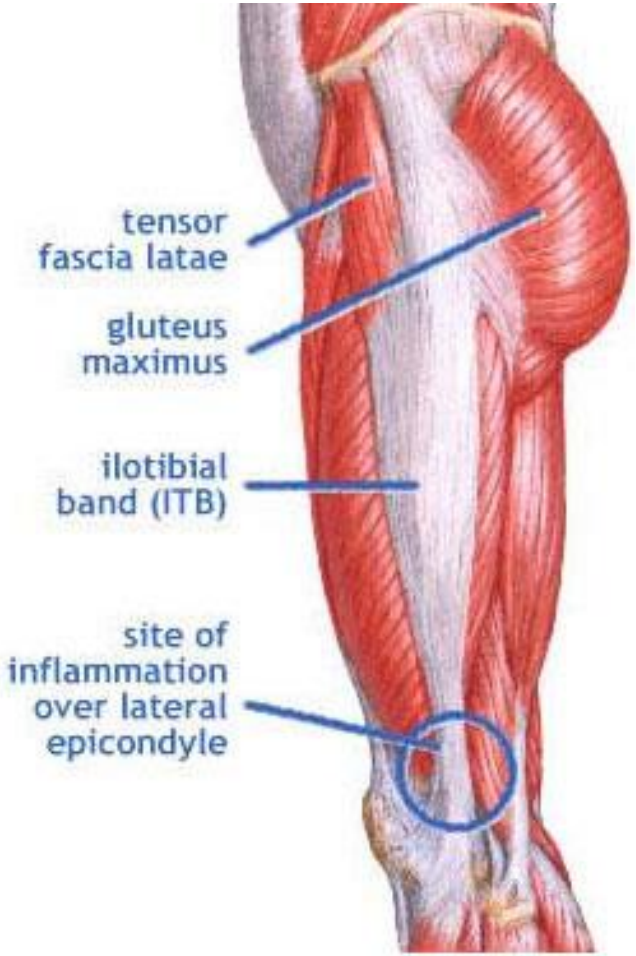
Treatment of Knee OA





- Surgical referral when
  - Conservative measures fail
  - Total knee replacement is considered
    - Treatment of last resort, but is very effective.
    - 85% of the knee will last 20 years

Iliotibial Band Syndrome



- The Iliotibial band is a long tendinous structure which runs antero-laterally across the knee joint
- The IT Band can become inflamed from repeated friction and rubbing on the lateral femoral epicondyle, as the knee is repeatedly flexed and extended (as in running)

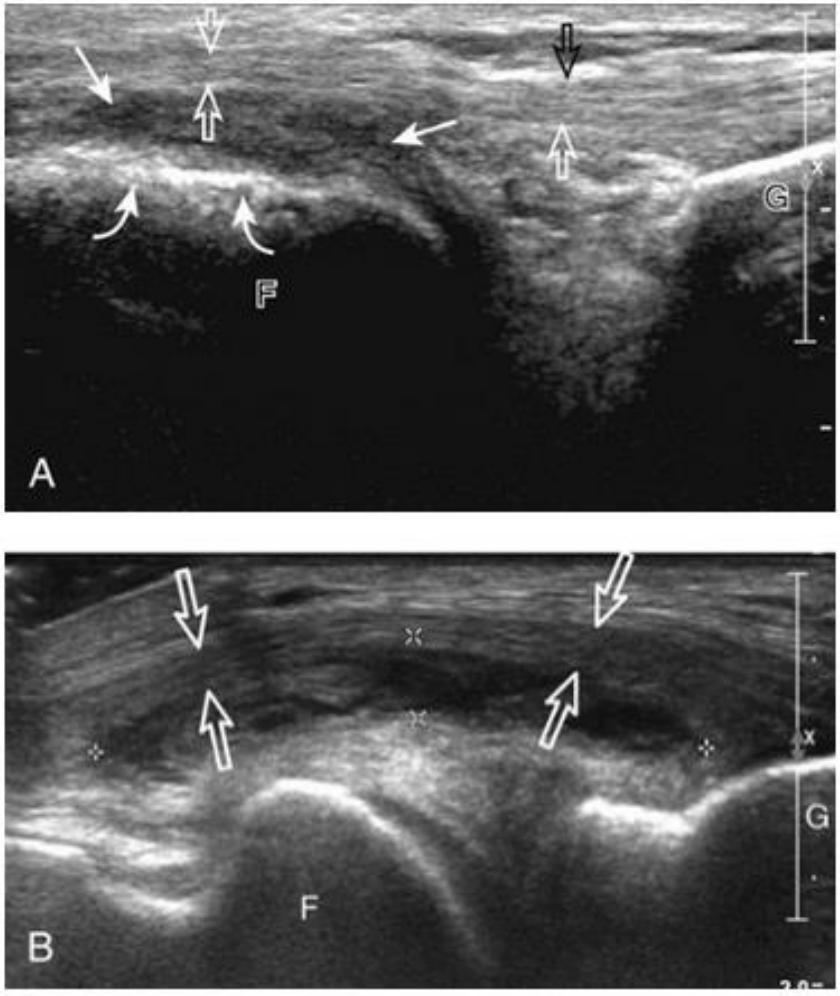
Symptoms of IT Band Syndrome

- The syndrome typically occurs in runners
- Made worse by:
  - Weak hip abductors
  - Circular track running (which can lead to asymmetric muscular development)
  - Running on a graded or crowned surface
  - Genu varum (bow legs)
  - Overpronation of the foot
  - Getting up from sit to stand

Diagnosis of ITB Syndrome

- Typical presentation of pain and aching on the outside of the knee, with or without a sliding or popping sensation.
- Positive Ober's Test
  - Indicates ITB contracture
  - Patient positioned side-lying with affected side up
  - Flex the knee and extend the hip
  - Reproduction of symptoms is a positive test
  - May feel IT band sliding and popping laterally

Diagnosis of ITB Syndrome



Ultrasound images long axis to the iliotibial tract in two different patients show (A) **hypoechoic soft tissue thickening** (arrows) and (B) **heterogeneous but hypoechoic bursa** (between cursors) deep to the iliotibial tract (open arrows). Note **bone irregularity of the femur in A (curved arrows)**. F, femur; G, Gerdy tubercle of tibia.

Treatment IT Band

- Activity modification
  - Conditioning
- Correct underlying problem (e.g., arch supports for over-pronation, avoid track running)
- Physical therapy aimed at strengthening hip abductors (the tensor fascia lata, which inserts into the ITB)
- Foam roller

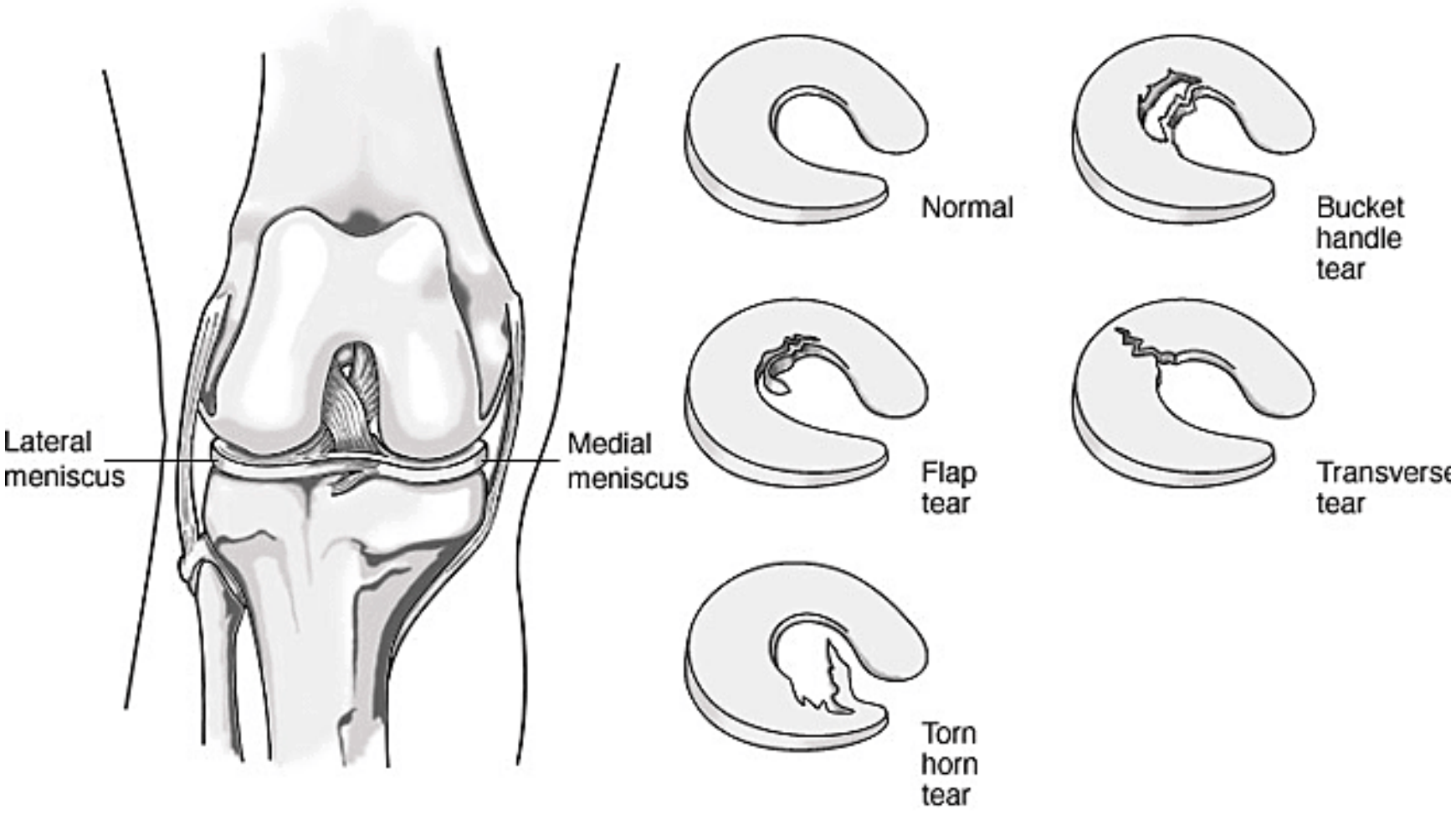
Meniscal Tears

- The medial and lateral menisci are easily frayed and torn by repeated rotational and axial stress.
- May occur acutely or slowly over time.
- May be injured in combination with other ligaments or tendons
  - "O' Donoghue's Triad" or "Unhappy Triad"
    - Medial meniscus
    - Medial collateral ligament
    - ACL

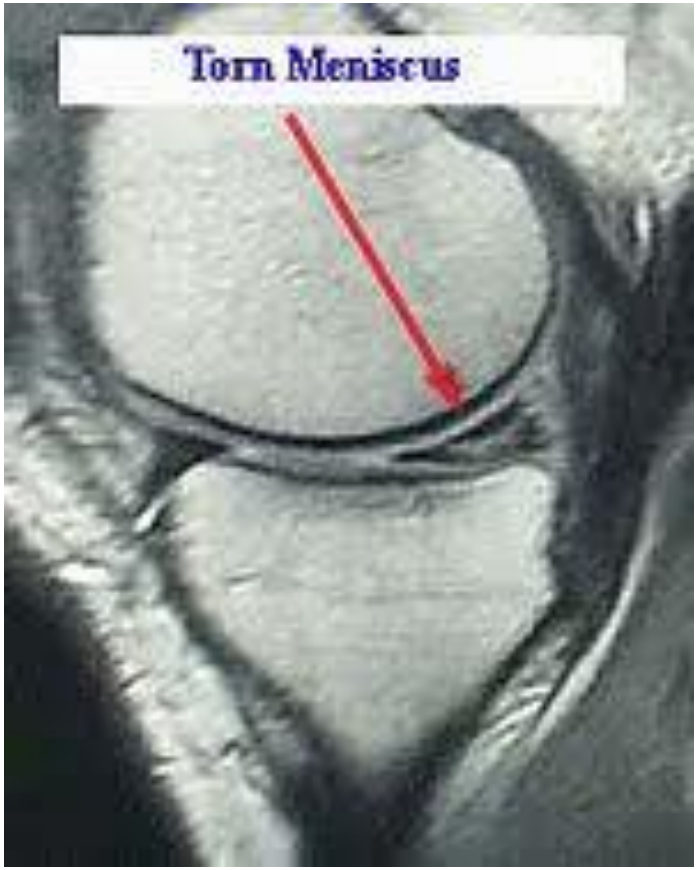
Diagnosis of Meniscal Tears

- Typical presentation of medial or lateral pain with twisting of the knee
- In acute injury, consider the mechanism, the location and the degree of pain and swelling.
- Pain typically occurs directly over the medial or lateral joint line.
- Locking of the knee can occur if the tear is large enough, such as a so called “bucket handle” tear.

Menisci


Lateral meniscus
Medial meniscus
Normal
Bucket handle tear
Flap tear
Transverse tear
Torn horn tear

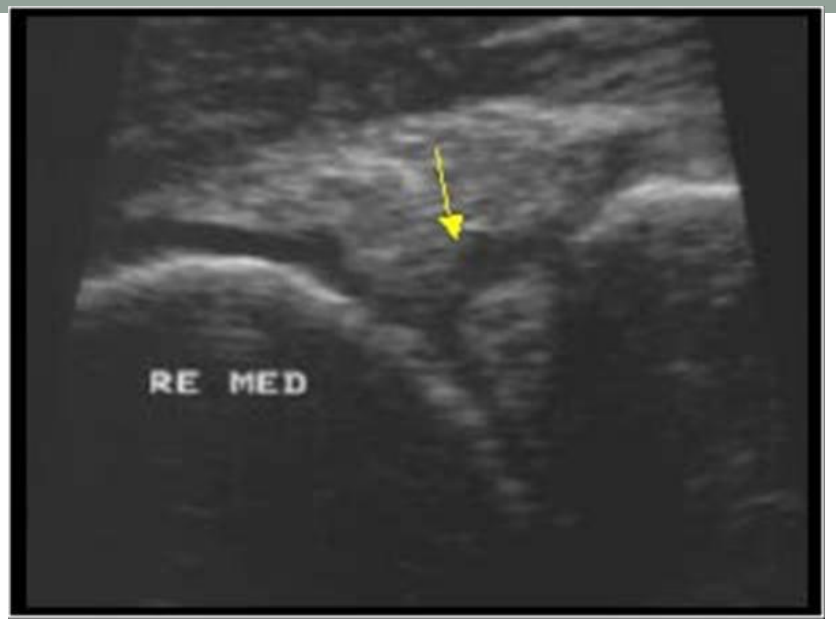
MRI Meniscus



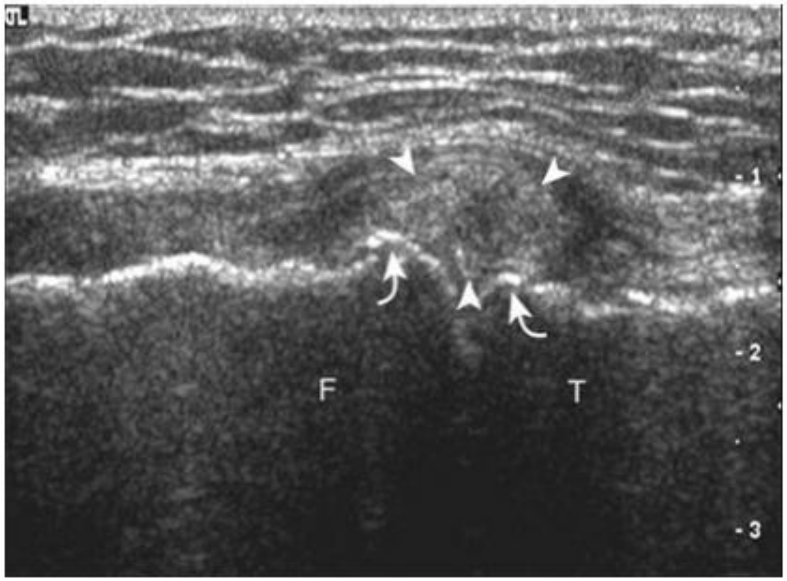
Menisci

- Bucket-handle meniscus tear
  - Tear around the rim of the meniscus
  - Generally involve large amounts of the meniscus
    - May limit range of motion if the tear is large enough to get caught inside the knee.
  - Central portion (the bucket-handle) displaces into the joint.
  - Tend to occur in younger patients
  - Always traumatic injuries (compared to degenerative tears seen in patients with early signs of wear and tear in the knee)
  - Often amenable to meniscus repair (rather than meniscectomy)

Normal Meniscus



Medial Meniscus tear



Medial Meniscus extrusion

Physical Exam Meniscal Tears

- Palpate the joint through its full range of motion, feeling for crepitus or locking.
- Test for localized pain over the involved joint line
  - Push there firmly.
- Look for a joint effusion, which may be subtle
- Diagnosis is highly suggested if you can reproduce symptoms by causing a twisting, axial load on the torn meniscus
  - McMurray's test
  - Apley's compression test
  - Thessaly test

Treatment

- Not all require surgery – many smaller tears will heal or become asymptomatic.
  - In adults, peripheral 3 mm of the menisci as well as anterior and posterior horns are well vascularized;
- Activity modification ("if it hurts, don't do it")
  - Avoid sports like tennis, basketball and soccer which require a lot of side-to-side cutting and quick starting-stopping.
- Ice, NSAIDS for acute injuries and then as needed.
- MRI is indicated when you are considering surgical referral

Katz et al NEJM March 2013

- To determine whether arthroscopic partial meniscectomy for symptomatic patients with a meniscal tear and knee osteoarthritis results in better functional outcomes than nonoperative therapy
- Multicenter, randomized, controlled trial involving symptomatic patients 45 years of age or older with a meniscal tear and evidence of mild-to-moderate osteoarthritis on imaging.
- 351 patients randomly assigned to surgery and Postop PT or standardized PT with option to cross over to surgery
- Pts evaluated at 6 and 12 months with respect in change in WOMAC score

- Results: Improvement in the WOMAC score after 6 months was 20.9 points in the surgical group and 18.5 in the physical-therapy group
- The results at 12 months were similar to those at 6 months.
- Conclusions: In the intention-to-treat analysis, they did not find significant differences between the study groups (PT vs surgery) in functional improvement at 6 months

ESCAPE Clinical Trial

- JAMA Oct 2, 2018 by van de Graaf et al group from the Netherlands
- Effect of early surgery vs physical therapy on knee function among patients with nonobstructive meniscal tears
- Non-inferiority randomized clinical trial
- 321 patients
  - 159 randomly assigned to arthroscopic partial meniscectomy
  - 162 randomly assigned to PT (16 sessions of exercise therapy over 8 weeks focusing on coordination and closed kinetic chain strength exercises)

ESCAPE Clinical Trial

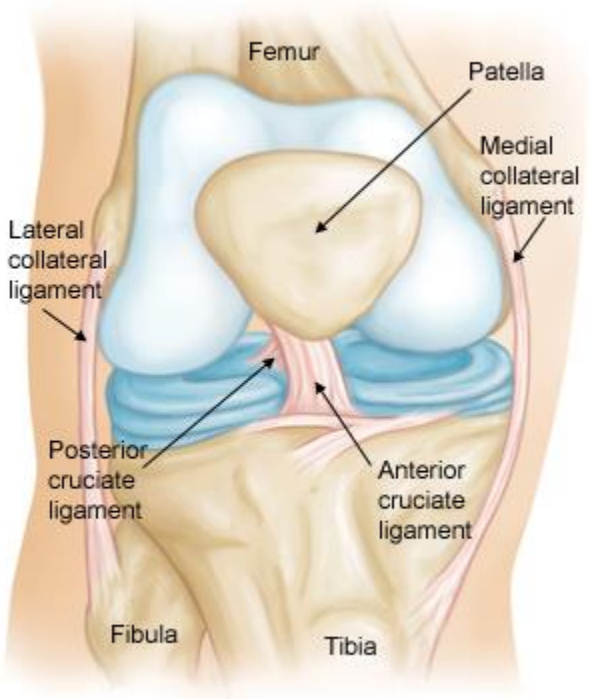
- Self-administered questionnaire on knee function (International Knee Documentation Committee Subjective Knee Form) from baseline over 24 month period
  - PT group: improved by 20.4 points
  - Surgery group: improved by 26.2 points
- Conclusion
  - Patients with nonobstructive meniscal tears, PT was noninferior to arthroscopic partial meniscectomy for improving knee function over 24 month period. PT may be considered an alternative to surgery

Treatment

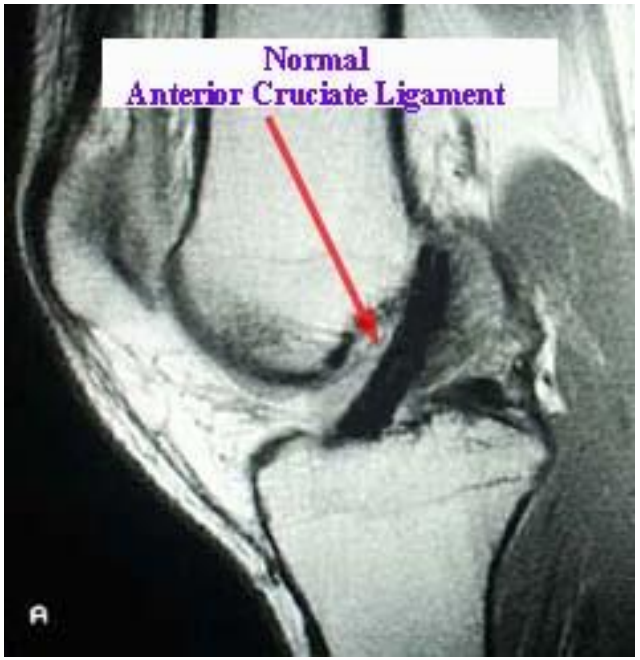
- Refer to surgery when:
  - Conservative measures fail and/or symptoms persist
  - The knee locks or catches more than once.
  - An athlete who needs to return to play quickly

ACL Tear

- Mechanism of injury is key to diagnosing knee injuries – twisting, often noncontact pivoting
- Common in female athletes
- "Pop" felt – and often heard by others.
- Acute, severe pain.
- Immediate knee effusion (hemarthrosis) which resolves in 1-3 weeks.
- Medial meniscus and/or MCL may be torn simultaneously (O' Donoghue's triad)


Femur
Patella
Medial collateral ligament
Lateral collateral ligament
Posterior cruciate ligament
Anterior cruciate ligament
Fibula
Tibia

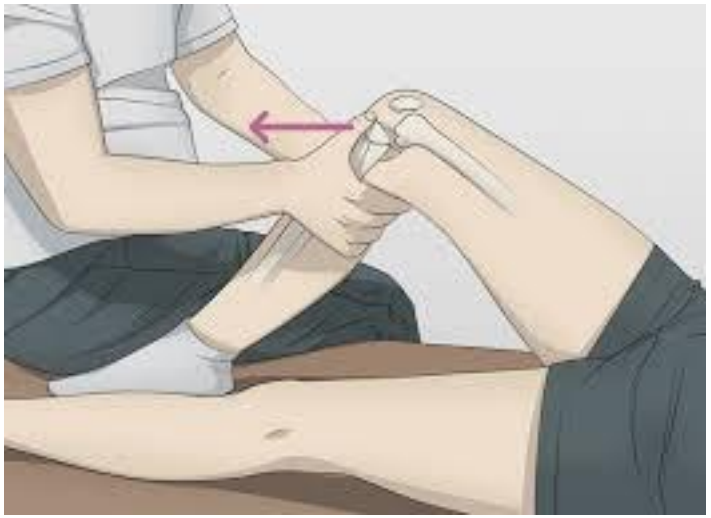

Complete Tear of the Anterior Cruciate Ligament
© SCHNITZ

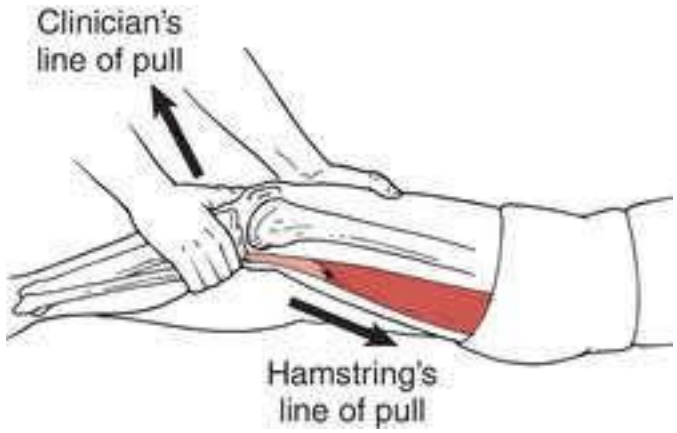

Normal
Anterior Cruciate Ligament

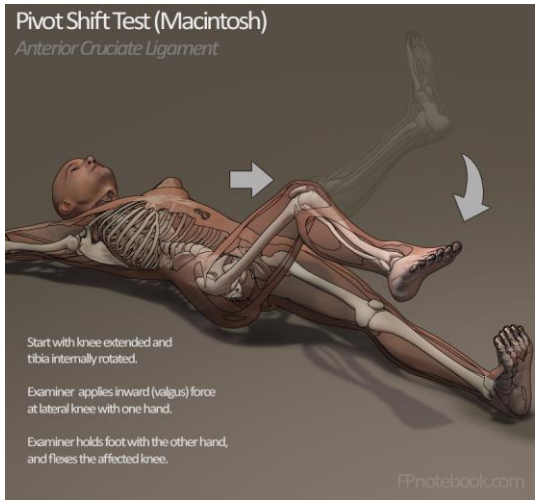

Torn
Anterior Cruciate Ligament

Physical Exam

- Anterior Drawer Test
- Lachman's Test
- Pivot Shift test







Treatment

- Acutely: Immobilize knee and make patient non-weight bearing until extent of injury can be evaluated
- Often waiting 3 days for swelling to resolve results in more accurate physical exam
- Limited weight bearing at 3-4 days
- Ice, Elevation, NSAIDS
- Obtain MRI if surgery considered or diagnosis in question

Surgical Referral

- Young patients under 40 and active older patients who plan to return to activity
- Any patient experiencing instability with routine activity
- Frobell (2010) in NEJM study
  - structured rehabilitation plus early ACL reconstructive surgery is not superior in pain and function to structured rehabilitation with delayed optional ACL reconstruction

Collateral Ligament Injury

- After ACL injury, medial collateral ligament injury is the most common knee injury
- Injuries often occur due to lateral force

Collateral Ligament

- Collateral ligament graded in severity
  - Grade I- strain, no fibers torn
  - Grade II- partial tear
  - Grade III- complete disruption
- Usually heal with conservative therapy including RICE, PT
- Refer to surgery usually only done with association of another injury such as ACL tear

Posterior Cruciate Ligament Tear

- Most uncommon of all tears
- Mechanism difficult to achieve- requires anterior force pushing tibia posteriorly against stationary femur (ex dashboard trauma or sports)
- + "Sag Sign", + posterior drawer test
- Injuries rarely require surgery

Summary

- Many reasons for knee pain
- History and physical examination
- Imaging can be helpful
- Most of the time conservative management can help with knee pain
- Surgery is usually the last resort

- Questions?