Science Education Collection

Knee Exam

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Overview

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The knee is a hinged joint that connects the femur with the tibia. It is the largest joint in the body, and due to its location in the middle of the lower leg, it is subjected to a variety of traumatic and degenerative forces. Examination of the knee can be quite complex, owing to the fact it is an inherently unstable joint held together by various ligaments and supported by menisci, which act as shock absorbers and increase the contact area of the joint. In addition, the patella lies in front of the knee, acting as a fulcrum to allow the forceful extension of the knee needed for running and kicking. As the largest sesamoid bone in the body, the knee is a common source of pain related to trauma or overuse.

When examining the knee, it is important to remove enough clothing so that the entire thigh, knee, and lower leg are exposed. The exam begins with inspection and palpation of key anatomic landmarks, followed by an assessment of the patient's range of motion (ROM). The knee exam continues with tests for ligament or meniscus injury and special testing for patellofemoral dysfunction and dislocation of the patella. The opposite knee should be used as the standard to evaluate the injured knee, provided it has not been previously injured.

Procedure

1. Inspection

1. Ask the patient to walk, and observe for limping and pain.
2. Carefully compare both knees and look for the following:
    1. Swelling or effusion: Suggested when the injured knee is visibly larger than the uninvolved knee. Swelling is defined as enlargement of the knee outside of the joint and is due to bleeding or excessive fluid in the soft tissues around the knee. Effusion, on the other hand, is due to bleeding or excessive fluid inside the knee joint. Palpating for effusion is often needed to determine whether a knee is enlarged due to swelling or a joint effusion.
    2. Ecchymosis: Bruising around the knee as seen in recent trauma.
    3. Quadriceps atrophy: Seen within a few weeks of a significant internal derangement, such as a ligament or cartilage tear.

2. Palpation

1. Palpation for swelling and effusion
   Encircle your fingers around the kneecap to evaluate for swelling. Swelling in front of the kneecap suggests pre-patellar bursitis or infection, while swelling behind the kneecap suggests a knee joint effusion and likely significant internal derangement. The amount of effusion has some diagnostic significance and can be roughly graded from 0 to 3+ where 0 stands for no effusion, 1+ stands for the trace effusion as seen in osteoarthritis or old meniscal tear, 2+ stands for the moderate effusion as seen in posterior cruciate ligament (PCL) or meniscal tear, and 3+ stands for large effusion that can indicate anterior cruciate ligament (ACL) tear or patellar dislocation.
2. Palpation for tenderness
   Location of the pain can suggest which structures might be injured.
   Have the patient in the supine position and palpate the following areas with your fingertips:
    1. Tibial tubercle: Feel for the roughened protrusion on the anterior surface of the proximal tibia (below the front of the knee in the midline). It is the insertion site for the patellar tendon. Tenderness here suggests Osgood Schlatter's disease in a child or adolescent.
    2. Patella: Palpate with your fingertips over and around patella (the large bone in front of the knee joint). Tenderness or pain around or under the patella suggests patellofemoral pain; over the top of the patella suggests pre-patella bursitis; under the patella suggests patellofemoral pain or chondral injury. Tenderness or pain at the inferior pole of the patella suggests Synding-Larsen disease (patella apophysitis).
    3. Patellar tendon: Palpate the broad rope-like structure, which begins just above the tibial tubercle and extends to the lower pole of the patella. Tenderness here suggests tendonitis.
    4. Joint line: This can be felt along the side of the knee, both medial and lateral. Tenderness or pain at the joint line may suggest a meniscus tear or osteoarthritis.
    5. Medial aspect of the knee: Palpate the medial collateral ligament (MCL), extending from the medial femoral condyle to the proximal medial tibia and the pes anserine bursa, located just below the anterior medial joint line.
    6. Lateral aspect of the knee: Palpate the lateral collateral ligament (LCL), which extends from the lateral femoral condyle to the proximal lateral tibia and fibula and the iliotibial (IT) band, which runs from the hip along with lateral side of the leg and hip and attaches on the lateral tibia at Gerdy's tubercle.

3. Range of Motion (ROM)

The ROM of the knee joint is generally assessed passively, with the patient lying supine. The knee should be checked for the following motions:

1. Extension (0°)
    1. Ask the patient to fully straighten the leg. A lack of knee extension suggests mechanical block (often from a torn meniscus, loose body, or large effusion).
    2. To detect a more subtle lack of extension, have the patient lying prone with thighs supported by the end of an examination table, and observe for the difference in heel height.

2. Flexion (130°): Ask the patient to lie supine and bend the knee as much as possible, bringing the heel as close to the buttocks as possible. Flexion can be limited by joint effusion or quadriceps spasm.
3. Extensor Mechanism: Ask the patient to actively straighten the knee in the sitting position. It is essential to check for active knee extension to assess the integrity of the extensor mechanism (quadriceps muscle and tendon, patella, and tibial tubercle).
4. Crepitus: Feel for crepitus (palpable grinding produced by motion) by placing the palm of your hand over the knee as the knee is either actively or passively flexed and then extended. This sign is rarely clinically significant unless associated with pain, effusion, or limitation of motion.

4. Ligament Testing

1. Test the medial collateral ligament (MCL) and lateral collateral ligament (LCL) for pain and laxity.
    1. Place the patient in the supine position.
    2. Passively extend (straighten) the patient's knee and then slightly flex it (to 20°).
    3. Test the MCL by applying valgus stress by holding the patient's ankle with one hand, while pushing against the lateral side of the knee with your other hand
        1. Score the MCL injury by pain and laxity.
        Laxity to valgus stress applied with the knee in full extension suggests injury to the ACL and/or PCL, as well as the MCL. The ACL and PCL are taut when the knee is in full extension and should thus act to prevent valgus laxity in this position. Bending the knee to 20° loosens these ligaments and allows isolated testing of the MCL.

    4. Test the LCL by exerting a varus stress by holding the ankle with one hand, while pushing against the medial side of the knee with your other hand, also with the knee extended and then flexed to 20°.
        1. Use the same grading for an MCL injury to describe an injury to LCL.
        The LCL is much less commonly injured than the MCL. If significant laxity to varus stress is noted, suspect more serious injury to the posterolateral corner of the knee. Such an injury may accompany a knee dislocation and warrants urgent orthopedic referral.

2. Evaluate the ACL by performing the following tests:
    1. Lachman test: With the patient supine and the knee in 20° of flexion (as described above), grasp the proximal tibia with one hand and apply an anteriorly directed force on the tibia while stabilizing the thigh with your other hand placed on the lateral side of the femur. This is the definitive exam to evaluate for an ACL tear.
    2. Anterior Drawer test: With the patient lying supine and the knee in 90° of flexion, place your hands around the upper aspect of the tibia, with your thumbs in the front of the knee, and pull the tibia forward. The sensitivity of this exam is limited because with the knee flexed to 90°, the collateral ligaments are taut and restrain anterior motion.
    3. Pivot shift: With the patient supine, grasp the leg by the foot and rotate the leg internally while flexing the knee past 20° and applying a slight valgus stress (pushing outside of knee medially). Look for the tibia to shift forward. This test is helpful in assessing the secondary restraints of the knee joint, and will usually be positive only when the knee is very lax. This test is often painful, which limits its usefulness.

3. PCL testing
    1. Posterior drawer test: position the patient and place your hands as for anterior drawer test and push the tibia posterior. Significant posterior displacement of the tibia suggests a PCL injury.
    2. Sag sign: position the patient supine with the knee flexed to 90° and foot flat on exam table. Note if the tibia sags (drops back) with respect to the femur. This suggests a PCL tear with significant posterior laxity.

5. Meniscal Tests

The tests done to evaluate for meniscal injury are often non-specific with a high rate of false positives. The most common meniscal tests described include:

1. Bounce test: With the patient lying supine, force the knee into full extension by pushing down on the kneecap. An injured meniscus will cause significant pain as it gets pinched with knee extension.
2. Joint line tenderness: Palpate along medial and lateral joint lines, where the meniscus is located. Tenderness here suggests injury to either the meniscus or osteoarthritis.
3. Prone knee extension: Ask the patient to lie prone with both knees hanging just off the end of the exam table, and then look for a difference in heel height. This may indicate a mechanical block to knee extension caused by a torn and displaced meniscus.
4. Duck walk: Ask the patient to get into a full squat and then walk in the squatted position. If able to do this, the patient is unlikely to have a significant cartilage or ligament injury.
5. McMurray's test
    1. With the patient lying supine, place one hand on the knee (providing varus stress) and the other hand on the heel.

2. Perform the test by flexing and extending the patient's knee while internally and externally rotating the tibia. A significant clunk with this maneuver may indicate a displacing meniscal tear. This test should be done with caution as it may cause a torn meniscus to displace and lock the knee joint. The usefulness of this test is limited by its high rate of false positives.

6. Apley compression test
    1. Have the patient lie prone on the examination table with the knee bent to 90°.
    2. Passively flex and extend the patient's knee while rotating the tibia both internally and externally with one hand, and simultaneously apply an axial load on the knee joint by pushing down on the heel with the other hand.
    3. Watch for a significant clunk during this maneuver, which may indicate a torn meniscus. The utility of this test is also severely limited by a high false positive rate.

6. Patella Tests

Several tests can be done to evaluate for patellofemoral dysfunction, pain, or dislocation. The patella tests are performed with the patient lying in the supine position.

1. Apprehension test: Push the kneecap in a lateral direction. The test is positive when the patient becomes apprehensive that the patella may recurrently dislocate. This suggests a prior patella dislocation.
2. Patella grind test: Push down on the kneecap and grind it back and forth. This test can aggravate the pain of patellofemoral dysfunction and has a very high false positive rate.
3. Q-angle (quadriceps angle): With the patient lying supine, estimate the angle formed by a line connecting the anterior superior iliac spine (ASIS) of the hip and the center of the patella, with a line down the anterior tibia (from the center of the patella to the tibial tubercle). Angles greater than 10° in male and 15° in female predispose to patellofemoral problems. The wider pelvis seen in women increases the Q-angle and predisposes the patient to patellofemoral pain.

Summary

Examination of the knee is best done following a stepwise approach with the patient in sitting and supine positions. The patient should be observed for limping or pain while walking into and out of the exam room. It is important to have the patient remove enough clothing so that the surface anatomy of the knee can be seen and compared to the uninvolved side. The knee exam should begin with inspection, looking for asymmetry between the involved and uninvolved knee, noting whether the involved knee is larger (indicating swelling) or smaller (indicating muscle atrophy). This is followed by palpation of key structures around the knee, looking for tenderness, swelling, warmth, or deformity. Next, ROM should be assessed, first actively and then passively, while comparing to the uninvolved side. From there, one should move on to assess common pain generators in the knee, including the various ligaments, meniscus, and patella.