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The Diagnosis of Knee Pain

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Abstract
The knee is open to injury because it is designed for rapid action, not simply during its large excursion from extension to full flexion, but also lesser accommodative movements of rotation, tilt and glide. As if that were not enough, that highly developed but sometimes temperamental sesamoid, the patella, adds its own unique problems. The complexities of these movements are reflected in the subtleties of the structure of the knee. Regrettably they have also led to a proliferation of clinical tests and surgical repairs whose sophistication confuses rather than enlightens.

Before enquiring about the characteristics of the painful knee the general characteristics of the patient should be assessed quickly. In children problems usually relate to patellar malalignment syndromes, possibly a discoid meniscus, and the aching discomfort produced by traction apophysitis such as Osgood-Schlatter's disease of the tibial tuberosity. After puberty girls are particularly likely to develop patellar pain, which may be associated with lateral subluxation of that bone. In the young woman the sources of such pain may be so prolix that the surgeon may do more harm than good if he operates. During adolescence and early adult life males are most likely to suffer from meniscal and ligamentous tears, often brought on by exertion or accidents during sport. A patient with an endomorphic physique usually has associated genu valgum and may present with medial ligament sprains and patello-femoral pain. Those with ligamentous laxity are also prone to sprains and patellar subluxation. The mesomorphic athlete is likely to injure the menisci, or may come in with significant tears of the ligaments and synovium.

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THE DIAGNOSIS OF KNEE PAIN

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Before enquiring about the characteristics of the painful knee the general characteristics of the patient should be assessed quickly. In children problems usually relate to patellar malalignment syndromes, possibly a discoid meniscus, and the aching discomfort produced by traction apophysitis such as Osgood-Schlatter's disease of the tibial tuberosity. After puberty girls are particularly likely to develop patellar pain, which may be associated with lateral subluxation of that bone. In the young woman the sources of such pain may be so prolix that the surgeon may do more harm than good if he operates. During adolescence and early adult life males are most likely to suffer from meniscal and ligamentous tears, often brought on by exertion or accidents during sport. A patient with an endomorphic physique usually has associated genu valgum and may present with medial ligament sprains and patello-femoral pain. Those with ligamentous laxity are also prone to sprains and patellar subluxation. The mesomorphic athlete is likely to injure the menisci, or may come in with significant tears of the ligaments and synovium.

The older patient begins to experience pain from degenerative changes in the knee which affect principally the menisci and articular cartilage. Symptoms arising from osteoarthritis, rheumatoid arthritis and allied arthropathies, such as haemophilia, constitute a major area of endeavour for the Orthopaedic Surgeon, but that lies beyond the scope of this article.

HISTORY TAKING:

The circumstances of an injury to the knee should be carefully recorded in a manner that would do justice to the police. The mechanism of injury should be recorded if possible although accidents are rarely recalled in detail. Was the violence direct or indirect? Was the knee flexed or extended? Was it weightbearing at the time of the injury, and was weightbearing possible immediately after? Could the patient finish the game of football or did he have to be carried off immediately? If the knee became swollen, how quickly did this develop? (A haemarthrosis is usually evident within two hours of injury, whereas an effusion will take six or more hours to develop).

Locking:

Locking of the knee should be carefully sought after, remembering that it classically refers to a block to extension. A major loss of extension, perhaps over 30 degrees, suggests ligament disruption rather than a meniscal lesion. Did the locking persist, or was it possible to straighten the knee after a certain manoeuvre? Has the locked knee gradually straightened out with forceful attempts at extension, suggesting that the tear has been completed anteriorly through the substance of the meniscus? Is the locking intermittent but regular? A loss of flexion always accompanies a block to extension, and the patient will find squatting impossible.

Instability:

The knee may also give way after an injury and

this may either be due to the instability resulting from a ligament rupture, or from meniscal pathology. Another common cause of giving way occurs when the patella subluxes laterally, but this is more usually a spontaneous feature, particularly in the individual with poorly developed quadriceps. Sometimes the instability will only be evident when the patient is changing direction, with no apparent problem when walking in a straight line on level ground. Ascending and descending stairs, particularly the latter, may produce discomfort and a feeling of uncertainty in the knee. This feature is not specific for any single internal derangement, but is a common complaint. Kneeling may also prove difficult, particularly in those with a damaged meniscus, and sitting for prolonged periods of time may precipitate acute discomfort in those with patello-femoral pathology.

The history should include any relevant past history, and previous injury or infection of the joint should be recorded. A family history of similar symptoms may be present, particularly in those prone to patellar subluxation or meniscal tears. In those suspected of an inflammatory condition, the enquiry must include the possibility of rheumatoid arthritis or a venereal arthropathy.

Fig. 1. The arthroscopic appearance of the normal meniscus with a smooth inner rim. The femoral and tibial articular surfaces can be seen above and below.

CLINICAL EXAMINATION:

Before asking the patient to lie on the examination couch, watch for the presence of a limp or any other abnormality in gait. Remember that pain in the knee, particularly in children, may stem from pathology in the hip joint. A good "acid" test of significant internal derangement of the knee is to check whether the patient can squat fully. A tell-tale loss of full flexion in the affected knee indicates damage to the meniscus or possibly the presence of an effusion. An even more demanding test is then to ask the patient to "duck waddle" by walking in the squatting position. This stresses the joint particularly severely.

If the examination is to be thorough a particular order should be followed, such as:—

1) to look

2) to feel

3) to move the knee.

Inspection:

Inspection should include the appearance of the skin, and the presence or absence of swellings such as prepatellar or infrapatellar bursae, a popliteal cyst, a saphena varix or a lateral meniscus congenital cyst. The chronically injured or inflamed knee will show a classical reversal in contour, in that the quadriceps muscle wastes and the synovial envelope hypertrophies. The presence of scars should complement details culled from the history. Valgus, varus and torsional abnormalities of the knee should be assessed and may have a bearing on the source of the pain. Patella alta is said to be more common in those suffering from retropatellar pain, and the general alignment of the patellae should also be observed. Quadriceps wasting is best measured at this stage and should be compared to the normal leg by a measurement of the thigh girth at a set level above the superior pole of the patella. Muscle wasting in the distal parts of the legs should be noted, and the knee, ankle and plantar reflexes assessed.

Palpation:

The next step is to palpate the knee. Four specific features are assessed, two with the knee straight and two with the knee flexed to 90

degrees. The posterior surface of the patella can be palpated partially when the knee is extended. The patient is asked to relax the quadriceps completely and this loosens the patella within its femoral groove and permits the examining finger to palpate approximately one-quarter of the posterior surface medially and again laterally. The next step is to trap the patella with the hand placed firmly over the superior pole, and then ask the patient to straighten the knee. This "patellar restraint" test produces a posteriorly directed vector of force, and acute pain is felt if a painful patellar condition is present. The other knee should be assessed in a similar manner since the discomfort produced by this test is often felt bilaterally.

A second palpation test with the knee straight is the quantification of fluid in the joint. Using the medial hollow of the knee, evident in most people at the level of the patella, the presence or absence of a fluid shift into this site can be checked. Major effusions will of course fill this space so completely that no hollowing is present and a patellar tap can be elicited. A moderate effusion will fill the medial hollow of its own accord after the examining hand has swept fluid upwards into the patellar pouch. In a minor effusion the trace of fluid present will not fill the hollow unless, after sweeping fluid upwards, the examining hand then empties the suprapatellar pouch. This shift of fluid is best achieved by sweeping the hand round the lateral side of the patella to the suprapatellar pouch. The hand should not be taken further round the knee over the area of the medial hollow since this will obscure the events at that site.

The knee is now bent to 90 degrees and in this position the joint lines can be palpated relatively easily. They lie at right angles to the plane of the shin, and can be located at the level of the lower pole of the patella. Careful fingertip pressure over discrete portions of the joint line permits a precise evaluation of the sites of tenderness. Joint line tenderness is of course synonymous with meniscal pathology unless proved otherwise, but there is a "no man's land" medially where the tibial collateral ligament crosses the joint line. This should be appreciated and palpation is then directed to assessing the points of attachment of the two collateral ligaments. Medially, the regions of the adductor tubercle proximally and the tibial flare distally should be felt. Laterally the fibular collateral ligament is more posteriorly placed and of course inserts into the head of the fibula. Other sites of capsular tenderness should be sought in this second stage of palpation when the constraining structures of the knee are being assessed.

Fig. 2. This view looks into the concavity of a medial meniscus. A horizontal cleavage lesion can be seen in the central portion of the meniscus, with a resultant "fish-mouth" abnormality.

Movement:

The final stage in examining the knee consists of moving the joint. Extension should be measured with the patient lying prone. This ensures that the back of the knee is examined, but equally important is the fact that it affords a fairly accurate assessment of minimal losses of extension. The patient is asked to hang the legs over the edge of the examining couch, with the knee joints at the edge of the couch. Any slight elevation of the heel on the affected side indicates a loss of full extension, and the eye is far better equipped in assessing a distance of this sort than minor alterations of angle. In the same way, full flexion is measured, with the patient lying prone or supine, by measuring in finger breadths the heel to buttock distance on either side.

During flexion and extension abnormalities of patellar mechanics can be roughly assessed by watching how the patella "tracks" in the femoral groove. Pain and crepitus during movement should also be recorded. Discomfort, and particularly a clunking sensation produced by rotating the tibia internally and externally when the knee is in flexion, suggests an internal derangement is present, although the test is by no means specific for a torn meniscus.

Coronal laxity implicates the collateral ligament, but stressing the knee in varus and valgus should always be conducted with the knee flexed to approximately 20 degrees, as well as fully extended. In this way, the screw-home action of the tibia and femur in full extension can be obviated. Rupture of single ligaments rarely occurs without associated soft tissue injuries, and thus tears of the tibial collateral ligament may be accompanied by rupture of its deeper lamina and synovium medially, by rents in the postero-medial capsule, and by damage to the anterior cruciate ligament or medial meniscus. It is important to realise that ligament rupture rarely occurs in isolation; for this reason, testing for, and repairing ligament disruptions is complex.

It should be remembered that ligaments are not simply passive restrainers of abnormal movement, but also carry nerve fibres concerned with proprioception and pain. Complete ruptures may therefore be relatively painless, the joint hinging open without discomfort. A haemarthrosis will escape through tears in the capsule and synovium, so that in significant ligament injuries the knee is never tensely swollen. Testing for rotatory instability of the knee is beyond the scope of this article, but the symptoms of pain and instability are frequently so gross that demanding surgical procedures and rehabilitative programmes become necessary.

Laxity in the sagittal plane is classically taught as a differentiation between the posterior and anterior drawer signs. These two tests are conducted with the knee in 90 degrees of flexion, and prior to any attempt at eliciting abnormal movement, the contour of the knee should be reviewed from the lateral side. If there is tibial "dropback", there will be a concavity below the patella where the tibia has sagged posteriorly. This is indicative of a posterior cruciate rupture which may occur from sudden violence directed to the shin in a backward direction, such as the leg striking against the dashboard of a car; or this laxity may occur after a dislocation of the knee, where clearly other significant ligament disruption will have occurred. Having assessed the tibio-femoral relationship, the hamstrings should be checked for slackness and then the proximal tibia pulled forwards and pushed backwards. Movement of more than a few millimetres indicates abnormal instability and implicates the cruciate ligaments.

Unfortunately a positive anterior drawer sign is rarely indicative of an anterior cruciate ligament disruption on its own, and both the postero-medial and postero-lateral capsule must be presumed to have ruptured with subsequent healing in an elongated manner. Perhaps a more specific test of anterior cruciate damage is the so called Lachman test where the anterior drawer sign is looked for with the knee in 20 to 30 degrees of flexion.

Although anterior and posterior cruciate disruption may be present, repair of these ligaments is extremely complex and sometimes of dubious merit. It therefore becomes somewhat academic to elicit these tests, and many of the instabilities detailed can be adequately controlled by due attention to quadriceps and hamstring muscle strength.

RADIOGRAPHY:

The radiograph is of great importance, particularly in assessing the painful knee after trauma. Fractures of the femoral and tibial condyles, and osteochondral fractures of the patello-femoral joint should be excluded. A "skyline" view of the patella is essential where a patellar dislocation or laterally directed shearing force may have produced an injury to the articular surface of the patella or associated femoral groove. This view is taken with the knee flexed, aligning the x-ray beam tangentially to the anterior surface of the knee.

An occasional source of locking in the young patient is the presence of a loose body secondary to osteochondritis dissecans, or more rarely to a torn portion of a meniscus. The fabella, located in the biceps tendon, is commonly mistaken for a loose body. In addition to the standard lateral and antero-posterior views of the knee, a "tunnel" view is essential if loose bodies within the inter-

condylar region are to be discerned. This view is taken with the knee flexed to at least 90 degrees, and the x-ray beam is directed in the antero-posterior direction. The radiograph will also show up other radio-opaque features, such as chondro-calcinosis, calcification in ligaments and the very rare occurrence of a true foreign body.

ARTHROGRAPHY:

Arthograms are of great use, particularly in eliciting medial meniscus tears. Trained personnel are required and the technique is not without slight hazard. Nevertheless it is a useful adjunct in the examination of the painful knee, particularly where both horizontal or vertical tears of the medial meniscus are suspected. Error is more likely in interpreting pathological conditions of the lateral meniscus owing to the artefact produced by the closely associated popliteus tendon. The size of a popliteal cyst can also be assessed, and if double contrast medium is used the cruciate ligaments may be outlined.

ARTHROSCOPY:

Competence at arthroscopy is essential before much reliance can be placed on the use of the instrument clinically. Diagnosis of meniscal tears, chondromalacia patellae, ruptures of the cruciate ligament, and confirmation of loose bodies are all possible with considerable accuracy. The arthroscope visualises the lateral meniscus better than the medial, and in this sense complements the arthrogram which is more accurate in assessing the latter structure. The postero-medial corner of the knee is poorly seen if the arthroscope is introduced anteriorly, although in cases of ligamentous laxity a better view may be obtained. It is for this reason that smaller diameter arthroscopes, often introduced in the posterior corners of the knee, can elucidate pathology in the posterior portions of the knee.

Surgeons experienced in arthroscopy now carry out a number of procedures through the operating arthroscope, such as partial meniscectomy, synovial biopsy, removal of loose bodies, cartilage shaving and partial synovectomy. The "plica syndrome", due to a symptomatic and fibrotic synovial band rubbing over the medial femoral condyle, can also be satisfactorily treated through the arthroscope. This syndrome is characterised by pain and tenderness over the medial femoral condyle rather than the joint line, and with a clicking sensation during flexion and extension of the knee. The thickened plica can be felt with the examining finger and may be visible during knee flexion. Diagnosis of this condition should include both the presence of a fibrotic or oedematous medial parapatellar plica and an associated medial femoral condylar lesion from contact with the abnormal band. Excision of the band through the arthroscope is perfectly possible and often relieves symptoms. Plicae in the suprapatellar pouch in relation to the fat pad are not a source of pain.

SUMMARY:

Diagnosing the cause of knee pain is often a complex clinical exercise and requires a careful history and examination in every case. Additional tests of knee instability, and realisation that many sources of knee pain are not due to meniscus lesions alone, have made the advent of newer diagnostic techniques most welcome. Arthrography and arthroscopy can complement each other in this endeavour, and ensure a successful diagnostic rate in approximately 90% of cases treated in specialist units. Every case of persistent knee pain should be investigated fully since the presence of pathological conditions in the knee cause a progressive worsening of symptoms if they are not treated with accuracy in the early stages.

Fig. 3. A discoid lateral meniscus removed at arthrotomy. This may be a source of pain and instability in the juvenile knee.