

Knee Pain

Aaron Formosa

Case Summary

JC is a 13 year old boy who presented with a 3 week history of anterior right knee pain. Pain is activity related and brought on whenever JC plays football or basketball. He never needed to stop from any particular activity because of the pain. After exercise, the knee pain only persists for a few of hours such that by the following morning JC is pain free. There is no history of trauma, there have been no previous similar episodes in the past and the pain was of insidious onset. There is no limitation in the range of movement and no swelling is described. On examination, there is no abnormality in the knee joint except for a moderately enlarged right tibial tubercle which is mildly tender on palpation.

Introduction

Knee pain accounts for approximately one third of musculoskeletal problems in a primary care setting.¹ The incidence of a new episode is about 10% per year.² Above the age of 50 years, only half of those with knee pain consult their family practitioner, the others probably self-manage their condition.³ Knee pain can be a source of significant disability, restricting the ability to work or perform activities of daily living.

The knee is a complex structure and far from being the simple hinge joint of popular belief. Knee pain would not be properly understood unless one is familiar with the anatomy and understands the role of the various structures.

A differential diagnosis of knee pain is very extensive, but it can be considerably narrowed down with a detailed history, a focused examination and, when indicated, the selective use of appropriate imaging and laboratory studies. Even with the rapid advancement of technology and medical imaging, there is still no substitute for a good history and physical examination.⁴

Keywords

In practice, orthopaedics

Aaron Formosa MD, FFSEM
Department of Primary Care, Floriana
Email: aaform@onvol.net

History

Pain characteristics

These include whether the pain is acute or chronic, past history of injury, any aggravating factors and if the pain is worse in the morning (inflammatory) or gets worse with repeated use (mechanical). In addition, the location of the pain and if it can be localized should not be left out.

Mechanical symptoms

- Locking, clicking, popping or giving way (Table 1)

These symptoms are very subjective and different patients will describe such symptoms differently. Direct and specific questioning is recommended to assess the nature of any positive symptoms. E.g. Some people might wrongly describe the inability to fully extend the knee because of pain, as locking.

Effusion

Timing and amount of effusion in relation to injury are important clues for diagnosis.⁵

- Swelling within 2 hours: indicates a haemarthrosis which is usually caused by an anterior cruciate ligament tear or a tibial plateau fracture
- Swelling between 2-6 hours: probably haemarthrosis, but a diagnostic aspirate is indicated
- Swelling after 6 hours: is the result of a synovial exudate secondary to meniscal or a collateral ligament injury.

Mechanism of injury

The extent and direction of the forces involved would lead the examining physician towards possible diagnosis, therefore details about the mechanism of injury are very useful.

Examples of useful questions include:

- Was it a direct blow to the knee? E.g. from the front like in a motor vehicle accident (posterior cruciate ligament tear), or from the side in sport (injury to collateral ligaments)
- From which side? (valgus movement leads to medial collateral ligament strain, while a varus movement would involve the lateral ligament)
- Was the foot planted on the floor? (maybe leading to a rotation injury with possible injury to menisci or cruciate ligaments)

Table 1: Mechanical symptoms associated with knee pain

Symptom	Suggested cause
Locking	Meniscal injury, foreign body in knee joint.e.g. bony fragment in osteochondritis dissecans and severe osteoarthritis
Clicking	Patellofemoral syndrome
Popping during injury	Ligamentous injury
Giving way	Knee instability, patellar subluxation/instability, ligamentous rupture, meniscal abnormality

- If no contact was involved, was there a twisting movement, or sudden acceleration / deceleration? (menisci or anterior cruciate ligaments)
- Was it associated with a fall / jump?
- Hyperextension? (anterior cruciate ligament)

Medical and Surgical History

- Previous history of injury or surgery to the knee
- Previous episodes of knee pain
- Other joint pains
- History of gout, rheumatoid arthritis, or other degenerative joint disorders

Examination

Observation

With the patient standing

- Whole of the lower limb for any obvious abnormalities
- Swelling of the knee
- Differences between the two limbs
- Pelvic tilt, which may be a sign of leg length discrepancy

With the patient sitting

- A tibial tubercle may be more obvious as in Osgood Schlatter's disease
- Quadriceps muscle wasting may show up more during active extension

With the patient lying supine

- Active range of movement
- Muscle wasting of the thigh, confirmed by tape measurement
- Swelling / effusion / bruising / discolouration

With the patient lying prone

- Active range of movement
- The popliteal fossa. With one hand placed above the patella, downward pressure is applied to empty the suprapatellar pouch into the knee joint proper. Depression on the patella is applied using the index finger of the other hand. A characteristic tap is felt in the presence of excessive fluid in the joint.

Table 2: Differential diagnosis of knee pain by anatomic site

Anterior knee pain

- Patellar subluxation or dislocation
- Patellofemoral pain syndrome (chondromalacia patellae)
- Tibial apophysitis (Osgood-Schlatter's disease)
- Patellar tendonitis

Medial knee pain

- Medial collateral ligament strain
- Medial meniscus tear
- Medial plica syndrome

Lateral knee pain

- Lateral collateral ligament strain
- Lateral meniscus tear
- Iliotibial band tendonitis

Posterior knee pain

- Popliteal cyst (Baker's cyst)
- Cruciate ligament/s injury
- Osteoarthritis

Palpation

Examination of the joint for swelling:

- Compress the suprapatellar pouch and note any distension of the medial / lateral sides of the patella
- patellar tap.

Specific tenderness may be elicited:

This should be done in both the fully extended knee and at approximately 45 degrees of flexion

- over medial, lateral collateral ligaments
- over the joint line, which may indicate meniscal injuries
- over the patella
- over the patellar tendon
- over the bursae around the knee
- over the tibial tubercle (Osgood-Schlatter's disease)

Muscle strength and tone should also be assessed, together with passive range of movements. Note should be taken of the end feel. A list of specific tests is provided in Table 6.

When to X-Ray in acute knee injuries

Most knee injuries involve the soft tissues. This makes plain-film radiographs generally unhelpful. The Ottawa Knee Rules (OKR) are a helpful guide of when to take X-Rays (Table 3). These were introduced in the 1990's and immediately resulted in a decrease in radiography with no difference in the number of missed fractures. Various studies have shown that implementation of these rules resulted in a decrease of between 25% and 46.5% of radiography with associated reduced waiting times and costs.⁶⁶⁻⁸ They were also shown to be 100% sensitive

Table 3: Ottawa Knee Rules

1. Age 55 years or older
2. Isolated tenderness of the patella
3. Tenderness at head of the fibula
4. Inability to flex to 90 degrees
5. Inability to bear weight both immediately and in the examining room (4 steps; unable to transfer weight twice onto each lower leg)

for identifying fractures of the knee.⁷⁷⁻⁹ It is also important to organize good follow-up and appropriate communication with the patient. This would definitely never allow an injury to pass unnoticed.

As regards the use of the OKR in children, results are a bit contradictory with Bulloch *et al* showing that these Rules are also valid in children having a 100% sensitivity and a possible reduction in radiography of 31.2%, while Khine *et al* concluding that they would only have a 92% sensitivity and that they could miss the occasional fracture.^{8,10,11} The most reliable rule in young children is the ability to bear weight, while point tenderness and knee flexion do not have any additional value.^{9,12}

Radiography

When radiography is indicated, two main views are usually taken - anteroposterior view and lateral view. In teenage patients complaining of chronic knee pain, a tunnel view might need to be done to exclude osteochondritis dissecans. Here, radiolucencies of the femoral condyles (usually the medial) are seen. In cases when a fracture of the patella is suspected, a skyline view of the patella is obtained.

A standing anteroposterior view can also be performed to assess joint width space in cases of osteoarthritis.

Magnetic Resonance Imaging (MRI)

The primary indication for MRI of the knee is evaluation of internal derangement. It mainly assesses the menisci and ligaments but the integrity of the osseous structures and the surrounding muscles may also be evaluated. An MRI is helpful in those cases where physical examination findings are equivocal, or compromised when the patient is in pain from a recent injury.^{10,13} Although this investigation can be a help, it is not without its pitfalls.

Discrepancies between arthroscopy and MRI findings can be numerous. Some are due to erroneous interpretation of normal structures that mimic meniscal tears.^{11,14} The medial transverse ligament and the lateral genicular artery can be mistaken for tears of the anterior horns of the medial and lateral menisci respectively. The oblique meniscomeniscal and the menisiofemoral ligaments can also be mistaken for a tear of the lateral meniscus.^{12,15,16} The popliteus tendon can produce the appearance of a tear of the posterior horn of the lateral meniscus. On the other hand, tears of the meniscus or a separation of the meniscus from the joint capsule can be missed if the orientation of the tear is parallel to the plane of the image.^{13,14}

Laboratory investigations

The presence of warmth, effusion, marked pain with a degree of limited range of movement could be the result of septic arthritis or acute inflammatory arthropathy. CBC, ESR and arthrocentesis are mandatory. Bacterial cultures and polarized light microscopy for crystals of the aspirate should be done. Blood tests for rheumatoid factor might also be indicated.

An arthrocentesis may be required to differentiate between haemarthrosis or a simple effusion. In case of the former, the finding of fat globules would indicate a fracture of the tibial or femoral condyles (intra-articular fracture).

Osgood-Schlatter disease

The case presented above is typical of Osgood-Schlatter disease (OSD).

This is one of the commonest causes of knee pain in active adolescents. It is generally a benign, self-limiting condition which can take months or years to settle. The usual course of the condition is from 12 to 24 months.

OSD is an osteochondrosis at the tibial tuberosity. The typical patient would be a 13 to 15 year old boy who participates in sport that involves jumping and sudden change of direction e.g football, basketball, volleyball. It can be bilateral in 20% of cases^{14,17} and the incidence in girls is on the increase with their increased participation in the mentioned sports. The condition results from excessive traction of the soft apophysis of the tibial tuberosity by the powerful patellar tendon. It occurs in association with high levels of activity during a period of rapid growth.^{15,18}

Table 4: Mechanical symptoms associated with knee pain

Children and adolescents	Adults	Older adults
Patellar subluxation	Patellofemoral pain	Osteoarthritis
Osgood-Schlatter's disease	Trauma: ligament strains/tears, meniscal tears	Gout
Referred pain (eg. slipped femoral epiphysis)	Medial plica syndrome	Popliteal (Baker's) cyst
Osteochondritis dissecans	Septic arthritis	Inflammatory arthropathy (eg. rheumatoid arthritis, Reiter's syndrome)

Table 5: Grades of Osgood-Schlatter disease

Grade	Characteristics
1	Pain after activity that resolves within 24 hours
2	Pain during activity and after that does not limit activity and resolves within 24 hours
3	Constant pain that limits sports and daily activity

Diagnosis

Typically the patient will point to a painful tibial tubercle with possibly a swelling and prominence over it. Pain occurs during activity and remains with rest. Onset would be insidious and the severity can be graded as shown in Table 5.

On examination, knee tenderness is very well localised over the tibial tubercle. Range of movement is complete and there would be no effusion or other physical signs.

Investigations

History and examination should be straightforward and highly indicative of OSD. In such a situation, radiographs are not required. These can be normal or show irregular ossification of the tibial tubercle. The latter could be a normal variant in asymptomatic adolescents.^{16,17}

Radiography should be restricted to cases with an acute onset of symptoms (to exclude avulsion fracture of the tubercle) and for patients with nocturnal pain or non-activity related pain (to exclude a tumour).

Ultrasound and MRI scans can confirm the diagnosis of OSD by highlighting the tibial tubercle, but these are generally unnecessary.

Treatment

Treatment depends on the severity of the condition.

Grade 1 and 2

In these cases, patients and their parents may only need reassurance that the condition is usually self-limiting and that the enlarged tubercle is not a tumour. Activity level and intensity depends on the severity of the symptoms.

In Grade 1 situations, no curtailment of physical activity is needed, while in Grade 2 patients, the intensity of exercise should be reduced to a level where no pain is felt during the activity. Short-term rest (approximately 2-3 weeks) would be needed during flare-ups, with a subsequent gradual introduction of the desired activity. Total rest is not recommended for long periods of time as it can lead to a greater risk of recurrence with return to sport.^{17,19} Icing the knee for 20 minutes after activity is beneficial. Topical anti-inflammatories, protective padding of the tubercle and hamstring / quadriceps stretching should be advised while cortisone injections are not recommended.^{18,19}

Table 6: Physical examination tests in relation to the knee

Valgus and varus stress tests

This is a test for the medial and lateral collateral ligaments and should be done at 0 and 30 degrees of flexion. Gross laxity might indicate a complete rupture.

Lachman test

This elicits stability of the ACL and should be done by grasping the distal femur and the proximal tibia with separate hands. With the knee in slight flexion, apply an anterior force to the tibia. Excessive anterior movement of the tibia suggests laxity / tear of the ACL.

The Drawer test

Another test for ACL / PCL injury. With the knee at 90 degrees of flexion and the foot stabilised, anterior and posterior force is applied to the proximal tibia. A posterior sag of the tibia is a sign of PCL tear while excess movement of the tibial plateau suggests ACL injury.

McMurray test

This test elicits integrity of the menisci. With the patient supine, the knee is held at maximum flexion and lateral and medial rotation applied. Maintaining rotation, the knee is passively extended. Pain or a clunking sensation at the joint lines results in a positive test.

Apley's test

With the patient prone, passively flex the knee to 90 degrees, again with internal and external rotation of the tibia. Passively flex and extend the knee whilst applying axial compression. A positive test is again the sensation of pain or clunking at the joint line.

Apprehension test

Flex the knee at about 30 degrees. With both thumbs try to forcefully displace the patella across the lateral epicondyle. Increased mobility with marked apprehension by the patient that the patella is going to be dislocated is a positive test for patellar subluxation or recurrent dislocation.

Grade 3

A minority of patients would present with grade 3 symptoms. More intense treatment is needed here. Rarely, immobilization would be needed to enforce the importance of rest. Its routine use has however been shown not to alter the natural history of the condition.^{19,20} After a period of rest, which would vary according to the severity, a rehabilitation programme including quadriceps strengthening is started. In resistant cases, surgical excision of the ossicle is performed with quite good results.^{20,21}

Sequelae

These would include a painful ossicle, painful kneeling and a permanent bump on the anterior knee.

References

- 1 Calmbach WL, Hutchens L. Evaluation of patients presenting with knee pain. Part I. History, physical examination, radiographs and laboratory tests. *Am Fam Physicians*. 2003 Sep 1;68(5):907-12
- 2 Jordan K, Jinks C, Croft P. A prospective study of the consulting behaviour of older people with knee pain. *Br J Gen Pract*. 2006 Apr;56(525):269-76
- 3 Mitchell HL, Carr AJ, Scott DL. The management of knee pain in primary care: factors associated with consulting the GP and referrals to secondary care. *Rheumatology*. 2006 Jun;45(6):771-6
- 4 Orndorff DG, Hart JA, Miller MD. Physical examination of the knee. *Cur Sports Med Rep*. 2005 Oct;4(5):243-8
- 5 Cooper R, Crossley K, Morris H. Acute knee injuries. www.clinicalsportsmedicine.com/chapters/23.htm (accessed on 31st August 2006)
- 6 Stiel IG, Wells GA, Hoag RH, Sivilotti ML, Cacciotti TF, Verbeek PR, *et al*. Implementation of the Ottawa Knee Rule for the use of radiography in acute knee injuries. *JAMA*. 1997 Dec 17;278(23):2075-9
- 7 Empananza JI, Aginaga JR. Validation of the Ottawa knee rules. *Ann Emerg Med*. 2001 Oct;38(4):364-8
- 8 Ketelslegers E, Collard X, Vande Berg B, Danse E, El-Gariani L, Poilvache P, Maldaque B. Validation of the Ottawa Knee Rules in an emergency teaching centre. *Eur Radiology*. 2002 May;12(5):1218-20.
- 9 Nugent PJ. The Ottawa Knee Rules. Avoiding unnecessary radiographs in sport. *Phys and Sports Med*. 2004 May; 32(5):26-32
- 10 Bulloch B, Neto G, Plint A, Lim R, Lidman P, Reed M, *et al*. Paediatric Emergency Researchers of Canada. Validation of the Ottawa Knee Rule in children: a multicentre study. *Ann Emerg Med*. 2003 Jul;42(1):48-55
- 11 Khine H, Dorfman DH, Avner JR. Applicability for the Ottawa Knee Rule for knee injury in children. *Pediatr Emerg Care*. 2001 Dec;17(6):401-4
- 12 Moore BR, Hampers LC, Clark KD. Performance of a decision rule for radiographs of paediatric knee injuries. *J. Emerg Med*. 2005 Apr; 28(3):257-61.
- 13 Schnitker JB, Light DW. Nonneurologic indications for MRI. Technological advances have broadened applications. *Postgrad Med*. 2001 Jun;109(6):81-4,87-9
- 14 Herman LJ, Beltran J. Pitfalls in MR imaging of the knee. *Radiology*. 1988 Jun;167(3):775-81
- 15 Sanders TG, Linares RC, Lawhorn KW, Tirman PF, Houser C. Oblique meniscomeniscal ligament: another potential pitfall for meniscal tear - anatomic description and appearance at MR imaging in three cases. *Radiology*. 1999 Oct; 213(1):213-6
- 16 Vahey TN, Bennett HT, Arrington LE, Shelbourne KD, Ng J. MR imaging of the knee: pseudotear of the lateral meniscus caused by meniscofemoral ligament. *AJR Am J Roentgenol*. 1990 Jun; 154(6):1237-9.
- 17 Wall EJ. Osgood-Schlatter disease. *The Phys and Sports Med*. 1998 Mar;26(3):29-34
- 18 Bloom OJ, Mackler L, Barbee J. What is the best treatment for Osgood-Schlatter disease? *J Fam Pract*. 2004 Feb;53(2):153-6.
- 19 Rostron PK, Calver RF. Subcutaneous atrophy following methylprednisolone injection in Osgood-Schlatter epiphysitis. *J Bone Joint Surg Am*. 1979 Jun;61(4):627-8
- 20 Krause BL, Williams JP, Catterall A. Natural history of Osgood-Schlatter disease. *J Pediatr Orthopod*. 1990 Jan-Feb;10(1):65-8
- 21 Hussain A, Hagroo GA. Osgood-Schlatter disease. *Sports Exer Injury*. 1996;2:202-206

Corinthia Group Prize in Paediatrics, 2006

Dr Laura Azzopardi was this year's winner of the Corinthia Group Prize in Paediatrics, having obtained the top aggregate mark over the combined examinations in Paediatrics in the fourth and final year of the undergraduate course. As always, competition for the Corinthia Group Prize was as stiff as ever, with several candidates vying for the honour. Whilst offering our congratulations to Dr Azzopardi, we would also like to congratulate all those undergraduates (now doctors) who performed admirably during the undergraduate course in Paediatrics. In the accompanying photograph, Dr Azzopardi is seen receiving a cheque for Lm100 from Dr Simon Attard Montalto, Head of Paediatrics at the Medical School. Finally, we are extremely grateful to the Corinthia Group for their ongoing support toward the Academic Department of Paediatrics.

Dr Simon Attard Montalto

