Anterior knee pain

Diagnosis and management

Chris Milne MBChB FRNZCGP FACSP

Introduction

Anterior knee pain is probably the commonest musculoskeletal problem in general practice. It rivals the acute ankle sprain in frequency, and frequently goes undiagnosed. Most anterior knee pain arises from patellofemoral joint irritation. However, there are three other causes of anterior knee pain that GPs should be aware of: the acute impact injury to the patella, jumper's knee problem (patellar tendinopathy) and Osgood Schlatter's disease. I will discuss the diagnostic features and management of each of these. In addition, I will briefly outline some less common conditions that GPs may see only rarely, but need recognition and often specialist referral.

Chris Milne *is a Sports Physician in private practice in Hamilton. He is national chairman of Sports Medicine New Zealand and has previously been team doctor to New Zealand Olympic and Commonwealth Games teams from 1990 to 2000. He was team doctor for the Chiefs Super 12 rugby team from 1997 to 2003.*

The typical case

1. Patellofemoral pain

a) History

This accounts for the vast majority of anterior knee pain. The onset may be acute or insidious. Symptoms are dominated by retropatellar pain. This is closely related to high loads through the patellofemoral joint, which occurs on walking or running down hill, or descending stairs. It is also noted getting in or out of vehicles, or with prolonged sitting. This is what causes affected people to seek out the aisle seat in the movies. In athletes, cycling with too high a gear causes excess torque through the patellofemoral joint. The flicking action of the breast stroke kick is often associated with patellofemoral pain. People on weights programmes in the gymnasium are often advised to perform leg extension exercises against high resistance. These can also result in retropatellar pain. Pain is not the only symptom. There may be associated symptoms of instability. True giving way is rare, but the patients lack confidence in the affected knee, particularly on descending stairs or uneven ground. The instability is thought to be caused by reflex inhibition of the quadriceps muscles. True locking is rare, but the patient may find they need to give their leg a shake or two on arising from a chair, before they can fully extend their knee; this is termed pseudo locking. Patients will often complain of clicking. Most experts regard this as a nuisance symptom that does not signify serious pathology, and this reassuring message should be conveyed to the patient. In occasional cases, there may be an intermittent effusion. The constellation of symptoms outlined above means that patellofemoral pain may mimic a meniscal tear or loose body in the knee.

Williams[1] termed it a 'clinical chameleon', which is an apt term.

b) Examination

Examination should commence as the patient enters the room. There may be a limp, but this is uncommon and usually signifies a chronic lower limb problem. Before lying the patient on the bed, get them to perform a shallow knee bend, first on the good leg, and then on the more affected leg. Usually, there will be a tendency to over-pronation of the foot on one or both sides, and there may be evidence of reduced proprioception through the affected leg. On palpation, there may be tenderness under the lateral or (less commonly) the medial facet of the patella. Occasionally there will be an effusion but, if so, this should increase the suspicion of other knee pathology (e.g. meniscal tear or degenerative joint disease). On flexing the knee, there may be a palpable click arising from the patellofemoral articulation. Usually this occurs at about 30 degrees flexion. In more severe cases, patellofemoral crepitus may be evident. On extension of the knee with the patient seated on the plinth, there may be evidence of maltracking of the patella – this is termed the 'J' sign by some experts. On mobilising the patella, a tight lateral retinaculum may be evident – this tends to cause lateral patellar tilting, and thereby increases pressure between the lateral patellar facet and the trochlea. Another useful sign re-

lates to diminished function of the vastus medialis obliqus (VMO) muscle. The best way to assess this is by holding your thumb over the centre of the belly of each VMO muscle and asking the patient to initiate an isometric quadriceps contraction whilst lying supine. The VMO muscle on the affected knee tends to have a slower onset and less forceful contraction, even when there is no difference in quadriceps bulk. The last test that should be performed is 'Clarke's test'. The patella is pressed against the femur and the patient is asked to contract the quadriceps. If this evokes pain it is regarded as a positive test. However, it is relatively non-specific, and may be evident in asymptomatic knees. The remainder of the knee examination should be normal. Any additional signs should prompt suspicion of an alternative diagnosis.

Table 1. Causes of anterior knee pain

Most common	Patellofemoral joint irritation
Common	Acute impact injury to the patella
	Jumper's knee (patellar tendinopathy)
	Osgood-Schlatter's disease (apophysitis of the tibial tubercle)
Less common – but not to be missed	Prepatellar bursitis (housemaid's knee)
	Patellar instability
	Fat pad irritation (Hoffa's syndrome)
	Referred pain from the hip
	Synovial plica
	Anterior knee pain as the predominant symptom of osteoarthritis
	Non-mechanical causes e.g. tumour, infection

c) Investigations

Imaging is rarely required. If the condition is not settling in the expected timeframe, plain x-rays may be ordered. In persistent cases these help to exclude any other more insidious underlying pathology masquerading as anterior knee pain. The skyline view should be specifically requested as this is the most useful view and usually shows evidence of patellar tilting and occasionally subluxation.[2]

d) Natural history

Untreated, the condition usually persists for weeks or months, before the patient modifies or reduces their activity. Even with treatment, relapses are common.

e) Epidemiology

Any age group may be affected, with an approximately equal gender distribution.

f) Management

This has been the subject of two recent Cochrane reviews. Since the publication of Australian physiotherapist Jenny McConnell's landmark study in 1986,[3] this has been the gold standard for treatment. Management consists of taping the patella medially and altering any patellar tilt so as to minimise symptoms. Taping is followed by isometric quadriceps exercises, and then more advanced exercises concentrating on improving core stability, particularly gluteus medius function. The Cochrane review in 2003[4] found significantly greater pain reduction in the exercise groups on one high and one low quality study, though at different time points. Overall, the evidence that exercise is effective was limited with respect to pain reduction, and conflicting with respect to functional improvement. Closed chain exercise (where the foot is fixed) or open chain exercise (where the foot is free to move) were both equally effective. Orthotic devices to reduce pronation have been used extensively in patellofemoral pain syndrome. The Cochrane review in 2002[5] concluded that the evidence from randomised controlled trials was too limited to draw definitive conclusions. It did conclude that the McConnell taping and exercise regimen was significantly more effective than use of a Coumans bandage. Other treatment strategies are also of value. In the acute phase, load reduction is important. For running-based athletes, body weight supported exercise as cross-training should serve to reduce symptoms. Cyclists should train in a lower gear at a higher cadence (pedal revolutions per minute). This will reduce torque through the patellofemoral joint. Swimmers should avoid the breaststroke kick for several weeks until their knee problem has settled. For the busy GP, referral to an experienced physiotherapist is recommended. The above mentioned exercises are as routine for them as treatment for respiratory tract infections is for the GP. If excess pronation is a feature, refer to a podiatrist. If the problem is not improving after one month, refer the patient for a specialist opinion. Depending on availability, this could be a sports physician, musculoskeletal medicine specialist or orthopaedic surgeon. For pure patellofemoral pain, surgery is rarely if ever indicated. Unfortunately, patients who trawl the internet may get a largely American perspective and in that country there are a variety of surgical procedures that are performed for this problem with minimal backing evidence. Natri et al.[6] reported that restoration of good quadriceps strength and function to the affected leg is important for good recovery.

Other factors associated with a good long-term outcome are reduction in patellar pain and crepitus, lack of bilateral symptoms, young age and low body height (shorter people have shorter lever lengths, so generate less torque through their joints).

Other common causes of anterior knee pain

2. Impact injury to the patella

a) History

This is an acute injury, with either a direct blow to the patella, or a fall landing on the anterior knee. The symptoms are the same as for patellofemoral pain, but generally more severe. Patients with this problem may become resentful, because many practitioners don't take them seriously.

b) Examination

There may be evidence of a contusion or laceration over the anterior aspect of the knee in the first two weeks following injury. An effusion is more common than in the standard patellofemoral problem.

c) Investigations

X-rays are usually normal, which leads many practitioners to conclude that no serious problem exists. In very severe cases, there may be a fracture of the patella. Pain is thought to arise from subchondral bone bruising, and an MRI scan may show evidence of this. However it is more often normal.

d) Natural history

This condition usually persists for several months, but in a few difficult cases the pain may be permanent.

e) Epidemiology

Any age group may be affected, but more active thrill-seeking patients, by the nature of their activities, may be more at risk.

f) Management

Initially, these patients need strong pain relief until they can confidently return to walking. At that stage, institute the standard McConnell taping and exercise regimen. If the pain is not settling after one month, orthopaedic referral is indicated. A specialist report is often needed to con-

Table 2. Summary of common causes of anterior knee pain

	Patellofemoral joint irritation	Impact injury to patella	Jumper's knee (patellar tendinopathy)	Osgood Schlatters disease
Onset	Acute or gradual	Acute - follows a direct blow to patella	Gradual or acute	Gradual, occasionally sub acute
Symptoms	Retropatellar pain Clicking Occasionally - effusion - instability - pseudo locking	As for patellofemoral pain, but often more severe	Pain in proximal half of patellar tendon, especially with jumping	Pain over tibial tubercle, worse after training camp or sports tournament
Signs Effusion Patellofemoral click or crepitus Tenderness	 Occasional Common Patellar border esp lateral facet	 Common Very common Patellar border esp lateral facet	 No No Proximal half of patellar tendon	 No No Tibial tubercle
Investigations	Usually, none, occ X-rays	X-rays including skyline view, occasionally MRI	Ultrasound scan	Usually none. X-rays if suspect disruption of extensor mechanism
Time course	Several weeks – prone to relapse	Several months to years	Months to years	Months to years
Age group	Any	Any	Younger jumping athletes	Adolescents, especially boys in kicking sports
Management	Load reduction - reduce running, cycle in low gear Avoid breaststroke kick Quadriceps exercises Patellofemoral taping Orthotics	Early - adequate analgesia load reduction Later patellofemoral taping Specialist referral if not settling Occasionally surgery	Load reduction Progressive concentric then eccentric strengthening exercises	Load reduction Information sharing with patient and parent Ice massage NSAID gel Occasionally, systemic NSAID

vince the patients' employer or case manager of the significance of their condition. In some cases, arthroscopy and debridement of the injured articular cartilage can be helpful. Microfracture is an additional useful therapeutic technique.

3. Patellar tendinopathy (jumper's knee)

a) History

The onset may be insidious or subacute (e.g. after a training camp or basketball tournament). Pain is localised to the proximal patellar tendon and distal pole of the patella. It is rare to have symptoms in the distal half of the tendon. There may be night pain after provocative activity.

b) Examination

There is usually tenderness and occasionally swelling of the proximal part of the patellar tendon. Pain is reproduced on landing from a jump.

b) Investigations

The most useful investigation is an ultrasound scan. This is useful to exclude an associated partial tear. It is important to realise that there is only a limited correlation between lesser changes on ultrasound (small hypoechoic areas) and clinical symptoms.[7] In any team of high level jumping athletes (e.g. basketballers) there is a high prevalence of ultrasound abnormalities even in asymptomatic knees.

d) Natural history

This condition can niggle on for months to years. Many players compete with low-grade symptoms for months at a time, but cannot play to their full potential.

e) Epidemiology

The term 'jumper's knee' accurately describes the epidemiology. This condition is endemic in both young and skeletally mature jumping athletes. Basketballers and volleyballers are particularly affected.

Table 3. Patient information sheet – Patellofemoral strain

Patellofemoral strain (also known as anterior knee pain)

1. **What is it?**
   It is an irritation behind the kneecap involving the articular cartilage.
2. **What causes it?**
   Most commonly, faulty alignment of the leg and foot, combined with running training. Occasionally, a fall onto the front of the knee can cause this problem.
3. **Symptoms** – what you notice:
   a) Pain behind the kneecap on stairs or hills, also sitting in the car or at the movies for long periods
   b) Often there is clicking, but this is not a serious symptom
   c) Occasionally there may be swelling
   d) Occasionally there may be catching, but rarely does the knee lock up
   e) Occasionally there may be a feeling of instability, but rarely does the knee give way such that you fall to the ground.
4. **Signs** – what the doctor finds:
   a) Often associated with flat feet, and over pronation of ankles
   b) Usually a patellofemoral click or grating on moving the knee
   c) Occasionally there will be an effusion – water on the knee.
5. **Investigations**
   X-rays are rarely required to make the diagnosis. They may help if you have had pain for over three months, or the original injury was a bad fall onto the front of the knee. A skyline x-ray view is the most useful one.
6. **Treatment**
   a) Isometric quadriceps exercises – you push the knee hard back, and hold for a count of 5. Repeat 10 times before every meal. For additional strength, turn your feet in towards each other.
   b) A wedge for the arch of your shoe can help reduce pronation. In some cases, orthotics may be required.
   c) Patellofemoral taping and more specialised exercises under the supervision of a physiotherapist can also help a lot.
   d) Surgery is not needed for this problem.
7. **Average recovery time** is 2–6 weeks
8. **Recovery sequence:**
   Step 1: Isometric quadriceps exercises 30 times daily
   Step 2: Cycling-spinning, with low loads on an exercycle initially, then build up resistance
   Step 3: Restart alternate day jogging when you can easily manage cycling
   Step 4: Speed up running, and add hills plus rapid stop/start and turning movements
   Step 5: Return to team training
   Step 6: When able to manage team training, return to play.

f) Management

In the acute phase, load reduction is indicated. The player should rest from all running or jumping activity. Ice massage and the application of NSAID gels can help settle acute pain. Once the athlete can walk about freely, they should begin a programme of progressive concentric then eccentric strengthening exercises. The aim of this is to induce shear forces that can promote tendon healing. This condition was originally thought to be a tendonitis with a marked inflammatory element. Histological studies have

Table 4. Patient information sheet – Osgood Schlatter's disease of knee

Osgood Schlatter's disease of knee (also called growing pains of knee)

1. **What is it?**
   It is a growth-related pain occurring at the insertion of the patellar tendon into the tibia (shin bone).
2. **What causes it?**
   It is caused by a discrepancy in growth – the bones grow first, and the muscles and tendons have to catch up. This causes pain at the tendon insertion sites.
3. **Symptoms** – what you notice (or your child reports)
   a) Pain – at the insertion of the patellar tendon into the insertion of the tibia. It is worse with running, kicking or kneeling on hard surfaces.
   b) Occasionally there may be swelling at the insertion site of the patellar tendon.
4. **Signs** – what the doctor finds
   a) Swelling at the insertion site of the patellar tendon.
   b) Tenderness at this site.
   c) Pain on resisted extension (straightening) of the knee.
5. **Investigations** – NB: None are routinely required
   X-rays – can show fragmentation of the tendon insertion site (apophysis). However, these are not necessary to make the diagnosis. Ultrasound and MRI scans are NOT needed.
6. **Treatment**
   a) First aid – ice massage and application of Voltaren emulgel can help settle the pain.
   b) Rest from provocative activity is helpful in the first few days; sometimes this is needed for 2–3 weeks.
   c) Cross-training – this involves swimming or cycling and kayaking if available. In this way you can maintain your general fitness without stirring up your sore knee.
   d) Progressive muscle strengthening exercises for the quadriceps muscles, e.g. leg press or shallow knee bends.
   e) In some cases, use of Brufen or Voltaren tablets can help an athlete get through games for a tournament that is important to their sporting career. This treatment should only be carried out after discussion between the doctor, the athlete and their parents or caregivers.
7. **Time course**
   a) The condition tends to improve a lot after the first week or two of rest, and with cross-training, the athlete can resume some skill-based activity at that stage.
   b) Throughout the next one or two seasons, there may well be good and bad weeks. The aim is to maximise the game time for each player through the competitive season.
   c) The good news is that once the athlete reaches their full height, and stops growing, the problem goes away.
   d) This condition has no effect on future sporting performance as an adult.
8. **Treatment stages**
   a) First aid – ice massage. Voltaren gel, rest from any provocative activity for 1–2 weeks.
   b) Start cross-training, e.g. swimming or cycling.
   c) Being a strengthening programme for the quadriceps muscles – start with 2–3 shallow knee bends twice per day, and build up to 10–20 three times per day.
   d) If tolerated, start gentle skills training, e.g. dribbling the ball, short passes.
   e) Resume running, then team training.
   f) Once able to manage team training, restart playing.

documented degenerative changes within the tendons of affected individuals. These changes take many months to reverse, thus explaining the prolonged time course. Local steroid injections in the region of the symptoms have been associated with tendon rupture, and are not recommended. If a partial tear is found, and symptoms fail to settle over several months, surgical debridement may be indicated.

4. Osgood-Schlatter's disease (apophysitis of the tibial tubercle)

a) History

This is a 'growing pain' seen most commonly in boys in sports requiring lots of kicking, especially soccer or rugby. The onset is usually during the playing season, and it is more common after a period of increased loading, e.g. a training camp or tournament, where several games are played on successive days. Pain is localised to the tibial tubercle at the insertion of the patellar tendon. Over time, the tibial tubercle becomes more prominent. Usually there are bilateral symptoms.

b) Examination

These players have a tender prominence of each tibial tubercle. They will often struggle to perform repeated shallow knee bends in your surgery, and there may be pain or resisted knee extension with clinical testing. The remainder of the examination is normal.

c) Investigations

Usually none are required. If x-rays are performed, these will show fragmentation of the tibial tubercle, but this is an expected finding and does not alter management. In the rare case of an adolescent falling from a height and landing heavily on one leg, there may be avulsion of the tibial tubercle. In this clinical setting, x-rays and same day orthopaedic referral are justified, as disruption of the extensor mechanism is a medical emergency.

d) Natural history

This problem can last for months to years. It tends to flare up for a few weeks to months during the playing season, and improves in the off-season. Once skeletal maturity is reached, it spontaneously resolves. Find out what height the child's (usually boy's) father is and explain that once he reaches Dad's height, the problem should burn out. The player (and his parents) should be reassured that the condition has no detrimental effect on future sporting performance as an adult.

e) Epidemiology

This condition affects mainly boys in the 12–15 year old age group. Usually they are playing a kicking sport, e.g. soccer or rugby, and are of above average ability. Therefore, they get selected to play for representative as well as school or club teams. It is therefore an overuse growth related tendon insertion problem.

f) Management

In the acute phase, use ice massage and NSAID gel to settle the pain. Load reduction is an essential part of treatment. Rest from any provocative activity for one to two weeks initially. The player should stop running and kicking. Instead, begin a programme of cycling and swimming. Once the acute pain has settled, the player can begin a programme of concentric then eccentric strengthening exercises as previously mentioned for jumper's knee. Once the player can manage 10–20 shallow knee bends three times a day, they can recommence running and skill-based training. They should ease back gently into competition, playing for one team only until they can manage full games. In some cases, you may be asked to see a young player with this problem who is off to an important tournament in a few weeks (or days). In such cases, the prescription of low dose NSAID, e.g. ibuprofen 200mg or diclofenac 25mg, on game days can help the player participate more fully in such a competition. This strategy needs full discussion with the player and their parents or caregivers before it is implemented. There will occasionally be times when you as a GP feel pressured by parents who have children with this condition. In such cases, referral to a specialist can often help defuse the situation. Usually, the same information will be given, but this in itself adds reassurance that all reasonable treatment is being carried out.

Less common causes of anterior knee pain

5. Prepatellar bursitis (housemaid's knee)

This condition is characterised by a tender fluctuant swelling over the patella. Combined treatment with oral anti-inflammatory medication plus antibiotics for 10 days is usually effective.

6. Anterior knee pain as part of a patellar instability problem

The major differentiating feature is patellar hypermobility, with apprehension and pain when the patella is pushed laterally by the examiner. Following an acute episode of instability, there is usually a haemarthrosis. X-rays including skyline views should be requested, as these may show an avulsion fracture affecting the medial aspect of the patella. Recurrent instability requires orthopaedic referral and consideration of a stabilisation procedure.

7. Fat pad irritation (Hoffa's syndrome)

The infra-patellar fat pad may become impinged (pinched) between the patella and femoral condyle especially at full extension of the knee. This condition is not that common, but often mimics patellar tendinopathy. Treatment is with patellofemoral taping, and occasionally local corticosteroid injections or surgery.

8. Referred pain from the hip

This should always be considered, particularly in an adolescent with knee pain where a slipped upper femoral epiphysis may be the cause. You should retain a high index of suspicion for this condition. Prior to examining the knee, gently rock the leg when the knee is fully, extended – pain with this manoeuvre is likely to be arising from the hip joint. Arrange x-rays including frog views, and urgent orthopaedic review (within a week).

9. Synovial plica

Occasionally a synovial fold under the medial border of the patella can become irritated and give rise to anterior knee pain. This condition is controversial and one should look for other pathology well before suspecting this one. In a few cases, arthroscopic resection of the plica may be required.

10. Osteoarthritis of the knee with predominant anterior knee pain

Most patients with osteoarthritis of their knee have pain arising from their medial or lateral compartment, or both. Occasionally, anterior knee pain will predominate. There may be associated instability, as for patellofemoral pain. On examination, look for an effusion, plus tenderness at the margins

of the patella. There may be a mild fixed flexion deformity and patellofemoral crepitus on flexion is a prominent finding. X-rays will usually show narrowing of the joint spaces, plus osteophyte formation. They should include skyline views, which profile the patellofemoral joint.

11. Non mechanical causes of anterior knee pain

We are all aware of the rare case of a tumour or infection masquerading as an injury that is not getting better. If you see patients with anterior knee pain that has not improved at all with appropriate treatment after three months, it is reasonable to order x-rays (including skyline views) and arrange specialist review, outlining your suspicions.

Conclusion

Anterior knee pain is both common and treatable. The vast majority is mechanical in origin, and responds well to mechanical treatment such as load reduction, quadriceps exercises and taping to realign the extensor mechanism. In some cases, podiatry referral for orthotics is required. X-rays are only required in a few cases acutely or if there has been no response to appropriate treatment after three months. Involve an experienced physiotherapist routinely in treatment, and refer on those patients who are not responding as expected.

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