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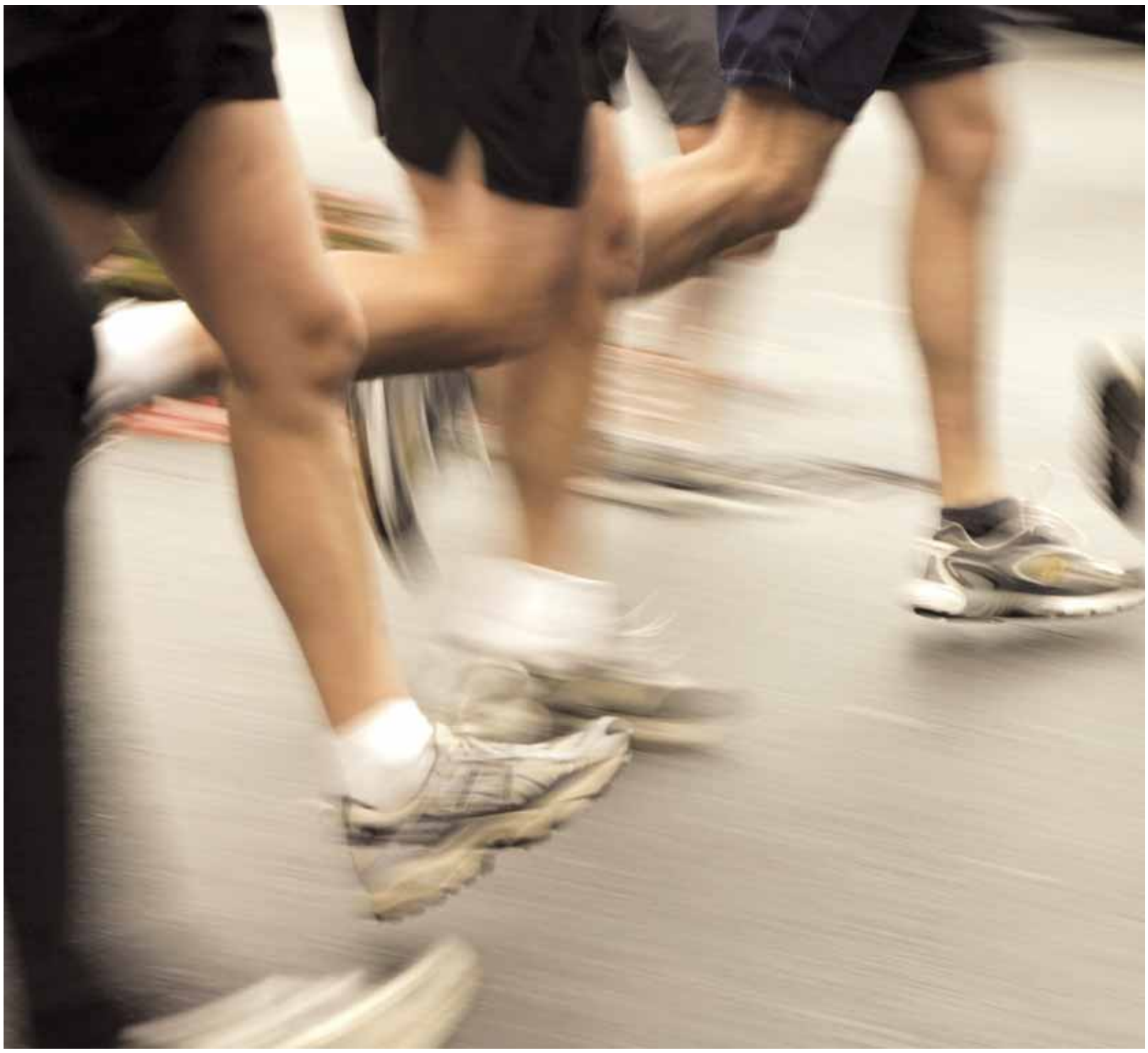

inside

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Exercise-related **LOWER-LIMB PAIN**

Background

PRESCRIBING exercise to our patients has become a common management strategy in 21st century general practice. With the rise in health challenges such as obesity, metabolic syndrome, diabetes, cardiovascular disease and osteoporosis, the need for improved aerobic and anaerobic fitness in society has been widely recognised.

Motivating patients to involve themselves in exercise programs is not always easy. If they succumb to injury early on in their new fitness regimen, future prospects of increased activity levels dwindle. Preventing injury, recognising injuries early and optimally managing injuries is thus paramount.

Maintaining fitness levels in adults is a health priority in preventive medicine and a key role for GPs. Whether it be preparing for a fun run, returning to social sport, starting a gym program or preparing for a walking holiday, our patients will expect their lower limbs to support their endeavour.

Lower-limb pain is a common presentation to general practice, according to BEACH data. Diagnosis is not always straightforward, as presenting features of many of the more common conditions overlap.

This article deals with some of the more important and common exercise-related lower-limb pains. Some conditions, such as patello-femoral dysfunction have previously been covered in their own right. Exercise is only one factor in the aetiology of these injuries but can bring out pre-existing factors such as endocrine dysfunction, atherosclerosis and biomechanical abnormalities.

Clinical assessment

A DETAILED history and thorough examination will often delineate the nature of the problem. Table 1 gives a brief overview of the more common conditions. Table 2 lists differential diagnoses.

A detailed pain history is crucial (see table 3). A pain diagram detailing the site of pain is often revealing. Focal tibial pain should raise suspicions of a stress injury, while diffuse pain invites a diagnosis of compartment syndrome, medial tibial stress syndrome or referred pain.

The nature of the pain is important, deep aching pain being most likely somatic in nature, while sharp shooting pains in a narrow band suggest radicular pain. Both somatic referred pain and radicular pain can arise from lumbosacral and pelvic structures and may cause predominantly leg pain.

An important part of history taking is to address red-flag and yellow-flag conditions. Appropriate markers are mentioned in tables 4 and 5. Conditions that should not be missed include:

- Neoplastic disease (primary and secondary).
- Vascular compromise (DVT, arterial obstruction).
- Osteomyelitis/septic arthritis.
- Inflammatory arthritis.
- Neurological disease (neuropathies, multiple sclerosis, cauda equina).

Yellow flags similarly alert practitioners to patients whose recovery may be slowed because of psychosocial distress. Early management of these issues can go a long way to preventing acute injures becoming chronic.

The physical examination is important for identifying red flags, picking up on pain behaviours and developing patient rapport. It may help with a specific diagnosis, but there is much overlap between different conditions causing exercise-related lower-limb pain, thus specific diagnosis on history and examination may not always be possible.

Full description of the examination of the lower limb is beyond the scope of this article but can be found in standard texts (see Recommended reading).

Discussing risk factors, preferably before patients start their increased physical activity, is advisable. Table 6 discusses some of the modifiable risk factors for exercise.

If investigations are required, physicians must consider how the results of an investigation will influence management before ordering the test. Other important considerations are the expense of the test (to the patient and the health community) and the radiation exposure involved.

Table 1: Diagnosing leg pain

Diagnosis	Symptoms and signs	Investigations
Patellar tendinosis	Focal tenderness, usually at the inferior pole of the patella	Plain X-ray to screen for bony abnormalities may be considered. Consider ultrasound, but this is not normally needed
Medial tibial stress syndrome	Diffuse pain and tenderness along posteromedial tibia	Plain X-ray ± bone scan or MRI
Tibial stress fracture	Focal pain and tenderness over the bone	Plain X-ray ± bone scan or MRI
Chronic exertional compartment syndrome	Pain with exercise over involved compartment	Compartment pressure testing
Achilles tendinosis	Achilles pain with or after exertion. Tender fusiform swelling mid-tendon or focal tenderness at insertion	Plain X-ray for insertional tendinosis, looking for Haglund's deformity. Consider ultrasound scan if concerned about a tear or bursitis
Iliotibial band syndrome	Lateral knee pain with exercise. Focal tenderness over the distal iliotibial band where it crosses the femoral condyle	Usually not necessary; plain X-ray to screen for bony abnormalities may be considered
Nerve entrapment	Claudication type pain, often burning in nature. Tinel's sign positive	Electrophysiological studies

Table 2: Differential diagnosis of exercise-related chronic leg pain

Tissue/process involved	Possible diagnoses
Bone/periosteum	Stress fracture Medial tibial stress syndrome
Muscle/tendon/enthesis	Tendinosis/enthesopathy Myofascial pain Compartment syndrome
Vascular	Popliteal artery entrapment syndrome Atherosclerosis
Referred pain	Somatic referred — lumbosacral spine, pelvis, hip Radicular Peripheral nerve entrapment
Neoplasm	Osteosarcoma, Ewing's tumour, osteoid osteoma; secondaries
Infection	Osteomyelitis, septic arthritis
Bursa	Bursitis

Table 3: Pain history (NILDOOCARRFPIS)

Nature	Sharp and shooting (typical of radicular pain) vs deep and aching (typical of somatic referred pain)
Intensity	This is usually measured by a numbered scale or visual scale; allows monitoring of response to interventions
Location	Site of pain suggests possible sources; patients should be encouraged to map their pain on a diagram
Duration	Ongoing pain should alert physicians to perform a full review
Onset/offset	Variation in pain should be recorded in relation to time of day, activities and its duration
Concomitant factors/ symptoms	Relationship of other symptoms such as paraesthesia or temperature change to the pain can suggest certain aetiologies
Aggravating/relieving factors	Factors that precipitate or relieve pain may give pointers to diagnosis, eg, mechanical or inflammatory
Radiation	Pain often refers along the length of the leg because of somatic referred or radicular features
Frequency	If the pain fluctuates, record the time period
Previous treatments	What has the response been to all management options prescribed or non-prescribed?
Irritability	What activities does the pain prevent? What is the effect on activities of daily living?
Sleep	Abnormal sleep patterns need to be noted and managed

Table 4: Red flags

- Age >50
- Trauma (osteoporosis)
- Neurological symptoms/signs
- History of cancer, weight loss or systemic illness
- Morning stiffness for longer than one hour
- Drug abuse, corticosteroid use
- Not improving after one month of management
- Fever, night sweats, recent surgery

Table 5: Yellow flags

- A tendency to lowered mood and withdrawal from social activity
- An expectation that passive treatments will help more than active participation (passive coping strategies)
- Fear-avoidance behaviour (avoiding activities for fear of further damage)
- Past history of chronic pain (anywhere in the body)
- Negative attitudes and outlook
- Somatisation and preoccupation with health

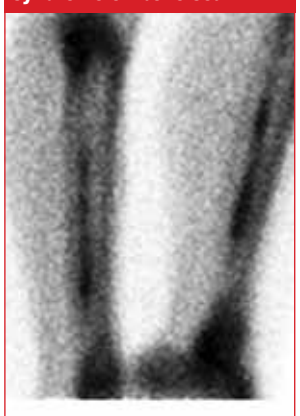
Table 6: Risk factors for exercise-related lower-limb pain

Extrinsic	Intrinsic
Training methods — sudden changes in training volume, intensity or technique	Previous injury — the biggest risk factor for leg pain is a history of a previous leg injury
Training surface — irregular, hard or banked surfaces	Osteopenia/osteoporosis — increases risk of stress fracture
Shoes — after 500km shoes lose their ability to absorb shock	Shortened quadriceps, altered vastus medialis obliquus reflex response time, decreased explosive power and hypermobile patella are all risk factors for anterior knee pain
Sports — risk of lower-leg injury is greatest in the first four weeks of the season; risk of injury is greater in competition than training	Weak plantar flexors and increased dorsiflexion of the ankle are risk factors for Achilles tendinosis
Inadequate nutrition — poor nutrition can lead to early fatigue, osteopenia and delayed healing	Sex — female military trainees have a highly increased risk of bone-stress injuries of the pelvis and hip, compared with male conscripts; females are more at risk for anterior cruciate ligament injuries

Medial tibial stress syndrome

MEDIAL tibial stress syndrome (MTSS) is best thought of as a stress reaction in the tibia. If it is not recognised early enough it can progress to stress fracture and a more protracted recovery. It is most commonly found in runners but is also found in the ballistic sports such as basketball, dancing, netball and volleyball. It often presents in preseason training when players are concentrating on regaining their aerobic fitness and is common with basic training in the armed forces.

Figure 1: Medial tibial stress syndrome on bone scan.



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The first symptom is diffuse pain along the posteromedial border of the middle and distal thirds of the tibia. Early on it usually only occurs at the start and end of the physical activity, and the pain subsides quickly after stopping activity. As the condition progresses the pain lasts longer and occurs with even gentle activities.

The main physical finding is diffuse tenderness along the posteromedial tibia. Usually there is no tenderness to percussion or vibration (eg, tuning fork), in contrast to stress fractures, where there often is tenderness. There is no swelling or erythema.

Plain X-rays are usually normal but occasionally posterior cortical thickening is seen as a result of persistent bony remodelling. Bone scan reveals the characteristic longitudinally orientated diffuse tracer uptake (figure 1).

Management centres on reorganising training techniques. Inevitably the offending activity (usually running) has to be temporarily replaced by cycling or water-based activities. Running in a pool with a flotation device can help maintain aerobic fitness.

Usually after a week or two training can be resumed, starting at about 50% of pre-injury intensity. Each week patients may increase workload by 10% as long as they remain asymptomatic. A search for modifiable risk factors is appropriate early on (see table 6, page 34).

Ice massage, simple analgesia and NSAIDs can be used to control pain in the recovery phase. Ultrasound, massage, phonophoresis (use of high-frequency, low intensity ultrasound waves to administer medications through the skin) and applied electrical fields have all been used but the evidence for their effectiveness is limited to case studies only.

Surgery for MTSS is rarely required but posterior fasciotomy may be performed when conservative therapy has failed. However, results are variable and patients need to be counselled that return to full pre-injury activities may not be possible.

Tibial stress fractures

FURTHER along the continuum from MTSS comes stress fracture. It is at this point that the bone's ability to repair itself has been compromised and bone resorption outstrips bone formation. As with MTSS, stress fracture usually occurs when there has been an increase in training duration, frequency or intensity. A change in training surface (including shoes) may also be a factor.

Other factors that are important to determine are eating habits, hormonal status, past history of stress fracture and the possibility of bone disease. Women are particularly at risk of stress fractures, so particular attention to the menstrual history, weight changes, level of nutrition and oral contraceptive use is necessary.

Classically, tibial stress fractures start insidiously, initially with an ache in the lower leg after exercise that settles quickly with rest. With progression the ache becomes pain, comes on more quickly and lasts longer. The pain is more focal and more proximal compared with that in MTSS.

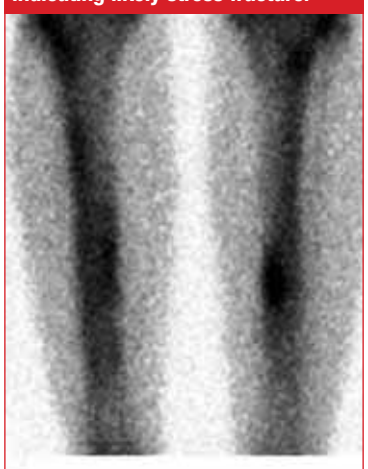
On examination, the tibia is normally tender at the posteromedial margin near the junction of the middle third with the lower third. Occasionally there will be anterolateral tenderness of the tibia, which should raise suspicion of an anterior cortex fracture.

Tibial stress fractures are more common in jumping sports and dancing and are notorious for non-union. They carry a risk of progression to complete fracture, as famously happened to Richard Boxall in the British Open golf major in the 1980s.

Investigations should be considered if there is diagnostic doubt, concerns regarding red-flag conditions or a high desire to return quickly to sport, for example, with elite athletes. A plain X-ray may reveal a small fracture line, periosteal reaction or callus formation. An anterior cortex defect, known as 'the dreaded black line' is the hallmark of anterior tibia stress fractures.

Triple-phase bone scintigraphy is useful for early diagnosis and is normally positive after three days of symptoms, compared with 2-3 weeks for plain X-ray. Bone scans show focally increased uptake in the region of the fracture (figure 2). They are sensitive but not specific, and so will not distinguish stress fracture from other pathology such as osteomyelitis or osteoid osteoma.

Figure 2: Tibial stress fracture. Increased uptake in the posteromedial aspect of the tibia indicating likely stress fracture.



RT ANTERIOR LT

MRI has the advantages of excellent anatomical detail, no radiation exposure and the ability to differentiate between longitudinal stress fractures and MTSS.

Management consists of reducing the bony stress and identifying modifiable risk factors (see table 6, page 34). Initially patients should be non-weight-bearing for 2-4 weeks. To maintain fitness while waiting for bony repair, cross-training by deep water running, cycling or other non-weight-bearing exercise is recommended. A graded rehabilitation program can then begin and when the person can bear weight without pain they can gradually wean back into activities, as for MTSS.

If pain persists past the initial four weeks of rest, bracing or casting should be considered for a further 3-12 weeks. Pain relief with simple analgesics, NSAIDs and ice massage may be used. NSAIDs, particularly selective COX-2s, have shown significant detrimental effects on fracture healing in animal studies, so they should be used with caution.

Usually patients can expect to return to full training after 8-16 weeks but in some cases recovery will be prolonged. Anterior cortex fractures average six months for full recovery and are prone to non-union requiring surgery. Longitudinal stress fractures and chronic non-union proximal medial stress fractures also often require surgical intervention.

Physical therapy interventions such as ultrasound, pulsed magnetic fields, electrical stimulation and laser have been used as adjunctive treatments, but compelling data on their effectiveness are lacking.

Other stress fractures

Tibial stress fractures are the most common stress fractures in the lower limb but many other areas in the lower limbs are vulnerable. A convenient way to classify these is into low-risk and high-risk groups.

Low-risk fractures include metatarsal shaft, femoral shaft, tibial shaft, fibula, calcaneus, sacrum and pubic rami. They are diagnosed on clinical grounds, with confirmation by radiology. Management usually requires only a short period of non-weight-bearing, if any, with 2-6 weeks of partial weight-bearing before weaning back into full activities.

High-risk stress fractures are prone to non-union and progression to complete fracture. They include femoral neck, patella, anterior cortex of the tibia, navicular, talus, medial malleolus, base of the fifth metatarsal and sesamoid.

These fractures require more conservative management, with an initial non-weight-bearing period of 4-6 weeks and often months of rehabilitation before there is a return to full activities. Surgical intervention with internal fixation may need to be considered.

Tendinosis

ALTHOUGH tendons have the highest tensile strength of all connective tissue, they are prone to mechanical breakdown. Manual workers, recreational sportspeople and even office workers can all be affected. Tendon injuries in professional athletes can be career threatening. Early identification of injury and initiation of appropriate management is vital for minimising time to recovery.

The most common injury to tendons is tendinosis, a non-inflammatory condition that results in intra-tendinous degeneration related to ageing, decreased vascular supply and microtrauma. Tendinosis needs to be distinguished from tendinitis and paratenonitis.

Tendinosis is responsible for 30% of all overuse sports injuries.

Tendinosis was first described by German pathologists in the 1930s but the first publication on tendinosis in English literature did not appear until 1976. The term is still not in common usage despite authors urging that the 'tendinitis myth' be corrected.

Tendinitis is a much less common condition than tendinosis and is usually associated with an inflammatory disorder such as rheumatoid arthritis. Paratenonitis is inflammation of the outer layer of the tendon (paratenon) and is responsible for the crepitus felt with movement.

A recent discovery in tendinosis has revealed neovascularisation in the painful areas of the structurally abnormal tendons not seen in pain-free normal tendons. These neovessels and their accompanying nerves have been suspected to play a role in the pain mechanism of tendinosis.

Studies on rats suggest the peripheral nervous system plays an important role in tendon repair along with vascular endothelial growth factor. Ohberg and Alfredson have shown that by guiding injections of polidocanol into neovessels, significant reduction in pain levels and remodelling of the tendon occurs.[1]

Tendinosis is responsible for 30% of all overuse sports injuries. The two most common persistent forms of tendinosis in the lower limb are Achilles and patellar tendinosis. Achilles tendinosis is most commonly associated with running activities, while patellar tendinosis is usually associated with jumping activities such as basketball.

Achilles tendinosis

Achilles tendinosis may be insertional or mid-tendon. In this article we will focus on mid-tendon tendinosis. Insertional tendinosis is usually associated with Haglund's deformity, a prominence of the posterior superior calcaneal tuberosity that contributes to irritation of the overlying tissues and the Achilles tendon. Surgery is often needed in persistent cases of insertional tendinosis.

Mid-tendon Achilles tendinosis is most commonly seen in recreational athletes aged 30-50, although it also occurs in the sedentary population. Men are three times more at risk than women.

Pain usually starts insidiously with some discomfort after exercise. As it progresses, patients notice pain during exercise and stiffness after inactivity. They may notice a thickening of the tendon. Clinically, there is a tender nodular thickening in the mid-tendon.

Paratenonitis can be differentiated, as the swelling is more sausage-like and stays fixed when the foot is plantar or dorsiflexed. The Thompson test should be performed if there is concern regarding complete tear of the tendon (see figure 3, page 41).

Imaging is not normally needed for Achilles tendinosis. Reasons to consider imaging include concern about a full tear, excluding other pathology and check-

ing the bursae. Ultrasound or MRI gives the best soft tissue views and a plain X-ray is usually all that is needed to exclude bony abnormalities such as Haglund's exostosis.

Management of Achilles tendinosis

Management of Achilles tendinosis centres on managing pain and strengthening the tendon. NSAIDs have not been shown to be useful in Achilles tendinosis, so paracetamol-based analgesics should be the first-line analgesia if needed. Ice is a simple but effective analgesic strategy and along with activity modification will usually suffice to control pain.

The most effective exercise regimen is eccentric exercise for the triceps surae (figure 4). Alfredson showed that a 12-week program of twice daily exercise (three sets of 15 repetitions) seven days a week resulted in return to pre-injury activity levels and a significant reduction in pain levels.[2]

Alfredson has subsequently shown sclerosing injections of polidocanol performed under ultrasound guidance significantly reduce pain in chronic mid-portion Achilles tendinosis.[1] A simpler injection therapy involving 30% dextrose, 0.1% lignocaine and 0.1% ropivacaine that does not require ultrasound guidance has shown promising results in case-controlled studies. Queensland researchers are currently performing a randomised controlled trial on this management. Other injections that have been used with varying success include aprotinin and blood-derived growth factors.

Steroid injections are very controversial for tendinopathy because of concerns regarding subsequent tendon rupture. Consideration may be given for their use when there is significant rest pain not responding to more conservative treatment. Injection of corticosteroid into the bursa around the Achilles tendon has been useful in managing persistent rest pain without increasing the risk of rupture.

Simple 1cm heel-lifts to deload the Achilles tendons bilaterally may be helpful. Alternatively podiatrists may prescribe an orthotic to minimise any biomechanical abnormalities placing unwanted stress on the Achilles tendon. However, it should be realised that to date, there has not been any clear association shown between lower-limb tendinopathies and biomechanical abnormalities.

Physiotherapy is useful to supervise exercise prescription and manage any associated joint or myofascial dysfunction. Nitroglycerin patches (one-quarter of a 5mg/24-hour patch) have been shown to be effective in other forms of tendinoses, so these may be considered if other management strategies have failed.

If there is no response to 6-9 months of conservative therapy, surgery may be considered. Results are variable, with up to 20% requiring re-operation, and complications occurring in 5-10%. About 75% of people will return to their usual activity level six months after surgery.

Figure 3: The Thompson test — when the calf muscle is squeezed, the foot should plantarflex if the Achilles tendon is intact.

Myths and facts regarding tendinosis

Myth	Fact
Tendinosis is self-limiting and heals in a few weeks	Tendinosis is recalcitrant, often taking months to settle
Imaging appearance can predict prognosis	Imaging is a very rough guide, false positives abound
Cyst-like structures on ultrasound require surgery	Cysts are commonly asymptomatic
Surgery provides rapid and full recovery	Expect at least 4-6 months to return to sport after tendon surgery. There is a small but significant morbidity associated with surgery

Patellar tendinosis

Patellar tendinosis is the other common lower-leg tendinosis. Mainly seen in the running and jumping sports, patellar tendinosis is an insidious condition that often presents late. There is tenderness to palpation of the tendon, usually at the inferior pole of the patella. The tendon may be thickened and there is often associated patello-femoral dysfunction. Pain is aggravated by decline squats.

Plain X-rays of the knee may help exclude bony pathology. Ultrasound scans and MRI will reveal tendinosis changes and bursal inflammation but are not normally needed.

Management of patellar tendinosis

Management incorporates the same general strategies as for the Achilles tendon. The recommended exercise regimen is eccentric quadriceps exercise (figure 5). Initially the patient should start with exercises on the flat and progress to decline squat exercises. A strap for the patellar tendon may decrease pain, as may patella taping, allowing quicker progression of therapeutic exercise.

Physiotherapy can be helpful for managing soft tissue and joint dysfunction (eg, of the vastus medialis and the iliotibial band) and for supervising the progression of exercises. Injections may be considered to enhance recovery. As with the Achilles, steroid injections may be used for any accompanying bursitis and polidocanol has been used successfully for the tendinosis component. Consideration can be given to injections of aprotinin, dextrose or blood-derived growth factors as well as nitroglycerin patches. Surgery can be considered if conservative measures fail.

The results for surgery for patellar tendinosis are similar to those for surgery for Achilles tendinosis.

Figure 4: Eccentric exercises for Achilles tendinosis. The patient slowly lowers the heel over the edge of the step.

Figure 5: Eccentric exercises for patellar tendinosis. The patient may start on the flat but should quickly progress to single leg squats on a 25° decline board, exercising into tendon pain and progressing their exercises with load.

Chronic exertional compartment syndrome

CHRONIC exertional compartment syndrome is not uncommon in active young people. It may also occur in the sedentary and can be disabling and very painful. The symptoms are usually bilateral and the condition occurs equally in men and women. The aetiology is not well understood.

The lower limb has four distinct compartments; anterior, lateral, superficial posterior and deep posterior (table 7). The anterior is the most commonly affected compartment.

In chronic exertional compartment syndrome the compartment pressures become raised during exercise and stay raised for 30 minutes or longer. It is thought this results in myoneural ischaemia but MRI studies have failed to confirm this.

Patients present with pain, cramping or burning over the affected compartment. It comes on with exercise, usually at a predictable time and level of intensity and subsides when exercise stops. There may be ongoing low-level symptoms at rest. Associated symptoms include paraesthesia in the associated nerve distribution and bumps or herniations over the affected compartment.

Table 7: Lower-leg compartments

Compartment	Muscles	Nerves
Anterior	Tibialis anterior, extensor digitorum longus, extensor hallicis longus, peroneus tertius	Deep peroneal nerve
Lateral	Peroneus longus and brevis	Common peroneal nerve, superficial and deep branches
Superficial posterior	Gastrocnemius, soleus and plantaris	Tibial nerve
Deep posterior	Flexor digitorum longus, flexor hallucis longus, popliteus and tibialis posterior	Tibial nerve

Clinically, there may be tight tender musculature over the affected compartment, more noticeable straight after exercise. At rest, neurovascular examination should be normal. After exercise, the following neurological changes may be detectable:

- For the anterior compartment, weakness of dorsiflexion and loss of sensation in the web of the first toe.
- In lateral compartment problems, weakness upon inversion, with loss of sensation on the anterolateral part of the shin and the dorsum of the foot.
- For the deep posterior compartment, the patient may exhibit weakness in the foot muscles and loss of sensation in the foot arch.

The gold standard test for compartment syndrome is compartment pressure testing. Other tests that may be useful are ultrasound (DVT, arterial insufficiency) plain X-ray (bony pathology) and nerve conduction studies (nerve entrapment).

Compartment pressures are measured before exercise and one and five minutes after exercise. A diagnosis of chronic exertional compartment syndrome may be established with a resting pressure ≥15mmHg, or with a pressure ≥30mmHg at one minute, and/or with a pressure ≥20mmHg taken at five minutes after exercise.

Management

Conservative treatment measures include correction of biomechanical abnormalities, reducing or stopping the offending activity, massage and physical therapy. Various needling techniques have been described to try to restore optimal myofascial function.

If significant progress is not made in 1-3 months, surgery should be considered. Fasciotomy is the treatment of choice and works best for anterior compartment problems, with successful outcomes the norm. Fasciotomy to the deep posterior compartment may involve a lengthy recovery. Usually patients return to full activities 6-12 weeks after surgery.

Nerve entrapments

NEUROLOGICAL causes of pain in the lower limb include peripheral nerve entrapment, radicular pain from the lumbosacral nerve roots, polyneuropathies and chronic regional pain type 1 and 2. Entrapment of the common, superficial and deep peroneal nerves, and the saphenous nerve are discussed.

Typically nerve entrapments cause pain with exercise that may mimic claudication pain. There may be a burning nature to the pain in the distribution of the cutaneous branch of the affected nerve. If there is associated bladder or bowel dysfunction, weakness or loss of sensation, referral for full neurological assessment should be arranged.

Clinically, reproducing the presenting pain by Tinel's sign (percussion) or compression of the affected nerve is very suggestive of the diagnosis. Electrophysiological studies will usually confirm the diagnosis, with other investigations such as X-rays, MRI and ultrasound being useful to rule out alternative diagnoses.

Common peroneal nerve

The common peroneal nerve may be irritated in the peroneal tunnel by repetitive inversion and pronation of the foot such as with running and cycling or even prolonged squatting or crossed-leg position. Pain with exercise causes anterolateral pain.

After exercise there may be weakness of ankle dorsiflexion. Foot drop is only present late in this syndrome. Percussion of the nerve in the peroneal tunnel (ie, fibrous tunnel that runs behind the lateral malleolus) may increase pain.

Superficial peroneal nerve

The superficial peroneal nerve supplies both peroneal muscles and is vulnerable where it crosses the ankle anteriorly and where it penetrates the crural fascia at the junction of the middle and distal thirds of the tibia. Usually loss of sensation over the lateral calf or dorsum of the foot during exercise is the presenting symptom.

Deep peroneal nerve

The deep peroneal nerve may be irritated in the tarsal tunnel, causing symptoms in the dorsum of the foot. Lateral and anterior compartment syndromes may be associated with superficial and deep entrapments, respectively.

Saphenous nerve

The saphenous nerve is the longest sensory branch of the femoral nerve and may be irritated in the adductor canal or where it crosses the medial femoral condyle. Exercise-related pain creates medial leg or knee pain. Percussion of the nerve at its vulnerable points produces pain or tingling over the medial malleolus.

Treatment

Conservative treatment involving reduction of the precipitating activity, biomechanical correction, physiotherapy, and/or soft tissue massage, is often successful for treatments of common peroneal and saphenous nerve entrapments. Superficial nerve entrapment usually requires surgical release.

Iliotibial band syndrome

THE iliotibial band assists in leg abduction and anterolateral stability of the knee. It is a continuation of the tensor fascia lata muscle, with indirect attachments from gluteus medius, gluteus maximus and vastus lateralis muscles. It inserts into the lateral border of the patella, lateral aspect of the retinaculum and into Gerdy's tubercle of the tibia.

With running, the posterior edge of the band may impinge against the lateral femoral epicondyle just after foot strike, setting up irritation in the underlying tissue. Anatomical studies show this tissue to be a lateral extension of the joint capsule rather than a true bursa.

Iliotibial band syndrome is related to increased running distance, knee flexion or extension weakness, and hip abductor weakness. No strong biomechanical correlates have been found.

Patients present with lateral knee pain that may be sharp, burning or aching and comes on at a predictable time or distance with running. It settles down quickly after the run but with progression may occur with simple activities such as walking.

Figure 6: Ober's test. The patient lies with the unaffected side down and the unaffected hip and knee at a 90° angle. If the iliotibial band is tight, the patient will usually have difficulty adducting the leg beyond the midline and may experience pain at the lateral knee. Always compare with the other side.

Clinically the knee is usually normal to examination except for focal tenderness over the iliotibial band where it crosses the femoral condyle. There may be a tight tender band in the vastus lateralis, gluteus medius and minimus and biceps femoris. Ober's test (figure 6) is the best way to determine iliotibial band tightness and is easily compared with the opposite side. A gait analysis may be considered for biomechanical purposes.

Iliotibial band syndrome is the most common cause of lateral knee pain in runners. Other diagnoses to consider include lateral knee joint pathology, superior tibio-fibular joint sprain, popliteal or biceps femoris tendinosis, common peroneal nerve injury and referred pain from lumbopelvic structures.

Management protocols are derived from case studies and have not been rigorously evaluated. The principles involve initially managing the pain with ice, activity modification and analgesics. In the acute phase running and cycling activities may need to completely stop and be replaced by swimming (arms only). If the pain is slow to settle, local corticosteroid injection can quickly control pain symptoms.

Common rehabilitation goals include stretching the iliotibial band and tight musculature (eg, iliopsoas, gluteus medius, rectus femoris, gastrocnemius), normalising myofascial dysfunctions, strengthening hip abductors, addressing risk factors and weaning back into normal activities. Surgical release of the distal iliotibial band has been used in recalcitrant cases.

Author's case studies

A shifting diagnosis

MR G, a 45-year-old recreational runner, presented complaining of bilateral calf pain with exercise. It had slowly worsened over three years to the point where he now no longer ran, and even brisk walking was affected. There was associated numbness in the toes and the right side was worse than the left.

He was otherwise healthy, a non-smoker and there was a family history of protein C deficiency. His work was sedentary and unaffected and there were no signs of depression.

Examination at rest revealed tight tender bands in both gastrocnemii, no neurological or vascular abnormalities, no abnormalities of the lumbo-pelvic region and no major biomechanical abnormalities.

He had previously been investigated with arterial ultrasound of both legs, a CT scan of the lumbar spine and FBC, EUC and LFTs. No abnormalities were found on these investigations.

It was explained to Mr G that his symptoms may be due to chronic exertional compartment syndrome and the relevant treatment options were outlined. He chose to have his myofascial dysfunction treated, which resulted in only a minor change in his symptoms.

Compartment pressure testing was arranged and found to be normal. His dorsalis pedis pulse on the right was noticed to be absent after the exercise for the compartment testing, raising the possibility of popliteal artery entrapment.

Ultrasound scanning after exercise was arranged at a dedicated vascular investigation laboratory. It was clear for popliteal artery entrapment but revealed significant atherosclerosis throughout the lower-limb arteries, sufficient to account for Mr G's symptoms.

The findings were explained to Mr G and arrangements were made for a full workup of his atherosclerosis and referral for a vascular surgery opinion.

Achilles tendinosis

Mr E, 42, presented with left Achilles tendon pain with exercise of 12 months' duration. It was not settling despite stopping his running, using ice, therapeutic stretches and having a podiatrist fit orthotics. He was well otherwise and took no medications.

Clinically there was a tender nodule mid-tendon on the left Achilles tendon. The Achilles insertion was pain free. There were no vascular, neurological or myofascial abnormalities; a squeeze test was negative and the yellow-flag checklist was negative.

An ultrasound scan previously performed was consistent with tendinosis, with no evidence of a tear. Mr E rated his pain after walking for 30 minutes as 6/10 on the numerical pain scale.

The management options for Achilles tendinosis were explained to Mr E, along with the nature of the condition. He was happy to commit to the 12-week eccentric exercise program and chose to trial 30% dextrose/0.1% lignocaine/0.1% ropivacaine injections weekly, as per the Griffith University Achilles trial.

After four weeks Mr E was pain free and had started to wean back into running. He was encouraged to continue the exercises for another eight weeks and to continue slowly increasing his running.

Summary

EXERCISE-related lower-limb pain is a common presentation to primary health practitioners. It can easily lead to prolonged periods of inactivity, impaired work performance and associated low mood.

GPs are ideally suited to manage these conditions.

Co-ordinating care with other health providers such as physiotherapists, sports and musculoskeletal physicians, radiologists, psychologists and orthopaedic surgeons is paramount to prevent fragmented care.

References

1. Alfredson H, Ohberg L. Sclerosing injections to areas of neo-vascularisation reduce pain in chronic Achilles tendinopathy: a double-blind randomised controlled trial. *Knee Surgery, Sports Traumatology, Arthroscopy* 2005; 4:338-44.
2. Alfredson H, et al. Heavy-load eccentric calf muscle training for the treatment of chronic Achilles tendinosis. *American Journal of Sports Medicine* 1998; 26: 360-66.

Further reading

- Louis Solomon, David J. Warwick, Selvadurai Nayagam. Apley's System of Orthopaedics and Fractures. 8th edition. London; Edward Arnold, 2001.
- Brukner P, Khan K. Clinical Sports Medicine. 3rd edition. North Ryde, Australia; McGraw-Hill, 2007.

Online resources

- Australian Acute Musculoskeletal Pain Guidelines Group. *Evidence-Based Management of Acute Musculoskeletal Pain:* www.nhmrc.gov.au
- Australian Association of Musculoskeletal Medicine. www.musmed.com
- The Physician and Sports Medicine Online. www.physsportsmed.com

GP's contribution

DR PHILIP LYE
Sutherland, NSW

Case study

JUSTIN is a 41-year-old office worker who plays amateur soccer once a week, and runs three times a week.

Six months ago, while playing soccer, Justin felt as though he had been struck in the back of his right calf. He was unable to play on and his calf quickly became painful and swollen. He presented to me the following evening.

Since the injury he had been able to walk, although he had noticed significantly decreased power on toe off. In retrospect, he realised he had had some symptoms in his right Achilles tendon over the preceding few months.

On examination, Justin's gait was antalgic. There was a palpable defect at the proximal extent of his right Achilles tendon, and Simmond's test was positive for a ruptured tendon.

An ultrasound confirmed a full-thickness tear of the muscular tendinous junction of the right Achilles tendon. The tendon appeared heterogeneous and thickened and there was retraction of the tendon fibres, which were separated by up to 2cm. There was also a localised haematoma in the region of the tear.

Justin was referred to an orthopaedic surgeon. Given that he had a palpable defect and significant functional loss, surgical reconstruction was recommended. An uncomplicated repair was performed one week after the injury.

Questions for the author

Could this injury have been prevented?

The best chance of preventing rupture of the Achilles

tendon is early identification and management of Achilles tendinosis. Initial symptoms may not always prompt referral to a health practitioner, as in this case, but patients need to be alerted that ignoring such pains may result in a full tear of the tendon.

If Justin had presented earlier, how should his pre-rupture symptoms have been managed?

As per the management described for Achilles tendinosis. In particular, confirmation of the suspected diagnosis through clinical examination and investigation as required. If tendinosis were confirmed, Justin should be encouraged to consider his immediate sporting future. Some time spent performing an eccentric training program to strengthen the tendon, ± injections would be needed with a return to sport preferably when pain free.

What is the risk of re-rupturing a repaired tendon?

The complication rate after surgery is 5-10% but has been reported as high as 20%. Complications include re-rupture, infection, thrombosis and ongoing pain. Most studies have shown a higher re-rupture rate, with conservative management of tears compared with surgical management.

Interestingly, a recent study incorporating early motion controlled in a removable orthosis for both surgically repaired and conservatively managed Achilles ruptures did not demonstrate any difference in outcomes up to one year.* This may cause a rethink on the management of ruptured Achilles tendon.

Are any particular sports contraindicated if a patient has Achilles tendinosis?

There are no absolute contraindications. Normal recommendations relate to returning to full function and controlling pain before returning to sport. Sports that are more 'explosive', such as jumping sports or sports that require constant acceleration, are classically considered most risky.

Swedish researchers recently showed that rehabilitation of Achilles tendinosis with a exercise program that included running and jumping activities did not pose a risk to the patients.** The trial involved use of a pain-monitoring model in the active group to guide activity level.

General questions for the author

Can you please clarify the difference between tendinosis and tendinopathy?

These terms are generally interchangeable. They both refer to chronic conditions affecting tendons. Tendinopathy may be a more inclusive term, as there is no assumption about the pathology, while tendinosis implies a degenerative non-inflammatory condition.

How do you measure compartment pressures?

Compartment pressure is measured by inserting a large-bore needle or catheter into the suspect compartment and connecting it to a pressure monitor. Generally pressures are measured at rest. The patient is then exercised until symptomatic, with pressures measured at one minute and five minutes post exercise.

American Journal of Sports Medicine 2007; 35(12):2033-38.
** *American Journal of Sports Medicine* 2007; 35(6):897-906.

How to Treat Quiz

Exercise-related lower-limb pain — 27 June 2008

INSTRUCTIONS

Complete this quiz online and fill in the GP evaluation form to earn 2 CPD or PDP points. We no longer accept quizzes by post or fax.

The mark required to obtain points is 80%. Please note that some questions have more than one correct answer.

ONLINE ONLY

www.australiandoctor.com.au/cpd/ for immediate feedback

1. When assessing patients with lower-limb pain, which THREE of the following are 'red flags' for conditions that must not be missed?
a) Age >50
b) Fever or night sweats
c) Past history of chronic pain
d) Neurological symptoms or signs

2. When assessing patients with lower-limb pain, which THREE of the following are 'yellow flags'?
a) Negative attitudes and outlook
b) Morning stiffness lasting more than one hour
c) Somatisation and preoccupation with health
d) Fear-avoidance behaviour

3. Chris, 25, runs five days a week and also plays volleyball. He presents with pain in the left lower leg with activity. Which THREE statements regarding medial tibial stress syndrome (MTSS) are correct?
a) Early on the pain usually only occurs at the start and end of physical activity, and subsides quickly after stopping activity
b) Examination findings are swelling, mild erythema and localised tenderness over the posteromedial tibia
c) Plain X-rays are usually normal but occasionally show posterior cortical thickening
d) Management centres on reorganising training techniques, temporarily replacing the offending activity with cycling or water-based activities

4. Chris is diagnosed with MTSS and responds well to management. Two years later he represents with pain over the mid to lower tibia. Which TWO statements regarding tibial stress fractures are correct?
a) On examination the tibia is commonly tender at the posteromedial margin near the junction of the middle and lower thirds, or occasionally over the anterolateral aspect
b) Plain X-rays are usually positive for the diagnosis of a stress fracture after one week of symptoms
c) Bone scans are both highly sensitive and highly specific for stress fractures
d) MRI has the ability to differentiate between longitudinal stress fractures of the tibia and MTSS

5. Stress fractures of the lower limb may be classified into low- and high-risk groups on the basis of outcome. Which TWO statements are correct?
a) Low-risk stress fractures include patella, anterior cortex of the tibia, navicular, talus, medial malleolus and base of the fifth metatarsal
b) Low-risk stress fractures require only a short period of non-weight-bearing, if any
c) High-risk stress fractures include metatarsal shaft, femoral shaft, tibial shaft, fibula and calcaneus
d) High-risk stress fractures require an initial non-weight-bearing period of 4-6 weeks

6. Bob, 47, presents with a four-month history of pain in his mid-right Achilles tendon when jogging each morning. Which TWO statements are correct?
a) Women are three times more at risk of mid-tendon Achilles tendinopathy than men
b) Nodules in the Achilles tendon will remain fixed when the foot is plantar- or dorsiflexed
c) The Thompson test should be performed if there is concern regarding complete tear of the Achilles tendon
d) Imaging is not normally needed for Achilles tendinosis but should be considered if there is concern about a full tear

7. Which THREE statements regarding Achilles tendinosis are correct?
a) Paracetamol is not effective as an analgesic for Achilles tendinosis
b) The most effective exercise regimen is eccentric exercise for the triceps surae
c) Simple 1cm heel-lifts may be used to deload the Achilles tendons bilaterally
d) Surgery may be considered if there is no response to 6-9 months of conservative therapy

8. Tina, 28, runs daily and also plays basketball. She presents with anterior knee pain of gradual onset. Which TWO statements regarding patellar tendinosis are correct?
a) In patellar tendonsis there is usually tenderness at the superior border of the patella
b) Pain in patellar tendinosis is usually aggravated by decline squats
c) Initial management involves an exercise program starting with decline squat exercises
d) A strap for the patellar tendon may decrease pain, as may patella taping

9. Which TWO statements regarding chronic exertional compartment syndrome are correct?
a) Patients with chronic exertional compartment syndrome present with pain, cramping or burning over the affected compartment, which comes on with exercise and subsides when exercise stops
b) In anterior compartment syndrome, after exercise there may be weakness on inversion of the foot and loss of sensation over the dorsum of the foot
c) In deep posterior compartment syndrome, after exercise there may be weakness of dorsiflexion and loss of sensation in the web of the first toe
d) Chronic exertional compartment syndrome may be diagnosed with a resting pressure ≥15mmHg, or with a pressure ≥30mmHg at one minute, and/or with a pressure ≥20mmHg taken at five minutes after exercise

10. Which TWO statements regarding iliotibial band (ITB) syndrome are correct?
a) ITB syndrome is an infrequent cause of lateral knee pain in runners
b) The knee is usually normal to examination except for tenderness over the ITB where it crosses the femoral condyle
c) Ober's test is the best way to determine ITB tightness
d) Corticosteroid injections are contraindicated in all cases of ITB syndrome

CPD QUIZ UPDATE

The RACGP now requires that a brief GP evaluation form be completed with every quiz to obtain category 2 CPD or PDP points for the 2008-10 triennium. You can complete this online along with the quiz at **www.australiandoctor.com.au.** Because this is a requirement, we are no longer able to accept the quiz by post and fax. However, we have included the quiz questions here for those who like to prepare the answers before completing the quiz online.

Australian Doctor Education.

HOW TO TREAT Editor: **Dr Marcela Cox**
Editor and Quiz: **Dr Wendy Morgan**
Co-ordinator: **Julian McAllan**

NEXT WEEK Not all adverse reactions to foods have an allergic basis. Labelling a patient with any food adverse reaction as 'allergic' may confer inappropriate risk and exclusion, while children with true food allergies need appropriate protection from potentially life-threatening reactions. Hone your skills in differentiating allergic from non-allergic food reactions with next week's How to Treat on food allergy in children. The author is **Dr Brynn Wainstein,** consultant paediatric immunologist, private practice, Randwick, NSW; and staff specialist, department of immunology and infectious diseases, Sydney Children's Hospital, Randwick, NSW.