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Independent learning program for GPs

Unit 499 October 2013

Sports medicine

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The five domains of general practice
Communication skills and the patient-doctor relationship
Applied professional knowledge and skills
Population health and the context of general practice
Professional and ethical role
Organisational and legal dimensions

RACGP

Regular physical exercise is key to a healthy life and a healthy population. This month's *check* unit focuses on sports medicine. It includes management of injuries sustained while playing sport or being physically active. Sports medicine encompasses the management of elite athletes, sports people and anyone who is engaged in exercise from children to the elderly. Often it is a multidisciplinary team that looks at diagnosis, management, rehabilitation and prevention, as well as sports enhancement through training, nutrition and psychological performance.

We would like to thank the authors for providing a wealth of information about sports medicine for this unit of *check*.

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The learning objectives for this unit are to:

- identify triggers for exercise-induced asthma
- formulate an exercise plan for patients presenting with tennis elbow
- describe causes for groin pain
- source and create an up-to-date list of medications prohibited by WADA and ASADA in elite athletes.

We hope this unit of *check* helps you in the management of sporting injuries presenting to your clinic.

Kind regards,

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GUIDE TO ABBREVIATIONS AND ACRONYMS IN THIS UNIT OF *CHECK*

ABI	autologous blood injection	FADIR	flexion, adduction and internal rotation	PIN	posterior interosseous nerve
AFL	Australian Football League	FAI	femoroacetabular impingement	PRP	platelet-rich plasma
ASADA	Australian Sports Anti-Doping Authority	FBE	full blood examination	PSS	pubic stress syndrome
ASDMAC	Australian Sports Drug Medical Advisory Committee	FEV_1	forced expiratory volume in 1 second	PTFL	posterior talofibular ligament
ATFL	anterior talofibular ligament	FVC	forced vital capacity	RECSy	recurrent exertional compartment syndrome
CFL	calcaneofibular ligament	GTN	glyceryl trinitrate	SUFE	slipped upper femoral epiphysis
EIB	exercise-induced bronchoconstriction	MRI	magnetic resonance imaging	TUE	therapeutic use exemption
FABER	flexion, abduction and external rotation	NSAIDs	non-steroidal anti-inflammatory drugs	URTI	upper respiratory tract infection
		OA	osteoarthritis	VMO	vastus medialis oblique
				WADA	World Anti-Doping Agency

CASE 1

MIA HAS SORE SHINS

Mia, aged 16 years, comes to your clinic and complains of shin pain. She is a netballer and plays competition netball for her school team. She rides her bike to school most days of the week.

She has had shin pain for 6 months. Selection trials for an interstate event are coming up later in the year and Mia is desperately keen to make the representative team.

QUESTION 1

What are the essential features of Mia's history you need to elicit during examination?

FURTHER INFORMATION

Mia describes her pain as a sharp, severe sensation over the lower medial tibial border, which has recently caused her to pull out of games due to the severity of the pain. She notices that the pain occurs mainly on impact with the ground and it feels like a jarring sensation up her shin. It used to ease after the warm-up for games and return as a dull ache following games; however, now it stays for the duration of every game and aches at night. Mia can still cycle most days with only mild discomfort in her legs.

QUESTION 2

What is your differential diagnosis?

FURTHER INFORMATION

Tibial bone pain is strongly related to heel strike/impact during running. In the early stages, it will disappear once the athlete warms up, although as the injury progresses, the pain may become constant throughout exercise. When severe, it may be symptomatic even at night and at rest, which is a strong indicator of a stress fracture. See *Figure 1* for the continuum of bone stress.

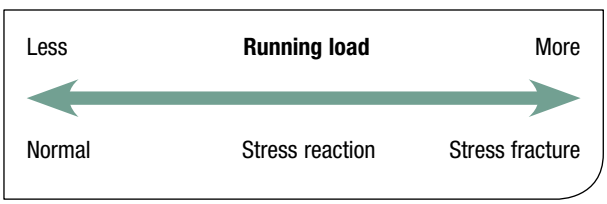

Figure 1. Continuum of bone stress. Stress fractures and reactions are part of the same process and are influenced by levels of running load

As impact loading increases, bone stress increases and tips the balance of bone deposition and resorption to the latter. Provided adequate rest or recovery periods occur after exercise bouts, this balance is restored as bone deposition is allowed to occur. However, if exercise duration, intensity or frequency is too great, a stress reaction or fracture may develop over time.

QUESTION 3

What findings do you look for on examination?

QUESTION 4

How do you investigate Mia's shin pain?

QUESTION 5

How would you manage Mia?

FURTHER INFORMATION

Mia represents to you 3 years later, having recovered from her tibial stress fractures. However, she now has bilateral exertional calf and medial shin pain that has limited her netball for the past season. Her calf pain comes on within the first quarter and she is now struggling to finish games. She describes a tight, cramping sensation that worsens the more she runs. This resolves within 30 minutes of the end of games and she is pain-free between exercise bouts. There is no tibial tenderness and Mia can hop without pain. She has had extensive massages on her calves and has worked on a stretching program, however, her symptoms are becoming progressively worse.

QUESTION 6

What is Mia's likely diagnosis now?

QUESTION 7

How will you manage Mia's condition?

FURTHER INFORMATION

It is not unusual for medial tibial stress fractures/reactions *and* recurrent exertional compartment syndrome (RECSy) to occur in the same patient, either simultaneously or sequentially over time. This can make the diagnosis challenging as the presentation may be a mixture of symptoms and signs.

RECSy usually occurs in adolescence to early adulthood and is then present indefinitely with running-based activity. It is rare for it to occur as an initial presentation of exertional calf or shin pain in later adulthood.

CASE 1 ANSWERS

ANSWER 1

You need to ask Mia specifically about the pain, including its:

- quality
- severity
- site
- radiation
- timing in relation to exercise
- precipitating and relieving factors.

It is essential to ask Mia to describe how the pain develops with each exercise bout, from commencement to completion, and also her symptoms in the days following exercise. Ask her what activities cause symptoms, whether it is impact (e.g. running) or non-impact (e.g. cycling) exercise.

Other important features to elicit are Mia's training and sporting history, particularly in the lead up to the onset of symptoms. Has there been a substantial change in the type or amount of exercise she has been doing?

Is there a past history of similar problems with exercise?

ANSWER 2

The differential diagnosis of Mia's pain is:

- stress fracture
- stress reaction.

ANSWER 3

You need to examine Mia for tibial tenderness:

- focal medial tibial tenderness is suggestive of a stress fracture
- linear or segmental tenderness is more likely to relate to a stress reaction.

Other signs to identify are:

- medial tibial pain on hopping or jumping
- pre-tibial swelling or palpable bony lump
- biomechanical abnormalities in the feet or overall lower limb alignment.

It is important to distinguish between true tibial tenderness and tenderness that occurs in the adjacent deep posterior compartment muscles that may be due to compartment syndrome or non-specific calf pain.

ANSWER 4

Imaging that might be useful for Mia include triple phase bone scan and MRI.

It is not essential to investigate this scenario, particularly if the injury is relatively clearly identified as a stress fracture as in Mia's case. However, factors such as time pressure to return to sport, chronic symptom duration, level of sport participation or poor response to previous management are examples where further investigation is useful.

The choice between imaging modalities depends on cost, availability and patient age (because of radiation). Although bone scanning is considered the gold standard, MRI has also been proven to be a valid imaging modality in stress fractures.[1]

Stress fractures typically appear as areas of intense focal uptake on triple phase bone scan in all three phases (*Figure 2*). On MRI they have a focal area of high signal on the T_2-weighted images (*Figure 3*).

Figure 2. Delayed phase bone scan of lower medial tibial stress fracture

Figure 3. Magnetic resonance imaging (MRI) of upper tibial stress fracture

ANSWER 5

Mia has a medial tibial stress fracture. This type of fracture resolves well with weight-bearing rest, typically taking 4–8 weeks for complete symptom resolution.

The use of ice and simple analgesics are useful in the early stages.

An initial period of limiting walking to essential amounts may be necessary in severe cases, and cross-training (e.g. bike/pool/upper body gym) can commence as soon as comfort allows (which is often immediately).

A slowly progressive return to impact-loading activity once hop/jump pain has resolved is essential to prevent recurrence of pathological bone stress.

There is no evidence that any supplements accelerate recovery; however, ultrasonic bone stimulators (e.g. LIPUS or EXOGEN) have limited evidence supporting their use.[2] Cost usually limits their use to high-demand athletes.

ANSWER 6

Mia's likely diagnosis is deep posterior RECSy.

RECSy is characterised by predictable onset of a cramping, tight pressure feeling in the involved muscle groups that comes on at some point into a running-based exercise bout and usually eases within 30 minutes of rest.[3] In the deep posterior compartment it is often associated with an element of medial tibial bone stress, which sometimes makes the diagnosis difficult due to a mixture of symptoms and signs.

Popliteal artery entrapment can present in a very similar fashion, although it is a rare condition with pain resolution typically within 1–3 minutes of rest.

ANSWER 7

RECSy is a clinical diagnosis that is made essentially on presenting features. As Mia's condition is becoming progressively worse despite appropriate conservative treatment (reduced exercise in addition to deep-massage therapy), it is worth performing intra-compartment pressure testing to confirm the diagnosis. This is an exercise test to pain with use of an indwelling muscle catheter system (see *Figure 4*) to prove raised intra-compartmental pressures post-exercise.

If elevated pressures are confirmed, counselling regarding possible surgical release of the relevant compartment fascia (fasciotomy or fasciectomy) is appropriate. Success rates for fasciotomy are considered good, as the majority of patients achieve good pain relief.[4]

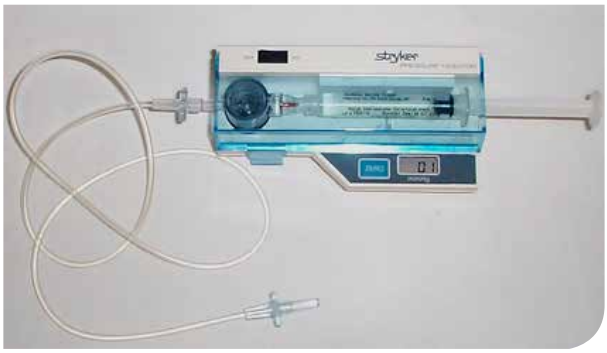

Figure 4. Stryker compartment pressure monitoring system

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CASE 2

ANNA HAS KNEE PAIN

Anna, aged 13 years, is fit and healthy. She enjoys playing netball and basketball. Her mother, Joan, brings her to your clinic. Anna has had right anterior knee pain for 2 months. She has had no acute injury to the knee, but the pain has prevented her from playing sport. She is able to walk comfortably on flat ground, but has pain while running, going down stairs, squatting and kneeling. She has not noticed any swelling in the knee.

On examination, Anna walks with a normal gait. Her knee has a full range of movement and there is no effusion. She has some mild tenderness at the lateral side of the knee.

QUESTION 1

What are the differential diagnoses of Anna's knee pain?

QUESTION 2

What features (both positive and negative) of Anna's presentation would make you consider patellofemoral pain as the most likely diagnosis?

QUESTION 3

What would lead you to request investigations for Anna?

QUESTION 4

What indications would lead you to refer Anna to a sports physician or orthopaedic surgeon?

FURTHER INFORMATION

Anna recalls that her knee pain may have begun while on a hiking trip through some mountainous country. She recalls it felt quite sore after a prolonged downhill walk. Her knee has been clicking a little, but has not locked. She has grown about 8 cm in the past 6 months. The pain has not disturbed her sleep, and she is otherwise well.

QUESTION 5

Assuming Anna has no indication for surgical intervention, what rehabilitation measures would be appropriate?

QUESTION 6

When can Anna return to sport?

CASE 2 ANSWERS

ANSWER 1

The most likely diagnosis is patellofemoral pain syndrome, also known as patellar maltracking or malalignment, or 'runners knee'.

Differential diagnoses include patellar instability, chondral or osteochondral injury (such as osteochondritis dissecans) and a discoid meniscus. Less common, but important, causes of atraumatic knee pain in children include hip joint pathology and bony tumours.

ANSWER 2

Typical features of the history of patellofemoral pain include onset of knee pain after a change in intensity, volume or type of sporting activity, or after a change in footwear. A recent growth spurt increases the load on the patellofemoral mechanism and can provoke pain. There may be a history of previous injury to the knee or thigh to cause some quadriceps inhibition, which subsequently leads to the development of knee pain. Subjective knee instability is unlikely, although pain may cause a feeling of weakness in the knee.

Relevant positive examination findings that you may note in Anna's stance include 'squinting patellae' (patellae pointing inwards), over-pronated stance, a 'Q' angle (the angle formed between the long axes of the femur and the tibia) of greater than 20°, and quadriceps atrophy, particularly vastus medialis obliquus (VMO). Another findings in patellofemoral pain may be a small effusion. Tenderness and tightness may be found in the lateral patellar retinaculum and iliotibial band as well as tenderness at the lateral femoral condyle and patellar margins. Patellar glide may be decreased medially, increased laterally or both. Generalised hypermobility can be assessed using the Beighton score (see *Table 1*).[1] Weakness in hip abductor muscles may be a contributing factor to patellofemoral pain.[2]

Relevant negative examination findings include stable collateral and cruciate ligaments, negative meniscal tests and an intact and pain-free range of movement at the hip.

Table 1. Beighton scoring for ligamentous laxity[1]

The Beighton score is calculated based on the following passive movement tests:

- 5th metacarpophalangeal extension ≥90° (1 point for each side)
- combined thumb/wrist flexion onto ipsilateral volar forearm (1 point for each side)
- elbow hyperextension ≥10° (1 point for each side)
- lateral patellar glide beyond the lateral femoral condyle in knee extension ≥10° (1 point for each side)
- palms to floor with bending from the waist, knees straight (1 point).

A score of ≥4 suggests generalised ligamentous laxity.

ANSWER 3

X-rays would be indicated if Anna had a history of a traumatic knee injury, or if she has persistent (i.e. greater than 7 days) or worsening night pain. An ultrasound examination is of little benefit in assessment of patellofemoral pain.

An MRI scan would be indicated if Anna had symptoms of a loose body in the knee (e.g. locking of the knee).

ANSWER 4

If Anna has recurrent effusion, locking or instability of the knee, or night pain, or if she fails to improve despite at least 8 weeks of good-quality rehabilitation, she should be referred to a sports physician or orthopaedic surgeon.

ANSWER 5

Successfully managing patellofemoral pain within the first 2 months may significantly decrease the risk of further anterior knee pain.[3]

Anna's initial treatment should be aimed at settling any effusion, and providing adequate analgesia with paracetamol and non-steroidal anti-inflammatory drugs (NSAIDs) if appropriate.

In the absence of surgical indications, treatment of patellofemoral pain requires a progressive rehabilitation program aimed at:

- improving VMO strength and timing. Isometric contractions allow for direct visual and palpable biofeedback for the patient (see *Figure 1*).
- decreasing tightness in lateral structures (e.g. iliotibial band)
- improving hip abductor strength.

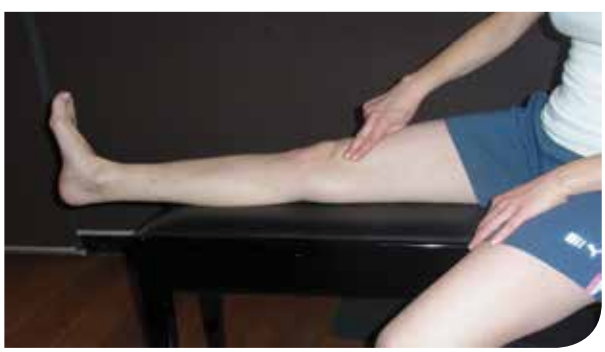

Figure 1. Isometric exercises of VMO

Other measures that may be of assistance in addition to rehabilitation are:

- controlling an over-pronated gait with orthoses[4]
- taping the patella or using a patellofemoral brace, which may provide some additional pain relief, although the evidence for this is mixed.[5]

ANSWER 6

Before Anna can return to netball she should have sequentially achieved:

- good isometric VMO contraction
- pain-free stairs, lunges and quarter squats
- pain-free straight-line running
- pain-free jumping, landing, stopping and pivoting drills
- full training.

Attempting to increase the intensity of activity before achieving the previous goal increases the risk of recurrent or persistent knee pain.

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CASE 3

JOHN PRESENTS WITH GROIN PAIN

John, aged 18 years, comes to your clinic with groin pain. He lives in the area and has attended your clinic all his life. John is an up-and-coming footballer with his eye on the AFL draft. He is frustrated about the development of right groin pain. He tells you that the pain started late last season and settled after the finals. Over the pre-season period, his pain was not too bad, but was 'just under the surface'. His pain started up again after starting the season. It is the fourth round now and he has significant pain.

John describes his pain as an intermittent pain in the central and medial right groin. During a game, it starts as an intermittently sharp pain and develops progressively into an ache that makes him limp. By the end of the game, he is quite sore. As he cools down, the pain worsens and he tends to limp for 24–48 hours after a game. Training tends to flare it again, so he has some level of pain most of the time.

QUESTION 1

Given John's history so far, what conditions may be causing his pain?

QUESTION 2

What key features are important to elicit in a focused history to help you differentiate the cause of pain?

FURTHER INFORMATION

John tells you that while running sometimes aggravates his pain, kicking practice is the most potent trigger. He also finds that the pain is worsened with leg-press exercises and deep weighted squats.

He does not have any other joint pains and there is no rash. He has no pain with cough or sneeze. He has not noticed any groin lumps. He has no urinary symptoms.

There is no family history of arthritis or psoriasis.

QUESTION 3

Which specific physical examination techniques can help differentiate the cause of John's pain?

FURTHER INFORMATION

When you examine John, you find normal back movement. He has no pain with cough or single-legged hop, and he has a normal Trendelenburg test. John has no groin masses on standing and no hernia is felt on palpation.

Right hip examination reproduces groin pain with full flexion and flexion, adduction, internal rotation (FADIR) testing. Inner quadrant stressing causes pain and a palpable click. There is pain with resisted right hip flexion.

John has no pain with adductor squeeze at any angle, and resisted sit-up is normal as is double-legged lift.

John has some anterior groin tenderness over the femoral triangle.

John has no cough impulse at any hernial orifices and testicular examination is normal.

QUESTION 4

What is the most likely diagnosis?

QUESTION 5

What investigations can be performed to confirm your provisional diagnosis?

FURTHER INFORMATION

The X-ray of John's hips shows changes consistent with femoro-acetabular impingement (FAI) (see *Figure 1*). There is a typical Cam lesion at the junction of the femoral neck and femoral head. There is also some sclerosis of the lateral acetabulum. FAI occurs when there is a mechanical mismatch between the ball and socket of the hip joint. When this occurs, the femoral head and acetabulum rub abnormally, damaging the hip joint. This situation can be caused by extremes of movement occurring with hyperflexion and internal rotation such as in kicking. A Cam lesion describes the loss of 'roundness' of the femoral head/neck, causing a mechanical mismatch in the joint.

Figure 1. X-ray showing FAI with a typical Cam lesion and some sclerosis of the lateral acetabulum

QUESTION 6

How should John be treated in the first instance?

QUESTION 7

How should John be managed if the pain does not settle?

CASE 3 ANSWERS

ANSWER 1

The most common causes of athletic pubalgia (groin pain) include hip joint pathology and pubic stress syndrome (PSS). Other causes are included in *Table 1*.

Table 1. Causes of athletic pubalgia[1]

Hip-related pain	PSS	Other
• FAI – Pincer, Cam • Acetabular labral tear • Femoral neck stress fracture • Post-traumatic synovitis • Inflammatory arthritis – e.g. rheumatoid, psoriatic, ankylosing spondylitis • Degenerative arthritis – previous Perthes disease, slipped upper femoral epiphysis (SUFE)	• Adductor origin tendinopathy/tear • Osteitis pubis • Pubic ramus stress fracture • Rectus abdominus tendinopathy • Conjoint tendon tear	• Iliopsoas tendinopathy or bursitis • Rectus femoris origin tendinopathy or tear • Sartorius origin tear • Hernia • Referred pain from T12 or L1 • Local lymphadenitis • Testicular cause for pain

ANSWER 2

The key features on the history that help differentiate the origin of groin pain are summarised in *Table 2*.

Table 2. Symptoms that differentiate various types of groin pain[1]

Hip joint pain	• Pain in the central groin • Radiation into the anterior thigh and, possibly, knee • Sharp groin pain with twisting and squatting
Pubic stress syndrome	• Pain in the medial groin • Radiation to the medial thigh and, possibly, lower abdomen • Pain with hip adduction stress
Conjoint tendon injury or hernia	• Groin pain with cough, sneeze and strain
Stress fracture	• Pain with hopping, jumping and leg jarring
Hernia or lymphadenitis	• Presence of a lump
Inflammatory arthritis	• Morning stiffness, rash, other joints involved

ANSWER 3

While the positive predictive value of isolated examination techniques may not be high, the key examinations shown in *Table 3* add greatly to the history and other findings.

Table 3. Examination for groin pain[1]

Hip origin	• Groin pain with full hip flexion ± overpressure • Groin pain with FADIR, FABER • Groin pain ± click with inner or outer quadrant test
Pubic stress syndrome	• Pain with adductor squeeze (0° and 60° hip flexion) • Tender adductor origin (usually adductor longus) • Tender over the pubic symphysis
Hernia	• Mass or impulse with cough
Lymphadenitis	• Tender lumps in the femoral triangle

ANSWER 4

The most likely diagnosis after history and physical examination is hip-related pain. The most likely causes are evolving rim lesion, FAI, labral tear and degenerative hip disease.

ANSWER 5

With a good history and examination, investigations can be minimised to those that will confirm the diagnosis. With John, an X-ray of the hip and pelvis would almost certainly be sufficient (see *Table 4*).

Table 4. Imaging for groin pain[1]

X-ray of the hip[2,3]	• Should show degenerative change and old Perthes or SUFE • Should show dysplasia from congenital dislocation of the hip • Will usually show evidence of FAI with lateral acetabular sclerosis, femoral neck Cam lesion • May show signs of a femoral neck stress fracture
X-ray of the pelvis	• May show sclerosis of the margins of the symphysis as well as erosions of the symphysis • May show evidence of a pubic ramus stress fracture
Soft tissue ultrasound	• Hernia, conjoint tendon tear
MRI	• Pubic stress syndrome (marrow oedema of pubic body) • Stress fracture (marrow oedema ± fracture)
MR arthrogram of the hip	• Detect labral tears not seen on plain MRI
Three-phase bone scan	• May localise source of pain in difficult cases

ANSWER 6

Many people with niggling FAI respond very well to an anti-inflammatory medication in association with a rehabilitation program and this should be suggested to John.

A rehabilitation program is designed to improve hip stability through gluteal and short hip rotator strengthening, to improve any imbalance between quadriceps and hamstring strength, and flexibility to avoid uncontrolled hyperflexion of the hip. A good appraisal of John's kicking style is also important so that cross-body kicking is avoided in favour of a fairly straight kick. This reduces the risk of the femoral neck jamming up into the supero-medial acetabulum.

FURTHER INFORMATION

In non-kicking sports where FAI is common, such as cycling, a similar approach is taken. In cycling, an alteration in the seat height and adducted position of the knee can stop the impingement that occurs in the racing position.

ANSWER 7

While many players with FAI will settle with the rehabilitation described above, those that don't settle will tend to have hip joint synovitis or a labral tear. In the first instance, John could be offered a hip joint corticosteroid injection for active synovitis, although there is dispute about the availability of this. This should be followed by a period of rest and then a graded return to sport.

If the steroid injection fails to settle things in the long term, a magnetic resonance arthrogram is generally performed as a preliminary investigation in the workup for surgery.[4,5] This test will normally be performed by a specialist.

In some instances, surgery in the form of arthroscopic debridement of the labral tear with or without debridement of the Cam lesion may be employed to remove the ongoing cause.[6–8]

FURTHER INFORMATION

While a great deal is made of PSS (osteitis pubis and related conditions), FAI is the most common cause of groin pain in the sporting community other than in the elite football group.[9]

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RESOURCES

For tips on physical examination of the hip, see the British Journal of Sports Medicine educational videos on examination techniques at http://bjsm.bmj.com/site/education/index.xhtml#videos

CASE 4

WAYNE HAS ELBOW PAIN

Wayne, aged 45 years, a carpenter, presents to your clinic with right elbow pain. Wayne is self-employed, and has two apprentice carpenters working for his business. He plays competitive tenpin bowling for a local club. He trains once a week and competes most weekends.

Wayne noticed vague right-sided elbow pain a few months ago without a precipitating injury. He first noticed elbow discomfort at work when using a cordless hand-drill. Lately he also experiences elbow pain with lifting and at night. He has significant lateral elbow pain when bowling.

He recalls that he had an elbow ligament injury when playing football many years ago.

When you examine Wayne, he has full range of elbow flexion, extension, pronation and supination with the right elbow equal to the left. He has mild discomfort at the end range of pronation of his right elbow. He had good strength and no pain on resisted actions of the elbow. The lateral elbow pain is reproduced with significant weakness on resisted wrist extension and gripping when compared to the unaffected left side. He has localised tenderness over the lateral humeral epicondyle and head of radius.

QUESTION 1

List the differential diagnoses for Wayne's elbow pain.

QUESTION 2

What are the most likely findings from history and examination to support a diagnosis of lateral epicondylitis (i.e. tennis elbow)?

QUESTION 3

Are any special investigations necessary for Wayne?

QUESTION 4

What would be an appropriate conservative management plan for Wayne?

FURTHER INFORMATION

Wayne presents to you again after 4 months of conservative management. He has responded to treatment and is now mostly pain free at work, even though he still avoids pronated forearm-lifting actions. He still, however, experiences significant elbow pain with tenpin bowling.

QUESTION 5

Describe the pathology of tennis elbow.

QUESTION 6

What special investigations will guide further management?

QUESTION 7

What treatment options are available to Wayne?

CASE 4 ANSWERS

ANSWER 1

The most likely diagnosis of Wayne's pain is lateral epicondylitis (i.e. tennis elbow). Other differential diagnoses (in decreasing likelihood) are elbow osteoarthritis (OA), posterior interosseous nerve (PIN) entrapment and cervical radicular referred pain.

ANSWER 2

Patients with tennis elbow usually experience a gradual onset of lateral elbow pain on lifting, especially lifting with a pronated forearm, and gripping. Patients occasionally experience an acute precipitating event. You would not expect the patient to have pain or clicking on elbow rotation, which may indicate underlying elbow OA, especially if there is a history of previous elbow injury. You would not expect pain to radiate to the forearm and wrist, which may indicate PIN entrapment. If there is a previous history of neck pain or associated upper limb neurological symptoms, it is important to consider a possible cervical radicular cause.

On examination you would expect to find reproduction of lateral elbow pain and weakness on resisted wrist extension and gripping when compared with the unaffected side. Tennis elbow is maximally tender over the lateral humeral epicondyle. You would not expect to find pain or clicking on passive elbow pronation and supination that may indicate elbow OA. Maximal tenderness below the lateral epicondyle may indicate PIN entrapment.

ANSWER 3

Tennis elbow is a clinical diagnosis and no special investigations are necessary.

If you suspect underlying elbow OA, an elbow X-ray may be of value.

ANSWER 4

The conservative management of tennis elbow is based on the principles of avoiding the aggravating actions and strengthening the common extensor tendon.

Wayne should be encouraged to use a safe lifting technique, with a supinated forearm (palm-up position) for all activities of daily living, work duties and sporting activities. He should avoid lifting with a pronated forearm (palm-down position). If typing or computer mouse use causes pain, consider supporting the wrist extensors with a wrist keyboard roll or wrist volar support splint.

In Wayne's case it is also important for him to consider his tenpin-bowling technique. He should always lift the ball using both hands and the right hand under the ball in the palm-up position. He should assess his technique of ball delivery, aiming for an open hand (supinated) delivery rather than closed hand wrist extension delivery.

To improve the strength of the common extensor tendon, Wayne should commence a daily, high-volume, eccentric strengthening program into the pain range. Wrist drops with a straight elbow over the edge of a table and a light weight in hand is recommended (aim to perform three sets of 15 repetitions, twice daily) (see *Figure 1*).

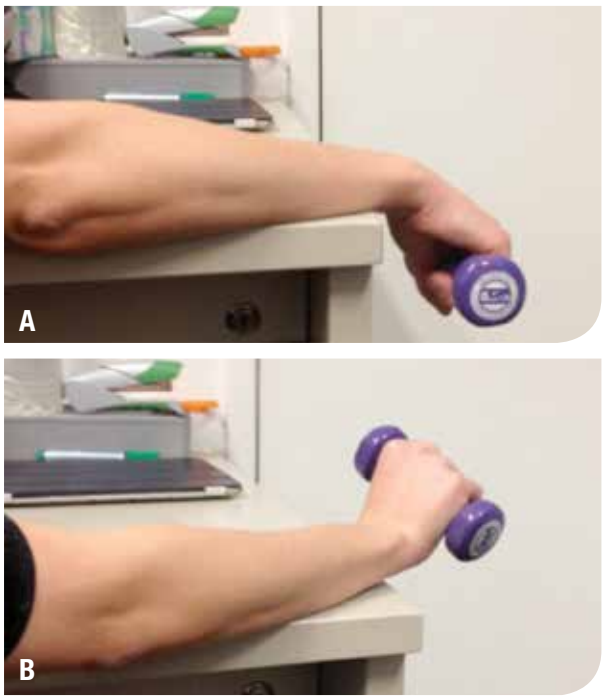

Figure 1. Wrist drops

To improve rotational strength, Wayne should perform broomstick rotations, rotating from a pronated wrist position to the thumbs up position, gradually moving the hand further away from brush side to increase resistance (aim to perform 2–3 sets of 15 rotations daily) (see *Figure 2*).

Figure 2. Broomstick rotations

ANSWER 5

There is no consensus on the pathology of tendinopathy. It can be best described as a chronic degenerative condition, where there is disorganisation of tendon fibres, with occasional tearing and abnormal neurovascular in-growth. Even though tendinopathy is not considered an inflammatory condition, there is growing evidence[1] of neurogenic inflammation as the main cause for pain, maintaining the pathology process and explaining short-term responsiveness to corticosteroids.

ANSWER 6

An ultrasound scan is a low-cost diagnostic investigation that confirms lateral epicondylitis, and helps plan further treatment options in patients who do not respond to initial conservative management.

An MRI scan may be of value for those patients where there is a suspicion of intra-articular pathology.

ANSWER 7

Patients who do not respond to initial conservative treatment should be encouraged to continue strengthening exercises and avoid aggravating actions. A physiotherapist may help with soft tissue measures around the elbow and to guide the strengthening program.

Most patients will have a favourable prognosis. In one trial, 80% of patients with elbow pain lasting longer than 4 weeks duration recovered after 1 year by following an expectant policy with no specific treatment.[2]

Patients with high-grade tendon neovascularity may respond to sclerosing injections,[3] while patients with tearing or large tendon hypoechoic areas may consider autologous blood or platelet-rich plasma injections. However, there is no evidence yet to support this decision-making process.[2] The current evidence suggests no difference between the outcomes of the above-mentioned interventions, apart from patients receiving corticosteroid injections being worse off long-term, even worse than wait-and-see groups.[4,5]

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CASE 5

KATIE GETS SHORT OF BREATH WHEN SHE EXERCISES

Katie, a tall, 17-year-old state-level freestyle swimmer, presents to your clinic with her mother, Elizabeth. For the past 4 months, Katie has had shortness of breath, chest tightness, wheezing and a dry cough during and after high-intensity swimming bouts. She tends to cough and have difficulty getting her breath between her swimming sets. She also gets frontal headaches, sinus congestion and rhinitis, which have been somewhat worse in spring. Katie has started to notice a decline in her training performance and has been increasingly tired over the last few months. She does not have a cough at night and does not wake short of breath.

Katie has recently moved to a new indoor swimming centre under a new coach. She trains in six sessions a week: four mornings, one afternoon session and one gym session. She has a rest day on Sunday.

She normally sleeps 7 hours a night with reasonable-quality sleep, waking at 5 am to get to training by 6 am for her 90-minute sessions.

Katie is not vegetarian and eats red meat 2–3 times a week. Her menarche was at the age of 14 and she has regular, light monthly periods.

Katie is otherwise well, does not take any medications and has no known allergies to any medications. She does not have a history or family history of asthma or eczema, nor any family history of sudden cardiac death under the age of 50 years.

On examination, Katie is a well-looking young woman with no pallor or dehydration. She is afebrile with a regular heart rate at 48 beats per minute and blood pressure of 110/70 mmHg with no postural drop. Her ear, nose, throat and cardiorespiratory system are unremarkable.

QUESTION 1

What is your differential diagnosis of Katie's problem?

QUESTION 2

What investigations would you order for Katie?

FURTHER INFORMATION

You order blood tests for Katie, which do not show anaemia or a nutritional deficiency.

Standard spirometry testing shows forced expiratory volume in 1 second (FEV_1) and forced vital capacity (FVC) in the normal range with the FEV_1/FVC ratio of 75% are suggestive of an obstructive pattern. Katie demonstrates a 12% increase in FEV_1 in response to two inhalations of salbutamol.

QUESTION 3

What are two likely diagnoses for Katie?

QUESTION 4

How would you treat these conditions?

FURTHER INFORMATION

You review Katie after 6 weeks. She reports that her cough following her swimming sessions improved and her wheeze and shortness of breath during sessions also improved. She responded well initially to the inhaled salbutamol you prescribed. However, she is now using two puffs of salbutamol prior to each swimming session and two puffs during and after each session. She has noticed that her chest tightness and shortness of breath are returning, her training times are slowing and her fatigue is returning.

QUESTION 5

What medications would you change and why?

CASE 5 ANSWERS

ANSWER 1

The most likely diagnosis of Katie's condition is exercise-induced asthma/bronchoconstriction. Differential diagnoses include allergic rhinosinusitis, nutritional deficiency – commonly iron, vitamin D or B_{12}, and overtraining – where the athlete is not allowing adequate recovery between training bouts, which results in fatigue and a decline in performance

ANSWER 2

Investigations that you should order for Katie are blood tests looking for anaemia or a nutritional deficiency – full blood examination (FBE), iron studies, vitamin B_{12} and vitamin D levels. You could also order spirometry.

ANSWER 3

The most likely diagnoses of Katie's condition are exercise-induced asthma and allergic rhinosinusitis.

ANSWER 4

The treatment of exercise-induced asthma includes the options described below.

- Discuss, diagnosis and educate – Exercise-induced asthma is defined as asthma that is triggered by exercise. Asthma is defined on spirometry as an increase in FEV_1 from baseline of 12% or greater in response to two inhalations of salbutamol. In 60% of cases it has an allergic component, which in Katie's case might be due to pollens and dust mites associated with hay fever or allergic rhinitis. The shortness of breath and chest tightness is caused by drying out of the upper bronchial airways in response to the large tidal volumes associated with high-intensity aerobic exercise. Following high-intensity bouts, fluid is drawn into the airways due to osmotic effects, causing bronchoconstriction and airflow restriction.[1]
- Minimise exposure to triggers
  - chlorine – exposure to high concentrations of chlorine and ammonia metabolites, which accumulate at the air–water interface just above the water level, can cause irritation of the upper airways of the lungs, further exacerbating airway inflammation.[2] To reduce this, indoor pools should be well ventilated to prevent such high concentrations accumulating above the pool
  - cold air
  - pollens.

- An adequate warm-up can induce a refractory period for 2 hours where the athlete has reduced susceptibility to exercise-induced bronchoconstriction (EIB)/exercise-induced asthma.
- Medications
  - start with a preventer inhaled corticosteroid[3], such as fluticasone 250 µg one inhalation twice a day via spacer or as accuhaler for 6 weeks
  - add an inhaled β_2-agonist reliever,[3] salbutamol 100 µg, two inhalations via a spacer as required for symptom relief.
- Patient must have the appropriate asthma plan – should the patient not respond to five sets of two inhalations of salbutamol, an emergency ambulance should be called.
- It is important not to prescribe terbutaline as this remains on the 2013 World Anti-Doping Agency (WADA) prohibited list both in and out of competition.[4] If an athlete is competing where drug testing may occur (in Australia by the Australian Sports Anti-Doping Authority [ASADA]), the athlete must have documented evidence by means of spirometry test that proves asthma – FEV_1 increase of >12% post inhaled bronchodilator *OR* EIB – FEV_1 decrease of >10% post bronchoprovocation test. (The most sensitive bronchoprovocation tests are the eucapnic voluntary hyperpnoea and the mannitol test. These are far more sensitive than exercise, histamine, methacholine or hypertonic saline challenge tests.) The athlete must then submit an application for a therapeutic use exemption (TUE)[5] to the Australian Sports Drug Medical Advisory Committee (ASDMAC) or the International Sport Governing body, depending on the athlete's level of competition and await approval for the TUE to allow use of the terbutaline. Alternatively, the athlete should instead use inhaled salbutamol as the reliever or consult their local sport and exercise physician for further advice.

The treatment for allergic rhinosinusitis includes the following:

- Avoid triggers
  - pollens.
- Medications
  - saline irrigations
  - oral antihistamines.
- Intranasal
  - topical decongestants – oxymetazaline nasal spray for 3–5 days. Avoid prolonged use as this can lead to rebound nasal congestion[6]
  - intranasal corticosteroids for 2–6 weeks.

It is important not to prescribe over-the-counter preparations containing pseudoephedrine as this is banned in competition above a urinary concentration 150 µg/L. It is best to avoid this in the week before and during competition to avoid possible adverse findings on doping tests.

ANSWER 5

Katie is developing tolerance to inhaled β_2 agonists, which can exacerbate EIB symptoms via tachyphylaxis. You should advise her to use inhaled salbutamol for symptom control only. Addition of a mast cell stabiliser or cromone such as nedocromil 2 mg, 2 inhalations 20 minutes prior to exercise via a spacer will reduce salbutamol needs and improve exercise-induced asthma control for up to 4 hours.

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CASE 6

BRENDAN HAS ANKLE PAIN

Brendan, aged 21 years, comes to your clinic with a 3-day history of left ankle pain. He is a university student who regularly plays soccer and basketball. He tells you that 3 days previously, he injured his foot at basketball and sustained an inversion injury to his right ankle. He was immediately unable to bear weight on the ankle. The lateral aspect of the left ankle and foot immediately became swollen and this was followed by bruising.

Brendan presented to the emergency department at the local hospital. X-rays ruled out fractures and tibia–fibula widening (Brendan brought the X-rays and the report with him). Brendan was advised to apply ice and a compression bandage, to elevate the left lower limb and to non-weight-bear. He was given crutches.

Brendan tells you his pain at rest is now 3/10. He has no night pain and is able to weight-bear partially on the left foot.

Brendan has had no previous history of ankle sprains and he has never used orthotics.

QUESTION 1

Which is the most commonly injured ligament in an ankle sprain?

FURTHER INFORMATION

On examining Brendan, you find he has localised oedema on the lateral aspect of the ankle and bruising on the left heel and lateral aspect of the ankle to the mid foot; he has tenderness on the anterior talofibular ligament (ATFL), the calcaneofibular ligament (CFL) and the lateral ankle joint line. Brendan is able to weight-bear partially on the left foot. His range of active motion shows plantar flexion, 50°; dorsiflexion, 10°; eversion, 10°; inversion, 20°. Passive movements show plantar flexion causing pain on resistance, but there is no pain on resisted dorsiflexion, eversion or inversion.

The anterior drawer test and the talar tilt test (for CFL) are positive. Tests for syndesmotic injury are negative.

Examination of the Achilles tendon and the toes is normal, as is the neurovascular examination.

QUESTION 2

What is your diagnosis? What are the differential diagnoses?

QUESTION 3

Which clinical tests are used to diagnose a syndesmotic sprain?

QUESTION 4

How would you manage Brendan today?

QUESTION 5

Why is an exercise rehabilitation program/physiotherapy vital in the management of ankle sprains?

QUESTION 6

Is there a role for lace-up shoes/braces in the initial management of ankle sprains?

CASE 6 ANSWERS

ANSWER 1

The lateral ankle complex is composed of the ATFL, CFL and posterior talofibular ligaments (PTFL). The ATFL is the weakest ligament due to its origin and insertion.[1,2]

ANSWER 2

The clinical diagnosis is a grade 2 lateral ligament sprain.

Differential diagnosis of this condition includes an osteochondral defect of the talar dome, an anterior process of calcaneal fracture, a sprain of the ankle syndesmosis, sinus tarsi synovitis and peroneal tendinopathy.

ANSWER 3

The tests used to diagnose a syndesmotic sprain are the external rotation test, the syndesmotic ligament palpation test and the syndesmosis squeeze test, used in combination.[3] The cotton and fibula translation tests are also used.[4]

Tenderness on palpating along the fibular shaft will be useful to rule out a fracture of the proximal fibula (Maisonneuve fracture) often seen in occurrence with high grade syndesmotic injuries.[2,5]

Associated tenderness over the medial deltoid ligament of the ankle should also arouse suspicion for this injury as it often occurs with high-grade syndesmosis injuries causing diastasis (widening) of the inferior tibiofibular joint.

ANSWER 4

Brendan's management at present should include:

- explanation of the diagnosis using an animated foot model or similar anatomy software (if available)
- continued elevation of the left lower limb at rest
- weaning off crutches and normalisation of gait
- commencement of low-impact activities such as cycling and swimming
- prescription of a short, 1-week course of NSAIDs to reduce inflammatory synovitis pain
- referral to a physiotherapist for an exercise rehabilitation program.

Brendan can attend lectures as he is able to safely arrange transport to and getting around campus.

You should ask Brendan to return in 4 weeks on completion of the rehabilitation program so you can judge the progress of the rehabilitation program and judge his readiness to return to sport.

If ankle pain persists at the 6-week mark, an MRI may be warranted to determine further management.

ANSWER 5

Early referral to a physiotherapist is beneficial in ensuring full range of movement, proprioception, muscle strengthening and functional training. These measures ensure that a patient can return to their pre-injury activity level quicker and they also help reduce the risk of a further sprain.[2,6]

ANSWER 6

Lace-up shoes and braces are shown to decrease oedema and support the ankle when used in ankle sprain management.[7] Lace-up ankle supports were superior to semi-rigid ankle supports, elastic bandages and tape in preventing persistent swelling.[8]

Although lace-up shoes have a role in supporting the ankle in high-impact pivoting sport and exercise, they do not replace the role of a good ankle strengthening and proprioceptive rehabilitation program.

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CASE 7

GREG HAS LEFT ACHILLES TENDON PAIN

Greg, aged 35 years, presents with a 3-month history of left Achilles tendon pain. He is a keen runner, covering 50–60 km over 5 days per week. He regularly attends his local gym.

He gives a history of generalised morning stiffness, which improves through the day at work. The pain initially warms up with his running, but has deteriorated recently.

QUESTION 1

What specific features of Greg's history and examination may be useful?

QUESTION 2

Describe what (if any) investigations you could suggest and what changes might be expected?

QUESTION 3

What is the underlying pathogenesis of Achilles tendinosis?

QUESTION 4

Describe the initial management of Greg's condition?

FURTHER INFORMATION

Ultrasound examination shows a high-grade focal region of deep surface tendinopathy. Greg presents for review 6 weeks later.

QUESTION 5

What other management options are available for Greg?

QUESTION 6

Does surgery play a role in Achilles tendinosis?

CASE 7 ANSWERS

ANSWER 1

The onset of Achilles tendon pain is multifactorial and insidious. You need to ask Greg about any pre-existing factors. These may include:

- increase in training volume or intensity
- change in shoe type
- change in training surface
- resumption of training after another injury lay-off.

You must assess possible underlying mechanical features. Restriction of ankle dorsiflexion range (e.g. after an ankle sprain), a supinated or pronated foot-type or calf weakness may all contribute.

As Greg's pain has recently deteriorated, you need to assess structures adjacent to the tendon, e.g. the paratenon may display thickening and crepitus, or an os trigonum may be causing a posterior-impingement syndrome.

It is important to carefully assess the tendon as to the site of maximal tenderness and swelling, e.g. mid-Achilles or insertional. As Greg's pain has recently deteriorated, you also need to assess other adjacent structures, e.g. the paratenon may display thickening and crepitus, or an os trigonum may be causing a posterior impingement syndrome.

ANSWER 2

In the early presentation of a mid-Achilles tendinosis, the history and examination remain the keys to diagnosis and so it is reasonable to withhold imaging at this stage.

However, if the patient presents with a rapid onset of Achilles pain, displays significant swelling or has any atypical features, ultrasound imaging is indicated. Ultrasound imaging is able to provide clear definition of fibre continuity, regions of swelling and the presence of neo-vascularity (see *Figure 1*). The movement of the tendon dynamically can also be assessed.

X-ray imaging is indicated in the presence of insertional tendinosis or posterior impingement, in which case ectopic bone formation or the presence of an os trigonum may be found (see *Figure 2*).

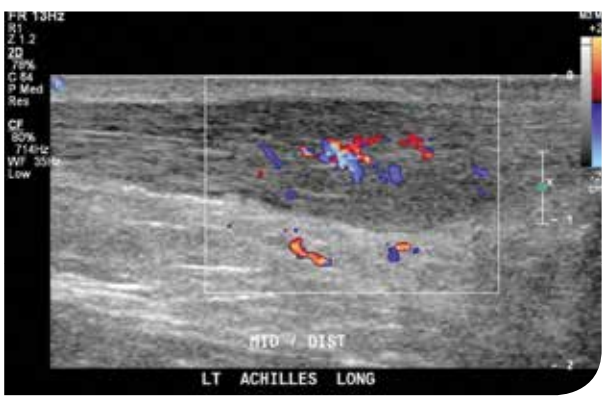

Figure 1. Ultrasound image of a tendon showing fusiform thickening and neovascularity. Image courtesy of Imaging@Olympic Park, Melbourne

Figure 2. Plain X-ray of a footballer with Achilles region pain showing an os trigonum

However, clinical outcomes for Achilles tendinosis are only moderately correlated to ultrasound imaging changes and so should not dominate clinical decision-making.[1]

ANSWER 3

The amount of load that results in tendon pathology is not clear. Insufficient time between training loads to allow for tendon adaptation is thought to contribute. Fully unloading a tendon has also been shown to result in changes that reduce the mechanical integrity of tendons.

Over the last decade, numerous histological studies have shown an absence or only minimal presence of inflammatory cells, so it is felt that other processes contribute. A continuum of tendon pathology has been proposed, in which three stages of tendon pathology exist, each correlating with distinctive clinical and imaging characteristics:[2]

- In the initial stage, a reactive process occurs in an acutely overloaded tendon often in a younger athlete. Tenocyte up-regulation and increased ground substance results in a fusiform region of tendon swelling, but with intact collagen fascicles seen on imaging.
- The second stage relates to tendon dysrepair in which there is an attempt at tendon healing, but with greater matrix breakdown. There is increased proteoglycan production shown as separation of collagen and focal structural changes seen on imaging. Increased vascularity may be evident.
- The third stage relates to degenerative tendinopathy presenting in the chronically overloaded tendon. One or more focal nodular areas characterised on ultrasound as hypoechoic regions are seen often with large areas of matrix breakdown and neovascularity. Individuals often have a history of tendon pain, which resolves on rest but recurs as load increases.

It should be noted that pain may occur at any point along this model. The presence of neuropeptides (such as tumour necrosis factor alpha [TNF-α]) suggests that 'neurogenic inflammation' may be a contributor to the disabling pain of Achilles tendinosis.

ANSWER 4

Greg demonstrates load-bearing pain, so he must have a period off running (6 weeks minimum), to allow the tendon time to adapt. Functional loading progression is the key, with attention to the intensity, duration, frequency and type of load. In conjunction, interventions can be commenced that reduce pain, and are also appropriate for the stage of pathology.

A physiotherapist, experienced in the management of tendinosis, is of great value in the prescription of loading programs, along with biomechanical assessment of lower limb alignment and strength.

Loads that reduce pain can be introduced early, such as isometric muscle contractions performed either bilaterally or unilaterally. Targeted eccentric exercise programs have reported excellent improvements in and reduction of pain, normalisation of tendon anatomy.[3] The full program consists of performing three sets of 15 slow heel drops (both straight and bent knee), twice daily for 12 weeks. A degree of pain is accepted as part of this program, and load can be increased through the use of a backpack with added weight.

If pain reduction occurs earlier in the eccentric program, progression to functional loading can occur. Graduating load through more explosive concentric work (e.g. skipping) and skill-specific eccentric re-education is vital prior to reintroduction of running, which should be in a graduated fashion on alternate days.[4]

Although there is an absence of inflammatory cellular activity in this condition, it has been proposed that specific NSAIDs may act via mechanisms other than those altering the standard inflammatory cascade. The use of ibuprofen has been shown to have a down-regulating effect on cellular responses, in addition to reducing ground substance proteins (aggrecan) responsible for tendon swelling.[2] A standard dosing of 400 mg 3 times daily for 7–10 days is appropriate.[5]

ANSWER 5

In very early reactive tendinopathy or with paratenon thickening, a guided peritendinous corticosteroid injection may have an analgesic effect by dampening cell response and limiting protein production. In Greg's case, however, the tendon has undergone a period of disrepair and corticosteroid injection is best avoided.

Biological therapies such as autologous blood injection (ABI) and platelet-rich plasma (PRP) have gained popularity in recent years with the aim to deliver a spectrum of growth factors to the region of pathology and stimulate a healing response. Numerous low-powered studies[6] have shown encouraging results but these need to be followed up with more rigorous blinded randomised controlled trials. There has not been any advantage shown in using PRP over ABI for mid-achilles tendinopathy.[7] Anecdotally, these injections can cause an acute flare of the tendon lasting up to 2 weeks and are best avoided in early reactive tendinosis.

The use of ultrasound-guided sclerosant therapy (polidocanol) to shut down neovascular changes can improve pain levels, and in one study showed sustained benefit to tendon thickness after 2-years.[8]

Use of topical glyceryl trinitrate (GTN) therapy has shown benefits. Treatment with low dose (1.25 mg) GTN patch daily for 12 weeks combined with eccentric exercises showed improved pain levels compared with placebo patch and similar eccentric program.[9] Appropriate GTN preparations should be used and risk of headache and local skin irritation discussed.

ANSWER 6

Historically, surgery has been a last resort in the management of mid-Achilles tendinosis. Traditional surgical techniques, often involving open resection of macroscopically abnormal tendon tissue, require extensive rehabilitation periods of 9–12 months and results are often variable. Less invasive techniques using ultrasound guidance and a ventral scraping technique to the external tendon have shown promising early results with much shorter rehabilitative time.[10]

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10. Alfredson H. Ultrasound and Doppler-guided mini-surgery to treat midportion Achilles tendinosis: results of a large material and a randomised study comparing two scraping techniques. Br J Sports Med 2011;45:407–10.

RESOURCES FOR DOCTORS

- Brukner P, Khan K. Pain in the Achilles region. In: Clinical sports medicine. 4th edn. Melbourne: McGraw Hill; 2012. 37:776–801. This book is a good resource for all topics.
- Rowe V, Hemmings S, Barton C Malliaras P, Maffulli N, Morrissey D. Conservative management of midportion Achilles tendinopathy. A mixed methods study, integrating systematic review and clinical reasoning. Sports Med 2012;42:941–67.
- Malliaris P, Barton C, Reeves N, Langberg H. Achilles and patellar tendinopathy loading programs. A systematic review comparing clinical outcomes and identifying potential mechanisms for effectiveness. Sports Med 2013;43:267–86.

Sports medicine

In order to qualify for 6 Category 2 points for the QI&CPD activity associated with this unit:

- read and complete the unit of *check* in hard copy or online at the *gplearning* website at www.gplearning.com.au
- log onto the *gplearning* website at www.gplearning.com.au and answer the following 10 multiple choice questions (MCQs) online
- complete the online evaluation.

If you are not an RACGP member, please contact the *gplearning* helpdesk on 1800 284 789 to register in the first instance. You will be provided with a username and password that will enable you access to the test.

The expected time to complete this activity is 3 hours.

Do not send answers to the MCQs into the RACGP office. This activity can only be completed online at www.gplearning.com.au.

If you have any queries or technical issues accessing the test online, please contact the *gplearning* helpdesk on 1800 284 789.

FOR A FULL LIST OF ABBREVIATIONS AND ACRONYMS USED IN THESE QUESTIONS PLEASE GO TO PAGE 3.
FOR EACH QUESTION BELOW SELECT ONE OPTION ONLY.

QUESTION 1

Ethan is a 16-year-old basketball player and long-distance runner. He has had shin pain for 4 months. Examination and X-ray findings confirm tibial stress fractures. What is important in your management plan for Ethan?

A. Weight-bearing rest for up to 6 weeks
B. Ice packs initially and simple analgesics
C. Cross-training while the pain subsides (upper body gym work, hydrotherapy)
D. A slow progressive return to impact-loading activity
E. All of the above.

QUESTION 2

Luisa is a 14-year-old girl with a 4-month history of anterior knee pain. The pain is worse on climbing stairs and after prolonged sitting. She has recently started training with the cross-country team at school. What is the most likely diagnosis?

A. Patella instability
B. Patellofemoral pain syndrome
C. Osteochondral injury
D. Discoid meniscus injury
E. Bone tumour.

QUESTION 3

Luisa has been chosen to represent the school in the cross-country event at the regional track and field carnival next month. She is keen to participate and has asked your advice on management of her knee pain. Which of the following will be the LEAST likely to help her?

A. Improving vastus medialis oblique (VMO) strength
B. Decreasing iliotibial band tightness
C. Non-weight bearing with crutches
D. Improving hip adductor strength
E. Taping the patella.

QUESTION 4

Steven is a keen Australian Football League (AFL) player with groin pain for 3 months. Which of the following features is MOST likely to indicate femoroacetabular impingement (FAI) of hip origin?

A. Mass or impulse in the groin with cough
B. Pain with FADIR (flexion, adduction and internal rotation) or FABER (flexion, abduction and external rotation) testing and central groin tenderness
C. Tender lumps in the femoral triangle
D. Tenderness over the pubic symphysis
E. Tenderness in the adductor longus origin.

QUESTION 5

Mary-Jo is a 40-year-old, right-handed admin assistant and a keen tennis player. She presents with pain in her forearm that worsened after a game of tennis. On examination, she has tenderness over the lateral epicondyle of her right arm. What is the most likely diagnosis?

A. Medial epicondlyitis
B. Elbow osteoarthritis (OA)
C. Posterior interosseous nerve entrapment
D. Lateral epicondylitis
E. Cervical radicular nerve pain.

QUESTION 6

Damian is a 15-year-old elite swimmer who presents with fatigue shortness of breath, chest tightness, wheezing and a dry cough after high intensity swimming bouts. He has a varied diet and does not have a history of allergy or atopy. What is the most likely diagnosis?

A. Viral upper respiratory tract infection (URTI)
B. Exercise-induced asthma
C. B_{12} deficiency
D. Iron deficiency anemia
E. Bronchitis.

QUESTION 7

Which medication is banned by the World Anti-Doping Agency (WADA)?

A. Terbutaline

B. Salbutamol

C. Anithistamines

D. Fluticasone

E. Oxymetazoline nasal spray.

QUESTION 8

Tamsin, 30 years of age, plays competition netball. She recently injured her foot at the grand final. She landed heavily on her left foot, which turned inwards. What is the most likely structure to be damaged in an ankle sprain?

A. The os trigonom

B. The anterior talofibular ligament

C. The deltoid ligament

D. The posterior talofibular ligament

E. The calcaneofibular ligament.

QUESTION 9

Simon is a 38-year-old distance runner who recently completed his first marathon. He has noticed that since the marathon he has had right Achilles tendon pain during day-to-day activities. You make a diagnosis of Achilles tendinosis. What is the most important step in management?

A. Stretching before he runs

B. Stretching after he runs

C. Allowing the tendon to adapt by having a period off running

D. Reducing his running time by half

E. Orthotics.

QUESTION 10

Elliot is a keen gardener and sports person. He has noticed tenderness in his left forearm for some weeks. On examination he has tenderness over the lateral epicondyle. You diagnose tennis elbow and outline a management plan for Elliot. What is the most appropriate advice?

A. Perform daily high-volume eccentric strengthening exercises into the pain range with wrist drops and broomstick rotations

B. Practice safe lifting techniques using the palm-up position

C. Avoid lifting with a pronated forearm

D. Consider using a wrist volar support splint for typing

E. All of the above.