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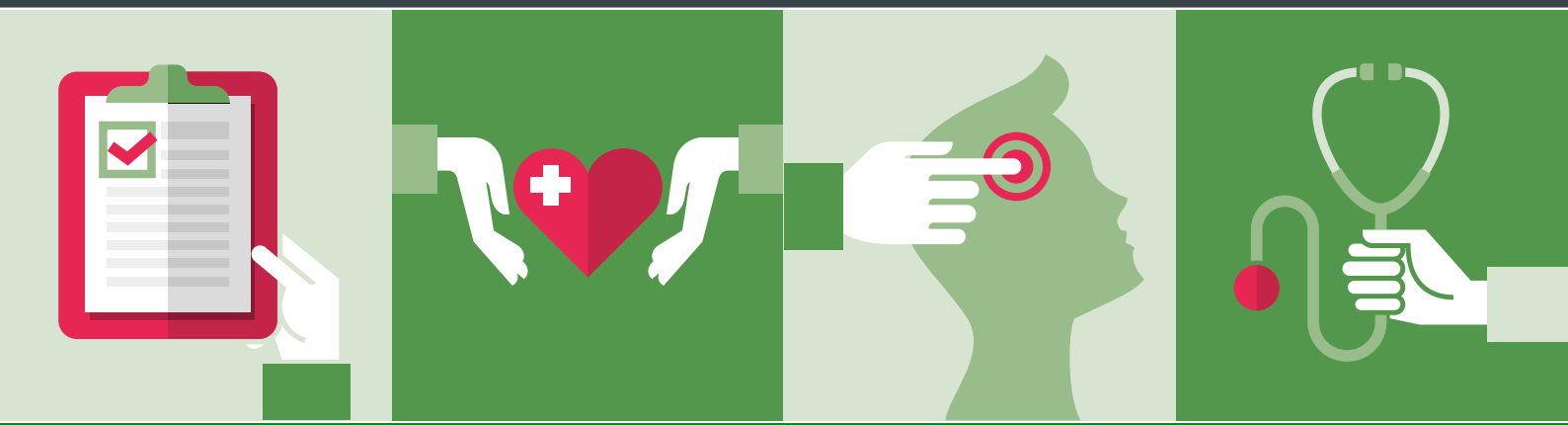
Independent learning program for GPs



Unit 531 September 2016

Sports medicine

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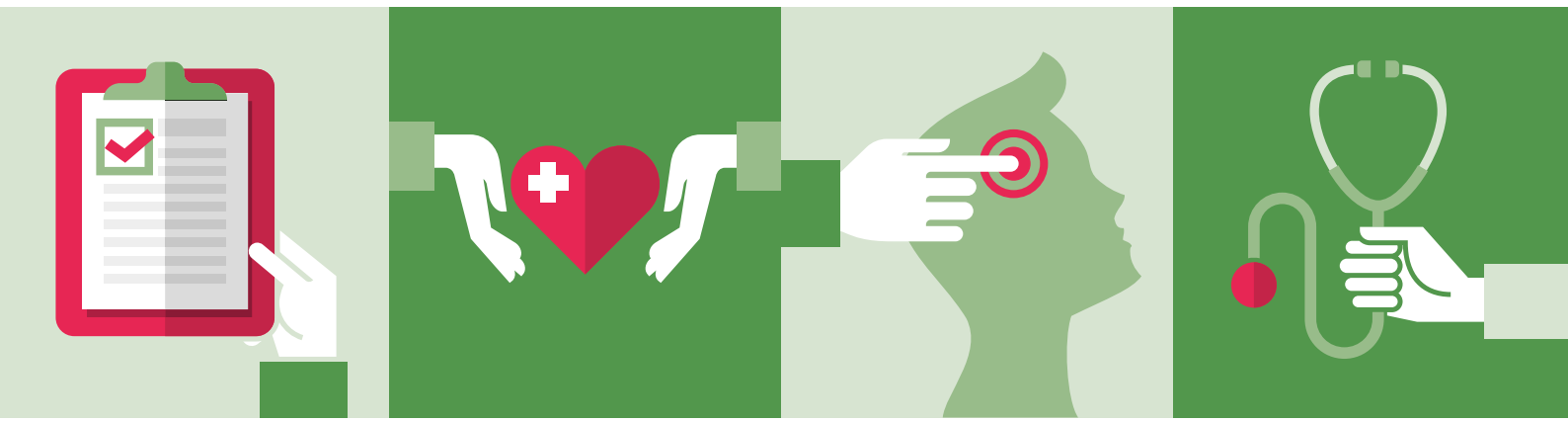

Sports medicine

Unit 531 – September 2016

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

ABOUT THIS ACTIVITY

More than six million Australians have a musculoskeletal condition, which places a major burden of disease on the Australian healthcare system.[1] Sports, whether recreational or professional, are an essential part of Australian society.[2] General practitioners (GPs) have a significant role in encouraging their patients to engage in sporting activities, but also in managing the conditions and injuries arising from such activities. In 2014–15, musculoskeletal conditions accounted for 19 per 100 encounters seen in general practice.[3]

This edition of *check* considers the management and treatment of various sports injuries in general practice.

Hamstring injury is one of the most common injuries in the various football codes, and has a high incidence of recurrence.[4,5] Hip pain can have a variety of causes, and it is important that GPs are able to diagnose and provide appropriate management. Sever's disease is one of the most common injuries of overuse,[6] with an incidence estimated at 2–16% of all musculoskeletal injuries in children.[7] Navicular stress fractures are relatively common and account for more than one-third of stress fractures.[8] Given the strict anti-doping code in sports, it is important for GPs to be aware of requirements around prescribing medication to athletes who compete at national and international levels.

LEARNING OUTCOMES

At the end of this activity, participants will be able to:

- identify clinical signs and risk factors for hamstring strain injuries
- discuss the assessment and management of a patient presenting with sports-related hip pain
- describe the approach to diagnosis and treatment of Sever's disease
- recognise the clinical signs suggestive of a navicular stress fracture
- outline the processes required for medication use by athletes during competition.

AUTHORS

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ACRONYMS

ACSP	Australasian College of Sports Physicians	**FAI**	femoroacetabular impingement	**MRA**	magnetic resonance arthrography
ADRV	anti-doping rule violation	**FHA**	functional hypothalamic amenorrhea	**MRI**	magnetic resonance imaging
AFL	Australian Football League	**FIFA**	Fédération Internationale de Football Association	**NWB**	non–weight bearing
AP	anterior–posterior	**FSH**	follicle-stimulating hormone	**OA**	osteoarthritis
ASADA	Australian Sports Anti-Doping Authority	**GnRH**	gonadotropin releasing hormone	**OS**	offset
ASDMAC	Australian Sports Drug Medical Advisory Committee	**GP**	general practitioner	**PE**	physical education
AVN	avascular necrosis	**IAAF**	International Association of Athletics Federation	**PRP**	platelet rich plasma
CAM	controlled ankle movement	**ITB**	iliotibial band	**REDs**	relative energy deficiency syndrome
CT	computed tomography	**LABA**	long-acting beta agonists	**SNAP**	smoking, nutrition, alcohol, physical activity
DDH	developmental dysplasia of the hip	**LFCN**	lateral femoral cutaneous nerve	**SUFE**	slipped upper femoral epiphysis
DEXA	dual-energy X-ray absorptiometry	**LH**	luteinising hormone	**TUE**	therapeutic use exemption
FABER	flexion, abduction, external rotation	**MBS**	Medicare Benefits Schedule	**WADA**	World Anti-Doping Agency

CASE 1

JOSHUA HAS A PAIN IN HIS HIP

Joshua is 19 years of age and presents to your practice complaining of a niggling left hip pain. The pain has been present intermittently for about three months. It is only at his mother's insistence that he has decided to come in to get the pain investigated.

QUESTION 1

What further information should you obtain on history?

FURTHER INFORMATION

Joshua is an active soccer player who plays for his university team. He trains and plays three times per week; however, he is finding this increasingly difficult because of his hip pain. Joshua first noticed the pain after he tripped and fell during a game, and now the pain occurs almost every time he plays. The pain occurs in the anterior groin area after 20–30 minutes of play. Joshua also notices the pain when sitting for extended periods and after a day at university. He describes the pain as sharp and catching. Joshua does not report any history of childhood hip problems, nor has he recently had a fever.

QUESTION 2

What might you look for on examination?

FURTHER INFORMATION

On examination, Joshua is a well-looking young adult with normal body habitus and no derangement in routine vital signs. He has no obvious limp. Joshua's left hip does not appear irritable, but there is a reduction in internal rotation and pain when the hip is flexed, adducted and internally rotated (positive anterior impingement sign). There is no pain over any of the bony landmarks. Lower back and knee joint examinations are unremarkable. The right hip shows a similar decrease range of internal rotation, but there is no pain.

QUESTION 3

What are the differential diagnoses at this stage? What other differentials would you include for a younger patient presenting with similar symptoms?

QUESTION 4

What are some important not-to-be-missed diagnoses? What are their red flags?

QUESTION 5

What are some of the rarer but important 'masquerades'?

QUESTION 6

What investigations might be necessary for Joshua?

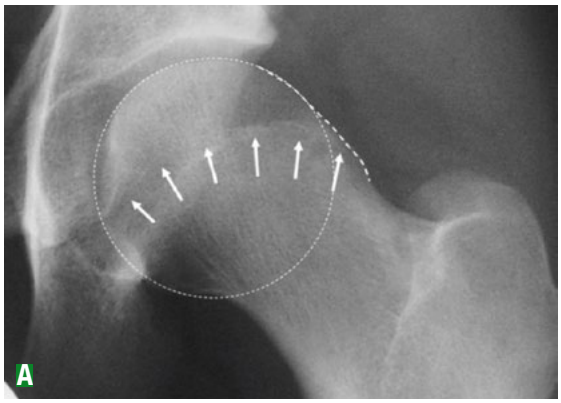
FURTHER INFORMATION

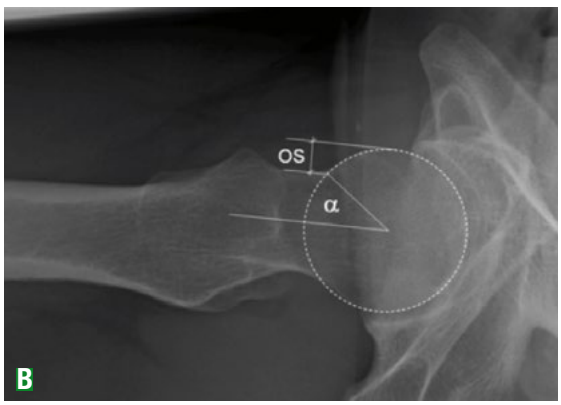
You order anterior–posterior (AP) pelvis radiographs for Joshua. The images are shown in Figures 1 and 2A.

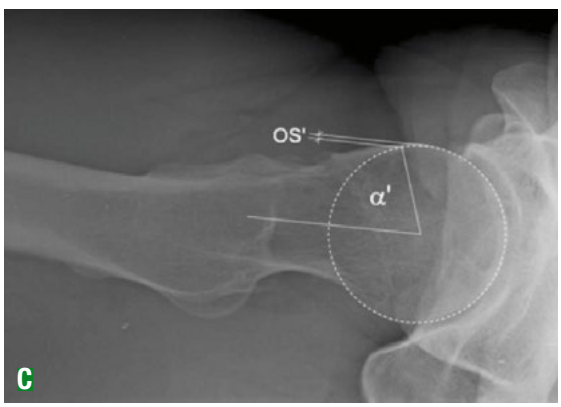
Figure 1. AP pelvis radiograph showing cam-type hip shape in femoroacetabular impingement (FAI)

Reproduced from Fernandez M, Wall P, O'Donnell J, Griffin D. Hip pain in young adults. Aust Fam Physician 2014;43(4):205–09. Available at www.racgp.org.au/afp/2014/april/hip-pain-in-young-adults [Accessed 15 June 2016].

Figure 2. Cam impingement[1]







A. Pistol-grip deformity with abnormal extension of epiphyseal scar (arrows) in 19-year-old man

B. Axial view of normal hip with normal offset (OS) and normal alpha angle (α <50°) in 32-year-old man

C. Decreased femoral head–neck offset (OS') with consecutive increased alpha angle (α') in 26-year-old man

Reproduced from Tannast M, Siebenrock KA, Anderson SE. Femoroacetabular Impingement: Radiographic diagnosis – What the radiologist should know. Am J Roentgenol 2007;188(6):1540–52, with permission from the American Journal of Roentgenology.

QUESTION 7

What is your assessment of the images shown in Figures 1 and 2? What is normal and abnormal?

QUESTION 8

What is now the definitive diagnosis? What information can you give Joshua about this condition?

QUESTION 9

What would be your management for Joshua?

CASE 1 ANSWERS

ANSWER 1

A history of preceding traumas should be thoroughly investigated. Evaluation of the symptoms (eg onset, and aggravating and alleviating factors) will help to diagnose the underlying pathology. Intra-articular hip pathology is more likely with symptoms such as 'catching' sensations, which is related to activity or posture.[2]

In this young adult age group (14 years of age or older) history-taking should seek to identify any symptoms related to sports and other activities. Sudden increases in training regimes, with associated pain, can point towards musculotendinous pathology such as osteitis pubis.[3]

A history of childhood hip problems or a family history of these problems may predispose to developmental hip pathology.[4]

ANSWER 2

A full hip joint examination should be performed, including looking for abnormalities in gait, and palpating the area around the hip joint and its major landmarks (pubic symphysis, greater trochanter, ischial tuberosity). Pain on palpation of these landmarks (eg over the greater trochanter) may point towards diagnoses such as trochanteric bursitis, gluteus medius tears or a snapping hip.[2]

The anterior impingement (90° flexion, adduction, internal rotation while the patient is supine) test and FABER (flexion, abduction, external rotation, again while supine) test should be performed. The adductor squeeze test is useful to examine groin injuries but is not specific for individual pathologies. The test can be positive in osteitis pubis and adductor tendinopathy.[5–8] A reproduction of symptoms with these tests and a decreased range of movement, compared with the other side, may point to intra-articular pathology.[2]

Limitations in the range of motion are more likely in impingement pathology, whereas if dysplasia of the hip is expected, there is often a full range of motion.[9]

Examination of the lumbar spine and knee should also be performed for referred pain.

ANSWER 3

There are a number of differential diagnosis categories at this stage including muscular, bony, soft tissue, ligamentous problems or referred pain from elsewhere (Table 1).

Common causes of chronic hip/groin pain at this age include osteitis pubis, incipient inguinal hernia, adductor tendinopathy and intrinsic hip pathology or bony abnormality.[2] In a younger (10–16 years of age) patient, other differentials would include septic arthritis, slipped upper femoral epiphysis (SUFE), transient synovitis, tumours or an inflammatory arthropathy.[10]

ANSWER 4

Important diagnoses that should be considered, and red flags to note, include the following:

Table 1. Differential diagnosis of hip pain in young adults[2]

Extra-articular	Intra-articular
Muscles	**Bones**
• Abductor muscle injuries	• FAI
• Gluteus muscle tears	• OA*
Nerves	• AVN*
• Sciatica	• DDH*
• Obturator nerve irritation	• Fractures*
• LFCN irritation	• Perthe's*
• Piriformis syndrome	• Septic arthritis*
Tendons	**Soft tissues**
• Snapping hip (ITB or iliopoas)	• Labral tear
• Bursa	• Chondral defect
• Trochanteric bursitis	• Ligamentum teres injury
Ligaments	
• Inguinal ligament strain	
• Joint capsule*	
Referred pain*	
• Lumbar spine	
• Knee	
• Non-musculoskeletal pathology	

ITB = iliotibial band, LFCN = lateral femoral cutaneous nerve, FAI = femoroacetabular impingement OA = osteoarthritis, AVN = avascular necrosis, DDH = developmental dysplasia of the hip.

*Not covered in this review

Reproduced from Fernandez M, Wall P, O'Donnell J, Griffin D. Hip pain in young adults. Aust Fam Physician 2014;43(4):205–09. Available at www.racgp.org.au/afp/2014/april/hip-pain-in-young-adults [Accessed 15 June 2016].

- Stress fractures[11]
  - Overuse injuries in athletes can lead to stress fractures, particularly when training without adequate rest. A high index of suspicion is important to avoid poor outcomes due to delayed diagnosis[12]
- Developmental dysplasia of the hip (DDH)
  - DDH should be suspected in a younger child who presents with leg length discrepancy and a painless limp, along with decreased range of abduction
  - Missed DDH in a young adult may present with aching groin or hip pain that is worse following exertion[4]
- Juvenile idiopathic arthritis[13]
  - Pain or swelling in one or more joint
  - Stiffness after rest
  - Associated with constitutional symptoms such as fever, rash or weight loss
- Rheumatoid arthritis[14]
  - Joint pain/swelling with or without fever (clinical examination findings include three or more tender and swollen joint areas,

symmetrical joint involvement, positive squeeze at metacarpophalangeal or metatarsophalangeal joints)
  - Morning stiffness (>30 minutes)
  - Previous episodes
  - Family history
  - Systemic flu-like features or fatigue
- Septic arthritis and osteomyelitis
  - Should be suspected in any child and considered in a young adult with joint pain, especially if sexually active[15] with severe pain, limp or non–weight bearing, and a fever[16,17]
  - Acute onset of painful monoarticular arthritis associated with fever is serious and considered septic unless proven otherwise.[18] Urgent blood and synovial fluid culture at a hospital with an orthopaedic service should be ordered to confirm/rule out infection[10]
- Malignancy/tumours[19]
- SUFE[17]
  - Tends to present in overweight adolescents with a limp and referred pain from the knee

ANSWER 5

Rare but important conditions to consider include:[17]

- reactive arthritis
- rheumatic fever
- post-streptococcal arthritis
- systemic lupus erythematosus
- sarcoidosis
- Henoch-Schönlein purpura
- trauma/occult fracture/non-accidental injury.

ANSWER 6

The first-line investigation should be a plain anterior–posterior (AP) radiograph of the pelvis with a cross-table lateral (groin lateral) view to evaluate bony or joint pathology. A cross-table lateral view may help identify and quantify abnormalities in the shape of the femoral head (Figures 2B, 2C).[9]

Magnetic resonance imaging (MRI) may also help. Currently, the Medicare Benefits Schedule (MBS) does not cover MRI of the hip if it is ordered by a general practitioner (GP). Therefore, a referral to a specialist may be indicated if this imaging modality is sought. MRI is indicated if pathology of the acetabular labrum and chondral surface is suspected.[20] A radial MRI arthrogram will aid in observing the labrum and acetabular cartilage.[21]

ANSWER 7

Figure 1 is a plain AP pelvis radiography of a male. The following features of the image should be noted:

- It is not rotated and is adequately projected (not over/underexposed).
- The bone mineral density appears adequate.
- Shenton's line is intact, bilaterally.
- There is no acute fracture.
- There is no lucent lesion.
- There is a cam-type deformity on the left side.

Features to note in Figure 2 include:

- aspherical femoral head
- pistol-grip deformity
- horizontal extension of the physeal scar
- decreased femoral head–neck offset with associated increased alpha-angle on cross-table view.

ANSWER 8

Figure 1 shows features consistent with a cam-type impingement of the hip. The radiological findings from Figure 2 confirm a diagnosis of femoroacetabular impingement (FAI; further explained in Figure 3).[1]

Short-term implications of FAI may include chondral injuries and detachment of the acetabular labrum, which are often present in combination.[21] These can act as precursors to early degenerative disease of the hip and osteoarthritis.[21]

Refer to 'Resources for doctors' for further reading.

ANSWER 9

Initial management may include simple analgesia with exercise modification and physiotherapy.[2]

Referral to an orthopaedic surgeon is indicated if there is little symptomatic improvement (particularly if pain persists for more than three months) and in athletes.[2]

An orthopaedic surgeon may order more detailed imaging to investigate and diagnose soft tissue and bony pathology. This will also help in prescribing the appropriate treatment. Modalities used might include magnetic resonance arthrography (MRA) and three-dimensional computed tomography (CT).[2] Three-dimensional surface reconstructed CT provides the best impression of all aspects of hip shape and is particularly useful in pre-operative planning for FAI surgery.[2]

If the diagnosis is still unclear, or the underlying pathology is thought to be more complex, the specialist may administer an intra-articular injection of local anaesthetic, which has been shown to have an accuracy of 90% for detecting intra-articular abnormalities.[22]

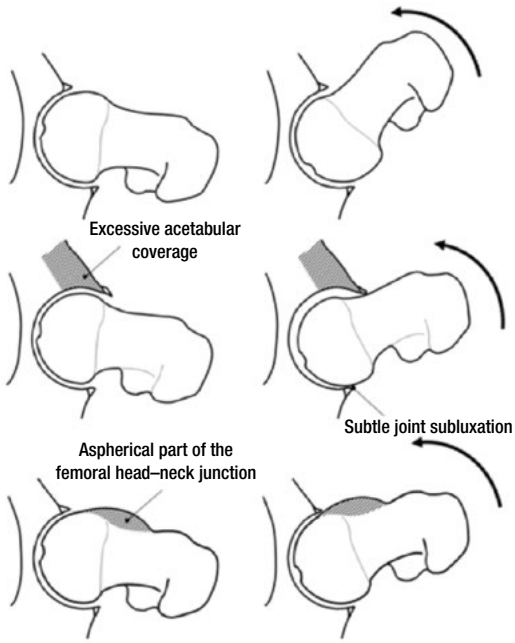
Arthroscopic surgery is effective for trochanteric bursitis, the snapping hip and focal isolated gluteus medius and minimis tendon tears. Given the risks, however, surgery would be considered only for patients with severe symptoms that do not improve with non-surgical treatment.[1]

Currently there is level III and IV evidence that surgery for FAI, often involving femoral head reshaping (either via open surgical dislocation, mini-open or arthroscopic approach) improves symptoms; especially in young, active patients without significant osteoarthritis.[23] It also improves hip kinematics and range of motion.[23] There is, however, a lack of long-term data and randomised controlled trials comparing surgical interventions to conservative therapy.[24]

CONCLUSION

You decide to treat Joshua with short-term pain relief and a recommendation to decrease his sporting activity in the short term. Considering that he takes his sporting activities seriously, you also refer him to an orthopaedic surgeon for more definitive management to allow him to play sport in the future.

Figure 3. Diagrammatic representation of femoroacetabular impingement[1]



Normal configuration of hip with sufficient joint clearance allows unrestricted range of motion (top). In pincer impingement, excessive acetabular over-coverage leads to early linear contact between femoral head–neck junction and acetabular rim, resulting in labrum degeneration and significant cartilage damage. Posteroinferior portion of joint is damaged (contrecoup) due to subtle subluxations (centre). In cam impingement, aspherical portion of femoral head–neck junction is jammed into acetabulum (bottom).

Reprinted from Tannast M, Siebenrock KA, Anderson SE. Femoroacetabular Impingement: Radiographic diagnosis – What the radiologist should know. Am J Roentgenol 2007;188(6):1540–52, with permission from the *American Journal of Roentgenology*.

Specialist referral and surgical treatment is most likely to be indicated for this young, active patient. Surgical treatment is likely to improve symptoms in the short term and it may help to postpone longer term complications, such as osteoarthritis and the need for early joint replacement.

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CASE 2

TARKYN HAS SORE HEELS

Tarkyn is 10 years of age and presents with bilateral sore heels. This has been a problem for six months, but after a recent weekend basketball carnival, his heels have become increasingly painful, especially the right heel. Tarkyn has no other past medical history and is not taking any medication. He has no allergies. His mother is present at the appointment.

QUESTION 1

What further history would you want to elicit from Tarkyn?

FURTHER INFORMATION

You conduct a physical examination, which shows that Tarkyn has bilateral pes plano-valgus (worse on the right side). He has posterior heel tenderness on the right side and posterolateral left-sided heel tenderness. His calves feel tight to palpation. Tarkyn has pain on heel walking. He has no other clinical findings upon examination of his lower limbs and is not overweight.

QUESTION 2

What is the most likely diagnosis of Tarkyn's heel pain on the basis of the physical examination?

QUESTION 3

How would you explain your clinical diagnosis to Tarkyn and his mother?

QUESTION 4

Are further investigations needed before initiating a management plan?

FURTHER INFORMATION

Tarkyn is extremely distressed that his heel pain is interfering with his sporting activities and wants to know when and how he will be able to return to sport.

QUESTION 5

What would be your initial management strategies for Tarkyn?

FURTHER INFORMATION

When you review Tarkyn's activity levels, you elicit that he runs 1 km every weekday around the school oval before school. He has basketball training Monday and Wednesday evenings, football training Tuesday and Thursday evening, basketball games on Friday evening and Sunday mornings and football on a Saturday morning. He also goes with dad to football on a Saturday afternoon and joins in his dad's team warm up, and cycles to school every day. Tarkyn's mother reports that Tarkyn is highly talented and is looking to make a career from sport.

QUESTION 6

How would you address activity level management with Tarkyn and his mother, both in relation to return to play and in the long term?

FURTHER INFORMATION

Tarkyn returns two months later to see you with his mother. He is limping because of right-sided heel pain. On close questioning, and despite your previous counselling, he has not reduced his activity level at all, but has been applying ice twice daily and after sport, and rubbing anti-inflammatory gel on his heel twice daily. Tarkyn has been doing calf stretches.

QUESTION 7

What further management options are open to Tarkyn?

CASE 2 ANSWERS

ANSWER 1

Obtaining an accurate history from Tarkyn involves taking a detailed history relating to his heel pain from him and a collateral history from his mother. There may be a need to question Tarkyn without his mother present if there is concern that he may have injured his heels doing something his mother is unaware of.

Red flags, such as night pain, history of falls or jumping from a height and landing on the heels, inability to bear weight, pain in other joints or areas of the body, and family history of inflammatory arthropathy should be sought.

A detailed sporting schedule from before Tarkyn developed heel pain to the present should be taken; this should identify training volume, load, rest days and additional tournaments, as well as regular competition and school sport. The timing of the heel pain, relation to and timing of associated flares, and variants in pain levels throughout the day, such as morning stiffness, should also be identified. It may also be useful to ask Tarkyn and his mother about recent growth spurt or weight gain.

Key factors to consider include identification of new or additional sporting activity, change in sporting footwear and appropriateness of footwear, use of orthotics and previous treatments that may have been used. This may include, but is not limited to, relative rest, anti-inflammatory medication, ice, physiotherapy, podiatric input, massage and chiropractic management.

ANSWER 2

The most likely diagnosis is Sever's disease or Sever's apophysitis. James Warren Sever was an American orthopaedic surgeon who first described the condition.

Heel pain is a common complaint in the skeletally immature athlete and Sever's disease is one of the most common overuse injuries.[1] The incidence is reported as 2–16% of all musculoskeletal injuries in children.[2] It is reported to be bilateral in 61% of cases.[3] Sever's disease occurs in children aged 8–15 years[4] (average age 10 years). It is a common traction apophysitis among adolescents[5] and is more common in boys than girls.

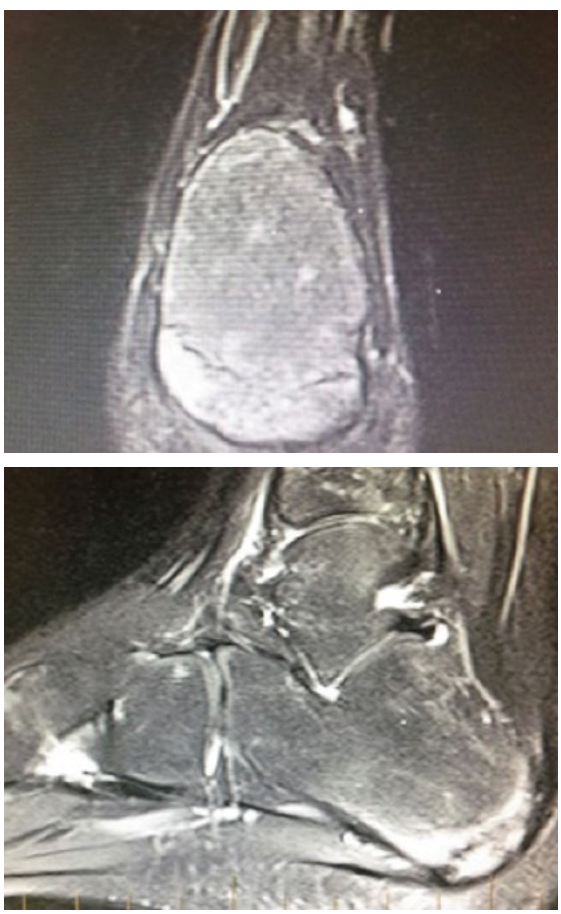
Risk factors for Sever's disease include high levels of activity in children and being overweight.

ANSWER 3

You should explain to Tarkyn and his mother that Sever's disease is a traction injury from repetitive activity where the Achilles tendon pulls on the growth plate at the heel (traction apophysitis). The pain is localised to the heel, aggravated by physical activity and seen in Tarkyn's age group with high levels of exercise. The condition is ultimately self-limiting (when the growth plate in the heel closes), but may cause intermittent symptoms during times of high growth and activity even after this episode is settled.[6]

Figure 1. Secondary ossification centre of calcaneus (lateral radiograph)

Figure 2. Marrow oedema within the metaphyseal region of the calcaneal tuberosity



Typically, Sever's disease is diagnosed clinically by the history and presence of tenderness when examining the back of the heel. There may not be any evidence of localised swelling, and redness is typically absent.

Sever originally described this condition in 1912 as being a result of inflammation at the apophysis.[7] It was subsequently reported as a condition resulting from repetitive micro-trauma to the calcaneus.[8] Magnetic resonance imaging (MRI) has confirmed that this condition is a non-inflammatory, chronic (repetitive) injury to the actively remodeling trabecular metaphyseal bone,[9] related to repeated traction of the Achilles tendon at the secondary ossification centre of the calcaneus.[10]

ANSWER 4

Sever's disease is a clinical diagnosis and no investigations are required.

Radiographically, the secondary ossification centre of the calcaneus shows greater fragmentation when compared with normal controls on lateral radiograph,[11] but individual radiographs demonstrating sclerotic changes and fragmentation can be difficult to distinguish from normal anatomical variation (Figure 1).[12]

On MRI, marrow oedema within the metaphyseal region of the calcaneal tuberosity adjacent to the apophysis is reported, but an oedema-like signal within the calcaneal apophysis itself can be a normal finding that persists after both heel pain and metaphyseal oedema resolve (Figure 2).[13]

A retrospective case study (level IV evidence) has shown that of 133 feet (age range 4–17 years), 3.75% had abnormal radiological findings on lateral radiograph. Patients with a history of insidious-onset heel pain, or a clinical diagnosis of Sever's disease, who do not respond to appropriate treatment,[14] and those with red flags such as night pain, inability to bear weight, have fallen from a height and landed feet first, or had other trauma involving the heel,[15] should be considered for further imaging.

ANSWER 5

Management of this condition is conservative. Initially, activity modification should be discussed. Activity should be modified such that the patient becomes pain-free. This may require a period of total rest from sport, or may only require relative rest, depending on the severity of symptoms (eg swimming with a pool float between the legs).

Relieving stress over the calcaneal apophysis in the acute stage of Sever's disease can be achieved with taping and heel cup with heel raise, and once the pain is less acute, calf stretching and a graded strengthening program should be introduced.[16]

Symptomatic relief may be provided by application of ice to the affected heel(s) on rising, before bed and after sport. Application of topical anti-inflammatory gel may also aid with symptom relief. If heel pain is more severe, oral anti-inflammatory medication, such as ibuprofen, and/or paracetamol, may be necessary.[17,18]

During this initial management phase, a review of the patient's current activity levels should be undertaken, and time should be spent with the patient and family addressing long-term load management.

Patients usually return to sport within three to six weeks of treatment,[19] but symptoms may take 6–12 months to fully settle and, occasionally, up to two years, hence the need for prolonged activity modification and load management.

ANSWER 6

Addressing current and future activity levels is critical to prevent recurrence in symptoms, and to reducing the risk of future load-related injuries. This can be very difficult, especially if the patient and family believe that there is sufficient talent for progression to high-level sport.

A review of previous sporting load and triggers for onset of heel pain should be conducted with the aim of the patient and family linking load to exacerbations. The school's sports teacher and coach may need to be involved in this process.

As well as retrospective review, it is useful to look at upcoming events, games and training expectations, and to consider prioritising these to allow for a graded, paced return to activity. The idea of early relative protection to reduce injury and prolong sporting longevity should be introduced.

ANSWER 7

It is apparent in this case that load reduction had not been achieved. Further management would be to have Tarkyn wear a controlled ankle movement (CAM) boot for two weeks, reiterate advice relating to load management and activity modification, and then review his symptoms.

The engagement of an exercise physiologist at subsequent review may be of benefit to reinforce the idea of load modification once the CAM boot is removed, and also to actively supervise a graded and paced return to sport. The exercise physiologist or sports doctor is well placed to act as a liaison with the patient's coaches, ensuring consistency of messages and management.

A regular course of oral anti-inflammatory medication for pain management may be required. There are case reports of iontophoresis being used under the supervision of a sports and exercise physician,[20] but there is limited evidence for the effectiveness of this approach and it is not currently recommended. The patient and parent must be made aware that without adequate, long-term load management, symptoms may recur, despite treatment.

If, as in this case, the patient has significant pes plano-valgus, a trial of a temporary felt orthotic padding of school, sports and leisure shoes by a sports podiatrist may be of benefit. The podiatrist may also be involved in providing heel cup and raise if over-the-counter options have not provided comfort.

Should there be concern that improvement is not related to non-compliance, further history, re-examination and further investigation may be required.

CONCLUSION

Tarkyn's mother was happy to agree with the use of a CAM boot, as she was concerned that his symptoms were now consistently preventing him from performing well at sports

After prolonged discussions with Tarkyn and his mother regarding his sporting load, Tarkyn was placed in a right-sided CAM boot for two weeks. There continued to be no red flags suggesting alternative diagnoses, and Tarkyn's mother was, appropriately, not keen to subject him to imaging of any sort. At the two-week review, his heel pain has already significantly reduced. His CAM boot was therefore removed and bilateral heel raises were placed in his shoes. Under the guidance of an exercise physiologist, he returned to full sport over the next 12 weeks, having agreed to cut out his daily 1 km run in the long term and have two sport-free days per week.

RESOURCES FOR DOCTORS

- www.betterhealth.vic.gov.au
- www.rch.org.au
- www.orthoinfo.aaos.org

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CASE 3

JOHN NEEDS ADVICE ABOUT HIS ASTHMA MEDICATION

John, 17 years of age, attends your consulting rooms for advice regarding his asthma medication. You know him well as a very keen sportsman and he has been a patient at your practice since childhood. John tells you that he has been awarded a scholarship by the state sports academy and was advised to see his doctor for a medication review as part of his induction. Looking through your notes, you see that he has had asthma since infancy and he saw a paediatrician about this on a number of occasions during adolescence. John has never been hospitalised but has had to use oral corticosteroids in short bursts on three occasions. He is a non-smoker and has no drug allergies, but has a significant family history of atopia. John tells you that currently he uses a salbutamol inhaler as required and a combination fluticasone/vilanterol inhaler for maintenance control. He has previously used montelukast, but not in the past 18 months.

QUESTION 1

What further information should you seek from John?

QUESTION 2

Which of John's drugs is not permitted for use in athletes subject to the Australian Sports Anti-Doping Authority (ASADA)?

QUESTION 3

What would you do with John's medication now?

QUESTION 4

Why is it important to ask John how many inhalations of salbutamol and permitted long-acting beta agonist (LABA) he takes?

FURTHER INFORMATION

Two months later, John presents with a severe exacerbation of his asthma relating to a respiratory infection. His symptoms are such that you feel he needs a short burst of oral corticosteroids to settle his asthma. It is out of his normal sporting competition season.

QUESTION 5

What are the issues around taking oral corticosteroids in an athlete subject to ASADA testing?

FURTHER INFORMATION

You see John again six months later. He tells you that he has been selected for an international 'Under 20s' competition and is due to leave in a month. Since you last saw him, John has had an acute anaphylactic episode after a bee sting. He has been advised to carry an EpiPen at all times, but wants to know if this is permitted under the World Anti-Doping Agency (WADA) rules.

QUESTION 6

How would you address this with John?

QUESTION 7

You see John again the following year for a general medical check-up. What should you consider regarding his asthma medication?

CASE 3 ANSWERS

ANSWER 1

Important questions to ask John would include:

- What is his perceived level of asthma control?
- Does he have an appropriate understanding of the nature and use of his asthma medications?
- Does he have an asthma plan and does he stick to it?
- How many inhalations of salbutamol does he take over the course of a day if his asthma is bad?
- Does he increase his inhalations of corticosteroid/LABA when his asthma is bad?
- Has he had any lung function tests in the recent past?
- Does he have pre-physical activity strategies to counter any exercise-induced bronchoconstriction?
- When do symptoms occur?
- Are symptoms associated with physical activity?
- Are there triggers for his symptoms?

ANSWER 2

Under the World Anti-Doping Code (to which ASADA is a signatory), vilanterol is not permitted in sport.[1] Some short-acting and long-acting beta$_2$ agonists are permitted in sport, but most are not. Therefore, it is critical to check because using a non-permitted medication will result in an anti-doping rule violation (ADRV), which generally results in a two-to-four-year ban from sport.[2]

The easiest strategies for those wanting to quickly check the status of a drug are to either:

- go to the ASADA website and use the GlobalDro *check your substances* tool[3] – enter the name of the drug and sport, and the tool will tell you if it is permitted
- look at its listing in MIMS, where the athlete symbol indicates whether something is permitted or not (providing you are using a current MIMS edition).

If you prefer to look at the WADA list[1] it is important to realise that at times the list may not mention a specific drug by name. In the case of $beta_2$ agonists, it states that:

'All $beta\text{-}_2$ agonists, including all optical isomers, e.g. *d*- and *l*- where relevant, are prohibited', with the exception of salbutamol, formoterol (eformoterol) and salmeterol.[1]

Therefore, a word search of the document would not find vilanterol, but it is banned. Careful reading of the document is important.

ANSWER 3

It is not the purpose of ASADA or WADA to dictate how doctors should practise medicine. In this case, John could be switched to a permitted long-acting bronchodilator such as formoterol, with suitable advice regarding the changeover. Alternatively, you could apply for a therapeutic use exemption (TUE)[4] to allow John to continue using vilanterol; however, there would have to be a strong clinical case for using this drug as opposed to a permitted medication. There is more information on the TUE process below. It is also worth considering that this may be an opportune time for John to have comprehensive respiratory function tests performed and to refer him to a respiratory physician for specialist review.

TUE process[4]

The TUE process is the pathway for seeking permission for the appropriate medical use of an otherwise banned substance. John (and all athletes subject to testing) should have comprehensive documentation of all medical conditions that may require them to use a prohibited substance. How the TUE process applies depends on the testing status of the athlete. Some athletes subject to the ASADA legislation are not required to obtain a TUE in advance; they are required to obtain one retrospectively if they are actually tested. For instance, if John (who is a relatively low-level athlete) had to take oral prednisolone for his asthma during competition and was not tested during or immediately around the time he was taking this medication, he would not require a TUE. However, if he were tested during that period, he would have to apply for a TUE retrospectively. If John moved up the ranks in his sport to compete at a national level or beyond, he would be required to notify the testing authorities of his whereabouts at all times (to be available for random testing) and must obtain a TUE in advance to cover the potential or actual use of the oral corticosteroids. In Australia, applications for a TUE are submitted to the Australian Sports Drug Medical Advisory Committee (ASDMAC).

It is critical to realise that whenever any application for a TUE is made, it needs to be carefully attended to. There are specific forms that must be signed by the athlete and their doctor. Additional information must be typed on a letterhead. In John's case, examples of additional information are copies of respiratory function tests and a specialist respiratory physician letter.[5] The application is unlikely to succeed without significant substantiating evidence of need. In other words, a single opinion without independent verification is unlikely to be approved.

To slightly complicate matters, once an athlete reaches international competition level, the TUE is the responsibility of the international federation governing that sport[6] (eg the International Association of Athletics Federation [IAAF])[7] rather than a national body such as ASDMAC. ASADA now has a system where TUEs granted at the national level can be 'seen' by international federations and 'accepted' once an athlete moves up the ranks, although the international federation may occasionally request clarification on a particular case.

ANSWER 4

Although inhaled salbutamol, formoterol and salmeterol are all permitted under the WADA code, they are subject to conditions.[1] For example, salbutamol is restricted to a maximum daily dosage of 1600 µg over 24 hours (<16 puffs per 24 hours). If the urinary concentration of salbutamol exceeds 1000 ng/mL, then the athlete is regarded as having committed an ADRV. WADA does note that there is the possibility of individual variation in salbutamol metabolism, meaning that <16 puffs in 24 hours could result in a urinary concentration greater than permitted. WADA does allow the athlete the option of proving 'through a controlled pharmacokinetic study, that the abnormal result was the consequence of the use of the therapeutic inhaled dose up to the maximum indicated'.[1] However, there are no approved protocols for such a study and it is unlikely that the athlete would be exonerated. Of course, the key consideration is that if an athlete is regularly taking more than 16 puffs of salbutamol in 24 hours, their asthma is not well controlled and better overall management is required. If, during an acute attack, John needs to use higher than recommended therapeutic doses, then a TUE application should be lodged. In the event of an emergency, a TUE application should be lodged as soon as possible after use.[5]

ANSWER 5

Provided that John is not competing (and not due to compete in the near future ([within one week]), oral corticosteroids are permitted and no notification process is required. However, if John was 'in competition', oral corticosteroids are not permitted.[1] Naturally, if this medication were necessary for the appropriate management of John's asthma, then there needs to be a pathway (TUE application) for him to use the medication without being penalised with an ADRV.

ANSWER 6

Under the current WADA code, possession of a prohibited substance or equipment for a prohibited method by an athlete or support staff is a doping violation even if that substance or method is not used.[8,9] Adrenaline for injection is prohibited. The rider for support staff is that they may carry such a substance with acceptable justification; for example, a team doctor may carry substances for treating acute or emergency circumstances.[6] This rider does not overrule local law and team doctors taking drugs internationally should be extremely well informed about what is legal in countries they will be visiting or transiting through. In

John's case, the most appropriate path would be to apply for a TUE in advance in order to carry an EpiPen. Alternatively, the team doctor could carry one, provided there is also adequate documentation of John's problem. It should not be assumed that it is legal for the EpiPen to be in the possession of other medical support staff in the absence of a travelling team doctor.

ANSWER 7

The WADA code is under constant review and a new version of the code is released at the beginning of each year. It is advisable to review the code each year for any significant changes. It would also be important to reassess John's asthma progression, mediation and medication use.

RESOURCES FOR PATIENTS AND DOCTORS

- The GlobalDro *check your substances website*, www.globaldro.com/AU/search
- ASADA has online education modules for doctors and other health practitioners, which are free to access. There is a basic module that details the issues around sports doping and an update module released each year, http://elearning.asada.gov.au
- Information around TUEs and the application form for TUEs, www.asada.gov.au/therapeutic-use-exemption, and specific checklists for the medical information required when applying for a TUE for common conditions (eg asthma, anaphylaxis) are in the process of being added to ASADA's website
- WADA prohibited list, www.usada.org/wp-content/uploads/wada-2016-prohibited-list-en.pdf

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CASE 4

ELLIE HAS FOOT PAIN

Ellie, 13 years of age, is a middle-distance runner who competes at the national level. She trains six times a week, with a combination of track and gym work. Ellie is currently training for nationals and has increased her training load. Ellie's mother brings her to see you as she has a three-week history of dorsal mid-foot pain that is progressing.

QUESTION 1

What further information should you obtain about Ellie's foot pain?

FURTHER INFORMATION

Ellie describes the pain as a dull ache that was initially worse after exercise, but is now present with daily walking. There is no radiation of her pain, and no swelling, neurovascular symptoms or night pain. Ellie has never had any similar episodes previously. Apart from the increase in her training load, there have been no other changes (eg change in shoes or spikes, training surface or running technique). Ellie follows a normal diet, with no restriction of any food types, and has never been diagnosed with an eating disorder. Ellie is yet to have her menses.

On examination, Ellie walks with an antalgic gait because of the pain. She has mild pes planus and pain with single leg balancing and hopping. On palpation, Ellie is point tender on the N spot. The rest of her ankle and foot are unremarkable on examination.

QUESTION 2

What is your provisional diagnosis?

QUESTION 3

How will you investigate Ellie's foot pain?

FURTHER INFORMATION

You referred Ellie for an X-ray and and bone scan, which confirmed a stress fracture of the navicular.

QUESTION 4

How will you manage Ellie's stress fracture?

QUESTION 5

What are the recommendations for return to sport after a navicular stress fracture?

QUESTION 6

What additional factors should you consider?

CASE 4 ANSWERS

ANSWER 1

You should obtain a thorough history, including:

- nature of the pain
- factors that improve or worsen the pain
- previous episodes
- changes to training routine or footwear
- past medical history.

You should also assess Ellie's gait and do a physical examination, looking for any tenderness on palpation.

ANSWER 2

One should have a high index of suspicion of a navicular injury if an athlete has vague foot pain with tenderness over the N spot. The N spot is located between the extensor hallucis longus and tibialis anterior tendons on the dorsum of the foot (Figures 1 and 2).

However, patients often complain of pain with an insidious onset that is worse during and following physical activity. In particular, sprinting, jumping and pushing off tend to aggravate their symptoms. The pain is usually localised to the dorsum of the foot, but patients can also complain of a vague pain along the longitudinal arch on the dorsolateral aspect of the foot.[1] Described signs are an aggravation of symptoms with percussion over the navicular and hopping on a plantar flexed foot.[2]

The navicular is one of the tarsal bones of the mid-foot. It articulates proximally with the talus, distally with the three cuneiform bones and laterally with the cuboid. The tibialis posterior attaches to it and the blood supply is from the dorsalis pedis artery. The central portion has poor blood supply, compared with the medial and lateral portions, and is subject to a compressive force during foot-strike with shear forces from the first and second metatarsals, and body weight. Therefore, the central portion is the most likely area to be injured.[3]

A navicular stress fracture is relatively common and accounts for 35% of stress fractures.[3] In the 2000 Sydney Olympics, bone stress was diagnosed in 67 athletes and 14.6% of these involved the navicular.[4] It is a high-risk stress fracture because it has a high rate of non-union (1–5%).[5] Despite its high risk, there is usually a significant delay (average four to seven months[5,6]) in the diagnosis of a navicular stress injury because the symptoms are usually vague.

A navicular stress fracture is bilateral in 5% of cases, more common in men and the right foot.[3] Predisposing factors for the development of a navicular stress fracture include:

- pes cavus
- short first metatarsal
- metatarsus adductus
- limited subtalar or ankle motion
- tarsal coalition
- medial narrowing of the talonavicular joint.

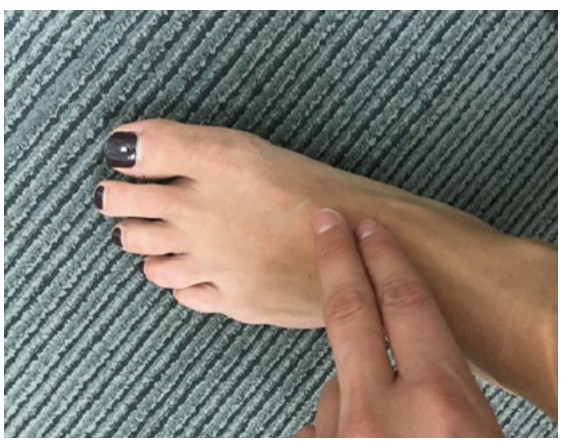
However, the statistical significance of any of these factors is yet to be demonstrated.[5,7,8]

Athletes often report a recent increase in the intensity or duration of training, or a change in equipment or technique. Training errors can also be the cause of a navicular stress fracture and need to be enquired.

ANSWER 3

A navicular stress reaction or fracture is rarely diagnosed on plain X-ray as this has poor sensitivity for stress fractures.[9] However, an X-ray should still be included in the investigations to rule out any other pathology. MRI or a bone scan are the most reliable forms of imaging. Nuclear bone scanning is sensitive in detecting stress reactions and a stress fracture. An MRI should use 2–3 mm thick slices orientated along and perpendicular

Figure 1. N spot surface anatomy



to the axis of the navicular.[10] Findings can include bone marrow oedema, a fracture line, sclerosis and cystic change.

CT can also be used alone or in conjunction with MRI to guide treatment and prognosis. It will best demonstrate a fracture line, if present. This requires thin (<2 mm) slices; the fracture line is usually in a sagittal plane and if through both cortexes will show a classic Mercedes Benz logo.[10]

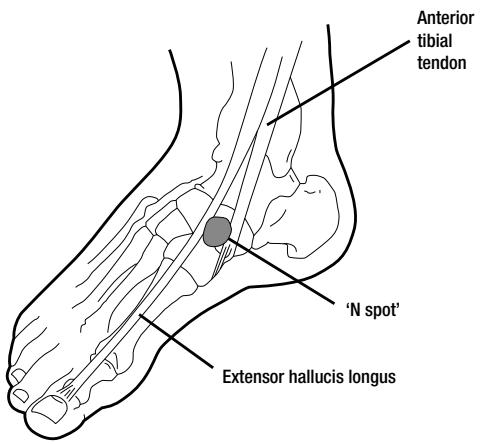
Ideally, a patient should be referred to a specialist for a CT scan and/or MRI if a navicular stress fracture has been identified.

ANSWER 4

Given the high risk of non-union in this type of fracture, it is very important to treat a navicular stress fracture correctly and as soon as a diagnosis is made. A navicular stress facture is treated with strict non-weight bearing (NWB) immobilisation in a cast or controlled ankle movement (CAM) boot for six to eight weeks. This treatment is associated with an 86% successful return to sport rate.[6] At the end of the NWB period, the N spot should be palpated for tenderness. If the N spot is non-tender, the patient can begin their return-to-sport program. However, if the N spot is tender, the patient needs to have a further two weeks of NWB immobilisation. There is poor correlation between clinical and radiological healing.[9] Assessment six weeks after NWB should therefore be based on clinical not radiological findings.

In cases of a fracture that shows delayed union or non-union, or fractures that breach both cortexes, surgical fixation with or without debridement and bone grafting is often required. A period of six weeks NWB immobilisation post-surgery is again needed. However, the evidence for surgical management is mixed. A meta-analysis[11] that assessed pain reduction and return to previous activity level showed no significant difference between NWB conservative treatment and surgical treatment. NWB alone had a 96% improvement compared with an 82% improvement with surgery. There was also no significant difference in return-to-play times; each had an average of five months. A retrospective case study comparing CT findings two years from injury showed no difference between surgical and conservative management.

Figure 2. N spot navicular



ANSWER 5

Following any injury, a patient must have a graded and monitored return to sport and activity. With navicular stress fractures, there are two recognised protocols that can be followed; the N spot should be reviewed at each milestone. However, patients may take up to eight months to return to full activity.[13]

Option 1[5]

- Weeks 6–8: Activities of daily living, deep water running, swimming
- Weeks 8–10: Alternate day running for 5 minutes (week 1) and 10 minutes (from week 2)
- Weeks 10–12: Running at 50% full effort
- Weeks 12–16: Return to play

Option 2[14]

- Weeks 6–8: Weight bearing in a CAM walker
- Weeks 8–10: Jogging
- Weeks 10–12: Full running and sport specific
- Weeks 12 onwards: Return to sport

Either of these return-to-sport protocols should to be followed in conjunction with mobilisation of the ankle, subtalar and midtarsal joints, and exercises for calf strengthening, flexibility and endurance. Biomechanics should also be assessed and the addition of orthotics may be needed. This process can be carried out in partnership with a sport and exercise physician, and/or podiatrist.

ANSWER 6

When clearing a patient to return to activity after a navicular stress fracture it is important to review their biomechanics and footwear to reduce the chance of recurrence. Poorly fitting or supportive footwear will cause undue load through the medial arch of the foot, mid-foot, and therefore navicular. Support can be achieved through the correct footwear for the patient's foot type and/or orthotics prescribed by a podiatrist. The orthotics can also target the other predisposing factors that can contribute to a navicular stress fracture, as stated above in Answer 2. Orthotics can help reduce the shear, stiffness and impact through the navicular during the gait cycle.

Reduced ankle dorsiflexion range of motion, and poor calf strength and endurance, may increase the risk of developing a navicular stress fracture as compensation occurs through the mid-foot.[15] Therefore, adequate calf rehabilitation focusing on flexibility, endurance and strength along with ankle range of motion is also important. This is best done under the supervision of a physiotherapist.

It is also imperative that when a female patient presents with a stress fracture, particularly if it is not her first, that one explores the possibility of female athlete triad syndrome,[16] more recently referred to as relative energy deficiency syndrome (REDs).[17] These syndromes include a combination of decreased bone mineral density (osteoporosis and osteopenia), secondary amenorrhea and disordered eating. They are all due to low energy availability, which sets off a cascade of hormonal changes in the body.

A reduction in gonadotropin-releasing hormone (GnRH) pulsatility and, therefore, luteinising hormone (LH) and follicle-stimulating hormone (FSH)

results in a disruption of the hypothalamic–pituitary–adrenal–ovarian axis and lead to amenorrhea, known as functional hypothalamic amenorrhea (FHA). It is theorised that altered levels of metabolic hormones (reduced insulin, growth hormone, insulin growth factor 1, triiodothyronine, leptin and increased cortisol) and substrates (glucose, fatty acids and ketones) signal the reduction in GnRH release. The resulting oestrogen deficiency causes abnormal bone remodelling and impairs peak bone mass attainment in young females. Several studies have shown a 2–2.5 times increase in the risk of musculoskeletal injury in athletes with disordered eating.[16,17] The risk of a stress fracture is two to four times higher in amenorrhoeic athletes.[18–20] These effects can occur in the absence of a definable eating disorder.

To diagnose female athlete triad syndrome, include the following questions in your history:

- Decreased bone mineral density/stress fractures: Have you had any previous known stress fractures or been diagnosed with osteopenia or osteoporosis? A dual-energy X-ray absorptiometry (DEXA) scan may help with diagnosis.
- Secondary amenorrhea: Have you ever had a time of no periods for longer than three months? This may be masked if they are taking oral contraception.
- Disordered eating: Do you follow any particular diet or restrict any food types? Have you ever been diagnosed with an eating disorder?

FURTHER INFORMATION

Ellie was placed in a CAM boot and was placed on an NWB period for six weeks. At the six-week review, she was pain-free at her N spot. She continued walking in the CAM boot for a further two weeks. Ellie started rehabilitation and a return to running program at the eight-week point. She returned to competition after a further six weeks; she unfortunately missed the nationals.

CONCLUSION

Navicular stress fractures affect athletes and active individuals, and can be a difficult condition to diagnose and treat. A high index of suspicion should be used in an active person with vague dorsal foot pain to allow early diagnosis and appropriate treatment.

KEY POINTS

This type of fracture:

- must be high on the differential diagnosis list for dorsal mid-foot pain, especially in an athlete
- is a high-risk stress fracture
- has a high rate of non-healing
- should be treated with a period of nonweight bearing
- warrants consideration of biomechanics and footwear
- warrants consideration of female athlete triad syndrome.

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CASE 5

PAUL HAS RECURRENT HAMSTRING STRAIN INJURIES

Paul, 28 years of age, works as a secondary school physical education (PE) teacher and is captain of the local Australian Rules football team. He presents on Monday morning, limping and his weight supported on one crutch. The local physiotherapist who looks after the town's football team referred Paul for an opinion and management of a right hamstring strain injury occurring two days ago.

Paul leads off with: 'Sorry to trouble you early in the week with something that, in the scheme of medical issues, is probably low on a list of priorities – just an old footballer with old hamstrings. But, no pun intended, I am running out of football years and am keen to understand what is happening and to get it right and have a better year this year as the team is travelling well. As a PE teacher, I see a bit in the papers about hamstrings and Australian Football League (AFL) and wonder if any of this might apply to these ageing legs'.

QUESTION 1

What further information will be helpful in assisting Paul?

FURTHER INFORMATION

Paul has had several episodes of hamstring strain events over a long local football career. These injuries have been of varied severity. At times, he has missed three or four games without impact on work. On one occasion, he struggled on during a game despite low level symptoms after an incident, had a further strain episode and ended up missing eight matches. He was able to continue work at school, but was unable to participate in physical activities and was restricted to classroom teaching and administration. On two occasions, he missed three games, returned to play feeling good, and played for several weeks only to experience recurrent symptoms in the same site. He has had no problems with his back. However, the physiotherapist asked whether imaging of the lumbar spine might be appropriate. In view of this variance, Paul is keen to have as much information as possible to assist his planning.

QUESTION 2

What features would suggest that Paul has a local muscle strain injury?

QUESTION 3

What features suggest the lumbar spine is a predisposing or compounding factor?

QUESTION 4

Would you use any imaging modalities to investigate Paul's injury? If so, what imaging modalities may be appropriate in the situation?

QUESTION 5

What are the risk factors for recurrent hamstring strain injuries? What are some preventive measures?

FURTHER INFORMATION

Paul says his current injury is more severe than the usual strains he has had in the past. He has never had to use crutches before. Paul mentions that a close friend from his university days, who also sustained a high-grade hamstring strain while playing for an AFL team, was referred for surgical care and had a good outcome. He shows you a newspaper article of another AFL player who had surgery for a hamstring injury and asks if he would need surgery, given his history of hamstring injury and the severity of his current injury.

QUESTION 6

What might be the circumstances in which surgery would be considered?

FURTHER INFORMATION

Paul mentioned, again apologetically and with a nervous smile, that he has read reports of athletes going to Germany for injection therapy and having injections of blood product. He asks if such treatment might be suitable for him.

QUESTION 7

What is the role of injection therapy?

QUESTION 8

What would be your approach for managing Paul?

CASE 5 ANSWERS

ANSWER 1

The critical features are to explore what actually happened and the immediate impact on continued play. In terms of the mechanism, the circumstances in which the injury was sustained – sprinting, reaching to tackle, stretching forward to collect a low ball, running and being pushed forward from behind – set the scene for what can happen. A description of what was felt at the time – cramp, tightness, tearing pop – gives clues to what may have happened to the tissues.

Features that suggest a high-grade event include:

- immediately clutching the thigh
- not being able to continue play
- subsequent pain
- difficulty with flexing the knee (eg when dressing and undressing).

It is important to determine if Paul has had previous hamstring strain injuries and whether these are similar or different in severity and location in the muscle, as well as previous management and outcomes.

It is important to clarify how the pain has progressed over the two days since the recent injury and how function, in terms of day-to-day activity and walking, has progressed.

For completion, a review of any other injuries that may influence decision making and management should be undertaken.

ANSWER 2

In potential hamstring strain injury, the key to recognition that local muscle injury has occurred is the presence of local clinical signs in terms of palpation, flexibility deficits on stretch and strength deficits on contraction. While features such as local bruising and palpable defects certainly indicate muscle strain injury, these signs are uncommon.

As in any clinical assessment, it is important to listen carefully to words used to describe the event and to examine carefully, looking for local tenderness, loss of flexibility and loss of strength. The description of circumstances surrounding the event are critical in determining whether it is more likely to be a muscle strain injury or proximal referred event (lumbar spine somatic referred or early radicular pain). As outlined above, the circumstances – what was actually felt at the time of injury and the immediate functional outcome – serve as important guides. Running at intensity, perhaps with trunk flexed and extension of the injured leg at the critical moment, with possibly a surge of energy to tackle or pick up a low ball, all suggest local muscle injury. The description of what actually happened in terms of 'snap, crackle, pop', sense of tearing or tightening, cramping, or giving way in this body position and these football circumstances is highly suggestive of local pathology, as are functional outcomes including features such as difficulty lifting the leg in dressing, and limping, especially on striding out to walk briskly. These are all suggestive of strain injury.[1]

From clinical experience, examination features indicative of local pathology include:

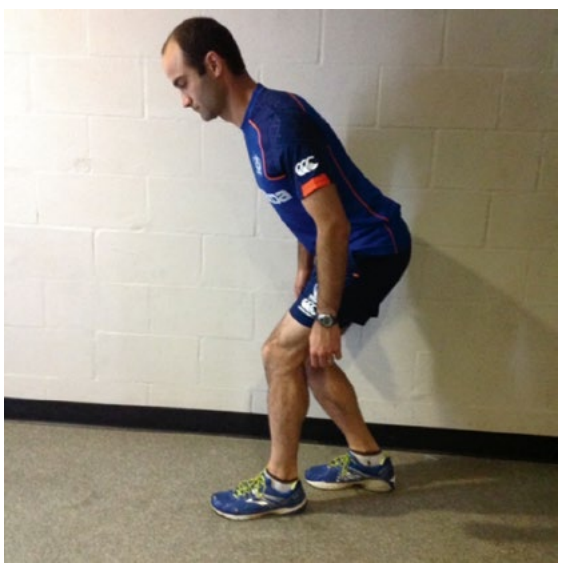
- pain scraping the sole of the foot or shoe on the floor – hip flexed and trunk flexed (Figure 1)
- pain on passive stretch (Figure 2)
- strength deficit and contraction pain or contraction inhibition assessed when supine (Figure 3 'bridge')
- prone and resisted knee flexion (Figure 4)
- local tenderness on prone palpation.

ANSWER 3

The circumstances are likely to be a lower intensity and lower acute sequelae incident, such as bending and rotating with a sense of cramp or tightening. Features on attempting to continue to play may be less restrictive – more a sense of more diffuse tightness rather than significant pain.[2]

From clinical experience, examination findings consistent with lumbar spine involvement include the absence of local features and presence of supportive lumbar spine provocative features.[1,3,4] Contraction pain

Figure 1. Scrape test



Trunk flexed and hip flexed dragging foot backwards

Figure 2. Supine hamstring stretch

The hip is flexed and knee passively extended until pain prevents further extension

and stretch soreness will be either less severe or absent. Standing scrape may be negative, but standing lumbar flexion and flexion-rotation may produce discomfort. Neural tension in the posterior thigh may also occur when maintaining hamstring length on stretch and varying ankle dorsiflexion and plantar flexion, or varying cervical flexion with hamstring length unchanged (slump test; Figures 5 and 6).[1]

ANSWER 4

The options for investigating hamstrings are ultrasonography or magnetic resonance imaging (MRI).[5] The decision as to whether to use imaging at all is guided by the severity of the event, whether this is a recurrent event and diagnostic uncertainty as to whether this is a local strain or a referred event.

For a low-grade incident, where there is sense of tightness but the player is able to continue play with minimal local contraction-type symptoms and signs after the game, imaging may not be required, but referral for physiotherapy may be appropriate.

Imaging may be warranted if the strain severity increases, which can be assessed on the basis of pain severity and immediate and subsequent disability. Imaging may also be warranted if there is no improvement with an appropriate management plan, or if there are inconsistent or new features.

In an extreme event, where there is a combination of high-grade pain with injury involving the trunk and hip flexion, reflex 'clutch' of the upper hamstring, and immediate severe pain and difficulty walking, imaging becomes advisable to exclude hamstring tendon avulsion or high-grade disruption of the upper intramuscular tendon. In such situations, MRI is the imaging of choice, if feasible. However, regional access and financial consideration may mean that ultrasonography is performed. This will provide valuable information in the setting of a possible avulsion or high-grade intramuscular tendon strain. If the ultrasound shows a high-grade injury, subsequent MRI within 7–10 days can provide more detailed information to clarify the diagnosis and further enhance decision making about management. In the adolescent athlete, if an ischial tuberosity apophysis avulsion is a possibility, plain X-ray alone will be the initial imaging modality.

ANSWER 5

The strongest risk factors for recurrence are history of previous strain events and increasing age.[6] Hamstring strain injury remains the single most common injury across football codes and there is a high incidence of recurrence.[7,8] Ideally, primary prevention of any hamstring strain is critical; however, it is even more important in an athlete who has already sustained such an injury, to try to minimise further strain (secondary prevention). Sports Medicine Australia has a list of recommendations for preventing hamstring strains (refer to 'Resources for patients and doctors').

As an example of a program aiming to minimise injury and maximise participation, the governing body of world soccer has piloted a warm-up program, the 'FIFA 11+' (refer to 'Resources for patients and doctors'). The aim of this program is to reduce injuries among male and female football players aged 14 years and older.

For conditioning, a program of lumbar spine, gluteal and hamstring strengthening is critical. This will be combined with a program of graded increase in distance running in pre-season, progressing to high speed over shortened distance and high repetition endurance load (football-specific running and agility). Progression is guided by discomfort during or after the session and the following day. Recovery periods are critical (one to three days interval, guided by soreness) to allow positive training

Figure 3. Supine contraction test lifting buttock from couch

Figure 4. Prone resisted knee flexion from extended position

adaptation response and avoid overuse injury. Recovery facilitation may include active training measures such as low-intensity cross-training in swimming, cycling or walking, massage and contrast hot and cold bathing.

Referral for rehabilitation to a regional physiotherapist in conjunction with a specific team-conditioning advisor and strength advisor is appropriate. This may include a review of running biomechanics if facilities allow.

ANSWER 6

The following discussion provides observations of management trends, rather than documented findings in recent literature. It is intended to provide a background to Paul's aim to keep abreast with trends that he hears about through the media and from his associates, and considers as appropriate in contemporary sports medicine practice.

With an improved understanding of imaging and injury, there has been a significant shift in considering and recommending surgery. In particular, this will apply to hamstring avulsion injuries in both young and older age groups up to late 50s. In general practice, it may be appropriate to seek the opinion of a doctor with interest and expertise in sports medicine or an orthopaedic surgeon experienced in repair of the avulsed hamstring tendon. A lapse of one to two weeks is reasonable depending on the difficulty in confirming the diagnosis. However, if there has been a longer delay, referral is still appropriate.

A less well defined area, and an area in evolution, is management of the high-grade disruption of the intramuscular tendon in biceps femoris (Figure 7). Given the delayed time frame for tendons to heal, the importance of allowing adequate time to rehabilitate following an intramuscular tendon strain, especially in biceps femoris injuries, and the potential for the tendon to fail after returning to play, even some weeks after return as Paul has described, has thrown more scrutiny on the care of these high-grade events in recent years.[6] The key element is that the tendon is ruptured and the tendon margins recoil, resulting in a 'pig-tail' corkscrew appearance. This type of injury in higher profile athletes undergoing surgery receives media attention.

Surgery does not seem to prolong the return to play from sport and may provide a more reliable return to play. It may warrant consideration for the non-professional participant. Howerver, factors such as level of competition, the person's profession and impact of surgery on work, all need to be factored into decision making.

ANSWER 7

There has been a recent surge of interest in the role of biologic injections, such as of platelet rich plasma (PRP) and activated serum (Orthokine) in muscle, tendon or joint conditions, to increase local growth factors in healing tissues. This has resulted in a surge in the use of such treatments, although level 4 evidence for the effectiveness of these injections is sparse. A Medicare Benefits Schedule rebate for PRP was available initially, but has now been cancelled. This treatment was included for hamstring injuries; however, enthusiasm for it, both for the muscle strain component and any intramuscular tendon component, has waned. Similarly, there has been high media exposure for some homeopathic preparations (eg actovegin and traumeel) and athletes flying overseas for treatment, but use of these measures has waned, probably in parallel with a more general concern about supplement use in sport.

ANSWER 8

Paul is on crutches following his recent injury, possibly placing it in the more severe spectrum. It is set against a background of recurrent strain

Figure 5. Seated slumping forward, neck flexed and knee extended to tension limitation

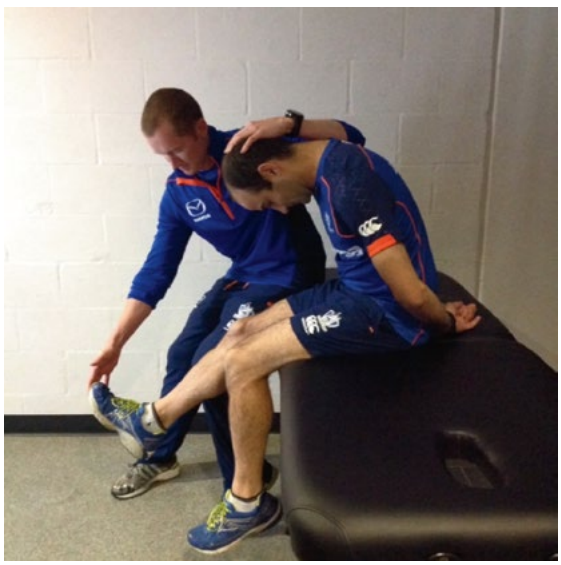
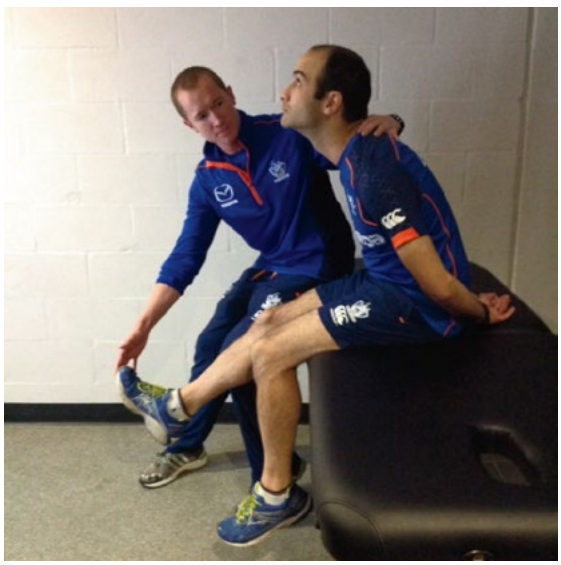


Figure 6. Knee extension position (hamstring length) held and neck flexed monitoring reduction in pain



injuries. Paul has enquired about higher end assessments and interventions given his previous strain injuries and the not-so-distant end to a football career chequered by his repeat hamstring incidents. He is a trained PE teacher and has been watching media events and discussing options with friends and colleagues.

Unless the primary practitioner has strong interest and expertise in managing these injuries, referring Paul for a specialist opinion on overall care is advisable.

Rehabilitation of hamstring strain events across all levels of severity will have common elements. These include physiotherapy and supervised exercises, and training for mobility and muscle strengthening.

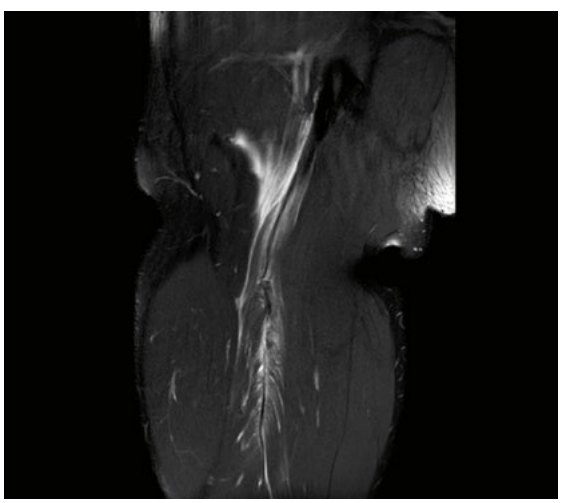
Initially, post-injury emphasis is on early lumbar spine strengthening, gluteal activation and hamstring strengthening guided by injury comfort.

For the high-end injury, walking without crutches should be delayed until pain-free walking around the house is possible. Once off crutches, and walking for day-to-day activities is comfortable, walking can be progressed on alternate days or daily as part of mobility training. Walking can be progressed from an initial 20-minute brisk walk, increasing to 30, 40, 50 and 60 minutes on alternate days, and then including hills and stairs as conditioning elements until sound lumbar, gluteal and hamstring strength under physiotherapy supervision has been regained.

Running can progress from low-intensity, moderate duration and distance (eg two sets of five repetitions of 200 m at 50% pace striding) while maintaining strength training, to high-intensity running (two sets of six repetitions of 120 m running at 80–90% maximum speed plus two sets of six repetitions of 60 m at 90%+ maximum speed).

Recovery of strength prior to resuming high-intensity and more sport-specific drills should be documented. The severity of the injury, and confidence and comfort at each rehabilitation step, will determine the time frame of progression and return to play (usually four weeks for the lower end of severity and up to 10 weeks for higher grade severity, especially in injuries involving the intramuscular tendon).[9]

Figure 7. MRI upper hamstring showing disruption of central intramuscular tendon of biceps femoris (detensioning without tendon retraction) treated conservatively



RESOURCES FOR DOCTORS AND PATIENTS

- FIFA 11+, http://f-marc.com/11plus/home
- Sports Medicine Australia, Prevention of hamstring strain, http://sma.org.au/resources-advice/injury-fact-sheets/hamstring-strain

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ACTIVITY ID: 56524

SPORTS MEDICINE

This unit of *check* is approved for six Category 2 points in the RACGP QI&CPD program. The expected time to complete this activity is three hours and consists of:

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CASE 1 – HAMISH

Hamish, 12 years of age, participates in track and field events at his school. His father brings him to see you because Hamish has been complaining of heel pain for the past two weeks. Hamish has no other medical history. After examining Hamish, you consider Sever's disease as a likely diagnosis.

QUESTION 1

Which of the following features is typically present in a patient with Sever's disease?

A. Redness at the base of the heel
B. Localised swelling
C. Tenderness when examining the back of the heel
D. All of the above

QUESTION 2

Which of the following is the most appropriate initial management for Hamish?

A. Anti-inflammatory medication
B. Activity modification, depending on the severity of the pain
C. A graded strengthening program
D. Calf stretching exercises

CASE 2 – CATE

Cate, 20 years of age, is a ballet dancer with a local dance company and has applied for selection into her state's young artists program. Cate has been healthy and has had no illnesses, but she has had worsening pain over the past year in her right foot. Initially, she ignored the pain, but it has intensified in the past few months, prompting her visit to you today. You examine her foot and provisionally diagnose a navicular injury.

QUESTION 3

Which of the following clinical signs are suggestive of a navicular injury?

A. Vague foot pain along the longitudinal arch on the dorsum and medial aspect of the foot
B. Pain localised to the dorsum of the foot
C. Vague foot pain with tenderness over the N spot
D. All of the above

FURTHER INFORMATION

Further investigation confirms a diagnosis of a navicular stress fracture and Cate is distraught to learn that she will need to wear a cast for a minimum of six weeks. She asks if there is any alternative treatment, such as medication for her pain and/or reduced activity, at least until after her audition for the young artists program in three weeks.

QUESTION 4

Which of the following is the best advice for Cate?

A. Immediate treatment with non–weight bearing (NWB) immobilisation is essential because navicular stress fractures have a high risk of non-union.
B. Immediate treatment with NWB immobilisation is preferable to alternative treatments, such as medication or reduced activity.
C. Treatment could be delayed for three weeks if Cate agrees to a program of reduced activity.
D. Treatment could be delayed for three weeks if Cate agrees to supervised training.

CASE 3 – JADE

Jade is a university student, 20 years of age, and recently qualified to join her university's rowing team, which competes in the state club championships. When she was a child, Jade had mild, persistent asthma, which was initially managed with montelukast and later with an inhaled corticosteroid. She no longer needs regular treatment, but has a salbutamol inhaler for occasional attacks of wheezing. On the advice of the rowing team's coach, she comes to see you to discuss her use of salbutamol.

QUESTION 5

Which of the following statements regarding the use of salbutamol by athletes is correct?

A. Inhaled salbutamol is prohibited under the World Anti-Doping Agency (WADA) code.

B. A maximum daily dosage of 1600 µg over 24 hours is permitted.

C. The maximum daily dosage allowed is equivalent to 12 puffs per 24 hours.

D. A urinary concentration of salbutamol exceeding 500 ng/mL is considered an anti-doping rule violation (ADRV).

FURTHER INFORMATION

Over the next two years, Jade's performance improves to the point she is selected in the state rowing team to compete at the national titles. One month before the competition, Jade is diagnosed with systemic lupus erythmatosus and prescribed oral corticosteroids. Jade is worried that using oral corticosteroids will disqualify her from the competition, so you discuss the WADA regulations with her.

QUESTION 6

Which of the following statements is the correct advice to give Jade regarding her use of oral corticosteroids during the competition?

A. Jade will need to notify the authorities of her whereabouts at all times and obtain a therapeutic use exemption (TUE) in advance of the competition

B. Jade can apply for a TUE retrospectively if she is tested during the competition.

C. Jade does not need to notify the authorities of her whereabouts if she has a TUE.

D. Jade would not need a TUE if she notifies the authorities of her need for oral corticosteroids and is available for random testing at all times.

CASE 4 – TERRY

Terry, an accountant aged 29 years, presents with a painful thigh. Terry plays basketball with a group of friends every Wednesday night. Before the last game, five nights ago, he felt a tightness in his right thigh, which seemed to improve with stretching. While running across the court during the game, he felt a sudden, sharp pain in the back of his right thigh. He immediately clutched his thigh and after a few minutes, limped off the court and was unable to resume play. The pain has persisted and he finds it difficult to bend his right knee when dressing.

QUESTION 7

Which of features in Terry's presentation suggests a high-grade hamstring injury?

A. Tightness in his right thigh

B. Immediately clutching his thigh

C. Sudden, sharp pain at the back of his thigh

D. Limping off the court

QUESTION 8

Which of the following is known to be a risk factor for a hamstring injury?

A. Increasing body mass index (BMI)

B. Low fitness level

C. Increasing age

D. Poor muscle strength

CASE 5 – DARYL

Daryl, 25 years of age, presents with hip pain. He plays tennis every Saturday afternoon at his local tennis club. His hip pain started about two months ago, after slipping and falling on the tennis court when he was running to return the ball over the net. He was sore at the time, but continued playing. The pain became worse the next day but seemed to improve with rest. He has continued his weekly tennis matches, but experiences an ache around his left hip after each session.

QUESTION 9

Which of the following differential diagnoses is important to consider in a patient of Daryl's age?

A. Septic arthritis

B. Slipped upper femoral epiphysis (SUFE)

C. Transient synovitis

D. Osteitis pubis

QUESTION 10

Which of the following clinical findings is most characteristic of impingement pathology in the hip?

A. Pain on palpation over the greater trochanter

B. Decreased range of motion on the affected hip

C. Tenderness over the pubic symphysis

D. Abnormal gait

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Independent learning program for GPs