

SELF ASSESSMENT EXERCISES

Self Assessment Exercises In Sports And Exercise Medicine

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You are the Medical Officer in a training establishment. There is a district general hospital about 5 miles away, with the usual facilities. The following patients present to you with problems related to their sport and training.



training some months ago, she has only had one period, which lasted 3 days. Her menstrual cycle was previously regular, at 4/28. She is otherwise well, has no PMH of note, and is on no medication. On examination, you notice she appears thin, and when measured, her height is 160cm and her weight is 40kg. She has tenderness on palpation of her right hip joint, and a subsequent X-ray is suggestive of a stress fracture of the femoral neck.

1. A 20 year old recruit presents to your clinic having completed 7 weeks of basic training. He complains of diffuse pain in his foot around the mid-tarsal area, and says that it swells towards the end of the day. This came on gradually over the last few days, but now he is hobbling and unwilling to run on it. The pain is eased by rest.

- What is the likely diagnosis?
- What investigations are appropriate?
- How should you manage him?

2. A 30 year old member of the training staff presents to you with pain in his lower leg on exercise. He has no past history of similar problems, but has recently put on about a stone in weight.

- What are the differential diagnoses and what differentiates them in the history?
- What factors may have predisposed him to develop problems?
- What investigations are appropriate?
- How should you manage him?

3. A female officer presents to you complaining of right sided groin pain. She is a member of the unit athletics team, running middle to long distance events. She admits that since she started intensive

- What is the likely cause of her oligomenorrhoea?
- What dangers lie ahead unless she is treated?
- How should you manage her stress fracture and her overall situation?

4. A 33 year old sergeant presents with symptoms of pain in the area of his Achilles tendon, which is worse in the mornings and following exercise, but is bearable once he is warmed up. The symptoms have been present for about 3 weeks, and are getting worse.

- What is the likely diagnosis?
- What is the likely pathology of this condition?
- Bearing this in mind, how do you propose to improve his symptoms?

5. A 22 year old recruit presents to you with left ankle symptoms. He describes the ankle giving way on numerous occasions, and intermittently swelling. It causes pain for a couple of days after giving way, and there is a background ache. He cannot remember when his symptoms first started, but says he sprained his ankle numerous times as a young footballer in his teens. He is otherwise well, and takes no medications.

- What specifically should you look for on examination?
- What is the likely cause of his symptoms?
- What are the differential diagnoses in an ankle injury that does not respond to the usual treatment?
- Is surgery appropriate?

6. Your Commanding Officer comes to you asking for advice about his diet. He is training for a marathon and is unsure whether carbohydrate loading before the race is a good idea, or just a commercial gimmick.

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- a. Is there any scientific basis behind carbohydrate loading?
 - b. Does this apply to training as well as the race?
 - c. Does this have implications for the whole training establishment?
7. A 20 year old recruit presents with bilateral anterior knee pain, following a gradual increase in his training load over the last week. He has had no previous knee problems, is otherwise fit and well, and on no medication.
- a. What is the likely cause of his symptoms?
 - b. How are you going to assess him?
 - c. How are you going to manage the problem?



be the guide to progress. Occasionally symptoms do not settle after conservative measures due to non-union or avascular necrosis and surgical internal fixation needs to be considered.

Question 2

- a. The differential diagnoses are listed in Table 1. The most common are stress fracture, medial tibial stress syndrome (MTSS), and chronic compartment syndrome (CCS).
- b. Intrinsic and extrinsic factors (see discussion below).
- c. Depending on the history, plain X-ray, isotope bone scan, MRI and compartment pressure studies may be necessary.
- d. Management depends on the diagnosis (see discussion below).

Table 1. differential diagnosis of exercise induced lower leg pain.

<ul style="list-style-type: none"> • Tibial stress fracture • Medial tibial stress syndrome (MTSS) • Chronic compartment syndrome (CCS) • Referred pain from knee or lumbar spine • Nerve entrapments • Fascial hernias • Popliteal artery entrapment • Intermittent claudication • Deep venous thrombosis • McArdle's Syndrome • Tumours
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Answers to self assessment questions

Question 1

- a. Stress fracture of the navicular.
- b. Plain X-ray, isotope bone scan, CT scan.
- c. Immobilisation in a non-weightbearing cast for 4-6 weeks. Consider surgical fixation if inadequate healing persists after this time.

Discussion

The differential diagnosis of an active patient presenting with these symptoms includes a stress fracture of the navicular, stress fracture of a metatarsal, tarsal coalition, or ligamentous injury in the area. Stress fractures of the navicular bone are seen most commonly in patients who are involved in sprinting and jumping (1). Often plain films are unhelpful, but an isotope bone scan will usually pick up a hot spot over the navicular, and a CT scan will give more information about the nature and orientation of the fracture (2). Conservative treatment is usually successful, with immobilisation in a non-weightbearing cast for six weeks. Then the patient should be monitored symptomatically, and pain should

Discussion

The symptom of exercise induced lower leg pain is very common among the active population, especially after an increase in activity (3). The term 'shin splints' has often been used to describe this presentation, but is unhelpful as it promotes a non-specific description of the symptoms rather than a diagnosis. A careful history should be taken to attempt to differentiate the different pathologies. Sudden onset of pain, or pain that comes on soon after exercise begins and reaches a crescendo that precludes further participation, is likely to be due to a stress fracture. This may continue for hours or days after exercise. Pain that comes on gradually and is described as a bursting or tight sensation that resolves soon after cessation of exercise is more likely to be due to CCS. MTSS, thought to be due to a traction periostitis of the bony origins of the deep flexors, gives a more insidious onset of symptoms, but they may also persist for hours or even days following exercise. There is an increasing body of thought that the three main causes may be a continuum of the same disease process of bone stress, and may co-exist in many patients. These are all examples of overuse type injuries, and both intrinsic and extrinsic factors may predispose to these conditions. Intrinsic factors such as

abnormalities of biomechanics (over-pronation, pes cavus), muscle weakness, tightness or imbalance, or obesity may be important precipitants, although extrinsic factors such as an increase in training intensity, the type of footwear or running on a hard surface should also be considered. Investigations should include plain X-ray, isotope bone scan, and possibly intra-compartmental pressure studies using specific exercise protocols (4).

Treatment of all these overuse conditions should address any intrinsic or extrinsic precipitant factors. A stress fracture should be rested for about six weeks, and in some circumstances is best treated in a non-weightbearing cast, along with an active rest program (maintaining cardiovascular fitness while protecting the injured limb). An Aircast pneumatic stirrup brace is a good and practical alternative. CCS may be treated conservatively, with active rest, stretching and strengthening exercises, and the use of analgesics or non-steroidal anti-inflammatories, but often requires surgical fasciotomy to alleviate symptoms. MTSS should be treated conservatively in the same way, with physiotherapy modalities such as deep friction, ultrasound and electrotherapeutic modalities playing a role (5).



Question 3

- The cause is probably exercise related, although pregnancy should be excluded.
- The main concern for an athlete is the risk of stress fracture, but long term risks include infertility, osteoporosis, and the loss of the protective effect of oestrogen in the risk of ischaemic heart disease.
- Fracture should be treated by either internal fixation (if on the superior surface of the femoral neck) or strict non-weight-bearing rest. Issues of diet, training and menstrual cycle need to be addressed.

Discussion

In a female athlete under intensive training, there is a risk of altering the hypothalamic-pituitary-ovarian axis to such a degree that oligo- or amenorrhoea is the result. Other factors, such as body image or striving to minimise any excess weight, especially among female distance runners, lead to disturbances in eating behaviour. The lack of cyclical oestrogen and inadequate calorific input predisposes these patients to a reduction in their bone mineral density (BMD), as discussed in a recent editorial in the *British Journal of Sports Medicine* (6). These factors may lead to the female athlete triad of menstrual disturbance, eating disorder and osteoporosis. A high index of suspicion should be maintained if there are stress fractures in unusual or multiple sites, and patients should be investigated with a hormonal screen (LH, FSH and oestradiol) and possibly a DEXA scan to quantify BMD. Other causes of amenorrhoea such as pregnancy should obviously be excluded. In treating these patients, it should be stressed that without an adequate diet, performance will be reduced, and that patients with amenorrhoea lose 2-6% of their BMD per year (7), more than counteracting the beneficial effects of weightbearing exercise on BMD. Adequate oestrogen levels can usually be restored by reducing the level of exercise, and correcting negative energy balance. If the athlete is unwilling to reduce the level of exercise, oestrogen replacement with the combined oral contraceptive and calcium supplementation may be used to optimise bone health in the circumstances, although this will be inadequate to restore normal BMD.

Stress fractures of the femoral neck may occur at the superior surface (distractive) or inferior surface (compressive), and usually present with groin pain, aggravated by weightbearing activities. Distractive fractures are a surgical emergency, which require urgent orthopaedic referral and usually internal fixation. Compressive fractures may be treated more conservatively, with a period of non-weightbearing rest, followed by gradual rehabilitation.

Question 4

- Achilles tendinopathy.
- Mucoid degeneration of the collagen within the tendon.
- Conservative and surgical treatment options (see below).

Discussion

This question illustrates and joins the recent clamour for the abandonment of the traditional concept of tendinopathies being inflammatory in origin (8). The nomenclature now reflects the pathology of the condition, and as such the term tendinopathy should be used as an umbrella, and tendinosis to describe the process resulting in collagen separation, fraying and myxoid degeneration commonly seen at operation. There is a distinct lack of inflammatory cells when these specimens are examined histologically, although it is still accepted that the paratenon may become inflamed. While the classical condition is seen particularly in those who have increased their training intensity or duration, or have underlying biomechanical abnormalities, other causes of Achilles tendinopathy should be considered, such as hypercholesterolaemia, a reactive arthropathy and other seronegative spondylarthritides. Recent analysis of the increased risk of Achilles tendinopathy following use of quinolone antibiotics such as ciprofloxacin or ofloxacin would suggest that the relative risk is increased, but mainly in the older population (9). Inappropriate heel tabs on running shoes that may be causing friction symptoms should also be addressed. The treatment options reflect the pathology and give the practitioner conservative and surgical options. There is no basis for the use of NSAIDs in the treatment of the condition in preference to simple analgesics (10). Biomechanical abnormalities should be corrected, and a shock absorbent heel raise may be of benefit. Initial treatment should include symptomatic relief, along with gentle stretching and strengthening exercises, progressing to eccentric exercises (11). Electrotherapeutic modalities such as ultrasound may have a role. The place for steroid injection around the tendon is controversial, and rarely indicated. In intractable cases, surgery to strip the paratenon and remove any degenerative material should be considered.

Question 5

- Examination should include assessment of stance, gait, proprioception, range of movement, anatomical as well as functional instability (anterior drawer test), and peroneal muscle strength.
- Inappropriate rehabilitation from a previous injury or a missed diagnosis.

- The most likely differentials are:
 - Osteochondral lesion of the talar dome or tibial plafond.
 - Syndesmosis sprain.
 - Peroneal tendon rupture/dislocation.
 - Sinus tarsi syndrome.
- Surgery should be considered only after an appropriate diagnosis has been made and a rehabilitation programme completed.

Discussion

Ankle inversion injuries are extremely common, yet they result in a huge amount of disability from neglect and inadequate treatment and rehabilitation. They represent the commonest single activity related injury, and often result in functional instability (a feeling of giving way with recurrent inversion injuries) caused by mechanical instability, muscle weakness, proprioceptive deficit and poor neuromuscular control. Inversion injuries usually occur when the ankle is plantarflexed, resulting in damage to several structures, including the joint capsule. In ligamentous injuries, the anterior talo-fibular ligament (ATFL) is damaged in 60%, along with the calcaneo-fibular ligament (CFL) in a further 25%. More serious injury as outlined in (c) above should be excluded. The initial treatment should consist of PRICE (protection, rest, ice, compression and elevation), followed at 24–48 hours by gentle stretching and mobilisation. If the ankle is too painful to move, isometric exercises should be started, progressing on to concentric and eccentric strengthening exercise as symptoms allow. A functional brace is often used at this stage (such as an Aircast stirrup brace). When able to weight bear, proprioception exercises should be commenced, and the patient should concentrate on regaining full range of movement, particularly dorsiflexion (a 15 degree angle of weightbearing dorsiflexion is needed to run effectively). Taping may have a role in the progressive rehabilitation of these injuries, probably as a result of increased afferent proprioceptive input (12). In acute ligamentous injuries, the results from conservative treatment are better than surgical repair (13). The role of surgery in chronically unstable ankles such as this is controversial, with good short term results, but variable longer term results, so it should only be considered in patients who have undergone an appropriate and supervised rehabilitation programme.

Question 6

- Yes – it has been proven to work in numerous clinical trials.
- It has implications for the replacement of muscle glycogen throughout the training period.

- c. Yes - the diet of recruits in training should follow the guidelines given below.

Discussion

Carbohydrate loading is a form of dietary manipulation used by (especially endurance) athletes to maximise performance. Over the few days before competition, the dietary carbohydrate is reduced and the muscles trained to maximum to deplete muscle glycogen stores. The training is then tailed off and a high (>70% of calorific intake) carbohydrate diet consumed for 3-4 days before competition. Many now believe that trying to deplete glycogen stores prior to loading, although biochemically sound, makes the athlete feel unwell and should therefore be avoided (14).

Carbohydrate and fat are the main fuels used for energy during exercise, and the relative proportions used depend on the intensity and duration of exercise. The main fuel in use when performing at near maximum is muscle glycogen, of which there is about 350-400g stored in the average subject, sustaining about 100 minutes of near maximal performance. The biochemical rationale behind carbohydrate loading originates from the study done by Bergstrom *et al* in the 1960's, (15) when they compared the endurance performance of athletes on a normal diet, then on a high or low carbohydrate diet for 3 days. The high carbohydrate diet group improved their performance by about 50%, whereas the low carbohydrate group had a deterioration in performance of about 50%. This was directly related to muscle glycogen content proven by biopsy, proving that supersaturation of the muscles with glycogen is possible. Numerous subsequent studies have confirmed this benefit.

During training, glycogen stores need to be replenished at regular intervals, and this is most easily achieved soon after exercise has finished, taking the form of high carbohydrate snacks or high energy drinks. The

normal diet should be as high in carbohydrate as possible, and fluid should also be replaced at regular intervals. This also has implications for recruits under training, who should be encouraged to maintain a high carbohydrate diet and replenish their glycogen stores as soon as possible after exercise. This may be more difficult to achieve in practice – after all, how many recruits would want to exchange a plate of bacon, sausage and eggs for a bowl of cornflakes?

Question 7

- He is complaining of anterior knee pain (AKP). The differential diagnosis of AKP is shown in Table 2.
- Assessment should begin with a thorough history and clinical examination (including lower limb alignment and biomechanics) that should identify and rule out some of the conditions in Table 2. He may display positive patella apprehension signs (such as Clarke's sign), a tendency to sublux and may have tenderness over the patellar retinacula and deep patellar border. He may also have a tight ilio-tibial band, quads and hamstrings.
- Investigations may be indicated to exclude any of the specific diagnoses in Table 2, such as plain radiographs, ultrasound or MRI. Management should follow the same principles as other overuse conditions, and should include correction of underlying factors and a program of active rest (see below).

Table 2: differential diagnosis of anterior knee pain.

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| <ul style="list-style-type: none"> • Patello-femoral pain syndrome • Patellar tendinopathy • Pre-patellar bursitis • Infra-patellar bursitis • Hoffa's fat pad impingement • Plica • Osgood-Schlatter or Sinding-Larsen-Johansson disease • Referred pain from the hip / lumbar spine • Osteochondritis dissecans |
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Discussion

Anterior knee pain (AKP) is another example of an overuse injury and is very common in both military and civilian athletic populations (16). It commonly presents following an increase in intensity, frequency or duration of training. Patellar malalignment has traditionally been cited as the main culprit in this condition, although recently abnormal mechanical loading and a retro-patellar synovitis have been implicated (17). Management of this condition should include patient education, settling of the acute symptoms with anti-inflammatories, activity modification, stretching of quads, hamstrings and ITB, strengthening of vastus medialis obliquus (VMO), patella taping and correction of any biomechanical abnormalities. Surgery should only be used as a last resort, in patients with malalignment, who have undergone a supervised rehabilitation programme.

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