



# Foot and ankle injuries in runners

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With recreational running becoming increasingly popular among people of all ages, understanding of the injuries that commonly affect the foot and ankle is important.

MedicineToday 2014; 15(4): 59-62

Over the past decade, running as a recreational activity has become increasingly popular. According to a recent report by the Australian Bureau of Statistics, approximately 8% of Australians aged 15 years and over participated in either running or jogging in 2011–2012.<sup>1</sup>

Running appeals to people of all ages, from the young to the elderly. Among them, there is a broad range of ability and level of participation. Some people engage in non-competitive recreational running only, whereas others may participate in the occasional fun-run or half-marathon while others compete in more serious events such as Ironman triathlons and other ultra-endurance races.

Foot and ankle injuries are very common in runners and may occur as a result of several factors. These include a sudden increase in running load, inappropriate footwear, an inefficient running technique or suboptimal pelvic and lower limb biomechanics.<sup>2</sup> This article will focus on three common overuse injuries: plantar fasciitis, Achilles tendinopathy and stress fractures. Barefoot running is also briefly discussed.

## SOFT TISSUE INJURIES

In runners with plantar fasciitis and Achilles tendinopathy, overload of the soft tissue structures is the usual cause (often combined with early degenerative change), but other medical conditions should always be considered. In spontaneous or severe cases, and also in patients who have other affected areas (e.g. lumbar spine, elbows, hands, knees), an inflammatory enthesitis such as psoriatic enthesitis should be suspected and subsequently investigated.<sup>3</sup> There are certain medications that also contribute to these conditions, such as anabolic steroids, corticosteroids, statins and fluoroquinolones.<sup>4</sup>

It should be appreciated that the symptoms of plantar fasciitis and Achilles tendinopathy may be quite prolonged but that

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Figure 1. Plantar fasciitis occurs when there is thickening and damage to collagen fibres at the calcaneal origin.

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natural resolution occurs in almost all cases, usually within 18 months to two years. Treatments are aimed at shortening the duration of this resolution. It is important that patients are made aware of this because many despair in their lack of progress in the short term.

## PLANTAR FASCIITIS

The plantar fascia arises from the calcaneus and inserts into the toes. It supports the longitudinal arch, providing structure and shock absorption for the foot when running. Plantar fasciitis occurs when there is thickening and damage to collagen fibres at the calcaneal origin (Figure 1).

### Presentation

Typical plantar fasciitis closely resembles a tendinopathy rather than an inflammatory condition because there are no inflammatory cells present in the area affected.<sup>5</sup> Patients often complain of pain at the medial aspect of the heel that is worse in the morning or after prolonged periods of sitting and may improve with initial walking but worsen towards the end of the day.<sup>6</sup> Although runners experience pain with activity, they often say



Figure 2. The typical location of tenderness in plantar fasciitis at the medial tuberosity of the calcaneus.

that the pain is much worse the next day. There will usually be tenderness at the medial tuberosity of the calcaneus, which may extend along the arch of the foot (Figure 2).

Ultrasound will often confirm the diagnosis by demonstrating thickening of the plantar fascia at its insertion, longitudinal tearing of collagen fibres and neovascularisation.<sup>7</sup> MRI may also be useful if the diagnosis is unclear. A calcaneal spur ('heel spur') may be seen on x-ray, but its significance is questionable because a spur may also be present in individuals who are asymptomatic and it is not related to the plantar fascia attachment. Important differential diagnoses not to be missed include calcaneal bone stress, plantar fibromatosis (Ledderhose's disease), nerve entrapments (e.g. tarsal tunnel syndrome and medial calcaneal nerve entrapment) and inflammatory enthesitis.

### Management

Treatment for plantar fasciitis should be aimed at symptom reduction, tissue healing and prevention of recurrence. An initial reduction in running load and activity modification (such as substitution with swimming or cycling) should be undertaken. Patients sometimes find that wearing raised heels reduces symptoms. In our experience, the use of a silicone gel heel pad or rubber waffle sole heel pad



Figure 3. Use of a rubber heel pad can reduce pain in plantar fasciitis.

can help to reduce pain (Figure 3); self-massage with a frozen water bottle and night splints such as a Strassburg Sock may also be of assistance (Figure 4). Calf and heel stretches may be useful for morning stiffness.

NSAIDs may be used judiciously for exacerbations. For more severe cases, a well-placed corticosteroid injection may be beneficial for pain reduction. A period of rest and immobilisation in a walker boot will often greatly improve symptoms and assist with healing. After the initial pain is managed, intrinsic foot muscle strengthening exercises should be prescribed to offload the plantar fascia.

Newer techniques that have been trialled in recalcitrant cases of plantar fasciitis include extracorporeal shockwave therapy (Figure 5), platelet-rich-plasma therapy, prolotherapy injections and autologous tenocyte implantations. However, the effectiveness of these techniques has not yet been proven in double-blinded trials.

To prevent recurrence, the use of an orthotic or a change in running footwear may be required to reduce any excessive biomechanical loads.

## ACHILLES TENDINOPATHY

The Achilles tendon is the strongest and thickest tendon in the body. It is the common tendon for the gastrocnemius and soleus calf muscles and inserts into the



Figure 4. Splinting with a Strassburg Sock.

calcaneus.<sup>8</sup> Injury to the Achilles tendon by repetitive load is referred to as Achilles tendinopathy (rather than the previously used term 'tendinitis') because there is a lack of inflammatory cells.

There are two variants of Achilles tendinopathy: mid-portion and insertional. This review will focus on mid-portion Achilles tendinopathy, which is the most common variant.

### Presentation

Patients with mid-portion Achilles tendinopathy usually complain of pain that worsens after activity, although there is associated morning pain and stiffness. Examination findings include swelling and tenderness around the mid-portion of the tendon accompanied by pain on functional testing, such as single leg heel raises and hopping on the affected leg. An ultrasound examination may demonstrate thickening of the Achilles tendon, hypochoic areas representing longitudinal tears and areas of neovascularisation.<sup>9</sup>

### Management

Treatment for mid-portion Achilles tendinopathy should be aimed at symptom reduction, tissue healing and prevention of recurrence. An initial reduction in running load and activity modification (such as substitution with swimming or cycling) should be undertaken. A high-heeled shoe can help unload the Achilles tendon to provide symptom relief.



Figure 5. Extracorporeal shockwave therapy for plantar fasciitis.

Calf eccentric strengthening exercises have been considered the mainstay of treatment for Achilles tendinopathy, and calf stretches can also help with morning stiffness.<sup>10</sup> The eccentric load program requires the therapist to fully understand the concept of graduated loads and the varying ability of the damaged tendon to adapt to that load. NSAIDs may be used judiciously for exacerbations.

There are several adjunctive treatments available for mid-portion Achilles tendinopathy, including nitric oxide patches and extracorporeal shockwave therapy.<sup>11</sup> Nitric oxide has various mechanisms of action in tendon healing, including improving local blood flow to damaged tissues.<sup>12</sup> Other techniques such as platelet-rich-plasma therapy, prolotherapy injections and autologous tenocyte implantations have been trialed for recalcitrant cases. The use of an orthotic or change in running footwear may be required to reduce any excessive biomechanical overload.

Corticosteroid injections are generally not recommended for Achilles tendinopathy because there is an increased risk of tendon rupture.

### STRESS FRACTURES

Stress fractures occur when there is an excessive load placed on a normal bone



Figure 6. Immobilising the foot in a walker boot to treat a metatarsal stress fracture.

or when a normal load is placed on a weakened bone.<sup>13</sup>

### Presentation

The most common site for running-related stress fractures in the foot is the metatarsals.<sup>14</sup> Patients initially present with pain on running and other heavy weightbearing activity, which then progresses to pain on walking and then to night pain. On examination, there is exquisite tenderness on palpation of the shaft of the affected metatarsal. Patients are not usually able to hop on the affected foot. Swelling may be present.

In the early stages of a stress fracture, x-rays usually appear normal. A bone scan or MRI scan may be required to confirm the diagnosis.

### Management

Treatment for a metatarsal stress fracture includes a short period of immobilisation in a walker boot with the aid of crutches, if required, until the patient is asymptomatic (Figure 6). When treated appropriately, symptoms generally improve in reverse order to their development (i.e. improvement of night pain first, followed by reduced pain on walking and finally less discomfort with running and hopping).

Generally, excessive running loads are



implicated as the cause of a stress fracture. Immediate cessation of running and other weightbearing physical activity should be advised, but patients should be encouraged to maintain their fitness through other means, such as swimming or cycling, during their recovery.

Once symptoms subside (usually after about six weeks), patients can commence a graduated return to running. To avoid a recurrence of symptoms, modification of footwear and the addition of an orthotic may be required.

Stress fractures may also occur in other parts of the foot, including the calcaneus, cuboid or navicular bones. A navicular stress fracture must be managed carefully in a non-weightbearing cast for at least six weeks because this bone is at high risk of nonunion or fibrous union.

### Special cases

Special attention should be given to the amenorrhoeic, thin female runner who presents with a stress fracture. This may be part of the female athlete triad, a syndrome that occurs when there is inadequate energy intake to sustain the requirements of both the menstrual cycle and exercise.<sup>15</sup> The advice of a nutritionist should be sought for such patients.

Other risk factors for decreased bone strength include low body weight, low muscle mass, low calcium intake and smoking.<sup>16</sup> Patients with suspected low bone mineral density (BMD) should have their vitamin D levels checked and be investigated with bone densitometry (DEXA) scanning.

### A NOTE ON BAREFOOT RUNNING

Running barefoot or in minimalist shoes has recently gained popularity as a result of claims that a more natural running style can increase foot strength and reduce injuries.<sup>17</sup> Barefoot runners tend to have a midfoot or forefoot strike, whereas shod runners land first on their rearfoot.<sup>18</sup> Runners who want to change from shod to barefoot running should do so initially under professional guidance because

there is often a period of biomechanical and structural adaptation – which may take much longer than an individual expects. Runners need time to adjust to the new conditions, such as the lack of rearfoot cushioning and heel raise found in most modern footwear.

Although it has been shown that running barefoot or in minimalist shoes can help to reduce the impact by spreading the force through the rest of the foot, a reduction in the number of injuries sustained has not yet been conclusively shown.<sup>19</sup> Further research is needed before barefoot running can be recommended as a form of injury prevention.

### SUMMARY

Exercise such as recreational running is becoming more accepted as a form of treatment for many lifestyle diseases, and understanding of the accompanying injuries is necessary. Three common foot and ankle injuries in runners have been presented in this review. In the majority of cases, these can be treated with a reduction in running load, substitution with another form of exercise during the recovery phase, and a close examination of footwear to prevent recurrence. **MT**

### REFERENCES

1. Australian Bureau of Statistics. Participation in sport and physical recreation, Australia 2011-12 (cat. no. 4177.0). Canberra: ABS; 2012. Available online at: <http://www.abs.gov.au/ausstats/abs@.nsf/mf/4177.0> (accessed April 2014).
2. Fredericson M. Common injuries in runners. Diagnosis, rehabilitation and prevention. *Sports Med* 1996; 21: 49-72.
3. Jennings F, Lambert E, Fredericson M. Rheumatic diseases presenting as sports-related injuries. *Sports Med* 2008; 38: 917-930.
4. Khaliq Y, Zhanel GG. Fluoroquinolone-associated tendinopathy: a critical review of the literature. *Clin Infect Dis* 2003; 36: 1404-1410.
5. Khan KM, Cook JL, Bonar F, Harcourt P, Astrom M. Histopathology of common tendinopathies. Update and implications for clinical management. *Sports Med* 1999; 27: 393-408.
6. Young CC, Rutherford DS, Niedfeldt MW. Treatment of plantar fasciitis. *Am Fam Physician* 2001; 63: 467-474, 477-478.
7. Goff JD, Crawford R. Diagnosis and treatment of plantar fasciitis. *Am Fam Physician* 2011; 84: 676-682.
8. Kader D, Saxena A, Movin T, Maffulli N. Achilles tendinopathy: some aspects of basic science and clinical management. *Br J Sports Med* 2002; 36: 239-249.
9. Paavola M, Kannus P, Järvinen TA, Khan K, Józsa L, Järvinen M. Achilles tendinopathy. *J Bone Joint Surg Am* 2002; 84-A: 2062-2076.
10. Alfredson H, Pietilä T, Jonsson P, Lorentzon R. Heavy-load eccentric calf muscle training for the treatment of chronic Achilles tendinosis. *Am J Sports Med* 1998; 26: 360-366.
11. Paoloni JA, Appleyard RC, Nelson J, Murrell GA. Topical glyceryl trinitrate treatment of chronic noninsertional achilles tendinopathy. A randomized, double-blind, placebo-controlled trial. *J Bone Joint Surg Am* 2004; 86-A: 916-922.
12. Murrell GA. Using nitric oxide to treat tendinopathy. *Br J Sports Med* 2007; 41: 227-231.
13. Datir AP. Stress-related bone injuries with emphasis on MRI. *Clin Radiol* 2007; 62: 828-836.
14. Brukner P, Bradshaw C, Khan KM, White S, Crossley K. Stress fractures: a review of 180 cases. *Clin J Sport Med* 1996; 6: 85-89.
15. Nattiv A, Loucks AB, Manore MM, Sanborn CF, Sundgot-Borgen J, Warren MP; American College of Sports Medicine. American College of Sports Medicine position stand. The female athlete triad. *Med Sci Sports Exerc* 2007; 39: 1867-1882.
16. Lane JM. Osteoporosis. In: Ireland ML, Nattiv A, eds. *The female athlete*. New York: Elsevier Science; 2003.
17. Squadrone R, Gallozzi C. Biomechanical and physiological comparison of barefoot and two shod conditions in experienced barefoot runners. *J Sports Med Phys Fitness* 2009; 49: 6-13.
18. Lieberman DE, Venkadesan M, Werbel WA, et al. Foot strike patterns and collision forces in habitually barefoot versus shod runners. *Nature* 2010; 463: 531-535.
19. Wakeling JM, Pascual SA, Nigg BM. Altering muscle activity in the lower extremities by running with different shoes. *Med Sci Sports Exerc* 2002; 34: 1529-1532.

COMPETING INTERESTS: None.