Common running injuries

1. Common running injuries

Recreational running is one of the most popular and accessible forms of exercise. It grew in popularity in the 1970s and, in 2023 in the UK, around 6 million people regularly participate in recreational running in England (2023 figures, Statista). Running has many health-related benefits (see our article *Physical activity: the science and environment* for more information).

But, despite clear health-related benefits, running puts participants at risk of running-related injury.

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1.1. Running injuries: a challenging area of research

Runners get anywhere between 6 and 59 running-related injuries per 1000 hours of running. This wide range is due to significant variations in trial design (BJSM 2010;44:598):

- Trials may involve novice runners, school competitions or professional runners of various ages.
- They involve different follow-up periods.
- They use different definitions of what exactly constitutes a 'running injury'.
- Some studies report on injury during an event; some report only injuries which require medical attention; and some report anything that results in time lost to training or competing (Sports Med. 2015;8:1143).

A noteworthy point: the smallest number of studies involve recreational runners, despite them making up the majority of participants. Why is this? As a group, casual, recreational runners are a little unpredictable and difficult to 'pin down' for a trial, unlike professional athletes, keen club runners or even those competing in school championships.

1.2. Running injuries: a common reason to quit

One Dutch study followed around 600 novice and recreational runners during their preparation for a 4-mile running event. Around 1 in 4 suffered an injury during the 8-week observation period prior to the event. Of those

who sustained injury, around 40% did not restart running. Being male, of a younger age and with lack of prior running experience were significant risk factors for injury. In females, higher BMI and lack of running experience were risk factors (BJSM 2010;44:598).

While the one-year injury rates in novice runners (1 in 4) are lower than for marathon runners (around 1 in 2), this is likely due to less 'time on feet'. Novice runners seem to face a significantly greater risk of injury *per hour* spent running (Sports Med. 2015;45:1017).

1.3. Causes

There are a number of contributing factors for running injuries, and we can divide these into intrinsic (person-specific) and extrinsic (environment) (BJSM 2010;44:598). We discuss the concept of intrinsic and extrinsic factors in more detail in our article *Tendinopathy*.

Intrinsic factors

Examples of intrinsic factors:

- Age.
- Sex.
- BMI.
- Physical fitness.
- Previous injury.
- Anatomical factors, e.g. femoral or tibial torsion, limb length discrepancy, scoliosis.
- Muscle imbalance or weakness, e.g. after sciatica.

Extrinsic factors

Examples of extrinsic factors:

- Running distance.
- Running frequency.
- Running surface.
- Intensity of effort.
- Worn-out shoes (reduced cushioning).
- Inadequate recovery periods (allow time for adaptation).

A BJSM article identified four factors that were consistently associated with running injury (BJSM 2010;44:598):

Running experience	More experienced runners have a lower rate of injury (per unit time). Graduated loading is important for novice runners because too much, too soon can lead to injury, and injury leads to quitting (J Sci Med Sport 2018;21:1221).
Previous injury	More likely in those who have been running for longer.
Running to compete	More likely to overload training.
Excessive running distance (volume overload)	While novice runners are more likely to become injured (more injuries suffered per hour), the more experienced, longer-distance runners spend a greater number of hours running, thus have cumulative risk.

A subsequent systematic review and meta-analysis also identified sprinting athletes (athletics distances on the running track) as also being at greater risk. Thus, there is a U-shaped relationship between running distance and time lost to injury (highest rates seen in long-distance runners and sprinters) (Sports Med. 2015;8:1143).

We can divide running injuries into acute and chronic types.

1.4. Acute running injuries

Several acute running injuries may occur, but we are unlikely to see many of them in primary care. They are either likely to be self-limiting (such as blisters and sunburn) or need hospital treatment (such as fracture or dislocation). Here is a brief summary of acute running injuries (Clinical Sports Medicine, 4th Ed. Brukner and Khan).

Injury	Probable cause and features	Management
Fracture or dislocation.	Fall or impact. Was this a fragility fracture? If so, consider REDs (see our associated article).	A&E.
Acute cruciate ligament rupture.	Most commonly running at speed, off balance, part of trip and fall. Painful, immediate swelling. Unable to continue sport.	A&E (see our article *Knee pain: traumatic*).
Achilles tendon rupture.	May feel like a blow to the heel; they may hear a snap. Check Simmonds' triad.	A&E (or speak to orthopaedic on-call team). See our article *Pain*

		in the Achilles region for more detail.
Ankle sprain.	Inversion injury. Check Ottawa rules to help assess fracture likelihood. Lateral ankle pain and swelling, worse on inversion, plus plantarflexion.	Depends on grade. More severe injuries may need hospital assessment. Bracing (such as taping) may be helpful for 6–12m after injury to help prevent recurrence.
Acute muscle tear.	Commonly seen in hamstrings, quadriceps and gastrocnemius during a sudden acceleration or deceleration. Any muscle crossing 2 joints is more vulnerable. Predisposing factors include: poor warm-up, poor range of motion, tight muscles, fatigue, overuse, previous injury.	Ice; short period of rest; early gentle mobilisation (range-of-motion exercises); early gentle massage after 48h followed by gradual rehabilitation, stretching and strengthening. Address predisposing factors.
Muscle cramp.	Painful, involuntary contraction of muscle. May be debilitating. If 'exercise associated', cramp in the calf is the most common location. The cause is still not known (despite multiple theories!).	Apply a passive stretch to the muscle to manage the cramp. There are no proven ways to prevent cramp.
Blisters.	Caused by shear forces, mainly while braking. Mechanical splits in the skin layers fill with fluid.	Sock choice may be important. Tape application prior to activity may prevent blisters.
Sunburn.	Inadequate sun protection.	Best prevented! Hat, clothing, sunscreen.

Delayed-onset muscle soreness (DOMS)

DOMS develops 24–48h after high-intensity activity (Clinical Sports Medicine, 4th Ed. Brukner & Khan). The discomfort peaks at around 48h post-activity. DOMS causes a reduction in muscle strength and increase in passive muscle tension. There may be pain and tenderness. It occurs less frequently in those that train regularly. Treatment includes massage, active recovery and NSAIDs. Several other things have been tried, but high-quality supportive evidence is lacking (vitamin C and E, protein supplements, electrotherapy, hyperbaric oxygen, compression garments).

1.5. Chronic running injuries

Knee pain, shin splints (medial tibial stress syndrome), plantar fasciitis and Achilles tendinopathy are the most common running-related musculoskeletal injuries (Sports Med. 2012;42:891). The most common causative factor for all these problems was **overuse**, i.e. excessive over-loading of musculoskeletal structures.

Knee pain

There are several causes of chronic knee pain in runners. The term 'runners knee' has been used, but is non-specific and is best avoided (Sports Med 2012;42:891). The most prevalent running-related knee conditions are (Am Fam Physician 2018;97:510):

Patellar tendinopathy (the most common knee injury in runners).	Excessive loading causes tendinopathy. The patellar tendon is heavily exposed during running. This presents with anterior knee pain and tenderness over the patellar tendon. Pain with single-leg decline is typical. Treatment is conservative, involving activity modification and eccentric loading exercises.
Patellofemoral pain syndrome.	This causes anterior knee pain, felt behind the patella. It is worse after activity and on squatting. There may be crepitus. Treatment is focused on exercise (quadriceps strength building). Taping the patella hasn't been proven effective.
Iliotibial band syndrome.	A cause of lateral knee pain, often around 2cm proximal to the lateral joint line. It worsens with running. There may be an associated 'click' during movement. There may be tenderness on the iliotibial band around 2cm proximal to the lateral femoral condyle. Treatment is primarily stretching the iliotibial band and hamstrings, along with strengthening the hip abductors.

See our article *Knee pain: non-traumatic* for more information on these conditions, and our article *Osteoarthritis* for information about running and knee osteoarthritis.

Shin splints (medial tibial stress syndrome)

Shin splints cause diffuse pain on the posteromedial border of the tibia, which settles during warm-up. They are usually worse in the morning and after activity. There might be tenderness down the tibial border around the area of pain. More localised pain raises the possibility of a stress fracture (Clinical Sports Medicine, 4th Ed. Brukner & Khan). X-ray will be normal in shin splints. If present, X-ray might show a stress fracture, but lacks

sensitivity (MRI is more sensitive, but this is probably something for the MSK team to request if this diagnosis is suspected).

Shin splints are a frequent issue for runners. They are a bone stress injury, thought to be due to the mechanical loading caused by landing and propulsion, which generates stress and resulting inflammation around the periosteum of the tibia (Am Fam Physician 2018;97:510). The impact from the ground also has a role.

Treatment involves rest, ice and analgesia. Assessment of risk factors, activity modification and physiotherapy aim to provide long-term relief.

Tibial stress fracture

This is the most common stress fracture in runners. Stress fractures may also occur in the navicular, metatarsals, femur and pelvis.

Stress fractures result from repetitive stress exceeding the bone's ability to remodel, starting as a stress reaction with pain and swelling, often undetectable on X-rays. Continued stress weakens the bone cortex, potentially leading to a complete fracture. They differ from insufficiency fractures, which occur in weakened bone under normal load, such as in osteoporosis (BJGP 2019;69:209).

Risk factors:

- Rapid increases in training load.
- Female sex (2–5x).
- Abnormal biomechanics.
- Reduced bone mineral density.
- Prolonged relative energy deficit (see our article *Relative energy deficiency in sport (REDs)* for more information).

Diagnosis can be challenging due to insidious onset and the need for imaging to confirm diagnosis (BJGP 2019;69:209).

Tibial stress fracture presents with pain and tenderness, usually over the mid to distal third of the tibia.

Treatment involves suspending running, but remaining weight-bearing. Return to activity is slow; athletes may take 3–10 months to return to sport (Am Fam Physician 2018;97:510).

Hamstring injuries

The hamstrings cross two joints (hip and knee) and are prone to injury. Acute tears are mentioned above, but the hamstrings may also be a site for tendinopathy at their origin, presenting with crampy pain in the posterior thigh or buttock which may radiate to the posterior knee. Examination may reveal tenderness around the hamstring origin (deep around the ischial tuberosity). Treatment is based on activity modification and physiotherapy (single-leg squat, lunges, Nordic curls) (Am Fam Physician 2018;97:510).

Chronic calf strain

Repeated or chronic calf muscle strain (often gastrocnemius) may occur from overuse or because of inadequate rehabilitation, which can result in disorganised, weak scar tissue that is susceptible to repeat injury.

Treatment involves stretching and strengthening (Clinical Sports Medicine, 4th Ed. Brukner & Khan).

Achilles tendinopathy

Achilles tendinopathy is common in runners, presenting with posterior heel pain. We have two articles, *Pain in the Achilles region* and *Tendinopathy*, which cover this condition in more detail.

Plantar fasciitis

This causes pain around the medial calcaneal tubercle during weight-bearing. It is one of the most prevalent running injuries (Sports Med 2012;42:891). The heel strike may cause an impact load of up to three times body weight; this mechanical impact has to be absorbed, and this role falls to the plantar fascia, the heel pad and the intrinsic muscles of the foot. There is more about this condition in our dedicated article *Plantar fasciitis*.

1.6. Injury prevention

It is thought that it's possible to prevent sports injuries, although the effectiveness of injury prevention techniques are not easy to translate robustly into real-world situations (Sports Med 2018;48:2227).

There are few high-quality trials looking at the effectiveness of soft-tissue running injury prevention (BJSM 2012;46:836).

Running injuries are complex. People are different, and there are many different running injuries, meaning there is no 'one size fits all' answer to injury prevention. Above, we discussed various intrinsic and extrinsic risk factors that may be modified (fixing the cause). In addition, there are some general principles which may be helpful to consider (BJSM 2012;46:836):

- Careful application of load and/or increasing the body's capacity to handle load (though training) may reduce running injury. Remember that overload is the most common factor in running injuries.
- Elevated adiposity is associated with reduced capacity of the tendon to handle load. Many novice runners are overweight (often a key motivation to run). A link between adiposity and soft tissue injury may help explain the higher injury rates in this group.

- Strengthening the muscles may help (including improvement in muscular endurance). In novice runners, we observe greater running-induced fatigue, which in turn alters body posture and biomechanics while running. In simple terms, as we get tired, our running 'form' suffers. This places additional mechanical (over)load on the lower limb soft tissues.

How can we translate these points into something helpful?

- A dynamic warm-up (active sport-specific movement) helps reduce injury (Arthroscopy, Sports Medicine and Rehabilitation 2024). At a basic level, this means starting the training session 'easy', then gradually increasing the intensity (rather than starting at high intensity). Static stretching (such as touching your toes) has been out of favour due to concerns over negative effects on running economy, but is not thought to be harmful and may be a helpful part of warm-up for some people (Int J Environ Res Public Health 2021;18:8386).
- Training progression: a gradual increase in training volume reduces injury risk. This is especially important in novice runners, to allow body tissues time to adapt to new loads. Anecdotally, the '10% rule' is often quoted, whereby training load is increased by no more than around 10% week-on-week.
- Adequate recovery time allows the body to adapt before the next training session.
- Strength training may reduce running injuries (BJSM 2024;58:722).

Do running shoes influence the frequency of running injury?

We've got this far without mentioning footwear!

There have been multiple advances in running shoe technology, but the incidence of running injuries hasn't changed since the 1980s. We've read the magazines too! Despite what we hear, there is little evidence that over-

pronation and impact are strongly associated with running injury.

The bottom line: a good running shoe is likely one that allows the skeleton to move along its own preferred 'movement path'. How do we translate this biomechanical conclusion into useable advice? It may simply be that 'the most comfortable shoe is the best'! A self-selected, comfortable running shoe reduces injury risk (BJSM 2015;49:1290).

Common running injuries

- Most running injuries are associated with overuse and/or prior injury.
- Novice runners, long-distance runners and sprinters are at increased risk.
- Review of training plans may be a cornerstone of injury treatment (and prevention!).

Useful resources:

Websites (all resources are hyperlinked for ease of use in Red Whale Knowledge)

- Oxford University Hospitals - Return to Running Programme (patient guide to returning to run training after injury)

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