

# Downhill skiing and snowboarding injuries: a guide for GPs

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At this time of year, GPs notice a steady flow of patients presenting with an injury sustained during a recent skiing or snowboarding holiday. Understanding injury patterns from these activities will assist in management decisions.



PHOTO COURTESY OF PERISHER BLUE SKI RESORT, NSW

Injury patterns in the snowfields in recent years have been well documented.<sup>1-3</sup> The knee, shoulder and thumb are the injured sites encountered most frequently in skiers, whereas the ankle, wrist, elbow and shoulder are those seen more commonly in snowboarders.<sup>1-4</sup> This article outlines the management principles of

common injuries to the upper and lower limbs, but does not discuss more serious problems such as head and spinal pathology.

## Skiing and snowboarding injuries

The ski resort business has changed considerably over the past 15 years, and consequently the aetiology of injury has changed. This is especially due to the increasing popularity of snowboarding, which is estimated by industry experts to be the activity of 40% of visitors to Australian snowfields.<sup>4</sup> As well as downhill skiing, other snow sports include snowblading, telemarking, cross-country skiing, snow-shoeing and tobogganing.

The design of ski gear has also changed significantly, with the introduction of ski boots of increased height and stiffness, the multidirectional binding release, and shaped skis. There is some evidence to suggest that these modifications may alter injury patterns. Current boot and binding equipment is designed to prevent ankle and midshaft tibial injuries. Shaped skis may present an increased risk of isolated anterior cruciate ligament rupture and

medial ligament sprains of the knee.<sup>5</sup> Further studies are needed in this area.

Equipment failure is rarely the cause of a snowboarder's injuries. These alpine adventurers are three times more likely to be injured in a jump than skiers. Collisions (with objects or people) account for only 10% of injuries (less than for skiers).<sup>4</sup> Almost half of snowboarding injuries occur in inexperienced individuals, but lessons may dramatically reduce this incidence.

## Initial management

For acute injuries, the principles of the RICED regimen should be followed (see the box on page 62). A double-layer Tubigrip bandage can be easily removed for the regular application of ice, physiotherapy and additional bracing (as required). Oral anti-inflammatories for five to seven days are helpful. Patients should be advised to avoid HARM:

- H – Heat, including skin lotions, lamps, spa and sauna
- A – Alcohol (which increases swelling)
- R – Running, skiing, dancing, etc
- M – Massage (which leads to

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## The RICED regimen

### R – Rest

Minimise weightbearing activity

### I – Ice

Apply an icepack, generally for 20 minutes every two to three hours during waking hours (educate the patient about how to avoid ice burns)

### C – Compression

Use a double Tubigrip bandage (for convenience and compliance with applying ice)

### E – Elevation

Keep the injured limb raised, preferably above the level of the heart (should include the time when in bed)

### D – Diagnosis

If uncertain, refer for specialist opinion

increased blood flow and, therefore, swelling).

## Knee injuries

The knee is the most frequently injured body part in downhill skiing, accounting for 20 to 30% of all injuries. These include ligamentous tears, meniscal and osteochondral injuries and, less commonly, patellar dislocations and tibial plateau fractures.<sup>1</sup>

One of the most important longer term considerations in the majority of knee injuries is minimisation of quadriceps inhibition and wasting. Pain or effusion in the joint causes inhibition of quadriceps tone and function (especially to the vastus medialis obliquus), which often leads to wasting of the quadriceps muscles. If attention is not paid to this possibility, a patient may have symptoms of secondary patellofemoral maltracking and anterior knee pain even after the primary condition, such as a medial ligament sprain, has healed.

Compared with skiing, snowboarding

is less likely to result in knee injury. Riders are fixed to the board with both feet and are therefore unable to exert a lever torque on the knee when falling (unlike skiers). Most snowboarding lower limb injuries occur to the leading leg.

## Medial collateral ligament injuries

Medial collateral ligament damage is the most common skiing injury, and is treated according to severity. Patients with grade I injuries can be managed well with a compression bandage, gradual mobilisation and physiotherapy. Patients with grade II and grade III injuries are best managed in a hinged, range of motion brace set from 30 to 90° of flexion for three to four weeks (Figure 1). Bracing to limit extension allows the ligament to scar in a tighter position. Patients should be advised to walk with the knee slightly bent during this period, even when not wearing the brace (for example, when showering).

If there is uncertainty about the grade of injury, the patient should be referred to a sports physician or an orthopaedic surgeon for assessment. Physiotherapy can be started early for analgesic modalities – and to limit quadriceps muscle wasting. Occasionally, complete medial collateral ligaments may be repaired surgically, although studies indicate comparable results with conservative management.

In general, patients have no residual symptoms and can return to full sporting and physical activities. An occasional complication is the Pellegrini–Stieda lesion, which is calcification over the proximal attachment of the ligament where injury has occurred (Figure 2). This will usually cause pain and marked restriction of movement and, therefore, delay resolution of injury. X-rays performed four to six weeks after the original injury will often visualise the pathology. Such lesions usually respond well to a corticosteroid injection at the site of tenderness.



Figure 1. A hinged, range of motion brace set at 30 to 90° of flexion for management of a ruptured medial collateral ligament. This has been applied over a Tubigrip bandage and can be worn over clothing.



Figure 2. Pellegrini–Stieda lesion, a complication after injury to the medial collateral ligament.

FIGURE 2 COURTESY OF DR JOCK ANDERSON, SYDNEY

### Anterior cruciate ligament injuries

Rupture of the anterior cruciate ligament has become a more common skiing injury and can be disabling. It is commonly associated with other pathology, such as medial collateral ligament injuries, meniscal tears and even osteochondral or chondral lesions. All patients should be considered for referral to an orthopaedic surgeon or sports physician to discuss treatment options.

Instability is initially best managed by fitting a straight knee brace over a Tubi-grip bandage (Figure 3) – this will usually allow the patient to walk without crutches and feel a lot more secure. A cheaper but less convenient alternative is the Robert Jones bandage. If the patient has a combination injury of the anterior cruciate and medial collateral ligaments, a hinged, range of motion brace is best (see preceding section, ‘Medial collateral ligament injuries’).

X-rays of the knee should be performed to exclude an avulsion of the tibial spine, especially in younger individuals. If this is present, the patient should be seen by an orthopaedic surgeon within seven days for K-wire fixation, if appropriate. A patient who is keen to remain active in sport will generally do better with a surgical reconstruction. Success rates for return to sport after surgery are operator dependent, but are generally over 90%. Early physiotherapy is recommended to improve and maintain hamstring and quadriceps strength, irrespective of whether the patient opts for surgical or conservative management in the longer term.

### Other knee injuries

Competitive skiers, professionals and instructors are at increased risk of overuse injuries such as patellofemoral syndrome and patellar tendinosis. Some skiers arrive on the snowfield with pre-existing injuries or adverse biomechanical factors, which increase their risk of overuse problems. Such injuries are usually managed conservatively, with rest and physiotherapy.



Figure 3. A straight knee brace is useful for acute anterior cruciate ligament rupture or patella dislocation.

Often the patient will need assessment of alignment, ski technique, foot mechanics and boot set-up to prevent recurrence.

Other important acute knee injuries include cartilage injuries (both meniscal and articular), patella dislocations, tibial plateau fractures and posterior cruciate ligament tears.

### Ankle injuries

The ankle is injured more frequently in snowboarding than skiing, with fractures and sprains being about equal in incidence. The style of snowboarding boot does not appear to alter the injury rate.<sup>4</sup>

Fracture of the lateral process of the talus is seen in snowboarders – a problem that is rare outside this sport. Its importance in the variety of snowboarder's injuries is highlighted in a study that suggested it accounts for 15% of ankle fractures.<sup>4</sup> The mechanism is said to be a combination of inversion and compression.

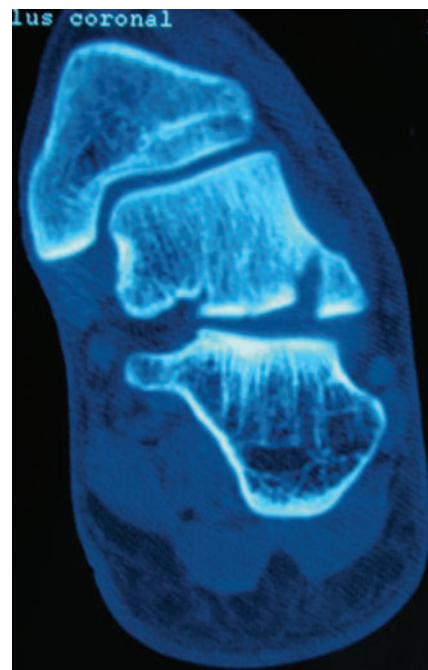


Figure 4. Coronal CT showing fracture of the lateral process of the talus.

FIGURE 4 COURTESY OF DR JOCK ANDERSON, SYDNEY

The lateral process fracture is often poorly visualised on x-ray, and patients may require a bone scan or CT scan to show the extent and grade of injury (Figure 4). If poorly managed, there is a potential for significant disability. Surgery may involve excision of small fractures or open reduction and internal fixation of large fragments.

### Upper limb injuries Skier's thumb

Skier's thumb refers to an injury to the ulnar collateral ligament at the metacarpophalangeal joint of the thumb. It accounts for approximately 7% of skiing injuries,<sup>1</sup> and is usually caused by the thumb getting caught in the strap of a ski pole or on the snow itself.

Ice should be applied early to the injured thumb, and x-rays performed to exclude an avulsion of the distal attachment of the ligament. A grade I or II injury can be managed in an appropriate

thumb splint for three to six weeks (Figure 5), and the thumb should be mobilised when out of the splint. Patients with a grade III or avulsion injury should be referred to an orthopaedic surgeon within seven to 10 days – most will require early surgery because the torn ulnar collateral ligament becomes interposed between the two heads of the adductor pollicis tendon (Stener lesion), which prevents healing.

The result of a poorly managed skier's thumb injury is weakness of the pinch grip. Patients should be warned that it is common to experience some low grade pain and stiffness for four to six months after the initial injury – even for grade I and II injuries that are managed in a splint. The thumb should be further protected by a splint or rigid sports tape for at-risk activities.

### Shoulder dislocation

Anterior shoulder dislocations account for 1 to 2% of skiing and snowboarding injuries (Figure 6).<sup>2</sup> A patient presenting to a GP after an injury on the snowfield will usually have had the dislocation reduced at the resort and be wearing a sling; ideally, x-rays will have also been

performed to exclude fracture. The GP should check for numbness over the outer aspect of the upper arm (over the deltoid muscle). It is important to assess the axillary nerve because palsy is a common complication of anterior shoulder dislocation (see Table).

Ongoing management depends on whether the dislocation is primary or recurrent. Primary dislocations have traditionally been treated in a sling for three weeks. Recent evidence suggests that there is a role for early referral to an orthopaedic shoulder specialist for possible stabilisation (especially for young patients). However, it is generally recommended that the patient be referred to a physiotherapist within the first week for isometric exercises, scapular retractions and pendular movements, who should then supervise a graduated strengthening program. External rotation is permitted in adduction. Strengthening with the shoulder in a 90° abducted position should be attempted after a period of six weeks. Elderly patients need to be mobilised sooner because stiffness rather than recurrence of dislocation is likely to be the main issue. Recurrent shoulder dislocations only need to be treated in a

sling for a few days until the pain settles.

Patients who are involved in contact sports should be considered for surgery because the chance of a redislocation in a young patient is extremely high.

### Other shoulder injuries

Other shoulder injuries can occur in skiers. Common ones include clavicle fractures, acromioclavicular dissociation, rotator cuff tear (especially in older skiers) and fractures of the greater tuberosity of the humeral head.

### Elbow dislocation

Elbow dislocations have become more common as the popularity of snowboarding has increased, and usually occur from a fall onto an outstretched hand.<sup>2,3</sup> The injury is almost always posterolateral and is accompanied by ligamentous rupture and/or fracture.

Following reduction, management will depend on whether a fracture is present. Common fractures that are usually seen on plain x-rays include coronoid, olecranon, radial head fracture and medial collateral ligament avulsion; osteochondral fractures, however, can be missed on plain x-rays. If clinical



Figure 5 (above). A thermoplastic thumb splint. This moulds well when heated and is still able to fit under a ski glove.



Figure 6 (right). X-ray of a dislocated shoulder.

### Table. Complications of anterior shoulder dislocation

- Axillary nerve palsy
- Fracture
- Rotator cuff injury
- Glenoid labrum tear
- Frozen shoulder

progress is slow, further investigation will be necessary – this is best achieved by an MRI scan.

If no fracture is present, the elbow is initially placed in a sling for pain relief; a range of motion brace is ideal. In the first week, movement within the pain-free range is encouraged, and the allowed range can then be increased under the supervision of a physiotherapist. It should be noted that more conservative texts still advocate three weeks in a backslab. Patients with dislocations accompanied by fracture should be referred to an orthopaedic surgeon. Expected return to sport takes four to six weeks when there is no fracture or other complications.

Elbow dislocations can be complicated by flexion contracture and myositis ossificans, problems which underpin the principle of early active mobilisation. Oral

indomethacin (Arthrexin, Indocid) has been shown to reduce the incidence of myositis ossificans.

### Wrist fractures

Wrist injuries have been reported to comprise 20 to 40% of snowboard injuries. About two-thirds of these are fractures, which have become far more common on the snowfield since this activity was introduced.<sup>2,4</sup> Snowboarders should be encouraged to use wrist-guards to prevent fractures – the overall prevalence of wrist injury in those who wear these items is low, but only about 10% of people do so.<sup>4</sup>

The common types of wrist fracture include:

- undisplaced fractures of the distal radius
- greenstick fractures in children
- Colles' fractures
- scaphoid fractures
- Salter–Harris (growth plate) fractures
- scapholunate dissociations.

Due to the high incidence of fracture, it is important to have a low threshold for performing an x-ray on a snowboarder's injured wrist.

### Undisplaced radius and greenstick fractures

The common greenstick and undisplaced fractures of the distal radius can be



Figure 7. Newer nonplaster materials used for short arm backslabs. These are also available for lower limb backslabs.

treated in a short arm backslab and, if necessary, completed in a full cast. However, many medical centres in ski resorts are now using nonplaster splint materials that are stronger and lighter and can be left for the duration of treatment for minor and greenstick fractures (Figure 7).

### Colles' fracture

A Colles' fracture that has been reduced at the ski resort medical centre will require x-rays at both weeks one and two to exclude movement of this unstable fracture. The period of immobilisation should be six to eight weeks. X-rays are further performed at eight weeks to

## Skiing and snowboarding injuries: key points

### Knee

The knee is the most frequently injured body part in skiing.

Tears of the medial collateral ligament are usually managed nonoperatively. They have an excellent prognosis with a well supervised rehabilitation program.

Tears of the anterior cruciate ligament are often associated with other intra-articular pathology.

### Ankle

In snowboarders with ankle injuries, consideration should be given to the possibility of a fracture of the lateral process of the talus. If clinically suspected, this is best seen on a CT scan.

### Thumb

Complete ligament ruptures in skier's

thumb injury require referral to a hand surgeon.

### Shoulder

Recurrent shoulder dislocation commonly follows initial injury. A well supervised rehabilitation program, with or without early surgery, reduces risk of redislocation.

### Elbow

If no fracture is present with a dislocated elbow, early mobilisation is required. If a fracture is present, immobilise the joint and arrange early orthopaedic referral.

### Scaphoid

All patients with proximal scaphoid fractures and any displacement in a waist fracture should be referred for a surgical opinion.

confirm callous formation and radiological union. Intra-articular fractures should be referred for orthopaedic opinion. Cast removal is followed by active and passive mobilisation and strengthening. Complications include malunion or nonunion,

rupture of the extensor pollicis longus tendon and Sudeck's atrophy (a form of complex regional pain syndrome of the wrist).

### Scaphoid fractures

Scaphoid fractures result from a fall on the outstretched hand. There is radial snuff-box tenderness. Undisplaced fractures tend not to be visualised on initial x-rays. If a clinical fracture exists, then a scaphoid cast is used for two weeks and x-rays are repeated. Alternatively, a bone scan may be arranged after the second day, which has a 100% success rate for detecting the fracture. CT scan will demonstrate the fracture and any displacement, thus assisting in management.

Fractures through the waist or proximal scaphoid should be referred to an orthopaedic surgeon for consideration of internal fixation. Any displacement will dramatically increase the risk of a poor outcome. Conservative treatment is reserved for distal fractures and nondisplaced waist fractures (where surgery is not desirable or easily available) and involves

immobilisation for a period of eight weeks in a scaphoid cast.

### Scapholunate dissociations

Scapholunate ligament ruptures also follow a fall on the outstretched hand. Tenderness is noted at the dorsal aspect of the joint. Initial x-rays may be normal, but should include clenched fist (with comparison to the noninjured side), ulnar deviation and lateral views. MRI scanning may be required to confirm the presence of the injury. Patients with these injuries should be referred to a hand specialist, as many will require surgery to achieve a satisfactory result.

### Conclusion

Skiing and snowboarding are the dominant snow sports in Australia and have their own injury patterns. The common injuries seen at a ski resort medical centre that often present to the GP in follow up often require ongoing investigation and specific treatment. Key points in management are listed in the box above **MT**

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**DECLARATION OF INTEREST: None.**