

UPMC ORTHO GRAND ROUNDS

WINTER 2018



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Winter Sports Injuries

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Introduction

Across all levels of winter sports participation, various injuries have been well-documented. For health care providers caring for both professional and recreational athletes, it is important to be familiar with the demands and injuries specific to each sport.¹ Injuries occur more frequently during competition than during practice. Non-time-loss injuries are the most common. However, the remainder may still be devastating to the athlete and more difficult to treat. Across the various winter sports, injuries include upper and lower body trauma (e.g., ankle sprains and clavicle fractures) and also concussion and spinal cord injuries. Although head and neck injuries account for a minority of all injuries, the sequelae can be severe.¹ Ten percent of all spinal cord injuries can be attributed to some kind of athletic activity.¹ Below, some of the most popular winter sports and their specific injuries are discussed.

Skiing

Skiing is very popular, with approximately 200 million people worldwide practicing the sport either professionally or at a recreational level. Skiing involves shifting body weight to allow turns, while the long thin boards allow sliding down hill. In downhill skiing and racing, this is done around poles at high speeds. Other varieties of skiing include cross-country and high jump, each having their own specific injuries.² Knee injuries are very common, resulting from the high speeds and failure of the boot bindings to release during a fall causing the knee to forcibly rotate. Meniscus, medial collateral, and anterior cruciate ligament tears can be the result of a fall [see Figure 1 on Page 2], as well as tibia, fibula, and ankle fractures.³ Prevention strategies include neuromuscular training and the use of proper equipment. Upper extremity injuries most commonly involve the thumb, and they can result in an acute sprain of the metacarpophalangeal joint ulnar collateral ligament of the thumb, also referred to as skier's thumb.⁴ Shoulder injuries may result from falls onto the extremity.

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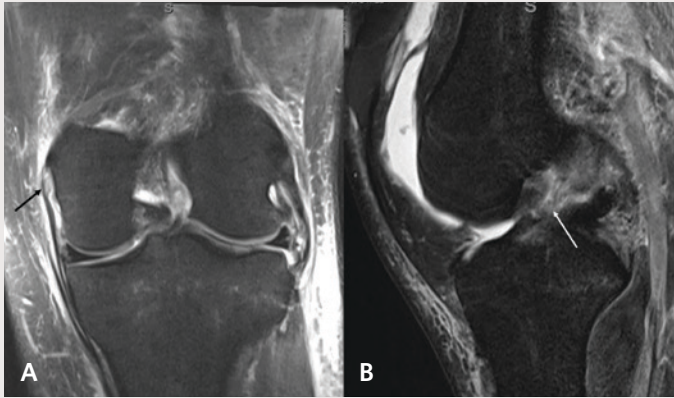


Figure 1. 29-year-old male who sustained left knee medial collateral ligament (A) and anterior cruciate ligament (B) tears.

Case Report 1

A 29-year-old male presented after returning from a skiing trip with a left knee injury. He stated that one ski became stuck in the snow, and his binding did not come undone. This led him to twist the knee. He felt a pop and could not continue to ski. He was taken down the mountain by the ski patrol, and from there to a local emergency room where he stated x-ray images were obtained and showed negative findings. Upon presentation at the office, he showed a large effusion, 2B Lachman, guarded pivot shift, and 1-2+ opening to valgus stress at 30 degrees of knee flexion. An MRI was performed, which showed a left knee medial collateral ligament (MCL) [Figure 1A] and anterior cruciate ligament (ACL) [Figure 1B] tear. The patient was placed in a hinged knee brace for the MCL tear, and sent to physical therapy to reduce the swelling and regain range of motion. He was counseled with regard to operative and nonoperative management approaches.^{5,6} Although skiing has not been shown to be a definite ACL-dependent sport, many athletes lack confidence in the knee without a functioning ACL.⁷ The patient was scheduled for an ACL reconstruction with patellar tendon autograft. The patient's postoperative rehabilitation included regaining range of motion and strength. Jogging is generally allowed after three months, and sport-specific training can commence at six months.⁸ Return to skiing after ACL reconstruction is generally possible at approximately nine months after surgery.⁸ The surgery has been shown to be very successful for skiers, with 87 percent returning to the sport at the same level they were prior to surgery.⁹

Snowboarding

Compared to skiing, snowboarding is a younger sport with a smaller but still sizable number of participants. Snowboarding competitions involve certain stunts with acrobatic maneuvers and high jumps.¹⁰ This results in a higher rate of upper extremity injuries compared to skiing, including proximal humerus, clavicle, distal radius, and carpal fractures, as well as dislocations, separations, sprains, and contusions.^{10,11} Lower extremity injury is most common in the lead extremity and can include lateral process of the talus and other ankle fractures, as well as patellar dislocations. The former is often missed on plain radiographs and may warrant a computed tomography (CT) scan.¹⁰ Although spinal cord and head injuries are uncommon, they can have significant morbidity. Spinal cord and head injuries are often the result of high-speed collisions with obstacles such as trees and rocks.²

Case Report 2

A 17-year-old female presented after returning from a snowboarding event out of the country where she twisted her left knee and fell, sustaining a patella dislocation. The injury required reduction in the local emergency room approximately two hours after the occurrence of the initial injury. Upon return to the United States, she sought follow-up care. On physical examination, she had full range of motion in the knee, 3 of 4 quadrants patellar-glide bilaterally without apprehension, and 7 of 9 Beighton criteria met. An MRI demonstrated the classic bone bruise pattern with the medial aspect of the patella and lateral femoral condyle periphery involved [Figures 2A and 2B]. Additionally, an MRI scan demonstrated a partial thickness tear of the medial patellofemoral ligament (MPFL) at the patellar insertion, and a grade 4 chondral defect in the central third

Case Report 2 – Diagnosis: Patella dislocation.

Treatment: MPFL reconstruction with allograft.

Rehabilitation: 4 to 5 months with sport-specific prevention exercises.

RTP: After formal testing of knee function specifically developed at UPMC Sports Medicine.

median ridge and lateral patellar facet. The patient underwent patella chondroplasty and MPFL reconstruction using allograft. At one week postoperatively, sutures were removed and physical therapy was initiated, with a focus on anti-inflammatory modalities and range of motion with quadriceps strengthening. At six weeks postoperatively, her range of motion was symmetric to the contralateral side, and she continued physical therapy for strengthening. At 12 weeks postoperatively, she had regained about 75 percent of quadriceps strengthening and started some agility training. She is continuing therapy for

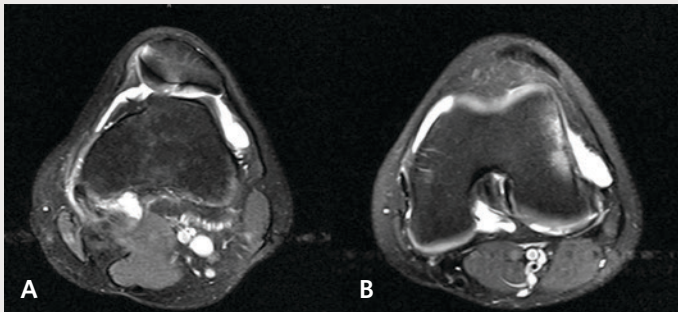


Figure 2. 17-year-old female with a left patellar dislocation after a snowboarding incident. An MRI demonstrated rupture of the MPFL and the classic bone bruise pattern with the medial aspect of the patella (A) and lateral femoral condyle (B) involved.

strength training, and will pick up more agility drills when she achieves 85 to 90 percent of her original strength. She will likely return to sports about five months postoperatively.

Ice Hockey

Ice hockey is played worldwide by both children and adults. Rules differ depending on male and female leagues, and they also vary with children. For women and children, there are strict regulations against body checking as this has been shown to increase the injury rate by threefold, resulting in upper and lower extremity trauma, as well as concussion.¹² Upper extremity injuries mostly involve glenohumeral dislocation, clavicle fractures [Figure 3], and acromioclavicular separations.¹³ Hand, wrist, and rib fractures are also commonly encountered as a result of contact with a stick or the puck, or being checked by an opponent.¹³ Lower extremity injuries range from extra-articular to intra-articular.¹⁴ Extra-articular injuries include hip adductor or flexor strain, hip pointer, and abdominal muscle injury. Intra-articular injuries include hip labral tears and

impingement, meniscal and knee collateral ligament injury, ankle sprains, and foot and ankle fractures.¹⁴ Another common injury is laceration resulting from the metal blades of the skates, or from a stick or the puck. Players can reach skating speeds approaching 30 miles per hour, and the puck can be shot as fast as 120 miles per hour. Lacerations can be deep and involve tendons, nerves, and blood vessels. Rules pertaining to protective equipment and facial protection aim to reduce the occurrence of these injuries.¹⁵

Case Report 3

A 15-year-old male hockey player presented with his parents for a second opinion regarding his left shoulder. He stated he was checked into the boards by an opponent, resulting in immediate pain and deformity about the left clavicle. He was seen at a local urgent care, where x-rays revealed a displaced, shortened, comminuted midshaft left clavicle fracture [Figure 3A]. He was referred to an orthopaedic surgeon who told the parents that the injury could be managed without surgery. He subsequently presented for another opinion to decide the best course of treatment. Upon evaluation in the office, he was a thin male with an obvious deformity about the left clavicle without evidence of skin compromise. He was neurovascularly intact. The benefits of nonoperative management (avoiding surgical risk such as infection or prominent hardware, lack of scar) and surgical

Case Report 3 – Diagnosis: Clavicle fracture.

Treatment: Open reduction internal fixation.

Rehabilitation: Sling < 3 weeks, then progressive ROM and strengthening.

RTP: Eight to 10 weeks for contact sports provided radiographic evidence of healing.

management (improved cosmesis, better healing rate, faster time to union, decreased symptomatic malunion rate, the possibility of more complex surgery, better shoulder endurance) were discussed. The patient and his family elected to proceed with surgery. Further support for this decision was the high degree of displacement and shortening with a Z-fragment interposed.¹⁶ He underwent open reduction internal fixation

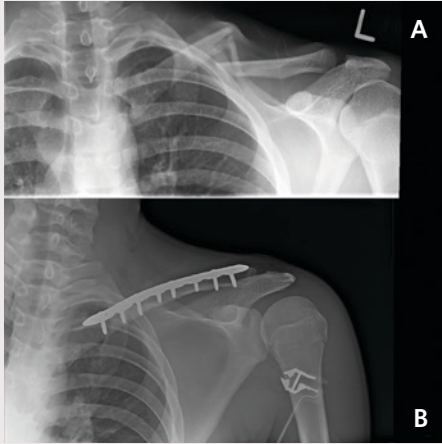


Figure 3. 15-year-old male hockey player was checked into the boards, resulting in a displaced, shortened, comminuted left clavicle fracture (A). He underwent open reduction internal fixation of the fracture (B).

(ORIF) of the fracture [Figure 3B]. To ensure strength, fixation should include at least six cortices on each side of the fracture.¹⁶ Postoperative rehabilitation includes one to three weeks in a sling while allowing pendulums, Codman exercises, isometric biceps exercises, and elbow and wrist range of motion. After four weeks, passive and active-assisted range of motion is allowed. At six weeks, active strengthening can be started as long as there is evidence of healing on radiographs. Lifting, throwing, and resisted activities should not be allowed until healing is confirmed. Introduction of contact sports, such as hockey, may take eight to 10 weeks.¹⁷

Figure Skating

Figure skating is popular in the United States, with a reported 680 clubs nationally numbering more than 196,000 total members.¹⁸ This sport is highly technical, involving jumps, spins, footwork, dancing, and acrobatics.¹⁹ Due to these demands, most injuries are related to overuse.¹⁹ Foot injuries are common because the high heel of the boot places the foot into constant plantarflexion. In addition, the laces of the skate can cause irritation to the tibialis anterior, extensor digitorum, and extensor hallucis longus tendons (referred to as “lace bite”).¹⁸ “Pump bump” refers to Haglund’s deformity caused by an overly wide heel of the skate that allows the skater’s heel to move up and down.¹⁸ This same mechanism can also lead to Achilles tendinitis and malleolar bursitis. Some of these injuries can be prevented by proper skate fitting. An accessory navicular is present in up to 21 percent of the normal population but can cause excessive friction of the skate in figure skaters.¹⁸ Providing

a cut-out in the boot of the skate can provide symptomatic relief. Stress fractures also are common and involve mostly the first and second metatarsals, as they accept most of the load.²⁰ When stress fractures occur, the physician should consider screening for nutritional deficiencies and recommend a decrease in the number of jumps, also referred to as the “jump count.” Jumping also can lead to knee problems, such as patellofemoral pain syndrome and patellar tendinitis [Figure 4]. Triple and quadruple jumps require a large amount of rotational torque, which can lead to iliac crest apophysitis.²⁰

Back conditions are common in skaters as well because of repetitive trunk extension. These include spondylosis, spondylolisthesis, lumbar strains, and facet joint pain.²¹ Upper extremity injuries are rare and are mostly the result of falls or collisions. These injuries are similar to collision injuries in ice hockey and involve fractures, dislocations, and concussions. These types of injuries are more common in paired synchronized skating where there are multiple skaters on the ice at one time in tight formations. A “domino effect” might occur when one skater falls, leading to injuries from the skates, such as finger lacerations and even amputations.²²

Case Report 4

A 24-year-old male figure skater presented with anterior knee pain after landing awkwardly after a jump. He stated he had had anterior knee pain on and off, but this time he felt like something gave. He was unable to jump secondary to pain and weakness. Examination in the office revealed tenderness over the patellar tendon insertion onto the patella. There was no defect palpable,

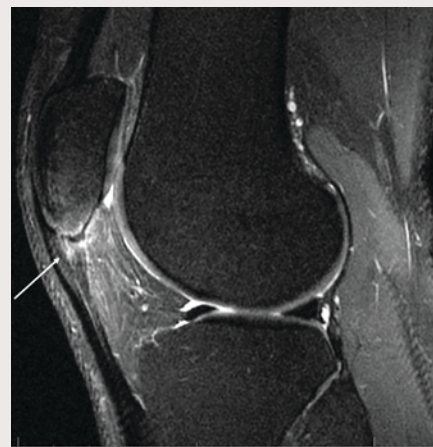


Figure 4. 24-year-old male figure skater presented with anterior knee pain after landing awkwardly after a jump. He was found to have patellar tendinitis with a 20 percent partial tear of the patellar tendon.

and quadriceps strength was 4+ out of 5, limited by pain. An MRI was ordered that revealed patellar tendinitis with a 20 percent partial tear [Figure 4]. Since the tear was partial, the decision was made to proceed with conservative management. The rehabilitation process was focused on progressively developing load tolerance of the tendon, musculoskeletal unit, and the kinetic chain. Rehabilitation also addressed key biomechanical and other risk factors, such as hamstring and IT band tightness.²³ However, rehabilitation of patellar tendinitis can be a slow and

Case Report 4 – Diagnosis: Patellar tendinitis with partial tear.

Treatment: Rehabilitation.

Rehabilitation: Progressive load tolerance of the tendon, musculoskeletal unit, and kinetic chain, addressing risk factors.

RTP: Unpredictable and related to symptom(s) resolution, may take > six months.

frustrating process. The most common frustration is the patient having an unrealistic expectation with regard to the healing time frame. This is understandable given an athlete's eagerness to return to sports and the demands of competing in an elite sport. Progression of rehabilitation is related to symptom response to load (load tolerance) and neuromuscular function, both of which also determine the capacity to return to play, which can take six months or longer.²⁴

Snowmobile Cross

Snowmobile cross is a popular winter sport, but accidents involving snowmobiles can have the same devastating consequences as motor vehicle accidents. This is in part because snowmobiles are used for recreation, as well as for work and travel in some parts of the world. Injuries resulting from crashes include trauma to the head and neck (e.g., concussion, head bleeds, facial trauma, whiplash, and spine fractures), as well as to the chest and abdomen.²⁵ In addition, injuries to the upper and lower extremities are common, ranging from simple sprains to dislocations [Figure 5], complex fractures, and crush injuries.^{25,26} In a study of 273 patients involved in snowmobile accidents seen

at a level I trauma center, the mortality rate was 3.6 percent and patients spent on average two to five days in the intensive care unit, and eight to nine days in the hospital.²⁵ A study out of Wisconsin indicated that from 1998 and 2002, 1,090 people in that state were hospitalized due to injuries related to snowmobiling.²⁷ The study also reported that from 2002 to 2004 there were 51 snowmobile-related fatalities.²⁷ Safety measures such as the use of seat belts and helmets may improve the injury rate.²⁸ However, a Canadian study showed that children ages 0 to 15 years old comprised 33.8 percent of all snowmobile-related fatalities.^{29,30} Furthermore, alcohol was frequently involved, with 66 percent of fatally injured snowmobilers testing positive for alcohol.²⁹

Case Report 5

A 43-year-old female was taken by ambulance to a level I trauma center after being involved in a snowmobile accident. Alcohol is thought to have been involved. The patient was morbidly obese, but upon examination there was a deformity about the left knee. Radiographs confirmed a left knee dislocation [Figure 5A]. A closed reduction was performed in the emergency department, and a CT angiogram was performed, which indicated no vascular injury. She was taken to the operating room and an external fixator was applied [Figure 5B]. A postoperative examination revealed intact neurovascular status. An MRI revealed complete tears of the ACL, PCL, and MCL. She underwent removal of the external fixation two-and-a-half weeks after surgery.

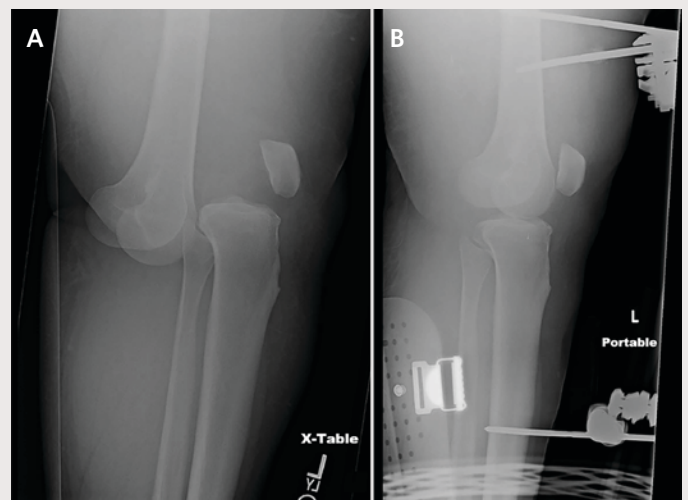


Figure 5. 43-year-old female involved in a snowmobile accident resulting in a left knee dislocation (A) that required closed reduction and external fixator placement followed by multiligamentous knee reconstructive surgery.

Examination under anesthesia revealed gross instability of the knee with 2+ anterior and 2+ posterior drawer, positive pivot shift test, and 3+ opening with valgus stress. Reconstruction of the ACL, PCL and MCL was subsequently performed. Rehabilitation after the reconstruction of multiple knee ligaments depends largely on which ligaments are reconstructed, and if staging of the surgery is performed. The prognosis for return to sports is not optimistic. Even at two-year follow-up, the quadriceps strength remains 85 percent of normal and

Case Report 5 – Diagnosis: Knee dislocation.

Treatment: Closed reduction, external fixation, delayed ligament reconstruction.

Rehabilitation: Early passive ROM while avoiding translation and rotation, progression to active ROM, strengthening, and sport-specific training.

RTP: ~Nine months after surgery but poor prognosis for return to preinjury activity level, and high incidence of osteoarthritis.

only 30 percent of patients return to their preinjury level of sports participation.³¹ More than one-half develop osteoarthritis, and gait and range of motion continue to be altered from the uninjured leg.³²

Bobsled

A fan favorite during the Winter Olympics, bobsledding is not only popular as a professional sport but also with recreational athletes. The most common injuries are those pertaining to high energy trauma resulting in spine and upper and lower extremity fractures. However, recent evidence suggests that spinal trauma may occur in the absence of a high energy impact.³³ Bobsledding imparts large amounts of force during events and can result in spinal trauma [Figure 6]. With the aging population and more individuals recreationally pursuing the sport, some studies have described spine fractures occurring during routine turns of the bobsled on the track.³³ Patients of older age, those with osteoporosis, or those who are suffering from metabolic disease may be at risk and should be educated about the possibilities of spine fractures prior to engaging in bobsledding.

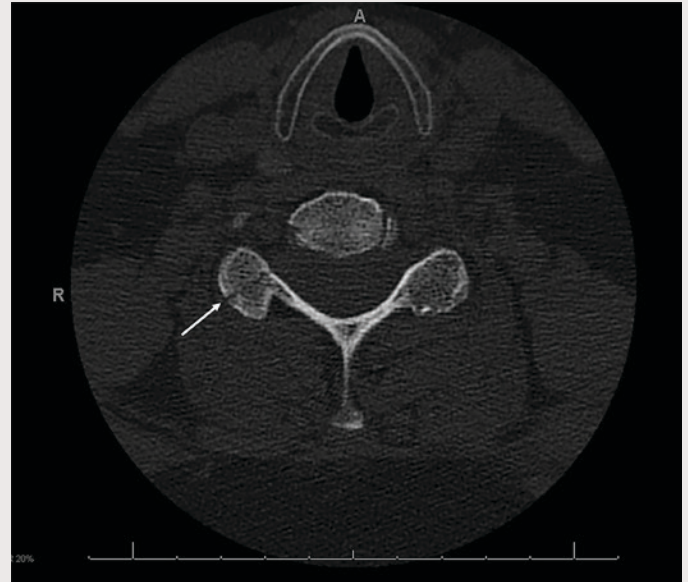


Figure 6. Unilateral nondisplaced facet fracture in a 58-year-old recreational bobsledder, which was not seen on plain radiographs.

Case Report 6

A 58-year-old male recreational bobsledder presented with increasing neck pain over several weeks. The pain was aggravated by activity and responded to rest and pain medication. The patient did not recall an injury. There were no radicular symptoms. Besides pain with neck range of motion, the office examination was unremarkable. Radiographs from the office visit did not show any abnormalities besides loss of normal cervical lordosis attributed to muscle spasm. Due to the persistent nature of the symptoms, a computed tomography (CT) scan was performed, which showed a unilateral nondisplaced facet fracture [Figure 6]. The patient was placed in a cervical collar for six weeks, after which he returned to his usual activities of daily living, but he was told not to return to bobsledding for six months. The literature suggests there is a

Case Report 6 – Diagnosis: Nondisplaced unilateral facet fracture.

Treatment: Cervical collar for six weeks.

Rehabilitation: Slow return to activities of daily living with progression to sport-specific activities.

RTP: At six months, as long as evidence of bony union (consider CT scan).

high degree of consensus with regard to return to sports in athletes with spinal trauma.³⁴ Generally, for this injury, most practitioners allow return to play three to six months after the injury, provided there is a resolution of symptoms.³⁴ Repeating the CT scan to evaluate healing may help in further delineating whether a safe return to sports is possible.³⁵

Conclusion

The winter sports presented here are enjoyed by numerous participants across a myriad of ages and levels of participation — from recreation to competition. Each sport has its own unique set of techniques, form, and demands. These predispose the athlete to a particular set of common injuries. Care must be taken by the treating physician to understand each sport and its specific demands. Accordingly, his or her index of suspicion can be high to identify common injuries and manage them appropriately. As above, while many injuries in this group are non-time-loss injuries, they can still confer significant hardship to the athlete if left undiagnosed or improperly managed. Swift diagnosis and treatment of these injuries affords optimal outcomes and the athletes' continued participation in their beloved sports.

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