Case reports

Snowboarder's fracture caused by a wakeboarding injury: a case report

Stephanie E. Mussmann DC^{a,*}, Jean-Nicolas Poirier DC^{b,c}

^a Resident in Diagnostic Imaging, Department of Chiropractic Clinical Sciences, New York Chiropractic College, Seneca Falls, NY 13148

^b Assistant Professor, Department of Chiropractic Clinical Sciences, New York Chiropractic College, Seneca Falls, NY 13148

^c Director of the Masters of Science in Diagnostic Imaging Program, New York Chiropractic College, Seneca Falls, NY 13148

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Abstract

Objective: The purpose of this case report is to describe the clinical presentation of a patient who had a lateral talar process fracture due to a wakeboarding injury.

Clinical Features: A 29-year-old male patient sustained a left ankle injury when the front edge of his wakeboard became immersed in the water. As he fell forward, his foot remained attached to the board, leading to inversion and dorsiflexion stress of the ankle. He presented to a chiropractic clinic with diffuse ankle swelling, tenderness, and pain at the distal aspect of the lateral malleolus. Mild ligamentous laxity of the lateral supporting structures was observed during the physical examination.

Intervention and Outcome: Static and stress radiographs of the left ankle demonstrated a small (McCroly-Bladin type 1) lateral talar process fracture without evidence of gross instability. The patient was referred to a local orthopedic medical specialist for immobilization of the ankle. The patient was treated conservatively with an air cast walking boot for 2 weeks (non-weight-bearing) followed by a 2-week period of partial weight-bearing. At 6 weeks following the injury, a repeated radiographic examination demonstrated complete healing of the fracture. The patient reported minimal tenderness and normal ankle function.

Conclusion: Because of the similar mechanism of injury to those sustained in snowboarding, this case demonstrates the need for increased awareness of lateral process fractures in wakeboarders.

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* Corresponding author. Resident in Diagnostic Imaging, Department of Chiropractic Clinical Sciences, New York Chiropractic College, 2360 State Route 89, Seneca Falls, NY 13148. Tel.: +1 315 568 3315; fax: +1 315 568 3017.

E-mail address: smussmann@nycc.edu (S. E. Mussmann).

Introduction

Fractures of the lateral process of the talus (LPT) are considered rare, accounting for less than 1% of all ankle injuries in the general population.^{1,2-4} These fractures

are nearly 15 times more likely to occur in snowboarders¹; thus, they are frequently known as *snowboarder's fractures*. Snowboarder's fractures account for 2.3% of all snowboarding injuries.^{1,5,6} It is reported that 6% to 38% of all snowboarding injuries involve the ankle, 6% to 15% of which present as fracture of the LPT.^{1,3,4,6-10}

Snowboarding has become the fastest growing winter sport in the United States and worldwide.⁹ The sport was first introduced in the early 1970s.⁹ The authors have found one report of a similar fracture in the summer cousin of this winter sport: wakeboarding.¹¹ Wakeboarding is a water sport involving a boat pulling a rider on a wakeboard. The wakeboard is wider than a snowboard, with similar bilateral firm bindings of the feet oriented perpendicular to the long axis of the board.^{11,12} Wakeboarding was founded much more recently, in the late 1980s.¹² This sport has found rapid increase in popularity, with a 49% increase in participation within the past 5 years.^{11,13} Currently, about 3 million people participate in the sport.^{11,13} Ten percent of wakeboarding injuries involve the ankle.¹¹ The purpose of this article is to provide a retrospective case study of a snowboarder's fracture sustained by a young adult wakeboarder.

Case report

A 29-year-old man sustained an injury while wakeboarding when the front edge of his board became submersed in the water, causing inversion and dorsiflexion of the left ankle. The patient presented to a chiropractic clinic with diffuse ankle swelling, pain with joint motion, and tenderness at the distal aspect of the lateral malleolus. Following a physical examination, the doctor noted sagittal and coronal hypermobility and requested stress views of the ankle to rule out the presence of instability. Conventional radiographic examination and inversion, eversion, and anterior drawer stress views of the left ankle were obtained. A comminuted fracture of the anterolateral apex of the LPT was seen, evidenced by 2 small minimally displaced fragments (Fig 1). The fracture line extended to the posterior talocalcaneal articulation of the subtalar joint without apparent involvement of the talofibular joint. The anterior drawer stress view showed anterior talar translation of 9 mm, measured with the Karlsson method, which represents the upper limits of normal.¹⁴ No evidence

Fig 1. Lateral stress view of the left ankle. Comminuted lateral talar process fracture (arrow).

of lateral or medial instability or injury to the stabilizers of the ankle was observed.

The patient was referred to a local orthopedic medical specialist for immobilization of the ankle. He was treated conservatively with an air cast walking boot for 2 weeks (non-weight-bearing) followed by a 2-week period of partial weight-bearing. At 6 weeks following the injury, a repeated radiographic examination demonstrated complete healing of the fracture (Fig 2). At follow-up, the patient reported minimal tenderness and normal ankle function.

Fig 2. Lateral neutral projection of the left ankle. Follow-up radiograph at 6 weeks postinjury demonstrates complete healing of the LPT fracture.

Discussion

The LPT is a wedge-shaped protuberance that articulates dorsolaterally with the fibula and inferomedially with the anterior portion of the calcaneal facet.^{2,4,5} The LPT plays an important role in the hinge and rotary motions of the subtalar and talocrural joints.¹⁰ Three of the lateral ankle stabilizing ligaments attach to the lateral talar process.^{2,9,15} The lateral talocalcaneal ligament originates in its entirety from the anterior inferior apex of the LPT. Portions of the anterior and posterior talofibular ligaments insert on each side, respectively.¹⁵ This was described by Langer et al⁹ who demonstrated that a lateral process fracture of 1 cm would involve 100% of the lateral talocalcaneal ligament attachment and 10% to 15% of each of the anterior and posterior talofibular ligament attachments. These 3 ligaments form a circumferential band of ligamentous tissue along the lateral talar process.¹⁵

Approximately 40% of LPT fractures are overlooked at the time of initial diagnosis and are frequently mistaken for lateral ankle sprains.^{1,4-7} The typical clinical presentation includes pain and swelling of the ankle with local tenderness anterior to the tip of the lateral malleolus.^{4,10,16} Although the cause of injury is most frequently due to snowboarding-associated trauma, this pathology has also been described in motor vehicle accidents and falls from heights.^{1,2,5,16}

Diagnosis of LPT fractures can most commonly be made via radiographic examination. The fracture is normally best visualized on the lateral ankle projection. An accessory view has been described by Miyamoto et al¹⁷ for better visualization of the lateral talar process. This unnamed view recommends the

following patient positioning: patient is seated with 30° external rotation of the hip; knee is flexed about 90°; the patient's heel is placed on the imaging receptor on the table; and the forefoot is raised approximately 1 in off the table, creating a 20° angle with the table. The tube to film distance should be 36 in, with a 20° tube tilt toward the toes. The central ray should be placed over the medial talus.¹⁷ On the standard lateral ankle projection, an asymmetrical or crooked V-shaped displaced osseous fragment may be seen at the fracture site. This appearance has been described as the positive V sign.⁵ Computerized tomographic examination may also be helpful in assessing the degree of comminution, orientation, and displacement and the size of a fragment. Magnetic resonance imaging of the ankle will also display the fracture line and associated surrounding edema, although small fractures of the apex may be more difficult to visualize.

The vectors of force enabling a fracture of the lateral talar process are not completely understood. There is no evidence that this type of fracture can be caused by pure inversion stress.^{7,16} Many case studies describe a mechanism of injury of forced dorsiflexion with inversion and axial loading.^{4,10,16} In the standing position, inversion stress causes a lateral shift of the head of the talus and superior displacement of the lateral talar process on the posterior articular surface of the calcaneus. If the foot is forced into dorsiflexion while in this position, the joint surfaces of the posterior talocalcaneal joint are then no longer aligned; and additional force is concentrated upon the LPT.^{7,16} Boon et al⁷ were able to reproduce LPT fractures in fresh cadavers only when inversion, dorsiflexion, and axial loading forces were combined with external rotation. They hypothesized that the

Table 1 Three classification systems of lateral talar process fractures

	Hawkins	McCroly-Bladin		Funk
Type 1	Simple fracture: talofibular articular surface to the posterior talocalcaneal articular surface	Chip fracture: does not extend to the talofibular joint	Type A	Avulsion: extraarticular ligament avulsion of the tip of the lateral process
Type 2	Comminuted: involving both fibular and posterior calcaneal articular surface	Single large fragment: involves both the subtalar and talofibular joints	Type B1	Simple fracture: disruption of the posterior talocalcaneal joint, but not the talofibular joint
			Type B2	Comminuted: disruption of the posterior talocalcaneal joint, but not the talofibular joint
Type 3	Chip fracture: does not extend to the talofibular articular surface	Comminuted: involves the entire lateral process	Type C1	Simple fracture: complete fracture involving both the posterior talocalcaneal and talofibular articular surfaces
			Type C2	Comminuted: complete fracture involving both the posterior talocalcaneal and talofibular articular surfaces

injury would be produced by shearing forces from the calcaneus onto the LPT. Another cadaveric study by Funk et al¹ revealed that the LPT fracture was also possible with dorsiflexion, axial impaction, and forceful eversion. Although the precise nature of the forces involved in LPT fractures is not confirmed, it is apparent that a combination of axial loading, dorsiflexion, and some form of ankle rotation is required to produce this injury.^{1,5-7,10,16}

Associated tendinous injuries can occur secondary to LPT fractures. Dislocation of the peroneal tendons has been demonstrated in up to 46% of these injuries.² In contrast, these fractures are rarely associated with primary ligamentous damage, as the articular anatomy normally provides a primary restraint to external rotation forces combined with inversion and axial loading.⁷

Three classification systems have been described to characterize snowboarder's fractures: Hawkins,¹⁶ McCrory-Bladin,¹⁰ and Funk et al¹ (Table 1). Because of their similarities, it is important for clinicians to report which classification system is used when describing LPT fractures. The accurate classification of the LPT injury presented in this case study was difficult because of the small size, the comminuted nature, and the absence of apparent involvement of the talofibular joint. Thus, it could be classified as a Hawkins type 3, McCrory-Bladin type 1, or Funk type A or B2. The McCrory-Bladin classification system is favored by many authors for its simplicity and clinical relevancy.

Treatment of LPT fractures is based upon the size, type, comminution, and displacement of the fragment(s). The fragments that are less than 1 cm, non-comminuted, or displaced by less than 2 mm may be treated nonoperatively.^{1,4-6,9,10,16} Nonoperative treatment consists of immobilization for 6 weeks with partial weight-bearing.^{1,4-6,9} Conservative treatment may also include physical therapy and rehabilitation following immobilization.⁶ Open reduction with internal fixation is the treatment of choice for injuries in which the fragments are greater than 1 cm, grossly comminuted, or displaced by more than 2 mm.^{1,4-6,9,10} If closed reduction fails or symptoms persist, excision is recommended to prevent loose bodies or future subtalar osteoarthritis.^{5,9,16}

The outcome of an LPT fracture is favorable provided that it is diagnosed early and treated sufficiently.⁵ Seventy-one percent of patients with isolated LPT fractures report return to full activity.² Long-term sequela of snowboarder's fractures may include nonunion, malunion, and subtalar osteoarthritis.

Studies report that 15% to 45% of patients experienced subtalar osteoarthritis following an LPT fracture.^{5,6}

Conclusion

This report demonstrates a classic case of snowboarder's fracture caused by a wakeboarding injury. With the similarities of the 2 sports and recent growing interest in wakeboarding, it is advisable to consider this fracture when evaluating patients who have sustained wakeboarding injuries.

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References

1. Funk J, Srinivasan S, Crandall J. Snowboarder's talus fractures experimentally produced by eversion and dorsiflexion. *Am J Sports Med* 2003;31(6):921-8.
2. Klein S, Varner K, Marymont J. Lateral talar process fracture and peroneal tendon dislocation: a previously unrecognized injury complex. *Foot Ankle Int* 2008;29(10):1020-4.
3. Langer P, DiGiovanni C. Incidence and pattern types of fractures of the lateral process of the talus. *Am J Orthop* 2008;37(5):257-8.
4. Nicholas R, Hadley J, Paul C, James P. Snowboarder's fracture: fracture of the lateral process of the talus. *J Am Board Fam Pract* 1994;7(2):130-3.
5. von Knoch F, Reckord U, von Knoch M, Sommer C. Fracture of the lateral process of the talus in snowboarders. *J Bone Joint Surg Br* 2007;89(6):772-7.
6. Valderrabano V, Perren T, Ryf C, Rillmann P, Hintermann B. Snowboarder's talus fracture. *Am J Sports Med* 2005;33(6):871-80.
7. Boon A, Smith J, Zobitz M, Amrami K. Snowboarder's talus fracture. *Am J Sports Med* 2001;29(3):333-8.
8. Yamagami T, Ishihara H, Kumura T. Clinical features of snowboarding injuries. *J Orthop Sci* 2004;9:225-9.
9. Langer P, Nickisch F, Spenciner D, DiGiovanni C. Effect of simulated lateral process talus "fracture excision" on its ligamentous attachments. *Am J Orthop* 2009;38(5):222-6.
10. Bladin C, McCrory P. Snowboarding injuries. *Sports Med* 1995;19(5):358-64.
11. Carson W. Wakeboarding injuries. *Am J Sports Med* 2004;32(1):164-73.
12. Narita T, Mori A, Hashiguchi H, et al. Anterior cruciate ligament injuries among wakeboarders: a case report. *J Nippon Med Sch* 2004;71(1):57-62.
13. Hostetler S, Hostetler T, Smith G, Xiang H. Characteristics of water skiing-related and wakeboard-related injuries treated in

- emergency departments in the United States, 2001-2003. *Am J Sports Med* 2005;33(7):1065-70.
14. Beynnon B, Webb G, Huber B, Pappas C, Renstrom P, Haugh L. Radiographic measurement of anterior talar translation in the ankle: determination of the most reliable method. *Clinical Biomechanics* 2005;20:301-6.
15. DiGiovanni C, Langer P, Nickisch F, Spenciner D. Proximity of the lateral talar process to the lateral stabilizing ligaments of the ankle and subtalar joint. *Foot Ankle Int* 2007;28(2):175-80.
16. Hawkins L. Fracture of the lateral process of the talus. *J Bone Joint Surg Am* 1965;47(6):1170-5.
17. Miyamoto W, Takao M, Nishiguchi K, Uchio Y. Technique tip: radiographic projection for an avulsion fracture of the talar attachment of the anterior talofibular ligament. *Foot Ankle Int* 2008;29(4):435-7.