Management of a Stage III Lisfranc Ligament Injury in a Collegiate Football Player

A Case Review

Chris H. Hummel, MS, ATC; Todd W. Lazenby, MA, ATC; and Paul R. Geisler, EdD, ATC

ABSTRACT

The diagnosis and management of the Lisfranc joint injury is a complicated and sometimes frustrating endeavor. Some consensus exists on the diagnosis of Lisfranc injuries; however, the proper management of these subtle injuries is still debated and poorly reported. This case review highlights a unique management of a stage III Lisfranc injury, in that the athlete was able to successfully return to full participation after 3 weeks of rest and conservative, nonsurgical treatment.

Injuries to the Lisfranc joint are considered rare in the general population and mostly have been associated with high velocity motor vehicle accident traumas.[1-6] However, injuries to the Lisfranc joint in the athletic population have become much more common. Meyer et al[7] found Lisfranc joint injuries to account for almost 4% of all collegiate football injuries. These athletic related injuries were usually found to be a result of low-velocity traumas, such as a twisting mechanism while the foot is planted.[1,2,7-9]

The Lisfranc joint complex is located at the junction of the midfoot and forefoot (Figure 1). This articulation complex is formed between the cuneiforms, cuboid, and corresponding metatarsal bases.[4] These tarsometatarsal joints are very stable due to both their bony configuration and strong ligamentous support. The recessed articulation between the base of the second metatarsal and the medial and lateral cuneiforms is the "keystone" of the joint.[1,2,4,10,11] Additional stability throughout the Lisfranc joint comes from the metatarsal interosseous ligaments, except between the bases of the first and second metatarsals. Rather, the Lisfranc ligament, a strong oblique structure that runs from the plantar surface of the base of the second metatarsal to the medial cuneiform, assists with the stability between the first and second metatarsals.

This ligament has been found to be the largest and strongest of the interosseous ligaments.[1,2,9,11] This configuration allows for a rigid connection between the medial and middle sections of the midfoot, while allowing mobility and increased function between the first and second metatarsals.[1]

Lisfranc ligament injuries can be complicated and result in a wide spectrum of outcomes. These injuries can have a subtle presentation and can be difficult to diagnose upon initial physical examination. The injured athlete may not think the injury is significant and will often try to "walk it off"—a strategy that is rarely successful and usually leads to delayed diagnosis and prolonged disability.

The mechanism of injury to the Lisfranc joints can be divided into both direct and indirect causes. Direct causes are usually related to either motor vehicle or industrial accidents. Indirect mechanisms are more common in athletics and usually involve low energy traumas. This type of injury usually results from the axial loading or twisting of the midfoot on a fixed plantar flexed foot.[1,2,7-9] If an athlete describes a mechanism similar to this, the examining clinician should be suspicious of Lisfranc involvement.

In a physical examination, the most reliable signs and symptoms for Lisfranc injuries are midfoot swelling, plantar ecchymosis, and tenderness over the first and second tarsometatarsal joints.[1-4,8,9,11] Pain or difficulty with

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Address correspondence to Chris H. Hummel, MS, ATC, Ithaca College, 953 Danby Road, Ithaca, NY 14850; e-mail: chummel@ithaca.edu.

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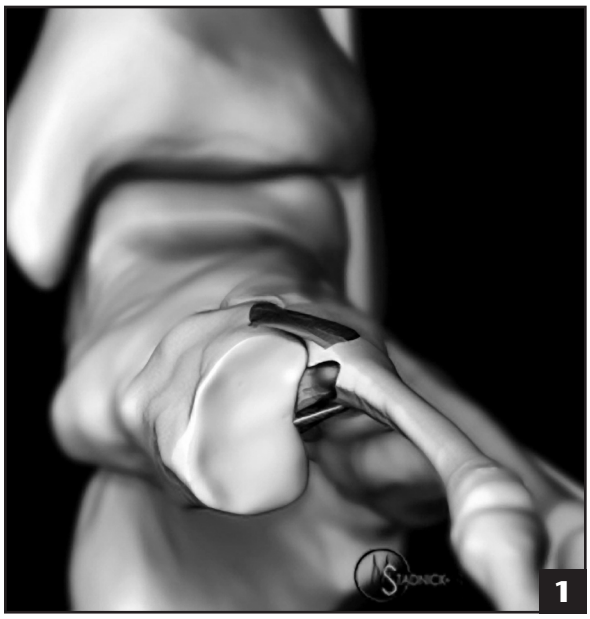

Figure 1. Lisfranc Ligament Complex. The top band is the dorsal, the middle band is the interosseous, and the lower band is the plantar component (Courtesy of Michael Stadnick, MD; Radsource, Brentwood, Tenn).

weight bearing might also suggest Lisfranc involvement. If the history and physical examination suggest Lisfranc involvement, diagnosis can be confirmed through comparison weight bearing radiographs.[1-3,5,9,12,13] An increased diastasis of greater than 1 mm bilaterally between the first and second metatarsals is considered diagnostic.[5] Nunley and Vertullo[5] classified 3 distinct stages of Lisfranc ligament sprains. The stage I injury involves no diastasis, stage II involves a diastasis of between 1 and 5 mm without evidence of longitudinal arch height loss, and stage III involves both a significant diastasis (greater than 1 mm) and a loss of longitudinal arch height.[5]

Some consensus exists on the diagnosis of these subtle injuries, but how to successfully manage these complicated injuries is still debated. Although Lisfranc classification systems have been developed that assist in standard terminology and diagnostic recommendations, they have not been correlated with outcomes.[2] Management recommendations usually revolve around whichever treatment will best result in a stable Lisfranc joint. Typically, stage III Lisfranc ligament injuries are surgically stabilized through open reduction and internal fixation.[3]

CASE REVIEW

A 22-year-old linebacker injured his left foot during the last play of the season's second game. He stated that he planted his left foot on the field turf to shuffle to his left, and he described experiencing a strange pain in his foot. He complained of pain in the midfoot region and was unable to ambulate without pain, especially during push off. The athletic training staff examined his foot and noted significant tenderness across the first to fourth tarsometatarsal joints and laxity at the first and second tarsometatarsal joints, with superior and inferior glides in comparison with the uninvolved foot. The patient denied pain with axial or compressive loads to the metatarsals.

The athlete was initially treated with an intermittent compression and cryotherapy unit. Following this treatment, a compression wrap was applied and he was instructed to elevate his foot overnight. He was placed in an ankle foot orthosis (AFO), given crutches, and instructed to remain non-weight bearing until his follow-up examination the next day.

During the follow-up examination, the athlete was unable to bear weight due to pain. Significant swelling and ecchymosis in the medial longitudinal arch and forefoot was noted. Non-weight bearing radiographs were negative for fracture. After 2 days of treatment consisting of cryotherapy, deep oscillation therapy, pulsed ultrasound, compression with an ERX Sport (Telesto Medtech, Belmont, Mass) therapeutic garment for the foot, rest, and the use of a temporary orthotic, the athlete stated that he was pain free while full weight bearing in the AFO. The temporary orthotic was made of Aquaplast (Sammons Preston Rolyan, Bolingbrook, Ill) and was intended to provide some support for the medial longitudinal arch. However, he was unable to progress to pain-free ambulation out of the AFO over the next 7 days. At this point, the team physician ordered weight bearing radiographs to rule out Lisfranc ligament involvement (Figures 2-5). The weight bearing radiographs showed first to second metatarsal diastasis of 3.7 mm and loss of longitudinal arch height. The team physician diagnosed a stage III Lisfranc injury and referred the athlete to a regional foot specialist for consultation. The specialist concurred with the diagnosis of a stage III Lisfranc injury and recommended an open reduction and internal fixation procedure, but the athlete decided to delay surgery until after the academic semester was complete.

The athlete continued with his treatment regimen, consisting of cryotherapy, deep oscillation therapy, use of the ERX Sport therapeutic garment, and ultrasound, along with full weight bearing ambulation using the temporary orthotic and AFO. Approximately 3 weeks post-

Figure 2. Left foot weight (WT) bearing AP view. Note the 3.7-mm diastasis between the first and second metatarsals.

Figure 3. Right foot weight (WT) bearing AP view, for comparison with Figure 2.

Figure 4. Left foot weight (WT) bearing lateral view. Note the drop of the midfoot complex relative to the first and fifth metatarsals.

Figure 5. Right foot weight (WT) bearing lateral view, for comparison with Figure 4. Note how the fifth metatarsal is more visible on this foot compared with the left foot in Figure 4.

injury, the athlete reported significant improvement in symptoms and function, and demonstrated the ability to perform heel raises and jog without pain. This progress was communicated to the team physician, and a discussion with the foot specialist, the athlete, and his parents was conducted to formulate a return-to-play decision. To determine the viability of return, a functional assessment was conducted, which involved running, cutting, pursuit drills, and blocking and tackling simulations. Following successful completion of this rigorous functional assessment over the course of 2 days, the team physician cleared the athlete for full participation.

For prophylactic support, the athlete's foot was taped with a longitudinal arch taping technique, along with an ankle taping and the temporary orthotic, which allowed him to fully participate for the next 2 weeks. When not practicing or participating in games, he continued to wear the temporary orthotic, AFO, and ERX Sport therapeutic garment. Treatments, including cryotherapy and deep oscillation therapy continued before and after activity. At the end of the 2 weeks, follow-up weight bearing radiographs were compared with the originals. No change was noted between these films. During the third game following return, the athlete sustained a season-ending midshaft fibula fracture caused by a direct blow. He continues to consider his treatment options following the completion of the season.

DISCUSSION

This specific management of a stage III Lisfranc ligament injury was unique and has raised some interest-

ing questions for future management and prognoses. It was surprising that an athlete with a diagnosed stage III Lisfranc joint would be able to return to full participation without immediate surgical intervention, especially a 6-ft, 245-lb athlete. Many factors influenced the management in this case; most notably, this athlete was a fifth-year senior who had returned after receiving a medical hardship waiver and was adamant about doing everything possible to be able to contribute to the team. He was also extremely compliant with our medical care, but he opted to delay his surgery until the post-season to avoid increased restraints on his academic responsibilities.

When the athlete approached the medical staff about his symptom resolution a few weeks after the injury, it was difficult to imagine that he would be able to run, let alone be able to play at a high level. Much to our surprise, this athlete was able to exceed and challenge our initial prognosis. He experienced some pain and performance limitations throughout his return-to-play, but he was able to perform at a high level during games. In addition, it appeared that his participation did not negatively affect the diastasis between the first and second metatarsals. Weight bearing radiographs obtained 2 weeks from the initial reentry, showed no further change in the alignment of the Lisfranc joint, compared with the original weight bearing radiographs. Further study of the implications of participation and delayed surgical intervention seems warranted. Knowledge of whether this early and progressive participation has any ill effect on his long-term outcomes, including degenerative arthritis, would be helpful in making the proper management decision and prognoses in future cases.

CONCLUSION

Lisfranc ligament sprains can be a challenging injury to diagnose and manage for unsuspecting clinicians. Although Lisfranc classification systems that assist in standard terminology and diagnostic recommendations have been developed, they have not been correlated with outcomes.[2] Most studies regarding treatment and management are retrospective case series. Recommendations do vary, but generally, surgical intervention has been recognized as helpful in achieving the goal of a more stable Lisfranc joint in stage II and III injuries.[1-3,5,8-10] Although we would not disagree, no long-term outcome studies assessing the differences between immediate and delayed surgical intervention have been done. This case demonstrates that an athlete might be able to successfully participate without such immediate intervention. As debate over the management of these complicated injuries continues to exist, we will continue to make return-to-play decisions on a case-by-case basis, utilizing both surgical intervention and conservative management strategies. Most importantly, this case highlights another possible management strategy following future diagnoses of stage III Lisfranc injuries.

IMPLICATIONS FOR CLINICAL PRACTICE

Lisfranc ligament injuries are becoming more common in the athletic population. A clinician's early recognition and diagnosis of these sometimes subtle injuries is the key to proper management. Clinicians should suspect a Lisfranc ligament sprain when an athlete has midfoot swelling, plantar ecchymosis, tenderness over the first and second tarsometatarsal joints, and pain with weight bearing. Diagnosis of these injuries can be confirmed through comparison weight-bearing radiographs. Although most stage III Lisfranc injuries are treated surgically, early immobilization and treatment might allow some athletes to return to activity without immediate surgical intervention. However, all cases should be managed on a case-by-case basis using both surgical intervention and conservative management strategies. ■

REFERENCES

1. DeOrio M, Erickson M, Usuelli FG, Easley M. Lisfranc injuries in sport. *Foot Ankle Clin*. 2009;14:169-186.
2. Desmond EA, Chou LB. Current concepts review: Lisfranc injuries. *Foot Ankle Int*. 2006;27:653-660.
3. Lattermann C, Goldstein JL, Wukich DK, Lee S, Bach BR. Practical management of Lisfranc injuries in athletes. *Clin J Sports Med*. 2007;17:311-315.
4. Mullen JE, O'Malley MJ. Sprains: Residual instability of subtalar, Lisfranc joints, and turf toe. *Clin Sports Med*. 2004;23:97-121.
5. Nunley JA, Vertullo CJ. Classification, investigation, and management of midfoot sprains: Lisfranc injuries in the athlete. *Am J Sports Med*. 2002;30:871-878.
6. Pease J, Miller M, Gumbuc R. An easily overlooked injury: Lisfranc fracture. *Mil Med*. 2009;174:645-646.
7. Meyer SA, Callaghan JJ, Albright JP, Crowley ET, Powell JW. Midfoot sprains in collegiate football. *Am J Sports Med*. 1994;22:392-401.
8. Curtis MJ, Myerson M, Szura B. Tarsometatarsal joint injuries in the athlete. *Am J Sports Med*. 1993;21:497-502.
9. Coetzee JC. Making sense of Lisfranc injuries. *Foot Ankle Clin*. 2008;13:695-704.
10. Mantas JP, Burks RT. Lisfranc injuries in the athlete. *Clin Sports Med*.

1994;13:719-730.

11. Hunt SA, Ropiak C, Tejwani NC. Lisfranc joint injuries: Diagnosis and treatment. *Am J Orthop*. 2006;35:376-385.
12. Shapiro MS, Wascher DC, Finerman GAM. Rupture of Lisfranc's ligament in athletes. *Am J Sports Med*. 1994;22:687-691.
13. Faciszewski T, Burks RT, Manaster BJ. Subtle injuries of the Lisfranc joint. *J Bone Joint Surg Am*. 1990;72:1519-1522.