PurposE and literatUre review

Previous literature reports the incidence of bipartite medial cuneiform to range between 0.3-2.4% (1). A more recent retrospective review of 1000 foot MRI’s at the University of California at San Diego from 2007-2013 determined the incidence to be closer to 0.1% (2). Lisfranc injuries account for approximately 0.2% of all fractures in the U.S with the highest of those coming from high-energy traumatic injuries. It is more common to occur in the third decade of life (3). Males are approximately four times more likely to sustain a Lisfranc injury (4). Only a few cases of a Lisfranc injury with a bipartite medial cuneiform have ever been documented. This case report presents one of a high-level collegiate football player and his subsequent surgical management, which while not a novel technique, is one that is increasing in frequency in patients who require a return to pre-injury activity level.

case study

A 21-year-old college athlete injured his right foot during a forced dorsiflexory injury while at football practice. Patient complained of global dorsal midfoot pain with difficulty WB and was placed in a CAM boot by McNeese State training staff. He followed up with our clinic the next day complaining again of dorsal midfoot pain that was increased with any weight bearing, had extreme pain on palpation to the dorsal midfoot, including the Lisfranc joint and medial and intermediate cuneiforms. There was also gross instability of his medial and middle columns when stressed in the sagittal plane. Weight-bearing films revealed just over 0.5cm diastasis of the medial cuneiform and second metatarsal base and also characteristic E-sign signaling potential bipartite cuneiform. Patient was sent for a MRI for further soft tissue evaluation which discovered not only the suspected increased attenuation of Lisfranc ligament but also a horizontal separation through the long axis of the medial cuneiform involving both the proximal and distal aricular surfaces. Increased signal intensity throughout the intramedullary aspect of the cuneiform was also noted.

Figure 1: Dorsoplantar view of injured right foot detailing diastasis of medial cuneiform and second metatarsal base.

Figure 2: Lateral nonweight-bearing film with characteristic “E sign” of bipartite medial cuneiform.

Patient underwent a right medial cuneiform open reduction with internal fixation, as well as a lisfranc repair. Cartilage was noted on the bipartite cuneiform surfaces with minimal cartilaginous damage. The cartilaginous surface was removed and the two bipartite segments were fused with two 2.4mm cannulated screws in parallel fashion in the dorsal-to-planter orientation perpendicular to the bipartite division. Attention was directed to the lisfranc repair which was repaired via Tightrope procedure using standard technique. Patient was placed in a posterior fiberglass splint and followed up accordingly.

His postoperative period was eventful and at the two week mark his sutures were removed and he was placed in a short leg nonweightbearing cast. At four weeks, he denied any pain and was allowed to transition to weight-bearing in a CAM boot. Six weeks postoperatively he was allowed to transition into his normal shoe gear with prefabricated orthotics. At twelve weeks postoperatively, he had returned to full activity. At his one year follow up, he denied any pain, no other complaints and no reoccurrence of deformity.

ANALYSIS AND DISCUSSION

The first description of a bipartite medial cuneiform was by Barlow in 1942 in which he cites a report by Morel in 1757. The theory is it develops due to not one but two ossification centers within the medial cuneiform. Typically, it results in two partitions, one dorsal and one plantar. The communication between the two fragments can be a fibrous syndesmosis, a cartilagnous synchondrosis, or a combination of the two. The majority of documented cases are incidental findings, however, symptomatic cases have increased in the last decade.

Many symptomatic patients are treated conservatively with high success via offloading by CAM boot and nonweightbearing status for a period of approximately six weeks. For those who failed conservative treatment, two surgical options have been reported: removal of the offending fragment or osteosynthesis of the two fragments.

Azuara et al, described a symptomatic bipartite medial cuneiform discovered after a traumatic injury in a 34 year old soldier (5). Due to his required active status, after failing conservative treatment he underwent osteosynthesis of the two cuneiform fragments with two 3.5mm fully threaded lag screws. At 12 weeks, he progressed to full activity and had total resolution of his pain. Choito et al performed a surgical excision of the painful fragment in a 32-year old female Olympic marathon runner, for which conservative treatment had failed and patient’s activity had drastically declined (6). After four months of postoperative treatment, she was back running at her pre-injury level. One other additional publication noted a lisfranc rupture in the setting of a bipartite cuneiform, such as our case, in which the patient underwent open reduction with internal fixation but no surgical details were given, nor of any follow up. (2)

With regards to the patient’s Lisfranc injury, there is also controversy regarding the appropriate treatment if patient is deemed a surgical candidate with the two options being arthrodesis or open reduction with internal fixation. Of course, several concepts need to be taken into account, including the extent of articular damage, number of joints affected, displacement, and number of fragments. However, only isolated ligamentous injuries will be discussed here, as this was the case in our patient. In support of primary arthrodesis, it has been well documented that those that undergo this type of procedure regain the majority of their pre-injury function and have lower complications (7). The negatives of this procedure are increased pain, stiffness, articular surface damage, and loss of the midfoot arch. Further evidence suggests it also leads to increased articular damage with increases in posttraumatic arthritis (8).

A more recent technique is the use of a suture button-fragment complex such as that used in syndesmotic injuries. This technique has been shown to be as effective as cannulated screw systems, regarding strength and stability (9). Chardon et al created five professional ballet dancers and two Division I soccer athletes with the suture-button technique with all seven returning to full activity at pre-injury level at six months (10). Their AOFAS midfoot score improved from a mean of 65 preoperatively to a mean of 97 postoperatively at the latest follow-up visit.

The success of the suture-button technique lies in that it restores the sagittal plane motion between the medial and middle columns of the foot without compromising the integrity of the Lisfranc ligament attachments. It was well documented that this sagittal plane motion is a necessity for adequate midfoot stability (11) which is crucial in the highly-active patient population, such as collegiate athletes, where the need to return to pre-injury level is imperative.

In conclusion, our case demonstrates surgical techniques to allow the high-level athlete to return to full pre-injury activity as soon as possible with this particular set of injuries. The suture-button complex has shown very effective at restoring the medial-column-middle column relationship in an isolated Lisfranc ligament rupture. Additionally, we have proven that osteosynthesis of the rare bipartite medial cuneiform fragments not only reduces symptomatic pain, but also allows for a stable construct for Lisfranc repair.

Figure 3: T2 MRI image showing ruptured Lisfranc ligament with increased signal

Figure 4: Axial T1 image revealing bipartite medial cuneiform with dorsal and plantar fragments. intensity.

Figure 5: DP postoperative NBW film demonstrating two interfrag screws with tight rope fixation.

Figure 6: Postoperative lateral NBW view detailing interfrag screws for osteosynthesis of medial cuneiform fragments with tight rope in place for lisfranc repair.

Some surgeons prefer to then perform a hardware removal once healing has occurred to combat these complications, which has shown to be effective, however, this comes with the expense of an additional procedure.

References
