The case:

A 19-year-old football quarterback was tackled, felt a pop in the plantar aspect of his great toe, and experienced significant pain. He immediately could not bear weight or walk, and subsequently developed ecchymosis about the great toe and medial forefoot. After clinical evaluation, magnetic resonance images were obtained (Figure).

Your diagnosis?

For answer see page 690
This is a classic presentation of traumatic dislocation of the tibial sesamoid of the hallux in a young adult football quarterback. After being tackled, this patient felt a pop in the plantar aspect of his great toe and experienced significant pain. He immediately could not bear weight or walk, and subsequently developed ecchymosis about the great toe and medial forefoot. The following discussion will encompass the mechanism of injury, hallux sesamoid capsuloligamentous anatomy, clinical evaluation, imaging, and treatment of sesamoid dislocation (otherwise known as turf toe).

MECHANISM OF INJURY

Traumatic dislocation of the hallux sesamoids is an uncommon injury, with displacement of one or both sesamoids either medially, laterally, proximally, or distally. There has even been a rare report of sesamoidal dislocation into the interphalangeal joint of the great toe in the literature. More common traumatic injuries of the hallux sesamoids include sesamoiditis, osteochondrosis, contusions, fracture and diastasis of a bipartite sesamoid. Sesamoid dislocation can occur in conjunction with a spectrum of traumatic capsuloligamentous injuries of the first metatarsal-phalangeal (MTP) joint known as turf toe.

Artificial turf was first placed in the Houston Astrodome in 1966. Turf toe was first described by Bowers and Martin in 1976 as a soft tissue hyperextension injury to the MTP joint of the great toe that occurred in football players only after the installation of AstroTurf on West Virginia University’s football field. Bowers and Martin recognized that injuries occurred with axial loading applied to the posterior leg of a foot fixed in equinus, resulting in hyperextension force at the hallux MTP joint.

The spectrum of turf toe injuries includes capsulitis, partial or complete disruption of the plantar plate, contusions, hallux limitus, traumatic hallux valgus, first MTP joint dislocation, or fractures and osteochondral lesions of the first metatarsal head and proximal phalangeal base. Valgus-directed forces are a common variation that can result in injury to the medial collateral ligament, plantar medial complex, medial head of the flexor hallucis brevis tendon, or tibial sesamoid. Turf toe can also occur in sports such as soccer, basketball, tennis, wrestling and gymnastics.

Injuries to the plantar capsuloligamentous complex are attributed to harder playing surfaces and lighter shoes used to increase traction and speed on artificial surfaces. Prevention of injuries with stiffer shoes is advocated by placing carbon fiber or graphite orthotic devices into the playing shoes, with or without a full steel plate or partial plate in the forefoot.

ANATOMY

The anatomy of the hallux sesamoid complex has been well elucidated through cadaveric and in vivo imaging studies. The tibial (medial) and fibular (lateral) sesamoids are embedded within the medial and lateral heads of the flexor hallucis brevis tendons and plantar plate, which is the...
thickened, central portion of the first MTP joint capsule. The abductor hallucis tendon attaches onto the medial aspect of the tibial sesamoid and extends distal to the medial plantar base of the proximal phalanx, and blends with the joint capsule. The adductor hallucis tendon attaches to the lateral aspect of the fibular sesamoid as well as the joint capsule. The flexor hallucis longus tendon is located between the 2 sesamoids in the groove formed by the plantar plate, but does not attach onto either sesamoid.

Each sesamoid is attached to the metatarsal head and proximal phalanx by several ligaments. The tibial sesamoid is anchored medially by the medial sesamoid ligament, also known as the medial metatarsosesamoid and sesamoid phalangeal ligaments. The fibular sesamoid is anchored laterally by the lateral sesamoid ligament, also known as the lateral metatarsosesamoid and sesamoid phalangeal ligaments. The sesamoids are separated by a small osseous ridge in the first metatarsal head, but connected by the intersesamoid ligament and plantar plate.

**Clinical Evaluation**

Physical examination of patients with sesamoid dislocation reveals maximal tenderness overlying the involved sesamoid, ecchymosis and/or swelling. The MTP joint range of motion (ROM) is gently tested with varus and valgus stress to evaluate collateral ligaments; the dorsoplantar (vertical) drawer test is used to evaluate the plantar plate.

Sesamoid dislocation is included in traumatic first MTP joint dislocation classification, and can be divided into 2 types of injuries. Type I injuries involve dislocation of the hallux with the sesamoids, and they are usually irreducible. Type II injuries are usually reducible, and there is disruption of the intersesamoid ligament (type II A, as in this case), transverse fracture of 1 or both sesamoids (type IIB), or complete disruption of the intersesamoid ligament and fracture of 1 of the sesamoids (type IIC). Rarely, dislocation of the first MTP joint can also entrap soft tissue structures, such as the flexor hallucis longus tendon.

The grading system for turf toe injuries reflects ligamentous sprains that are relatively mild stretching injuries (grade I), partial (grade II), or full-thickness tears (grade III). Patients with grade I injuries have mild symptoms such as attenuation of the plantar structures, focal swelling, and minimal ecchymosis. Patients with grade II injuries have partial tearing of the plantar structures, moderate swelling, and restricted motion. Grade III injuries are the most severe and include complete disruption of the plantar structures, significant swelling/ecchymosis, hallux flexion weakness, and instability of the hallux MTP joint. Our case report is classified as a grade III turf toe injury.

**Imaging**

After proper clinical evaluation, radiographs may be obtained to identify any fractures, dislocations, or alterations in the joint spaces. Sesamoid dislocations are easily identified on weight-bearing anteroposterior (AP), lateral, and sesamoid views. Bilateral AP images have been advocated to assess any subtle proximal migration of 1 or both sesamoids, reflecting a disruption of the plantar complex. However, routine radiographs cannot delineate the extent of soft tissue injuries to the plantar plate and ligamentous structures. Forced dorsiflexion lateral radiographs or fluoroscopy are helpful adjuncts for the evaluation of turf toe, allowing visualization of sesamoid tracking in cases of possible plantar plate disruption. The patient pushes the plantar forefoot against a fixed surface and hyperextends both hallux MTP joints. If there is a lack of distal sesamoid excursion with toe extension, the plantar capsuloligamentous complex is disrupted.

Historically, metatarsophalangeal joint arthrography was performed for diagnosing rupture of the plantar plate. Arthrography was performed by placing a 25-gauge needle from a dorsal approach into the MTP joint and injecting 0.5 to 1 cc of contrast. If contrast communicated with the flexor tendon sheath, then plantar plate rupture was diagnosed. However, this invasive technique is now uncommonly used.

Magnetic resonance imaging (MRI) and sonography are the next imaging modalities of choice. Magnetic resonance imaging is recommended for evaluation of patients with radiographic abnormalities and grade I and II injuries. Evaluation of the hallux capsuloligamentous complex is best achieved with a high field strength magnet, dedicated surface coil, small field of view, and multiple imaging planes and sequences. Magnetic resonance imaging was obtained in this case of traumatic dislocation of the medial sesamoid to more fully evaluate the extent of soft tissue. Magnetic resonance imaging also demonstrated rupture of the intersesamoid ligament, rupture of the adjacent medial aspect of the plantar plate, medial head of the flexor hallucis brevis tendon, and medial sesamoid ligament (Figure 1).

Sonographic evaluation of the hallux sesamoid complex is made with a linear array high-frequency transducer (11-17 MHz), such as the hockey stick footprint probe. Sonography has proven to be highly accurate in the hands of experienced radiologists for the detection of plantar plate injuries. The position of the echogenic sesamoids can be evaluated relative to the first metatarsal head, plantar plate, and flexor hallucis longus tendon. Furthermore, the integrity of the plantar plate can be assessed. The normal plantar...
■ radiologic case study

Plate will be a homogeneous and slightly hyperechoic central fibrocartilaginous structure along the plantar aspect of the MTP joint, located between the flexor hallucis longus tendon and metatarsal head cartilage. Tears will be evident as hypoechoic or echogenic defects. The sensitivity of sonography proved to be superior to MRI in a study of 320 plantar plates, with 96% sensitivity for lesions with sonography and 87% sensitivity with MRI compared with surgical results.

TREATMENT

The vast majority of patients with turf toe are treated nonsurgically, beginning with rest, ice, compression, and elevation. Nonsteroidal anti-inflammatory drugs are used for pain management. Patients with grade I sprains have mild symptoms (attenuation of the plantar structures, focal swelling, and minimal ecchymosis), are treated symptomatically, and can return to sports as tolerated. Minor injuries are treated with gentle ROM exercises. Stiff-soled shoes, nocturnal bracing, and walking cast with toe spica extension in slight plantar flexion are treatment options, depending on the severity of injury. Patients with grade II sprains are often treated with walking boots or crutches, and athletes may not return to their activities until 2 to 6 weeks postoperatively.

This case report of sesamoid dislocation falls into the category of grade III turf toe injury. Grade III injuries can be treated with either long-term immobilization or surgical reconstruction, with a 6- to 10-week delay in return to sports if successful with nonoperative treatment. Indications for surgical treatment include a large capsular avulsion with unstable joint, diastasis of bipartite sesamoid, diastasis of...
fact that fluoroscopic imaging
level football, as well as the
to the severity of his grade IIA
constructive surgery of the
of running in a straight line at
weeks in a boot, then gradual
with no weight bearing on the
patient will be instructed to
in his rehabilitation therapy,
pair. Although he is still early
sion of the sesamoid complex,
ion only, maintaining excur-
the toe splint 5 to 7 days post-
tive fluoroscopic images dem-
ophalanx (Figure 2). Intraopera-
tar plate and medial head of
sessed of reattaching the plan-
sion of the hallux. Surgery con-
noted no distal excursion of
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