Fractures and Dislocations of the Forefoot: Operative and Nonoperative Treatment

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Abstract

Effective treatment of common bone injuries of the forefoot is dependent on a clear understanding of both the osseous anatomy of the foot and the biomechanics of gait. Obtaining a thorough history and performing a careful physical examination are especially important because the complex anatomy of the region often makes radiographic diagnosis difficult. The keys to making the correct diagnosis in the injured forefoot are detailed, with emphasis on obtaining the appropriate radiographic studies. Included in the discussion are injuries to Lisfranc's joint and the metatarsophalangeal and sesamoid joints, as well as metatarsal and phalangeal fractures. Guidelines for operative and nonoperative management of these injuries are presented.

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The forefoot, strictly defined, encompasses the tarsometatarsal joint (Lisfranc's joint) complex and the portion of the foot distal to it. Injury to the forefoot has a potential for chronic disability if a correct diagnosis is not made. However, a correct diagnosis is often difficult to make because the complex anatomy involves overlapping structures, which may produce confusing radiographic images. Other injuries, such as a Lisfranc's joint sprain, may require weight-bearing radiographic views to make the diagnosis clear. Fortunately, the diagnosis of most forefoot injuries is fairly straightforward when a good history is obtained, a careful physical examination is performed, and the results of a thorough radiographic evaluation are considered in light of a basic knowledge of anatomy. Once diagnosis is certain, therapeutic decisions range from simple to complex.

This review will describe the appropriate diagnostic and therapeutic management of forefoot fractures and dislocations from Lisfranc's joint to the metatarsals and the phalanges, with the exception of injuries to the base of the fifth metatarsal and compartment syndromes of the foot, which will be covered in other reviews.

Anatomy

Lisfranc's joint is the stable arch articulation between the tarsus (distally defined by the three cuneiforms and the cuboid) and the five metatarsals. This joint complex creates the "metatarsal break," an oblique line running from the lateral aspect of the proximal forefoot to the medial aspect of the distal forefoot. The stability of Lisfranc's articulation is a result of its osseous architecture (Fig. 1). The three medial metatarsals articulate with the three cuneiforms, while the fourth and fifth metatarsals articulate with the cuboid. The second metatarsal is the longest of the metatarsals.[1] In the frontal plane, the three cuneiforms form a recess or notch in which the second metatarsal sits, locking it into position. When viewed in sagittal and transverse sections, the three medial metatarsals are broader dorsally than plantarly. These wedge shapes combine to form a configuration resembling the keystone of a Roman arch. The cuneiforms effectively lock in the base of the second metatarsal and prevent mediolateral metatarsal motion at Lisfranc's joint. Similarly, the Roman-arch configuration of the bases of the three medial metatarsals strongly resists their plantar displacement.[1-3]

Lisfranc's joint has limited soft-tissue support, provided primarily by the joint capsule and ligaments. The most substantial structure is Lisfranc's ligament, which runs from the plantar aspect of the medial cuneiform to the base of the second

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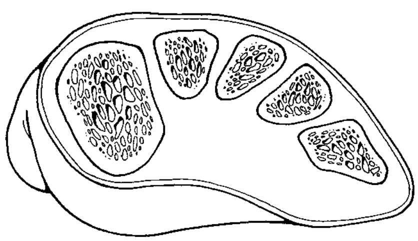

Fig. 1 **Top,** Osseous and ligamentous anatomy of the tarsometatarsal (Lisfranc's) joint. **Bottom,** Roman-arch anatomy of the five metatarsal bones.

metatarsal, in effect connecting the lateral four metatarsals to the medial side of the forefoot.[2] Additional plantar support is provided by the plantar fascia and the peroneus longus tendon. The second, third, fourth, and fifth metatarsal bases are interconnected both dorsally and plantarly by transverse ligaments, but there is no intermetatarsal ligament between the first and second metatarsals, which creates an area of relative weakness between the first metatarsal and the other four.

The arterial supply to the forefoot includes contributions from the posterior tibial, lateral plantar, and dorsalis pedis arteries. The dorsalis pedis crosses Lisfranc's joint and dives between the first and second metatarsals to form the plantar arterial arch at the proximal aspect of the first intermetatarsal space.[3] Thus, with any tarsometatarsal dislocation, the dorsalis pedis artery is at risk for injury as a result of the initial dislocation itself or the operative repair of the dislocation. However, even with a disruption of the communication between the dorsalis pedis and the plantar arch, the vascularity of the forefoot is usually not compromised unless the posterior tibial or lateral plantar artery is also injured.[2]

The interosseous muscles originate from the shafts of the metatarsals. The plantar interosseous muscles insert into the associated phalanges of each ray. The dorsal interosseous muscles, however, originate from adjacent metatarsals and insert into the proximal phalanx of the ray of the more medial metatarsal. Distally, the metatarsals are connected by the deep transverse metatarsal ligaments. These soft-tissue structures limit displacement of an isolated metatarsal shaft fracture. The plantar flexion force of both the intrinsic flexors (musculi interossei and lumbricales) and the extrinsic flexors tends to produce plantar displacement and angulation of metatarsal neck fractures. As the amount of plantar flexion increases, the extrinsic extensors lose their mechanical advantage, and displacement becomes greater.

Restoration of the normal biomechanics of the forefoot should have a high priority in the treatment of a forefoot injury. Normally, the metatarsal heads bear 50% of the weight in normal flat-footed stance.[4] The first metatarsal carries twice the load of each lesser metatarsal head (with each lesser head bearing an equal amount of load). Fracture displacement in the sagittal plane should be reduced to restore this relationship of the metatarsal heads so that excessive pressure is not borne by any one. In addition, the relative lengths of the metatarsals must be maintained to ensure proper forefoot mechanics.

Understanding the complex anatomy of the first metatarsophalangeal (MTP) joint is key in the diagnosis and treatment of injuries to it. Stability is provided both by joint congruence and by the surrounding ligaments. The convex head of the first metatarsal articulates with the concave base of the proximal phalanx. The supporting ligamentous structures are virtually circumferential, with the collateral ligaments and the plantar plate combining to provide joint stability in both flexion and extension. The plantar plate is a thick fibrocartilaginous structure with strong attachments to the base of the proximal phalanx and thin attachments to the metatarsal neck. The true collateral ligaments tighten in flexion, and the plate becomes taut in extension. With extreme dorsiflexion, the weaker proximal attachments to the metatarsal neck are usually the site of failure.[1,2,5,6]

Continuous with the plantar plate is the sesamoid complex (Fig. 2). During extension of the first MTP joint, the sesamoid bones are pulled distally by their attachments to the plantar plate. The sesamoids articulate with the first metatarsal head and are contained within the substance of the flexor hallucis brevis tendons. The medial (tibial) sesamoid serves as a point of insertion for the abductor hallucis and the medial head of the flexor hallucis brevis.[2] The lateral (fibular) sesamoid serves as the insertion for the lateral head of the flexor hallucis brevis and the tendon of the adductor hallucis. Between the sesamoids lies the flexor hallucis longus tendon as it travels to insert into the base of the distal phalanx of the hallux. A strong interosseous ligament holds the two sesamoids together. The sesamoids provide a mechanical advantage to the flexor hallucis bre-

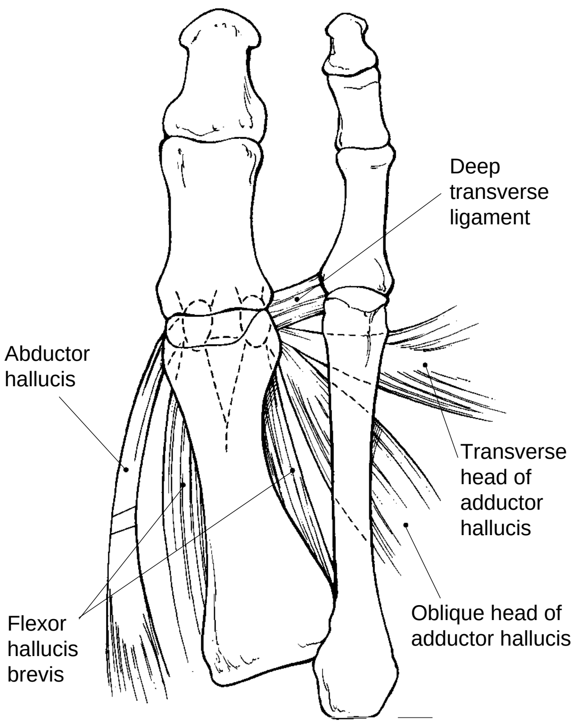

Fig. 2 The first MTP–sesamoid complex. The sesamoids articulate with the first metatarsal head and are contained within the substance of the flexor hallucis brevis tendons. The medial (tibial) sesamoid, situated directly beneath the medial condyle of the first metatarsal head, is a point of insertion for the abductor hallucis and the medial head of the flexor hallucis brevis. The lateral (fibular) sesamoid extends laterally beyond the metatarsal head into the web space between the heads of the first and second metatarsals and serves as the insertion for the lateral head of the flexor hallucis brevis and the tendon of the adductor hallucis. A strong interosseous ligament holds the sesamoids together.

vis and also assist in the weight-bearing function of the first ray. The tibial sesamoid is situated directly beneath the medial condyle of the first metatarsal head. The fibular sesamoid extends laterally beyond the metatarsal head into the web space between the heads of the first and second metatarsals.

The sesamoids develop from one or more ossification centers. Failure of fusion of the centers may result in partitioned (most commonly, bipartite or tripartite) sesamoids. Separate ossification centers persist more often in the tibial sesamoid. Bipartite sesamoids may be bilateral and symmetrical, and the presence of a partitioned sesamoid in the contralateral foot can help distinguish a partitioned sesamoid from a fresh fracture.[2,7] Inge and Ferguson,[8] however, found multipartite sesamoids to be unilateral in 75% of the patients in their study and bilateral in only 25%.

Tarsometatarsal (Lisfranc's) Joint Injuries

Injury to Lisfranc's joint is probably more common than is reported in the literature because it is sometimes difficult to diagnose, which often results in delay of treatment. Early recognition is the key to preventing long-term disability. Typically, patients complain of forefoot pain and note an inability to bear weight on the foot. When the joint is dislocated, gross deformity and swelling can make the diagnosis obvious. Partial reduction is common, however, and swelling may be the only obvious finding in subluxated joints.

Radiographic Findings

Anteroposterior (AP), 30-degree oblique, and lateral radiographs are required to evaluate an injury to Lisfranc's joint. It is important to include the entire foot and ankle as well. Comparison views are frequently helpful in both the diagnosis of dislocation and the determination of the adequacy of reduction. The 30-degree oblique plain radiograph will "open up" the bases of the lateral metatarsals, allowing the most complete evaluation of the joint complex.[3] A consistently reliable x-ray finding in the normal, uninjured tarsometatarsal articulation is the alignment of the medial borders of the second and fourth metatarsals on the tarsus. The medial edge of the second metatarsal should parallel the medial border of the second cuneiform on both AP and oblique projections. Furthermore, the first intermetatarsal space should align with the intertarsal space between the medial and middle cuneiforms. Likewise, on the medial oblique view of the foot, the medial border of the fourth metatarsal should align with the medial border of the cuboid. Also, the intermetatarsal space between the second and third metatarsals should be continuous with the intertarsal space between the middle and lateral cuneiforms.[1-3] Finally, on the normal lateral x-ray projection, a metatarsal should never lie more dorsal than its respective tarsal bone.

Subtle findings on radiographs may be the only indication of a significant Lisfranc's joint injury. Careful evaluation for such subtle findings is mandatory because a spontaneous reduction of a fracture-dislocation may have occurred, and even a minimally subluxated Lisfranc's joint may cause significant residual impairment. Any fracture of the base of the second metatarsal, even a small avulsion fracture, should make one suspect a tarsometatarsal injury. Wiley[9] pointed out the frequent association of fractures of the base of the second metatarsal and the cuboid with a tarsometatarsal dislocation. Any loss of the alignment of the medial borders of the second and fourth metatarsals with the medial borders of the middle cuneiform and cuboid should be considered a sign of subluxation of this joint. Displacement of the metatarsals on lateral radiographs dorsally or, less commonly, plantarly implies a significant injury to the Lisfranc's joint complex.

If there is any question about the presence of an injury to Lisfranc's joint, weight-bearing AP views should be obtained. These views will often show a widening of the first intermetatarsal space of more than 2 mm, which is an indication of joint subluxation (Fig. 3, A and B).[10]

Faciszewski et al[11] reported on the long-term results in a group of 15 patients with subtle Lisfranc's joint injuries, defined as a diastasis measuring 2 to 5 mm between the bases of the first and second metatarsals on the postinjury AP radiograph. Despite the modest appearance of these injuries, 7 of the 15 patients had persistent disability and pain.

Mechanism of Injury

A knowledge of the mechanism of injury is useful in understanding both the classification and the appropriate reduction maneuvers. The three most common injury patterns are twisting of the forefoot, axial loading with the foot fixed in equinus angulation, and crushing. The forces producing these injuries are either direct (crush) or indirect (axial load in equinus). Twisting injuries are commonly seen in equestrians when the forefoot is sharply abducted on the tarsus.[12] With severe abduction, the cuboid can be fractured as a result of compression by the bases of the fourth and fifth metatarsals. Fractures of the metatarsal bases (most commonly the base of the second metatarsal) also occur with this abduction mechanism. Axial loading can occur with a blow to the heel or can be the result of the patient's body weight being placed on the foot with the ankle in extreme equinus. The axial load causes the metatarsals either to displace as a group (a homolateral dislocation) or to split apart.[13] The metatarsals can split in an isolated

A B C

Fig. 3 **A,** Non-weight-bearing AP radiograph of the left foot after a twisting injury . **B,** A weight-bearing stress view reveals further subluxation of the second metatarsal. **C,** Postoperative radiograph after open reduction and internal fixation of the Lisfranc's fracture-dislocation.

pattern, with only the first metatarsal displacing medially, or in a divergent pattern, with the first metatarsal displacing medially and the second through fifth metatarsals displacing laterally as a group. Crushing results in displacement of the metatarsals in the direction of the force, usually plantarward.[9,13] Reversing the mechanism of injury often can achieve, or at least facilitate, reduction of dislocation of this joint.

Treatment

The goal of treatment is a stable, plantigrade, painless foot.[1-3,14] Effective treatment requires anatomic reduction and secure fixation. It is imperative to demonstrate weight-bearing stability if nonoperative treatment is to be undertaken.[3] Nondisplaced injuries with a normal appearance on weight-bearing stress radiographs (i.e., sprains) can be treated with a short-leg cast and non-weight-bearing immobilization for 6 weeks.

With any degree of displacement, anatomic reduction becomes essential. Closed reduction and cast immobilization are insufficient; rather, closed reduction and percutaneous pin fixation or open reduction and screw fixation is recommended for the displaced Lisfranc's fracture-dislocation.[1-3,13]

Closed reduction can be blocked by an entrapped tendon or ligament, creating a complex dislocation and an absolute indication for an open reduction. DeBenedetti et al[15] emphasized that the complex dislocation with an entrapped tibialis anterior tendon occurs only with lateral dislocations of the first metatarsal. Other reports have noted that reduction can be blocked by displacement of the tibialis anterior tendon between the middle and medial cuneiforms.[2] Superior dislocation of the peroneus longus tendon may also prevent reduction of the lateral tarsometatarsal joints. A third (actually the most common) cause of a blocked reduction is the interposition of a fracture fragment from the base of the second metatarsal.[2] The avulsed fragment remains attached to Lisfranc's ligament and prevents concentric reduction of the second metatarsal into the cuneiform mortise.

Open reduction utilizing a longitudinal dorsal incision over the second metatarsal is the safest method. This incision allows access to the first, second, and third rays. A second parallel incision over the fourth interspace may be used to access the fourth and fifth rays when necessary.

During the operative exposure of the first interspace, care must be taken to avoid injury to the dorsalis pedis artery and the sensory branch of the deep peroneal nerve, which are in the area of dissection.[3] The most stable fixation can be achieved with two or three partially threaded 4.0-mm AO screws placed from the metatarsals into the cuneiforms and the cuboid. Although such screws cross (and damage) articular surfaces, a more secure restoration of anatomy is possible than can be achieved with wires or pins (Fig. 3, C).

Initial postoperative management is with a splint, toe-touch weight-bearing on crutches, and early range-of-motion exercises. Progressive weight-bearing as tolerated is instituted after 6 weeks. To avoid breakage, the screws should be removed before commencement of full weight-bearing (usually 12 weeks postoperatively).[13] Injuries to Lisfranc's joint can be disabling, and salvage may require joint fusion if arthritis develops or if displacement was not addressed in the initial treatment.[14]

Metatarsal Shaft Fractures

Because of their unique and complex nature, fractures involving the base of the fifth metatarsal shaft are presented in a separate article in this issue. While a twisting injury can produce a spiral fracture, the most common mechanism of shaft fracture is a direct blow to the foot, most commonly affecting the second, third, and fourth metatarsals.[3] Avulsion fractures of the base of the fifth metatarsal and stress fractures of the neck of the second, third, and fifth metatarsals are also commonly seen.

Shaft fractures with minimal or no displacement should be treated in a short-leg walking cast for 3 weeks, followed by weight-bearing as tolerated in a well-padded shoe. Moderate displacement in the frontal plane is usually well tolerated when only the second, third, or fourth metatarsal is involved.

Persistent medial or lateral displacement of the first or fifth metatarsal should be reduced by either open or closed means and fixed with Kirschner wires or screws. Residual frontal displacement of either of these metatarsals will widen the foot and may later cause footwear problems.

Dorsal or plantar displacement of any fracture in the sagittal plane will change the weight-bearing characteristics across the metatarsal heads. Reduction and fixation of these displaced fractures should be undertaken to avoid deformity. Usually, the displacement can be reduced by closed manipulation, and the position can be maintained with percutaneously placed 0.0625-inch Kirschner wires for 4 to 6 weeks while healing occurs.

Stress fractures of the shaft result from repetitive stresses, which cumulatively lead to fatigue fractures of the bone, commonly referred to as "march fractures" because of their high incidence in military recruits.[14,16] Athletes commonly sustain these fractures, but they also occur after procedures to correct hallux valgus and hallux rigidus, in which the weight-bearing distribution to the lesser metatarsal heads is changed.[2,3,13]

The diagnosis of a metatarsal stress fracture is usually straightforward. The patient presents with complaints of localized pain and tenderness. Careful questioning will often elicit the history of a change in the patient's level of activity, although these changes in activity may be quite subtle. The sensitivity of radiographs varies, especially early in the course of injury. When the clinical picture indicates a stress fracture but the radiographs appear normal, a technetium-99m bone scan should be performed. Because it is extremely sensitive, the scan will depict virtually all metatarsal stress fractures. Treatment of metatarsal stress fractures involves restriction of activity for approximately 3 to 4 weeks. When these fractures are displaced in the sagittal plane, operative reduction and pin fixation is indicated to prevent abnormal transfer of weight-bearing to the other metatarsals.[2,13]

Fractures of the metatarsal heads usually result from a direct blow to the foot, and multiple metatarsals are frequently involved. Allowing displaced fractures to persist will disrupt the normal weight-bearing across the forefoot. Closed reduction of displaced fractures with finger (toe) traps is usually successful and often stable. The reduction should be protected by a short-leg walking cast with a toe plate. If the closed reduction is unstable, percutaneous pinning with 0.0625-inch Kirschner wires is required. Only on rare occasions is open reduction and pin fixation required with a fracture of this type.

First MTP Joint Injuries

The most common injury to the first MTP joint is a sprain resulting from forced hyperextension beyond the normal range of dorsiflexion (usually about 90 degrees). This injury is referred to as "turf toe" because of its frequent occurrence in football players on artificial turf.[2,13,17]

The injury results from wearing a flexible shoe while playing on a relatively hard surface. Stiff-soled shoes are useful in protecting the joint from this injury. Extreme dorsiflexion of the first MTP joint results in subluxation accompanied by stretching of the plantar capsule and plantar plate. Because a fracture rarely is visible, there is a tendency to underdiagnose and undertreat this injury, which may then continue to produce disabling pain for several weeks, particularly in the active athlete. This sprain should be treated initially with rest, ice, elevation, and compression until the initial swelling has subsided and then by splinting the first toe to the second with nonconstrictive taping. Most injuries are painless by 3 weeks after the injury, and the athlete can return to play using a modified athletic shoe with a molded plastic or spring-steel innersole to prevent another episode of hyperextension. Reinjury, however, is frequent, and recovery can be prolonged, with some patients remaining symptomatic for 10 weeks or longer.

Frank dislocation of the first MTP joint is almost always dorsal in direction. Jahss classified these dislocations into two types (Fig. 4).[5] Type I dislocations occur with disruption of the sesamoid–plantar plate complex through the relatively weak proximal attachments of the plate to the metatarsal neck. There is no injury to the intersesamoid ligament, and the space between the sesamoids is not widened when viewed on the plain AP radiograph. The sesamoids come to lie between the joint surfaces just dorsal to the metatarsal head, which can be visualized on a lateral radiograph. This complex injury pattern is not reducible by closed means because the plantar plate is interposed into the MTP joint.

Type II injuries involve a disruption of the sesamoid complex and are subclassified into types IIA and IIB. In type IIA dislocations, the intersesamoid ligament has been disrupted, and radiographs reveal widening of the space between the sesamoids and dislocation of the metatarsal head into or through the sesamoid split. Type IIB injuries produce a transverse fracture through one or both sesamoids. The proximal fracture fragment remains in its normal relationship to the adjacent sesamoid, held in place by the intersesamoid ligament. Frequently, the distal sesamoid fragment becomes a loose body within the joint and may require surgical removal.

It is important to distinguish between type I and type II first MTP joint dislocations because open reduction will be required in the complex type I dislocation, whereas closed means can usually achieve reduction in both patterns of the type II dislocation. However, operative treatment may be necessary for removal of the loose intra-articular fragment in a type IIB dislocation.[2,5]

If an initial attempt at closed reduction of a first MTP joint dislocation fails, a complex type I dislocation should be suspected. The impediment to reduction is usually entrapment of the metatarsal head by the interposed plantar plate. Such a complex dislocation can be openly reduced either through a transverse plantar incision, with care to avoid injury to the digital nerves, or through a dorsal approach.[6] The dorsal approach is considered the safer of the two and is our preferred method. Once opened, the joint can usually be reduced by lifting the plantar plate–sesamoid complex with a small periosteal elevator. Occasionally, it is necessary to release the adductor tendon and the deep trans-

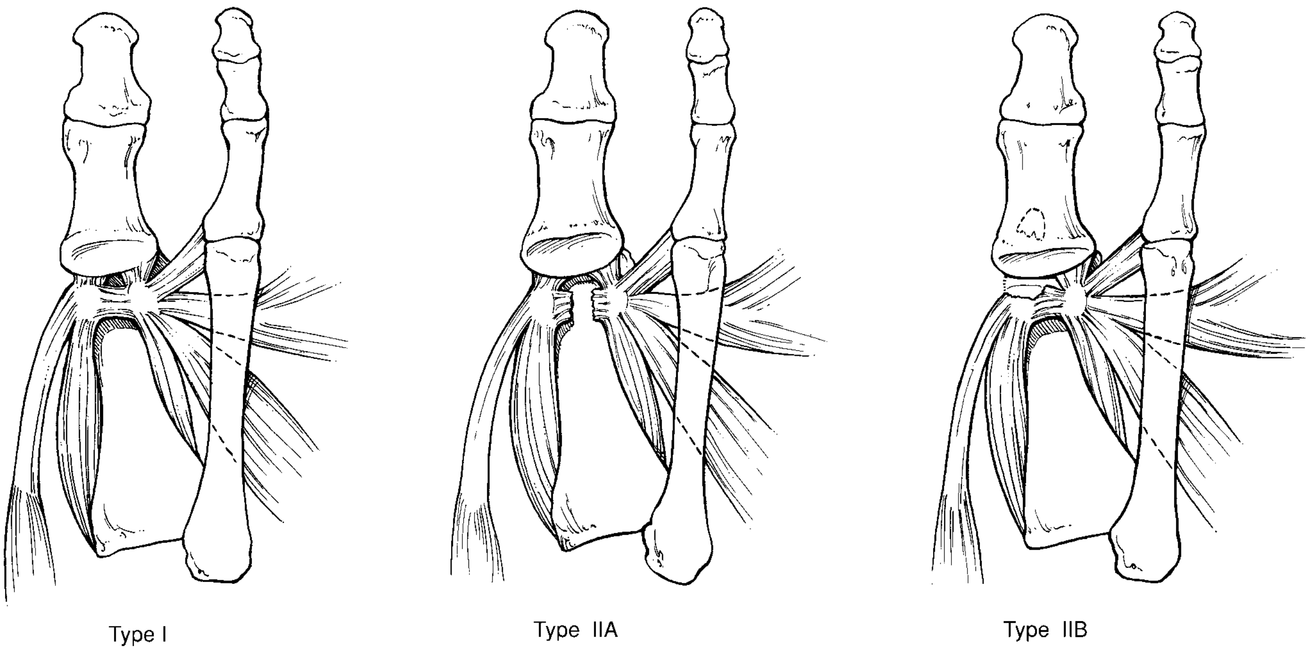

Fig. 4 The Jahss classification of first MTP joint dislocations. Type I is a complex dorsal MTP dislocation, which requires operative reduction. In a type IIA dislocation, the intersesamoid ligament is torn; the injury can usually be reduced closed. In a type IIB dislocation, there is a fracture through one or both sesamoids (in this illustration the tibial sesamoid is fractured).

verse metatarsal ligament sharply from the lateral side of the plantar plate to allow the toe to reduce.

Closed reduction of type II injuries is performed manually with gentle traction and hyperextension of the MTP joint. Postmanipulation radiographs are required to ascertain that an adequate reduction has been achieved and that no intra-articular fracture fragment remains.

Because of the osseous architecture, first MTP joint dislocations are usually stable once reduced. Operative repair of the capsule is not necessary, and a period of 4 weeks of cast or even stiff-soled shoe protection is sufficient to obtain stable healing.

Sesamoid Fractures

Sesamoid fractures result from avulsion forces, overuse, or direct trauma. The medial (tibial) sesamoid is more commonly injured than the lateral (fibular) sesamoid because of its direct weight-bearing position under the first metatarsal head.[7,8,13] Acute fractures present with tenderness directly over the involved sesamoid.

Radiographic evaluation should include AP, lateral, and tangential views[2] (Fig. 5). A sesamoid fracture can be distinguished from partition (the failure of fusion of the ossification centers) by the sharp appearance of the fracture surfaces, which are usually transverse in orientation, and the lack of a dense layer of subchondral bone. In contrast, the fragments that result from a failure of fusion have sclerotic edges. Failure of fusion is bilateral and symmetrical in about one in four cases. Another radiographic characteristic that can be used to differentiate a partitioned sesamoid from a fractured one is the total size of the sesamoid. A partitioned sesamoid is larger than a single sesamoid; with a fracture, the sum of the parts is usually equal to the size of a normal sesamoid. Rarely are sesamoid fractures displaced sig-

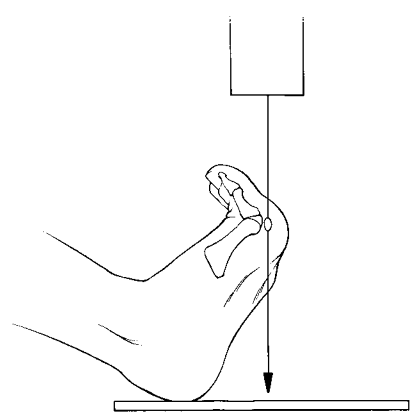

Fig. 5 Method for obtaining a tangential radiograph for evaluation of sesamoid injuries.

nificantly because of their extensive soft-tissue attachments.

An acute sesamoid fracture should be treated with initial immobilization in a short-leg cast or wooden-soled shoe. Weight-bearing stresses should be avoided until the local fracture tenderness has subsided and there is some radiographic evidence of bone healing, which usually is present by 6 weeks after the fracture.

Sesamoid stress fractures occur on occasion and may be difficult to differentiate from other causes of metatarsalgia, especially sesamoiditis.[18] A bone scan is frequently useful in identifying a stress fracture. Unlike fresh fractures, stress fractures of the sesamoid rarely heal with only immobilization and activity restriction. Pain often persists and is unresponsive to footwear modification. Persistent, severe symptoms from a nonunited sesamoid stress fracture may eventually necessitate excision of the fracture fragments, but surgery should be considered only after other, more common causes of metatarsalgia have been excluded. After excision, the short flexor tendon should be meticulously repaired to maintain the proper balance and support for the first MTP joint.

Injuries of the Lesser MTP Joints

Dislocation of the lesser MTP joints occurs most commonly with lateral and dorsal displacement of the digit on the metatarsal head.[19] The injury frequently results from striking the bare foot on a leg of a piece of furniture. Reduction can almost always be accomplished by applying gentle longitudinal traction to the toe combined with manual pressure over the phalangeal base. The reduction is usually stable, and only rarely is open reduction necessary. Complex dislocations of the lesser MTP joints have been reported very infrequently.

Great-Toe Fractures and Dislocations

One of two mechanisms is commonly involved in a great-toe fracture: stubbing of the toe or a direct blow from a falling object. Nondisplaced fractures of the great toe should be treated with immobilization in a wooden-soled shoe for 2 to 3 weeks. Displaced fractures usually can be reduced by closed means, but if closed reduction is unsuccessful, open reduction through a midlateral incision should be done, accompanied by fixation with one or two Kirschner wires of appropriate size.

Dislocation of the interphalangeal joint results from axial loading, such as might occur from kicking a heavy object. The distal phalanx is commonly displaced dorsally and can be readily reduced by closed means under digital-block anesthesia. The reduced joint should be splinted to the second toe with nonconstrictive tape for 3 weeks until soft-tissue healing has occurred.

Injuries to the Lesser Toes

Fractures of the lesser toes are quite common. If displaced, they should be reduced with gentle traction under digital-block anesthesia. Splinting with tape to an unaffected toe for 2 to 3 weeks usually provides a satisfactory outcome.

Dislocations of the proximal or distal interphalangeal joints of the lesser toes are rare. When these dislocations occur, they are easily reduced under digital-block anesthesia and are usually quite stable once reduced. Short-term splinting with “buddy taping” for 2 weeks is satisfactory treatment.

All toe fractures and dislocations are quite painful. The patient should be given adequate analgesia to control the pain during the first few days after injury.

Summary

Fractures and dislocations of the forefoot are common injuries. Most can be treated by closed means, but selected injuries require open reduction and stable internal fixation to avoid the long-term complications of posttraumatic arthritis and the creation of osseous prominences, which can become painful with weight-bearing.

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