**Foot and Ankle Injuries**

**Jorge del Castillo**

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**EPIDEMIOLOGY**

Inversion injuries occur at a rate of 1 per 10,000 people per day, which equates to about 28,000 injuries per day in the United States. Injury to the dominant ankle is more likely than injury to the nondominant ankle. These injuries are common during recreational sports involving running, such as basketball, soccer, baseball, and volleyball.

Inversion injuries may at first glance appear to be common and minor. A large percentage of these injuries continue to be symptomatic for a year or longer after the injury. Chronic instability eventually develops in some individuals and requires surgical repair. 1

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**PATHOPHYSIOLOGY**

**ANATOMY**

The ankle is composed of two joints: the talar mortise and the subtalar joint. The talar joint is a modified hinge joint similar to a “mortise and tenon,” as referred to in carpentry. It is composed of three bones: the tibia, the mortise, and the talus of the fibula, which form the tenon (Fig. 85.1). The plafond or “ceiling” of this joint is formed by the tibia with its medial malleolus and articulation with the fibula.

The dome of the talus has a trapezoidal shape—wider anteriorly and narrower posteriorly. This anatomic shape confers greater stability in dorsiflexion. However, when the ankle moves into plantar flexion, the narrow part of the talus sits in the mortise, which results in ankle instability and predisposes it to injury. 2, 3

**Ligaments of the Ankle**

The medial side of the ankle is supported by the deltoid ligament (Fig. 85.2). The deltoid ligament has five components: one deep and four superficial. The deep ligament attaches to the tibia and the undersurface of the talus. The superficial ligaments are the tibiocalcaneal, anterior talocalcaneal, calcaneonotal, and posterior talocalcaneal.

The lateral aspect of the ankle has three supporting ligaments: the anterior talofibular, calcaneofibular, and posterior talofibular (Fig. 85.3). The tibiofibular ligaments include the anterior and posterior inferior ligaments, which bind the distal ends of the tibia and fibula, and the superior ligaments of the
same name, which bind the tibia and fibula at the proximal articulation. Other supporting structures are the inferior transverse ligament and the interosseous ligament. The latter is not part of the ankle but nevertheless provides a strong bond between the tibia and fibula.2,3

### PRESENTING SIGNS AND SYMPTOMS

As noted previously, the ankle is a modified hinge joint; its motion is predominantly executed in a sagittal plane.

Most ankle sprains are due to inversion during plantar flexion of the ankle. Thus approximately 85% of injuries involve the lateral ligaments: the anterior talofibular ligament, the calcaneofibular ligament, and the posterior talofibular ligament. Of sprains caused by inversion, 65% are isolated to the anterior talofibular ligament. In some patients the subtalar complex may also be injured. The calcaneofibular ligament is rarely injured in isolation. Classification of these injuries and examination findings are presented in Table 85.1.

Isolated injury to the medial (deltoid) ligament is uncommon, and such injury is usually accompanied by a medial malleolar fracture. Distal tibiofibular syndesmotic rupture is very rare and is associated with forceful dorsiflexion and external rotation.2,4

### HISTORY AND PHYSICAL EXAMINATION

A methodic approach to elicitation of the history of the injury and examination of the ankle joint is of paramount importance. Frequently, the mechanism is unknown because of the sudden and rapid occurrence of the injury. Specific questions about the mechanism, time of the injury, ability to bear weight, and previous history of injury involving the affected joint are helpful in arriving at an accurate diagnosis (Box 85.1).

The physical examination (Box 85.2) should be thorough and orderly with the intent of assessing joint stability and possible neurovascular compromise. The emergency physician (EP) should make sure that the patient is in a comfortable
talofibular ligament. It is, unfortunately, not very reliable, especially in acute injuries with significant swelling and pain.

![Side-to-side test (clunk test)](image)

The side-to-side test (clunk test) evaluates the integrity of the tibiofibular ligament. The foot is held in a neutral position and then moved from side to side. A “clunk” is heard or felt if the ligament is ruptured.

The talar tilt test can be used to assess the deltoid ligament and the calcaneofibular ligament by applying eversion and inversion stress, respectively. The calcaneus is held in one hand while the examiner moves the ankle into inversion or eversion (Fig. 85.5). Frequently, it is accompanied by simultaneous radiographic evaluation to determine the amount of tilt at the level of the talus.

Stress testing is not generally performed in the acute phase of an injury because of its inaccuracy and the pain that it inflicts on the patient. Since the advent of magnetic resonance imaging (MRI), which can reveal soft tissue injuries of varying degrees, stress testing is rarely used at all.

**DIFFERENTIAL DIAGNOSIS AND MEDICAL DECISION MAKING**

Ankle sprains result from traumatic rotational forces applied to the ankle and usually occur in individuals who are involved in sports activities. They have been classified to better understand treatment modalities, as well as prognosis.
CLASSIFICATION OF ANKLE SPRAINS

Subluxation of the Peroneal Tendons

The peroneus longus and brevis tendons lie in a shallow groove immediately posterior to the distal end of the fibula. Rupture of the superior peroneal retinaculum results in subluxation or dislocation of the peroneal tendons. This injury is often mistaken for a common sprain in the emergency department (ED). However, it differs in that the pain and swelling are located along the posterior border of the lateral malleolus. It results from forced dorsiflexion with reflex contraction of the peroneal muscles. Patients complain of pain and a snapping sensation over the posterolateral aspect of the ankle with weakness of eversion.\(^6\)

During physical examination, pain is elicited on palpation of the area, and swelling is also noted. The subluxation can be reproduced with dorsiflexion and eversion of the foot.

Do not mistake subluxation of the peroneal tendons for an ankle sprain because the treatment and prognosis are different.

Treatment is directed at stabilization of the subluxed tendon. A U-shaped felt pad is placed over the lateral aspect of the ankle with the tip of the fibula lying inside the “U.” The ankle is then taped to ensure that the U-shaped pad stays in place. Refer to an orthopedic surgeon for further evaluation in the event that corrective surgery is warranted.

Achilles Tendon Injuries

The most common conditions affecting the Achilles tendon in patients seen in the ED range from tendinitis to rupture. Rupture of the Achilles tendon is missed in more than 20% of patients with this injury. The rupture may be partial or complete. Occasionally, because of significant swelling and a hematoma over the area, a discernible defect in the tendon may be difficult to identify.

The history usually includes some form of violent motion around the ankle; the injury is often seen in basketball and tennis players. Weekend athletes in their third or fourth decade are most commonly affected.

Physical examination reveals swelling and tenderness, as well as a partial or complete defect in the tendon. A positive Thompson test is diagnostic. It is performed by having the patient lie prone on a gurney or stand with the knee of the affected leg resting on a chair (Fig. 85.6). The examiner then squeezes the calf muscles. Individuals with normal Achilles tendons will plantar flex as the maneuver is performed.\(^3\)

Note that the Thompson test can be misleading, especially with partial tears, because the accessory ankle flexors are often squeezed together with the contents of the superficial leg compartment.

Treatment consists of either a compression wrap or a short leg plaster splint with the foot positioned in equinus (plantar flexion). Crutches, non–weight bearing, and analgesics are also indicated. Prompt orthopedic consultation to determine the necessity for surgical repair is advised.

CLASSIFICATION OF FRACTURES

Several classifications of ankle fractures have been published over the years in an effort to facilitate accurate description and subsequent treatment. The most comprehensive classification, still in use, was proposed by Lauge-Hansen in 1950 and was based on cadaver experiments involving the use of foot position (supination or pronation) and direction of the force exerted on the joint (external rotation, adduction, or abduction) at the time of the injury. The Danis-Weber Arbeitsgemeinschaft für Osteosynthesefragen (AO) classification proposes a simpler description based on the location and appearance of the fibular fracture. The fracture lines are designated A, below the syndesmosis; B, at the level of the syndesmosis; and C, above the syndesmosis (Fig. 85.7).

The Orthopedic Trauma Association has since expanded the Danis-Weber classification by keeping the three types (A, B, and C) and adding nine groups (1, 2, and 3 for each type) and 27 subgroups.\(^3\)

In 1987, Tile recommended another classification that identifies ankle fractures by their stability. Because unstable fractures require a different treatment approach than stable fractures do, such distinction is clinically important. For example, identification of a medial injury will generally determine the stability of the ankle joint. Therefore, always suspect an unstable fracture of the ankle when the medial structures are identified as injured clinically or radiographically.\(^5,7\)

Danis-Weber Classification System

This classification system has four injury patterns: (1) supination adduction (SA or Weber A), (2) supination external rotation (SE or Weber B), (3) pronation abduction (PA or Weber C), and (4) both directions (SB or PA or Weber D).
CHAPTER 85  FOOT AND ANKLE INJURIES

C1), and (4) pronation external rotation (PE or Weber C2). The names of these injury patterns can be thought of in simple terms as indicating the initial position of the foot (supination or pronation) and the direction of the injuring force acting through the talus (adduction, abduction, external rotation). The location and type of fibula fracture are the key to understanding the classification.

SUPINATION ADDUCTION (SA, WEBER A) Supination (inversion) of the foot and application of an adducting force on the talus result in two sequential injuries: transverse fracture of the lateral malleolus below or up to the level of the tibiofibular joint and a ligament tear (SA I). As the force progresses, the talus impacts the medial malleolus and causes an oblique medial malleolar fracture (SA II) (Fig. 85.8).

SUPINATION EXTERNAL ROTATION (SE, WEBER B) This is the most common mechanism of a “twisted ankle” injury. Supination of the foot and application of an external rotation force on the talus result in up to four sequential injuries (Fig. 85-9): tear of the anterior inferior tibiofibular ligament (SE I); short oblique fracture of the fibula (SE II), which is best seen on a lateral radiograph; fracture of the posterior malleolus (SE III); and transverse fracture of the medial malleolus (SE IV) or a tear of the deltoid ligament (or both).

PRONATION ABDUCTION (PA, WEBER C1) In this injury, pronation (eversion) of the foot and application of an abducting force on the talus result in up to three sequential injuries (Fig. 85.10). First, a transverse fracture of the medial malleolus occurs (PA I), and then as the forces progress, the anterior inferior tibiofibular ligament tears (PA II). Finally, further abduction of the talus results in an oblique fracture of the distal end of the fibula (PA III). This fibula fracture ends just above the level of the joint line and is best seen on an anteroposterior (AP) or mortise view.

PRONATION EXTERNAL ROTATION (PE, WEBER C2) In pronation external rotation, pronation (eversion) of the foot and application of an external rotation force through the talus result in up to four sequential injuries (Fig. 85.11). Similar to the pronation abduction mechanism, the first two injuries are the same: transverse fracture of the medial malleolus (PE I), followed by a tear of the anterior inferior tibiofibular ligament (PE II). The third injury is a short spiral or oblique fracture, usually 6 to 8 cm above the syndesmosis but possibly as high as the midshaft level (PE III). The fourth injury is fracture of the posterior malleolus (PE IV).

Maisonneuve Fracture (Weber C3) The exact mechanism leading to a Maisonneuve fracture is not clear. It appears to combine different forces and possibly shifting foot positions. Patients have isolated medial ankle tenderness and swelling. On further examination, tenderness at the level of the proximal end of the fibula is also identified. This fracture is unstable and warrants clinical and radiographic evaluation of the entire lower extremity below the
knee. It often goes unrecognized and is identified merely as “just another ankle sprain.” Therefore, vigilance must be exercised when a medial ankle injury is identified in any patient. These medial ankle injuries could be limited to the deltoid ligament, an isolated fracture of the posterior tibial tubercle, or a medial malleolar fracture in the absence of a lateral malleolar fracture. The classic appearance of the injury is a fracture of the neck of the fibula—either linear or comminuted (Fig. 85.12). Emergency orthopedic consultation is necessary.

**Salter-Harris Classification System**

The Salter-Harris classification system describes injuries that occur only around growth plates. Hence, just children have Salter-Harris fractures.

Injuries to the ankle in the pediatric population generally occur at the level of the bone physis. The Salter-Harris classification system enables definition of the type and severity of the fracture. Salter-Harris fractures are generally broken down into five categories as shown in Figure 85.13 and Table 85.2.

**Triplane Fractures**

This type of fracture is generally seen in older children with partially closed epiphyses and resembles a Salter-Harris type IV fracture. The mechanism is usually external rotation. Even with proper care and reduction, this fracture can result in epiphyseal growth arrest and deformity. If unsure of the fracture lines on plain film radiographs, computed tomography (CT) is recommended to ascertain the position of the fracture fragments (Fig. 85.14).

**DISLOCATIONS**

Dislocations can occur at multiple sites in the foot and ankle. An in-depth description of these dislocations is beyond the scope of this chapter. Nevertheless, two of these types of dislocations are worth mentioning.

Dislocations at the level of the tibiotalar joint, or tibial dislocations, are generally associated with fractures. On occasion, a pure tibial dislocation will occur. They require prompt anatomic reduction in an effort to diminish cutaneous and neurovascular injury. If orthopedic consultation is not readily available, reduction under conscious sedation should be performed by the EP.
The second type is subtalar dislocation. This injury occurs at the level of the talocalcaneal and talonavicular joints. Subtalar dislocations can be medial or lateral, depending on the direction of the foot and the effecting forces. These high-energy injuries result from sports (basketball and baseball), as well as from motor vehicle accidents and falls from heights.6

Clinical examination of patients with subtalar dislocations shows significant and obvious deformity. Skin tenting and neurovascular compromise should be promptly assessed and remediated by reduction. Standard lateral radiographs are sometimes not diagnostic, and an AP projection of the foot may be the only view that depicts the actual talonavicular dislocation. CT is recommended to further assess for associated fractures and the integrity of the reduction. Open subtalar dislocations carry significant morbidity and require emergency orthopedic intervention.

FOOT INJURIES

Talar Fractures
Injuries to the talus result from high-energy trauma such as falls from heights or motor vehicle accidents. These injuries may occur at the neck or the body of the talus. Avascular necrosis is common when the injury involves the neck of the talus because of the limited blood supply to this area of the bone. Most of these injuries are significant and all warrant orthopedic consultation. For complete classification details, see Fracture and dislocation compendium. Orthopaedic Trauma Association Committee for Coding and Classification. J Orthop Trauma 1996;10(Suppl 1):104-8.

Osteochondritis Dissecans (Osteochondral Fracture)
These fractures result from a mechanism similar to that of ankle sprains. When the ankle is forcibly inverted while in plantar flexion or dorsiflexion, the dome of the talus is compressed against the fibula or the tibial plafond. This results in several degrees or “stages” of lesions (Fig. 85.15). More often than not, the initial radiographs are negative, and diagnosis will require CT or MRI. The diagnosis is missed in 40% to 50% of patients seen in the ED with an ankle injury. Therefore, a high index of suspicion is warranted with these injuries, especially if the patient has experienced reinjury, chronic swelling, or locking of the ankle 4 to 5 weeks after the injury.2
Calcaneal Injuries

The calcaneus is the most frequently fractured tarsal bone and accounts for more than 60% of tarsal fractures. These fractures are frequently work-related injuries in roofers or other individuals working at heights. The majority are intraarticular, with the remainder being classified as extraarticular.

The most common extraarticular fracture is a calcaneal body fracture. In decreasing frequency, other locations of calcaneal fractures are at the anterior process, the superior tuberosity, and the area of the sustentaculum tali; isolated injuries are rarely seen at these sites. Calcaneal fractures are infrequently encountered as open fractures. Open injuries are reported to occur in only 2% of cases. As a result of the accompanying mechanisms and forces related to calcaneal fractures, other pathology such as spinal injuries and extremity fractures are usually associated with injuries to the os calcis. Multiple complications such as gait abnormalities, arthritis, and leg length discrepancy are generally the sequela of calcaneal fractures.8

Plain films, including AP, lateral, and axial views of the hindfoot, provide a good initial assessment. CT is generally used to ascertain the true extent of these complex fractures.

One method of assessing the integrity of the calcaneus is measurement of the Böhler angle. This angle is normally 30 to 35 degrees and is determined by tracing two lines on a lateral view of a radiograph of the foot (Fig. 85.16). One line is drawn from the posterior tuberosity to the apex of the posterior facet. A second line connects the apex of the posterior facet to the anterior (beak) process. An angle of 20 degrees or less should raise suspicion for a compression fracture of the calcaneus.3

Another less frequently used angle measurement is the crucial angle of Gissane. This angle is formed by the downward portion of the posterior facet where it connects to the upward portion. This angle normally measures 100 degrees.3

Other Tarsal Conditions

Avascular necrosis occurs in many areas of the skeleton. The foot is not spared, with the tarsal navicular experiencing the greatest frequency of this condition. Stress fractures can result in avascular necrosis when they go unrecognized and untreated.8 Examples of these injuries, with a description of the clinical findings, diagnosis, and treatment, appear in Table 85.3.

Lisfranc Injury

A Lisfranc injury is uncommon and generally associated with significant force. Physical examination reveals significant swelling and tenderness of the midfoot area commensurate with the magnitude of the injury. On occasion, ecchymoses of the midarch area of the foot are present and are diagnostic of this injury. The vasculature should be scrutinized carefully, especially if the intercommunicating arterial branch between the dorsalis pedis artery and the plantar arterial arch has been disrupted. It can lead to a compartment syndrome, which requires prompt intervention by an orthopedic surgeon.8

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<th>Table 85.3 Other Tarsal Conditions</th>
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<td><strong>ETIOLOGY</strong></td>
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<td>Kohler disease</td>
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<td>Tarsal navicular stress fracture</td>
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Ballet dancers suffering from these injuries may at some time the case of the os trigonum, plantar flexion is the mechanism. A hyperdorsiflexion-type injury that results in the fracture. In impact with an external object. Indirectly, the great toe suffers indirectly trauma. Direct traumatic injuries result from crush-injury. They can occur as a result of direct and commonly injured are in the area of the great toe and occasionally in the os trigonum located posterior to the posterior tubercle of the talus. These fractures are infrequent and often go unrecognized. They can occur as a result of crush-type mechanisms such as falling from a height or direct impact with an external object. Indirectly, the great toe suffers a hyperdorsiflexion-type injury that results in the fracture. In the case of the os trigonum, plantar flexion is the mechanism. Ballet dancers suffering from these injuries may at some time require removal of the bone because of chronic pain.^

Examination reveals localized tenderness over the sesamoid and reproducible pain on dorsiflexion of the great toe. In the case of the os trigonum, physical examination almost always reveals tenderness anterior to the Achilles tendon and posterior to the tibia, as well as decreased plantar flexion. Pain is reproduced by plantar flexion or resisted plantar flexion of the great toe.

Radiographically, sesamoid fractures appear to have irregular margins, as opposed to the smooth contours of a bipartite sesamoid bone. Nonunion is frequent because of their poor vascular supply. This can result in chronic pain and swelling, as well as disability. It is therefore important to stress the need for orthopedic follow-up.

Treatment is directed at protection and immobilization of the affected area in either a walking cast or boot for 4 to 6 weeks.^

**Toe Fractures**

Toe fractures are generally the result of direct trauma such as a heavy object falling on the foot. Occasionally, walking or kicking an immobile object will result in a displaced fracture. The ponym “nightwalker” fractures has been given to injuries that occur at night while navigating in a dark room.

Treatment is directed at anatomic integrity and immobilization. Therefore, reduction of displaced fractures with “buddy tape” immobilization is the standard. All other fractures that are not displaced warrant immobilization in the same fashion; a hard-soled cast shoe is recommended until the pain resolves, at which time an athletic shoe can be worn. In the event of a large intraarticular fracture fragment or significant displacement of the fragments, emergency orthopedic consultation is required.^

**Plantar Fasciitis**

Plantar fasciitis is a fairly common condition in runners and long-distance walkers. It can have an acute cause from sudden excessive loading of the foot; more commonly, however, it becomes symptomatic in a gradual manner from excessive pronation of the foot. These chronic insults result in micro-tears of the plantar fascia.

Individuals with a high-arched foot are more prone to this injury. The patient reports pain in the plantar area of the foot, especially in the morning. Occasionally, the pain can be sharp and lancinating and resemble neuropathic pain.

Physical examination reveals tenderness along the plantar area of the hindfoot, near the origin of the plantar fascia. Swelling may be noted occasionally, as well as reproduction of the pain with dorsiflexion of the foot.

Treatment consists of ice massage and gentle stretching of the fascia. The latter is accomplished by stretching of the Achilles tendon, as well by rolling the foot back and forth over an object such as a can of soup. An orthotic device is helpful for individuals with excessive pronation on ambulation. Physical therapy in the form of massage and ultrasonography is sometimes necessary. Steroid injections can occasionally be used but should be done judiciously.^

**Tarsal Tunnel Syndrome**

Compression of the posterior tibial nerve as it courses through the tarsal tunnel is known as tarsal tunnel syndrome. The tarsal canal is covered by the flexor retinaculum, which extends posteriorly and distally to the medial malleolus. The

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**Metatarsal Injuries**

**METATARSAL FRACTURES** Three types of fractures commonly occur in the proximal fifth metatarsal (proximal to distal): tuberosity avulsion fracture, Jones fracture, and proximal diaphysial stress fracture. Each has distinct characteristics, and the approach to treatment is often controversial. Nevertheless, most of these fractures heal with immobilization over a period of 3 to 8 weeks, depending on location. Treatment of displaced intraarticular fractures, delayed union, and nonunion usually requires operative methods. A Jones fracture has a high rate of nonunion and may require surgical intervention. Patients must be warned of this potential problem. Tuberosity fractures and Jones fractures must not be confused despite their proximity on the fifth metatarsal (Fig. 85.17).^

**FREIBERG DISEASE** Freiberg disease is caused by repetitive trauma to the head of the second metatarsal, which deprives the epiphysis of adequate circulation, with consequent necrosis of the metatarsal head and pain in the area of the second metatarsal in the forefoot. Radiography shows flattening of the metatarsal head with a fragmented epiphysis.

Freiberg disease is most common in adolescent girls and is associated with the wearing of high-heeled shoes.

Treatment is directed at prevention of trauma by rest and diminishing sports activities, as well as by wearing flat shoes instead of high heels. Nonsteroidal antiinflammatory drugs (NSAIDs) may be used as necessary to decrease inflammation.^

**Sesamoid Bone Fractures**

The foot has many sesamoid bones. However, those most commonly injured are in the area of the great toe and occasionally in the os trigonum located posterior to the posterior tubercle of the talus. These fractures are infrequent and often go unrecognized. They can occur as a result of direct and indirect trauma. Direct traumatic injuries result from crush-type mechanisms such as falling from a height or direct impact with an external object. Indirectly, the great toe suffers a hyperdorsiflexion-type injury that results in the fracture. In the case of the os trigonum, plantar flexion is the mechanism. Ballet dancers suffering from these injuries may at some time require removal of the bone because of chronic pain.^

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**BOX 85.3 Causes of Tarsal Tunnel Syndrome**

- Trauma
- Medications
- Heavy metals or solvents
- Flat feet (pes planus)
- Tendonitis in the posterior tibialis
- Varices
- Space-occupying mass
- Medical conditions: diabetes, hypothyroidism
- Alcoholism
- Transition from a raised heel to a flat shoe

The floor is formed by the calcaneus, tibia, and talus. Tendons of the flexor hallucis longus, flexor digitorum longus, and tibialis posterior muscles, the posterior tibial nerve, and the posterior tibial artery and vein pass through the tarsal tunnel.

Patients complain of shooting or radiating pain to the forefoot or the plantar arch. Numbness or a burning or tingling sensation may also be present in the ankle, heel, arch, or toes. Activity will often aggravate the symptoms.

Shooting pain distally may be elicited when the entrapped nerve is percussed (Tinel sign). Nerve conduction velocity studies are helpful in obtaining a definitive diagnosis. The multiple causes of tarsal tunnel syndrome are listed in Box 85.3.

Several treatment options are available, depending on the cause. Conservatively, the area can be put at rest with the use of night splints. Orthotics can be used to correct hyperpronation of the foot. Women should stop wearing high-heeled shoes.

NSAIDs and occasionally physical therapy may be of benefit. Steroid injections may also be of some help. Ultimately, tarsal tunnel release can be performed to alleviate the condition.

**DIAGNOSTIC TESTING**

**IMAGING**

Views of the ankle should include AP, lateral, and mortise views. The mortise view allows a fairly good image of both the mortise and the talar dome.

Stress views are sometimes helpful but are not presently used as much as in the past. A posteroanterior or mortise view is obtained while stressing the affected ligaments (lateral ligaments) to ascertain the degree of instability as identified by talar tilt. Comparison with the uninjured ankle is necessary, and joint stability is defined as less than 5 degrees of difference between the injured and uninjured sides. A tilt angle greater than 15 degrees with respect to the uninjured side often signifies rupture of the anterior talofibular and calcaneo-fibular ligaments.

Another radiographic method of assessing ankle joint stability is identification of the medial clear space. This is the distance, as measured on a mortise view, between the lateral border of the medial malleolus and the medial border of the talus. Any value greater than 4 mm is considered abnormal and is a sign of instability (Fig. 85.18).

Finally, CT and MRI have become very popular in the diagnosis of these injuries but are still not in common use in the ED.

**Ottawa Ankle Rules**

In an effort to decrease the number of ankle radiographs used in the diagnosis of acute ankle injuries, Stiell et al. from the Ottawa Civic and the Ottawa General Hospitals in Canada conducted a prospective study that included more than 750 patients seen in the ED with acute blunt ankle injuries. They determined that ankle films were necessary only when patients with pain near the malleoli exhibited one or more of the findings shown in Box 85.4.

Likewise, for injuries to the foot, radiographs would be necessary only with pain in the midfoot area and with bone tenderness at the navicular, the cuboid, or the base of the fifth metatarsal.

**TREATMENT**

In general, the approach to treatment of foot and ankle injuries is directed at protecting the affected limb from further injury at the same time that other modalities, including early mobilization, are used. Box 85.5 outlines a brief summary of the standard and basic treatment of these injuries.

An ankle stirrup will protect the joint by preventing lateral motion of the ankle. At the same time it allows plantar flexion and dorsiflexion, which contribute to early motion and rehabilitation of the affected joint. These devices can be inflated and deflated by the patient to allow a tolerable degree of compression, as well as stability.
**CHAPTER 85  FOOT AND ANKLE INJURIES**

**BOX 85.5 ICEMM Mnemonic for Treatment of Fractures of the Foot and Ankle**

ICE: Every 2 hours or as needed for the first 24 to 48 hours

**COMPRESSION**: Compression dressing (Webril or Ace) to decrease swelling; ankle stirrup to lend stability, if indicated

**ELEVATION**: To reduce swelling

**MOBILIZATION**: Early, as soon as patient is pain free

**MEDICATION**: Nonsteroidal antiinflammatory drugs or narcotics when applicable

**FOLLOW-UP, NEXT STEPS IN CARE, AND PATIENT EDUCATION**

The patient can begin exercises when the pain subsides (do not use heat) and can return to full activity when full pain-free motion and equal strength are attained in both ankles.

For weekend and other athletes, depending on age and conditioning, **Box 85.6** outlines some guidelines when sports activities can be resumed safely.

**BOX 85.6 Guidelines for When Sports Activities Can Be Resumed Safely**

- **Type I injury** (ligament stretch or minor tear): Return to play in 1 to 10 days
- **Type II injury** (partial ligament tear): Return to play in 2 to 4 weeks
- **Type III injury** (complete ligament tear): Return to play in 5 to 8 weeks

**SUGGESTED READINGS**


**REFERENCES**

References can be found on Expert Consult @ www.expertconsult.com.
REFERENCES