INTERNATIONAL DEVELOPMENT PLANNING REVIEW
ISSN:1474-6743 | E-ISSN:1478-3401

# ATHLETIC ANKLE SPRAINS

**Amal Hadi Hakmi, Rayan Abdullah Alangari, Aljawharah Mohammed Alanazi, Hiam Ali Alsalem, Sarah Dkheil Alenazi, Abdullah Mohammed Albaiz, Nadia Ahmed Abo shreea, Maram Abdullah Aljumah, Abdulaziz Mohammed Alsinan, Albandari Fayez Alshehri**
Corresponding Author: Amal Hadi Hakmi
Ministry of Health, Saudi Arabia

**Abstract**
Ankle injuries are prevalent among athletes, with lateral ligament sprains constituting the majority. The medial ligament complex, distal tibiofibular syndesmosis, and any bones comprising the ankle joint may also sustain injuries. Common injury mechanisms encompass inversion-plantarflexion and external rotation of a supinated, dorsiflexed, or pronated foot. Lesions of the ankle manifest with analogous signs of pain, edema, and soreness. Consequently, a comprehensive history and physical examination must be conducted to establish an accurate diagnosis. This is particularly crucial for athletes, as specific injuries may result in career termination if not treated promptly and correctly. Imaging may be beneficial in certain instances to verify or exclude differential diagnosis. The majority of injuries can be effectively handled by conservative methods, employing the Protection, Rest, Ice, Compression, and Elevation regimen, succeeded by an extensive rehabilitation program. Surgery is indicated for grade III ligament rips that do not respond to initial conservative treatment and for displaced fractures that are unlikely to heal without surgical intervention. The purpose of this study is to address the common ankle injuries observed in the sports population and the methods to their diagnosis and therapy.

**Key Words:** Ankle sprain; Athlete; Deltoid ligament; Lateral ligament; Syndesmosis; Fracture

## INTRODUCTION

The physiological and social advantages of engaging in exercise are substantial. Nevertheless, sports rank as the second leading source of injuries, following home and leisure accidents, and significantly contribute to pain, loss of mobility, disability, and even mortality. The prevalence of ankle injuries in the general population is 1 in 10,000 daily, however it escalates to 5.23 in athletes, reaching up to 9.35 ankle injuries per 10,000 athletes during competition. Ankles are the predominant location for sports injuries, with lateral ligament sprains constituting 76.7% of cases, followed by fractures at 16.3%. Elevated occurrences of sprains were observed in team sports like soccer and rugby, which require rapid directional alterations when running. Conversely, fractures were prevalent in high-impact sports such as trampolining, parachuting, and mountaineering. Syndesmotic injuries, or "high" ankle sprains, which occur above the ankle joint, are recorded less commonly. These typically arise in high-speed, high-impact sports conducted on uneven surfaces, such as downhill skiing, football, and basketball. This review aims to summarize prevalent ankle injuries in athletes and the methods for their assessment and management.

## ANATOMY

The talocrural joint, commonly referred to as the "true" ankle joint, is formed by the articulation of the tibia and fibula of the lower leg with the talus of the foot. It is a synovial hinge joint facilitating dorsiflexion and plantarflexion of the foot in relation to the lower thigh. The medial and posterior malleoli of the tibia, along with the lateral malleolus of the fibula, further stabilize the joint. The talocalcaneal, or subtalar joint, lies directly below the ankle joint and is formed of the talus and the calcaneus. This joint facilitates the inversion and eversion of the foot.

The ligaments of the ankle are separated into the lateral collateral ligaments, the medial (deltoid) collateral ligaments and the syndesmotic ligaments (Figure 1)[7]. The lateral ligament has three distinct ligaments: the anterior talofibular ligament (ATFL), the posterior talofibular ligament (PTFL), and the calcaneofibular ligament (CFL). The ATFL and CFL arise from the lateral malleolus and attach to the talar neck and calcaneus, respectively. The ATFL limits pathological inversion and plantar flexion, while the CFL controls excessive inversion of the ankle joint. The PTFL originates from the malleolar fossa of the lateral malleolus and attaches to the posterior talus. The foot experiences tension in dorsiflexion and relaxation in plantarflexion or a neutral position. The PTFL is the most robust of the lateral ligaments, making solitary injuries uncommon unless accompanied by total ankle dislocation. The PTFL lacks an autonomous function in preserving ankle stability when the other lateral ligaments remain intact. Nonetheless, if the adjacent ligaments are torn, the short and long fibers of the PTFL inhibit external rotation of the talus, talar tilt, and dorsiflexion, while the short fibers additionally impede internal rotation.

The deltoid ligament comprises four superficial components: tibionavicular, tibiocalcaneal, tibiospring, and posterior tibiotalar ligaments. These ligaments traverse the ankle and subtalar joint, anchoring to the medial malleolus proximally and to the talus, calcaneus, and navicular distally. The deep components consist of the anterior tibiotalar ligament and the deep posterior tibiotalar ligament, which solely traverse the ankle joint. The surface layers inhibit talar abduction, while the deep layers obstruct external rotation. The two layers collaborate to restrict talar pronation. The distal tibiofibular syndesmosis connects the tibia and fibula, secured by four principal ligaments: the anterior inferior tibiofibular ligament, the posterior inferior tibiofibular ligament, the transverse tibiofibular ligament, and the interosseous ligament. The syndesmosis complex is essential for preserving ankle stability and counteracting pressures that could otherwise displace the tibia and fibula, thereby widening the ankle mortise. This configuration of ligaments offers both static and dynamic congruity. The motion of the ankle joint is depicted in Figure 2.

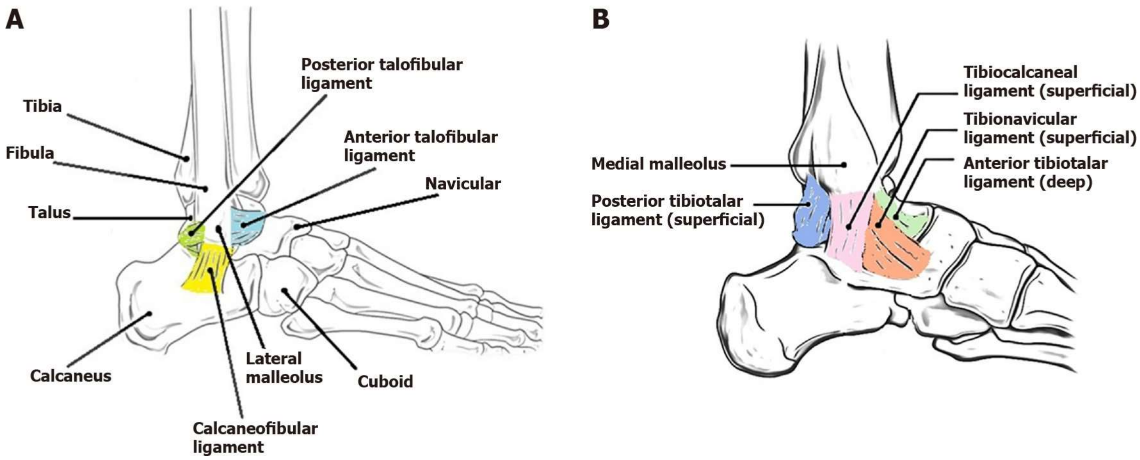


**Figure 1 Lateral and medial view of the ankle.** A: Lateral view of the ankle showing anatomy of the ankle joint and the lateral collateral ligaments (Adapted from Wikipedia[43]); B: Medial view of the ankle showing the medial collateral ligaments (Adapted from Earth's Lab[44]).

## LATERAL LIGAMENT ANKLE SPRAINS

### Mechanism of injury

The term ankle sprain refers to a spectrum of injuries, from ligament overstretching to complete ligament rupture within the ankle joint. In most instances, the injury process entails the inversion of the plantarflexed, weight-bearing foot. The lateral ligaments are predominantly affected, with the ATFL sustaining injury in 65% of cases, as it opposes inversion and is the weakest among the three lateral ligaments. Infrequently, both the ATFL and CFL are involved, although PTFL damage is more uncommon and typically results from significant ankle joint dislocation.

### History

A prior lateral ligament sprain constitutes a risk factor for subsequent sprains and is frequently noted during a medical history assessment. The primary symptom is pain, situated laterally over the ATFL region. The definitive method for identifying lateral ligament injury is a delayed physical examination of the ankle joint. In the hours and days immediately following the accident, pain and soreness are felt diffusely and haematoma has not grown, therefore diagnosis is not accurate. Nevertheless, after 4 to 5 days, the site of pain and tenderness upon palpation, along with the distinctive hematoma and edema, may be precisely identified. The specificity and sensitivity at this stage is 84% and 96%, respectively, in deducing the presence or absence of an ATFL injury[18].

### Physical examination

Two provocative assessments can be conducted to evaluate the stability of the ankle joint, both of which should be compared to the uninjured leg: the anterior drawer test and the talar tilt test. These are most effective when performed a few days post-injury, allowing the patient to be more relaxed and have reduced discomfort. The anterior drawer test assesses the integrity of the anterior talofibular ligament (ATFL). The patient is positioned with the knee joint flexed at 90° to facilitate relaxation of the calf muscles, and the ankle joint in a plantarflexed posture of 10°-15°. The calcaneus is dragged anteriorly while the tibia is secured. An inadequate or deficient endpoint resulting from heightened anterior talar displacement coupled with joint laxity signifies a positive test result. In 50% of cases, a dimple sign can be visible over the area of the ATFL during the movement. The talar tilt test evaluates the integrity of the calcaneofibular ligament (CFL). The patient is supine, and the ankle is in a neutral position. With the heel braced and both the talus and calcaneus gripped, the heel is inverted relative to the tibia. A positive test result is indicated when a definitive endpoint cannot be determined, accompanied by increased joint laxity.

### Investigations

Radiographic evaluation is generally unnecessary for ankle sprains, as a physical examination is considered adequate. Magnetic resonance imaging (MRI) if employed yields 75%-100% sensitivity in identifying lateral ligament sprains. Nonetheless, its elevated expenses, along with the frequent occurrence of ankle sprains, make its utilization financially impractical. Occasionally, an X-ray is necessitated based on the Ottawa Ankle Rules criterion to exclude a fracture.

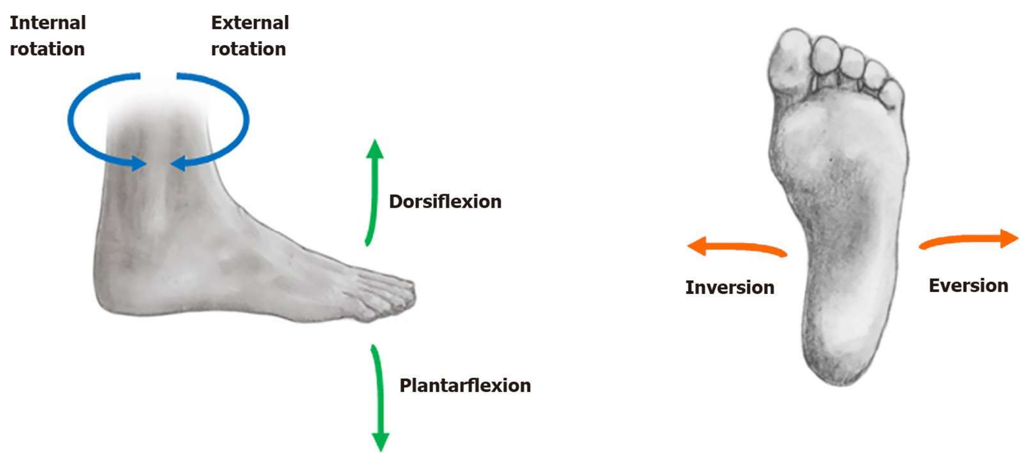


**Figure 2 Ankle joint planes of motion (Adapted from CrossFit[45]).**

### Classification

Ankle sprains can be classified both physically and functionally based on their severity. Grade I injuries involve the stretching of the ATFL, potentially accompanied by tiny tears. Moderate edema is present, and ambulation is feasible with slight discomfort. Grade II injuries result from a distended ATFL, and occasionally CFL, characterized by partial fiber ripping. Moderate edema and ecchymosis are present, and ambulation is uncomfortable. Grade III injuries are the most serious, involving damage to the ATFL, CFL, and PTFL, resulting in ankle joint instability. Significant acute edema and bruising are observed, and the severe pain hampers weight-bearing ability. An advanced method for assessing ankle sprains categorizes them as stable or unstable based on the results of the anterior drawer test and talar tilt test. If both tests yield negative results, this indicates a stable grade I injury. A positive anterior drawer test indicates an unstable grade II injury, while the presence of positive results in both tests categorizes it as an unstable grade III injury. This technique, while limited to injuries of the ATFL and CFL, is highly reproducible and user-friendly, making it suitable for application in the Emergency Department[15]. Grading is inherently subjective, with considerable discourse surrounding classification systems and notable discrepancies in inter-rater agreement. The return-to-play (RTP) period for grade I injuries is 1 to 2 weeks, whereas grade III injuries require an additional 4 to 6 weeks.

### Nonoperative management

The majority of ankle sprains can be treated conservatively. For mild to moderate injuries, providing functional support to the ankle joint together with gradual activity is considered more effective than immobilization. Cast immobilization can lead to muscular stiffness and atrophy, whereas functional support, such as ankle taping and/or tubular elastic bandages, facilitates a more rapid return to play and reduces residual pain. Furthermore, semi-rigid supports like the Aircast Air-Stirrup ankle brace (DJO Global Inc., Vista, California, United States) have demonstrated considerable enhancement in ankle joint function at 10 days and 30 days in comparison to elastic support bandages. For stable grade I and II injuries, the PRICE (Protection, Rest, Ice, Compression, and Elevation) therapy strategy is advised to mitigate swelling and inflammation, in conjunction with functional support and early activity aimed at enhancing range of motion. Grade II injuries may necessitate prolonged orthotic support, such as the Aircast, for a duration of up to 6 weeks. Subsequently, a rehabilitation program comprising peroneal strengthening and proprioceptive exercises should be implemented to facilitate expedited recovery and return to play. Early mobilization facilitates healing by promoting the alignment of collagen fibers. Due to the instability of grade III injuries, immobilization for up to one month is recommended in conjunction with strengthening activities. In the acute phase, the use of nonsteroidal anti-inflammatory medicines (NSAIDs) results in a substantial decrease in pain. Nonetheless, one study indicated that the rapid resumption of activities facilitated by NSAIDs may hinder the healing process, as trial participants administered piroxicam exhibited increased edema and instability 14 days post-injury. The assessment of therapeutic ultrasound's impact on acute ankle sprain treatment reveals insufficient evidence[24].

### Surgical intervention

Although the majority of patients recover effectively, individuals with persistent symptoms beyond three months despite conservative treatment should be assessed for chronic lateral ankle instability. This is predominantly addressed by physical therapy and bracing. Surgery is warranted for individuals who exhibit no improvement after 3 to 6 months. Surgery is generally conducted as an outpatient procedure utilizing general anesthesia accompanied by a popliteal nerve block. Surgical procedures are categorized as anatomical or nonanatomical reconstruction. Anatomical reconstruction include the Broström and modified Broström techniques, in which the ATFL and CFL are reduced and reattached. These effectively restore ankle stability and ensure durability. Nonanatomical reconstruction encompasses tendon transfers, including the Watson-Jones, Evans, and Chrisman Snook techniques. These surgical procedures include possible postoperative risks and consequences, including functional instability and early arthritis, and may also restrict range of motion.

## MEDIAL LIGAMENT ANKLE SPRAINS

### Mechanism of injury

Injuries to the medial ligament of the ankle joint are rare and are usually associated with fibular fractures and sprains of the tibiofibular syndesmosis. Approximately 4% of all ankle ligament injuries result from damage to the deltoid ligament. The typical mechanism of injury is often a pronation-external rotation position of the foot, although pronation-abduction and supination-external rotation situations are sometimes noted. These injuries commonly arise in activities such as basketball, dance, and long jump.

### History

Pain, soreness, and swelling are evident on the medial aspect of the ankle, with ecchymosis potentially appearing a few days thereafter. Weightbearing on the affected foot will be challenging and may be accompanied by a sensation of instability. Certain patients additionally describe a popping sensation or a sensation of the foot 'giving way,' particularly when descending slopes.

### Physical examination

Upon assessing the injured ankle, it is crucial to evaluate for indications of fractures and syndesmotic sprains, as these frequently occur in conjunction with deltoid ligament injuries. A complete rupture of the ligament may be palpated beneath the medial malleolus. The external rotation stress test suggests deltoid ligament injury if the talus displaces from the medial malleolus.

### Investigations

Conventional weight-bearing radiographs in the anteroposterior (AP), lateral, and mortise views may offer further insights to assist in diagnosis. A medial clear space width of 4 mm or greater between the talus and medial malleolus signifies disruption of the deltoid ligament and syndesmosis. Isolated deltoid injuries do not result in the enlargement of the medial clear space, as the lateral malleolus stabilizes the talus.[5,10,17]

### Classification

Deltoid ligament sprains are classified based on the degree of ligament involvement. Type I lesions are proximal tears, type II lesions involve the intermediate component, and type III lesions are distal injuries of the deltoid ligament.

### Nonoperative management

The PRICE protocol is the recommended therapy strategy for medial ligament ankle sprains, akin to its application for lateral ligament sprains. Immobilization in a cast, supplemented by bracing or taping, enhances healing. A rehabilitation program emphasizing strength enhancement and the improvement of coordination and proprioception is recommended. Resumption of exercise at a low level is anticipated within 6 to 8 weeks[10,27].

### Surgical intervention

Surgery is not typically warranted for isolated deltoid ligament problems.

## SYNDESMOTIC ANKLE SPRAINS

### Mechanism of injury

Syndesmotic ankle sprains, in contrast to lateral ankle sprains, are believed to result from external rotational pressures applied to a dorsiflexed foot. The exact process cannot be determined as the movement occurs too quickly to be reliably recognised. In this position, the ligaments commonly affected are the anterior inferior tibiofibular ligament and the interosseous ligament, contingent upon whether the foot is everted or in a neutral position, respectively. Isolated syndesmotic ankle sprains are uncommon, typically occurring alongside fibular fractures and/or deltoid ligament sprains. Syndesmotic injuries can lead to functional limits and chronic discomfort, thus quick diagnosis and treatment are crucial[11,30].

### History

The primary complaint is pain, localized to the anterior inferior tibiofibular ligament, frequently aggravated by both active and passive external rotation and/or dorsiflexion of the foot. The ankle exhibits tenderness upon probing in this region. Pain may also be experienced proximally due to injury to the interosseous membrane or a more severe injury. Swelling is considerably reduced compared to lateral ligament sprains. Nonetheless, inadequate or absent weight-bearing and/or plantar flexion is observed[11,15,17].

### Physical examination

Three assessments can be conducted to evaluate syndesmosis injury: the squeeze test, crossed-leg test, and external rotation stress test (Kleiger's test). During the squeeze test, the foot is dorsiflexed as the midshaft of the tibia and fibula are compressed together. In the crossed-leg test, the patient positions the distal third of the fibula of the afflicted leg on the knee of the contralateral leg. A mild downward compressive stress is subsequently exerted on the knee of the affected leg. The patient is seated to do the external rotation test. The tibia is thereafter stabilized while the foot is dorsiflexed and externally rotated in relation to the tibia. Throughout all three maneuvers, discomfort in the syndesmotic region signifies a positive indication.

### Investigations

Syndesmotic injuries are infrequent, so the aforementioned tests have been verified solely in a limited cohort of patients. Their sensitivity and specificity cannot be accurately assessed. Consequently, imaging is advised in this situation. Standard weight-bearing ankle radiographs in the anteroposterior, mortise, and lateral views should be conducted to exclude fractures and assess syndesmosis widening. In the presence of syndesmosis widening or proximal fibular discomfort, full-length radiographs of the tibia and fibula in both anteroposterior and lateral views are necessary to rule out a Maisonneuve fracture. No consensus exists about the guidelines for identifying syndesmosis diastasis. A joint space widening exceeding 5 mm or a tibiofibular overlap of less than 10 mm on the anteroposterior view is commonly utilized. Lateral stress radiographs with the foot externally rotated in both dorsiflexion and plantarflexion may reveal diastasis and any posterolateral displacement of the fibula. MRI demonstrates great sensitivity (100%), specificity (93%), and accuracy (96%) in assessing the severity of syndesmotic injury[6,15,30]. A high-intensity signal resembling the Greek letter lambda (λ) is observed on a coronal MRI, referred to as the 'lambda sign.' The lambda sign, while not a diagnostic signal on its own, can assist clinicians in identifying patients who necessitate surgical intervention when considered alongside positive physical examination findings. MRI can reveal secondary abnormalities, including bone bruises, osteochondral lesions, and anterior talofibular ligament injuries, all of which correlate with reduced rehabilitation outcomes and extended recovery durations. Arthroscopy demonstrates potential as a diagnostic instrument; one study reported it to be 100% accurate in detecting syndesmotic damage.

### Classification

The categorization system for syndesmotic ankle sprains categorizes injuries from I to III based on severity, analogous to lateral ligament sprains. Athletes must be made aware that recovery durations for syndesmotic ankle sprains can be twice as long as those for lateral ligament sprains, particularly when treated conservatively[6,8]. A study indicated that the duration to return to play (RTP) and/or functional impairment was directly connected with the level of pain of the interosseous membrane[33].

### Nonoperative management

Conservative care is the conventional approach for athletes with a sprain absent diastasis. Initially, PRICE is advised to alleviate pain and related symptoms. Whilst lateral ligament sprains benefit from early mobilization, syndesmotic injuries are more severe and consequently require nonweight-bearing immobilisation and support such as bracing, walking boots and casting during the acute period. This facilitates healing, safeguards the syndesmosis from more injury, and inhibits further rotation of the talus and fibula. Once the pain diminishes, protected weight-bearing training may commence with the use of crutches. Initiation of light balancing training on a balance pad and low-intensity strength training utilizing Theraband (The Hygienic Corp., Akron, Ohio, United States) is permissible. Exercises like seated heel lifts can aid in strengthening. As the patient recuperates, functional exercises, including double to single heel raises and hops, are incorporated into the rehabilitation regimen. The concluding phase entails advancement from brisk walking to jogging, running, and sport-specific training. Ankle braces and/or taping are essential for stability upon return to play.

### Surgical intervention

Surgery is warranted for patients with diastasis of the syndesmosis, with or without an accompanying fibular fracture, as well as for individuals with lower-grade injuries that do not respond to conservative treatment. The syndesmosis must be initially decreased, which can be accomplished using open, closed, or arthroscopic methods, and verified with fluoroscopy. Two surgical techniques are frequently employed. In syndesmotic screw fixation, screws are positioned to stabilize the syndesmosis till healing transpires. The surgical plan includes being nonweight-bearing for 6-8 wk, and the functional outcomes are favorable if the syndesmosis is minimized appropriately. There is no substantial distinction between the usual retention or removal of syndesmotic screws, as both patient groups exhibit comparable clinical outcomes, and removal is not frequently advised. Screw fracture that occurs in situ may be removed in symptomatic patients 8 to 12 weeks after the first surgical treatment. Nevertheless, for the overwhelming majority of patients, screw fracture will have few clinical implications. Typically, one or two cortical screws are positioned above the ankle joint, traversing three or four bone cortices in an anteromedial orientation (from fibula to tibia) to prevent malreduction. Currently, there is no agreement regarding the number of screws utilized, the cortices acquired, the diameter of the screws, or the precise place of the fixation. It also depends on patient characteristics such as a history of osteoporosis and smoking and degree of syndesmotic instability. Two screws are typically favored due to their enhanced resistance. The screw type may be cortical, characterized by full threading, or cancellous, which can be fully or partially threaded. Cortical screws are utilized for placement, particularly in plate fixation, whereas cancellous screws serve effectively as lag screws, applying a compressive strain. There is insufficient data to endorse placement through three versus four cortices. The Syndesmosis TightRope XP implant fixation device (Arthrex Inc., Naples, Florida, United States) employs a robust suture loop that is tensioned between two buttons affixed to the tibia and fibula. This strategy eliminates the possibility of hardware failure and the necessity for device removal. Moreover, research indicates that the functional outcomes are comparable to or exceed those attained with screw fixation, and that TightRope fixation facilitates quicker return to play.

## ANKLE FRACTURES

### Mechanism of injury

Ankle fractures in sports typically accompany ankle sprains and arise from diverse forms of trauma. The predominant mode of damage is an external rotating force applied to a supinated foot, transmitted through the talus to the malleoli. Any of the malleoli may sustain injury: lateral, medial, or posterior. The fracture pattern may be unimalleolar, bimalleolar (usually involving the lateral and medial malleoli), or trimalleolar. Trimalleolar fractures signify a high-energy transfer injury that leads to soft tissue damage and an increased risk of consequences. In bimalleolar equivalent fractures, the medial ligament sustains injury concurrently with the fibula or the lateral malleolus. causing ankle instability. A Maisonneuve fracture is characterized by the destruction of the distal tibiofibular syndesmosis or a medial malleolar fracture accompanied by a fracture of the proximal head of the fibula. Pilon fractures entail a fracture of the tibia adjacent to the ankle, frequently accompanied with a fracture of the fibula. The fracture pattern is contingent upon the orientation of the external force and the foot's posture at the moment of damage.

### History

Symptoms encompass acute intense pain, edema, contusions, soreness, and an inability to bear weight on the affected foot. A dislocated ankle joint has a pronounced deformity. A comprehensive history must be conducted, encompassing the mechanism of injury, foot posture, and impact force, all of which can elucidate injury patterns and assess potential compromise of ankle stability. Identifying drugs is essential. Prolonged administration of corticosteroids may elevate the risk of osteoporosis and fractures. It is essential to document a history of smoking and chronic medical disorders, including peripheral vascular disease and metabolic bone disease, as they influence treatment strategies. Additional significant elements of the history encompass vocation, excluding professional athletics, and living conditions, such as the presence of stairs in the residence.

### Physical examination

In addition to palpating the ankle joint and proximal fibula and tibia, an evaluation of the neurovascular state and a comprehensive examination of the soft tissue must be conducted. The joints next to the ankle joint (knee and foot) and both active and passive range of motion of the ankle joint should be assessed. A comprehensive motor and sensory evaluation is essential for ascertaining whether any postoperative neurological abnormalities are attributable to the fracture or to iatrogenic factors, such as a regional nerve block. Tenderness at the proximal fibula indicates a Maisonneuve fracture. Any significant abnormalities should be corrected promptly under conscious sedation or by an intra-articular block to mitigate the risks of neurovascular and soft tissue complications[12,36].

### Investigations

The Ottawa Ankle Rules delineate the criteria for necessitating an ankle X-ray. The guidelines indicate that pain in the malleolar region, along with bony tenderness within 6 cm of the posterior edge of the medial malleolus, bony tenderness within 6 cm of the posterior edge of the lateral malleolus, or an inability to bear weight either immediately or in the Emergency Department, requires imaging. X-rays must consist of conventional three-view images: anteroposterior, lateral, and mortise views. The mortise film must be acquired with the foot internally rotated by approximately 15° to eliminate the shadow of the tibia on the fibula. MRI is not typically required for ankle fractures but may be beneficial thereafter to evaluate associated ligamentous damage. Computed tomography scans are especially beneficial in Pilon fractures for precisely defining the fracture pattern, aiding in preoperative planning, and informing surgical fixing options.

### Classification

Two classification systems exist for ankle fractures. The Danis-Weber system is anatomical and classifies fractures according to their position on the fibula in respect to the syndesmosis. Type A fractures are infrasyndesmotic and typically do not induce ankle instability; type B fractures are trans-syndesmotic, whereas type C fractures are suprasyndesmotic. The Lauge-Hansen system categorizes fractures according to the foot's position and the direction of the force exerted during the injury. Despite its comprehensiveness, it does not consistently predict damage patterns reliably.

### Nonoperative management

For stable fractures with minimal or no displacement, administering analgesics and applying cast immobilization for six weeks is generally adequate to facilitate healing in most instances. Following the removal of the cast, a gradual transition to crutch-assisted weight-bearing and physical therapy may be initiated. During the duration of cast immobilization, radiographs are acquired at predetermined intervals (1 week, 2 weeks, and 6 weeks) to assess progress. Thromboprophylaxis is administered to adults while the lower leg is immobilized in a cast, demonstrating both clinical efficacy and cost-effectiveness by diminishing the risk of venous thromboembolism, encompassing deep vein thrombosis and pulmonary embolism.

### Surgical intervention

Unstable and displaced medial and/or lateral malleolar fractures, or posterior malleolar fractures exceeding one-third of the articular surface of the distal tibia, accompanied with talar tilt and/or talar shift, necessitate surgical intervention. This is often accomplished through open reduction and internal fixation employing a range of established surgical procedures and diverse hardware to attain anatomical realignment of the fracture. Postoperative cast immobilization is a standard procedure. A organized physiotherapy rehabilitation program is then advised to restore the patient to their pre-injury level of activity[37,40,41].

## CONCLUSION

The elevated prevalence of ankle sprains and fractures in athletes requires prompt diagnosis to avert enduring functional impairments. Due to the overlapping symptoms of these injuries, it is essential to distinguish between them by patient history, physical examination, and imaging studies. An accurate diagnosis leads to timely treatment and enables earlier recovery and RTP for the athlete. The PRICE method, along with immobilization and rehabilitation, effectively addresses most injuries; nevertheless, surgical intervention is designated for soft-tissue injuries unresponsive to conservative measures or for misplaced and unstable ankle fractures.

## REFERENCES

1. Dekker R, Kingma J, Groothoff JW, Eisma WH, Ten Duis HJ. Measurement of severity of sports injuries: an epidemiological study. Clin Rehabil. 2000;14:651-656. [PubMed] [DOI] [Cited in This Article: 1] [Cited by in Crossref: 29] [Cited by in F6Publishing: 33] [Article Influence: 1.4] [Reference Citation Analysis (1)]
2. O'Loughlin PF, Murawski CD, Egan C, Kennedy JG. Ankle instability in sports. Phys Sportsmed. 2009;37:93-103. [PubMed] [DOI] [Cited in This Article: 8] [Cited by in Crossref: 70] [Cited by in F6Publishing: 58] [Article Influence: 3.9] [Reference Citation Analysis (2)]
3. Nelson AJ, Collins CL, Yard EE, Fields SK, Comstock RD. Ankle injuries among United States high school sports athletes, 2005-2006. J Athl Train. 2007;42:381-387. [PubMed] [Cited in This Article: 2]
4. Fong DT, Hong Y, Chan LK, Yung PS, Chan KM. A systematic review on ankle injury and ankle sprain in sports. Sports Med. 2007;37:73-94. [PubMed] [DOI] [Cited in This Article: 3] [Cited by in Crossref: 768] [Cited by in F6Publishing: 765] [Article Influence: 45.0] [Reference Citation Analysis (0)]
5. Lynch SA, Renström PA. Treatment of acute lateral ankle ligament rupture in the athlete. Conservative versus surgical treatment. Sports Med. 1999;27:61-71. [PubMed] [DOI] [Cited in This Article: 3] [Cited by in Crossref: 149] [Cited by in F6Publishing: 153] [Article Influence: 6.1] [Reference Citation Analysis (0)]

6. Hunt KJ, Phisitkul P, Pirolo J, Amendola A. High Ankle Sprains and Syndesmotic Injuries in Athletes. J Am Acad Orthop Surg. 2015;23:661-673. [PubMed] [DOI] [Cited in This Article: 8] [Cited by in Crossref: 59] [Cited by in F6Publishing: 58] [Article Influence: 6.4] [Reference Citation Analysis (0)]
7. Hockenbury RT, Sammarco GJ. Evaluation and treatment of ankle sprains: clinical recommendations for a positive outcome. Phys Sportsmed. 2001;29:57-64. [PubMed] [DOI] [Cited in This Article: 8] [Cited by in Crossref: 29] [Cited by in F6Publishing: 29] [Article Influence: 1.3] [Reference Citation Analysis (1)]
8. Dubin JC, Comeau D, McClelland RI, Dubin RA, Ferrel E. Lateral and syndesmotic ankle sprain injuries: a narrative literature review. J Chiropr Med. 2011;10:204-219. [PubMed] [DOI] [Cited in This Article: 3] [Cited by in Crossref: 71] [Cited by in F6Publishing: 42] [Article Influence: 3.2] [Reference Citation Analysis (1)]
9. Rasmussen O, Jensen IT, Hedeboe J. An analysis of the function of the posterior talofibular ligament. Int Orthop. 1983;7:41-48. [PubMed] [DOI] [Cited in This Article: 1] [Cited by in Crossref: 12] [Cited by in F6Publishing: 12] [Article Influence: 0.3] [Reference Citation Analysis (0)]
10. Lötscher P, Lang TH, Zwicky L, Hintermann B, Knupp M. Osteoligamentous injuries of the medial ankle joint. Eur J Trauma Emerg Surg. 2015;41:615-621. [PubMed] [DOI] [Cited in This Article: 7] [Cited by in Crossref: 21] [Cited by in F6Publishing: 21] [Article Influence: 2.3] [Reference Citation Analysis (0)]
11. Lin CF, Gross ML, Weinhold P. Ankle syndesmosis injuries: anatomy, biomechanics, mechanism of injury, and clinical guidelines for diagnosis and intervention. J Orthop Sports Phys Ther. 2006;36:372-384. [PubMed] [DOI] [Cited in This Article: 7] [Cited by in Crossref: 136] [Cited by in F6Publishing: 124] [Article Influence: 6.9] [Reference Citation Analysis (0)]
12. Shearman A, Sarraf KM, Thevendran G, Houlihan-Burne D. Clinical assessment of adult ankle fractures. Br J Hosp Med (Lond). 2013;74:C37-C40. [PubMed] [DOI] [Cited in This Article: 5] [Cited by in Crossref: 4] [Cited by in F6Publishing: 4] [Article Influence: 0.4] [Reference Citation Analysis (0)]
13. van den Bekerom MP, Kerkhoffs GM, McCollum GA, Calder JD, van Dijk CN. Management of acute lateral ankle ligament injury in the athlete. Knee Surg Sports Traumatol Arthrosc. 2013;21:1390-1395. [PubMed] [DOI] [Cited in This Article: 3] [Cited by in Crossref: 111] [Cited by in F6Publishing: 112] [Article Influence: 10.2] [Reference Citation Analysis (1)]
14. Lin CW, Hiller CE, de Bie RA. Evidence-based treatment for ankle injuries: a clinical perspective. J Man Manip Ther. 2010;18:22-28. [PubMed] [DOI] [Cited in This Article: 2] [Cited by in Crossref: 35] [Cited by in F6Publishing: 38] [Article Influence: 2.9] [Reference Citation Analysis (0)]
15. Polzer H, Kanz KG, Prall WC, Haasters F, Ockert B, Mutschler W, Grote S. Diagnosis and treatment of acute ankle injuries: development of an evidence-based algorithm. Orthop Rev (Pavia). 2012;4:e5. [PubMed] [DOI] [Cited in This Article: 14] [Cited by in Crossref: 83] [Cited by in F6Publishing: 64] [Article Influence: 5.3] [Reference Citation Analysis (3)]
16. Beynnon BD, Murphy DF, Alosa DM. Predictive Factors for Lateral Ankle Sprains: A Literature Review. J Athl Train. 2002;37:376-380. [PubMed] [Cited in This Article: 1]

17. Lynch SA. Assessment of the Injured Ankle in the Athlete. J Athl Train. 2002;37:406-412. [PubMed] [Cited in This Article: 14]
18. Renström PA, Konradsen L. Ankle ligament injuries. Br J Sports Med. 1997;31:11-20. [PubMed] [DOI] [Cited in This Article: 3] [Cited by in Crossref: 78] [Cited by in F6Publishing: 70] [Article Influence: 2.6] [Reference Citation Analysis (0)]
19. Chan KW, Ding BC, Mroczek KJ. Acute and chronic lateral ankle instability in the athlete. Bull NYU Hosp Jt Dis. 2011;69:17-26. [PubMed] [Cited in This Article: 1]
20. Kaminski TW, Hertel J, Amendola N, Docherty CL, Dolan MG, Hopkins JT, Nussbaum E, Poppy W, Richie D; National Athletic Trainers' Association. National Athletic Trainers' Association position statement: conservative management and prevention of ankle sprains in athletes. J Athl Train. 2013;48:528-545. [PubMed] [DOI] [Cited in This Article: 4] [Cited by in Crossref: 157] [Cited by in F6Publishing: 137] [Article Influence: 12.5] [Reference Citation Analysis (1)]
21. Boyce SH, Quigley MA, Campbell S. Management of ankle sprains: a randomised controlled trial of the treatment of inversion injuries using an elastic support bandage or an Aircast ankle brace. Br J Sports Med. 2005;39:91-96. [PubMed] [DOI] [Cited in This Article: 2] [Cited by in Crossref: 75] [Cited by in F6Publishing: 78] [Article Influence: 4.1] [Reference Citation Analysis (0)]
22. van Dijk CN. Management of the sprained ankle. Br J Sports Med. 2002;36:83-84. [PubMed] [DOI] [Cited in This Article: 1] [Cited by in Crossref: 37] [Cited by in F6Publishing: 38] [Article Influence: 1.7] [Reference Citation Analysis (0)]
23. Ogilvie-Harris DJ, Gilbart M. Treatment modalities for soft tissue injuries of the ankle: a critical review. Clin J Sport Med. 1995;5:175-186. [PubMed] [DOI] [Cited in This Article: 1] [Cited by in Crossref: 93] [Cited by in F6Publishing: 99] [Article Influence: 3.4] [Reference Citation Analysis (0)]
24. van den Bekerom MP, van der Windt DA, Ter Riet G, van der Heijden GJ, Bouter LM. Therapeutic ultrasound for acute ankle sprains. Cochrane Database Syst Rev. 2011;CD001250. [PubMed] [DOI] [Cited in This Article: 1] [Cited by in Crossref: 15] [Cited by in F6Publishing: 13] [Article Influence: 1.0] [Reference Citation Analysis (0)]
25. Camacho LD, Roward ZT, Deng Y, Latt LD. Surgical Management of Lateral Ankle Instability in Athletes. J Athl Train. 2019;54:639-649. [PubMed] [DOI] [Cited in This Article: 2] [Cited by in Crossref: 29] [Cited by in F6Publishing: 25] [Article Influence: 5.0] [Reference Citation Analysis (0)]
26. Ribbans WJ, Garde A. Tibialis posterior tendon and deltoid and spring ligament injuries in the elite athlete. Foot Ankle Clin. 2013;18:255-291. [PubMed] [DOI] [Cited in This Article: 3] [Cited by in Crossref: 39] [Cited by in F6Publishing: 35] [Article Influence: 3.2] [Reference Citation Analysis (0)]
27. McCollum GA, van den Bekerom MP, Kerkhoffs GM, Calder JD, van Dijk CN. Syndesmosis and deltoid ligament injuries in the athlete. Knee Surg Sports Traumatol Arthrosc. 2013;21:1328-1337. [PubMed] [DOI] [Cited in This Article: 3] [Cited by in Crossref: 105] [Cited by in F6Publishing: 109] [Article Influence: 9.9] [Reference Citation Analysis (0)]
28. Fong DT, Chan YY, Mok KM, Yung PS, Chan KM. Understanding acute ankle ligamentous sprain injury in sports. Sports Med Arthrosc Rehabil Ther Technol. 2009;1:14. [PubMed] [DOI] [Cited in This Article: 1] [Cited by in Crossref:

97] [Cited by in F6Publishing: 132] [Article Influence: 8.8] [Reference Citation Analysis (0)]
29. Hintermann B, Knupp M, Pagenstert GI. Deltoid ligament injuries: diagnosis and management. Foot Ankle Clin. 2006;11:625-637. [PubMed] [DOI] [Cited in This Article: 1] [Cited by in Crossref: 125] [Cited by in F6Publishing: 87] [Article Influence: 4.8] [Reference Citation Analysis (0)]
30. Wake J, Martin KD. Syndesmosis Injury From Diagnosis to Repair: Physical Examination, Diagnosis, and Arthroscopic-assisted Reduction. J Am Acad Orthop Surg. 2020;28:517-527. [PubMed] [DOI] [Cited in This Article: 5] [Cited by in Crossref: 17] [Cited by in F6Publishing: 20] [Article Influence: 5.0] [Reference Citation Analysis (0)]
31. Magan A, Golano P, Maffulli N, Khanduja V. Evaluation and management of injuries of the tibiofibular syndesmosis. Br Med Bull. 2014;111:101-115. [PubMed] [DOI] [Cited in This Article: 3] [Cited by in Crossref: 56] [Cited by in F6Publishing: 54] [Article Influence: 5.4] [Reference Citation Analysis (0)]
32. Ryan LP, Hills MC, Chang J, Wilson CD. The lambda sign: a new radiographic indicator of latent syndesmosis instability. Foot Ankle Int. 2014;35:903-908. [PubMed] [DOI] [Cited in This Article: 1] [Cited by in Crossref: 21] [Cited by in F6Publishing: 23] [Article Influence: 2.3] [Reference Citation Analysis (0)]
33. Nussbaum ED, Hosea TM, Sieler SD, Incremona BR, Kessler DE. Prospective evaluation of syndesmotic ankle sprains without diastasis. Am J Sports Med. 2001;29:31-35. [PubMed] [DOI] [Cited in This Article: 1] [Cited by in Crossref: 139] [Cited by in F6Publishing: 110] [Article Influence: 4.8] [Reference Citation Analysis (0)]
34. Schepers T. To retain or remove the syndesmotic screw: a review of literature. Arch Orthop Trauma Surg. 2011;131:879-883. [PubMed] [DOI] [Cited in This Article: 2] [Cited by in Crossref: 110] [Cited by in F6Publishing: 102] [Article Influence: 7.8] [Reference Citation Analysis (0)]
35. de-Las-Heras Romero J, Alvarez AML, Sanchez FM, Garcia AP, Porcel PAG, Sarabia RV, Torralba MH. Management of syndesmotic injuries of the ankle. EFORT Open Rev. 2017;2:403-409. [PubMed] [DOI] [Cited in This Article: 1] [Cited by in Crossref: 17] [Cited by in F6Publishing: 18] [Article Influence: 2.6] [Reference Citation Analysis (0)]
36. Lawson KA, Ayala AE, Morin ML, Latt LD, Wild JR. Ankle Fracture-Dislocations: A Review. Foot Ankle Orthop. 2018;3:2473011418765122. [DOI] [Cited in This Article: 5] [Cited by in Crossref: 5] [Cited by in F6Publishing: 7] [Article Influence: 1.2] [Reference Citation Analysis (0)]
37. Lampridis V, Gougoulias N, Sakellariou A. Stability in ankle fractures: Diagnosis and treatment. EFORT Open Rev. 2018;3:294-303. [PubMed] [DOI] [Cited in This Article: 2] [Cited by in Crossref: 52] [Cited by in F6Publishing: 38] [Article Influence: 6.3] [Reference Citation Analysis (0)]
38. Broomhead A, Stuart P. Validation of the Ottawa Ankle Rules in Australia. Emerg Med (Fremantle). 2003;15:126-132. [PubMed] [DOI] [Cited in This Article: 1] [Cited by in Crossref: 22] [Cited by in F6Publishing: 22] [Article Influence: 1.0] [Reference Citation Analysis (0)]
39. Goost H, Wimmer MD, Barg A, Kabir K, Valderrabano V, Burger C. Fractures of the ankle joint: investigation and treatment options. Dtsch Arztebl Int. 2014;111:377-

388. [PubMed] [DOI] [Cited in This Article: 1] [Cited by in Crossref: 18] [Cited by in F6Publishing: 42] [Article Influence: 4.7] [Reference Citation Analysis (0)]

40. Robertson GA, Wood AM. Fractures in sport: Optimising their management and outcome. World J Orthop. 2015;6:850-863. [PubMed] [DOI] [Cited in This Article: 2] [Cited by in CrossRef: 16] [Cited by in F6Publishing: 16] [Article Influence: 1.8] [Reference Citation Analysis (1)]

41. Robertson GA, Wood AM, Aitken SA, Court Brown C. Epidemiology, management, and outcome of sport-related ankle fractures in a standard UK population. Foot Ankle Int. 2014;35:1143-1152. [PubMed] [DOI] [Cited in This Article: 2] [Cited by in Crossref: 26] [Cited by in F6Publishing: 25] [Article Influence: 2.5] [Reference Citation Analysis (0)]

42. Pandor A, Horner D, Davis S, Goodacre S, Stevens JW, Clowes M, Hunt BJ, Nokes T, Keenan J, de Wit K. Different strategies for pharmacological thromboprophylaxis for lower-limb immobilisation after injury: systematic review and economic evaluation. Health Technol Assess. 2019;23:1-190. [PubMed] [DOI] [Cited in This Article: 1] [Cited by in Crossref: 12] [Cited by in F6Publishing: 18] [Article Influence: 3.6] [Reference Citation Analysis (0)]

43. Wikipedia. Lateral collateral ligament of ankle joint, 2020. [cited 25 March 2021]. Available from: https://en.wikipedia.org/wiki/Lateral_collateral_ligament_of_ankle_joint. [Cited in This Article: 1]

44. Earth's Lab. Easy Notes On [Ankle Joint (Talocrural Joint)] Learn in Just 4 Minutes! [cited 25 March 2021]. Available from: https://www.earthslab.com/anatomy/ankle-joint-talocrural-joint/. [Cited in This Article: 1]

45. Crossfit. Movement About Joints, Part 7: The Ankle. [cited 25 March 2021]. Available from: https://www.crossfit.com/essentials/movement-about-joints-part-7-the-ankle. [Cited in This Article: 1]