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Editor's Note—Each year, sports injuries account for approximately 500,000 visits to the doctor.¹ Athletes who present as sports participants may be male or female, pre-adolescent, adolescent, or older. In the latter group, many of the injuries are musculoskeletal in nature. The joints most commonly involved are shoulder, ankle, and knee. This article, divided into two parts, describes the clinical presentation, examination, and intervention of several of the more common pathologies derived from sports-related injury.

Ankle Injuries

Boney Anatomy

The ankle joint is made up of three bones: the tibia, the fibula, and the talus. In addition, the talus sits on top of the calcaneus forming another joint called the talo-calcaneal or sub-talar joint.²

Ligaments

The lateral ligaments include the anterior talofibular ligament (ATFL) and the calcaneofibular ligament (CFL) (*see Figures 1 & 2*).^{2,3}

The deltoid ligament resides medially. It is a triangular shaped ligament that fans out from the medial malleolus to the navicular, talus, and calcaneus.² Other major ligament structures include the interosseus ligaments and the anterior and

posterior tibio-fibular ligaments.³ Each of these ligaments plays major stabilizing roles relative to the ankle and foot.⁴ Musculotendinous structures include the tendons of the peroneus longus and brevis on the lateral aspect that traverse the lateral aspect of the ankle while the medial aspect of the ankle includes the tibialis posterior tendon, the flexor digitorum longus, and the flexor hallucis longus tendons.²

Biomechanics

Both the ankle joint proper and the sub-talar joint contribute to the motions of inversion and eversion. Other motions that occur at the ankle are plantar flexion and dorsiflexion. The distal fibula, or lateral malleolus, extends fur-

ther distally than the medial malleolus does. In addition, the dome of the talus is wedge-shaped from front to back. The dome of the talus is wider posteriorly than it is anteriorly. This means that when the ankle moves into dorsiflexion, the bones are more congruent; therefore, the ankle is more stable. Conversely, when the ankle is in plantar flexion, it is less stable.

General Considerations: Ankle History and Physical Exam

Ankle injuries are the most common injuries that occur in the athletic arena.^{4,5} Common injuries include sprains, fractures, and tendon injuries.⁴ When performing a history of the ankle injury, it is critical to determine the mechanism of injury

Common Sports Injuries: Part I

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of the ankle.³⁻⁵ In most instances, the athlete will be able to recall this in some detail, but if the athlete cannot recall the mechanism of injury, there may have been an onlooker who could determine the mechanism of injury. This may be a teammate, coach, or athletic trainer.

General physical exam considerations include position of the foot—specifically, both the weight bearing and the non-weight bearing neutral position.⁵ A relatively normal gait can occur if the athlete can maintain the neutral position of the foot. In addition, this inspection should include the typical concern regarding swelling and ecchymosis. This swelling may be isolated over the sinus tarsi or it may be general edema. If this is a chronic sprain that has not been well taken care of, there may be pitting edema or general edema that is pitted when pressed. For example, this could occur if the athlete uses heat too soon after an acute injury.

The athlete should also be asked to perform active range of motion. This includes plantar flexion, dorsiflexion, inversion, and eversion. These motions are usually limited by swelling and pain.

A neurovascular exam including strength and sensation should be performed on all acute injuries. This includes evaluation of a distal pulse (tibialis posterior and/or dorsalis pedis) and an evaluation of dermatomes and myotomes. (For a discussion of myotomes, see Holmes CF. The preparticipation exam. *Primary Care Reports* 2000;6:189-202). Dermatomes are as follows: L-4 anterior medial lower leg, L-5 anterior lateral lower leg, S-1 lateral border of the foot, and S-2 is posterior leg (see Table 1).⁶ Myotomes should be checked for relative strength and dermatomes should be checked to determine if

sensory input is intact to light touch.

Ankle Sprains

Different authors use different classifications of ankle sprains.^{4,5,7} In general, sprains are defined as damage to ligaments. Sprains are graded according to a cross-sectional micro-trauma that occurs within each ligament. In other words, the anterior talofibular ligament could have a 1st degree (stretch), 2nd degree (partial tear), or a 3rd degree (complete tear) sprain (see Table 2).⁸ However, Nitz has described ankle sprains differently.⁸ In fact, he described 1st degree sprains as isolated anterior talofibular ligament sprains, 2nd degree sprains as those sprains involving other ligaments including the deltoid ligament, and 3rd degree sprains as those that involve tearing ATFL, deltoid ligaments, and involvement of ATFL and CFL. Perhaps a more appropriate classification is to modify the Nitz classification to include only the tibiofibular or high ankle sprain as the third degree. Regardless of the categorization scheme that is used, it is clear that anterior talofibular ligament involvement is present in the vast majority of ankle sprains.^{3-5,7} In addition, the lateral ligaments are involved 85% of the time.⁷

Grade I Ankle Sprains: History and Specific Physical Examination

The mechanism of injury of the classic lateral ankle sprain, primarily involving the anterior talofibular ligament, is plantar flexion with inversion.^{4,5,7} These sprains, while very common, can also be somewhat debilitating. In fact, if these sprains are not well taken care of, including a full course of rehabilitation, then recurrence of an ankle sprain is much more likely to occur.⁹

Inspection may indicate minimal or no swelling, which may be restricted to the sinus tarsi immediately overlying the ATF. The most common special tests used to evaluate the lateral ligaments include the anterior drawer test and the medial talar rock test. The anterior drawer test is performed specifically to evaluate the integrity of the anterior talofibular ligament. One hand stabilizes the distal leg while the other hand grasps the calcaneus and a force in an anterior direction from heel to toe is directed across the foot (see Figures 3 & 4).¹⁰ The medial talar rock is performed to test the integrity of the calcaneal fibular ligament. While performing this test, the foot is held in neutral with one hand while the other hand stabilizes the distal leg. The foot is then rocked into inversion, thus mimicking the mechanism of injury.⁵ Both of these tests are highly specific for a grade 1 ankle sprain.

Grade I Ankle Sprain: Treatment/Rehabilitation

Treatment of grade 1 ankle sprains includes ice and rest acutely (mnemonic: R.I.C.E. = rest, ice, compression, elevation). The key to determining whether the athlete needs crutches is this: "Can the athlete ambulate with a normal gait?" If the athlete can ambulate with a normal gait, he or she may not need crutches or may just need one crutch (on the opposite side of the injury). If, however, the athlete has to walk with a limp, he or she needs crutches. However, with a grade 1 sprain, crutches should be only for relative rest. The athlete should practice a heel-toe gait while walking on crutches.¹¹

As soon as the athlete can ambulate and has full range of

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Table 1. Dermatomes of the Lower Extremity

Nerve Root	Dermatome Description
L1	lower back and groin
L2	anterior thigh
L3	anterior distal thigh and knee
L4	medial lower leg
L5	lateral lower leg
S1	posterior lower leg to mid calf
S2	posterior lower leg from mid calf up

Adapted from: Reese NB. Muscle and Sensory Testing. 1st ed. Philadelphia, Pa: WB Saunders Company; 1999.

returned to that sport. This is the last phase of any rehabilitation in athletic injury. This rehabilitation should be directed by a physical therapist or an athletic trainer.^{4,7,9}

**Grade II Ankle Sprains:
History and Specific Physical Exam**

Grade 2 ankle sprains are those involving the deltoid ligament and take longer to heal.⁸ This is primarily because most feet pronate and the deltoid ligament bears more weight than the lateral ligaments of the ankle.⁴ Fortunately, these only constitute about 5% of ankle sprains.⁴

The mechanism of injury here is the opposite of the 1st degree sprain. That is, eversion is involved. When violent eversion occurs at the ankle, the fibula should be evaluated for fracture.

Inspection may reveal a more general swelling and obvious point tenderness over the deltoid ligament to palpation (medial joint line). In addition, a talar rock into eversion is often done to test the integrity of the deltoid ligament. This is performed in

Figure 2. Deltoid Ligaments of the Ankle.
Reprinted with permission from: *Am Fam Physician* 1998;57:475.

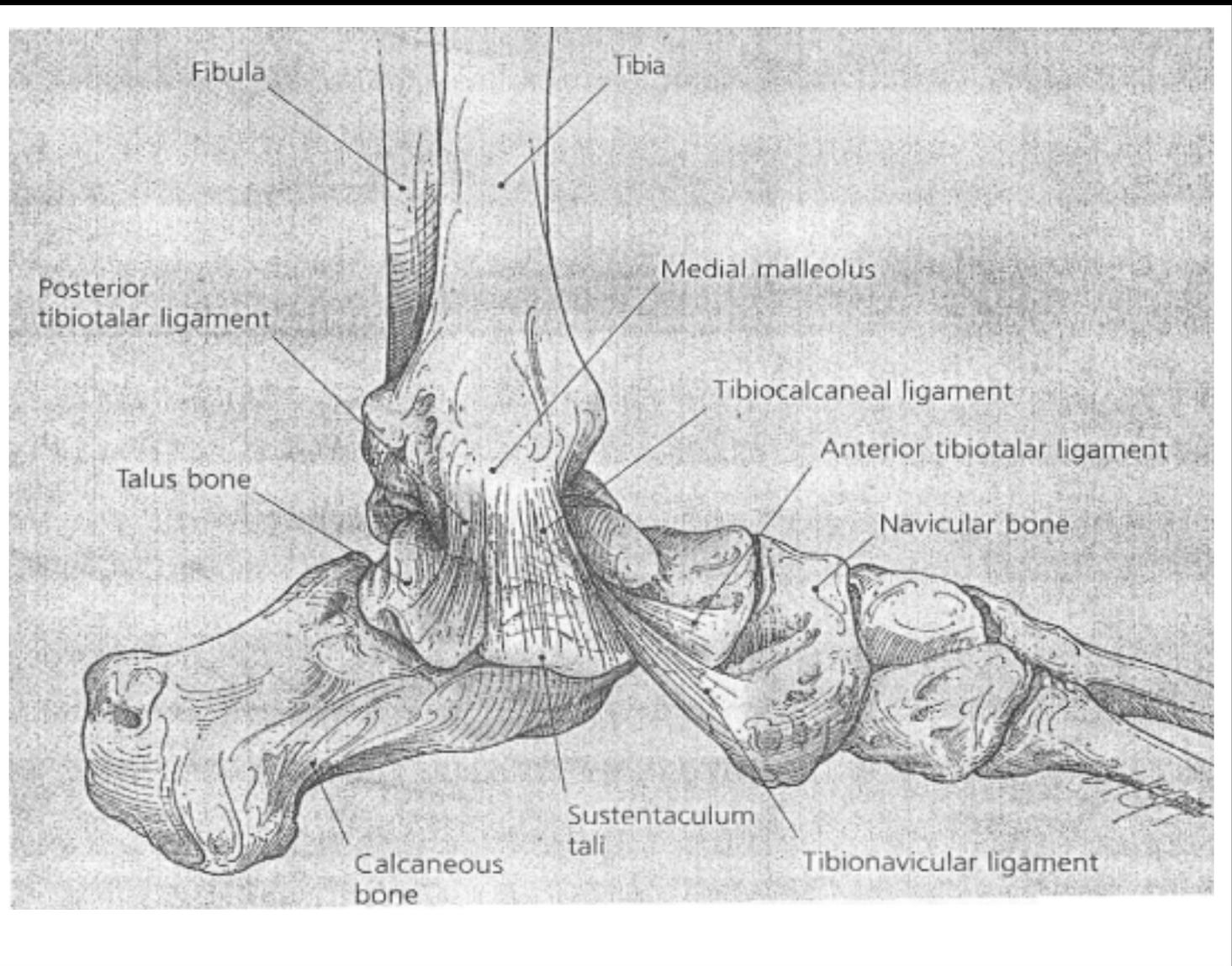


Table 2. Nitz Categories of Ankle Sprains

Grade 1	lateral ligament involvement
Grade 2	lateral and medial ligaments involved
Grade 3	lateral, medial, and tibiofibular ligaments involved

Adapted from: Nitz AJ, et al. Nerve injury and grades II and III ankle sprains. *Am J Sports Med* 1985;13:177-182.

the same manner as inversion except the foot is rocked into eversion rather than inversion.^{10,16} Ecchymosis will appear much more frequently with grade 2 sprains and will overlie the medial joint.

Grade II Ankle Sprain: Treatment

Treatment is similar to that of the grade 1. The athlete may be out of action somewhere between two to four weeks (for grade 2 sprains).⁴

Grade III Ankle Sprains

Again, according to a modified Nitz classification, grade 3 sprains are syndesmosis sprains usually involving the anterior tib-fib ligament.⁸ Since the anterior tib-fib ligament traverses the talocalcral joint, it is much more difficult to heal. Specifically, every time the athlete bears weight, the talocalcral space is spread apart and this further traumatizes the tib-fib ligament.

History considerations include the mechanism of injury,

which in this case is quite often a torsional stress. In other words, the talus rotates within the talocalcral joint. This injury usually involves ligaments other than the tib-fib ligament. It can include the interosseous ligament and the ligaments below the medial and lateral ligaments (ATF, CF, and deltoid).⁸

Inspection will be similar to that of a grade 2 sprain. There may be point tenderness over the anterior tib-fib ligament. In the acute phase, weight bearing and active range of motion will be painful. Strength should not be tested secondary to pain. The squeeze test, which is performed by compressing the fibula and the tibia at the mid-portion of the lower leg, is a common special test performed to determine if there is a syndesmosis sprain. Pain in an area of the anterior talocalcral joint may indicate a syndesmosis sprain.⁵

Radiographs

The Ottawa Ankle Rules have been put into place to determine the need for x-rays when ankle sprain is suspected to rule out fractures (see Table 3).³ Their usefulness has been demonstrated.^{3,17}

Grade III Ankle Sprains: Treatment

There is some controversy with regard to immobilization of the grade 3 or high ankle sprain.^{4,5} Quite often, the use of an air cast in both severe grade 2 and grade sprains 3 is used. The athlete will definitely be nonweight bearing for a time with a grade 3 sprain to allow some healing to occur before weight

bearing begins on the tib-fib ligament. Once the athlete gains full range of motion, rehabilitation can begin. This rehabilitation will follow much the same course as the grade 1. Obviously, the rehabilitation will be much slower and the ankle may take 4-8 weeks to heal.⁴

Tendonitis

History/Pathophysiology

Tendonitis about the ankle and foot is also a relatively common condition. Unlike ankle sprains that present with a history of trauma, tendonitis presents with a history of insidious onset. In other words, no specific mechanism of injury is recalled. This is not always true and acute tendonitis can occur. However, many times tendonitis occurs from chronic overuse. Table 4 summarizes common tendonitis sites, common causative factors, and signs and symptoms. The pathophysiology of tendonitis is relatively simple. Most tendons have a diminished blood supply

Figure 3. Medial Talar Rock

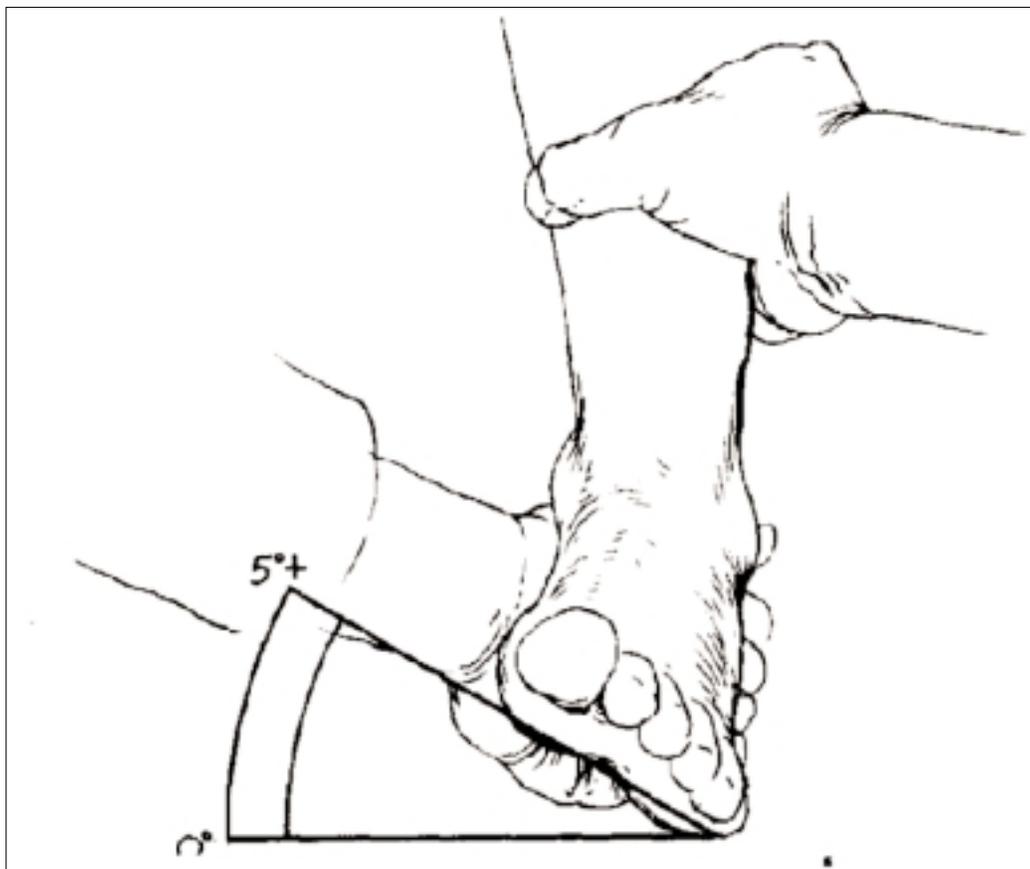


Figure 4. Lateral Talar Rock



relative to the rest of the contractile mechanism. In other words, poor blood supply can lead to an inability to recover from microtrauma. As that microtrauma accrues, at some point a critical mass of fibers is involved and the pain begins. As mentioned previously, this pain can slowly grow to a point to where many people have had tendonitis for several months before they seek help. Other common sites of tendonitis are the tibialis

posterior, the tibialis anterior, and the peroneal tendon, but by far the most common is the achilles tendon.⁵

Specific Physical Examination

Achilles tendonitis is relatively common. Quite often, pain occurs just proximal to the insertion of the calcaneus. This could be due to faulty foot mechanics. Acutely, however, a heel lift should be used. It is also important to evaluate the athlete's footwear. Many times, injuries such as tendonitis occur when shoes are "worn out." A list of training areas that cause tendonitis is included in Table 4. Signs and symptoms include pain with active movement. This pain may or may not be aggravated by weight bearing. There will be pain with passive stretching of the same tendon. Obviously, with palpation there will be localized tenderness. There may be swelling or thickening of the tendon in addition to some possible crepitous around the perry tendon tissues. Tendonitis pain is usually more prevalent in the early morning. As the day wears on, the blood supply of the tendon improves with motion and pain decreases.⁵

Treatment

Treatment for tendonitis about the ankle usually involves some form of orthotic fabrication and usually some form of heel lift. In addition, a course of rehabilitation should be undertaken usually by a physical therapist and/or athletic trainer.^{4,5,9} Initially, treatment should be relatively conservative. Obviously, changes in any training errors that have occurred should be a primary consideration. Lower leg alignment should also be

Table 3. Ottawa Ankle Rules for Radiographic Series Following Acute Ankle Injuries

Ankle Radiographs are required only if the patient presents with pain in the malleolar zone and any of the following:

- bony tenderness at tip of lateral malleolus
- bony tenderness at tip of medial malleolus
- presents with inability to bear weight

Foot Radiographs are required only if patient has pain in the midfoot zone and any of the following:

- bony tenderness at the base of the fifth metatarsal
- bony tenderness at the navicular
- presents with inability to bear weight

Adapted from: Wexler RK. The injured ankle. Am Fam Physician 1998;57(3):474-480.

Table 4. Tendonitis in the Lower Leg, Ankle, and Foot

Common Sites

- Achilles tendon just above its insertion into the calcaneus
- Tibialis posterior just behind the medial malleolus
- Tibialis anterior on the dorsum of the foot just under the extensor retinaculum
- Peroneal tendon behind the lateral malleolus and at the insertion into the base of the fifth metatarsal

Common Causative Factors

- Faulty foot mechanics producing friction and compression between the tendon, sheath, and underlying bony structure, or causing compression of the tendon against the shoe
- Poor footwear that creates poor mechanics or is not fit properly
- Training errors that include:
Intensity too high, with poor work:rest ratio;
Muscle fatigue leading to mechanical breakdown of foot function
Poor training surface (dirty gym floor), sudden change from soft to hard or hard to soft (road camber change when running)
Sudden changes in program such as adding hills, sprints, or distance
Returning or progressing too quickly following an illness
Poor flexibility in the gastrocnemius soleus muscle, which increases twist and whipping action of Achilles tendon because foot must increase pronation to increase dorsiflexion of the ankle joint in weight-bearing position; this in turn can produce chronic overstretching of Achilles tendon and result in microtears of tendon
Trauma (direct blow)
- Infection from an overlying cut or a penetrating wound into the tendon

Signs and Symptoms

- Pain with active movement, aggravated in weight bearing
- Pain on passive stretching
- Localized tenderness
- Possible swelling and/or thickening in the tendon and peritendon tissues
- May have "snowball crepitus"
- Morning stiffness at site of lesion; this also occurs following any period of inactivity during the day when the part is not moved for 15-20 minutes or longer

Adapted from: Athletic Injuries and Rehabilitation. Zachazewski JE, Quillen WS, eds. Philadelphia, Pa: WB Saunders Company; 1996.

evaluated. Typical rehabilitation usually includes some form of heat to improve blood flow, followed by active exercises within the tolerance of pain (exercise should not increase the pain). Common exercises include stretching of the tendon with contract-relax techniques that may include weight bearing on a trampoline progressing to weight bearing on ground. Functional rehabilitation will always include proprioceptive training such as static single-leg stance followed by balance in a dynamic environment (BAPST board, sliding board, etc.). The critical point of rehabilitation is the last phase of rehabilitation, which is the return to play. This should be done very slowly. Stress across the tendon should be increased slowly as activities of the sport should be mimicked in a lower load environment. This may be in water or on a trampoline. The athlete then progresses to a soft flat level surface, such as a grass field, and finally progresses to his or her athletic surface. These injuries generally occur in runners. The last surface that the athlete would return to would be a hard concrete surface. In fact, it is preferable that all athletes train on a softer surface.^{4,5,9}

Part II of Common Sports Injuries will discuss knee injuries, including the anatomy, history, and physical exam; ACL tears, rehabilitation, the patella femoral joint, patellar tendonitis, radiographs, and the shoulder.

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Physician CME Questions

59. In treating a grade I ankle sprain, which of the following should be administered?
 - a. R.I.C.E.
 - b. Crutches
 - c. Heel-toe gait
 - d. All of the above

60. Ankle radiographs are required only if the patient presents with pain in the malleolar zone and which of the following?
 - a. Bony tenderness at tip of lateral malleolus
 - b. Bony tenderness at tip of medial malleolus
 - c. Presents with inability to bear weight
 - d. All of the above

61. Some symptoms of tendonitis in the lower leg, ankle, and foot include:
 - a. pain with active movement, aggravated in weight bearing.
 - b. pain on passive stretching.
 - c. localized tenderness.
 - d. "snowball crepitus."
 - e. All of the above

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