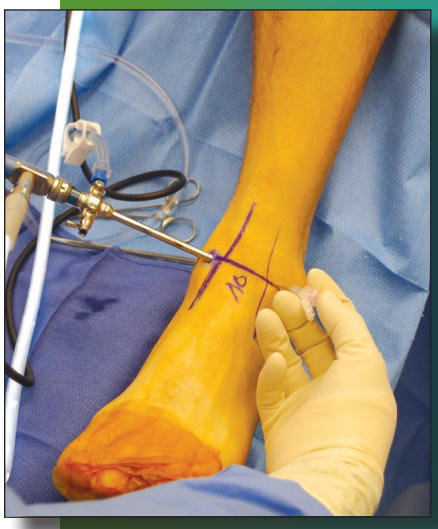
Continuing Medical Education



Lateral Ankle Injuries: Scope and Stabilization

Proper diagnosis and treatment leads to better outcomes.

BY PATRICK R. BURNS, DPM

Goals and Objectives

1) To understand the pathology associated with the lateral ankle sprain

2) To learn the current treatment recommendations and techniques.

Welcome to Podiatry Management's CME Instructional program. Podiatry Management Magazine is approved by the Council on Podiatric Medical Education as a provider of continuing education in podiatric medicine. Podiatry Management Magazine has approved this activity for a maximum of 1.5 continuing education contact hours. This CME activity is free from commercial bias and is under the overall management of Podiatry Management Magazine.

You may enroll: 1) on a per issue basis (at $29.00 per topic) or 2) per year, for the special rate of $249 (you save $41). You may submit the answer sheet, along with the other information requested, via mail, fax, or phone. You can also take this and other exams on the Internet at www.podiatrym.com/cme.

If you correctly answer seventy (70%) of the questions correctly, you will receive a certificate attesting to your earned credits. You will also receive a record of any incorrectly answered questions. If you score less than 70%, you can retake the test at no additional cost. A list of states currently honoring CPME approved credits is listed on pg. 136. Other than those entities currently accepting CPME-approved credit, Podiatry Management cannot guarantee that these CME credits will be acceptable by any state licensing agency, hospital, managed care organization or other entity. PM will, however, use its best efforts to ensure the widest acceptance of this program possible.

This instructional CME program is designed to supplement, NOT replace, existing CME seminars. *The goal of this program is to advance the knowledge of practicing podiatrists. We will endeavor to publish high quality manuscripts by noted authors and researchers. If you have any questions or comments about this program, you can write or call us at:* ***Program Management Services, P.O. Box 490, East Islip, NY 11730, (631) 563-1604 or e-mail us at bblock@podiatrym.com.***

*Following this article, an answer sheet and full set of instructions are provided (pg. 136).—**Editor***

Lateral ankle instability is one of the most common traumatic events the foot and ankle surgeon will encounter. There are approximately two million acute sprains per year, or about 20,000 a day that are reported. The most common are lateral ankle injuries making up approximately 85% of sprains.[1] The remainder of "sprains" are less common and include the deltoid or medial ankle sprain, as well as "high ankle sprains," or injuries of the syndesmosis. This article will focus on the more common lateral ankle injuries, with focus on both acute and chronic pathology as well as frequently associated injuries. The goal of this article is for the reader to understand the pathology associated with the lateral ankle sprain and learn the current treatment recommendations and techniques.

Understanding lateral ankle injuries requires knowledge of the pertinent anatomy and familiarity with proper physical exam techniques.

Lateral Ankle Exam and Imaging

Understanding lateral ankle injuries requires knowledge of the pertinent anatomy and familiarity with proper physical exam techniques. The exam itself is based on understanding the anatom-

Continued on page 128

Lateral Ankle (from page 127)

ic structures of the lateral ankle and the related surface anatomy. As with most exams, there should be a systematic approach. In the acute ankle sprain, it may be more difficult as edema and guarding may interfere, so starting the evaluation away from the primary area of complaint avoids irritating the lateral ankle and subsequently limiting participation in the remaining examination. The exam should be based on a knowledge of injuries associated with inversion or twisting-type mechanisms.

The calcaneal fibular ligament is part of the lateral ankle ligament complex.

Edema, ecchymosis, and ankle joint effusion should be noted, and neurovascular status of the intermediate dorsal cutaneous and sural sensory distributions should be documented. The exam is then moved to muscle strength, which again may be guarded, but making sure all groups are functioning, paying attention to the peroneal tendons laterally and noting any pathology such as tenderness, loss of power, or subluxation. Bone is next on the list, palpating the proximal fibula to help rule out high fibular fracture, and a squeeze test at mid-leg will give information about syndesmotic involvement.

The lateral process of the talus, anterior process of the calcaneus, base of the fifth metatarsal, and the Lisfranc complex should all be examined as they all may be associated with the typical lateral ankle/inversion mechanism. Finally, attention is now turned to the primary area of concerns and a more thorough exam of the lateral ankle ligaments, remembering they are typically tender so the exam may be limited. The deltoid ligament is first palpated to ensure that there is no medial injury. The lateral ankle ligaments are the last to examine, again remembering anatomic characteristics during palpation and the exam (Figure 1).

The calcaneal fibular ligament is tested by inversion stress during physical examination.

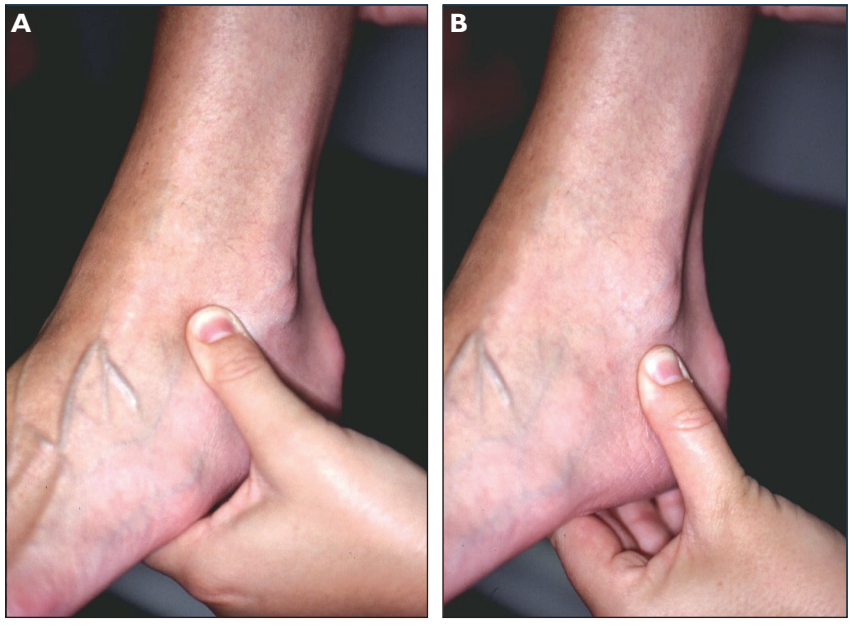


Figure 1: Anatomic location and palpation of the ATFL (A) and CFL (B).

Laterally, there are three ligaments of most concern. Once all other issues are ruled out, the anterior talofibular (ATFL), calcaneofibular (CFL), and posterior talofibular (PTFL) ligaments are surveyed. The least likely to injure is the PTFL. It is perhaps the strongest, but it also protects the ankle from posterior translation, which is much less common as far as mechanism. Because of this, it tends to only be ruptured in severe injuries such as talus dislocation. The PTFL is difficult to examine clinically but can be seen on MRI images.

The CFL is a relatively strong ligament and primarily resists inversion forces, particularly when the foot is neutral or dorsiflexed. It originates on the distal fibula and inserts into the calcaneus and plays a role in both ankle and subtalar instability. The course of the CFL is easy to palpate from the distal tip of the fibula to the lateral wall of the calcaneus and is tested with a talar tilt test or inversion stress clinically. This test is less useful in acute injuries because of guarding but is certainly helpful in cases of chronic insufficiency. Most frequently, the amount of inversion while the foot is in neutral is compared to the contralateral side, but it can also be compared on radiographs.

ATFL

The ATFL is the most common ligament injury. It is the only intracapsular ligament and is the weakest of the three lateral ankle ligaments. It is easy to palpate at the anterior edge of the fibula, extending toward the neck of the talus. The ATFL resists anterior translation of the talus, but also aids in limiting inversion when the foot is in a plantarflexed position. This ligament is likely to be tender with palpation, and the most common clinical exam is the anterior drawer test. This is typically done

Continued on page 129

Lateral Ankle *(from page 128)*

by holding the tibia and heel firmly and applying opposing forces at the ankle. If there is an issue with the competency of the ATFL, the ankle will displace anteriorly.

Anterior Drawer Test

A positive anterior drawer test reveals a large "dimple" at the anatomic location of the ATFL, signifying its lack of integrity whether it is acute or chronic. This is somewhat controversial, however. Since many ankle sprains do not occur when the foot is in a neutral position, the anterior drawer test should be performed with the foot in slight plantarflexion. That is when the ATFL, from an anatomic standpoint, is engaged to aid the CFL in limiting inversion.

Imaging

Imaging is typically the next step. Standard radiographs are common and include the ankle and foot depending on physical exam findings. There is some debate about the need for radiographs, and the Ottawa ankle rules may be of some benefit in decision-making, trying to limit unnecessary imaging and radiation exposure by as much as 30-40%.[2] However, the standard of care with lateral ankle injury generally includes radiographic evaluation. Radiographs not only aid in the diagnosis of fracture but can be useful for those with chronic instability, looking for biomechanical causes such as pes cavus and calcaneal or ankle varus. Pes cavus is commonly associated with lateral ankle instability.

The anterior talofibular is the most common ligament injured during a lateral ankle sprain.

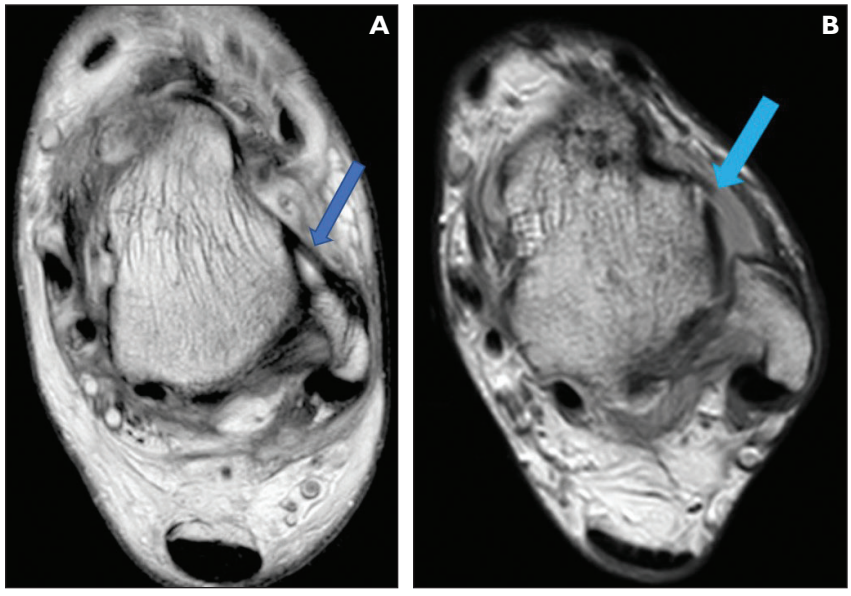


Figure 2: MRI of normal appearing ATFL (A) and typical torn, attenuated ATFL (B).

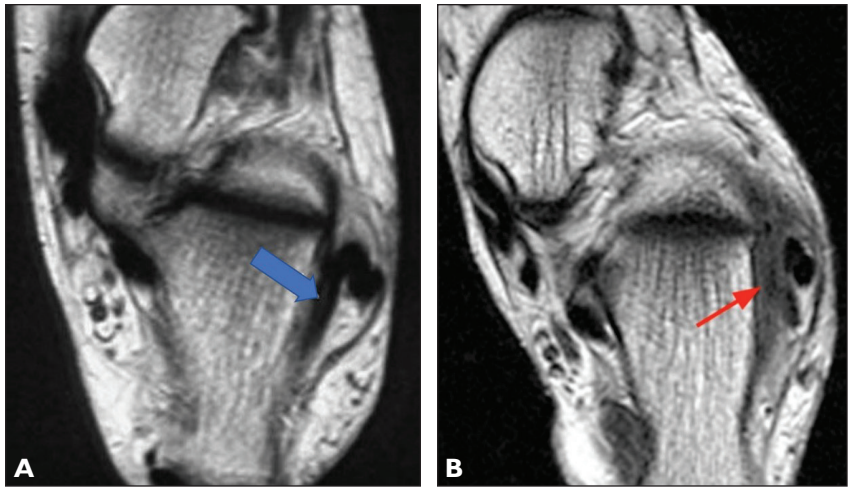


Figure 3: MRI of normal appearing CFL (A) and attenuated CFL (B). Note this ligament is deep to the peroneal tendons.

X-Rays

Typical radiographs include the anterior-posterior (AP), mortise, and lateral images of the ankle. These images would be utilized to diagnose large fracture issues, but also smaller avulsion types that can be utilized in the diagnosis of specific ligament injuries. The overlap of the tibia and fibula on the mortise is at times helpful in syndesmotic injury and should be compared to the contralateral ankle. Large fracture and syndesmotic injury are out of the scope of this article but obviously should be considered and recognized.

MRI

MRI is the standard imaging for lateral ankle sprain and ligament injury. This should only be utilized when the information is useful. Most ankle sprains resolve with non-surgical means, and so MRI should only be ordered in cases that either have high suspicion of a larger issue at the initial exam, or those that continue to express symptoms and do not progress at 10-12 weeks post-injury and treatment. For most injuries, MRI in the early weeks only clouds treatment as the MRI will show edema and torn or attenuated ligaments, which is information al-

Continued on page 130

Lateral Ankle (from page 129)

ready known from the history and exam. MRI should only be considered when there are continued issues to aid in the diagnosis or treatment of chronic pathology, such as unhealed ligaments, osteochondral defects, or peroneal tendinopathy that may be limiting recovery.

When an MRI is obtained, the physician should be able to identify the appropriate anatomy as well as normal and abnormal findings. In particular, one should note the appearance of the ATFL and CFL as well as the peroneal tendons, articular cartilage, and all associated structures of the lateral ankle. The ligaments should appear as homogenous black structures, with attenuated or partially torn ligament showing signs of edema and thickening or absence of the structure in the case of complete tears.

The ATFL is best viewed on a modified axial image (Figure 2), while the CFL is best seen on axial and coronal images deep to the peroneal tendons. The articular surface should be uniform without depression or defect. Peroneal tendons likewise should be uniform black circles on axial images without edema. One should pay close attention to the shape of the peroneal tendons, looking for tendinosis and tear as well as abnormalities to the peroneal retinaculum, the presence of tenosynovitis and low-lying muscle belly that may contribute to impingement, subluxation, and the shape of the posterior fibular groove. All of these issues can contribute to continued pain after lateral ankle sprain and may need to be addressed surgically when a patient has not responded to conservative management.

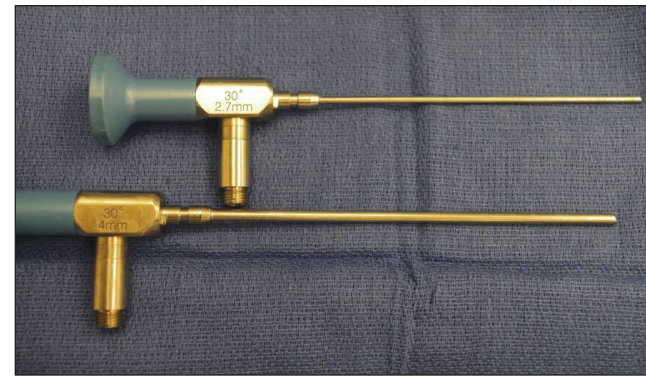


Figure 4: Comparison of 2.0mm lens (top) and 4.0 mm lens (bottom).

Lateral Ankle Injury Treatment

The mainstay of lateral ankle injury is non-operative, with most patients responding to initial splinting, immobilization, rest, ice, anti-inflammatory modalities, and physical therapy. Early, controlled mobilization with functional rehabilitation generally allows patients to return to work 2-4 times faster than those treated with initial surgery or casting with similar functional outcomes.[3-4] Therapy typically consists of range-of-motion exercises, stretching, strengthening, and proprioceptive or balance and control exercises. The proprioceptive exercises have been shown to be particularly useful for prevention of re-injury in patients with a sprain and for primary prevention of injury.[5]

Rehabilitation under direct supervision compared with home exercise programs has been shown to improve short-term patient recorded outcomes—including pain, strength, and instability. However, these metrics normalize over 4 months whether supervised or not, and re-injury rates between supervised and home programs are debated.[6-8]

If there is continued instability, pain, reliance on bracing, or other continued symptoms after 12 weeks of supervised treatment, advanced imaging such as MRI is suggested. The advanced imaging is to help determine the potential cause of the symptoms and to then aid in surgical planning. Arthroscopy is an integral part of most surgical plans. It is a useful tool for diagnosis as well as managing intra-articular pathology. However, MRI has low inter-observer reliability in chronic ankle instability, and has been shown that synovitis and osteochondral lesions of the talus may be under-appreciated with MRI sensitivity of 21% and 46%, respectively.[9] Given that intra-articular pathology is noted to present in as much as 95% of ankle scopes performed during lateral ankle ligament procedures, it has been recommended that arthroscopic examination be considered in patients with continued symptoms, even without MRI findings of intra-articular lesions.[9-11]

Pes cavus is commonly associated with lateral ankle instability.

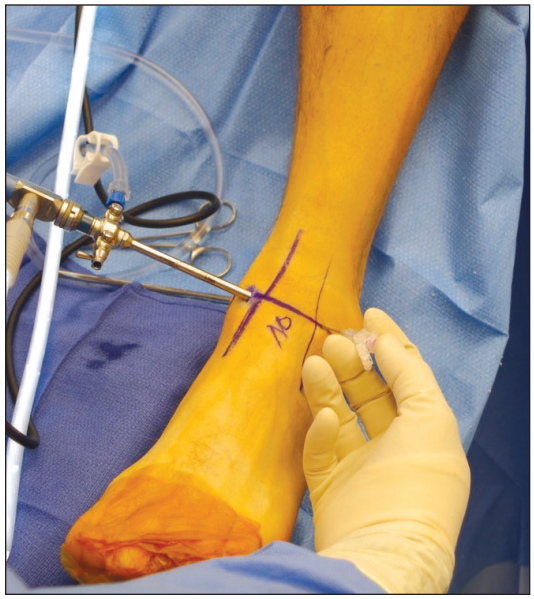
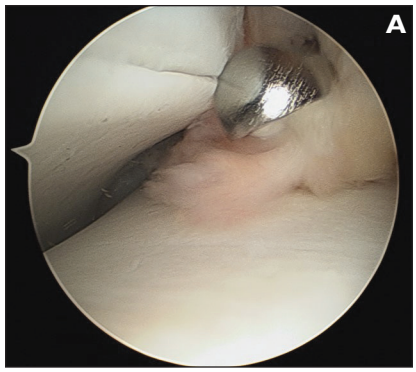


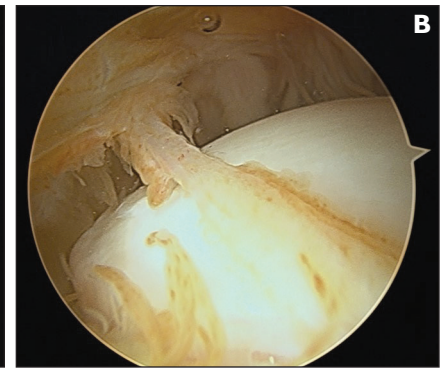
Figure 5: Typical portals and surface anatomy for ankle arthroscopy.

Ankle Arthroscopy

Ankle arthroscopy is a workhorse of lateral ankle injury surgical treatment. Manipulating the camera

Continued on page 131





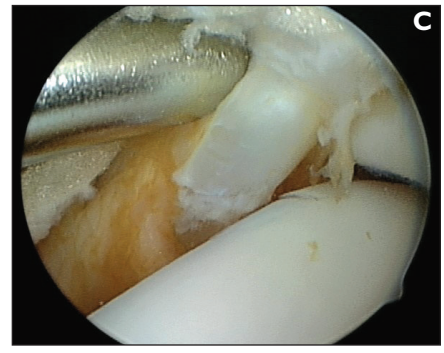


Figure 6: Intraoperative arthroscopic findings typical with ankle sprain pathology. Synovitis (A), adhesions (B), and a Bassett ligament (C).

Lateral Ankle *(from page 130)*

and lens is a specialized skill that allows for intra-articular diagnosis and treatment as well as an adjunct to many ligament repair techniques. The most common arthroscope sizes are the 4.0 mm and 2.7 mm diameter lenses. There are pros and cons with both. The obvious issue is the size. Some surgeons like the 2.7 mm scope as the ankle is considered a "small" joint, and it is felt to fit better and is easier to manipulate within the joint. The down side is availability.

Although becoming more common, not all facilities carry the smaller scope sizes in-house. Another issue is length. Some 2.7 mm scope lenses are short which may pose an issue during the procedure, limiting access to the extremes of the joint. If utilizing a 2.7 mm scope lens, one must be sure of its availability as well as being sure it is a "long" version. As an aside, take caution with the 2.7 mm long arthroscope lens in training situations as the lens is easier to bend or break during manipulation.

In contrast, the larger 4.0 mm is the most common size in orthopedics and is readily available. It is also much sturdier for training and manipulation as well as providing a significantly larger field of view for only a small increase in diameter. The 4.0 mm system tends to also be slightly heavier compared with the smaller 2.7 mm version and, for some, more awkward to hold and learn to manipulate (Figure 4). If available, utilizing both to see which works best for the surgeon would be valuable.

Arthroscopy is typically performed as the initial portion of surgery for lateral ankle repair. All pertinent superficial anatomy and incisions should be marked before the arthroscopy as there can be distortion of the soft tissue with extravasation of fluid. The medial border of the tibialis anterior tendon, the lateral border of the long extensor tendons, the distal fibula, and the intermediate dorsal cutaneous nerve should be outlined (Figure 5). If possible, the surgeon should also try to limit the amount of time of the arthroscopic portion of the surgery as this can help limit the fluid distortion.

The most common utilized portals for ankle arthroscopy are the anteromedial and anterolateral portals. There are additional portals for select pathology but these two allow a majority of access and tend to be the safest. The anteromedial is typically the first and is placed at the level of the ankle joint line just medial to the tibialis anterior tendon. The incision is vertical and deepened with a hemostat to the level of the joint capsule. A trochar and cannula are then introduced through this incision and the capsule is entered. The trochar is removed and the camera and lens are placed through the cannula.

Once the joint is visualized, initial inspection can be performed taking note of synovitis, cartilage lesions, or other abnormalities. The camera light is then utilized to help transilluminate the skin of the lateral ankle joint to aid in the positioning of the anteriolateral incision. An 18 gauge needle can then be introduced into the ankle joint just lateral to the long extensor tendons to help directly visualize the access of this portal. This ensures instruments placed through this portal have direct line access to the joint and pathology. When confirmed, the incision is made vertically, taking care to avoid veins and the intermediate dorsal cutaneous nerve which are being transilluminated from below.

AP radiograph of the ankle would be appropriate for the initial evaluation of an acute ankle sprain injury.

Both the camera and shaver are now able to be moved through the joint, inspecting and removing pathology as needed. Arthroscopy will frequently encounter synovitis, both chronic and acute, as well as adhesions, meniscoid bodies, osteochondral pathology, loose bodies, and other ligament issues (Figure 6). One common pathology noted laterally is the Bassett ligament, a prominent low extension of the anterior inferior tibiofibular ligament. Most consider this a normal anatomic variant, but with ankle instability can be an area of impinge-

Continued on page 132

Lateral Ankle (from page 131)

ment and is typically removed when encountered.

Arthroscopy has become a vital part of lateral ankle sprain treatment. Having arthroscopic skills adds to the surgeon's armamentarium. Shavers can be utilized to remove excessive soft tissue, synovium, loose bodies, and cartilage. Arthroscopic burrs help with removing prominent exostosis and spurs, as well as helping to clear soft tissue coverage to access subchondral bone for arthroscopic assisted ligament repair. Awls and drills can be placed to provide micro-fracture, and there are numerous soft tissue cutters and graspers to aid in repair. Bone can also be exposed along the anterior border of the distal fibula to aid in placement of anchors for ATFL repair. With continued advancements and innovations, more surgeons are successfully utilizing arthroscopy to place anchors in the lateral talus, with outcomes similar to those for open repair.[12]

For most surgeons, arthroscopy is utilized as an adjunct, and actual ligament repair is done as an open procedure. Traditionally, lateral ankle injuries and lateral ankle stability have been treated with open techniques. They can be divided into primary repair and secondary repairs. Primary ligament repair essentially tightens or augments the normal ligament anatomy. Most often this is repair of the ATFL, and at times the CFL.

The two most common incisions to access the lateral ankle ligaments are 1) a curvilinear parallel to the distal border of the fibula and 2) a longitudinal over the distal 3cm of the fibula, bisecting the fibula, then extending distally over the sinus tarsi area. Both of these incisions allow access to the two most common injured ligaments (Figure 7). Decisions about the placement, many times, depends on other pathology and the need for access to the peroneal tendons.

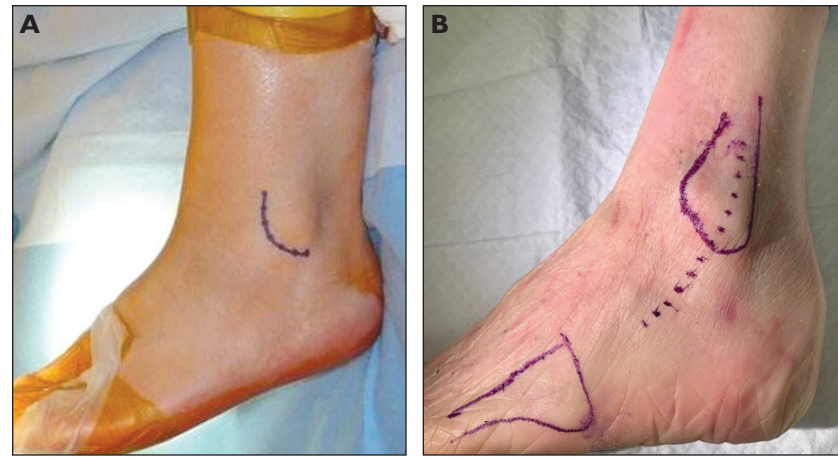


Figure 7: Most common open lateral ankle ligament surgical approaches, curvilinear along distal edge of fibula (A), and longitudinal bisection of distal fibula (B).

A semi-rigid ankle brace is an appropriate initial treatment for a lateral ankle injury.

The ATFL is the most common repaired lateral ankle ligament, with much literature to support its repair with generally good to excellent results.[13-15] Through the years, there have been many techniques described to repair the AFTL. Most are open procedures, although arthroscopic-assisted and now completely arthroscopic techniques have been described.[12,16]

In either case, repair of the ATFL typically involves utilizing bone anchors along the anterior edge of the distal tip of the fibula corresponding to the ATFL attachment (Figure 8). The number and size of bone anchors can vary depending on surgeon preference but have allowed for easier and improved strength versus

Continued on page 133

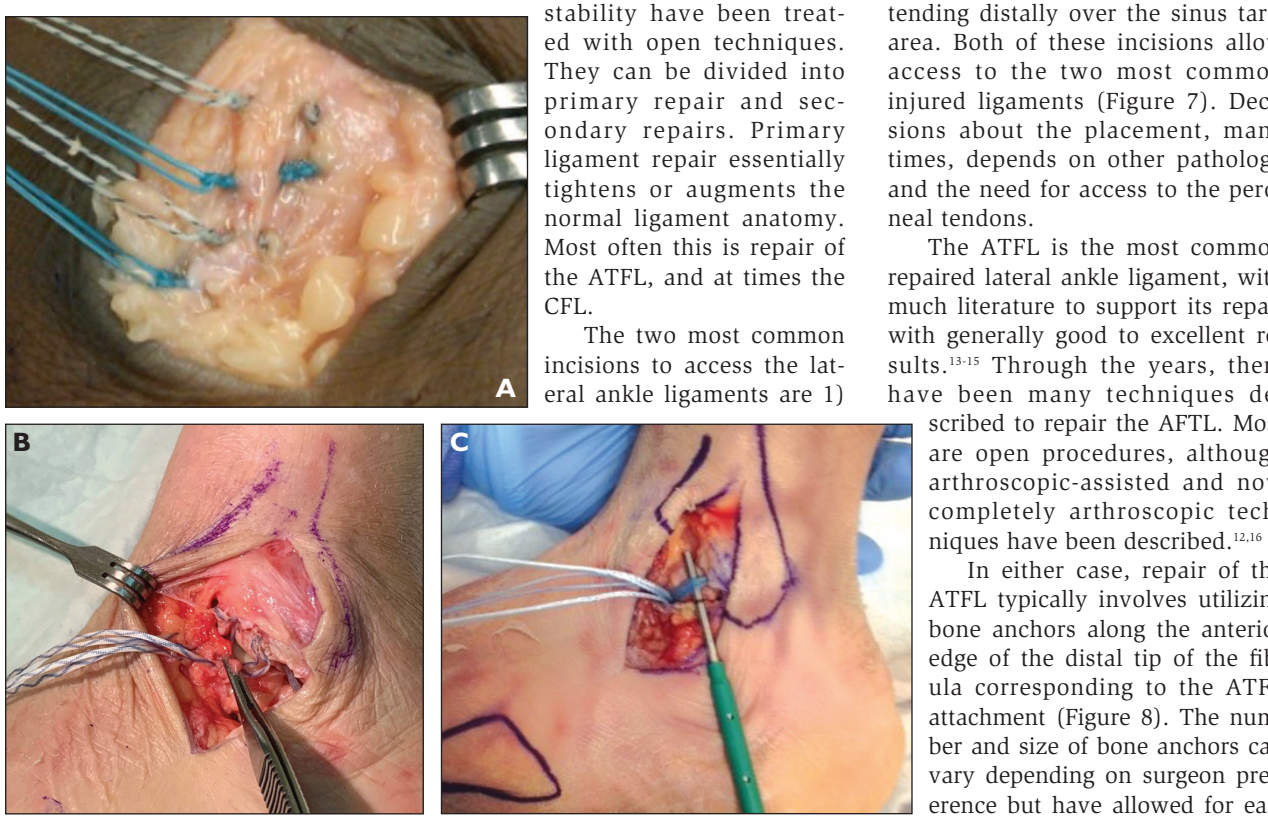


Figure 8: Examples of ATFL repair with non-absorbable suture (A), bone anchors in distal fibula with non-absorbable suture (B), and ATFL repair augmented with non-absorbable "brace" (C).

Lateral Ankle *(from page 132)*

traditional bone tunnels from years past.[15,17-18]

Sutures are then utilized to repair the ligament directly, in an anatomic fashion. During the repair, most surgeons remove a small portion of the injured or chronically diseased ATFL to have a "fresh edge" and to allow for some advancement to perhaps aid in increasing healing and stability. The extensor retinaculum may be included as well to add strength and provide more tissue for the repair.

The CFL is frequently injured during these injuries and can be a large part of chronic instability, so in many cases, it is repaired surgically as well. At the very least, the CFL should be tested with an inversion test to reveal competency. If incompetent, repair again can be anatomic, although just slightly more difficult. One thing to remember is that the CFL is deep to the peroneal tendons, so there is slightly more dissection required to access the anatomy. Once identified, the CFL is frequently loose and anatomically different from the AFTL (Figure 9).

The CFL is much more tendon-like in appearance and shape. Unlike the broad, thin ATFL, the CFL is thick and more cord-like but can be repaired directly in a similar fashion with just non-absorbable suture or bone anchors taking care to shorten and achieve a more stable ankle after repair.

Recently, along with anatomic primary repair, augmentation has become common and almost a mainstay in lateral ankle stabilization procedures. This technique comprises the more typical anatomic repair but at the same time applies a "brace" to augment the natural structures.[15,17-18] This technique entails additional bone anchors with non-absorbable suture or tape, used not to replace the anatomy, but to augment the repair. The native ligaments and anatomy are still able to function and allow for proprioception and support, but the "brace" is seen more as a preventative structure in the event the lateral ankle sprain and inversion forces overcome the body's own composition.

For the "brace" technique, again there are several described techniques, and some depend on the deficiencies about the ankle ligaments. Once the ATFL is repaired, anchors can be placed from the lateral talar neck to the distal fibula superficial to the primarily repaired ATFL to lend support. For the CFL, an anchor is typically placed in the origin at the distal fibula with the foot held in appropriate position; then the distal portion is attached to the lateral wall of the calcaneus deep to the peroneals to mimic the native ligament.

After failed non-operative management of a lateral ankle injury, ankle joint synovectomy would be best addressed with ankle arthroscopy.

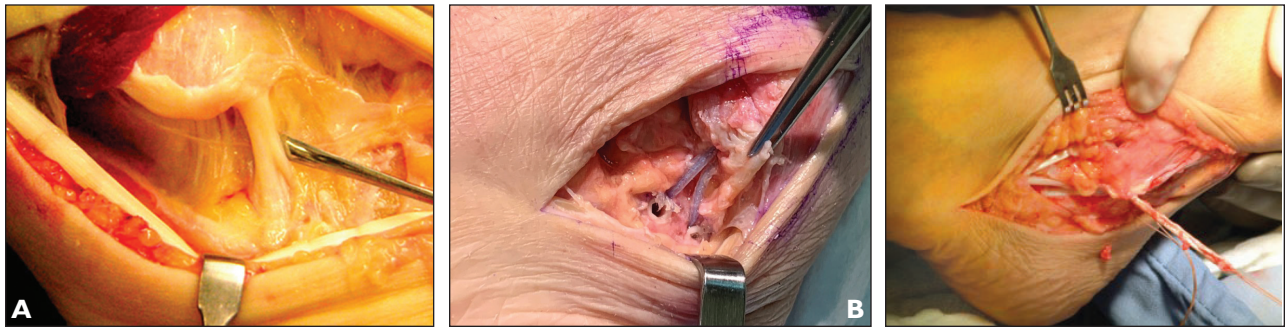


Figure 9: Intraoperative picture of attenuated CFL (A), and "brace" type repair (B).

Figure 10: Intraoperative example of a lateral ankle ligament secondary repair. Note the amount of dissection required, sacrifice of a portion of the peroneus brevis and fibula bone hole required.

The intermediate dorsal cutaneous nerve is the most common injured nerve during ankle arthroscopy.

Post-Operative Recovery

Post-operative recovery for primary repair continues to evolve, with repairs becoming stronger. With the advent of bracing, non-weight-bearing is typically three weeks, with progression from that point along with rehabilitation.

For patients with failed primary repair, larger BMI, or in patients with connective tissue disorders, secondary repair is a consideration. Secondary repair involves utilizing either autograft or allograft tendon to stabilize the lateral ankle complex. As with most surgery, there are many described techniques, different tendons, and different drill-hole configurations, all with the goal of stabilizing the ankle when the

Continued on page 134

Lateral Ankle *(from page 133)*

patient's anatomy has failed or just cannot be corrected due to size or connective tissue compromise. When utilizing tendon in this manner, it can be classified as anatomic or non-anatomic (Figure 10).

Anatomic secondary repairs represent a construct that, when complete, mimics the body's original anatomy in the design, attachment, and function. Non-anatomic secondary lateral ankle repair is a construct that when complete aids in ankle stability but may not allow "normal" function as the attachments and orientation do not follow native anatomy. This can lead to altered mechanics and possible long-term issues such as arthritis.[19] Secondary repairs have a potential of making an ankle too stiff, and require a larger incision, larger surgery, lingering recovery, and the comorbidity of sacrificing native tendon function if autograft is utilized in the repair. With the advent of improved primary repair techniques, there is less need for secondary repairs.

A mini bone anchor with non-absorbable suture material is an acceptable way to anchor the ATFL to the distal fibula during lateral ankle ligament repair.

Lateral Ankle Pathology

Lateral ankle pathology is one of the most common issues facing foot and ankle surgeons. Lateral ankle sprains are typically treated non-surgically and generally do well with functional rehabilitation and without need for surgical intervention. Surgery is generally only considered with continued pain, instability, issues with proprioception, or other pathology such as tendon and cartilage injury. Understanding the appropriate exam and imaging modalities is a must. Once surgery is planned, ankle arthroscopy has been an indispensable adjunct, aiding in diagnosis and management of intra-articular problems which are frequently associated.

Techniques have evolved to allow the primary repair and even augmentation of the lateral ankle ligaments to be performed through smaller incisions, or even arthroscopically. With bone anchors and non-absorbable suture material, rehabilitation is earlier and more tolerated. These techniques have also limited the need for the more traditional secondary procedures as well. Although there are still some cases based on anatomy and history that require such procedures, trying to keep the repair anatomic may provide better outcomes and limit secondary osteoarthritis. As with any surgery, one must take into consideration the entire pathology, which may consist of tendon issues or anatomic deformities that would need to be addressed as well. The lateral ankle is a complex series of interactions and structures that need to be respected to achieve the best results. **PM**

Utilization of peroneus brevis for ligament reconstruction is an example of a secondary lateral ankle ligament repair.

References

[1] Waterman BR, Owens BD, Davey S, Zacchilli MA, Belmont PJ. The epidemiology of ankle sprains in the United States. J Bone Joint Surg. 2010; 92(13):2279-2284.

[2] Bachmann LM, Kolb E, Koller MT, Steurer J, ter Riet G. Accuracy of the Ottawa ankle rules to exclude fractures of the ankle and mid-foot: systematic review. BMJ. 2003; 326:417.

[3] Pihlajamaki H, Hietaniemi K, Paavola M, Visuri T, Mattile VM. Surgical versus functional treatment for acute ruptures of the lateral ligament complex of the ankle in young men: a randomized controlled trial. J Bone Joint Surg Am. 2010; 92(14):2367-2374.

[4] Kannus P, Renstrom P. Treatment for acute tears of the lateral ligaments of the ankle. Operation, cast, or early controlled mobilization. J Bone Joint Surg Am. 1991; 73(2):305-312.

[5] Rivera MJ, Winkelmann ZK, Powder CJ, Games KE. Proprioceptive training for the prevention of ankle sprains: an evidence-based review. J Athl Train. 2017; 52(11):1065-1067.

[6] Holme E, Magnusson SP, Becher K, Bieler T, Aagaard P, Kjaer M. The effect of supervised rehabilitation on strength, postural sway, position sense and re-injury risk after acute ankle ligament sprain. Scand J Med Sci Sports. 1999; 9(2):104-109.

[7] Hupperets MD, Verhagen EA, van Mechelen W. Effect of unsupervised home based proprioceptive training on recurrences of ankle sprain: randomized controlled trial. BMJ. 2009; 339:2684.

[8] Feger MA, Herb CC, Faser JJ, Glaviano N, Hertel J. Supervised rehabilitation versus home exercise in the treatment of acute ankle sprains: a systematic review. Clin Sports Med. 2015; 34(2):329-346.

[9] Cha SD, Kin HS, Chung ST, Yoo JH, Park JH, Kim JH, Hyunh JW. Intra-articular lesions in chronic lateral ankle instability: comparison of arthroscopy with magnetic resonance imaging findings. Clin Orthop Surg. 2012; 4(4):293-299.

[10] Komenda GA, Ferkel RD. Arthroscopic findings associated with the unstable ankle. Foot Ankle Int. 1999; 20(11):708-713.

[11] Ferkel RD, Chams RN. Chronic lateral instability: arthroscopic findings and long-term results. Foot Ankle Int. 2007; 28(1):24-31.

[12] Brown AJ, Shimozono Y, Hurley ET, Kennedy JG. Arthroscopic versus open repair of lateral ankle ligament for chronic lateral ankle instability: a meta-analysis. Knee Surg Sports Traumatol Arthrosc. (2018) https://doi.org/10.1007/s00167-018-5100-6

[13] Pijnenburg AC, Van Dijk CN,

Continued on page 135

Lateral Ankle *(from page 134)*

Bossuyt PM, Marti RK. Treatment of ruptures of the lateral ankle ligaments: a meta-analysis. J Bone Joint Surg Am. 2000; 82(6):761-773.

[14] Hsu AR, Ardoin GT, Davis WH, Anderson RB. Intermediate and long-term outcomes of the modified Brostrom-Evans procedure for lateral ankle ligament reconstruction. Foot Ankle Spec. 2016; 9(2):131-139.

[15] Coetzee JC, Ellington JK, Ronan JA, Stone RM. Functional results of open Brostrom ankle ligament repair augmented with a suture tape. Foot Ankle Int. 2018; 39(3):304-310.

16. Guelfi M, Zamperetti M, Pantalone A, Usuelli FG, Salini V, Oliva XM. Open and arthroscopic lateral ligament repair for treatment of chronic ankle instability: a systematic review. Foot Ankle Surg. 2018; 24(1):11-18.

[17] Hu CY, Lee KB, Song EK, Kim MS, Park KS. Comparison of bone tunnel and suture anchor techniques in the modified Brostrom procedure for chronic lateral ankle instability. Am J Sports Med. 2013; 41(8):1877-1844.

[18] Waldorp NE, Wijdicks CA, Jansson KS, LaPrade RF, Clanton TO. Anatomic suture anchor versus the Brostrom technique for anterior talofibular ligament repair: a biomechanical comparison. Am J Sports Med. 2012; 40(11):2590-2596.

[19] Noailles T, Lopes R, Padiolleau G, Gouin F, Brilhault J. Non-anatomical or direct anatomical repair of chronic lateral instability of the ankle: a systematic review of the literature after at least 10 years of follow-up. Foot Ankle Surg. 2018; 24(2):80-85.

The lateral ankle is a complex series of interactions and structures that need to be respected to achieve the best results.

Dr. Burns is an Assistant Professor of Orthopaedic Surgery at the University of Pittsburgh School of Medicine.

CME EXAMINATION

SEE ANSWER SHEET ON PAGE 137.

1) Which of the following ligaments is part of the lateral ankle ligament complex?
- **A) Anterior inferior tibiofibular ligament**
- **B) Calcaneal fibular ligament**
- **C) Posterior inferior tibiofibular ligament**
- **D) Anterior tibiotalar ligament**

2) The calcaneal fibular ligament is tested during physical exam by which technique?
- **A) Inversion stress**
- **B) Eversion stress**
- **C) External rotation**
- **D) Anterior drawer**

3) Which is the most common ligament injured during a lateral ankle sprain?
- **A) Deltoid**
- **B) Syndesmotic**
- **C) Bifurcate**
- **D) Anterior talofibular**

4) Which foot type is commonly associated with lateral ankle instability?
- **A) Pes planus**
- **B) Pes cavus**
- **C) Vertical talus**
- **D) Pronated**

5) Which of the following imaging modalities would be appropriate for the initial evaluation of an acute ankle sprain injury?
- **A) AP radiograph of the ankle**
- **B) CT scan of the ankle**
- **C) Ultrasound of the ankle**
- **D) MRI of the ankle**

6) Appropriate initial treatment for a lateral ankle injury consists of which of the following?
- **A) Ankle joint steroid injection**
- **B) Opioid pain management**
- **C) Application of heat to the ankle**
- **D) Semi-rigid ankle brace**

Continued on page 135

7) After failed non-operative management of a lateral ankle injury, which associated pathology would be best addressed with ankle arthroscopy?

A) Ankle joint synovectomy
B) Peroneal tendon debridement
C) Deltoid ligament repair
D) CFL repair

8) Which is the most common injured nerve during ankle arthroscopy?

A) Sural nerve
B) Medial dorsal cutaneous nerve
C) Intermediate dorsal cutaneous nerve
D) Saphenous nerve

9) Which of the following is an acceptable way to anchor the ATFL to the distal fibula during lateral ankle ligament repair?

A) 4.0 cannulated screw
B) Compression bone staple
C) Absorbable suture material through bone holes
D) Mini bone anchor with non-absorbable suture material

10) Which is an example of a secondary lateral ankle ligament repair?

A) Open repair of anterior talofibular ligament with bone anchors
B) Arthroscopic repair of anterior talofibular ligament
C) Utilization of peroneus brevis for ligament reconstruction
D) Open repair of calcaneal fibular ligament with bone anchors

SEE ANSWER SHEET ON PAGE 137.

The author(s) certify that they have NO affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest), or non-financial interest (such as personal or professional relationships, affiliations, knowledge, or beliefs) in the subject matter or materials discussed in this manuscript.

PM's CME Program

Welcome to the innovative Continuing Education Program brought to you by *Podiatry Management Magazine*. Our journal has been approved as a sponsor of Continuing Medical Education by the Council on Podiatric Medical Education.

Now it's even easier and more convenient to enroll in PM's CE program!

You can now enroll at any time during the year and submit eligible exams at any time during your enrollment period.

CME articles and examination questions from past issues of *Podiatry Management* can be found on the Internet at http://www.podiatrym.com/cme. Each lesson is approved for 1.5 hours continuing education contact hours. Please read the testing, grading and payment instructions to decide which method of participation is best for you.

Please call (631) 563-1604 if you have any questions. A personal operator will be happy to assist you.

Each of the 10 lessons will count as 1.5 credits; thus a maximum of 15 CME credits may be earned during any 12-month period. You may select any 10 in a 24-month period.

The* Podiatry Management Magazine *CME program is approved by the Council on Podiatric Education in all states where credits in instructional media are accepted. This article is approved for 1.5 Continuing Education Contact Hours (or 0.15 CEU's) for each examination successfully completed.

PM's privacy policy can be found at http://podiatrym.com/privacy.cfm.

This CME is valid for CPME-approved credits for three (3) years from the date of publication.

Enrollment/Testing Information and Answer Sheet

Continuing Medical Education

Note: If you are mailing your answer sheet, you must complete all info. on the front and back of this page and mail with your credit card information to: **Program Management Services, P.O. Box 490, East Islip, NY 11730.**

TESTING, GRADING AND PAYMENT INSTRUCTIONS

(1) Each participant achieving a passing grade of 70% or higher on any examination will receive an official computer form stating the number of CE credits earned. This form should be safeguarded and may be used as documentation of credits earned.

(2) Participants receiving a failing grade on any exam will be notified and permitted to take one re-examination at no extra cost.

(3) All answers should be recorded on the answer form below. For each question, decide which choice is the best answer, and circle the letter representing your choice.

(4) Complete all other information on the front and back of this page.

(5) Choose one out of the 3 options for testgrading: mail-in, fax, or phone. To select the type of service that best suits your needs, please read the following section, "Test Grading Options".

TEST GRADING OPTIONS

Mail-In Grading

To receive your CME certificate, complete all information and mail with your credit card information to: **Program Management Services, P.O. Box 490, East Islip, NY 11730. PLEASE DO NOT SEND WITH SIGNATURE REQUIRED, AS THESE WILL NOT BE ACCEPTED.**

There is **no charge** for the mail-in service if you have already enrolled in the annual exam CME program, and we receive this exam during your current enrollment period. If you are not enrolled, please send $29.00 per exam, or $249 to cover all 10 exams (thus saving $41 over the cost of 10 individual exam fees).

Facsimile Grading

To receive your CME certificate, complete all information and fax 24 hours a day to 1631-532-1964. Your CME certificate will be dated and mailed within 48 hours. This service is available for $2.95 per exam if you are currently enrolled in the annual 10-exam CME program (and this exam falls within your enrollment period), and can be charged to your Visa, MasterCard, or American Express.

If you are *not* enrolled in the annual 10-exam CME program, the fee is $29 per exam.

Phone-In Grading

You may also complete your exam by using the toll-free service. Call 1-800-232-4422 from 10 a.m. to 5 p.m. EST, Monday through Friday. Your CME certificate will be dated the same day you call and mailed within 48 hours. There is a $2.95 charge for this service if you are currently enrolled in the annual 10-exam CME program (and this exam falls within your enrollment period), and this fee can be charged to your Visa, Mastercard, American Express, or Discover. If you are not currently enrolled, the fee is $29 per exam. When you call, please have ready:

1. Program number (Month and Year)
2. The answers to the test
3. Credit card information

In the event you require additional CME information, please contact PMS, Inc., at **1-631-563-1604**.

ENROLLMENT FORM & ANSWER SHEET

Please print clearly...Certificate will be issued from information below.

Name _____ Email Address _____
Please Print: FIRST MI LAST

Address _____

City _____ State _____ Zip _____

Charge to: _____Visa _____ MasterCard _____ American Express

Card # _____ Exp. Date _____ Zip for credit card _____

Note: Credit card is the only method of payment. Checks are no longer accepted.

Signature _____ Email Address _____ Daytime Phone _____

State License(s) _____ Is this a new address? Yes _____ No _____

Check one:

_____ I am currently enrolled. (If faxing or phoning in your answer form please note that $2.95 will be charged to your credit card.)

_____ I am not enrolled. Enclosed is my credit card information. Please charge my credit card $29.00 for each exam submitted. (plus $2.95 for each exam if submitting by fax or phone).

_____ I am not enrolled and I wish to enroll for 10 courses at $249.00 (thus saving me $41 over the cost of 10 individual exam fees). I understand there will be an additional fee of $2.95 for any exam I wish to submit via fax or phone.

Over, please

ENROLLMENT FORM & ANSWER SHEET *(continued)*

EXAM #2/20
Lateral Ankle Injuries: Scope and Stabilization (Burns)

Circle:

1.	A	B	C	D	6.	A	B	C	D
2.	A	B	C	D	7.	A	B	C	D
3.	A	B	C	D	8.	A	B	C	D
4.	A	B	C	D	9.	A	B	C	D
5.	A	B	C	D	10.	A	B	C	D

Medical Education Lesson Evaluation

Strongly agree [5]	Agree [4]	Neutral [3]	Disagree [2]	Strongly disagree [1]

1) This CME lesson was helpful to my practice ____

2) The educational objectives were accomplished ____

3) I will apply the knowledge I learned from this lesson ____

4) I will makes changes in my practice behavior based on this lesson ____

5) This lesson presented quality information with adequate current references ____

6) What overall grade would you assign this lesson?

A B C D

7) This activity was balanced and free of commercial bias.

Yes _____ No _____

8) What overall grade would you assign to the overall management of this activity?

A B C D

How long did it take you to complete this lesson?

_____hour _____minutes

What topics would you like to see in future CME lessons ? Please list :

_____

_____

_____

_____

_____