

Management of Chronic Lateral Ankle Instability in Military Service Members



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KEYWORDS

• Ankle instability • Lateral instability • Ankle sprain • Chronic • Military • Treatment

KEY POINTS

- Chronic lateral ankle instability is a condition frequently encountered by orthopedic surgeons treating highly active patient populations, particularly military service members.
- Providers treating military service members must have a high index of suspicion for this condition when signs and symptoms of functional or mechanical instability exist.
- Stress testing and ankle magnetic resonance imaging, although not definitive in sensitivity for detecting instability or other concomitant injuries, should be considered during the treatment decision-making process.
- Appropriate nonoperative treatment should be attempted initially; however, when nonoperative treatment fails, surgical management is warranted to prevent untoward long-term sequelae.
- Proper surgical treatment and subsequent postoperative management are at the discretion of the individual surgeon but must account for the concomitant diseases frequently associated with chronic lateral ankle instability.
- Low recurrence of lateral instability can be achieved even in high-demand military patient populations with a focused treatment plan.

INTRODUCTION AND EPIDEMIOLOGY

Acute lateral, or inversion, ankle sprains are among the most common musculoskeletal injuries encountered in military patients. Within the civilian population, daily estimates of acute and subacute ankle sprains range from 5000 per day in the United Kingdom to as high as 23,000 to 30,000 in other societies such as the United States.¹⁻⁶ Overall, ankle sprains account for an estimated 10% to 40% of civilian athletic injuries annually and can result in significant time lost to injury.^{5,7-10} The mainstay of

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management for acute inversion ankle sprains remains nonoperative treatment, typically with early immobilization and functional rehabilitation, focusing on achievement of full range of motion, peroneal tendon strengthening and proprioception, and gradual progression of weight bearing as tolerated.^{4,10,11} A rich body of evidence exists showing no significant improvement in long-term functional outcomes when high-grade acute lateral ankle sprains are initially managed operatively compared with nonoperatively with early functional rehabilitation.^{12–15} Despite appropriate nonoperative management after acute inversion ankle sprains, 10% to 30% of individuals have recurrences of instability and progress to chronic symptomatic lateral ankle instability.^{2,5,6,16–18} Repeated inversion ankle sprains can propagate osteochondral lesions of the talus (OCLT),^{18,19} chronic peroneal tendinopathy,^{4,20–22} peroneal neuropathy,²³ varus malalignment, and risk for early tibiotalar osteoarthritis.^{4,21,22} Given the increased rate of ankle sprains in athletic populations, coupled with high recurrence rates and the potential for disabling long-term sequelae, management of chronic lateral ankle instability in high-demand military and populations poses significant challenges for orthopedic surgeons.

The US military armed forces represent a diverse, physically active population, with generally high occupational demands. Service members participate in organized physical fitness training programs and must meet the standards of the physical fitness tests of their individual services as well as height and weight requirements semiannually.²⁴ The active duty service population is not unlike athletic populations in civilian cohorts. Military personnel consistently train on and are deployed to regions with a multitude of uneven surfaces, carrying combat loads often exceeding 45 kg (100 lb). They are at increased risk for inversion ankle sprains and subsequent chronic lateral ankle instability. Waterman and colleagues²⁵ reported on the incidence of ankle sprains in cadets at the US Military Academy (USMA) in West Point, New York, and noted an overall incidence rate of 58.4 sprains per 1000 person-years, regardless of participation in intercollegiate versus mandatory intramural athletics. These results suggest that inversion ankle sprains, the precipitant of chronic lateral ankle instability, may be more common in military than civilian populations. Orr and colleagues²⁴ reported on the increased incidence of OCLTs among US military personnel, with significant progressive increases in incidence noted throughout the years of overseas conflict from 2002 to 2008. The investigators cited the likely relationship between increasing ankle instability and its role in causing more OCLTs. The lead author of this review performed approximately 75 primary and revision lateral ligamentous reconstructions annually between 2009 and 2013 at a large tertiary care military medical treatment facility servicing a high volume of active duty military personnel.

In this review, the anatomy, risk factors, and clinical presentation associated with chronic lateral ankle instability are discussed, as well as preferred nonoperative and operative treatment strategies in military populations. The nuances of early diagnosis and management of acute ankle sprains are beyond the scope of this review. We have focused specifically on management of chronic instability within the military population. These same principles are valid when considering treatment of this condition in other physically active patient populations, whose activity demands are through sports or high-demand occupational activities.

ANATOMY AND CAUSE

The lateral ligamentous complex can best be thought of as a capsuloligamentous complex, because the anterolateral joint capsule contributes to the ligamentous stability of the lateral ankle. The ligamentous complex consists of 3 ligaments: anterior

talofibular ligament (ATFL), calcaneofibular ligament (CFL), and posterior talofibular ligament (PTFL). The ATFL is contiguous with the anterolateral joint capsule, representing a discrete intracapsular thickening, originating on the anteroinferior border of the lateral malleolus and inserting on the lateral talar neck.^{26,27} Just posteriorly adjacent to the ATFL origin, the CFL originates on the distal fibula. It is an extracapsular structure, coursing obliquely to its insertion on the lateral calcaneal tubercle, traversing the tibiotalar and subtalar joints.^{26,27} Biomechanically, the thicker CFL is stronger than the ATFL.²⁶ The largest and strongest of the 3 ligaments, the PTFL is rarely injured during typical inversion ankle sprains.^{6,26}

Lateral ankle stability requires both dynamic and static constraints. Dynamic stability is provided most directly from the strength of the peroneal tendons and through involuntary proprioceptive feedback.^{28,29} Static stability is provided by osseous anatomy as well as ligamentous, retinacular, and capsular constraints. The primary static ligamentous stabilizers are the ATFL and CFL.^{26,29–31} The ATFL serves as the primary constraint to anterior talar translation and talar inversion during plantarflexion.^{32,33} Similarly, the CFL serves as the primary constraint to talar inversion in neutral and dorsiflexion.^{32,33} The ATFL is injured more commonly in inversion ankle sprains than the CFL.^{31,34–36} Evidence by Broström³⁵ showed intraoperative ATFL tears in all patients with chronic lateral ankle instability; however, there were no isolated CFL tears. It is likely given the role of ATFL as the primary static ligamentous constraint to talar inversion in plantarflexion that it is more prone to injury during inversion ankle sprains. This concept has been reproduced biomechanically, because inversion stress with progressive plantarflexion produces significantly more strain on the ATFL compared with the CFL.³⁷ Subsequently, many investigators historically address only the ATFL during primary lateral ligamentous reconstruction.^{21,35}

Most inversion lateral ankle sprains, whether acute or recurrent, occur after axial loading on an externally rotated leg with excessive inversion of the hindfoot. The ankle may be in any position, but most commonly is plantarflexed. This situation places maximum stress on the lateral ligamentous complex, particularly the weaker ATFL. The ATFL is 3 times more likely than the CFL to be injured in cases of acute or chronic ankle instability.^{27,38}

RISK FACTORS FOR CHRONIC LATERAL ANKLE INSTABILITY

Waterman and colleagues^{39,40} identified several nonmodifiable and modifiable risk factors for development of lateral ankle instability. Specifically, nonmodifiable risk factors noted by these investigators included gender, age, and previous ankle sprain. In addition, increased body mass index (BMI) and presence of hindfoot or midfoot malalignment conditions as well as poor neuromuscular postural control (proprioception) can predispose one to chronic lateral ankle instability.

Gender does seem to play a role in the development of chronic lateral ankle instability. A recent epidemiologic study by Waterman and colleagues²⁵ found that in cadets at USMA, the adjusted incidence rate ratio for ankle sprains in female cadets was 1.83 compared with matched male cadets. As well, a recent prospective randomized controlled trial by Frey and colleagues⁴¹ compared the incidence of lateral ankle instability in 957 high-school volleyball players who wore prophylactic rigid, semirigid, and nonrigid ankle braces with controls without braces. Although the study did not find significant benefit from use of ankle bracing in athletes with a history of lateral ankle instability, it did note a significantly increased incidence of inversion ankle sprains in female athletes wearing nonrigid braces compared with men wearing the same type of brace. This finding may represent a natural tendency toward increased ligamentous

laxity in women compared with men, as has been described with anterior cruciate ligament laxity.^{42,43} Female service members account for 13.5% of all US Army forces.⁴⁴ Because female service members are expected to perform the same rigorous physical training as male service members, possible increased ligamentous laxity and resultant increased ankle instability may contribute to a higher incidence of chronic lateral ankle instability in female service members. Age also seems critical to the development of chronic lateral ankle instability. Younger age, as would be expected in military personnel, is associated with increased risk of ankle sprain and subsequent chronic lateral ankle instability. A recent population-based study within an active duty service member population⁴⁵ reported the highest incidence rates for ankle sprain (the forerunner of chronic lateral ankle instability) in military populations younger than 20 years, regardless of gender.

In addition, increased BMI has been shown to increase the likelihood of lateral ankle instability. Epidemiologic data have shown significantly higher incidences of ankle sprains in patients with increased BMI, because increased body weight imparts more exertional forces across the lateral ankle during axial loading activities.^{25,46} Although most active duty service members are physically fit secondary to stringent height-related BMI restrictions, military personnel are expected to carry heavy combat loads, often exceeding 45 kg (100 lb), over uneven terrains.

Previous ankle sprains are sometimes harbingers of later chronic lateral ankle instability.^{2,5,6,16,17,28,47,48} Other investigators have reported that after even a single inversion ankle sprain, there exists altered ankle proprioception, decreased peroneal tendon strength and function, and accumulation of inflammatory scar tissue in the injured capsuloligamentous complex.^{4,28,48–50} As well, previous investigators^{28,48,49} have reported that reduced peroneal tendon strength can result in reduced proprioception and resultant lateral ankle instability. Other risk factors for development of chronic lateral ankle instability include anatomic malalignment conditions and impaired proprioception. Specifically, hindfoot varus, midfoot cavus, or combined cavovarus deformities predispose patients to lateral ankle instability by abnormally altering normal hindfoot alignment and placing untoward stress on the lateral ligamentous complex and peroneal tendons.^{51,52} Similarly, impaired proprioception, especially when combined with a previous ankle sprain, has been shown to increase risk of chronic lateral ankle instability.^{28,48,50,53–57}

CLINICAL PRESENTATION

Assessment of military service members with suspected chronic lateral ankle instability should include a complete patient history to assess the service member's chief complaint, previous mechanisms and degrees of injuries, previous nonoperative and operative treatments, and current levels of activity and limitations. Although presentations of acute ankle inversion injuries are often more obvious to the examiner, the clinical presentation of persistent, chronic lateral ankle instability may be more insidious and subtle. Military patients on active duty often articulate feelings of giving way or rolling on both flat and uneven surfaces. Regarding daily activities, a service member will use terms such as loose, weak, and unsteady to describe their ankle. Service members may describe a sense of apprehension while walking on uneven surfaces. Commonly, pain is not a persistent complaint and more commonly accompanies new ankle sprains. If ankle pain is persistent, then, other concomitant injuries should be suspected, such as anterior ankle soft tissue or osseous impingement; ankle synovitis; OCLT(s); syndesmotic injury; associated fractures about the ankle, hindfoot, and midfoot; peroneal tendinopathy(s); intra-articular loose body(s); peripheral neuropathy

(ie, peroneal nerve and associated branches); or early-onset degenerative joint disease. In our opinion, one of the most crucial series of questions that should be asked of all military patients is: (1) “Does it seem that you have a sharp pain, followed by rolling the ankle?” and (2) “Does it seem that you roll the ankle and have pain afterward?” This is an important factor during the initial clinical evaluation, because pain that causes instability could be a sign of mechanical factors such as loose body(s), OCLT(s) (**Fig. 1**), anterior impingement, or anterior synovitis, which can be mitigated without formal lateral ligamentous reconstruction.

PHYSICAL EXAMINATION

All patients with suspected chronic lateral ankle instability should undergo a thorough examination of both lower extremities. Typically, we assess standing alignment first. Particular attention is given to the presence of hindfoot varus, midfoot cavus, or combined cavovarus deformities (**Fig. 2**), because these conditions must be addressed at the time of any successful lateral ligamentous reconstruction.^{51,52} Next, a thorough neurovascular examination should be performed. Special attention is given to any peroneal nerve dysfunction, because repeated lateral ankle sprains place untoward tensile stress on the nerve fibers and can propagate peroneal neuropathy.²³ Palpation about the ankle is important as well, and focus should be given to palpation of the anterior ankle joint to identify possible anterior synovitis or joint effusion. In addition, the presence of a sulcus sign just anterior to the lateral malleolus is an indicator of lack of ATFL continuity. Initial assessment should include evaluation of bilateral ankle and subtalar joint ranges of motion with notation of any pain or crepitus during range of motion. During examination, if there is any indication of generalized ligamentous laxity, then a complete evaluation for joint hypermobility must be conducted in accordance with the Beighton scoring system,⁵⁸ because generalized ligamentous laxity can alter the treatment decision-making process.

A full motor strength examination should be performed, but special attention is given to the peroneal tendon examination. A dedicated peroneal tendon examination should

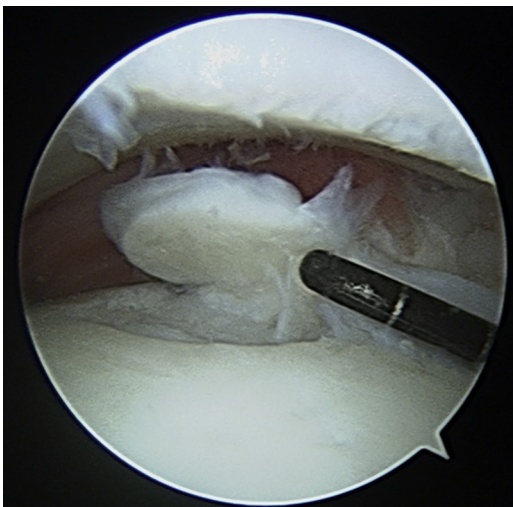


Fig. 1. Intraoperative arthroscopic view of a partially detached centrolateral osteochondral lesion of the talus.



Fig. 2. Clinical presentation of patient with cavovarus deformity, contributing to chronic lateral ankle instability.

be performed to determine the possibility of peroneal tendinopathy or instability. Chronic lateral ankle instability may lead to primary or secondary chronic peroneal tendinopathy.^{4,20–22,59} The strength of the peroneus brevis muscle, the primary hindfoot evorter, is determined by evaluating resisted ankle plantarflexion with simultaneous hindfoot eversion. Direct palpation over the peroneal tendons during resisted plantarflexion and eversion can elicit isolated peroneal tendon pain or fullness (**Fig. 3**), suggestive of tenosynovitis or tendon tears (ie, longitudinal split tears). The examiner must evaluate for possible peroneal instability. Although peroneal tendon instability is rare, if present, it must be addressed just as with any other peroneal tendon condition at the time of lateral ligamentous reconstruction.^{20,60}

STRESS TESTING

Routine use of dynamic, fluoroscopic-assisted stress testing is controversial, and most investigators agree that stress test results should not be a dominant factor in determining surgical candidacy.^{4,6,22,61} We advocate anterior drawer and talar tilt fluoroscopic stress testing in every patient with suspected chronic lateral ankle instability for treatment decision making. Traditionally, the anterior drawer stress test is performed in plantarflexion, with attempted anterior translation of the talus in relation to the tibia. Because the ATFL is the primary restraint to anterior talar translation,^{32,33} the anterior drawer stress test most reliably evaluates integrity of the ATFL. The talar tilt stress test is performed in dorsiflexion, with attempted inversion or varus tilting of the talus within the mortise. Because the CFL is the primary restraint to talar inversion in dorsiflexion,^{32,33} this examination most reliably evaluates the integrity of the CFL. However, the ATFL is the primary restraint to talar inversion in ankle plantarflexion.^{32,33} Thus, a talar tilt stress test performed in plantarflexion evaluates integrity of the ATFL



Fig. 3. Clinical presentation of patient with chronic lateral ankle instability and associated peroneal fullness (*asterisk*).

as well. For this reason, the ability to identify specific ligamentous disease based on stress testing results is questionable.⁶² Furthermore, there is an unknown contribution from the subtalar joint, especially in cases with concomitant subtalar instability, to the talar tilt stress test.⁶¹ We believe that an anterior drawer 3 to 5 mm greater than the uninjured side is suspicious for abnormality.^{4,5,22,62} Similarly, we believe that a talar tilt in both dorsiflexion and plantarflexion of 5° greater than the uninjured side is suspicious for ligamentous abnormality.^{4,5,22,62}

FUNCTIONAL VERSUS MECHANICAL INSTABILITY

Functional instability implies loss of voluntary control to maintain lateral ankle stability on unforgiving surfaces that military populations are frequently exposed to (ie, uneven terrain, rocks, and gravel).⁶³ It has been postulated that functional instability is secondary to loss of normal proprioception and neuromuscular control.^{22,63,64} Service members with functional instability describe a feeling of giving way or rolling on uneven surfaces. In our military patient populations, to determine if functional instability exists, we routinely ask service members the following questions: (1) “Do you feel like your ankle gives way on uneven surfaces?” and (2) “Do you frequently roll your ankle during training and on uneven surfaces?” Conversely, mechanical instability implies loss of normal anatomic constraint to lateral ankle stability. It is usually identifiable on physical examination in the form of abnormal stress testing or generalized laxity. Several investigators^{38,65} agree that the 2 forms of instability rarely occur in isolation. Instead, most chronic lateral ankle instability is a combination of functional and mechanical instability, with increased lateral ligamentous laxity necessarily accompanied by impaired proprioception.^{38,65–67} In our experience, it is a service member’s functional instability that prompts an orthopedic surgical evaluation. In the military population, it is the presence of functional instability and not isolated, asymptomatic mechanical instability that warrants intervention.

RADIOGRAPHY

Initial radiographic evaluation of all service members with suspected chronic lateral ankle instability begins with weight-bearing ankle radiographs to assess for missed ankle and hindfoot fractures, early degenerative changes, and other associated injuries. As discussed earlier, we routinely evaluate fluoroscopic-assisted stress testing. We universally obtain magnetic resonance imaging (MRI) of the ankle in all cases of confirmed chronic lateral ankle instability. Some investigators do not encourage routine ankle MRI in patients with chronic lateral ankle instability.^{4–6} O'Neill and colleagues⁶⁸ reported that ankle MRI had a sensitivity of only 63% for detection of OCLTs, loose bodies, and peroneal tendon tears in patients with lateral ankle instability. Other investigators have reported higher sensitivity at detecting OCLTs and peroneal tendon tears.⁶⁹ The overall level of evidence is insufficient to recommend in favor of or against routine use of ankle MRI. We prefer to obtain MRI, especially in operative candidates, to help determine the need for concomitant ankle arthroscopy, peroneal tendon exploration, or larger cartilage restorative surgery secondary to OCLT(s) (Fig. 4A). Ankle MRI can best detect the presence of an abnormal ATFL on axial T2-weighted sequences (see Fig. 4B). Similarly, ankle MRI can best detect the presence of an abnormal CFL on coronal T2-weighted sequences (see Fig. 4C). Suspicion of ATFL or CFL abnormalities based solely on MRI does not indicate surgical management of lateral ligamentous instability but simply should be used (just as with stress testing results) during treatment decision making. Ankle MRI can elucidate the presence of anterolateral ankle synovitis (see Fig. 4B) or the presence of peroneal tendon disease (see Fig. 4D), both of which affect operative planning.

NONOPERATIVE MANAGEMENT

Early functional rehabilitation should be the initial treatment of first-time lateral ankle sprains. There is no advantage with early operative management of acute ankle sprains compared with nonoperative management incorporating initial immobilization, RICE (rest, ice, compression, and elevation) therapy, early range of motion and physical therapy, and progression of weight bearing as tolerated.^{12–15,70}

In military patient populations, we prefer an initial 2-month to 3-month course of structured physical therapy before consideration of operative management. Although other investigators have recommended shorter periods of nonoperative management,^{4–6,22} we concur with previous investigators who have recommended at least 2 to 3 months of attempted nonoperative treatment.^{17,21,71} Patients who present with chronic lateral ankle instability, particularly functional or combined functional and mechanical instability, are immediately started on a physical therapy program that incorporates range of motion, peroneal tendon strengthening, and proprioceptive exercises.^{48,54,72} Nonoperative treatment of functional instability focuses on improvement in balance and proprioception. To this end, many physical therapists incorporate the use of a biomechanical ankle platform system (BAPS) board (Fig. 5).^{54,63,72,73} Improvement in mechanical instability is directed toward motor strengthening, particularly the peroneal tendons, through a directed course of active and passive strengthening regimens in conjunction with proprioceptive therapy.^{28,48,49} In general, the athletic patient or military service member with purely functional instability is more likely to benefit from nonoperative management compared with those with combined functional and mechanical instability.⁷⁴

In addition, the investigators routinely recommend use of semirigid ankle stabilizers (braces) in military service members undergoing a 2-month to 3-month nonoperative treatment program. The efficacy of semirigid ankle braces has been questioned, with

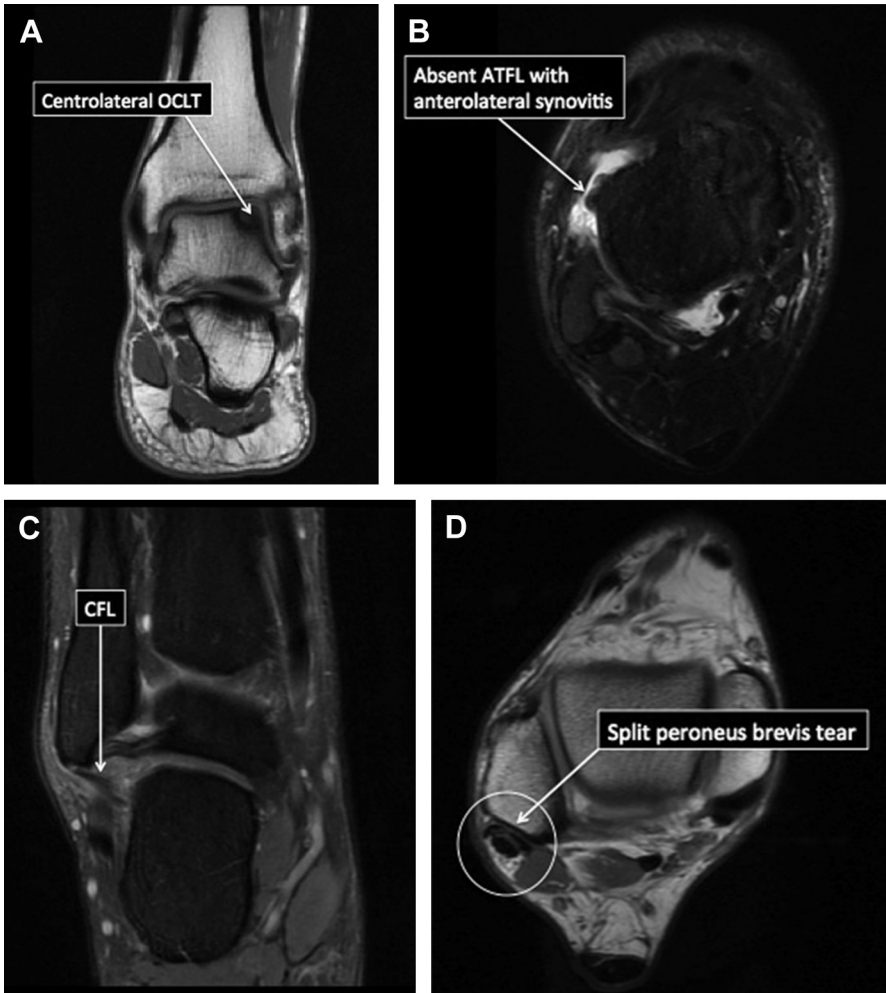


Fig. 4. (A) T1-weighted coronal ankle MRI showing centrolateral osteochondral lesion of the talus. (B) T2-weighted axial ankle MRI showing suspected chronic ATFL injury with associated anterolateral synovitis. (C) T2-weighted coronal ankle MRI showing normal-appearing CFL. (D) T1-weighted axial ankle MRI showing suspected longitudinal split tear of the peroneus brevis tendon.

some investigators noting reduction in episodes of instability^{11,73,75} and other investigators⁴¹ finding no benefit in athletes with diagnosed chronic lateral ankle instability. Regardless, we believe that semirigid ankle braces can provide valuable protection for military personnel, frequently exposed to unforgiving, uneven terrains during physical and military training, as they undergo therapy to restore peroneal tendon strength and proprioception. A variety of commercially available semirigid ankle braces exist that include strap (Fig. 6A; DJO Global Aircast, Vista, CA) or lace-up (see Fig. 6B; DJO Global Procure, Vista, CA) designs. All incorporate some type of low-profile anatomically molded semirigid medial and lateral plastic supports. These ankle braces may be difficult to comfortably fit into a standard military working boot. Therefore, we find that



Fig. 5. Clinical demonstration of use of BAPS for rehabilitation of a patient with functional chronic lateral ankle instability.

most service members refrain from use of the semirigid ankle brace during military boot wear and prefer to use the braces only with athletic shoe wear. The overall level of evidence is insufficient to recommend in favor of or against routine use of ankle bracing in these patients. Military service members undergoing nonoperative management for chronic lateral ankle instability are also placed on stringent work-related activity limitations.

OPERATIVE MANAGEMENT

The primary indication for operative management of chronic lateral ankle instability is continued instability after an appropriate course of comprehensive nonoperative management. Appropriate nonoperative management implies that the service member completed a 2-month to 3-month course of therapy and was consistently compliant with therapy and activity restrictions throughout the treatment course. In 2006,

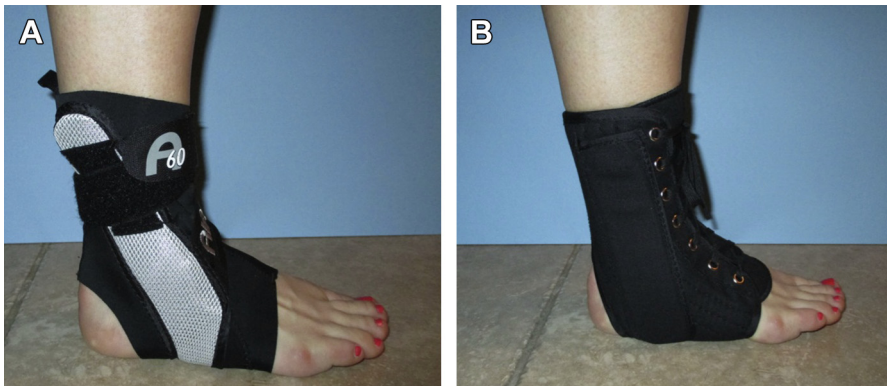


Fig. 6. (A) Clinical photograph showing semirigid strap design ankle brace. (B) Clinical photograph showing semirigid lace-up design ankle brace. (Courtesy of DJO Global Aircast, Vista, CA; with permission.)

DiGiovanni and Brodsky⁴ provided a comprehensive current concepts review of each of the most relevant lateral ligamentous reconstructive procedures and the most popular modifications of each procedure. A complete discussion of these operative procedures is outside the context and scope of this review. Therefore, we have focused on our operative treatment preferences for military personnel with chronic lateral ankle instability, cognizant that no singular, best operative technique exists. Furthermore, the nuances of revision lateral ligament reconstruction when primary reconstruction has failed are outside the context of this review.

Operative reconstruction techniques can be classified as anatomic, nonanatomic, or anatomic tenodesis reconstructions.^{4,22} The foundation of anatomic reconstruction techniques is the Broström repair, described in 1966.³⁵ Regardless of technique, the goal of all anatomic reconstructions is to restore lateral ligamentous integrity and maintain ankle and subtalar joint kinematics. Numerous studies have reported good to excellent outcomes in more than 85% of patients using a variety of anatomic lateral ligamentous repairs for treatment of chronic lateral ankle instability.^{17,21,35,71,76–83} Common to all nonanatomic reconstructions is transosseous rerouting and tenodesis of local tendon autografts (ie, peroneus brevis tendon) to restore lateral ankle stability. These techniques have consistently had poor long-term outcomes secondary to altered ankle and subtalar joint kinetics.^{4,22,84,85} Anatomic tenodesis reconstructions are numerous and involve augmentation of anatomic reconstructions by splitting the peroneus brevis tendon and tenodesing the tensioned tendon through transosseous tunnels or directly to the primary anatomic repair itself. Although overtightening is possible with this technique, clinical results have been favorable and indicate that this augmentation may preserve normal ankle and subtalar joint kinematics with the added benefit of enhanced repair strength.^{71,86,87}

Role of Ankle Arthroscopy

The overall level of evidence is insufficient to recommend in favor of or against routine ankle arthroscopy in all primary lateral ankle ligamentous reconstructions.^{4,22} However, several investigators^{18,19,88,89} support routine ankle arthroscopy for these patients, citing high incidences of intra-articular disease and OCLTs in as many as 25% of patients. However, not all investigators routinely obtain preoperative ankle MRI before lateral ligamentous reconstruction as we do. The ability of ankle MRI to successfully identify intra-articular disease such as loose bodies and OCLTs has yielded mixed results.^{68,69} The advantages of not performing arthroscopy before lateral ligamentous reconstruction are easier patient positioning and a more clearly defined soft tissue envelope during the open procedure. We use the following algorithm in our military population undergoing lateral ankle ligamentous reconstructions:

1. All patients undergo preoperative ankle MRI
2. If ankle MRI shows intra-articular pathology → ankle arthroscopy
3. If ankle MRI is inconclusive or negative for intra-articular pathology(s), and intra-articular ankle pain is a predominant presenting symptom → ankle arthroscopy
4. If ankle MRI is inconclusive or negative for intra-articular pathology(s), and intra-articular ankle pain is not a predominant presenting symptom → no ankle arthroscopy

Our Preferred Treatment of Primary Lateral Ligamentous Reconstruction

In military service members who have failed appropriate nonoperative treatment of chronic lateral ankle instability, we prefer anatomic reconstruction. Specifically,

we routinely perform a modified Broström technique,^{35,78} using a lateral capsuloligamentous imbrication similar to Karlsson and colleagues' description.^{76,77} The repair is secured with suture anchors and reinforced with a local distal fibular periosteal flap similar to previous investigators' descriptions.^{81,82,90} In rare cases when the local soft tissues are less than optimal, we typically enhance the reconstruction with local split peroneus brevis tendon, as described by previous investigators.^{86,87}

The procedure is typically performed under general anesthetic with a thigh or calf tourniquet. If diagnostic arthroscopy is performed before ligament reconstruction, the patient is placed in a semilateral position on a beanbag to best facilitate both procedures. If no arthroscopy is performed, the patient is placed in a direct lateral position on a beanbag. With regard to the lateral ligament reconstruction, a curvilinear incision is made over the lateral ankle. We prefer the lateral curvilinear approach because of its versatility to allow for proximal and distal extension. We first identify and isolate the inferior extensor retinaculum (IER) for later augmentation (**Fig. 7A**). It is critical to meticulously identify and dissect the IER from the underlying tissues to preserve its integrity. Next, if indicated, the peroneal tendon sheath is incised longitudinally along the posterior fibula to allow exposure of the peroneal tendons (see **Fig. 7B**). In most cases, only a limited tenosynovectomy is required. After irrigation and closure of the peroneal tendon sheath with absorbable suture, the periosteal flap harvest is marked and lifted sharply off the lateral border of the fibula (see **Fig. 7C–D**). Next, the investigators release the capsuloligamentous complex from the lateral malleolus, identifying the ATFL remnant anteriorly (see **Fig. 7E**). Two small double-armed suture anchors (Arthrex, Naples, FL) are then placed in the distal fibula, approximately 1 to 2 cm proximal to the tip of the lateral malleolus. The suture anchors are placed in a parallel manner, at an angle 45° to the surface of the bone along the longitudinal axis of the fibula.

After placing the suture anchors, a 3-layered repair is performed. Using a small roll of surgical towels, the ankle is positioned in a neutral position, with the hindfoot in slight eversion. First, the capsuloligamentous complex is secured by passing the sutures through the leading edge of the tissue, advancing the complex retrograde over the lateral malleolus, and tying all 4 sutures from anterior to posterior (see **Fig. 7F**). We ensure that the ATFL remnant is captured in this first layer. We agree with previous investigators that it is not critical to incorporate the CFL in the repair.^{17,21,35,71,83} Maintaining the same ankle-hindfoot position, the periosteal flap is advanced anterograde over the first layer of the repair and secured with the same sutures (see **Fig. 7G**). The IER is advanced to the repair site and secured by passing and securing all 4 sutures through its leading edge. The sutures are then cut, completing the repair (see **Fig. 7H**). The wound is irrigated and closed in a layered fashion. We routinely close the skin with interrupted mattress-type suture technique instead of metallic staples. Sterile dressings are applied, and a well-padded plaster splint is applied. The splint is applied with the ankle in neutral flexion and the hindfoot in subtle eversion to protect the ligamentous repair.

Concomitant Procedures

As discussed earlier, concomitant disease contributing to or resulting from chronic lateral ankle instability must be addressed at the time of any successful lateral ligamentous reconstruction. Most commonly, these conditions include hindfoot malalignment, peroneal tendon diseases, and OCLTs.^{18,19,51,52,88,89} Hindfoot varus or combined cavovarus deformities (see **Fig. 2**) are corrected with appropriate corrective osteotomies at the time of lateral ligament reconstruction. In addition, appropriate surgical procedures are performed to address peroneal tendinopathy(s) at the time of

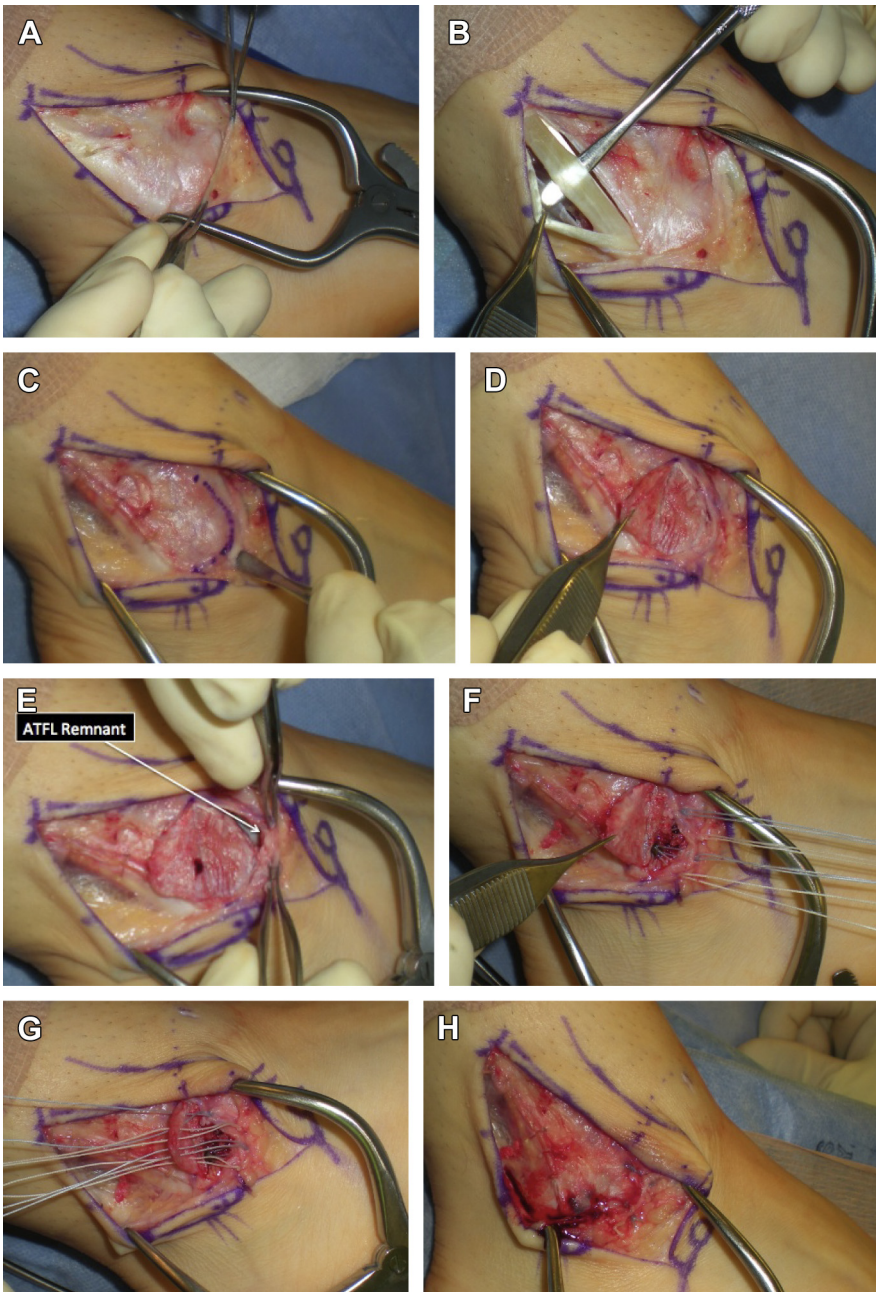


Fig. 7. (A) Intraoperative exposure and isolation of IER. (B) Exposure and exploration of normal-appearing peroneal tendons. (C) Marking of local distal fibular periosteal flap dissection for lateral ligamentous reconstruction augmentation. (D) Augmentative periosteal flap after subperiosteal dissection from lateral border of fibula. (E) Complete release of capsuloligamentous complex, exposing ATFL remnant. (F) Suture anchor repair of capsuloligamentous complex and ATFL remnant (layer 1). (G) Suture anchor repair of periosteal flap augmentation (layer 2). (H) Completed 3-layered lateral ligamentous reconstruction with periosteal flap augmentation.

lateral ligamentous reconstruction. If an OCLT is present (see [Fig. 1](#)), these are typically treated at the time of lateral ligamentous reconstruction with concomitant arthroscopic debridement and microfracture^{18,19,88,89} or other indicated larger cartilage restorative procedures.

Postoperative Management

At our centers, all service members undergoing lateral ankle ligamentous reconstruction are evaluated preoperatively by physical therapists and are instructed to begin immediate postoperative hip and knee range of motion to minimize postoperative pain, swelling, thigh atrophy, and overall deconditioning. Service members then return to clinic at 2 weeks postoperatively for suture removal. The postoperative regimen is at the discretion of the individual surgeon and must be individually tailored to account for any other concomitant surgical procedures. In most cases, when only a standard primary lateral ligamentous repair with or without arthroscopy is performed, a weight-bearing short-leg fiberglass cast is placed at 2 weeks postoperatively. The patient is then allowed to begin weight bearing as tolerated. Generalized conditioning therapy continues, with the goal to prevent quadriceps atrophy and deconditioning. At 4 weeks postoperatively, the service member returns to clinic for removal of the cast and transition into a controlled ankle motion (CAM) boot for daily use. A structured postoperative functional rehabilitation program is initiated and tailored to the service member's individual needs, dependent on other concomitant procedures performed. During therapy sessions, the service member is allowed to remove the CAM boot and use a semirigid ankle brace (see [Fig. 6](#)). In addition, we allow service members to wear the brace at night during sleep.

In general, the rehabilitation course consists of 4 phases, incorporating a variety of lower extremity strengthening programs, seated and standing BAPS therapy to restore balance and proprioception, and focused peroneal tendon strengthening.^{48,49,54,63,72,73} Between postoperative weeks 8 and 12, the CAM boot is discontinued and transition into a semirigid ankle brace is allowed at the therapist's discretion. A graduated walk to run program is generally initiated at the 12-week postoperative stage, and achievement of return to full sporting activities and military duties is expected by the 6-month postoperative stage. In military populations, we recommend using the semirigid ankle brace during running, sporting activities, and while on uneven surfaces until the 6-month postoperative stage. After 6 months, we allow service members to discontinue use of the brace altogether.

SUMMARY

Chronic lateral ankle instability is a condition frequently encountered by orthopedic surgeons treating highly active patient populations, particularly military service members. Providers treating military service members must have a high index of suspicion for this condition when signs and symptoms of functional or mechanical instability exist. Stress testing and ankle MRI, although not definitive in sensitivity for detecting instability or other concomitant injuries, should be considered during the treatment decision-making process. Appropriate nonoperative treatment should be attempted initially; however, when nonoperative treatment fails, surgical management is warranted to prevent untoward long-term sequelae. Proper surgical treatment and subsequent postoperative management are at the discretion of the individual surgeon but must account for the concomitant diseases frequently associated with chronic lateral ankle instability. Low recurrence of lateral instability can be achieved even in high-demand military patient populations with a focused treatment plan.

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