34 Lateral ankle instability

34.1 Introduction

An ankle sprain is the most common athletic injury — approximately 30,000 of these injuries occur each day in the US (1,2) — and the most common reason to see an orthopedist.(2-7) Ankle sprains are more prevalent in certain sports such as basketball, where in one study, they accounted for 13% of all injuries.(8) Historically, most physicians have recommended various forms of conservative management, with the adage, “All these injuries get better.” More recently, however, careful assessment of ankle sprains has revealed that 10% to 40% result in persistent symptoms after acute injury (2,4-6,9-11) due to a number of issues:

- Peroneal tear or dislocation
- Underlying cartilage defect
- Chronic ankle instability

While the exact incidence of chronic ankle instability as a result of an initial ankle sprain remains unknown, many authors have reported that injury to the mechanoreceptors and attenuation of the lateral ligament complex are likely causes.(10, 12)

34.2 Anatomy

The lateral ligament complex of the ankle is comprised of the anterior talofibular ligament (ATFL), the posterior talofibular ligament (PTFL), and the calcaneofibular ligament (CFL).
• The ATFL originates from the anterior aspect of the fibula, just distal to the anterior joint line of the ankle, and inserts on the lateral aspect of the talar neck just distal to the articular surface.\(^{13}\) It is a capsular thickening.

• The CFL is located at the distal (inferior-most) aspect of the fibula, originating just anterior to the mid-coronal line and inserting obliquely and posteriorly along the calcaneal tuber.\(^{13}\) This ligament crosses both the tibiotalar and subtalar joints, and as such has been thought to play a role in subtalar stability as well.\(^{14}\)

• The PTFL originates along the posterior aspect of the lateral malleolus, and after directing itself further posteriorly, inserts on the posterolateral talar body just beneath the talar dome.\(^{13}\) While this is a ligament, it is contiguous with the ankle joint capsule.

The CFL and PTFL course deep to the peroneal tendons, which traverse the posteroinferior aspect of the fibula, en route to their insertions in the foot, where they provide dynamic stabilization to the ankle. Although these tendons should always be inspected during evaluation of any ankle sprain to rule out tear or dislocation (instability), fortunately the peroneals and their retinaculum are rarely injured in an acute ankle sprain. The ATFL, on the other hand, represents the most commonly injured structure in an ankle sprain; it is involved in over 90% of all sprains.\(^{16-18}\) The CFL is involved 50-75% of the time, and the PTFL is involved in fewer than 10% of all ankle sprains.\(^{16,17,19,20}\)

### 34.3 Biomechanics

The lateral collateral ligament complex represents the primary static stabilizer of the ankle. The ATFL is the ankle's primary restraint to varus stress, when the ankle is in a plantar-flexed position; the CFL is the ankle's primary restraint to varus stress, when the ankle is in a dorsi-flexed position.\(^{21}\) Both are major static stabilizers of the ankle when in varus, and both are usually affected in patients who have lateral ankle instability.\(^{22}\) When the ATFL and CFL have been sectioned during cadaveric testing, talar tilt increases by an average of 20 degrees.\(^{21}\)

In contrast, the PTFL is usually not injured during inversion sprain, and it is rarely involved in lateral ankle instability. It is also the largest of all the lateral ankle ligaments, and a tear is often indicative of a significant traumatic event.

The peroneal tendons provide primary dynamic stabilization to the ankle joint. Injury to the peroneal tendons and impaired peroneal reaction time have been implicated in lateral ankle instability.\(^{23}\)

### 34.4 Clinical Presentation

Patients with functional lateral ankle instability most commonly complain of an inability to rely on their ankle and report repeated episodes of the ankle "giving way," during which the ankle will exhibit pathologic inversion. These individuals may provide a history of either multiple repetitive injuries or simply a singular severe ankle sprain. Patients often describe their ankles as "loose", and avoid any activities or uneven surfaces which they think may lead to another instability episode. Pain can also be a complaint, although this is not a predominant symptom, and careful questioning usually identifies that any pain typically follows (rather than precedes) an instability episode.\(^{24}\)
When evaluating such patients, it must be remembered that chronic lateral ankle instability is frequently accompanied by concomitant pathology. Between 93% and 100% of patients with ankle instability have been reported to have associated problems such as osteochondral lesions of the talus, loose bodies, or synovitis, which may also contribute to the patient's symptoms. (2, 11, 25, 26)

### 34.5 Pathogenesis

The true pathogenesis of ankle instability has yet to be fully elucidated, and it is probably multi-factorial in etiology. In a study of open primary repairs following an acute ankle injury, surgeons found that the ligament ends were never approximated. (27) Furthermore, manipulation had no effect on reduction of the ligament ends. It seems likely, based on this evidence, that some degree of scar tissue forms in the gap that occurs when the lateral ligament complex is torn, which may attenuate over time.

Other authors have argued that slowed proprioceptive feedback and peroneal dysfunction may also be culprits. (10, 23)

Considering the sheer number of ankle sprains that occur every day, it is puzzling that ankle instability is not more common. The inherent osseous stability of the ankle joint, as well as dynamic compensatory muscle function, gravity, and ground reactions forces probably have a role in keeping these numbers low. (10)

### 34.6 Classification (Staging)

Anatomic and functional classifications of ankles have been developed.

#### Anatomic Classification of Ankle Sprains

- **Grade I** - Stretching of the lateral ligament complex
- **Grade II** - Partial tearing of one or several of ligaments in the lateral ligament complex
- **Grade III** - Complete rupture of the lateral ligament complex (typically the ATFL and CFL)

#### Functional Classification of Ankle Sprains (based on patient's ambulatory ability)

- **Grade I** - Patient is able to fully weight-bear and walk
- **Grade II** - Patient walks with a noticeable limp
- **Grade III** - Patient is unable to walk

These grading systems also predict timelines for recovery which range from 1-2 weeks (Grade I) to 6-8 weeks (Grade III). (10)

Lateral ankle stability can also be divided into functional and mechanical instability:

- Patients with *functional ankle instability* have subjective complaints of the ankle giving way, but they lack radiographic and clinical evidence of tibiotalar instability (lateral ligament laxity as demonstrated clinically or by stress X-rays). (28)
- Patients with *mechanical ankle instability* have clinical and radiographic evidence that demonstrates excess movement of the talus within the ankle mortise or a significant difference from the contralateral (typically) asymptomatic extremity.
34.7 Physical Examination

The physical examination of patients who present with complaints of ankle instability should always commence with an assessment of alignment. Certain factors, such as cavus and varus, may predispose patients to recurrent instability. Furthermore, failure to recognize and address malalignment may compromise treatment results.(15) Similarly, one should assess for evidence of joint hypermobility and ligamentous laxity, which can also predispose patients to ankle instability, as well as adversely impact the outcome of any chosen treatment.

When examining the ankle, it is important to assess range of motion and strength, and compare them with the contralateral extremity. Talar tilt and anterior drawer testing should also be done and compared with the contralateral side, although defining and examining for isolated ligament injury is difficult.(29, 30)

The presence of a joint effusion is often indicative of a chronic inflammatory process and intra-articular pathology. Care should also be taken to rule out concomitant (confounding) pathology, such as peroneal or Achilles tendinopathy and occult fractures of the anterior calcaneal process, lateral talar process, or 5th metatarsal base.

34.8 Imaging

Standard imaging should begin with a standing ankle series (AP, lateral, and mortise views) to evaluate alignment and rule out fracture.

Further testing for ankle instability, when suspected based on clinical grounds, should include stress radiographs:

- Lateral x-ray in which an anteriorly directed force is placed on the talus and calcaneus either manually or via stress device (eg, Telos)
- AP radiograph in which a varus force is placed across the ankle joint

The radiographic criteria for instability are talar tilt > 10º or greater than 5º of a contralateral, asymptomatic extremity and/ or anterior translation with an absolute value of 1 cm or that measures 5 mm greater than the contralateral, asymptomatic extremity. (Figures 1-2) Physiologic talar tilt can range between 5º and 23º, however, so clinical correlation is important.(1)

Magnetic resonance imaging (MRI) is useful in identifying concomitant pathologies being considered in the differential diagnosis. MRI is particularly helpful for evaluating osteochondral lesions of the talus and peroneal pathology, and can aid in surgical planning. As a screening test, however, MRI has no role in the initial assessment of ankle instability, and certainly not all patients being worked up for or treated for ankle instability require this study.
34.9 Conservative Treatment

The gold standard for treating ankle sprains remains non-operative management. Several prospective Level I studies that have compared non-operative and operative treatment for Grade III sprains have failed to demonstrate a difference in outcome.(31-34) Early functional rehabilitation, therefore, remains the cornerstone of conservative management. This includes:

- RICE protocol
- Early range of motion
- Progressive weight-bearing guided by symptom tolerance
- Physical therapy focusing on peroneal strengthening and proprioceptive training(10)
Several studies have shown that patients may develop proprioceptive deficits and increased peroneal latency. (23, 35) Functional rehabilitation should focus on identifying and restoring these deficits, as well as overall limb strengthening. Most patients who undergo this form of management will have an uneventful post-injury course and return to sport and/or routine activity within 6 weeks. Despite these encouraging data, 10% to 40% of patients will go on to develop chronic ankle instability, though not necessarily symptomatic. (1, 2)

Although some authors have suggested periods of casting, taping, or bracing after the injury, none have been shown to be more effective than a functional rehabilitation program. (36) In athletes with a history of prior sprains, however, bracing has been shown to decrease the frequency and severity of ankle sprains. (37)

It should be noted that this rehabilitative program should always be considered the first-line treatment in any patient with previously unaddressed ankle instability, and certainly in all patients with any level of functional instability. Improved proprioception and muscle strengthening can be very successful in managing these patients, and current data do not support operative ligament stabilization or augmentation in these individuals. Patients with mechanical instability can also benefit significantly from a guided therapy program focusing on peroneal strengthening to improve dynamic ankle stability. Patients usually reach a maximum benefit at 6-12 weeks. (2, 38)

Any patient who exhibits associated injuries, recurrent effusions, early degenerative disease, and potential cartilage injury can be considered a candidate for more aggressive management with the goal to decrease the risk for future ankle arthrosis. (39)

### 34.10 Operative Treatment

Patients with mechanical instability who are recalcitrant to conservative measures despite a course of adequate physical rehabilitation, peroneal strengthening, proprioceptive training, and bracing may be candidates for operative intervention. Operative candidates are those with symptomatic, frequent mechanical instability, not functional instability. Those with a history of the ankle giving way in the face of recurrent effusions are more likely to have cartilage injury accompanying their instability episodes, which can have a bearing on treatment choice.

Although more than 70 operative techniques have been described for ankle instability, they can be divided into three main categories:

- Anatomic repair
- Non-anatomic repair
- Anatomic augmented tenodesis reconstructions (10)

Despite its increasingly widespread use, the role of arthroscopy for ankle instability has yet to be fully defined. Some authors recommend concomitant arthroscopy in all such patients because of the high prevalence of intra-articular lesions, but adequate comparative outcome assessment of employing this additional technique in such patients is lacking. (11, 25, 40) At least one author has attempted to perform lateral stabilization arthroscopically, with encouraging results, although to date there is no level I evidence to support or refute an arthroscopic approach. (41)
34.10.1 Anatomic Reconstructions

The gold standard for open anatomic reconstruction remains the Brostrom procedure. It was initially described in 1966 in a series of 60 patients. (18) In this procedure, the torn ligament ends — usually the ATFL and CFL — are oversewn and tightened in a pants-over-vest fashion (Figure 3). This effectively reduces any redundancy in the lateral collateral complex as a result of prior scarring or stretching.

Due to concern over poor-quality tissue, this procedure was modified by Gould in 1980 (Figure 4). (42) The Gould modification mobilizes and employs the extensor retinaculum to provide additional support to the repaired ankle ligaments. Numerous studies have confirmed that the Brostrom technique with the Gould modification provides excellent long-term results, with over 85% satisfaction and good return to sports. (10, 43-45) Failures have been attributed to a variety of factors, including poor tissue quality, generalized ligamentous laxity, prior repair, long standing instability, and persistent cavovarus foot alignment.

34.10.2 Non-Anatomic Reconstructions

These techniques are considered non-anatomic because they do not repair or recreate the the native anatomy of the lateral collateral ligament complex. The first non-anatomic reconstruction was described in 1952. (46) In this surgery, the peroneus brevis tendon was detached proximally and re-routed through the fibula, from posterior to anterior, and secured to the talus through drill holes. While such reconstructions have been shown to help prevent ankle subluxation, they have also been reported to limit subtalar motion.
Other authors have used local tissue in the form of the peroneal tendons, in part or in their entirety, to augment the lateral ligament complex through a variety of tunnels and insertions. These include the Evans procedure and the Chrisman-Snook. The goal of these procedures has been to use local tendon to augment what was presumed to be incompetent native ligament. It was also found in later variations that taking only part of the peroneus brevis rather than the entire tendon limited the deficiency of post-operative eversion strength; some authors have argued that any amount of autologous peroneal harvest for this procedure effectively deteriorates dynamic stability of the ankle.(47)

34.10.3 Anatomic Augmented Tenodesis Reconstructions

Anatomic augmented tenodesis reconstructions have recently received a great deal of attention, and have become the subject of many contemporary studies. They typically combine the traditional Brostrom repair with either autograft or allograft tissue.(22, 48-50) The benefits of allograft are, of course, limited donor site morbidity and avoiding what may already be damaged tendon. A number of authors harvest one of the hamstring tendon (gracilis, semitendinosus). Such harvesting has been shown to have minimal long-term sequelae.(51, 52) A purported advantage of these reconstructions has been their more anatomic orientation. They originate posteriorly on the calcaneus adjacent to the CFL footprint, course proximally to the fibula along this trajectory, exit anteriorly, and then insert onto the talus near the native ATFL footprint to also mirror the latter ligament's course. These free transfers can be affixed to the bones via a variety of techniques including suture anchors, soft tissue interference screws, metallic screws, washers, and staples. They have gained popularity due to the increased availability and efficacy of allograft tissue, as well as the minimal morbidity associated with gracilis harvest. Moreover, the graft can be tensioned appropriately to restrict inversion past a predetermined point.

An alternative is using the patient's own tendon as a graft, such as one of the medial hamstring tendons.

34.11 Controversy

With myriad procedures described for chronic lateral ankle instability, there is little consensus on optimal treatment outcome or a truly "ideal" operation. While the Brostrom-Gould remains the clinical standard, certain factors may yield suboptimal results, such as severely attenuated tissue, generalized ligamentous laxity, prior repair, long-standing instability, and cavovarus foot alignment. In these cases, some type of augmentation should be considered and may be necessary. In the case of a considerable varus heel that is not driven by a plantar-flexed first ray, a calcaneal osteotomy should be considered.

Non-anatomic repairs have been associated with hindfoot stiffness, decreased range of motion, and eversion weakness.(10) Despite limited direct comparison, the non-anatomic repairs have not performed quite as well as the anatomic repairs from certain perspectives, and the exact indications for augmentation remain ill defined.(44, 53-55) This has led many authors to adopt a more anatomic approach.
Alignment and tissue quality should be considered when assessing the patient and should be factored into the surgical algorithm. Furthermore, one should also consider the possibility of intra-articular pathology that may need to be addressed. The potential for a single arthroscopic approach to address both intra-articular lesions and ankle instability exists; however, the arthroscopic treatment of ankle instability is in its infancy and in need of further study.

34.12 References


