



Resident's backpack

Important articles for the surgical treatment of lateral ankle instability

A. Abarquero Diezhandino

Foot and Ankle Unit. Hospital Universitario Fundación Jiménez Díaz. Madrid (Spain)

Correspondence:

Dr. Ana Abarquero Diezhandino
E-mail: ana.abarquero@gmail.com

Received 9 April 2022
Accepted 19 July 2022
Available online: September 2022

ABSTRACT

A sprained ankle is a very common injury seen in our clinical practice. However, chronic lateral ankle instability, and its treatment, is often little known to residents in training.

Knowledge of the ligaments of the ankle and their function is essential in order to understand this disorder. The peculiar anatomical configuration of the three main lateral stabilizers of the ankle determines the function and offers the key to planning surgical treatment. Ankle arthroscopy is becoming increasingly important, since it allows us to confirm the diagnosis and assess the extent of the ligament damage, as well as evaluate other lesions associated to instability, and makes it possible to successfully perform any of the reparatory or reconstructive surgical techniques. We can define the most appropriate treatment strategy based on the particular characteristics of each individual case. In this regard, most injuries that fail to respond to conservative management can be treated through direct ligament repair. Only in those cases where repair has failed, or in the presence of limiting instability with poor tissue quality for repair, should we consider anatomical reconstruction techniques that may include one or two ligaments, depending on the type of lesion involved. Any of these techniques may be performed through open or arthroscopic surgery - with arthroscopy offering advantages in terms of patient recovery time.

With this selection of articles for the resident's backpack, we offer a review of the anatomy of the joint and of the lateral ligament complex of the ankle, and examine the different surgical treatment techniques and their indications.

Key words: Chronic ankle instability. Ankle spraining. Ankle arthroscopy.

RESUMEN

Artículos destacados para el tratamiento quirúrgico de la inestabilidad lateral de tobillo

El esguince de tobillo es una lesión muy habitual en la práctica clínica de nuestra especialidad; sin embargo, la inestabilidad lateral crónica de tobillo –y su tratamiento– es una patología muchas veces desconocida para los residentes en formación.

El conocimiento de los ligamentos del tobillo y su función es fundamental para entender esta patología; la peculiar disposición anatómica de los 3 principales estabilizadores laterales del tobillo determina su función y nos da la clave a la hora de planificar el tratamiento quirúrgico. La artroscopia de tobillo está ganando un papel muy importante, ya que nos permite confirmar el diagnóstico y valorar el alcance de la lesión ligamentosa, así como otras lesiones asociadas a la inestabilidad, y desarrollar con éxito cualquiera de las técnicas quirúrgicas, ya sean de reparación o reconstrucción. Atendiendo a las características particulares de cada caso, podremos establecer el tratamiento más adecuado; la mayoría de las lesiones que no responden al tratamiento conservador se pueden manejar mediante reparación ligamentosa directa. Solo en aquellos pacientes en los cuales haya fracasado la reparación o bien presenten un cuadro de inestabilidad limitante con un tejido de pobre calidad para la reparación, nos debemos plantear técnicas de reconstrucción anatómicas que podrán incluir 1 o 2 ligamentos, según el tipo de lesión. Cualquiera de estas técnicas se puede realizar mediante cirugía abierta o artroscópica, presentando la artroscopia ciertas ventajas en cuanto al tiempo de recuperación.

Con esta selección de artículos para la mochila del residente hacemos un repaso desde la anatomía de la articulación y el



<https://doi.org/10.24129/j.reacae.29377.fs2204005>

© 2022 Fundación Española de Artroscopia. Published by Imaidea Interactiva in FONDOSCIENCE® (www.fondoscience.com). This is an Open Access article under license CC BY-NC-ND (www.creativecommons.org/licenses/by-nc-nd/4.0/).

complejo ligamentoso lateral del tobillo hasta las diferentes técnicas de tratamiento quirúrgico y su indicación.

Palabras clave: Inestabilidad crónica de tobillo. Esguince de tobillo. Artroscopia de tobillo.

Introduction

The ankle, and particularly the lateral ligament complex, is the most common location of sprains, which are often related to sports activities⁽¹⁾. The anterior talofibular ligament (ATFL), followed by the calcaneofibular ligament (CFL), are the most affected structures. Between 10-20% of all acute injuries can evolve towards symptomatic chronic ankle instability⁽²⁾. It is important to mention the difference between joint laxity and instability. Laxity is a clinical sign that manifests at physical examination of both ankles equally and affects all joints in general — without necessarily implying joint instability. Instability in turn is characterized by ligament failure of the ankle under study, and we can observe two types of joint instability: one presentation consists of mechanical instability, where ligament incompetence can be objectively confirmed through exploratory maneuvers of the anterior compartment (anterior translation of the talus > 10 mm) and forced varus (> 10°), while the second presentation consists of functional instability seen in patients with repeated joint spraining and/or failure, who experience apprehension related to certain movements or activities — the exploratory maneuvers revealing no anomalies⁽³⁾.

Conservative management, based on functional recovery and proprioception training, is the strategy of choice in cases of acute ankle sprains, with acute surgical repair being reserved for selected cases only. In patients with repeated sprains and/or subjective clinical manifestations of instability with limited functionality, where conservative management fails, we can resort to surgery with ligament repair or ligament reconstruction in situations in which the tissue quality is too poor to allow stable suturing. The study published by Brostrom⁽⁴⁾ on the surgical treatment of lateral ankle instability through direct repair is the reference for all other open and arthroscopic techniques that have been described since then.

Review articles such as those recently published by Mafulli⁽⁵⁾ and Chang⁽⁶⁾ constitute an excellent starting point for understanding ankle instability and its treatment. A selection of articles which we consider relevant for understanding the surgical management of ankle instability is provided below, with emphasis being placed on those aspects which we consider to be most important in each of them.

Brostrom, 1966⁽⁴⁾

In 1966, Brostrom published a series of articles on ligament injuries of the ankle and established the bases for their surgical treatment as we understand it today. The article “Sprained ankles. VI. Surgical treatment of ‘chronic’ ligament ruptures” presented a prospective cohort study of 60 patients using a direct repair technique that afforded good outcomes in terms of stability and patient satisfaction. Most of the patients presented avulsions of ligament origin in the fibula involving the anterior talofibular ligament (ATFL), and received treatment in the form of reinsertion with transosseous sutures. The within-tissue lesions were directly sutured following debridement of the damaged extremities, and in those cases where the tissue proved insufficient, reinforcement was provided taking advantage of a flap of the lateral talocalcaneal ligament (LTCL). In cases presenting concomitant damage to the calcaneofibular ligament (CFL), the latter was subjected to direct repair.

The publication of this article represented a turning point in the management of ankle instability, since it evidenced the feasibility of using residual capsule-ligament tissue for repair in patients with chronic lesions, without having to resort to tenodesis or tendon transference techniques, which in many cases can adversely affect subtalar mobility. The subsequent modification introduced by Gould⁽⁷⁾ included mobilization and reinsertion of the lateral portion of the extensor retinaculum toward the tip of the fibula, in order to reinforce the repair and limit tibiotalar inversion while also contributing to correct the subtalar instability component.

Golanó et al., 2010⁽⁸⁾

The review and anatomical dissection study of Pau Golanó *et al.* entitled: “Anatomy of the ankle ligaments: a pictorial essay” is a reference in the study of the anatomy of the ankle. This study describes each of the ligaments that intervene in ankle joint stability: the lateral ligament complex, the deltoid ligament complex and the tibiofibular syndesmosis.

The anatomical configuration of the ligaments helps us to better understand their function. The anterior talofibular ligament (ATFL) appears as a thickening of the

joint capsule and is composed of two fibrous bands. It is the main structure preventing anterior subluxation of the talus, acting mainly in plantar flexion (the inferior band of the ligament remains relaxed and the superior band tenses - with the opposite occurring in dorsal flexion). The calcaneofibular ligament (CFL), dependent upon the capsule, is in intimate relation to the lateral astragalocalcaneal ligament, complementing the subtalar stability of the latter. The CFL maintains its tension over the entire dorsiflexion trajectory of the joint and acts as a primary inversion restrictor, tensing its fibers in the face of varus stress and relaxing them in valgus. The posterior talofibular ligament (PTFL) is a multifascicular element with variable insertion along the talus, where some of its fibers conform the tunnel for the flexor hallucis longus (FHL), and it is also in close relation to the posterior intermalleolar ligament. This ligament remains relaxed in plantar flexion and neutral ankle position, and tenses in dorsiflexion.

This article constitutes a purely descriptive anatomical dissection study in the cadaver — with the limitations this implies. It is worth reviewing in order to understand how the different ankle structures are injured, and is interesting due to the detailed anatomical preparations it provides.

LaPrade et al., 2014⁽⁹⁾

The ankle, composed not only of the tibiofibular component forming a joint with the talus but also of the subtalar joint between the talus and the calcaneus, remains stable thanks to two powerful ligament complexes, one medial (or deltoid) and the other lateral, which is the subject of the descriptive anatomical study entitled: “Qualitative and quantitative anatomic investigation of the lateral ankle ligaments for surgical reconstruction procedures”, which helps us to understand the anatomy of each of the ligaments intervening in lateral stability of the ankle: ATFL, CFL, PTFL and talocalcaneal (cervical) ligament.

The ATFL is a flat rectangular structure identified as an anterolateral thickening of the joint capsule of the ankle, and may present as two anatomical variants: uni- or bifascicular. The hiatus between the two fascicles allows the passage of the branches of the perforating peroneal (or fibular) artery. Its origin is located at the anterior fibular margin, at a midpoint between the tip of the lateral malleolus and the anterior tubercle of the fibula (the most anterior point of the fibula in contact with the tibial joint surface) — the footprint being more extensive in the case of a double ligament, with the two fascicles being spaced an average of 6.9 mm apart. The distal insertion is located at the anterior margin of the lateral joint surface of the talus; this point is closer to the vertex of the lateral process of the talus than to the anterolateral vertex of the trochlea of the talus, and the distribution is divergent in the case of a bifascicular ligament.

The CFL is more cylindrical and runs from the antero-inferior margin of the fibula, very close to the malleolar vertex and just beneath the lower limit of the ATFL, inserting on the lateral surface of the body of the calcaneus in a small tubercle (*tuberculum ligamenti calcaneofibularis*) posterosuperior to the posterior limit of the fibular process of the calcaneus. This ligament passes through the tibiotalar and subtalar joints, playing a role in the lateral stability of both of them.

The PTFL originates in the lower portion of the medial digital fossa of the fibular malleolus at a distance of 4.8 mm from the tip, and fans out along the posterolateral portion of the talus — inserting at a point immediately lateral to the posterolateral tubercle of the talus.

The cervical ligament is located within the tarsal sinus, originating in the anterior third of the calcaneal surface (anterior calcaneal tubercle), and runs perpendicular to the lateral crest of the calcaneus of the tarsal sinus, inserting in the neck of the talus (*tuberculum cervicis*).

This again is an anatomical dissection study in the cadaver, with a limited number of specimens that do not afford a reliable representation of the real population.

This article, and that published by Golanó *et al.*⁽⁸⁾, serve as a starting point to understand the function of each of the ligaments and to establish the essential anatomical references for the correct surgical treatment of lateral ankle instability, based on anatomical techniques. In the same line of research, the group of LaPrade has published other interesting articles evaluating the biomechanical properties of the different surgical techniques for managing ankle instability, and drawing the conclusion that plasty-based anatomical reconstructions afford the same biomechanical features of rigidity and strength as the native ATFL, though not so in the case of tissue repair, where resistance is poorer⁽¹⁰⁻¹²⁾.

Thès et al. (Société Francophone d'Arthroscopie), 2018⁽¹³⁾

The clinical history and physical examination are fundamental for establishing the diagnosis of lateral ankle instability. Imaging techniques in the form of magnetic resonance imaging (MRI) and computed tomography (CT) are used for precise identification of the affected ligament structures and for assessing other associated lesions. However, surgical repair is conditioned by the quality of the remaining tissue. This article entitled: “Arthroscopic classification of chronic anterior talofibular ligament lesions in chronic ankle instability” presents an arthroscopic classification that may serve as a guide in deciding between ligament repair or reconstruction of the ATFL.

Arthroscopically, a number of 4 grades are identified, specifically, grade 0 = healthy ligament; grade 1 = an in-

tact ligament but without adequate tension in response to palpation with the hook test; grade 2 = presence of avulsion, whether fibular or talar, with fibrous scar tissue; grade 3 = thinning of the ligament, without mechanical resistance to traction; and grade 4 = denuded malleolus, without residual ligament. With this classification, presenting moderate interobserver reliability⁽¹⁴⁾, the authors establish that grade 1 and 2 patients can be treated with the open or arthroscopic Brostrom technique, while grade 3 and 4 cases preferably should be treated using graft-based reconstruction techniques.

This was a multicenter retrospective study involving a considerable number of patients. However, patient evaluation was based on the recorded registries of the surgeries, which may lead to error in defining the true extent of ligament damage and its grade within the mentioned classification. Furthermore, it must be remembered that correct evaluation depends on the skill and experience of the surgeon.

Vega et al., 2013⁽¹⁵⁾

The ligament repair technique of Brostrom-Gould, involving reinsertion of the ATFL in its fibular footprint with reinforcement of the extensor retinaculum, is regarded as the gold standard for treating ankle instability in patients that remain symptomatic despite conservative management. Advances in ankle arthroscopy have allowed the introduction of less invasive surgical techniques for the treatment of lateral ankle instability. The article published by Jordi Vega *et al.*, entitled: "All-inside arthroscopic lateral collateral ligament repair for ankle instability with a knotless suture anchor technique", describes a fully arthroscopic technique for repair of the ATFL, reducing the surgery time and the complications in comparing with its predecessors.

Anterior arthroscopy of the ankle through the standard anteromedial and anterolateral portals without the need for traction allows the identification of concomitant lesions that may aggravate the symptoms of ankle instability, such as anterolateral impingement secondary to inflammatory tissue hypertrophy or medial osteochondral lesions; these can be treated in the same surgical procedure. The all-inside technique presented in this article makes use of a third accessory portal located close to the tip of the fibular malleolus for suture passage — thus reducing the risk of damage to the superficial fibular and saphenous nerves. The use of knotless anchoring devices would minimize discomfort caused by prominent subcutaneous material, and also shorten the surgery time. This technique allows the simultaneous repair of the ATFL and CFL, and in this case two independent anchorings are to be used, with CFL repair being performed first.

Vilá and Rico et al., 2017⁽¹⁶⁾

Not all patients with lateral ankle instability are amenable to direct repair. In the case of long-standing lesions and poor tissue quality; avulsions of the talar insertion of the ATFL; complete rupture at mid-body level of the ATFL; and patients with hyperlaxity or collagen disorders, obesity or high-demand athletes, reconstruction techniques are the preferred option. The poor long-term outcomes of the non-anatomical reconstruction techniques implied the need for new reconstruction procedures capable of mimicking the native ligament, improving the clinical and functional outcomes obtained^(4,17). The article entitled: "All-inside arthroscopic allograft reconstruction of the anterior talofibular ligament using an accessory transfibular portal" describes an anatomical reconstruction technique for the ATFL that combines the benefits of ankle arthroscopy with the biomechanical stability of a reconstruction plasty for those patients in which ligament repair proves insufficient — including athletes with high functional demands.

The study reviewed 22 patients with chronic ankle instability at the expense of a single ATFL injury (excluding CFL injuries), with a minimum follow-up of two years. The fully arthroscopic (all-inside) technique included the use of a posteroanterior accessory transfibular portal allowing anatomical identification of the talar insertion of the native ATFL through the fibular tunnel giving way to the plasty procedure, with fixation at both points using respective bio-tenodesis screws. In the presented series, where half of the patients were elite athletes, all the subjects recovered their sports activity, with a single reported case of joint stiffness.

Guillo et al. (Ankle Instability Group), 2015⁽¹⁸⁾

The Ankle Instability Group, led by Stephan Guillo, published the article entitled: "Arthroscopic anatomical reconstruction of the lateral ankle ligaments", which describes the key elements for all-inside arthroscopic anatomical reconstruction of the ATFL and CFL, indicated in cases of chronic instability with involvement of both ligaments, poor tissue quality and impaired subtalar stability.

The main complexity of combined ATFL and CFL plasties is the difficulty of identifying the CFL, due to its extraarticular location, in depth to the peroneal tendons. The arthroscopic technique described makes use of four portals: two classical anterior compartment portals (anteromedial and anterolateral), a third portal in the tarsal sinus, and an optional fourth retromalleolar portal allowing the identification of associated peroneal tendon lesions, as well as localization of the CFL. The procedure is technically demanding and combines the benefits of arthroscopy with the tibiotalar and subtalar biomechanical stability of anatomical plasty.

This study, as well as the two previously presented articles⁽¹⁶⁻¹⁸⁾, describe a surgical technique involving a limited number of patients and with no objective assessment tool to score the functional outcomes. This situation is quite common in studies of this kind, and limits the comparison and reproducibility of the results obtained.

Attia et al., 2021⁽¹⁹⁾

Advances in arthroscopic surgery of the ankle have allowed the treatment of ankle instability using techniques that cause less damage to the soft tissues. The theoretical benefits of arthroscopy have been widely described, and include improved identification and visualization of the ATFL, as well as the identification of concomitant lesions that condition the patient prognosis. The recent meta-analysis “Outcomes of open versus arthroscopic Brostrom surgery for chronic lateral ankle instability: a systematic review and meta-analysis of comparative studies” involves a systematic review of comparative studies between open and arthroscopic Brostrom surgery. A total of 8 studies were included, with a total of 408 patients: 193 subjected to open repair and 215 to arthroscopic repair. Both groups were comparable in terms of age and follow-up.

This meta-analysis evidences the advantages of arthroscopic surgery, which allows earlier functional recovery as assessed by the start of weight-bearing and the return to sports activity, with fewer surgical wound complications. Both procedures were found to be comparable in terms of joint stability as measured by the anterior drawer test and subtalar varus. It must be pointed out that arthroscopy involves a greater learning curve; however, once the technique has been mastered, the surgery time is not significantly different from that of the open procedure.

This methodologically well designed meta-analysis reviews a limited number of heterogeneous studies. Given the relatively recent incorporation of the arthroscopic repair techniques, long-term comparisons of the two techniques cannot be established.

Conclusions

Ankle instability is a disorder that can give rise to functional limitation in young adults when conservative management fails. A number of articles have been presented that provide insight to the surgical management of this disorder, based on the premise that the quality of the damaged tissue and the functional demands of the patient must guide the treatment indication in each individual case. Knowledge of the anatomy is crucial for ensuring good outcomes. The arthroscopic techniques optimize the

management of these injuries and allow the identification of concomitant lesions, affording clinical and functional outcomes not inferior to those obtained with conventional surgery.

Ethical responsibilities

Conflicts of interest. The authors state that they have no conflicts of interest.

Financial support. This study has received no financial support.

Protection of people and animals. The authors declare that this research has not involved human or animal experimentation.

Data confidentiality. The authors declare that the protocols of their work centre referred to the publication of patient information have been followed.

Right to privacy and informed consent. The authors declare that no patient data appear in this article.

References

1. Van den Bekerom MPJ, Kerkhoffs GMMJ, McCollum GA, Calder JDF, van Dijk CN. Management of acute lateral ankle ligament injury in the athlete. *Knee Surg Sports Traumatol Arthrosc.* 2013;21:1390-5.
2. Krips R, de Vries J, van Dijk CN. Ankle instability. *Foot Ankle Clin.* 2006;11:311-29,vi.
3. Ajsis A, Maffulli N. Conservative management of chronic ankle instability. *Foot Ankle Clin.* 2006;11:531-7.
4. Broström L. Sprained ankles. VI. Surgical treatment of “chronic” ligament ruptures. *Acta Chir Scand.* 1966;132(5):551-65.
5. Aicale R, Maffulli N. Chronic Lateral Ankle Instability: Topical Review. *Foot Ankle Int.* 2020;41:1571-81.
6. Chang SH, Morris BL, Saengsin J, et al. Diagnosis and Treatment of Chronic Lateral Ankle Instability: Review of Our Biomechanical Evidence. *J Am Acad Orthop Surg.* 2021;29:3-16.
7. Gould N, Seligson D, Gassman J. Early and late repair of lateral ligament of the ankle. *Foot Ankle.* 1980 Sep;1(2):84-9.
8. Golanó P, Vega J, de Leeuw PA, et al. Anatomy of the ankle ligaments: a pictorial essay. *Knee Surg Sports Traumatol Arthrosc.* 2010;18(5):557-69.
9. Clanton TO, Campbell KJ, Wilson KJ, et al. Qualitative and Quantitative Anatomic Investigation of the Lateral Ankle Ligaments for Surgical Reconstruction Procedures. *J Bone Joint Surg Am.* 2014;18;96(12):e98.
10. Viens NA, Wijdicks CA, Campbell KJ, Laprade RF, Clanton TO. Anterior talofibular ligament ruptures, part 1: biomechanical comparison of augmented Broström repair techniques with the intact anterior talofibular ligament. *Am J Sports Med.* 2014;42:405-11.
11. Clanton TO, Viens NA, Campbell KJ, Laprade RF, Wijdicks CA. Anterior talofibular ligament ruptures, part 2: biomechanical

- comparison of anterior talofibular ligament reconstruction using semitendinosus allografts with the intact ligament. *Am J Sports Med.* 2014;42:412-6.
12. Waldrop NE, Wijdicks CA, Jansson KS, LaPrade RF, Clanton TO. Anatomic suture anchor versus the Broström technique for anterior talofibular ligament repair: a biomechanical comparison. *Am J Sports Med.* 2012;40:2590-6.
 13. Thès A, Odagiri H, Elkaïm M, et al. Arthroscopic classification of chronic anterior talo-fibular ligament lesions in chronic ankle instability. *Orthop Traumatol Surg Res.* 2018;104:S207-11.
 14. Elkaïm M, Thès A, Lopes R, et al.; French Arthroscopic Society. Agreement between arthroscopic and imaging study findings in chronic anterior talo-fibular ligament injuries. *Orthop Traumatol Surg Res.* 2018;104(8S):S213-S218.
 15. Vega J, Golanó P, Pellegrino A, Rabat E, Peña F. All-inside arthroscopic lateral collateral ligament repair for ankle instability with a knotless suture anchor technique. *Foot Ankle Int.* 2013;34:1701-9.
 16. Vilá-Rico J, Cabestany-Castellà JM, Cabestany-Perich B, Núñez-Samper C, Ojeda-Thies C. All-inside arthroscopic allograft reconstruction of the anterior talo-fibular ligament using an accessory transfibular portal. *Foot Ankle Surg.* 2019;25:24-30.
 17. DiGiovanni CW, Brodsky A. Current concepts: lateral ankle instability. *Foot Ankle Int.* 2006;27:854-66.
 18. Guillo S, Takao M, Calder J, et al. Arthroscopic anatomical reconstruction of the lateral ankle ligaments. *Knee Surg Sports Traumatol Arthrosc.* 2016;24:998-1002.
 19. Attia AK, Taha T, Mahmoud K, Hunt KJ, Labib SA, d'Hooghe P. Outcomes of Open Versus Arthroscopic Broström Surgery for Chronic Lateral Ankle Instability: A Systematic Review and Meta-analysis of Comparative Studies. *Orthop J Sports Med.* 2021;9:23259671211015210.