Focus On
Lateral ankle instability

Ankle sprains are one of the most common soft-tissue injuries and are especially prevalent at all levels of sport, with lateral sprains accounting for 85% of all such injuries.[1] The lateral ankle ligament complex consists of the anterior talofibular ligament (ATFL), the calcaneofibular ligament (CFL), and the posterior talofibular ligament (PTFL).[2] They provide lateral stability to the ankle joint, which is more complex than a simple rolling hinge joint. As the talus rotates internally and externally within the mortice of the ankle as the joint moves, a single ligament on the lateral aspect of the ankle would not be able to provide stability at all the positions of the tibiotalar joint.[3]

The terms 'ankle ligament laxity', 'lateral ankle instability', and 'chronic ankle instability' are often used interchangeably. Laxity is a physical sign that is objectively detected on examination. Lateral ankle instability is a symptom, which identifies the presence of an unstable ankle resulting from lateral ligamentous injury. The patient with such instability may describe a feeling of the ankle giving way. Meanwhile chronic ankle instability refers to repeated episodes of instability that result in recurrent ankle sprains.[3]

Acute ankle instability

The position of the ankle at the time of injury, as well as the applied force, will determine which structures of the ankle are injured. Lateral ankle sprains most commonly occur after excessive inversion and internal rotation of the hindfoot while the leg is in external rotation.[4] The ATFL, which is the weakest of the three lateral ankle ligaments, is involved in the majority of lateral ankle sprains; the CFL is involved in 50% to 75% of such injuries and the PTFL in < 10%.[5]

There is no standard system for grading ankle injuries. The proposed scores include an anatomical system,[6] the Trevino, Davis and Hecht system,[7] grading by presenting symptoms,[8] by anatomical damage, and clinical presentation.[9,10] Malliaropoulos et al proposed a classification system into four grades,[6] modifying Hertel's three-grade classification.[4] They subclassified grade III injuries in athletes into IIIA and IIIB, based on anterior-drawer-test stress radiographs. In a grade IIIA injury, the decrease in range of movement (ROM) was > 10°, oedema > 2 cm was present, and stress radiographs were normal. In a grade IIIB injury, the decrease in ROM was > 10°, oedema was > 2 cm, and a radiological comparison of uninjured and injured ankles demonstrated a > 3 mm difference in the distance between the posterior articular surface of the tibia and the nearest point on the talus.

Assessment of the patient with a lateral ankle sprain begins with the history. A cracking sound at the time of injury and the feeling that the ankle has, at the time, been bent double are not pathognomonic of a rupture of one or more of the ligaments of the lateral ligamentous complex of the ankle.[11,12] Physical examination is based on the guidelines of the Ottawa ankle rules for diagnosing a possible ankle fracture.[13] Marked swelling and pain on palpation are usually present in patients with a ligament rupture.

When indicated, according to the Ottawa ankle rules, standard ankle radiographs are taken to exclude fractures and associated pathology.[1] The natural history of an untreated rupture of the lateral ligament of the ankle leads to a more unfavourable result when compared with adequate treatment.[12] Standard protection, rest, ice, compression, and elevation are the most common treatments for patients with ankle sprains. In a randomised controlled trial, participants were randomised to an accelerated intervention with early therapeutic exercise (exercise group) or a standard regime with protection, rest, ice, compression, and elevation (standard group).[14] An accelerated exercise protocol during the first week after an ankle sprain improved ankle function; the group receiving this intervention was more active during that week than the group which received standard care.[14]

Results from another randomised controlled trial suggest that peri-articular injections of hyaluronic acid combined with standard care (rest, ice, elevation, and compression) in acute grade I or II4 lateral ankle sprains are associated with reduced pain, more rapid return to sport, fewer recurrent ankle sprains, fewer missed days from sport, and fewer adverse events for up to 24 months post-injury when compared with a placebo injection of normal saline solution combined with standard care.[15]

A one-year follow-up randomised controlled trial showed that the use of a proprioceptive training programme after standard care of an ankle sprain was effective in the prevention of self-reported recurrences in athletes who had sustained an acute sports-related injury to the lateral ankle ligament.[16]

Cast immobilisation, functional management, and surgical anatomical repair are the three most common methods used to manage grade III4 acute lateral ankle ligament injuries[3] A Cochrane review compared surgical versus conservative treatment for acute injuries of the lateral ligament complex of the ankle in adults.[17] This concluded that there is insufficient evidence available from randomised controlled trials to determine

the relative effectiveness of surgical and conservative treatment for acute injuries of the lateral ligament complex of the ankle.[17]

Cast immobilisation normally entails a brief period (three weeks) in a below-knee walking cast, followed by up to 12 weeks of proprioceptive rehabilitation.[3] Immobilisation in a below-knee cast or an Aircast (DJO Incorporated, Vista, California) boot for ten days results in faster resolution of pain than if a patient is only given a tubular compression bandage.[18] In a randomised controlled trial, the below-knee cast and the Aircast brace offered cost-effective alternatives to a tubular bandage for an acute, severe ankle sprain; however, the former had the advantage in terms of overall recovery by three months.[19] As there are no differences in long-term outcome, practitioners should consider likely compliance and acceptability to patients when choosing a brace.[19]

Functional management implies early mobilisation with external support and a protocol of rest, ice, compression, and elevation. This is followed by a rehabilitation programme that comprises ROM exercises, strengthening, proprioception, and activity-specific training.[1] Proprioception training, which is essential for the recovery of balance and postural control, consists of a series of progressive drills on devices such as wobble boards and trampolines.[5]

Functional management was associated with a higher percentage of patients returning to sports in a meta-analysis (level I) of randomised controlled trials which compared immobilisation with functional management for acute lateral ligament injuries of the ankle.[20] Functionally-managed patients have also been shown to have a higher rate of satisfaction than patients managed with cast immobilisation.[20] In a systematic review of nine studies on functional management, lace-up supports were most effective, while tapes were associated with skin irritation and were no better than semi-rigid supports. Elastic bandages were the least effective form of management.[21] A meta-analysis of surgical versus non-surgical management of acute ankle injuries found that all available trials had methodological flaws and it was not possible to demonstrate a clearly superior management option based on the available pooled data.[22] However, a more recent randomised controlled trial comparing surgery with functional management, found statistically significant differences in favour of surgical intervention in respect of pain, giving way and recurrent sprains at follow-up.[11] Evidence from a systematic review[23] of seven high-quality studies suggested that proprioceptive/neuromuscular training is effective in reducing the incidence of certain types of sporting injury in adolescent and young adult athletes during pivoting sports, including ankle sprains. Proprioceptive training, compared with no intervention, was an effective way to reduce the rate of ankle sprains among male soccer players.[24] However, often player compliance with the prescribed training programmes can be low and any effect of the intervention on the risk of injury cannot be detected; this has been shown in a randomised controlled trial.[25]

Chronic ankle instability

Patients with chronic ankle instability usually complain of persistent pain, recurrent sprains, and recurrent episodes of the ankle giving way. Major factors in chronic ankle instability are the combination of mechanical and functional insufficiency resulting from the primary ankle sprain. Deformities, including hindfoot varus, plantar flexion of the first ray, midfoot cavus, and generalised laxity may also play a role in the predisposition to a lateral ankle sprain. The findings on clinical examination may be subtler than in acute injuries, with minimal ecchymosis and swelling limited to the joint line, suggestive of an effusion. Ligamentous laxity is more easily noted in the patient with chronic instability because the limb tends to be less painful in this category of patient.

MRI can be a useful way to show associated causes of ankle pain, such as chondral injury, radiographically occult fractures, bone bruising, peri-articular tendon tears, degeneration, sinus tarsi injury, and impingement syndrome. The main signs of ligament injury on MRI scans are ligament swelling, discontinuity, a lax or wavy ligament, and non-visualisation.[26]

A meta-analysis of seven randomised trials based on the interventions for the management of patients with chronic lateral instability of the ankle was unable to come to a conclusion about the best surgical option for its management. There was insufficient statistical significance and poor methodological quality of the randomised controlled trials that were available.[27]

Generally, the indication for surgery in patients with chronic instability of the ankle is a failure of conservative management.[28] Several surgical techniques have been described although all are modifications of techniques which fall into two basic categories: anatomical repair and tenodesis stabilisation.[29,30]

Anatomical repairs restore normal anatomy and joint mechanics and seek to maintain movement of the ankle and subtalar joints. However, such repair is dependent on the condition of the injured ligaments, which may be attenuated. Tenodesis stabilisations employ various types of local tendon graft in order to restrict movement, but without repair of the injured ligaments. Ankle and hindfoot biomechanics are altered as a result.[31]

The most common and time-tested anatomical repair is the Broström technique.[32] The original procedure involved mid-substance imbrication and suture of the ruptured ends of the ligament. Gould, Seligson and Gassman[29] augmented the Broström repair with the mobilised lateral portion of the extensor retinaculum, attached to the fibula after imbrication of the ATFL and the CFL. Karlsson et al[30] proposed that the ATFL and the CFL were usually elongated and scarred, not disrupted, recommending that the ligaments be shortened and then reattached to the fibula at their anatomical origins through drill holes. No studies demonstrate superiority of these more complicated techniques over the classical Broström repair.

Watson-Jones first described a non-anatomical tenodesis stabilisation in 1952,[33] by weaving a peroneus brevis graft through the calcaneum and talus. This was later simplified by Evans,[34] who passed the distally-attached peroneus brevis graft through an oblique posterior-superior drill hole in the distal fibula. This construct does not replicate the ATFL or the CFL; rather, it lies in a position in between these two ligaments. The Evans method has been used to augment the Broström repair,[35] effectively

negating the advantages of an anatomical procedure. Chrisman and Snook[36] described a weave intended to more closely approximate the ATFL and the CFL, incorporating a split peroneus brevis tendon graft in order to maintain some function of peroneus brevis.

Arthroscopic management of lateral instability of the ankle is an emerging method of treatment but is technically demanding. The inability to address the CFL arthroscopically, and a lack of long-term results, are obstacles that are yet to be overcome.[3]

Summary

Acute lateral ankle sprains are common, while chronic lateral instability of the ankle is much less so. The latter is a multifactorial condition, often resulting from undertreated acute injuries. The initial management of chronic instability of the ankle is a robust, structured programme of functional and prophylactic rehabilitation. Failed rehabilitation is an indication for surgery. Anatomical repair is preferable to a non-anatomical tenodesis reconstruction.

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References

1. **Maffulli N, Ferran NA.** Management of acute and chronic ankle instability. *J Am Acad Orthop Surg* 2008;16:608-15.
2. **Ferran NA, Maffulli N.** Epidemiology of sprains of the lateral ankle ligament complex. *Foot Ankle Clin* 2006;11:659-62.
3. **Ferran NA, Oliva F, Maffulli N.** Ankle instability. *Sports Med Arthrosc* 2009;17:139-45.
4. **Hertel J.** Functional Anatomy, Pathomechanics, and Pathophysiology of Lateral Ankle Instability. *J Athl Train* 2002;37:364-75.
5. **Malliaropoulos N, Ntessalen M, Papacostas E, Longo UG, Maffulli N.** Reinjury after acute lateral ankle sprains in elite track and field athletes. *Am J Sports Med* 2009;37:1755-61.
6. **Malliaropoulos N, Papacostas E, Papalada A, Maffulli N.** Acute lateral ankle sprains in track and field athletes: an expanded classification. *Foot Ankle Clin* 2006;11:497-507.
7. **Trevino SG, Davis P, Hecht PJ.** Management of acute and chronic lateral ligament injuries of the ankle. *Orthop Clin North Am* 1994;25:1-16.
8. **Jackson DW, Ashley RL, Powell JW**. Ankle sprains in young athletes. Relation of severity and disability. *Clin Orthop* 1974;101:201-15.
9. **Hamilton WG.** Sprained ankles in ballet dancers. *Foot Ankle* 1982;3:99-102.
10. **Kaikkonen A, Kannus P, Jarvinen M.** A performance test protocol and scoring scale for the evaluation of ankle injuries. *Am J Sports Med* 1994;22:462-9.
11. **Pijnenburg AC, Bogaard K, Krips R, Marti RK, Bossuyt PM, van Dijk CN.** Operative and functional treatment of rupture of the lateral ligament of the ankle. A randomised, prospective trial. *J Bone Joint Surg [Br]* 2003;85-B:525-30.
12. **Pijnenburg AC, Van Dijk CN, Bossuyt PM, Marti RK.** Treatment of ruptures of the lateral ankle ligaments: a meta-analysis. *J Bone Joint Surg [Am]* 2000;82-A:761-73.
13. **Stiell IG, Greenberg GH, McKnight RD, Nair RC, McDowell I, Reardon M, Stewart JP, Maloney J.** Decision rules for the use of radiography in acute ankle injuries. Refinement and prospective validation. *JAMA* 1993;269:1127-32.
14. **Bleakley CM, O'Connor SR, Tully MA, Rocke LG, Macauley DC, Bradbury I, Keegan S, McDonough SM.** Effect of accelerated rehabilitation on function after ankle sprain: randomised controlled trial. *BMJ* 2010;340:c1964.
15. **Petrella MJ, Cogliano A, Petrella RJ.** Original research: long-term efficacy and safety of periarticular hyaluronic acid in acute ankle sprain. *Phys Sportsmed* 2009;37:64-70.
16. **Hupperets MD, Verhagen EA, van Mechelen W**. Effect of unsupervised home based proprioceptive training on recurrences of ankle sprain: randomised controlled trial. *BMJ* 2009;339:b2684.
17. **Kerkhoffs GM, Handoll HH, de Bie R, Rowe BH, Struijs PA.** Surgical versus conservative treatment for acute injuries of the lateral ligament complex of the ankle in adults. *Cochrane Database Syst Rev* 2007-2:CD000380.
18. **Lamb SE, Marsh JL, Hutton JL, Nakash R, Cooke MW.** Mechanical supports for acute, severe ankle sprain: a pragmatic, multicentre, randomised controlled trial. *Lancet* 2009;373:575-81.
19. **Cooke MW, Marsh JL, Clark M, Nakash R, Jarvis RM, Hutton JL, Szczepura A, Wilson S, Lamb SE.** Treatment of severe ankle sprain: a pragmatic randomised controlled trial comparing the clinical effectiveness and cost-effectiveness of three types of mechanical ankle support with tubular bandage. The CAST trial. *Health Technol Assess* 2009;13:iii, ix-x, 1-121.
20. **Kerkhoffs GM, Rowe BH, Assendelft WJ, Kelly K, Struijs PA, van Dijk CN.** Immobilisation and functional treatment for acute lateral ankle ligament injuries in adults. *Cochrane Database Syst Rev* 2002-3:CD003762.
21. **Kerkhoffs GM, Struijs PA, Marti RK, Blankevoort L, Assendelft WJ, van Dijk CN.** Functional treatments for acute ruptures of the lateral ankle ligament: a systematic review. *Acta Orthop Scand* 2003;74:69-77.
22. **Kerkhoffs GM, Handoll HH, de Bie R, Rowe BH, Struijs PA.** Surgical versus conservative treatment for acute injuries of the lateral ligament complex of the ankle in adults. *Cochrane Database Syst Rev* 2002-3:CD000380.
23. **Hübscher M, Zech A, Pfeifer K, Hänsel F, Vogt L, Banzer W.** Neuromuscular training for sports injury prevention: a systematic review. *Med Sci Sports Exerc* 2010;42:413-21.
24. **Mohammadi F.** Comparison of 3 preventive methods to reduce the recurrence of ankle inversion sprains in male soccer players. *Am J Sports Med* 2007;35:922-6.
25. **Engebretsen AH, Myklebust G, Holme I, Engebretsen L, Bahr R.** Prevention of injuries among male soccer players: a prospective, randomized intervention study targeting players with previous injuries or reduced function. *Am J Sports Med* 2008;36:1052-60.
26. **Griffith JF, Brockwell J.** Diagnosis and imaging of ankle instability. *Foot Ankle Clin* 2006;11:475-96.
27. **de Vries JS, Krips R, Sierevelt IN, Blankevoort L.** Interventions for treating chronic ankle instability. *Cochrane Database Syst Rev* 2006-4:CD004124.
28. **Ajis A, Maffulli N.** Conservative management of chronic ankle instability. *Foot Ankle Clin* 2006;11:531-7.
29. **Gould N, Seligson D, Gassman J.** Early and late repair of lateral ligament of the ankle. *Foot Ankle* 1980;1:84-9.
30. **Karlsson J, Bergsten T, Lansinger O, Peterson L.** Reconstruction of the lateral ligaments of the ankle for chronic lateral instability. *J Bone Joint Surg [Am]* 1988;70-A:581-8.
31. **DiGiovanni CW, Brodsky A.** Current concepts: lateral ankle instability. *Foot Ankle Int* 2006;27:854-66.
32. **Broström L.** Sprained ankles. VI. Surgical treatment of "chronic" ligament ruptures. *Acta Chir Scand* 1966;132:551-65.
33. **Watson-Jones R.** Recurrent forward dislocation of the ankle joint. *J Bone Joint Surg [Br]* 1952;34-B:519.
34. **Evans DL.** Recurrent instability of the ankle: A method of surgical treatment. *Proc R Soc Med* 1953;46:343-4.
35. **Bell SJ, Mologne TS, Sitler DF, Cox JS.** Twenty-six-year results after Brostrom procedure for chronic lateral ankle instability. *Am J Sports Med* 2006;34:975-8.
36. **Chrisman OD, Snook GA.** Reconstruction of lateral ligament tears of the ankle. An experimental study and clinical evaluation of seven patients treated by a new modification of the Elmslie procedure. *J Bone Joint Surg [Am]* 1969;51-A:904-12.