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Rotational ankle instability: A current concept review

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Rocco Aicale[1,2] and Nicola Maffulli[1,2,3,4]

Abstract

Ankle sprains are extremely common. It is important to have a clear insight of the course of recovery after such injury to evaluate the effective strategies to guide management decisions, and understand the potential risk factors involved in the development of chronic problems and recurrent ankle sprains. When a prompt diagnosis is not formulated, ligament tears can remain untreated, and chronic ankle instability can result after acute lateral or medial ankle sprain. When the medial ligament complex (MLC), in particular the anterior fascicle of the deltoid ligament, is involved, rotational ankle instability (RAI) can develop. Generally, a tear of the anterior fibres of the MCL accompanied by anterior talofibular ligament (ATFL) insufficiency has been associated with RAI, while injury of the intermediate fibres of the MLC has been associated with medial ankle instability (MAI). Conservative management is the first line of treatment, with surgery reserved for special cases or if rehabilitation has failed. Regarding surgery, several options are available, including anatomic repair, anatomic reconstruction, and tenodesis procedures. Ankle arthroscopy is increasingly used to address ligament insufficiency and to identify and treat intra-articular pathologies. Repair of MLC tears by an arthroscopic all-inside procedure is effective in both MAI and RAI.

Keywords

ankle, arthroscopy, CLAI, chronic instability, MAI, RAI, ligamentous repair

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Introduction

Ankle sprains are one of the most common musculoskeletal and sport injuries.[1] Clinical presentation can be confusing, and frequently ankle sprain can remain untreated, resulting in chronic ankle instability (CAI) of the medial or lateral ligaments; if medial and lateral ligament tears are combined, rotational instability of the ankle joint can result.[2–4] Injury to the medial ligament complex (MLC) may result in case of chronic overload, as, for example, in long-standing posterior tibialis tendon dysfunction.[5]

Medial and lateral instability arise from lesions of the several ligaments of the ankle: anterior and posterior talofibular ligaments (AFTL and PFTL), calcaneofibular ligament (CFL), anterior tibiotalar ligament (ATTL); the superficial part of the deltoid ligament complex (DLC), the tibiocalcanear ligament (TCL); the deep part of the DLC, and the posterior tibiotalar ligament (PTTL).

[1]Department of Musculoskeletal Disorders, Faculty of Medicine and Surgery, University of Salerno, Fisciano, Italy
[2]Clinica Ortopedica, Ospedale San Giovanni di Dio e Ruggi D'Aragona, Italy
[3]Queen Mary University of London, Barts and the London School of Medicine and Dentistry, Centre for Sports and Exercise Medicine, Mile End Hospital, London, UK
[4]Keele University, Faculty of Medicine, School of Pharmacology and Bioengineering, Guy Hilton Research Centre, Hartshill, Stoke-on-Trent, UK

Corresponding author:
Nicola Maffulli, Trauma and Ortopedics, Universita degli Studi di Salerno Dipartimento di Farmacia, Salvator Allende, Fisciano 84084, Italy.
Email: n.maffulli@qmul.ac.uk

Acute injuries of the MLC may involve pronation with external rotation of the ankle, or, less frequently, supination with external rotation,[6] leading to a fracture of the lateral, medial or both malleoli, or a syndesmosis injury. Isolated injuries of the MLC are rare.[7,8] Acute surgical repair is still controversial, and usually conservative management is instituted.[9,10]

At present, the available scientific literature about the clinical course of acute lateral ankle sprains is still not univocal, and it is still unclear what the prognostic factors for incomplete recovery and recurrent sprains are.[3] When weight bearing, ATFL deficient ankles show significant increase in anterolateral extrusion of the talus, internal rotation, and proximal translation from the mortise. All these abnormalities induce biomechanical impairment, with eventual development of secondary degenerative arthritis.[11]

The ATFL ligament is the most frequently injured, followed by the CFL. Despite adequate conservative management, approximately 15–20% of patients remain symptomatic, and eventually develop CAI, experiencing repetitive ankle sprains.[2,3,12] CAI can be both medial and lateral,[13] with 40% of CAI patients presenting a partial deltoid injury.[14]

In case of tears of the MLC, conservative therapy is the first line of management. When conservative measures fail, patient are likely to develop medial ankle instability (MAI),[15,16] described as a medial 'giving way' sensation of the ankle during walking or sports, in relaxed position, with asymmetric hindfoot valgus.

Ankle anatomy and biomechanics

In neutral position, the tibia and fibula stabilise the ankle joint, containing the talus in a tight fit.[17] In plantar flexion, the soft tissues are more susceptible to injury and strain.[17] The lateral ligamentous complex (LLC) consists of the CFL, ATFL, and PTFL. The CFL is a cord-like extracapsular structure that originates from the lower aspect of the fibula, runs posteroinferiorly, deep to the peroneal tendons, and inserts on the posterior aspect of the lateral surface of the calcaneus on a small tubercle.[18] During dorsiflexion, it is vertical, stabilising primarily the ankle and secondarily the subtalar joint. Isolated tears of the CFL ligament are uncommon.

The ATFL is a simple thickening of the lateral capsule;[19] it is the weakest and the most anterior ligament, and the most easily injured ligament of the LLC.[20] In plantar flexion, the ATFL is vertical, and is a primary stabilizer of the ankle during inversion.

The ATFL and CFL are interconnected by arciform fibres, which play a role as intrinsic reinforcement of the subtalar joint capsule.[21]

The PTFL is the strongest and least vulnerable ligament of the lateral complex. Isolated tears are rare, and the PTFL generally tears only after injury of the ATFL and CFL. A trapezoid-shaped structure, the PTFL originates from the distal portion of digital fossa of the fibula and inserts on the posterolateral tubercle of the talus or on the os trigonum when present.[18]

The most common mechanism of lateral ankle sprain is excessive internal rotation with hindfoot inversion and the leg externally rotated.[22] The ATFL is the most commonly ligament injured, while the CFL is involved in 50%–75% of cases, and the PTFL in less than 10%.[22,23] On examination, clinical laxity tests may be difficult to perform because of pain and swelling, and it is recommended that clinical examination is performed 48 h after the injury to allow more reliable assessment of ligamentous damage.[24]

Ankle microinstability has recently been described as a result of an isolated tear of the superior fascicle of the ATFL.[25,26] Patients with symptomatic microinstability may report recurrent ankle sprains and chronic anterolateral pain. If inversion forces continue to be exerted, the inferior fascicle of the ATFL and the CFL can be involved, with frank ankle instability.[21,27]

Lateral sprains account for 85% of all ankle injuries.[23] Isolated medial ligament complex injuries can occur[24] with forced external rotation and can be associated with fractures/dislocations.[28] The role of the MLC in ankle instability is not well described, but tears can manifest with a medial instability, with giving way and pain on the medial gutter of the ankle and a correctable valgus and pronation deformity of the hindfoot.[29] Most patients (77%) have concomitant LLC tears requiring repair in 69% of cases.[29] Generally, deltoid ligament tears associated to ankle fractures are managed conservatively.[28]

Rotational ankle instability (RAI)

When both the MLC and LLC are injured following an ankle sprain, rotational ankle instability (RAI) may develop.[4] RAI can be defined as increased internal rotation of the talus within the tibiofibular mortise which may strain the superficial deltoid ligament that is then overloaded,[1] and the anterior fibres of the DLC may be injured.[1]

RAI is often difficult to assess clinically, especially if patients do not report medial ankle sprain symptoms. These particular patients, if surgically treated with an isolated repair of the LLC, will develop medial symptoms after a few months.[1] For this reason, when possible, the DLC needs to be checked and, if necessary, treated alongside the LLC repair or reconstruction.

As mentioned, isolated MAI is rare, but, in case of flatfoot deformity, hyperpronation, or ankle laxity, CAI and a predisposition to MLC injury can develop.[13,14] In case of MAI, medial and lateral ankle symptoms (pain, swelling,

and tenderness, or all of them) can be found, and many physical tests (talar tilt test, valgus test, or external rotation test) have been investigated to ascertain the competence of the MLC,[15,22,30] but frequently no signs are reported in most patients, and several physical tests are inadequate to evaluate MAI.[31]

Up to 10%–15% of CAI patients will develop RAI, which is very difficult to assess clinically, and for this reason underestimated.[1] In case of RAI, often patients describe chronic lateral ankle instability symptoms and medial ankle pain, with tenderness at and around the medial aspect of the medial malleolus. These complaints generally appear later than the lateral ankle symptoms, and 23% of patients do not report medial ankle symptoms, making MAI undetected.[1] Therefore, the medial aspect of the ankle should be carefully examined for pain, tenderness, and ligament incompetence to identify subsequent valgus and pronation deformity. In case of restrain deficit of the most anterior facet of the deltoid ligament, the talus can translate anteriorly and externally rotate within the ankle mortise, predisposing to medial rotational instability.

The current literature reports anatomical and non-anatomical reconstruction techniques to tackle lateral instability regardless of the rotational component,[32,33] but no such techniques have been published to treat injuries of both lateral and medial ligaments in patients with RAI.

In the last 2 decades, new techniques have been developed, using ankle arthroscopy to manage ankle ligaments injury.[25] Arthroscopic MLC repair has also been recently described with excellent results.[1] At arthroscopy, MLC tears can be classified into anterior fascicle injury (tibiotalar and tibionavicular ligaments) and intermediate fascicle injury (tibiospring and tibiocalcaneal ligaments). Commonly, the first is described as an open book lesion and it may be associated with RAI,[13] and is evidenced, in vivo, by the increased distance between the medial malleolus and the anterior fascicle of the MLC allowing instruments to push the ligament medially. This type of tear can be classified in 2 grades according to the capacity of instrument to pass the space between the medial malleolus and the anterior fascicle of the MLC (type 1: instruments can partially pass; type 2: instruments can pass fully).

Instead, tears of the intermediat6e fascicle of the MLC may be associated with MAI. Generally, deep fascicles are shorter than the superficial ones, and are more prone to injury after an ankle eversion injury. Arthroscopically, the tears of this ligament have always been observed at its attachment on the medial malleolus, and never at its mid-portion or talar attachment. These tears can be graded in two types: type 1 with partial injury or wave shape injury and type 2 with complete injury.[34]

Conservative and operative treatment

Conservative management is the optimal initial choice.[35,36] It consists of early mobilisation and early weight bearing, sometimes combined with the use of an external support (tape, bandage, or brace). To evaluate the effectiveness of various therapeutic interventions and guide treatment decisions, a clear insight of the recovery course after an acute lateral ankle injury is essential.

Proprioceptive training should be implemented for at least 3 months; if patients experience no improvement in symptoms, surgery is recommended.[2] Surgical treatment is divided into anatomic repair, and anatomic and non-anatomic reconstruction.[30] The latter are non-physiologic and movement of the ankle and hindfoot joints may be restricted, with increased intra-articular tension and impingement.[32,37] When possible, anatomical reconstruction techniques should be preferred,[38,39] but, in patients with chronic instability and poor tissue quality, a repair cannot be performed, and a reconstruction is indicated.

The role of arthroscopy in ankle instability is not totally clear. Given the good results reported in arthroscopic lateral ankle ligament repair or reconstruction,[25,40,41] several authors developed MLC repair techniques to decrease post-operative recovery time and facilitate earlier return to sport and/or daily activities.[42]

At arthroscopy, concomitant intra-articular pathologies can be addressed. Arthroscopic-assisted techniques to manage MLC tears have been described in two studies.[41,42] After suture anchors introduction through arthroscopic portals, they are passed percutaneously through the ligament complex[41] (Figure 1).

Arthroscopically assisted all-inside repair of the MLC using a knotless suture anchor technique without any percutaneous step showed very encouraging preliminary results with low complications rates for the treatment of RAI,[1] and can probably also be used in MAI. Vega et al.[1,34] reported excellent results after treating both RAI and MAI, in particular, 13 patients were managed arthroscopically after failing conservative management, with a mean follow-up of 35 months, resulting in subjective improvement in all patients after the arthroscopic all-inside ligaments repair, with an increase in AOFAS score from 70 (44–77) pre-operatively to 100 (77–100) at final follow-up.

Associated tears of the LLC should be managed only after completing MLC repair to reduce stresses on the repaired ligament during ankle flexion and extension; arthroscopic techniques are probably to be preferred.[43–45]

After surgery, a removable walker boot is maintained for 3 or 4 weeks, and weight bearing is allowed as tolerated with the use of crutches. However, in case of chondral or osteochondral injuries identified at arthroscopy, no weight bearing is allowed for 4–6 weeks. Antithrombotic

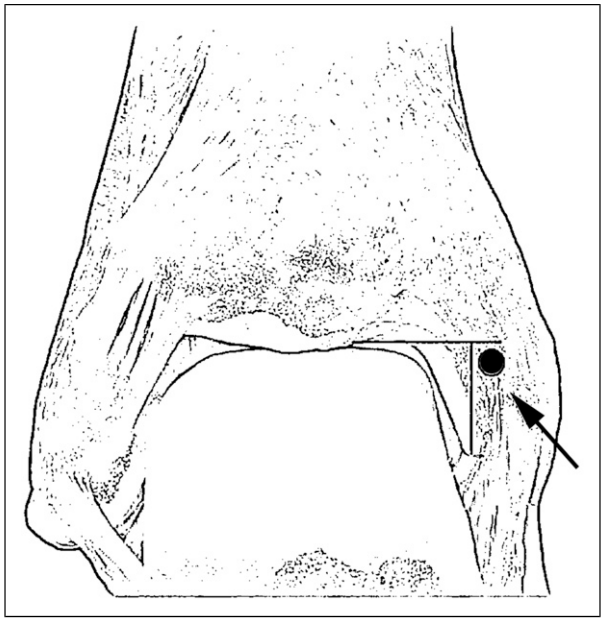

Figure 1. Anterior view of the ankle that shows the area of anchor insertion. The ankle joint line and a perpendicular line arising from the lateral border of the medial malleolus tip are the anatomical landmarks.

prophylaxis is indicated of at least 15 days after surgery, but, when the boot is removed, active and passive range of motion (ROM) exercises and gait training are encouraged. After 2 weeks, strengthening of ankle dorsiflexion, plantarflexion, eversion, and inversion, and proprioceptive training with weight bearing are gradually started. Low impact sports such as swimming or cycling are allowed after 2 months from operation, and after 3 months, based on appropriate muscle conditioning, unrestricted sports, including contact sports, can be allowed.

Conclusion

Arthroscopy of the ankle has recently contributed to better understand the mechanisms and classification of ankle instability. Two types of clinical pictures can emerge after MLC tears, namely MAI and RAI. Ankle instability is frequently associated with intra-articular pathologies, and arthroscopy allows to manage the intra-articular ailments, in addition to address ligament tears. Despite the limited number of studies available regarding the arthroscopic management of RAI and MAI, arthroscopic all-inside repair of the lateral and medial ankle ligament complex shows promising good clinical results.

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ORCID iD

Nicola Maffulli https://orcid.org/0000-0002-5327-3702

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