Ankle Impingement In Athletes

Essay

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Acknowledgement

Thanks to **Allah**… My Lord...First and foremost…

To my **Family** and **Wife**…to whom I shall always show my truest of love…

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May **Allah** accept our dedication and always make this work a help for everyone who may seek it.

List of abbreviations

ATFL	anterior talo-fibular ligament
CFL	calcaneo-fibular ligament
ED	emergency department
M/F	male/ female
MCL	medial collateral ligament
LCL	lateral collateral ligament
US	ultrasonography
MR	magnetic resonance
PTFL	posterior talo-fibular ligament
CT	computed tomography
LTCL	lateral talo-calcaneal ligament
IL	interosseous ligament
CL	cervical ligament
IER	inferior extensor retinaculum
SER	superior extensor retinaculum
ROM	range of motion
MROM	maximal range of motion
FROM	free (or functional) range of motion
TCJ	talo-crural joint
STJ	sub-talar joint
AJC	ankle joint complex
OA	osteo-arthritis
PRT	peroneal reaction time
ATFC	anterior tibio-talar fascicles
AITFL	antero-inferior tibio-fibular ligament
AMI view	antero-medial impingement view
PAI	posterior ankle impingement
FHL	flexor hallucis longus
PTTL	posterior tibio-talar ligament
AP	antero-posterior
OCD	osteo-chondral defect
VAS	Visual analogue scale
RICE	rest, ice, compression, elevation
HA	Hyaluronic acid
PRP	platelet-rich plasma
NWB	non weight bearing
PWB	partial weight bearing
FWB	full weight bearing

Abstract

Persistent ankle pain in athletes is a common problem in this group of population whether on the professional or the amateur basis. It often follows ankle sprains or repetitive trauma and is often a manifestation of impingement. Impingement that echoes underlying pathologies as intra-articular fibrous bands, scars or bony spurs, can occur at many sites of preference. While anterolateral and posterior impingement represent the commonest of all, still medial, anteromedial and calcaneofibular impingements do occur. Impingement runs a somehow long course, however, unless adequately timed suspicion and well planned prevention are performed, the resultant pain and disability shall not be sufficiently relieved except via surgery. Recently, after the vast steps achieved in the field of arthroscopy, it's become the mainstay of operative intervention for such a morbidity, reinforced by evidence-based medicine.

Key word: Ankle- impingement- athletes- arthroscopy- rehabilitation- ankle pain- ankle sprain

Introduction

Impingement has been recently a more frequently identified cause of the so widely encountered complaint of ankle pain in the athletic group. It is due to chronic opposition and friction of intra-articular soft tissue that gradually gets inflamed. In the athletic population overuse and trauma are the responsible cause of ankle impingement.

Recent studies estimate that about 25% of athletic injuries are related to the ankle joint [(1)] and about 3% of ankle sprains are followed by the antero-lateral type impingement of the ankle. [(2)] Both ankle sprains and overuse injuries are frequently encountered in a wide spectrum of sports, specially football, basketball, ballet dancing, downhill running, professional diving, skiing and ice hockey. Several sites are identified, namely: antero-lateral, anterior, antero-medial, medial and posterior impingement.

In general, impingement incorporates a soft tissue component with or without a bony component (a spur). In football for example, a spur may form at the distal tibia or the talus due to either capsule stretching or more probably due to repetitive direct trauma [(3)].The soft tissue component may be in the form of intra-articular fibrous scars, cords or folds that can result from chronic hypertrophic synovitis or the dislocation of the anterior part of the tibio-fibular ligament [(4)]. Repetitive micro-trauma in the form of recurrent ankle sprains and instability or excessive hyper-plantar-flexion or dorsi-flexion (characteristic of certain sports as mentioned above) are always precipitating factors for the disease and the resultant pain. [(3)]

Various ligaments of the ankle joint are specifically involved during the development of the condition. Such ligaments have a major role in the stability of

the joint due to their mechanical and proprioceptive function and when checked, a vicious circle of instability, recurrent micro-trauma and impingement is established, and it proceeds towards a serious impairment of the athletic ankle and foot function. [5, 6, 7]

Therefore, adequate management of ankle sprains in the acute setting and the proper planned physiotherapy program are clearly becoming essential steps towards the prevention of further sprains, instability (that may reach up to 20%) and impingement [8]. However, when the situation of ankle impingement is fully established, the room for conservation is getting narrower as surgical management (in the form of arthroscopic debridement and spur resection) has recently become the primary treatment modality due to non-optimum results of conservative management in most cases. [9]

Following is a concise discussion of the various dimensions of the problem of impingement, its classical presentation in clinical practice, and the recent treatment modalities whether non-operative or surgical.

Epidemiology

All around the world, medical doctors and sports scientists were actively promoting regular physical exercises to gain health benefits and to prevent cardiovascular related disease. People nowadays are more eager in participating in sports and exercises for personal interest, leisure, relaxation, health and fitness purposes. However, in contrary to the promotion of the health benefits from sports participation, sports often cause injuries. [8]

A study in Sweden [8] reported that 17% of the 3,341 acute visits to a clinic due to accidents in a one-year prospective study were from sports. It was comparable to home accident (26%), work accident (19%) and was much higher than traffic accident (7%). In United Kingdom, there were 7.1% of the 2,432 new patients attending accident and emergency department in a 10-day period sustained trauma from sports. In North Ireland, for adolescent of age 11–18 who actively participated in sports, as much as 51% of the attendees sustained sports injuries. As the sports participation rate is becoming higher, the exposure to potential injury increased and thus the high incidence of sport injury. [8]

Impingement lesions are frequently seen in active people and are among the most commonly observed injuries in athletics with a reported incidence rate of 16% [10], and they follow 3% of ankle sprains [2]. Injuries to the ankle joint and foot were the most common injuries during the Olympics. Radiographs of the foot and ankle were the most frequently requested imaging examination, whereas MRI of the ankle was the second most requested MR examination [11]. Ankle was the most common injured body site in 24 of 70 included sports and is also the most common single type of sport-related trauma among all body sites and types. [8] Twenty-five

percent of athletic injuries are related to the ankle joint, and estimates indicate that about 7-37/1000 people seek emergent medical care for this injury. [1]

Acute ankle sprain accounts for approximately 300 000 patient attendances to UK emergency departments (EDs) every year [12], of which 42000 are severe [6], whereas in the USA they occur with an estimated frequency of one injury per 10 000 people per day, amounting to approximately 27 000 injuries each day. [12] In ballet dancers, the total injury incidence rate is 0.8/1000 dancing hours in both male and female dancers, with 76% affecting the lower extremities mostly ankle sprains. [13] In soccer players, the incidence rate of ankle sprains among overall injuries is 17-20 %. [14] The residual problems following a sprain included pain (30.2%), instability (20.4%), crepitus (18.3%), weakness (16.5%), stiffness (14.6%) and swelling (13.9%) [8]

All these figures reflect the likelihood of ankle impingement in most sports participants, and thus the great impact it causes on the performance of players and level of the game and eventually on the national income, specially when considering the expenses of the investigations and the operative management and the time spent away from the fields.

Anatomy

Due to the multi-factorial predisposition to ankle impingement, and the complex nature of the precipitating activity and the possible concomitant morbidity (instability or fractures), a well orientation of the relevant surface and surgical anatomy of the ankle joint ligaments is of crucial importance for the accurate and well-timed diagnosis and management of the condition. Following is an illustrated brief of the relevant anatomy of the ankle ligaments that possess mechanical and proprioceptive function.

A- Lateral group:

1- Anterior talo-fibular ligament

Is the most frequently injured ligament of the ankle and is the most frequently observed injury in the emergency room. This ligament plays an important role in limiting anterior displacement of the talus and plantar flexion of the ankle. The anterior talo-fibular ligament originates at the anterior margin of the lateral malleolus (Figs. 3-1). From its origin, it runs antero-medially to the insertion on the talar body immediately anterior to the joint surface occupied by the lateral malleolus. The ligament is virtually horizontal to the ankle in the neutral position but inclines upward in dorsiflexion and downward in plantar flexion. [14]

A lateral gutter exists with borders including the talus medially, the fibula laterally, and the tibia with the tibio-fibular ligament superiorly. Anteriorly (Fig. 3-2A), it is bordered by the anterior talo-fibular, calcaneo-fibular, and anterior inferior tibio-fibular ligaments. On the posterior aspect (Fig. 3-2B), it is bounded by the posterior talo-fibular, calcaneo-fibular, and posterior inferior tibio-fibular ligaments and extends inferiorly to the CFL. [10]

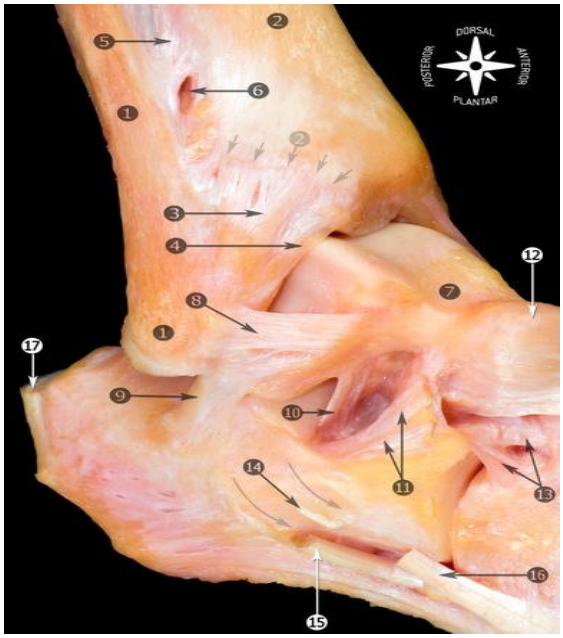

Fig 3-1 Anatomic dissection of the lateral region of the foot and ankle showing the morphology and relationship of the anterior talofibular with the calcaneofibular ligaments. *1* Fibula and tip of the fibula; *2* tibia (anterior tubercle with *arrows*); *3* anterior tibiofibular ligament; *4* distal fascicle of the tibiofibular ligament; *5* interosseous membrane; *6* foramen for the perforating branch of the peroneal artery; *7* talus; *8* anterior talofibular ligament; *9* calcaneofibular ligament; *10* talocalcaneal interosseous ligament; *11* inferior extensor retinaculum (cut); *12* talonavicular ligament; *13* bifurcate ligament; *14* peroneal tubercle (*arrows* showing the peroneal tendons sulcus); *15* peroneus longus tendon; *16* peroneus brevis tendon; *17* calcaneal tendon. [14]

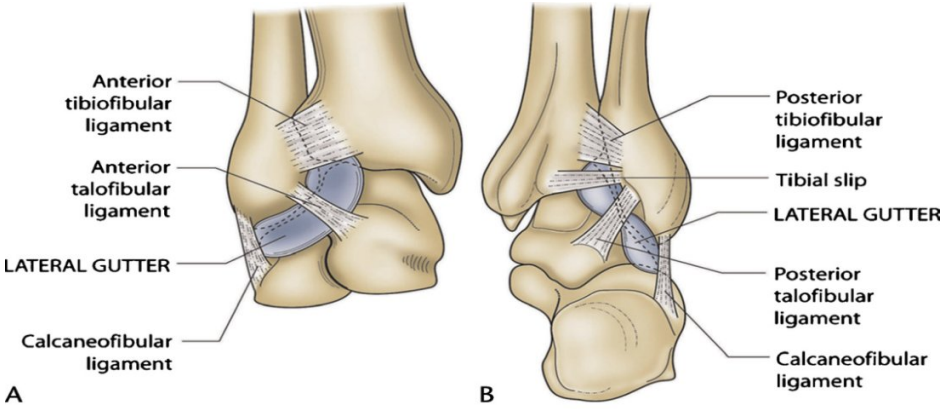

Fig 3-2 A, B Lateral ankle anatomy. Schematic depictions of anterior (A) and posterior (B) borders of the lateral gutter. ([10]

An ultrasound image of the ATFL is shown in (fig. 3-3). [2]

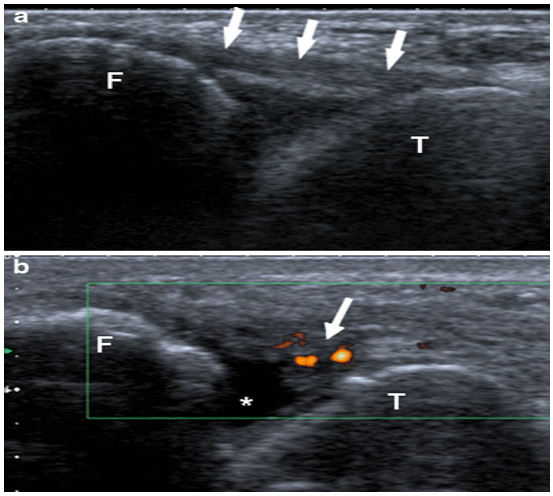

Fig 3-3 Ultrasound of the anterior talofibular ligament. **a** Axial oblique view showing a normal ligament (*arrows*). **b** Axial oblique image of another ankle, showing chronic tear of the anterior talofibular ligament. The ligament is thickened and hyper-vascular (*arrows*). There is fluid in the anterolateral gutter (*asterisk*). *F* fibula, *T* talus. [2]

2- Calcaneofibular ligament

It originates from the anterior part of the lateral malleolus just below the ATFL (Fig.3-1). In the neutral ankle position, the ligament runs obliquely downwards and backwards to attach to the posterior region of the lateral calcaneal surface (Fig. 3-4). In a study [14], 42% of the cases had no lateral talo-calcaneal ligament and is replaced by an anterior talo-calcaneal ligament. In these cases, the CFL acquires more functional significance in providing stability to the subtalar joint (Fig. 3-4). The CFL is the only ligament bridging both the talo-crural joint and subtalar joint. Broström [14] found that isolated rupture of the CFL was very rare. The CFL becomes horizontal during extension and vertical in flexion, remaining tense throughout its entire arc of motion (Fig. 3-4). A valgus or varus position of the talus considerably changes the angle formed by the ligament and the longitudinal axis of the fibula. The ligament is relaxed in the valgus position and tense in the varus position. This explains the potential for injury even without dorsiflexion-plantar flexion movement in the ankle. [14]

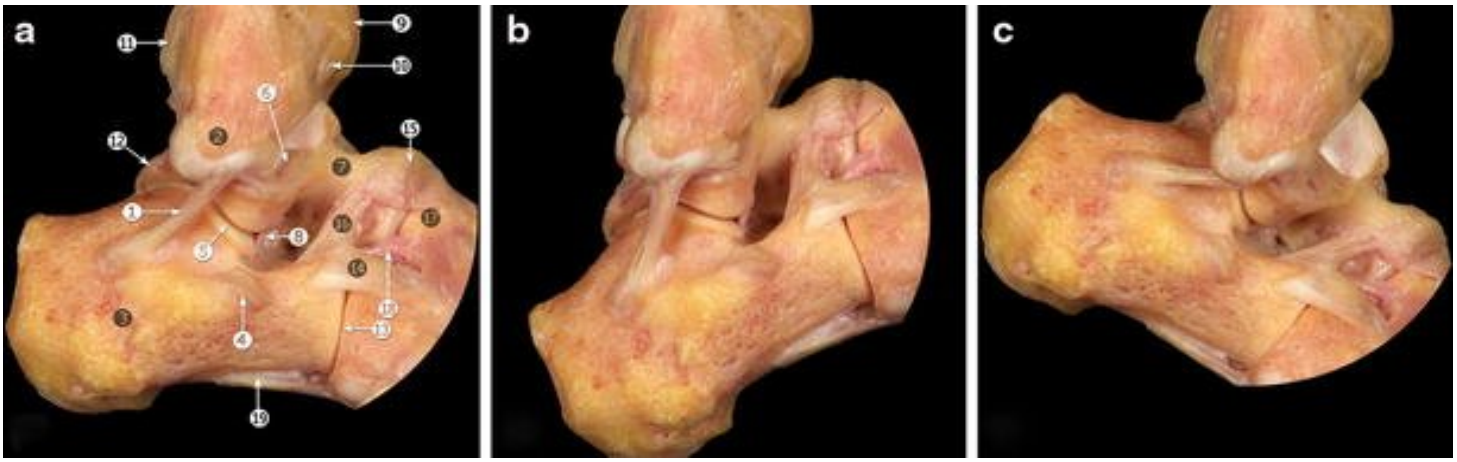

Fig 3-4 Osteoarticular dissection of the calcaneofibular ligament during ankle movements. **a** Neutral position. **b** Dorsal flexion. **c** Plantar flexion. CFL becomes horizontal during plantar flexion and vertical in dorsal flexion, remaining tensed throughout the entire arc of motion of the ankle. *1* CFL; *2* tip of fibula; *3* calcaneus; *4* peroneal tubercle; *5* subtalar joint; *6* ATFL; *7* neck of talus; *8* talocalcaneal interosseous ligament; *9* anterior tubercle of the tibia; *10* anterior tibiotalar ligament; *11* posterior tubercle of the tibia; *12* lateral talar process; *13* calcaneocuboid joint; *14* lateral calcaneocuboid ligament; *15* talonavicular ligament; *16* cervical ligament; *17* navicular; *18* bifurcate ligament (calcaneonavicular fascicle); *19* long plantar ligament. [14]

3-**Posterior talo-fibular ligament**

It originates from the malleolar fossa, located on the medial surface of the lateral malleolus, coursing almost horizontally to insert in the postero-lateral talus. In plantar flexion and in the neutral ankle position, the ligament is relaxed, while in dorsiflexion, the ligament is tensed (Fig.3-5). Moreover, a group of fibers fuse with the posterior inter-malleolar ligament. The posterior inter-malleolar ligament has been the subject of recent studies because of its involvement in the posterior soft tissue impingement syndrome of the ankle. The posterior inter-malleolar ligament as it bridges between both malleoli, it tenses during dorsiflexion and relaxes during plantar flexion, and therefore, trauma that causes forced dorsiflexion of the ankle can be assumed to produce either injury or rupture of this ligament, or osteochondral avulsion. Plantar flexion would cause it to relax and become susceptible to trapping between the tibia and the talus, leading to impingement (Fig.3-6). [14]

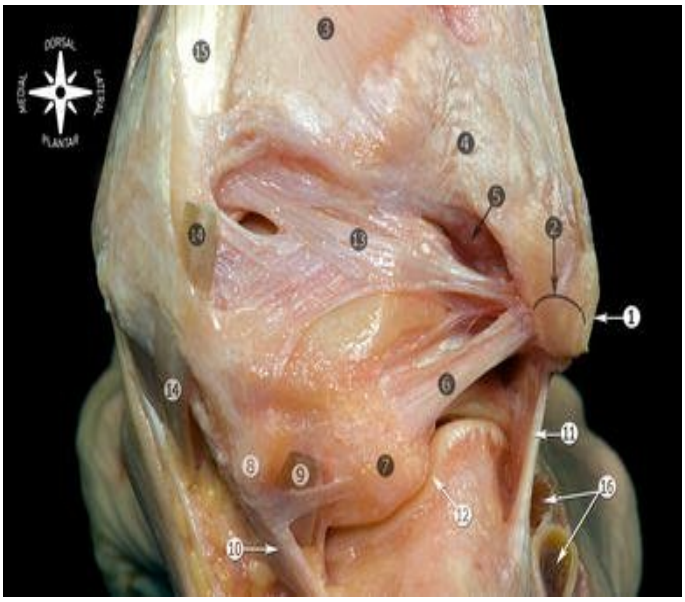

Fig 3-5 Posterior view of the anatomic dissection of the ankle ligaments. *1* Tip of the fibula; *2* peroneal groove of the fibula; *3* tibia; *4* superficial component of the posterior tibiofibular ligament; *5* deep component of the posterior tibiofibular ligament or transverse ligament; *6* posterior calcaneofibular ligament; *7* lateral talar process; *8* medial talar process; *9* tunnel for flexor hallucis longus tendon; *10* flexor hallucis longus retinaculum; *11* calcaneofibular ligament; *12* subtalar joint; *13* posterior intermalleolar ligament; *14* flexor digitorum longus tendon (cut); *15* tibialis posterior tendon; *16* peroneal tendons. [14]

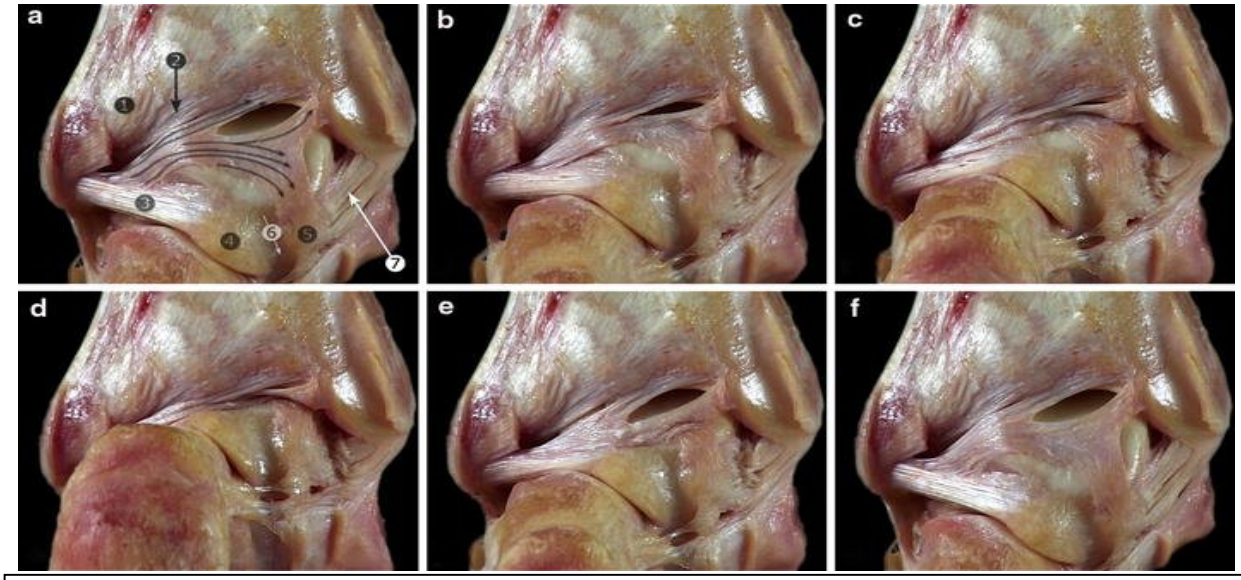

Fig 3-6 Anatomic view of the posterior intermalleolar ligament (*arrows*) showing its involvement in the posterior soft tissue impingement of the ankle. From dorsiflexion (**a**) to plantar flexion (**d**), to dorsiflexion (**f**). *1* Superficial component of the posterior tibiofibular ligament; *2* deep component of the posterior tibiofibular ligament or transverse ligament; *3* posterior talofibular ligament; *4* lateral talar process; *5* medial talar process; *6* tunnel for the flexor hallucis longus tendon; *7* deep layer of the medial collateral ligament (deep posterior tibiotalar ligament). [14]

B- Medial collateral ligament

Is a multifascicular ligament originating from the medial malleolus to insert in the talus, calcaneus, and navicular bone. The anatomical descriptions of the MCL vary widely in the literature; however, in general most agree that it is composed of two layers; the superficial and deep. [14]

The most commonly accepted description of the MCL is the one originally proposed by Milner and Soames [15]. Six bands or components have been described for the MCL: three of them are always present (the tibio-spring ligament, tibio-navicular ligament, and deep posterior tibio-talar ligament as in Table 3-1; Figs. 3-7, 3-8). [14] These findings are somewhat similar to the description of Boss and Hintermann. [16] .However, the anatomy of this ligament and its components is still confusing. [14]

Table 3.1 Comparison of the nomenclature used for the medial collateral components, as suggested by Sarrafian and Milner and Soames [15]

Milner and Soames	**Sarrafian**
Superficial layer	
Tibiospring ligament (major component)	Tibioligamentous fascicle
Tibionavicular ligament (major component)	Tibionavicular fascicle and anterior superficial tibiotalar fascicle
Superficial tibiotalar ligament (additional band)	Superficial posterior tibiotalar ligament
Tibiocalcaneal ligament (additional band)	Tibiocalcaneal ligament
Deep layer	
Deep posterior tibiotalar ligament (major component)	Deep posterior tibiotalar ligament
Anterior deep tibiotalar ligament (additional band)	Deep anterior tibiotalar ligament

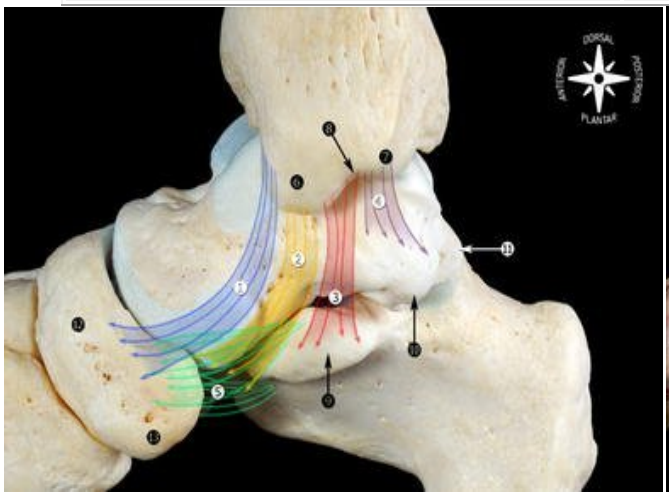

Fig 3-7 Schematic representation of the MCL. In the medial view, two areas or segments (culliculi) can be seen, separated by the intercollicular groove. *1* Tibionavicular ligament; *2* tibiospring ligament; *3* tibiocalcaneal ligament; *4* deep posterior tibiotalar ligament; *5* spring ligament complex (plantar and superomedial calcaneonavicular ligaments); *6* anterior culliculus; *7* posterior culliculus; *8* intercullicular groove; *9* sustentaculum tali; *10* medial talar process; *11* lateral talar process; *12* navicular; *13* navicular tuberosity. [14]

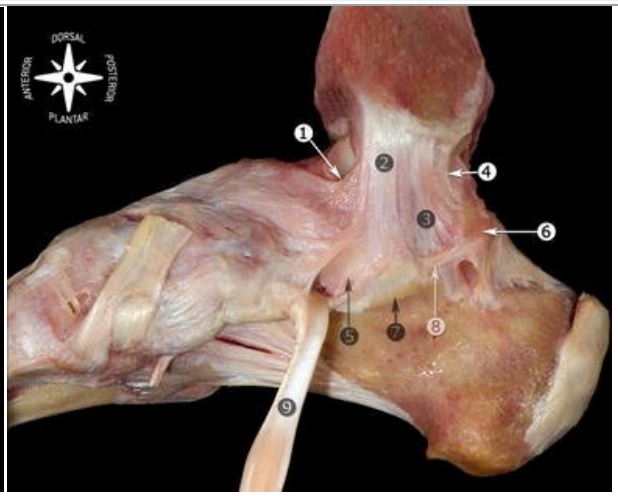

Fig 3-8 Medial view of the anatomic dissection of the main components of the medial collateral ligament. *1* Tibionavicular ligament; *2* tibiospring ligament; *3* tibiocalcaneal ligament; *4* deep posterior tibiotalar ligament; *5* spring ligament complex (superomedial calcaneonavicular ligament); *6* medial talar process; *7* sustentaculum tali; *8* medial talocalcaneal ligament; *9* tibialis posterior tendon. [14]