Ligamentous Injury of the Ankle

Essay

Submitted for Partial Fulfillment of the Requirements of the master Degree in Orthopaedic Surgery.

By

Abd Elaziz Abd Elfattah Elbarky

M.B.B.Ch.,

Supervisors

Prof. Dr. Ahmad Mohammad Alsaeed

Prof. of Orthopaedic Surgery

Faculty of Medicine

Ain Shams University

Dr. Ahmad Salem Eid

Lecturer of Orthopaedic Surgery

Faculty of Medicine

Ain Shams university

٢٠١٤

ACKNOWLEDGMENTS

I would like to express my deepest gratitude and appreciation to my ***Professor Prof. Dr. Ahmad Mohammad Alsaeed,*** Professor of Orthopedic surgery , faculty of Medicine , Ain Shams University . It was through his supervision, his meticulous revision, cooperation, unlimited guidance, and kind encouragement that our work came to existence.

I would like also to express my deepest gratitude and appreciation to ***Dr. Ahmad Salem Eid***, lecturer of Orthopaedic Surgery, faculty of medicine, Ain Shams University, for his meticulous revision, enthusiastic cooperation and enormous help, patience and efforts.

Abd Elaziz Abd El Fattah El Barky

Contents

	Contents	Page No.
١	Acknowledgment	II
٢	Contents	III
٣	List of Figures	IV
٤	List of abbreviations	VII
٥	Introduction	١
٦	Aim of the work	٣
٧	Anatomy	٤
٨	Biomechanics	١٥
٩	Mechanism of injury	٢٣
١٠	Classification	٢٧
١١	Diagnosis	٣٥
١٢	Treatment	٨٥
١٣	Summary	٩٩
١٤	References	١٠٢
١٥	Arabic summary	١

List of Figures

Figure	Items	Page
Fig. ١	Anatomy of the ankle joint	٥
Fig.٢	Coronal section of the ankle	٦
Fig.٣	Anatomy of the talus	٧
Fig.٤	Anatomy of medial part of ankle	٨
Fig.٥	Normal anatomy of the medial ankle	٩
Fig.٦	Lateral ligamentous complex of the ankle	١٠
Fig.٧	Lateral view of the ankle and ligaments that maintain articulation	١٠
Fig.٨	Angle between the ATFL and the CFL	١١
Fig.٩	Anterior inferior tibiofibular syndesmosis	١٣
Fig.١٠	Posterior inferior tibiofibular syndesmosis	١٣
Fig.١١	The talocrural axis of rotation	١٦
Fig.١٢	The subtalar axis of rotation	١٨
Fig.١٣	Movement of the ankle joint	٢٠
Fig.١٤	Eversion injury	٢٥
Fig.١٥	Schematic diagram of the Danis-Weber classification of ankle fractures	٣١
Fig.١٦a	Schematic diagram and of Lauge-Hansen supination-external	٣٣

Fig.١٦b	Schematic diagram of Lauge-Hansen pronation-external rotation and pronation-abduction ankle fractures	٣٤
Fig.١٧	Dimple sign	٣٦
Fig.١٨	Measurement of the movement of the ankle joint	٣٧
Fig.١٩	Varus stress test	٣٨
Fig.٢٠	Anterior drawer test	٣٩
Fig.٢١	External rotation stress test	٤٠
Fig.٢٢	Normal ankle	٤٢
Fig.٢٣	Tibiofibular overlap	٤٣
Fig.٢٤	Tibiofibular distance	٤٤
Fig.٢٥	Talar tilt	٤٥
Fig.٢٦	Lateral view Xray of the ankle showing Talus	٤٦
Fig.٢٧	Mortis view	٤٧
Fig.٢٨	tibiofibular line	٤٨
Fig.٢٩	tibiofibular overlap in mortise view	٤٨
Fig.٣٠	Talar tilt	٤٩
Fig.٣١	Mortis view of the ankle (talar tilt)	٥٠
Fig.٣٢	lateral talar shift	٥١
Fig.٣٣	Inversion stress X-ray	٥٢
Fig.٣٤	Anterior drawer sign	٥٤
Fig.٣٥-a	Method of measuring Anterior drawer sign	٥٥
Fig.٣٥-b	Posterior hiatal sign	٥٥

Fig.٣٦	Obliquwe view of the ankle	٥٦
Fig.٣٧	Chronic tear of the anterior talofibular ligament(MRI)	٦٠
Fig.٣٨	Injury of the calcaneofibular ligament (MRI)	٦١
Fig.٣٩	Injury of the deltoid ligament (MRI)	٦٢
Fig.٤٠	Torn anterior inferior tibiofibular ligament(MRI)	٦٣
Fig.٤١	deltoid rupture with trans-syndemotic fracture of fibula	٦٩
Fig.٤٢	deltoid rupture with supra-syndemotic fracture of fibula	٦٩
Fig.٤٣	MR Arthrography of the Ankle joint	٧٢
Fig.٤٤	Lateral subluxation of talus	٧٣
Fig.٤٥	Total tibiofibular diastasis	٧٨
Fig.٤٦	Tear drop sign	٨٠
Fig ٤٧	External Rotation Stress X-ray	٨٢
Fig ٤٨	ATFL injury	٨٣
Fig.٤٩	Technique of tapping of the ankle	٨٧
Fig.٥٠	Modified Brostrom procedure	٩٠
Fig.٥١	Watson johnes procedure	٩٢
Fig.٥٢	Reconstruction of the lateral ligaments of the ankle.	٩٣
Fig.٥٣	Modefied Elmis reconstruction	٩٣
Fig.٥٤	syndesmotic screw	٩٥
Fig.٥٥	Reconstruction of deltoid ligament	٩٧

List of abbreviations

- **CAI:** Chronic ankle instability.
- **MAI:** Mechanical ankle instability.
- **FAI:** Functional ankle instability.
- **MRI:** Magnetic Resonance Imaging.
- **ATTL:** Anterior deep talotibial ligament.
- **PTTL:** Posterior deep talotibial ligament.
- **TNL:** Tibionavicular ligament.
- **CTL:** Calcaneotibial ligament.
- **ATFL:** Anterior talofibular ligament.
- **PTFL:** Posterior talofibular ligament.
- **CFL:** Calcaneofibular ligament.
- **ATBFL:** Anterior tibiofibular ligament
- **AITFL:** Anterior inferior tibiofibular ligament.
- **PITFL:** Posterior inferior tibiofibular ligament.
- **IOL:** Interosseous tibiofibular ligament.
- **TTFL:** Transverse tibiofibular ligament.
- **LTCL:** Lateral talocalcaneal ligament.
- **FTCL:** Fibulotalocalcaneal ligament.
- **A.P:** Antero posterior
- **TFD:** Tibiofibular Distance
- **PRICE:**protection, rest, ice, compression and elevation.

Introduction

Ankle injuries are one of the most common problems seen by physicians and in emergency departments; unless these injuries are properly managed, they may lead to ankle instability and serious disability. Chronic ankle instability (CAI) has been reported to occur in approximately ٣١٪ to ٤٠٪ of people with a previous history of a lateral ankle sprain [١].

Stability of the ankle depends upon three factors: Bony architecture, Ligaments, and Joint capsule. Ligaments are four groups: the lateral ligamentous complex, lateral subtalar ligaments, medial ligaments (deltoid ligament), and distal tibiofibular interosseous ligamentous complex. In the standing, dorsiflexed position, ankle joint stability is conferred principally by articular congruity. In the non-weight-bearing, planterflexed position, ankle joint stability is mostly conferred from ligamentous structures [١].

Ankle instability can be classified into acute and chronic ankle instability. Two primary causes of chronic ankle instability (CAI) have been deemed responsible; mechanical ankle instability (MAI) and functional ankle instability (FAI) [٢].

Ligamentous ankle instability can be classified into: lateral, medial and syndesmotic instability. Over ٩٠٪ of ankle ligament injuries involve the lateral ligamentous complex [٣].

Ankle instability due to internal derangements; include occult avulsion fracture and osteochondritis dissecans of talus [٤].

Diagnosis of ligamentous injury of the ankle depends mainly upon:

History taking, Clinical examination, and Radiographic examination. History is important to detect the nature of injury and any other diseases. Clinical examination depends upon careful palpation of all structures that are potentially involved and clinical stress tests. Radiographic parameters can be obtained from plain x-rays and they are enough to provide an objective measurement of ankle instability and are useful not only in diagnosis, but also in planning treatment program. Magnetic Resonant Image (M.R.I). and arthrography can help to establish the diagnosis [٢].

Today, the preponderance of evidence suggests that early recognition and conservative treatment are appropriate for most acute traumatic ankle ligament ruptures. Surgical treatment is usually reserved for chronic, recurrent ankle instability [٥].

Aim of the Work

The aim of this work is to present the latest advances in the management of ligamentous injury of the ankle joint and clarify the new modalities of the repair and reconstruction mthods .

Anatomy

The ankle is a complex joint, consisting of functional articulation between the tibia & fibula, tibia & talus & fibula & talus, each supported by a group of ligaments. Stability of the ankle joint depends upon three factors:

١- Bony architecture

٢- Ligaments

٣- capsule of the ankle joint [١].

١) Bony Architecture

The shape of the joint bones alone provides some stability, especially in the standing position. The trochlea of the talus is inserted into a deep socket made by the distal end of the tibia, the medial malleolus on the medial side, and the lateral malleolus on the lateral side[٢].

The inferior surface of the distal tibia is smooth for articulation with the body of the talus. It's wider in front than behind, concave from before backwards and slightly convex from side to side. The trochlear surface of the talus is reciprocally shaped and this provides stability to the ankle joint when the joint is locked in the position of dorsiflexion, because the talus fits snugly into a socket and lateral movement are resisted (fig.١)[١].

The medial malleolus is shorter than the lateral malleolus which lies on a more posterior plan. Its anterior surface gives attachment to the anterior part of the articular capsule of the ankle joint, while its lower border gives attachment to the deltoid ligament [٢].

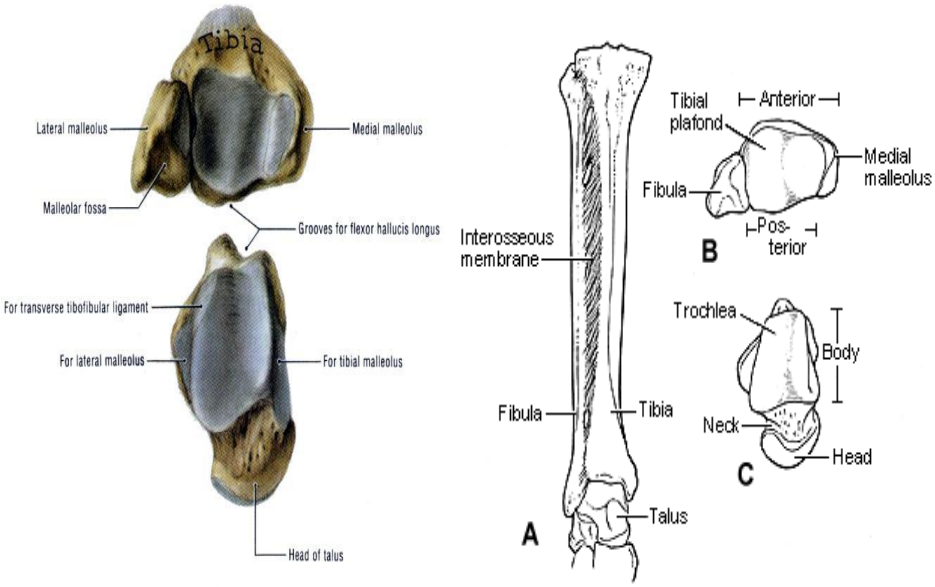

Fig (١): *Anatomy of the ankle joint A) Anteroposterior view B) View of the tibial side of the joint, Illustrating the quadrilateral shape of the articular surface and the posterior position of the fibula. C) The corresponding surface of the talus* [٣].

The anterior surface of the lateral malleolus gives attachment to the anterior talofibular ligament, while the calcaneofibular ligament is attached to a notch on the apex of the lateral malleolus. Behind on the posterior aspect, the posterior talofibular ligament is attached to the lower part of the malleolar fossa, while the posterior tibiofibular ligament is attached to its upper part. Above the lateral malleolus on the its medial surface, a triangular area gives attachment to the interosseous ligament of the tibiofibular syndesmosis, and its anterior and posterior margins to the anterior and posterior tibiofibular ligaments respectively [٢].

The tibiofibular syndesmosis is formed between the rough surface on the medial side of the lower end of the fibula and the fibular notch of the tibia. The bones, however, are not in contact with each other but separated by the interosseous ligament which binds them together the distance which separates the distal ends of the tibia and the fibula is about ٤ mm. If this distance is abnormally increase this means that there is disruption of the tibiofibular ligaments [٢].

Some times the interosseous ligament does not reach the distal end of the tibia, in such cases there is a narrow strip of lower end of the tibia covered with cartilage for articulation with the upper most part of the lateral malleolus (figure ٢) [١].

The relationship between the two bones in the tibiofibular syndesmosis allows the fibula to undergo some amount of rotation during dorsiflexion of the ankle to adapt the lateral malleolus the lateral surface of the talus and keep intimate contact between them in all position of the ankle joint [٢].

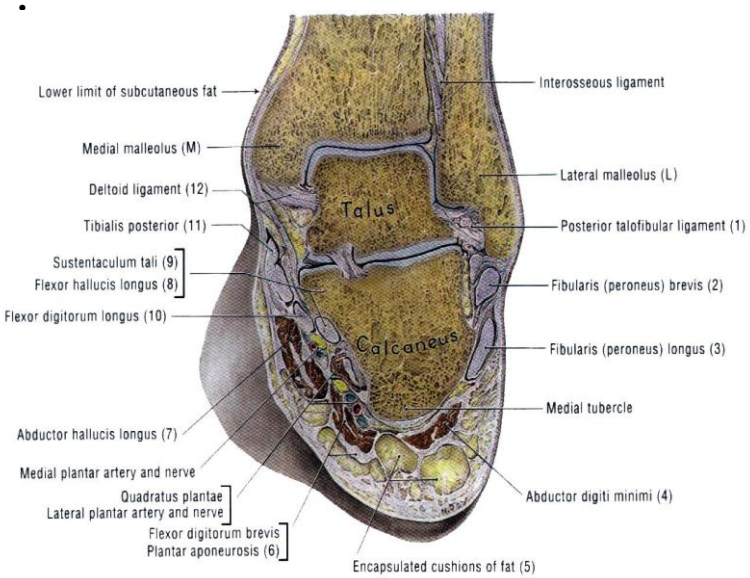

Fig. (٢): *Coronal section of the ankle showing the bony architecture and the surrounding structures of the ankle* [٣].

Talus

The talus has a curved head, neck and trapezoid body (Fig ٣). The dorsal surface of its neck gives attachment distally to the dorsal talonavicular ligament and the articular capsule of the ankle joint. The lateral part of the neck gives attachment to the anterior talofibular ligament which extends downwards along the anterior border of the lateral surface. The inferior surface to the interosseous talocalcanean and cervical ligaments. The posterior process gives attachment to the posterior talofibular ligament. Its planter border gives attachment to the posterior talocalcanean ligament. The medial tubercle gives attachment to the talocalcanean ligament below, and the most posterior part of the superficial fibers of the deltoid ligament above. The deep fibers of the deltoid ligament are attached to the rough area on the medial surface below the articular facet [٣].

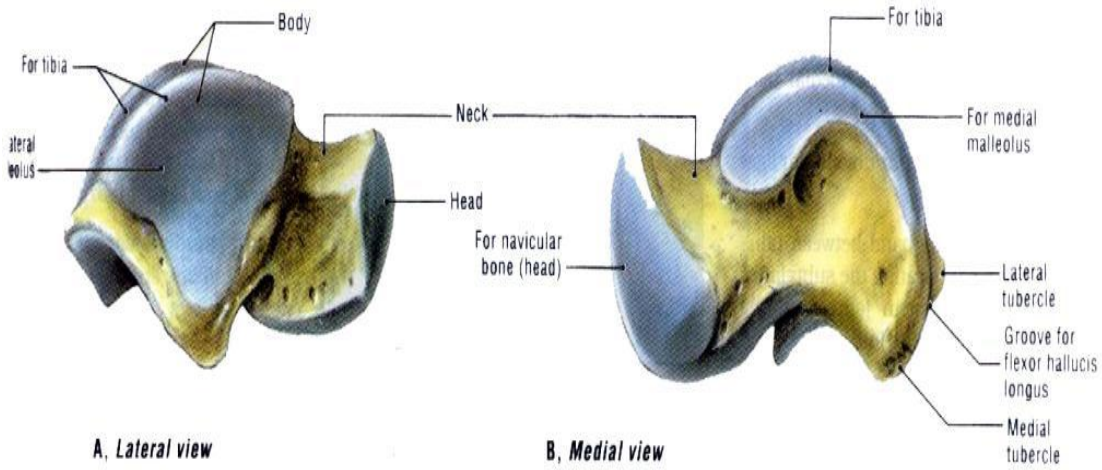

Fig (٣): *Anatomy of the talus, A) lateral view, B) medial view* [٤].

٢) Ligament of the ankle joint:

Medial ligamentous complex

The strong, flat, triangular deltoid ligament consists of five components. The deep portion of the deltoid ligament is probably the most important and provides the greatest restraint against lateral translation. The two deep components, the anterior and posterior deep talotibial ligaments (ATTL, PTTL), attach to the undersurface of the medial malleolus and the body of the talus (figs., ٤, and ٥). Both deep components are intraarticular but extrasynovial. The posterior deep talotibial ligament is the strongest of the entire deltoid complex. The superficial portion of the deltoid ligament that runs from the tibia to the sustentaculum tali, consists of the other three components: the tibionavicular ligament (TNL) anteriorly, the calcaneotibial ligament (CTL) in the middle and the posterior talotibial component posteriorly. The superficial and deep components equally resist valgus tilting of the talus and are secondary restraints against anterior translation of the talus [٥].

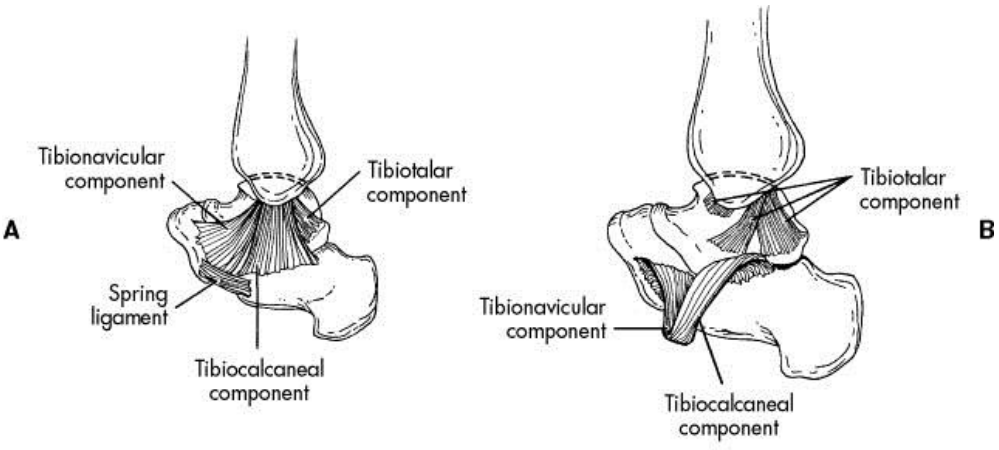

Fig. (٤): *Anatomy of medial part of ankle to show superficial* ***(A)*** *and deep* ***(B)*** *deltoid ligament* [٥].