Ministry of Higher Education and scientific research

University of Babylon

Department of surgery/ Radiology

College of medicine

Role of magnetic resonance imaging in Diagnosis of ankle ligaments Injury

A thesis submitted to the University of Babylon/ College of Medicine as partial fulfillment of requirements for the degree of a high diploma in diagnostic radiology .

By Dr. Noran Yousif Taher
MB.Ch.B

Supervised by:

Dr. Kassim Amir Hadi Taj Al-Dean

Prof. Of radiology

D.M.R.D F.I.B.M.S. R.D

2022

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

﴿وَأَنزَلَ اللَّهُ عَلَيْكَ الْكِتَابَ وَالْحِكْمَةَ
وَعَلَّمَكَ مَا لَمْ تَكُن تَعْلَمُ وَكَانَ
فَضْلُ اللَّهِ عَلَيْكَ عَظِيمًا﴾ النساء ١١٣

صَدَقَ اللهُ الْعَظِيمُ

A thesis submitted to the University of Babylon/ College of Medicine as partial fulfillment of requirements for the degree of a high diploma in diagnostic radiology.

Dr. Noran Yousif Taher
MB.Ch.B

Supervisor Certification

We certify that this thesis entitled "**Role of magnetic resonance imaging in Diagnosis of ankle ligaments Injury**''
was prepared under our supervision as a partial fulfillment of requirements for the degree of a high diploma in diagnostic radiology

Dr. Kassim Amir Hadi Taj Al-Dean

Prof. Of radiology

D.M.R.D F.I.B.M.S. R.D

Examination committee certification

We, the examining committee, after reading this dissertation (**Role of magnetic resonance imaging in Diagnosis of ankle ligaments Injury**), and examining the candidate (Dr. Noran Yousif Taher) in its contents, find that it meets the standards and requirements as a dissertation in partial fulfillment of requirements for the degree of a high diploma in diagnostic radiology.

Dr. Amjaad M. Hameed
Prof .of Radiology
D.M.R.D F.I.B.M.S. R.D
(Chairman)

Dr.Jabir Hasan Obaid Al sanafi
Consultant radiologist
F.I.B.M.S. (Rad.)
(member)

Dr.Osama Ayad Abdulsattar
Prof . of Radiology
M.B.CH.B. F.I.B.M.S (Rad.)
D.M.R.D (RAD)
(member)

Dean's certification

I , the Dean of faculty of Medicine at University of Babylon, certify that this thesis "**Role of magnetic resonance imaging in Diagnosis of ankle ligaments Injury**'' was prepared by the student Dr . Noran Yousif Taher and submitted to our college committee on graduate studies .

Prof.
Dr . Mohend A.N. Al- Shalah
The Dean of College of Medicine
University of babylon

Dedication

To my family for her help, support and encouragement to finish this work.

With Love and Respect.

Acknowledgement

I would like to express my sincere gratitude & deep appreciation to my supervisor **Dr.Qassim Amir Taj –Aldeen** for his great help, kind advice and support throughout the period of this study.

Great appreciation to staff of MRI units in Al Hilla General Teaching hospital, for their cooperation in facilitating the examination of patients for this study.

Abstract

Background: Ankle is a complex mechanism consisting of two joints: the true ankle joint and the subtalar joint. MRI is increasingly being utilized in assessing patients with residual symptoms after initial conservative treatment because of its superior soft-tissue resolution Aim of the study: To highlight on useful role of MRI in investigation about ankle ligaments injuries.

Patients and method: A cross sectional study was carried out in Babylon teaching hospital from 1st August 2021 to 1st September 2022. the study enrolled patients with ankle sprain was performed with GE general electric 1.5 Tesla. For this purpose, the patients were positioned in a powerful magnetic field in supine position with feet first, ankle angle of 90 degrees. Data was collected and analyzed using SPSS 23.

Result: The study enrolled 40 patients with ankle pain the 26 female and 14 male with age range 20-50 years (mean age 36.1±8.4 year). Ligaments injuries by MRI study, reveal 40% anterior talo- fibular ligament, 17.5% posterior talo-fibular ligament, 20% Calceneo-fibular ligament, 15% deltoid ligament, 5%, anterior tibio-fibular ligament and 2.5% Posterior tibio-fibular ligament were affected. Regarding to pathological finding, ligament sprain was seen in 16 patients, partial tear were found in 10 patients and complete tear of ligament present in 14 patients.

Conclusion: MRI is vitally significant in diagnosing abnormalities of ligaments and tendons of ankle trauma and plays a significant role in detecting lesions of tendons and ligaments.

List of Abbreviations

MRI	Magnetic resonance image
ATFL	Anterior talo-fibular ligament
PTFL	Posterior talofibular ligament
CFL	Calcaneofibular ligament
CT scan	computed tomography scan
SI	signal intensity
ROI	region of interest
SPSS	statistical package of social sciences
SD	standard deviation

List of Contents

List of tables

List of figures

CHAPTER ONE

Introduction

Introduction

One of complex joint in the body is ankle joint it comprised two joint subtalar joint and true joint, subtalar joint is lie under true joint it consist from calcanium and above it a talus bone this joint responsible for movement of foot in inversion and eversion manner. Superior to subtalus the true ankle joint this joint consist from three bone tibia fibula and talus, it responsible for movement of foot in dorsiflexion and plantar flexion manner [(1).]

These joints are stable by many types of ligament and tendon to support and maintain in position. Trauma to ankle consider common disaster might be associated with sport activity, falling walking or car accident [(2).]

Frequent site of injuries in ankle are ligaments during sprain and some time in relation with bone fracture or avulsion [(2).]

The type of ligaments that support ankle consist from three major collection, syndesmotic, lateral group and medial group also called deltoid that have two component superficial and deep, which as follow[(1)],

I-Lateral ligament

Anteriorly called anterior talo-fibular ligaments (ATFL), posteriorly called posterior talo-fibular ligaments (PTFL) and lastly calcaneo-fibular ligaments (CFL).

-ATFL which is composed the anterior component extend from anterior edge of fibular malleolar bone antero-medially to reach talus, connect inferiorly to talus and lateral articular facets. ATFL thickness range from 2-3 millimeter, its best seen in axial view.

- CFL ligament that occupied middle component round from anterior depression to top of fibular malleolus to surface of lateral calcaneal. It thickness about 2 millimeter, its best seen in coronal view. It covered by fibularis longus and breves.

-PTFL: A ligament in posterior part extend in horizontal pathway it start from fossa in lateral malleolus to tubercle on talur process. A band of fibers attach tibia to medial malleolus.

2-Medial ligaments

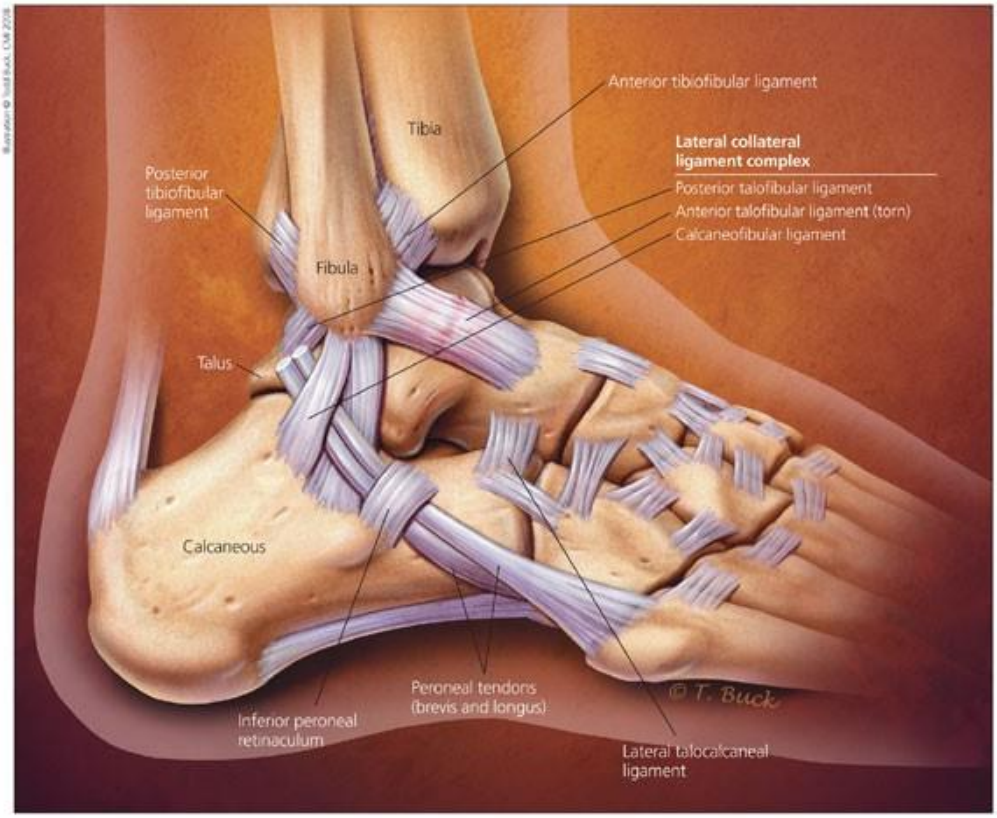
Also called deltoid, it's triangular in shape and strongest band it connect to top, anterior and posterior edge of medial malleolus. they has two part or layer superficial one had various surface of attachment for two joint. Deep component differ from superficial had talar connection and cover one joint, medial ligament are best seen in coronal view.

Some authors consider calcaneo-navicular ligaments as component of medial deltoid ligaments [3].

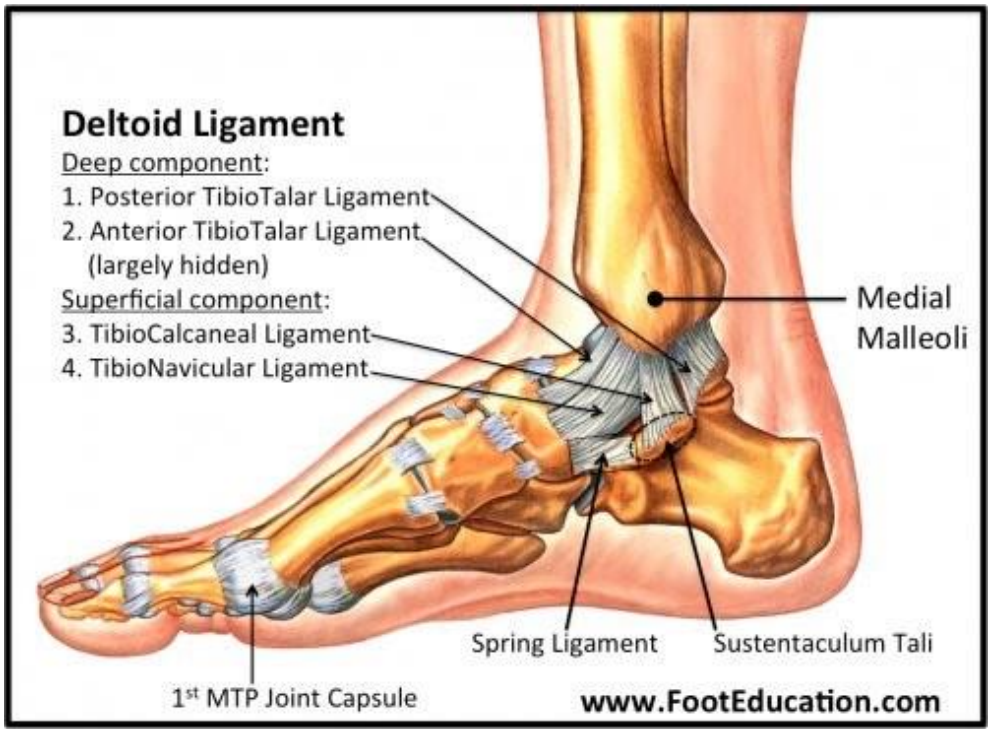
Deltoid ligament superficially composed from Tibio-calcaneal ligaments, Tibio-navicular ligaments , and Tibio-spring ligaments. While deep compartment consist from anterior tibio-talar ligaments and Posterior tibio-talar ligaments. Thickness of posterior tibio-talar ligaments are 6-11 millimeter, other ligament had more light thickness [4].

Syndesmotic ligaments:

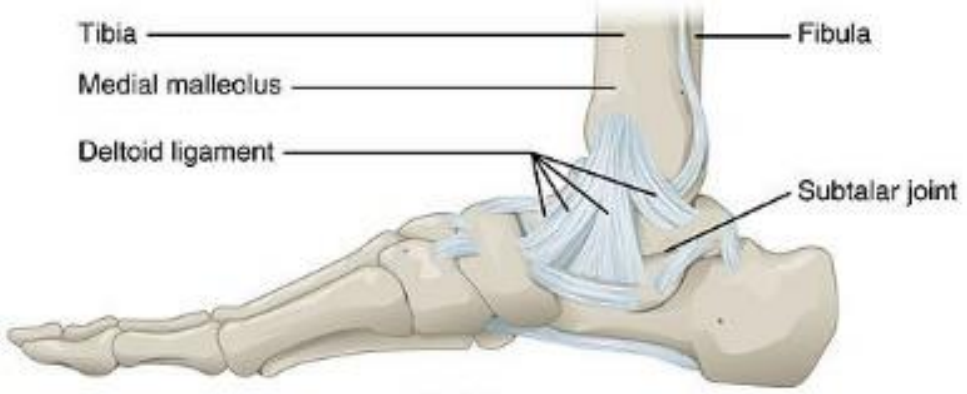
It consist from antero-inferior tibio-fibular ligaments, postero-inferior tibio-fibular ligaments, interosseus membranes and inferior transverses. On routine MRI anterior and posterior inferior tibio-fibular ligament can be simply detected. The last two ligaments are injured concurrently. Oblique plane with 45° is more in investigation the usual integrity or abnornal composition [5], best seen in MRI in axial view. (90


Anterior tibiofibular ligament
Tibia
Lateral collateral ligament complex
Posterior talofibular ligament
Anterior talofibular ligament (torn)
Calcaneofibular ligament
Posterior tibiofibular ligament
Fibula
Talus
Calcaneous
Peroneal tendons (brevis and longus)
Inferior peroneal retinaculum
Lateral talocalcaneal ligament
© T. Buck

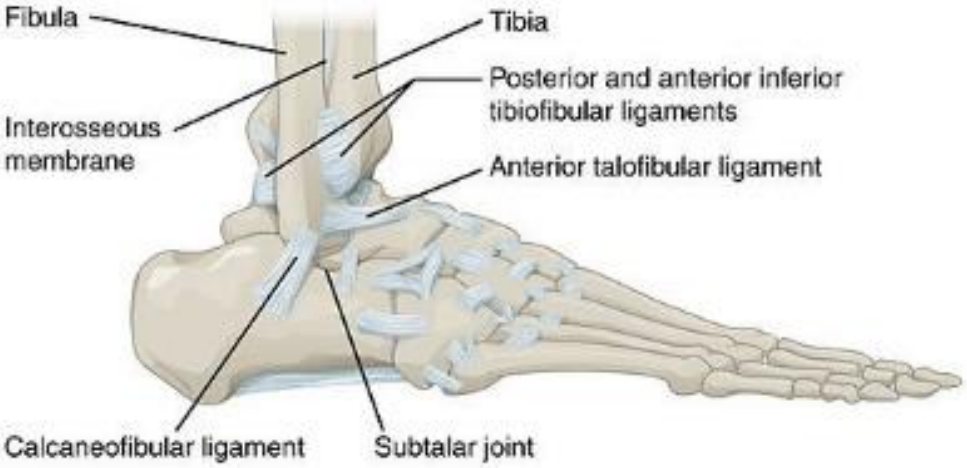
(31)


Deltoid Ligament
Deep component:
1. Posterior TibioTalar Ligament
2. Anterior TibioTalar Ligament (largely hidden)
Superficial component:
3. TibioCalcaneal Ligament
4. TibioNavicular Ligament
Medial Malleoli
Spring Ligament
Sustentaculum Tali
1st MTP Joint Capsule
www.FootEducation.com

(32)



Medial view



Lateral view

(33)

Ankle sprain contributes to 20-45% of sport injury. Specific types of ligament will be injury that depend on mechanism trauma. Eighty five percent of ankle sprain are due to inversion damage this kind of injury seen in high velocities type of sport such as football and basketball. Lateral ligaments group are mostly affected by this type of injuries. From these complex group the weakest one ATFL are frequently damage. In addition, ATFL injuries least common among talar connection because it support by dense fibrocartilage high bone density in comparison to fibular

connection [6].

While eversion damage frequently affected the medial ligaments group, which range about 5% of all types of ankle sprain injuries. It present with kind of sport for example gymnastic and rugby [7].

Injury for syndesmotic ligaments account about 8% of ankle sprain and frequently seen in sport activity it about 40% of injury in athlete. It presented with special types of sport such as football, running and skiing [8].

When fluid in tibia-fibular recess reach more than 12 ml. consider pathological it come more with acute injury specifically with syndesmotic ligaments [9]

Type of injuries

There are many types of damage according time of presentation such as acute or chronic and according to intensity of injuries as partial or complete tear. They differ in presentation in examination and investigation [10].

In acute injuries MRI can illustrated the blurry edges, uneven contour, wavy shape or sloppy fiber, irregular signal and lose of usual hypo-intense signals inside ligaments [1].

Specific classes of ligaments for example posterior tibiofibular ligament and deep part of medial ligaments and anterior inferior tibio-fibular ligaments presented the hidden of standard striation because of found the hemorrhage and edema through tissues [3].

On radiological finding the ligaments might be weakened increase in thickness, thinnest or lengthened. More over the injuries can sub class in partial, complete and interstitial tear [8].

Partial tear: appear as in complete or partial break in ligament attainment to surface but not complete thickness of ligaments body.

Complete tear:- the break through all thickness of ligaments body and fluid can be seen filled the break site. Joint swelling due to effusion and destruction of neighboring fat plane could be seen obviously.

Interstitial tear :- the finding are due to presence of edema and hemorrhage in side ligaments, it appear in hyper intense signals on T2WI

Regarding chronic damage of ligaments, in MRI study show lessened, thin or thick with hyperplastic or hypoplastic with abnormal contour and almost without edema and hemorrhage [11].

Impingement Syndrome: these result from alteration in anatomy of ligaments making difference mechanism of joint damage, this damage created chronic unstable joint through repetitive stress on joint. impingement syndrome the most affected ligaments are anterolateral and medial. These are diagnosed by MRI adequately [12].

Chronic tear of anterior talo-fibular ligament: there is granulation tissues some time become fibrosis in anterolateral groove similar to meniscus, clinically causes anterolateral impingement syndromes. Same results could be gotten in postero-medial and antero-medial [13],[14].

Due to superiority in resolution of soft tissues and worthy correlations with arthroscopic finding, MRI progressively actuality employed in evaluation of patients with outstanding symptom after preliminary treatment in conservative manner [12].

MRI have greatest variability in precision of findings and consistency has not been established. A study reported MRI accuracy about 85% in investigation and detection of osteochondral lesion in the talus and peroneus brevis tendons tear , while other study stated a 20% detecting rate of cartilage lesion exist at surgical procedures. Little studies that assessed the lateral ligaments group, stated significant variability of parameter of sensitivity and specificity for detection of anterolateral talo-fibular and calcanenofibular ligaments tear. These literatures study patients that had chronic symptom and damage of ligaments and with little authors assess the efficacy of MRI in acute injuries [15] .

Investigation of patients with acute ankle injuries by MRI the images show hemorrhage in space of joint and swelling of soft tissues covering lateral malleolus, more over at site of ligaments avulsion there were great bones signal, which is disappear with repeated and chronic disorder [16] .

These inconsistency in accuracy of ankle MRI, given the usage in diagnosis of lateral ligament damage become hard to justifying uses because high cost and cost efficiency of practice [17] .

Many study reported about contours and thickness of ligaments of ankle, a study assessed the appearance of lateral ligaments by MRI, average thickness of ATFL 2.1mm and appear homogenous hypo-intense in MRIs. Another study reported ATFL appear delineation contours and signals variable on normal MRI images, with changeability in signal intensity between low and increase. Whereas the unbroken ATFL of constant thickness and lower signals intensities while damage ATFL appear on MRI condensed and elevated signals intensity [17] .

Aim of study

To highlight on useful role of MRI in investigation about ankle ligaments injuries.

Chapter two Patients and methods

Patient and method

Study design

The study design as cross section was carried out in Babylon teaching hospital from 1st August 2021 to 1st September 2022, the study enrolled patients with ankle sprain.

Study sample

The sample consists from 40 patents who's referred to MRI unit in radiological department of hospital, Patients were selected according to having the ankle sprain without open wound or fracture,

Data collection

A well-structured questionnaire was prepared and data was gathering according to it, it consist from demographic part such as age gender residence of patients, previous surgical and medical history and history of present illness in detail side of foot effected period of illness and concomitant injury and last part about image findings.

Exclusion criteria:-

I-when ankle or foot of affected side had clear bone fractures.

2-Had history of interventional surgery in ankle of affected side.

3-Ankle instabilities of functional type.

4-Avulsions injuries in fibular or talus connection.

5-Metallic foreign body.

MRI protocol

MRI study was achieved with equipment of general electric 1.5 Tesla.

The patients put on magnetic field in supine position with feet first, and angle in 90 degree with special surface coil. Field of view about 13-17 cm to ensure good pictures for ankle and feet of high resolution. Three planes were included for ankle examination. Firstly the sagittal plane, coronal plane and axial planes. For every plane had specific types of ankle damage. Coronal planes used to assess the tendons injuries, whereas ligament can be assessed by axial and coronal plane. While the injury to bone of tibia, fibula and talus evaluated by sagittal and coronal plane in combination. Standard slice thickness used are less than 3 mm, sometime reach as larger as 5 mm in thickness was employed in work. Tl and T2 weight images pulse sequence were used in evaluation of ankle joint, with addition of fat suppress.

Evaluation of MRI images

Assessment of images concentrated on three aspect:

a) Signal intensity was calculated for ligaments and tendons for ATFL by using region of interest. All contour of the ATFL will be defined as region of interest. In addition for compute the signal intensity to normalized level the signal noise ratio should be measured.

b) ATFL length measure by line extend from anterior and inferior edges of fibula to necks of talus bone.

c) Width of ATFL it measured by equation: area of ATFL /length of ATFL.

Outcome measurements

For diagnosis of ligaments tear we used specific criteria such as lack of visible ligaments, ligaments appear irregular and thicken, signal images show heterogeneity. Result of study categories as normal, partial tears and complete tears. Complete tear show definitive break in ligament and bond of neighboring tissues. Partial tear define as incomplete adhesives of ligaments and rough cut fibers with integral continuities.

Statistical analysis

Data was collected and included in a data based system and analyzed by statistical package of social sciences ((SPSS, Inc., Chicago, IL, USA)) version 23.

Parametric data were expressed as mean± standard deviation (SD) . While non-parametric data were expressed as percentages and were analyzed using chi square, such as relation between ligament injuries and time of presentation. P-value < 0.05 was considered statistically significant.

Chapter three
Results

Results

The enrolled 40 patients with ankle pain the 26 female and 14 male with age range 20-50 years (mean age 36.1±8.4 year). Twelve patients were not working and 28 were working in various occupation, as in table 1.

Table 1: show demographic characters.

Variables		Number	Percent
Age	<30 years	13	32.5%
	≥ 30 years	27	67.5%
Gender	Female	26	65%
	Male	14	35%
Occupation	Not worker	12	30%
	Worker	28	70%

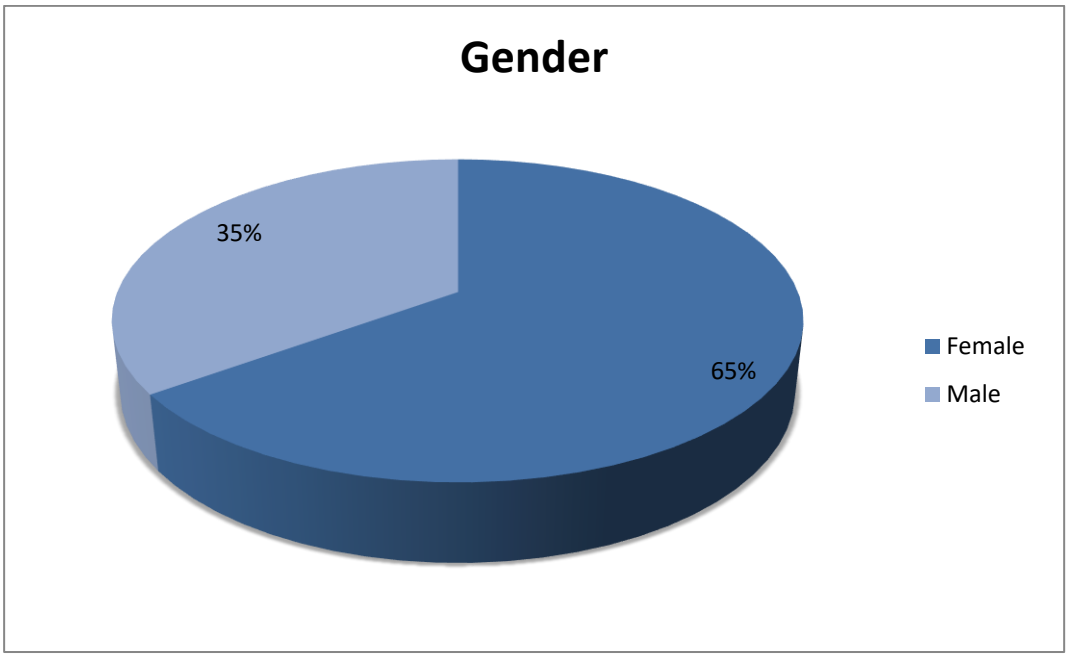


Figure 1: General distribution

Acute presentation was seen in 77.5% of patients whereas 22.5% come with chronic complain. Clinical finding by orthopedic only show by eight patients. Seventy percent of patients had right joint affected and 30% left ankle. Majority of causes of ankle pain was during walking 45%, 17.5% accidently, 10% during sport activity and 27.5% during football. Regarding the clinical presentation, patients mainly give more than one sign and symptom, limitation of movement seen in 70%, swelling of joint in 92.5% and tingling and numbness in 15% of patients, as in table 2.

Table 2: clinical features of patients.

Variables		Number	Percent
Acute		31	77.5%
Chronic		9	22.5%
Clinical diagnosis	Positive	8	20%
	Negative	32	80%
Affected joints	Right	28	70%
	Left	12	30%
Main causes	Accidents	7	17.5%
	Sport's	4	10%
	Football	11	27.5%
	Stump	18	45%
Clinical presentation	Limitation of movement	28	70%
	Swelling	37	92.5%
	Tingling and numbness	6	15%

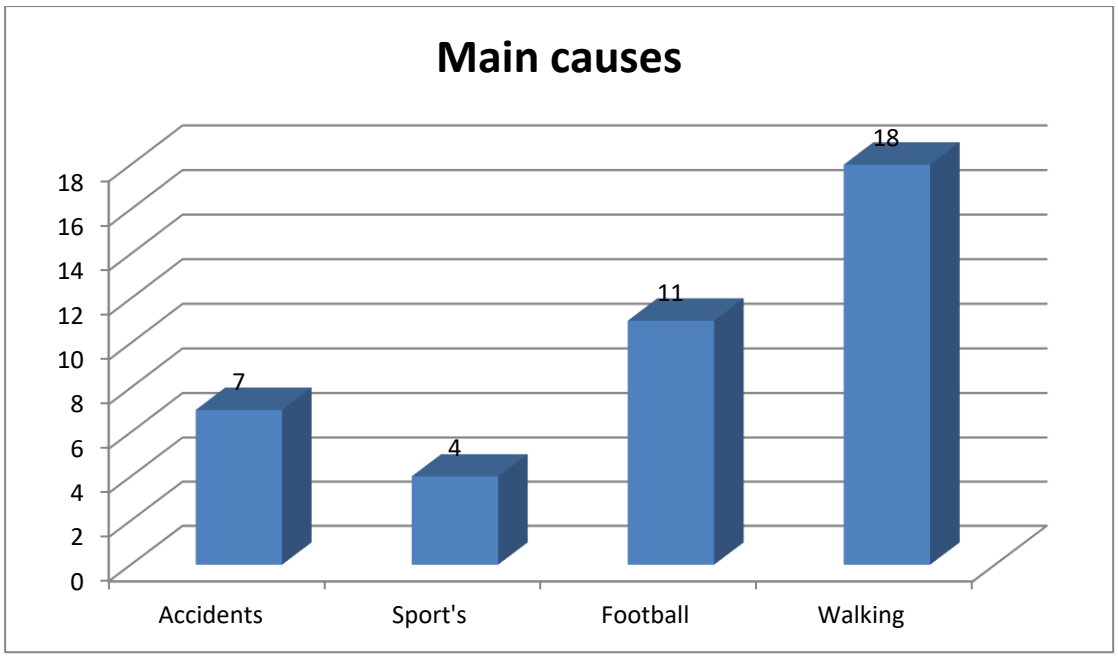


Figure 2: show main causes of ankle pain.

Ligaments injuries by MRI study, reveal 40% anterieor talo-fibular ligaments, 17.5% postereior talofibular ligaments, 20% Calceneofibular ligaments, 15% deltoid ligament, 5% , anterior tibiofibular ligaments and 2.5% Postereior tibiofibular ligaments were affected, as shown in table 3.

Table 3: show types of ligaments injuries.

Ligaments injuries by MRI	Number	Percent
Anterior talofibular ligaments	16	40%
Posterior talofibular ligaments	7	17.5%
Calceneo-fibular ligament	8	20%
Deltoid ligament	6	15%
Anterior tibiofibular ligaments	2	5%
Posterior tibiofibular ligaments	1	2.5%

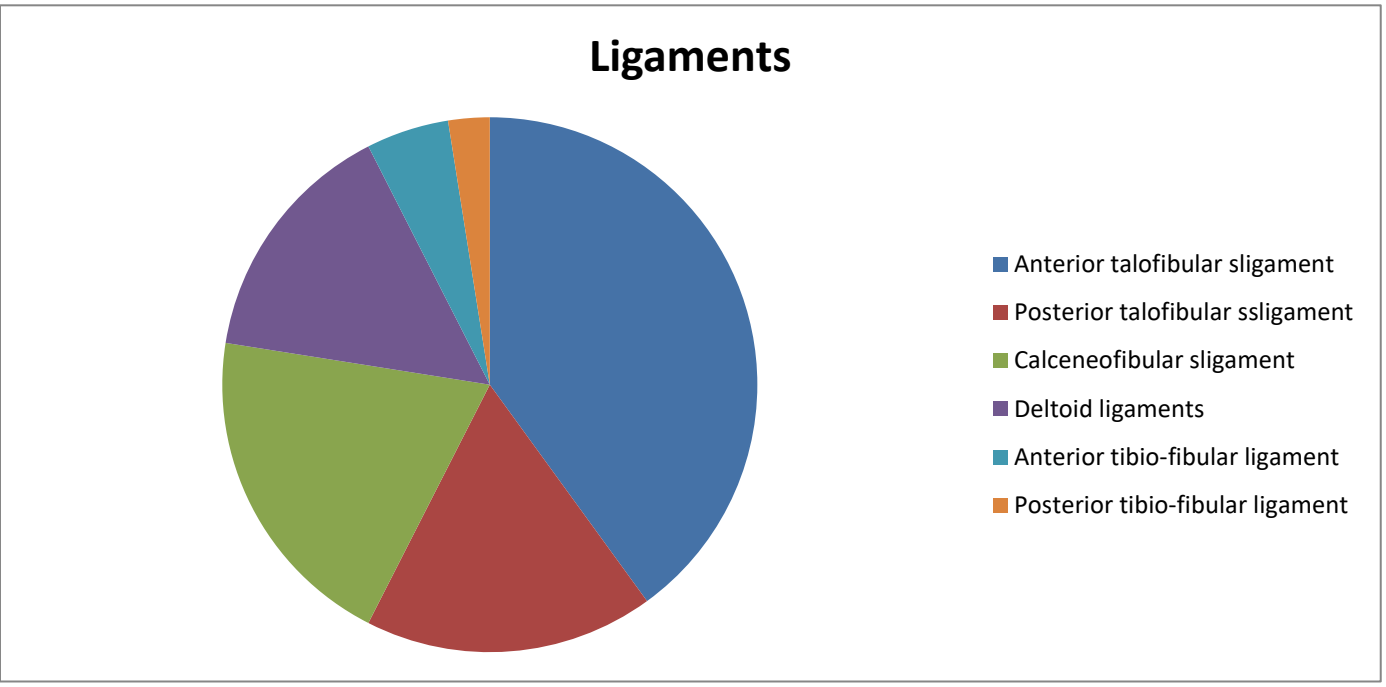


Figure 3: types of ligaments affected.

Regarding to pathological finding, ligament sprain was seen in 16 patients, partial tear were found in 10 patients and complete tear of ligament present in 14 patients these result in table 4. Table 5 show the relation between pathological findings and types of ligament was affected, 8 patients of anterior talo- fibular ligament had sprain , three show partial tear and 5 with complete tear. While 3 patients with posterior talo-fibular ligament had ankle sprain. From 8 patients with Calceneo-fibular ligament 3 of them had complete tear.

Table 4: show pathological types by MRI.

MRI pathological findings	Number	Percent
Ligaments sprain	16	40%
Partial tear	10	25%
Complete tear	14	35%
Total	40	

Table 5: reveal the association between types of ligaments injuries and pathological findings.

Ligaments injuries	Sprain	Partial tear	Complete tear	Total
Anterior talo- fibular ligament	8	3	5	16
Posterior talo-fibular ligament	3	2	2	7
Calceneo-fibular ligament	3	2	3	8
Deltoid ligament	1	2	3	6
Anterior tibio-fibular ligament	0	1	1	2
Posterior tibio-fibular ligament	1	0	0	1
Total	16	10	14	40

Ligaments sprain was seen in older age group in more than 30 years. Age group less than 30 there were 3 patient has partial tears, 5 patient has complete tears, these relation was statistically not significant, as shown in table 6. For acute presentation 14 of them had ligaments sprain, 7 had partial tear and 10 complete tear whereas chronic presentation had sprain partial tear and complete tear in two, three and four respectively in addition this figure not significant association, as in table 7.

Table 6: the association between ligament injuries and age of patients

MRI findings	< 30 years	≥30 years	p-value
Ligaments sprain	5	9	0.9
Partial tear	3	7	
Complete tear	5	11	
Total	13	27	

Table 7: show the relation between ligament injuries and time of presentation.

MRI findings	Acute	Chronic	p-value
Ligaments sprain	14	2	0.4
Partial tear	7	3	
Complete tear	10	4	
Total	31	9	

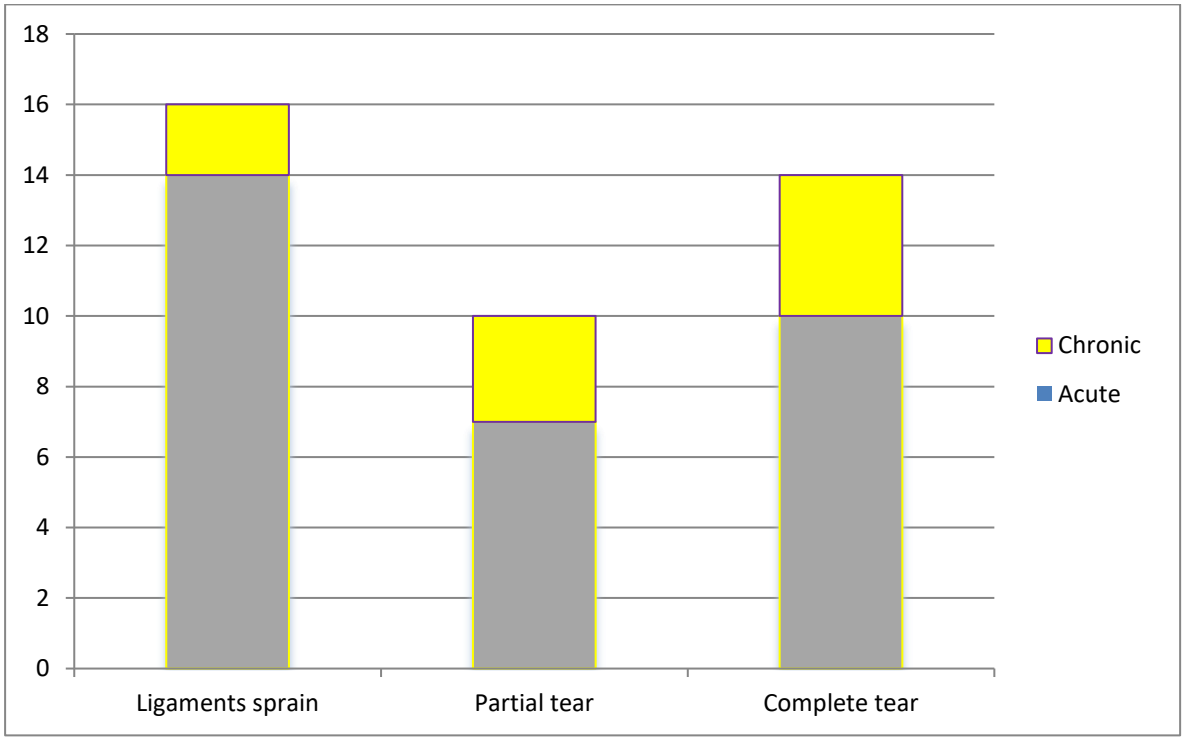
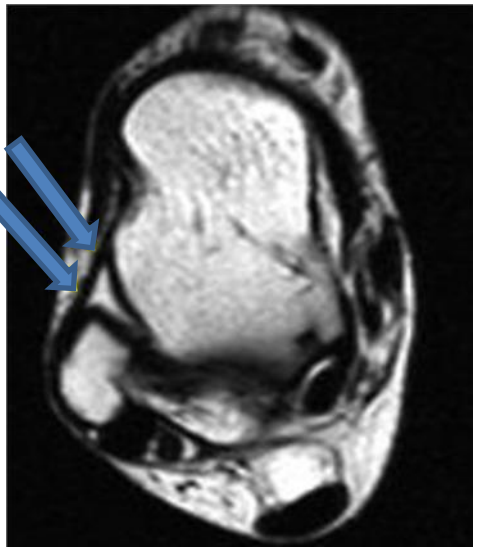
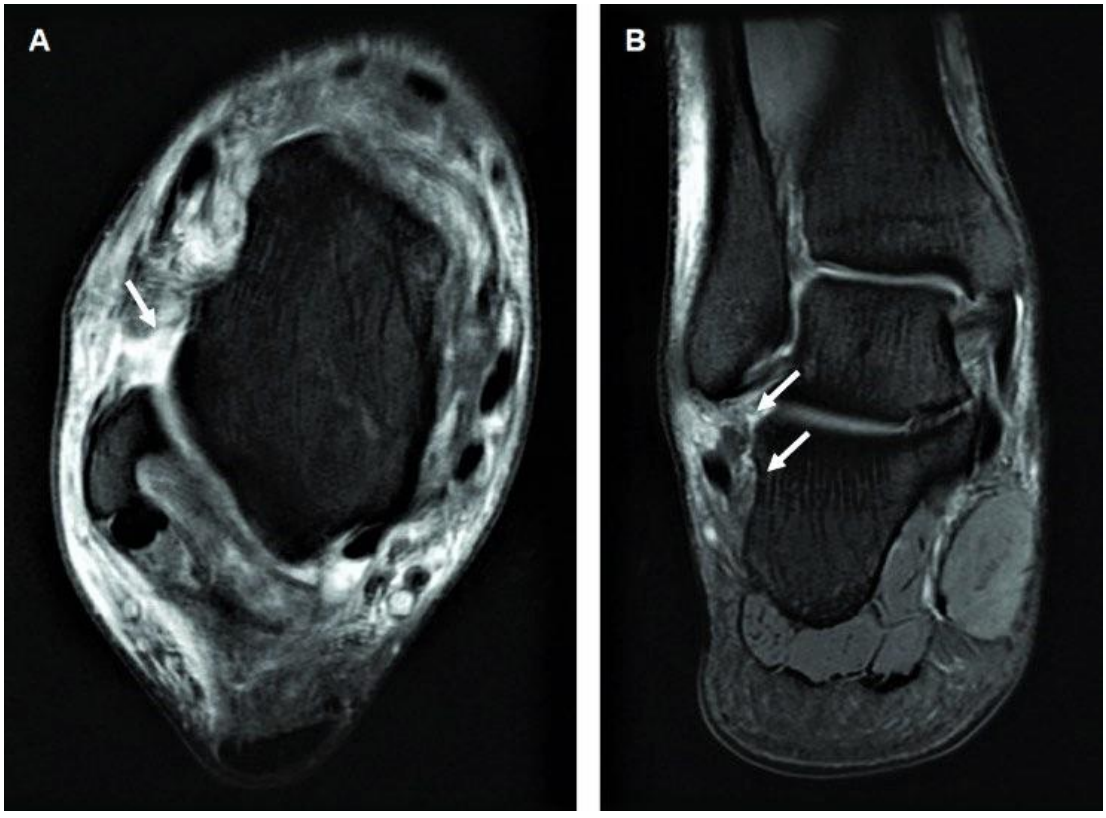


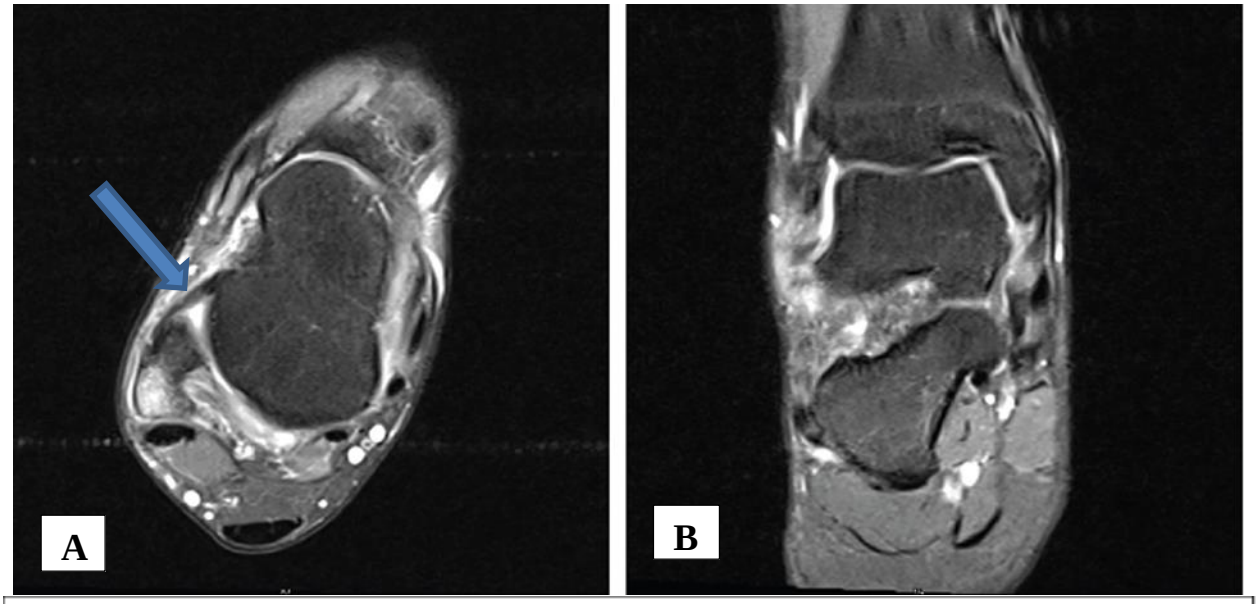
Figure 4: types of ligaments injuries and time of presentation.



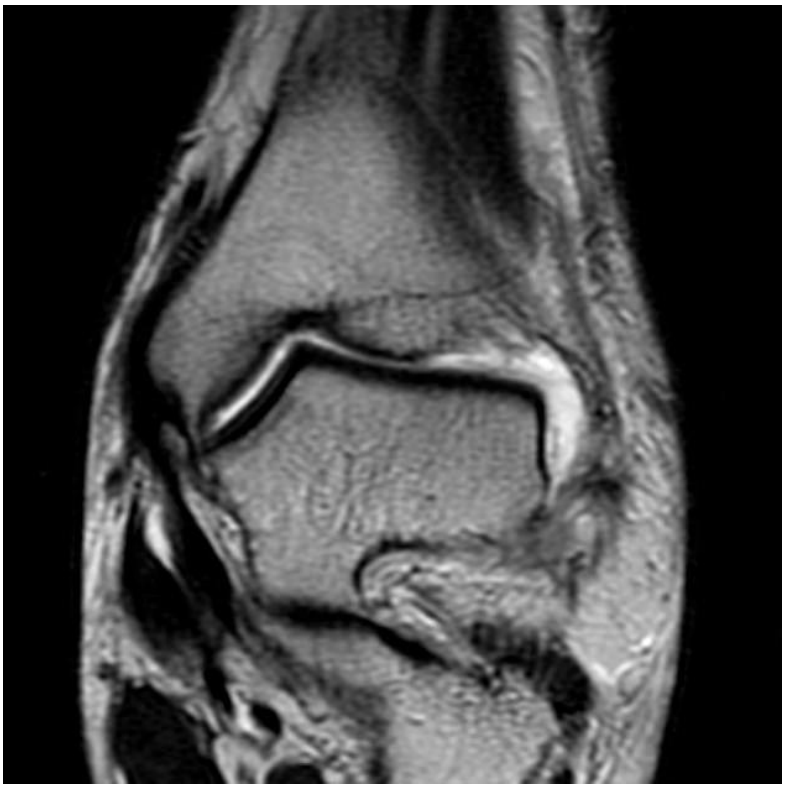
Axial section T1 WI Intact ATFL (arrowed)



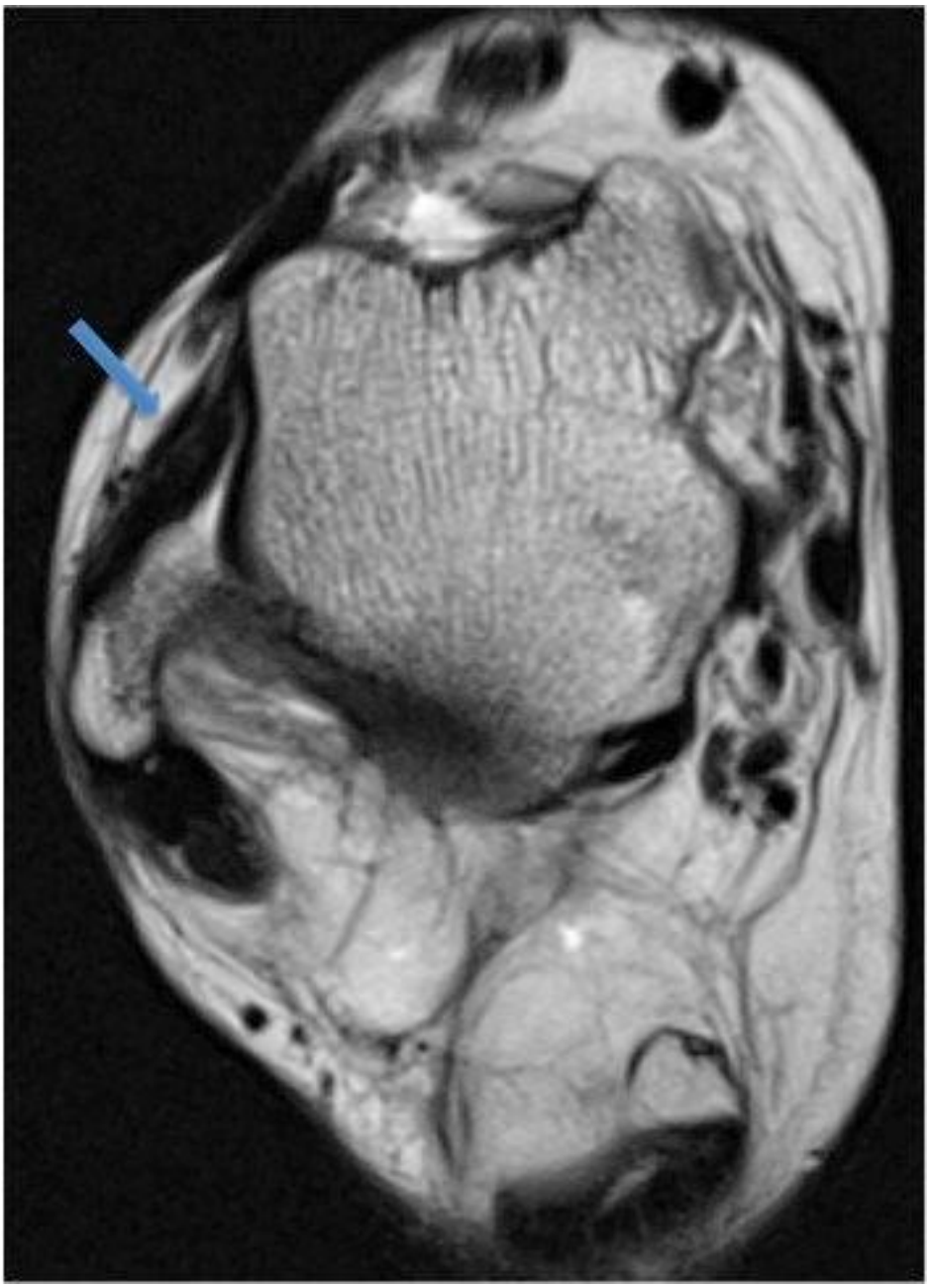
Acute lateral ankle ligament injury. (A) Axial PD image showing complete discontinuity of the anterior talofibular ligament (ATFL). (B) Coronal PD image showing complete discontinuity of the calcaneofibular ligament (CFL).



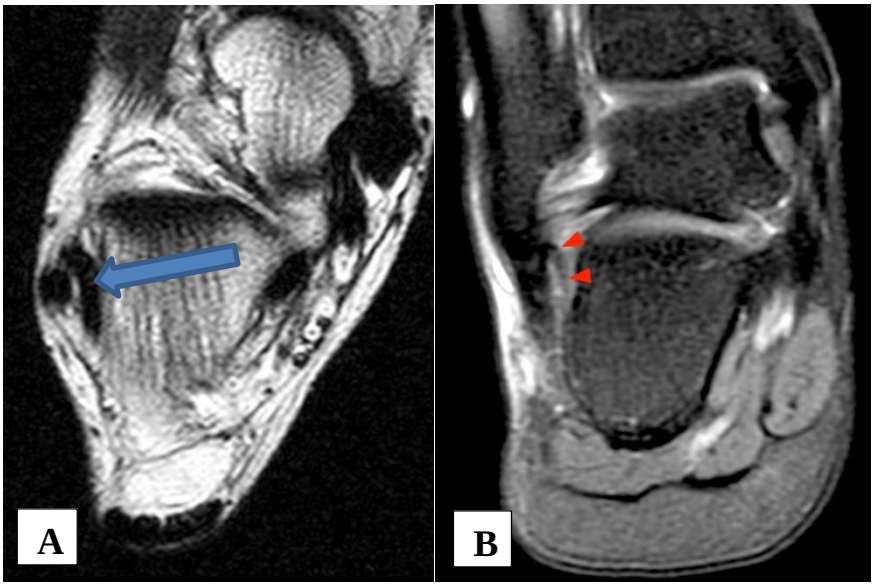
Torn ATFL (A): axial T2 WI shows ATFL mid-substance signal changeb(arrowed). (B): coronal T2 WI



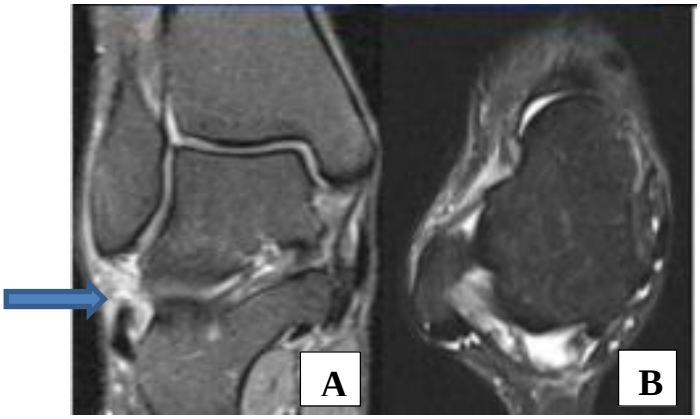
The anterior talofibular ligament is torn, and is discontinuous at its talar insertion. There is increased signal in the calcaneofibular ligament.



Axial T2 weighted image shows thick anterior talofibular ligamemt



Intact CFL : (A) The axial T2-weighted image shows the cord-like intact CFL (blue arrow) positioned medial to the peroneal tendons with an intervening fat plane. (B) shows a thin, well defined CFL (red arrowheads) in its entirety extending from the anterior tip of the lateral malleolus to the calcaneal attachment site.



Torn calcaneo-fibular ligament: (A) T2 WI coronal section (arrowed). (B)T2 WI axial section tear CFL

Chapter four
Discussion

Discussion

MRI images can provide specific higher soft tissues resolution and have ability to illustrating anatomical integral ligament through their pathways. In acute injury of ankle joint MRI show presence of hemorrhage and accumulation of fluid interstitial of joint soft tissues and swelling appear over lateral malleolus. Moreover, image reveal high signal for bone at site of ligaments avulsion. But with recurrent or chronic injuries these signs might be not present, therefore in chronic presentation diagnosis hard [17].

However, the MRI offer beneficial evidence of related pathological signs of functional instability for example chondral lesion and loose body, which similar to structure un stability secondary to ligaments deficit [15] .

Our study of 40 patients with ankle pain the 26 female and 14 male demonstrated age range 20-50 years (mean age 36.1±8.4 year). It is with line of study **Mohamed Ibrahim Harraz.et al** [18] . In Erbil **Nawroz** et al([19] whose reveal maximum of the patient fit to the age group 31-40 and 41-50 year with 20 and 14 case, in respective.

Regarding the association between MRI finding and age group in the study groups, the ATFL injuries, tenosynovitis, joint effusion , bone contusions and fractures were found more in patients below thirty year [20] .{10}

A study by martin et al. stated that prevalence of ankle sprain are most frequently seen in person age between 14-19 age groups [21].

More over other authors reported the age of 18-49 year are more prevalent for ankle sprains with mean age 25 year [16].

The findings reveal the incidence of ankle sprain were mostly happened among male than female, 32 in male and 18 female.

These results not in line with finding of study done by waterman et al. which is stated female over age of thirty with higher incidence of ankle sprain than male of same age([22]).

The result agree with other thesis reported female had greater chance of ligaments injuries. The scarce data about these findings and why ankle sprain happened in female than male, the authors suggestive physical damage and emotional stress through sport action which more prone to ankle injuries in compared to male [23] .{ 12}

These consistent with study by El-Liethy and Kamal which enrolled 35 patients male constitute 30% and female constitute 70% with range of age 19-61 years and mean age 36 year, and right side are more affected than left side 54%, 46% respectively [12].

Further more, in spite of these studies findings many reporter appear the age and gender are not risk factor for ankle joint injuries [19] .{ 1}

Our result reported main causes of ankle pain was during stumping 45%, 17.5% accidents, l0% during sport activity and 27.5% during football, it agreement with other study [24] ·{·5}

Nawroz recorded the cause of ankle sprains, the greatest patients were because accidents in 40%, 26% by sport , 18% by stumping and 16% by football ([19]).{l}

El- Liethy and Kamal study ,reported that traumatic insult was the most common etiology of ligament injury noticed in 67% of their cases. This is agreed with our study in which most of our cases are presented by traumatic insult (noticed in 18/30 cases representing 60%) while the other patients were non-traumatic [12] .

Other findings of our study reveal ligaments injuries by MRI study, 40% anterior talofibular ligaments, 17.5% posterior talofibular ligaments, 20% Calceneofi.bular ligaments, 15% deltoid ligaments, 5%, anterior tibiofibular ligaments and 2.5% Posterior tibiofibular ligaments were affected. Ligament sprain was seen in 16 patients, partial tear were found in 10 patients and complete tear ofligament present in 14 patients. It agree with previous conducted studies [8,11]. 32 37{1}

Mervat Elgohary *et al* reported the anterior talofibular ligament are more frequent damage ligaments constitute (37.5%) of the whole ligaments injury followed by Deltoid ligaments (5%). This coincides with differents literature assessing ankle ligament [20] .

Michela Barini found anterior talofibular ligaments firstly injured by trauma, he stated this ligaments more often damaged in all type of ankle trauma. Calceneofibular ligaments injury might be happened in main inversion strain, although it related with an anterior talofibular ligaments injury. On other hand, posterior talofibular ligaments is infrequently tom apart from case of entirely ankle dislocation [25] .

Study by Helms et al. show the ATFL is frequently torn ligaments in ankle joint. Followed by CFL tear also come after and rarely PTFL ligaments injury happened [26] .

Azni study enrolled 43 patients, anterior talus fibular ligaments tear presented in 76% with same percent injury by Calceneofibular ligaments,

while deltoid presented in 52% and posterior talo fibular ligaments in less than 50%, most of patients reveal more than one ligament damaged and frequently reported partial tear in 66% [23] .

Gross terlindenet al., 2016stated that the ATFL was the extremely common affected ankle ligaments injury in his study noticed in 34% of his cases. This is agreed with our study which revealed also that the ATFL being the furthermost common damage ligaments, it is follow by PTFL ligaments [27] .

Cremaetal. ,2018 quantified that, imagining of an unbroken anterior talofibular ligaments nearly exclude separation of some of the lateral collateral ligament and also listed that Calceneofibular ligaments and posterior talofibualr ligament rupture are not establish in the occurrence of an unbroken anterior talofibular ligaments[28] . This is also agreed with previous conducted studies which reveal that Calceneofibular ligaments tear and posterior talofibular ligaments tears were continuously related with anterior talofibular ligaments tears[29] .

Gross terlindenet al., 2016 stated that the deltoid ligaments is the toughest ankle ligaments and slightest to be wounded. He mentioned that 5.7% of his patients showed deltoid ligament tear [27] .

Cremaetal. ,2018 stated in his study that ligaments sprain were further commonest than ligaments tear. He mentioned that 63% of all patients in his study showed different sprained ligaments[28]. In our result ligaments sprain were most common than ligaments tear.

MRI examination clearly demonstrates the soft tissue abnormalities and can also detect bony. MRI has a superior sensitivity and specificity in assessment of ankle numerous ligaments wounds as well as impingement syndromes and bony abnormalities [16]

Chapter five
Conclusion
and
Recommendations

Conclusion

1-MRI is vitally significant in diagnosing injuries of ligaments of ankle strain and play an important role in detect lesion of tendon and ligament.

2-MRI can assist with the initial judgment of bad consequence of ankle trauma and avoid the probable complications that might be arise from delay in distinguish of ankle damage and defects.

3- MRI findings are more common in age group over 30s than those who are younger and with acute injuries than those with chronic injuries.

Recommendation

1-MRI is predominantly beneficial for evaluating soft tissues structure about the ankle for example tendon, ligament, nerve, and fascia and for detected hidden bone damages. So it is recommended to use MRI for assessment of ankle joint problem.

2- Further studies are needed to give a clear description and guidelines to evaluate the lesions of ankle joint ligaments.

References:

I-Doherty C, Delahunt E, Caulfield B, Hertel J, Ryan J, Bleakley C. The incidence and prevalence of ankle sprain injury: a systematic review and meta-analysis of prospective epidemiogical studies. Sports Med 2014; 44(1):123-40.

2-Wang J, Hua Y, Chen S, Li H, Zhang J, Li Y. Arthroscopic repair of lateral ankle ligament complex by suture anchor. Arthroscopy 2014;30(6):766-73.

3- Li HY, Hua YH, Wu ZY, Chen B, Chen SY. Strength of suture anchor versus trans-osseous tunnel in anatomic reconstruction of the ankle lateral ligaments: a biomechanical study. Arthroscopy 2013; 29(11):1817-25.
4- Wang J, Hua Y, Chen S, Li H, Zhang J, Li Y. Arthroscopic repair of lateral ankle ligament compl
5- 3690ex by suture anchor. Arthroscopy.
2014;30:766e773.

6-Boonthathip M, Chen L, Trudell D, Resnick D. Lateral ankle ligaments: MR arthrography with anatomic correlation in cadavers. Clin Imaging. 2011;35:42e48.

7-Leardini A, O'Connor JJ, Giannini S. Biomechanics of the natural, arthritic, and replaced human ankle joint. J Foot Ankle Res2014; 7(1):8.

8-van den Bekerom MP, Kerkhoffs GM, McCollum GA, Calder JDF, van Dijk CN. Management of acute lateral ankle ligament injury in athletes. Knee Surg Sports Traumatol Arthrosc 2013;21(6):1390-5.

9-Howard DR, Rubin DA, Hillen TJ, Nissman DB, Lomax J, Williams T, et al. Magnetic resonance imaging as a predictor of return to play following syndesmosis (high) ankle sprains in professional football players. Sports Health 2012; 4(6):535-43.

10- Aurich M, Hofmann GO, Rolauffs B, Gras F. Differences in injury pattern and prevalence of cartilage lesions in knee and ankle joints: a retrospective cohort study. Orthop Rev (Pavia)
2014; 6(4):5611.

11-Ballester M, Lucar G, Saeedi S. Bone edema after ankle sprain and update. Biomed J Sci Tech Res 2019; 13(4):1028-9.

12- Melanson SW, Shuman VL. Acute ankle sprain. Treasure Island (FL): Stat Pearls Publishing;2019.

13- El-Liethy N, Kamal H. High resolution ultrasonography and magnetic resonance imaging in the evaluation of tendino-ligamentous injuries around ankle joint. The Egyptian Journal of Radiology and Nuclear Medicine 2016;47(2):543-55.

14- Fong DT, Hong Y, Chan LK, Yung PS, Chan KM. A systematic review on ankle injury and ankle sprain in sports. Sports Med. 2007;37:73e94.

15- Li HY, Hua YH, Wu ZY, Chen B, Chen SY. Strength of suture anchor versus transosseous tunnel in anatomic reconstruction of the ankle lateral ligaments: a biomechanical study. Arthroscopy. 2013;29:l 8l 7e1825.

16- Braun HJ, Dragoo JL, Hargreaves BA, Levenston ME, Gold GE. Application of advanced magnetic resonance imaging techniques in evaluation of the lower extremity. RadioI Clin North Am. 2013;5 l :529e545.

17- Tan DW, Teh DJW, Chee YH. Accuracy of magnetic resonance imaging in diagnosing lateral ankle ligament injuries: A comparative study with surgical findings and timings of scans. Asia Pac J Sports Med Arthrosc Rehabil Technol 2016; 7:15-20.

18- Park HJ, Cha SD, Kim SS, Rho MH, Kwag HJ, Park NH. Accuracy of MRI findings in chronic lateral ankle ligament injury: comparison with surgical findings. Clin Radiol 2012; 67:313-8.

19- HananArafa, Merhan Ahmed Nasr and Mohamed Ibrahim Harraz. Ankle Ligaments on MRI: Appearance of Nonnal andlnjured Ligaments. SOHAG MEDICAL JOURNAL: Jan 2019 Vol. 23 No.1.222-226.

20- Nawroz Dhahr Othman!* Salwa Ahmed AL-Najjar. Role of magnetic resonance imaging in ankle sprains. Zanco J. Med. Sci.2021:, Vol. 25, No. (1).438-445.{ l}

21- Mervat Mohamed Ibrahim Ali Elgohary, Susan Adel Ali Abdul Rahim, Thura Aamer Ahmed Ibrahim. Role of MRI in Evaluation of Traumatic Ankle Injuries. The Egyptian Journal of Hospital Medicine (October 2017) Vol.69 (3), Page 2016-2024.

22- Martin R, Davenport T, Paulseth S, Wukich D, Godges J. Ankle instability and movement coordination impairments: ankle ligament strains-clinical practice guidelines linked to the International Classification of Functioning, Disability and Health for the Orthopaedic Section of the American Physical Therapy Association. J Orthop Sports Physical Therap 2013; 43(9):lA-40.

23- Waterman BR, Owens BD, Davey S, Zacchilli MA, Belmont PJ Jr. The epidemiology of ankle sprains in the United States. J Bone Joint Surg. Am 2010; 92(13):2279-84.

24- Khaulah Karimah Azni, Suraini Mohamad Saini. Correlation Of Clinical Examination, Magnetic Resonance Imaging And Surgical Findings In Diagnosing Ankle Joint Ligament Injuries. European Journal of Molecular & Clinical Medicine:2020:Volume 7, Issue 2,1474-1484.

25- Shengxuan Cao, Chen Wang, Xin Ma, Xu Wan, Jiazhang Ruan, Chao Zhang and Kan Wang. Reliability and validity of different ankle MRI scanning planes for the anterior talofibular ligament injury diagnosis: a cadaveric study. Journal of Orthopaedic Surgery and Research (2019) 14:69.

26- Barini, M.; Zagaria, D.; Licandro, D.; Pansini, S.; Airoldi, C.; Leigheb, M.; Carriero, A. Magnetic Resonance Accuracy in the Diagnosis of Anterior Talo-Fibular Ligament Acute Injury: A Systematic Review and Meta-Analysis. Diagnostics 2021, 11, 1782.

27- Helms CA, Major NM, Anderson MW *et al.* (2009): Musculoskeletal MRI, 2nd ed., Chapter 16, Foot and ankle. https://www.amazon.com/Musculoskeletal-MRI-2e-Clyde

28- Gross terlinden, L. G., Hartel, M., Yamamura, J., Schoennagel, B., Burger, N., Krause, M., ...&Rupprecht, M. Isolated syndesmotic injuries in acute ankle sprains: diagnostic significance of clinical examination and MRI. Knee Surgery, Sports Traumatology, Arthroscopy, 2016:24(4), 1180-1186.

29- Crema, M. D., Krivokapic, B., Guermazi, A., Gravilovic, P., Popovic, N., D'Hooghe, P., & Roemer, F. W. MRI of ankle sprain: the association betvveen joint effusion and structural injury severity in a large cohort of athletes. European radiology, 2018: 1-9.

30- Hunt, K. J., Hurwit, D., Robell, K., Gatewood, C., Botser, I. B., & Matheson, G. Incidence and epidemiology of foot and ankle injuries in elite collegiate athletes. *American Journal of Sports l'vfedicine,2017: 45(2),* 426---433.

31. Anatomy of the Ankle (courtesy of the Journal of Musculoskeletal Medicine . © Todd Buck, CMI 2008) .

32. Hamill, Joseph, Kathleen Knutzen, and Timothy R. Derrick. Biomechanical basis of human movement. Philadelphia: Wolters Kluwer Health, 2015.

33. Hertel, J. (2002). Functional anatomy, pathomechanics, and pathophysiology of lateral ankl. e instability. Journal of athletic training, 37(4), 364.

الملخص
خلفية:. الكاحل عبارة عن آلية معقدة تتكون من مفصلين: مفصل الكاحل الحقيقي والمفصل تحت الكاحل. يتم استخدام التصوير بالرنين المغناطيسي بشكل متزايد في تقييم المرضى الذين يعانون من الأعراض المتبقية بعد العلاج المحافظ الأولي بسبب الدقة الفائقة للأنسجة الرخوة
الهدف من الدراسة: إبراز الدور المفيد للتصوير بالرنين المغناطيسي في التحقيق في إصابات أربطة الكاحل.
المرضى والطرائق: أجريت دراسة مقطعية في مستشفى بابل التعليمي من 1 أغسطس 2021 إلى 1 سبتمبر 2022. سجلت الدراسة مرضى التواء في الكاحل. تم إجراؤه باستخدام GE General Electric 1.5 Tesla. لهذا الغرض ، تم وضع المرضى في مجال مغناطيسي قوي في وضع ضعيف مع القدمين أولاً ، وزاوية الكاحل 90 درجة. تم جمع البيانات وتحليلها باستخدام SPSS. 23

النتائج: شملت الدراسة 40 مريضا يعانون من آلام الكاحل 26 أنثى و 14 ذكر تتراوح أعمارهم بين 20-50 سنة (متوسط العمر 36.1 ± 8.4 سنة). إصابات الأربطة من خلال دراسة التصوير بالرنين المغناطيسي ، تكشف عن 40٪ من الرباط الأمامي الشظوي الأمامي ، 17.5٪ من الرباط الكاحلي الشظوي الخلفي ، 20٪ الرباط التكلسي الشظوي ، 15٪ الرباط الدالي ، 5٪ ، الرباط الظنبوب الشظوي الأمامي و 2.5٪ الظنبوب الشظوي الخلفي تأثرت الأربطة. فيما يتعلق بالنتائج المرضية ، شوهد التواء في الرباط في 16 مريضًا ، وتم العثور على تمزق جزئي في 10 مرضى وتمزق كامل في الرباط في 14 مريضًا.

الخلاصة: يعتبر التصوير بالرنين المغناطيسي مهمًا بشكل حيوي في تشخيص تشوهات الأربطة والأوتار لصدمات الكاحل ويلعب دورًا مهمًا في الكشف عن آفات الأوتار والأربطة.

وزارة التعليم العالي والبحث العلمي

جامعة بـــــابل/ كلية الطب

قسم الجراحـــة/ فرع الاشعة التشخيصية

دور الرنيـــن الغناطيسي في تشخيص اصابة اربطة الكاحل

الطالبة
نوران يوسف طاهر

بأشراف
د.قاسم امير تاج الدين
بروفيسور الاشعة التشخيصية