

**“FUNCTIONAL OUTCOME OF OPEN REDUCTION
AND INTERNAL FIXATION IN BIMALLEOLAR
FRACTURES OF ANKLE”**

By

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**DISSERTATION SUBMITTED TO SRI DEVARAJ URS ACADEMY OF
HIGHER EDUCATION AND RESEARCH CENTER, KOLAR, KARNATAKA**

In partial fulfilment of the requirements for the degree of

**MASTER OF SURGERY
IN
ORTHOPAEDICS**

Under the Guidance of

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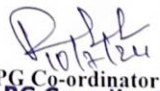
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PRIOR PERMISSION TO START OF STUDY

The Institutional Ethics Committee of Sri Devaraj Urs Medical College, Tamaka, Kolar has examined and unanimously approved the synopsis entitled "**Functional outcome of open reduction and internal fixation in bimalleolar fracture of ankle**" being investigated by **Dr. Akshay P & Dr. Arun H S** in the Department of Orthopaedics at Sri Devaraj Urs Medical College, Tamaka, Kolar. **Permission is granted by the Ethics Committee to start the study.**

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Dr. AKSHAY P

ABSTRACT

TITLE: “FUNCTIONAL OUTCOME OF OPEN REDUCTION AND INTERNAL FIXATION IN BIMALLEOLAR FRACTURES OF ANKLE”

INTRODUCTION: One of the main causes of morbidity in both young people and the elderly has been shown to be ankle fractures. In this study, the functional outcome and the factors related to the functional outcome of patients who underwent ankle fracture surgery at our center will be evaluated.

METHODOLOGY: A cross-sectional study of 30 patients undergoing fixation using screws or plates for the medial malleolus and fixation of the lateral malleolus with plates or pins will be conducted after receiving approval from the institutional ethical committee and the necessary authorities. The study was conducted in the R.L. Jalappa Hospital and Research Centre associated with the Sri Devaraj Urs Medical College, Kolar. From September 2022 to December 2023. Results were evaluated using Baird and Jackson score.

RESULTS: Thirty patients were enrolled during the study period; their mean age was 40.77%. and their mean radiological union was 11.04%. In our patient sample, supination external rotation was the most often observed injury. 10% of patients had superficial skin infections after surgery, while 16.7% had swelling. As per the Baird and Jackson score, 63.3% of patients had an outstanding clinical functional outcome, 26.7% had a good outcome, 6.7% had a fair outcome, and 3.3% had a bad outcome.

CONCLUSION: Our research led us to the conclusion that, in skilled hands, open reduction and internal fixation, using screws or plates for the medial malleolus and plating or pins for the lateral malleolus, is a very successful treatment option for bimalleolar fractures.

KEYWORDS: Bimalleolar fractures, Supination external rotation, Baird and Jackson criteria.

LIST OF ABBREVIATIONS

AITFL	:	Anterior Inferior Tibiofibular Ligament
AO	:	Arbeitsgemeinschaft fur Osteosynthese fargen
AOFAS	:	American Orthopaedic Foot and Ankle Society
ASIF	:	Association of study of internal fixation
CC SCREW	:	Cannulated Cancellous Screw
L-H classification	:	Lauge-Hansen classification
MRI	:	Magnetic Resonance Imaging
OMAS	:	Olerud-Molander Ankle Score
ORIF	:	Open Reduction and Internal Fixation
PAB	:	Pronation-abduction
PER	:	Pronation External Rotation
PITFL	:	Posterior Inferior Tibiofibular Ligament
SAD	:	Supination-adduction
SER	:	Supination External Rotation

TABLE OF CONTENTS

SL. NO	TITLE	PAGE NO
1	INTRODUCTION	1
2	OBJECTIVES	3
3	REVIEW OF LITERATURE	4
4	SURGICAL ANATOMY	10
5	METHODOLOGY	48
6	OPERATIVE PHOTOGRAPHS	54
7	X-RAY AND CLINICAL PHOTOGRAPHS	57
8	RESULTS	61
9	DISCUSSION	71
10	SUMMARY	77
11	CONCLUSION	79
12	BIBLIOGRAPHY	80
13	ANNEXURES	86
	• PATIENT INFORMATION SHEET	86
	• INFORMED CONSENT FORM	88
	• PROFORMA	90
	• MASTER CHART	96

LIST OF TABLES

Table No.	Title	Page No
1	Distribution of patient according to age	61
2	Distribution according to sex	62
3	Different bimalleolar injuries according to Lauge- Hansen classification	63
4	Distribution of study participants according to side of injury	64
5	Distribution of study participants according to mode of injury	65
6	Distribution of study participants according to scoring system	66
7	Complications associated after fixation of fracture	67
8	Mean of age and radiological union	68
9	Association between Age and outcome (Baired and Jackson score)	69
10	Distribution of study participants according to various parameters	70

LIST OF GRAPHS

Graph No.	Title	Page No
1	Distribution of patient according to age	61
2	Gender wise distribution	62
3	Percentage of different bimalleolar injuries according to Lauge-Hansen classification	63
4	Percentage of distribution according to side of injury	64
5	Percentage of distribution according to mode of injury	65
6	Percentage wise distribution of study participants	66
7	Percentages complications encounter	67

LIST OF FIGURES / PHOTOGRAPHS

Fig. No.	Title	Page No
1	Skeletal components of ankle joint	12
2	Ankle (only Talar half) with foot	12
3	Lateral collateral ligament	14
4	Medial collateral ligament	15
5	Syndesmotic ligaments of ankle	16
6	Tendon sheath of ankle (Lateral view)	18
7	Tendon sheath of ankle (Medial view)	18
8	Tendons and neurovascular structures over the anterior aspect of ankle	19
9	Ankle joint movements	21
10	Inversion and eversion at subtalar joint	21
11	Supination injury of ankle	28
12	Pronation injury of ankle	30
13	Danis weber classification	32
14(a)	Assessment of reduction	36
14(b)	Assessment of reduction	37
15(a)	Assessment of fibular length	38
15(b)	Assessment of fibular length	38
16	Approach to lateral malleolus	43
17	Approach to medial malleolus	44
	OPERATIVE PHOTOGRAPHS	
	Instruments	54
	SURGICAL PROCEDURE	
	Medial malleolus	55
	Lateral malleolus	56
	CASE 2	57
	CASE 9	58
	CASE 20	59
	CASE 27	60

INTRODUCTION



INTRODUCTION

Ankle fractures occur in about 187 out of every 100,000 individuals annually. Only 2% of ankle fractures are open fractures, making them extremely uncommon. An elevated Body mass index is considered a risk factor for suffering an ankle fracture.

Ashurt and Bromer categorized and assessed ankle injuries in 1922 after looking at a lot of instances, taking the direction of forces into account. Lauge and Hansen (1948–1954) identified four patterns based only on damage sequences, taking into consideration the foot's location and the direction of the deforming force at the time of injury.¹

Ankle injuries can involve both ligamentous and skeletal components. These days, Magnetic Resonance Imaging (MRI) is helpful in accurately identifying ligamentous damage; therefore, it's important to keep these parts in mind when treating these fractures.² Similar to other intraarticular fractures, bimalleolar ankle fractures require internal fixation and anatomical reduction by open techniques to prevent complications.

Bimalleolar ankle fracture results have improved since the Arbeitsgemeinschaft für Osteosynthesefragen (AO) principles of care were implemented, with a focus on anatomical fracture reduction, stable internal fixation, restoring full fibula length, and early active pain-free movement.³

LANE led the way in the surgical management of ankle fractures at the start of this century. He used a no-touch surgical approach and favoured screwing fracture fragments into place. Some clinicians are now using biodegradable implants to repair

bimalleolar ankle fractures. The duration of hydrolysis-induced deterioration in the body ranges from two to six months.⁴

AIMS & OBJECTIVES

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OBJECTIVES

- To evaluate the functional outcome of ankle fracture post plates/screws fixation for medial malleolus and pin/plates fixation for lateral malleolus over a six-month period using the Baird and Jackson scoring.
- To evaluate the fracture's radiological union following surgical treatment.

REVIEW OF LITERATURE

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REVIEW OF LITERATURE

HISTORICAL REVIEW

According to Purvis G. D. (1982), who reviewed 157 cases of displaced unstable ankle fractures, the majority of ankle fractures are caused by external rotation injuries, with pronation-type occurring six times more frequently than supination-type injuries. Good outcomes can be achieved by precisely fixing displaced, unstable ankle fractures and then mobilizing the affected ankle early to restore movement. If not, early arthrosis is highly likely. In particular, the fibula is not fixed; instead, it tends to shorten and permits the syndesmosis to expand or tilt, which causes arthrosis.⁵

Pettrone FA et al. (1983) reported 146 cases of displaced ankle fractures. The patient's age, the degree of deltoid ligament and distal tibiofibular syndesmosis repair, and the suitability of the medial and lateral malleoli post-reduction placements were the three most important variables. Rebuilding just the medial side of a bimalleolar fracture was less desirable than an open reduction of both malleoli. Additionally, it was shown that open reduction was better than closed reduction.⁶

In prospective research conducted by Lindsjo U. (1985), 306 instances (95%) of 321 consecutive cases of ankle fracture dislocation that were operated on using the AO principles were monitored for up to two or six years following the procedure. 1.8% of the patients had an infection, although there was no septic arthritis. 82% of the clinical findings were rated as "excellent and good," 8% as "acceptable," and 10% as "poor." Post-traumatic arthritis affected 14% of people and was far more common in middle-aged women. The degree of arthritis and the clinical outcome were highly correlated. Perfect reduction, strict internal fixation, early joint mobilization after

surgery, and complete weight bearing in a walking plaster below the knee are necessary for the best outcome in fracture-dislocations of the ankle joint.⁷

In a prospective analysis of 102 patients with displaced unimalleolar and bimalleolar fractures, Bostman O et al. (1989) employed cylindrical biodegradable implants of 3.2 and 4.5 mm in diameter and observed 87% positive outcomes.⁸

In 1989, Bray TJ, Endicott M, and Capra SE conducted a retrospective evaluation of 31 open ankle fractures that were treated over an 11-year period, with an average follow-up of 61 months. Delay in internal fixation and closed immobilization were used to treat fifteen patients. Internal fixation and rapid open reduction were used on sixteen patients. At the follow-up assessment, both groups' functional scores were the same. There was reduced range of motion limitation in the fractures treated with immediate open reduction and internal fixation (ORIF), but there was a higher prevalence of chronic ankle oedema. Patients treated with internal fixation and open reduction spent much less time in the hospital. For open ankle fractures, immediate ORIF speed up healing without increasing the risk of infection compared to conservative care.⁹

Twenty-two displaced medial malleolar ankle fractures that were surgically treated utilizing the modified tension band approach of Cleak and Dawson were retrospectively examined by White DB and Georgiadis GM (1995), with an average follow-up of twenty-five months. A figure-of-eight wire was to be anchored using a screw in this manner. Every fracture had a good healing rate and there were no mal-reductions. Asymptomatic wire migration, medial ankle soreness, and hardware placement mistakes were among the technique's problems. For the repair of certain displaced medial malleolar fractures, modified tension band wiring is still a valid technique. It works very well for osteoporotic bone and tiny fracture fragments.¹⁰

Eighty-one patients with ankle fractures of AO types A, B, and C participated in a prospective randomized trial that evaluated two postoperative treatment regimes after internal fixation (Van der Werken C ,Van Laarhoven CJ, Meeuwis JD, 1996). The patients were either non-weight-bearing or weight-bearing when rendered mobile, using crutches or a below-knee walking plaster. Only those wearing walking plasters below the knee showed a transient improvement in subjective assessment. Regarding the loaded dorsal range of motion and the overall clinical outcome, there were no appreciable variations between the groups. They chose between the two treatments because they were deemed suitable for non-weight-bearing individuals and wound healing, as well as personal preference.¹¹

In a significant review of research conducted by Beris AE et al. (1997), malleolar fractures that occurred over a ten-year period were categorized and managed using the AO system. The Baird and Jackson grading systems, which are based on subjective, objective, and radiological criteria, were used to assess the results. The majority of patients who underwent surgical treatment saw excellent and good outcomes; overall, all unimalleolar fractures saw excellent and good outcomes. It was discovered that posttraumatic arthritis was substantially linked to poor clinical outcomes and inadequate surgical reduction. The presence of a large bone fragment or dislocation also had a major impact on the result.¹²

A 1998 study by R. G. McCormack and J. M. Leith examined the complications of surgically treating ankle fractures in diabetic patients. Using a case-control study, they compared the outcomes of the treatment of displaced malleolar fractures in 26 patients with those of a matched group of patients who were not diabetic. Six severe complications resulted from the surgical treatment of 19 diabetic patients; these included two cases of profound sepsis, one of necrosis of the incision

edge necessitating a flap, and one case of malunion. Two patients who needed their limbs amputated also passed away. Although loss of reduction and malunion were common in diabetic patients with non-operatively treated displaced ankle fractures, they rarely produced symptoms. Given the increased likelihood of serious complications following surgery and the older patient's acceptance of malunion due to lesser demands, non-operative therapy may have been preferred in these individuals.¹³

The hazards of ORIF of ankle fractures were elucidated by Nelson E., SooHoo M.D., et al. (2009) through an analysis of a sizable and heterogeneous patient group. Strong risk factors for a complex short-term postoperative outcome included open injury, diabetes, and peripheral vascular disease. The type of fracture was a reliable indicator of the need for an ankle replacement or fusion procedure.¹⁴

Metikala, S., Mohammed, R., and S. When syndesmosis disruption and Weber type C lateral malleolar fractures are combined, S.A. Ali (2011) assessed syndesmotic-only fixation for Weber-C ankle fractures with syndesmotic injury and came to the conclusion that syndesmosis-only fixation is a successful therapeutic choice.¹⁵

Based on Szczesny G. and Janowicz J. (2012), a minimally invasive procedure can serve as a substitute for the conventional method. It enables appropriate stabilization with the least amount of stress to soft tissues; therefore, patients who refuse open reductions for esthetic reasons or who also have simultaneous large soft tissue injuries may benefit from it. It makes shorter hospital stays and shorter operating times possible. However, it requires increased fluoroscopic exposure and, occasionally, a wider surgical approach.¹⁶

After examining medial malleolar insufficiency fractures of the ankle in an older osteoporosis patient, Kim GD et al. (2013) found that the most common cause of insufficiency fractures is postmenopausal osteoporosis. Radiographs may first appear normal; subsequently, an early diagnosis is best made with a bone scan or magnetic resonance imaging.¹⁷

After conducting research on the false negative rate of syndesmotic injury in pronation external rotation stage 4 ankle fractures, Song KS et al. (2013) came to the conclusion that, despite the fracture pattern appearing normal on anteroposterior radiographs, it is crucial to understand the characteristics of PER stage IV ankle fractures. Routine intraoperative external rotational stress radiography is to be used to confirm the presence of the hidden syndesmotic damage.¹⁸

After examining the osteosynthesis of Danis-Weber type A and B lateral malleolar fractures using both plate-screw and tension band procedures, Isk C et al. (2013) came to the conclusion that both surgical approaches produce outstanding outcomes when used to treat Danis-Weber Type A and B fractures. An affordable and clinically useful treatment option for lateral malleolar fractures is the tension band approach. The tension band technique was clearly superior for the following reasons: it caused less impairment of periosteal circulation, it caused less mechanical irritation when skin problems were present in the surgical area, it required a shorter incision, it did not cause screw loosening, and it did not require implant removal. In cases of osteoporotic fractures, comminuted fractures, or oblique fractures, plates and screws should be used because they offer more firm fixation and better control over the length of the fibular bone.¹⁹

A prospective study (November 2016–March 2018) of 40 patients treated by Patil N et al. indicated that after 6 months, ankle function in bimalleolar fractures treated with ORIF ranged from excellent to good, based on the Baird and Jackson grading technique.²

According to Motwani GN et al.'s prospective study, which involved 40 patients in India between June 2013 and June 2014, surgical therapy for bimalleolar ankle fractures results in an excellent functional outcome and early mobilization.³

Ankle fractures treated within 24 hours after damage had outstanding to good functional outcomes compared to fractures operated beyond 24 hours, according to an observational study (Jan 2017–Dec 2017) involving 84 patients treated in Mangalore by Mohapatra A and Raj K.²⁰

In 2017, Vem KB et al. conducted a prospective 18-month study on 30 patients receiving treatment in Hyderabad, and the results showed that ORIF restored the ankle joint's articular congruity. When it comes to internal fixation of the medial malleolus, cancellous screws or malleolar screws outperform K-wires, while lateral plating works best for fibular fractures.²¹

According to Singh G et al.'s prospective study conducted in 2021 on 48 patients receiving treatment in Jammu and Kashmir, ORIF with plating for the lateral malleolus and cannulated cancellous screw for the medial malleolus is a very successful treatment option for bimalleolar fractures.²²

SURGICAL ANATOMY^{23,24}

A composite joint makes up the ankle. Syndesmosis, which joins the distal end of the crural bones, and diarthrosis, which separates their ends from the talus, are its two distinct articulations. The talus is restricted by the tibia superiorly and medially and the fibula laterally in the mortise formed by the ankle; this arrangement is also known as the malleolar fork.

TALOCRURAL JOINT (ANKLE JOINT):

The tibial plafond, which articulates with the talus body, hosts the posterior malleolus, as well as the medial and lateral malleolus, which make up the talocrural or ankle joint. Ligaments and bones play crucial and complementary roles in the complex hinge that is the ankle.

By dividing the ankle into syndesmotic complexes (lateral and medial), a physician can more effectively comprehend the cause of damage and create a treatment plan. The lateral complex is made up of the distal end of the fibula, the lateral facet of the talus, the lateral collateral ligaments of the ankle, and the subtalar component. The ligaments that join the syndesmosis to the interosseous membrane and the articulation between the tibia and fibula make up the syndesmotic complex. The medial complex is made up of the medial malleolus, the medial facet of the talus, and the superficial and deep components of the deltoid ligament.

SKELETAL COMPONENTS OF ANKLE JOINT: (Fig. 1)

TIBIA: The tibial shaft flares distally and the bone changes from tubulocortical to metaphyseal and cancellous. It is quadrilateral in cross section, terminating in an articulating surface. The anteromedial aspect of the distal tibia is notable for

prominent medial malleolus, which carries the medial articular surface of the ankle mortise. It is smaller than the lateral malleolus and can be divided into an anterior colliculus, covered laterally with articular cartilage, and posterior colliculus. The inferior surface is articular, concave antero-posteriorly, and slightly convex transversely, dividing the surface into a wider lateral and narrower medial segment. Laterally the distal tibia is indented by a shallow groove or incisura for the fibula. This is joined by a larger anterior tubercle (Chaput's or Tillaux-Chaput's) and significantly smaller posterior tubercle also known as the third malleolus or the Volkmann's process. The posterior border of the ankle joint is lower than the anterior border. The posterior border is in continuity with the posterior surface of the medial malleolus.

FIBULA: The term "lateral malleolus" refers to the distal fibula, which morphs into a triangular cross-section. The medial surface has a triangular facet that articulates with the lateral surface of the talus, situated inferiorly. The fibular fossa is situated posterior to this facet. Located more posteriorly, the lateral malleolus extends approximately 1 cm lower than the medial malleolus.

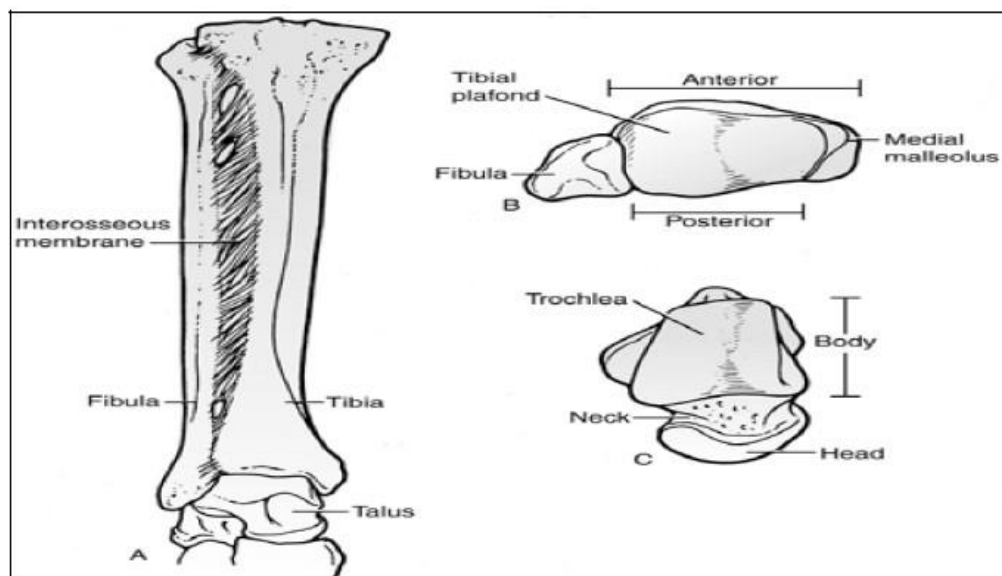


Fig. 1 SKELETAL COMPONENTS OF ANKLE JOINT

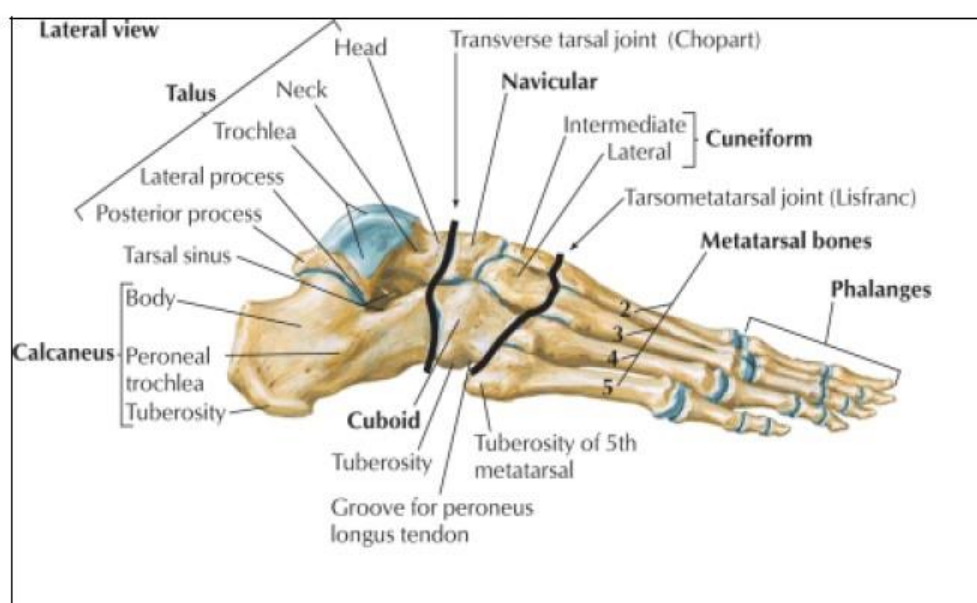


Fig. 2 ANKLE (ONLY TALAR HALF) WITH FOOT

TALUS: The trochlear articular surface, which transfers body weight to the joint, forms the superior body of the talus. The front surface of the talus dome is larger than the posterior area, forming a trapezoidal shape. The superior surface is somewhat concave from side to side and convex from front to back. The superior articular

surface is contiguous with the medial and lateral talus facets. The articular cartilage covers the talus almost fully; there are no musculotendinous attachments present.

LIGAMENTS:

Three different groups are thought to comprise the ligaments supporting the ankle joint:

- A) Lateral collateral ligaments
- B) Medial collateral ligaments
- C) Syndesmotic ligaments

THE LATERAL COLLATERAL LIGAMENTS: (Fig.3)

It is made up of three portions:

- Anterior Talofibular Ligament: When the ankle is plantar flexed, it stops the anterior displacement of the talus and is directed antero-medially. It originates from the inferior oblique segment of the anterior border of the lateral malleolus, inserting in to the talar body.
- Posterior Talofibular Ligament: It emerges from the medial surface of the lateral malleolus in a nearly horizontal manner and inserts on the posterior side of the talus. It resists posterior and rotator subluxations of the talus. The posterior talofibular ligament is the strongest of the two.
- Calcaneofibular ligament: A oval-shaped ligament that begins at the lower segment of the lateral malleolus' anterior border, extends deep to the peroneal tendons, and ends on the lateral calcaneus' posterior aspect. Stabilizing the

ankle and subtalar joint, this ligament prevents inversion while the ankle is in dorsiflexion.



Fig. 3: LATERAL COLLATERAL LIGAMENT

THE MEDIAL COLLATERAL LIGAMENTS: (Fig. 4)

The large, powerful, triangular medial collateral ligament, also known as the deltoid ligament, spreads like a fan over the medial portion of the ankle joint. It is divided into two sections: the deep part and the superficial part.

- From the anterior colliculus, the superficial deltoid ligament extends distally to the talus, calcaneus, and navicular bone. It holds the responsibility of inhibiting the calcaneus' eversion.
- The medial surface of the talus is where the short, thick deep deltoid ligament inserts. The bigger area between the anterior and posterior colliculi is where it originates. It is the primary medial stabilizer of the ankle joint. It stops the talus from turning outside of the mortise.

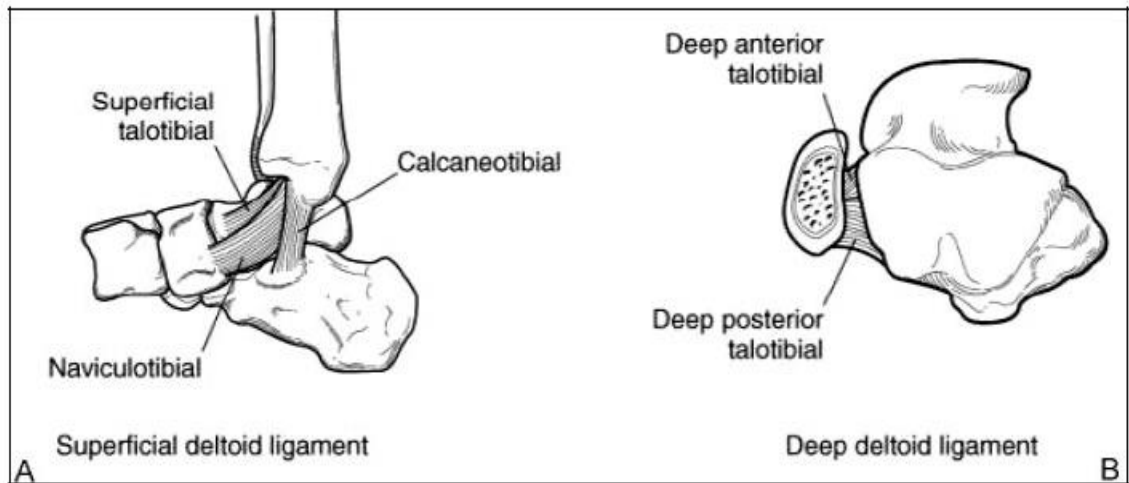


Fig. 4: MEDIAL COLLATERAL LIGAMENT

THE SYNDESMOTIC LIGAMENTS:

The most important ligamentous complex, the syndesmosis, connects the fibula and the distal tibia and is primarily in charge of maintaining the structural integrity of the ankle mortise. It is divided into three sections: the Interosseous ligament, the Posterior Inferior Tibiofibular Ligament (PITFL), and the Anterior Inferior Tibiofibular Ligament (AITFL). From the antero-lateral tubercle of the tibia to the anterior part of the lateral malleolus, the anterior inferior tibiofibular ligament (AITFL) extends obliquely and slightly distally.

From the posterior tubercle of the lateral malleolus to the posterior boundary of the tibial articular surface, the posterior inferior tibiofibular ligament (PITFL) extends obliquely proximally.

Compared to the anterior tibiofibular ligament, the posterior tibiofibular ligament is longer. The tibiofibular interosseous membrane thickens at the interosseous ligament, which is located a short distance above the ankle and can vary in thickness. It is the ankle's primary transverse stabilizer.

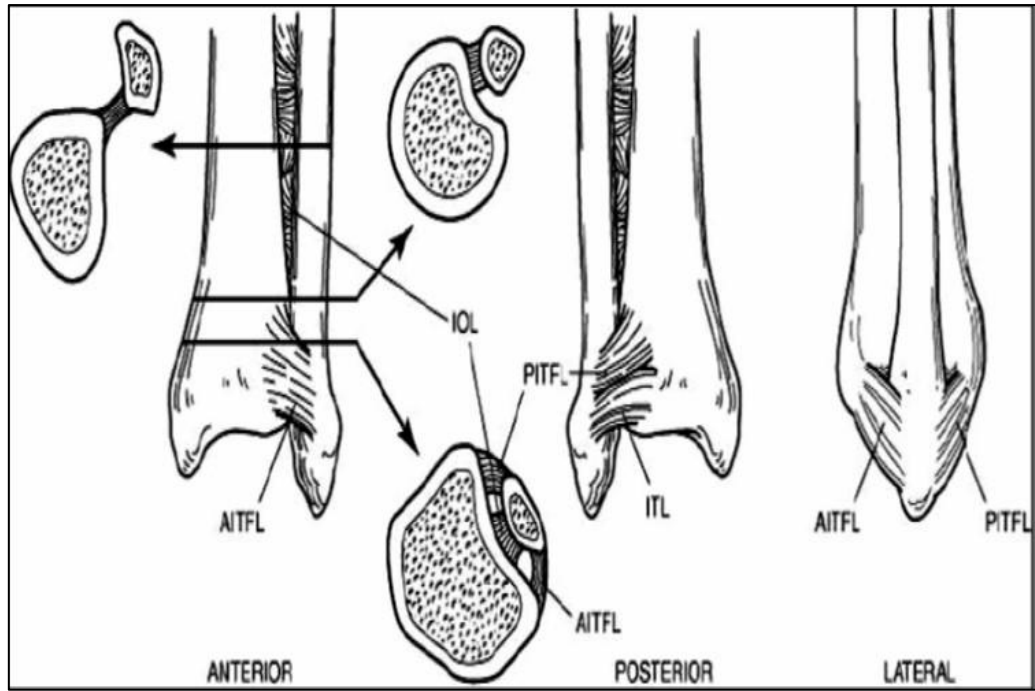


Fig. 5: SYNDESMOTIC LIGAMENTS OF ANKLE

Syndesmosis relationship

AITFL = Anterior inferior tibiofibular ligament IOL = Interosseous ligament

PITFL = Posterior inferior tibiofibular ligament ITL = Inferior transverse ligament

TENDONS AND NEUROVASCULAR STRUCTURES: (Fig .6, 7 & 8)

The ankle is crossed by 13 tendons, two main arteries and veins, and five nerves. The prominent tendon called the tendo calcaneus is the powerful plantar flexor of the ankle, both superficially and posteriorly. The plantaris tendon joins the calcaneus immediately medial to the Achilles tendon, running along its medial border. The sural nerve, which innervates the skin of the lateral heel and lateral border of the foot, is located directly lateral to the Achilles tendon.

On the lateral side of the ankle, posterior to the fibula, the peroneal tendons are passed beneath the superior peroneal retinaculum. As the proximal first metatarsal and first cuneiform cross plantar wards beneath the peroneus brevis and go closer to the lateral edge of the foot, the peroneus longus inserts on them. The peroneus brevis inserts near the base of the fifth metatarsal.

Beneath the retinaculum lie the flexor tendons on the medial side of the ankle. Just posterior to the medial malleolus are the Posterior tibial artery, Flexor hallucis Longus tendon, Tibial nerve, and associated vein, as well as the Posterior tibial tendon.

In front of the medial malleolus are the saphenous vein and associated nerves. Within the anterior region of the ankle, the extensor retinaculum confines the deep peroneal nerve, anterior tibial arteries, and external tendons. The Peroneus tertius Extensor digitorum longus tendon, Tibialis anterior tendon, Deep peroneal nerve, Anterior tibial artery, and Extensor hallucis longus tendon are the ones arranged from lateral to medial.

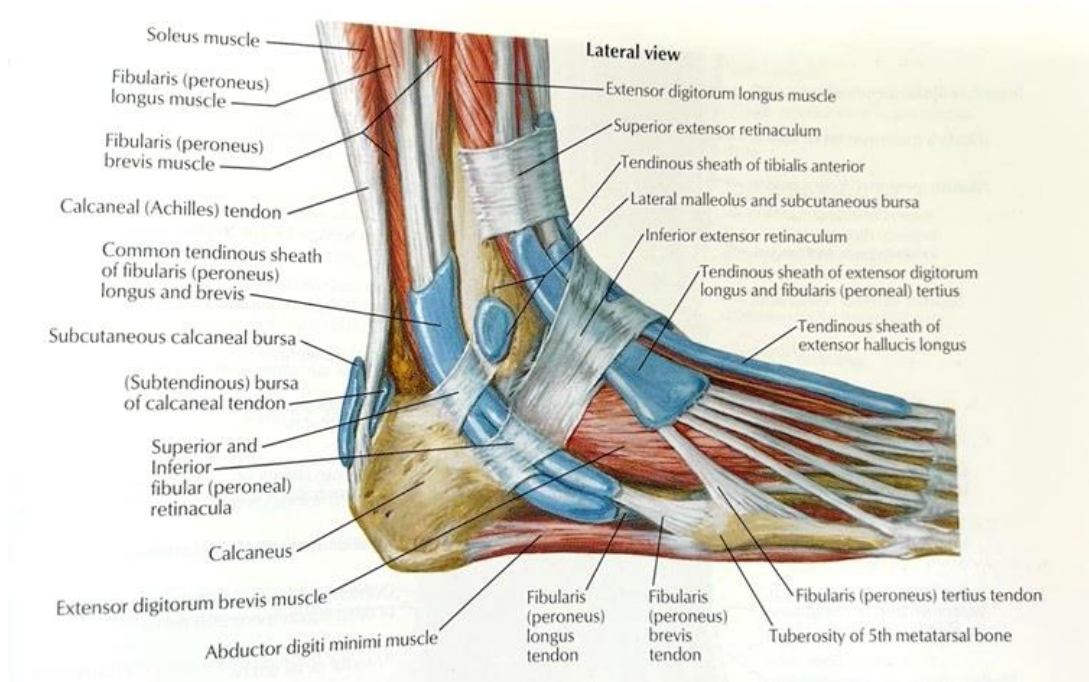


Fig. 6: TENDON SHEATH OF ANKLE (lateral view)

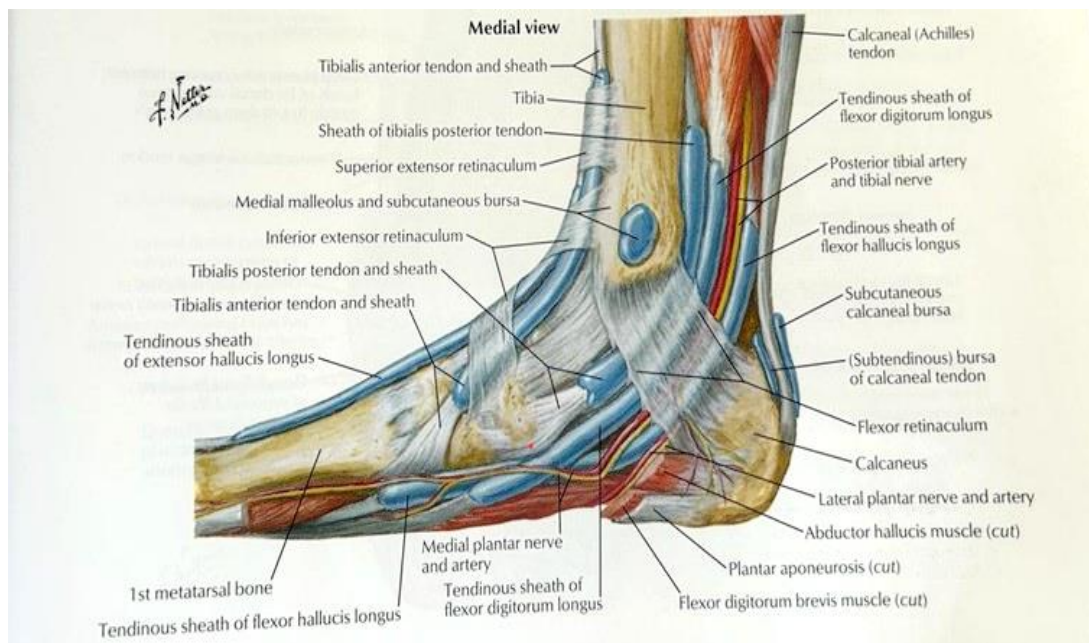


Fig. 7: TENDON SHEATH OF ANKLE (Medial view)

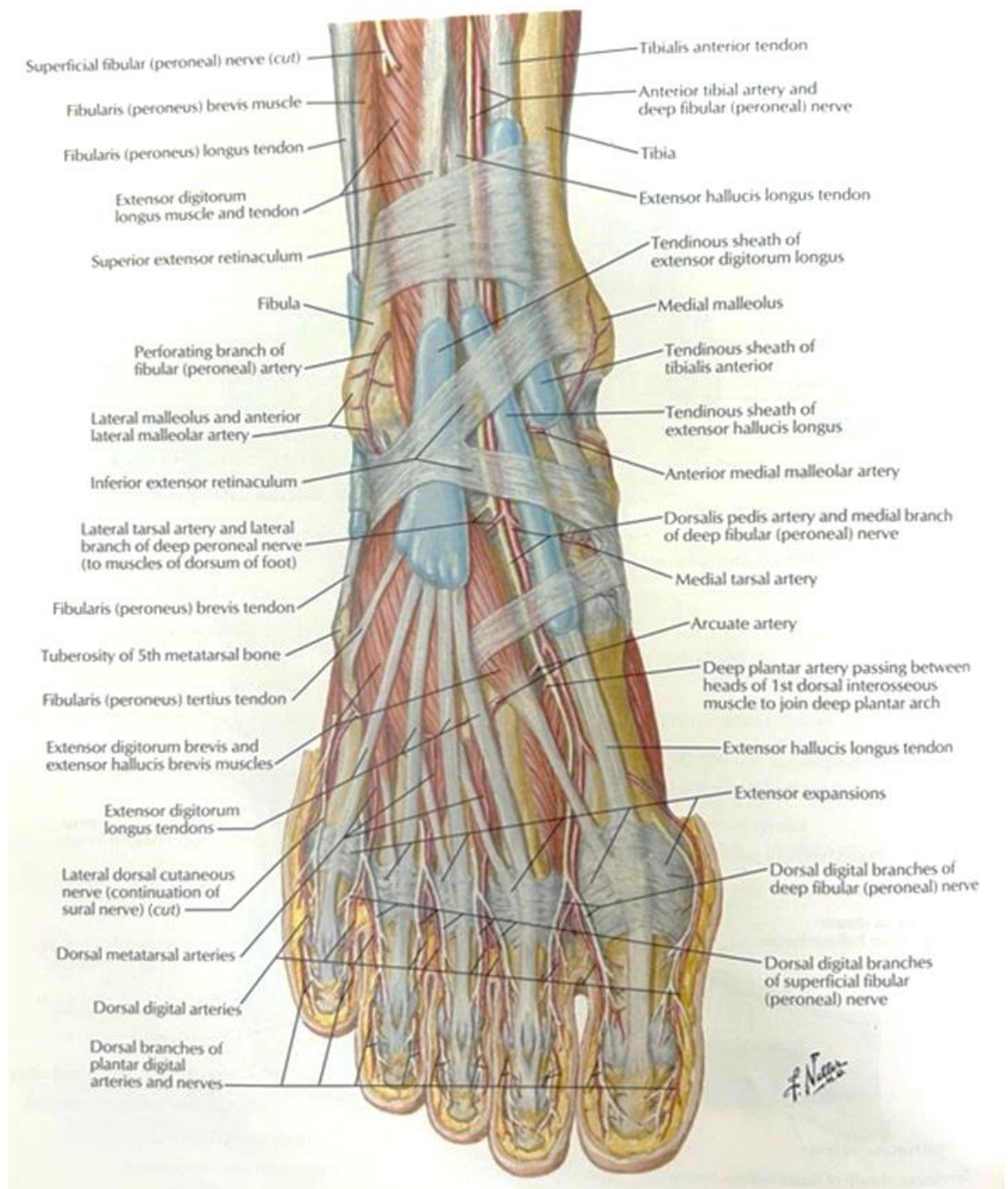


Fig. 8: TENDONS AND NEUROVASCULAR STRUCTURES OVER THE ANTERIOR ASPECT OF ANKLE

MOVEMENTS OF THE ANKLE:

The movements of the ankle joint are hinged in nature and occur about an axis through the body of the talus. They are: dorsiflexion, about 20–25°; plantar flexion, about 35–50°.

The Tibialis anterior, Extensor digitorum longus, Extensor hallucis longus, and Peroneus tertius muscles all aid in dorsiflexion. The talocalcaneal ligament, deltoid ligament, and tendo-achilli are the structures that restrict dorsiflexions. The main stabilizer in the dorsiflexion of the ankle joint is the calcaneofibular ligament. During dorsiflexion, the talus rotates externally and glides posteriorly. The anterior talofibular ligament, anterior fibre of the deltoid ligament, soleus, and gastrocnemius are the muscles that limit plantar flexion, whereas the Tibialis posterior, Flexor hallucis longus, and Flexor digitorum longus muscles help with it.

During plantar flexion, the anterior talofibular ligament is taut, which offers stability during inversion. This movement revolves around an axis that passes in front of and beneath the tip of the lateral malleolus in the frontal plane. This axis and the bimalleolar axis are at a 30-degree angle. The larger deviation between the lateral surface of the talus and the lateral malleolus can be explained by this configuration. This is also the cause of the little inversion that occurs with plantar flexion and the eversion that occurs with dorsiflexion. Adduction and abduction are terms used to describe movements along the anteroposterior axis that are restricted by collateral ligaments.

Inversion and eversion are two additional motions connected to ankle movements. The calcaneocuboid, calcaneo-navicular, and subtalar joints are the sites of these motions. The tibialis anterior and posterior muscles aid in inversion, while the peroneus longus and peroneus brevis muscles aid in eversion.



Fig. 9: ANKLE JOINT MOVEMENTS

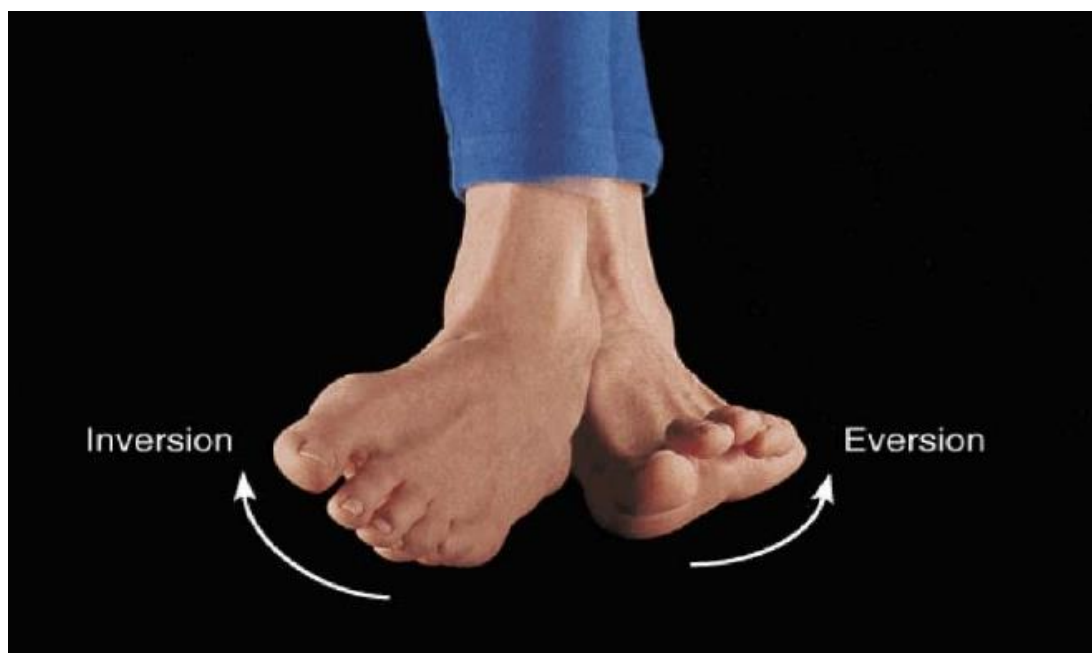


Fig. 10: INVERSION AND EVERSION AT SUBTALAR JOINT

Normal Movements of Ankle Joint:

Sl. No.	Movements	Range of Movements in degree	Muscle Acting	Nerve supply
1	Dorsiflexion	20-25	Tibialis anterior External digitorum longus External hallucis longus Peroneus tertius	Deep peroneal nerve
2	Plantarflexion	35-50	Tibialis posterior Flexor hallucis longus Flexor digitorum longus	Tibial neve
3	Inversion	0-35	Tibialis anterior Tibialis posterior	Deep peroneal nerve Tibial nerve
4	Eversion	0-35	Peroneus longus Peroneus brevis	Superficial peroneal nerve

BIOMECHANICS:²⁵

Normal motion of the ankle joint is predominantly in the sagittal plane, but it involves variable degrees of rotation around the vertical and longitudinal axes.

According to Inman, the lateral malleolus is located 8 mm anteriorly, and the medial malleolus is located 5 mm distal along the empiric axis of the ankle joint. The ankle joint actually has a continuously shifting axis of rotation, despite the fact that the idea of a single axis may be useful for maximizing the location of a single-axis external fixator. The axis is tilted downward and laterally during dorsiflexion and downward and medially during plantar flexion. The varying talar dome trochlea outlines, both medial and lateral, provide an explanation for the shifting axes of rotation. The fibula rotates externally and moves laterally during ankle dorsiflexion, increasing the intermalleolar distance by around 1.5 mm. This motion is coordinated with the talus's

lateral rotation and is governed by the talus's corresponding wedge-shaped profile within the mortise.

The syndesmosis firmly joins the tibia and fibula. It assists in preserving the talus's rotational stability in the ankle mortise and allows it to adopt a closely packed position with dorsiflexion during the gait stance phase, in conjunction with the deltoid ligament. In stance, articular congruity appears to be the primary source of ankle joint stability.

MECHANISM OF INJURY:

Strong rotational or mostly axial loading forces are the cause of the ankle fractures.²⁵ Rotational forces are the primary cause of malleolar fractures, while axial loading is mostly responsible for tibial plafond fractures.

In addition to frequently affecting other ankle bones, the lateral or medial malleolus is the primary site of malleolar fractures. They are produced indirectly by tensile and shearing pressures applied through the talus. The majority of malleolar fractures happen when the talus or any other part of the body is weighted down by the earth.²⁵

The foot's position at the time of injury—supination or pronation—as well as the deforming force—external rotation, abduction, or adduction—determines the type of malleolar fracture that takes place.^{26, 25} Rotation in the transverse plane causes the tibia to rotate relative to the talus, or it can rotate in the coronal plane, producing talar adduction or abduction relative to the tibia, creating a relative bending moment, we call these ailments “external rotation injuries”.²⁶

The first step is important because it determines which structures are the strongest and, thus, most likely to be damaged first. When the foot is pronated and the

deltoid ligament is stiff, a medial malleolar fracture or a disruption of the ligament happens. That is the first harm. The two most common types of injuries are SER and PER.²⁶

The supination-external rotation injury begins in the ankle's anterolateral corner. The structures that are injured in that sequence are the tibiofibular ligament (stage 1), lateral malleolus (stage 2), posterolateral side of the capsule, or the posterior malleolus (stage 3), and medial malleolus, or the deltoid ligament (stage 4).²⁵

The first stage of a pronation-external rotation injury is a deltoid ligament or medial malleolus injury. This injury begins on the medial side of the ankle and progresses around it to the anterolateral ligaments (stage 2), lateral malleolus or proximal part of the fibula (stage 3), and posterolateral ligaments or posterior malleolus (stage 4).²⁵

Supination adduction produces a transverse fracture below the syndesmosis level when the foot supinates and the lateral structures tighten. This can happen if the supination and adduction forces are prolonged and cause some of the lateral collateral ligaments to rupture or avulse from their bony attachment sites on the distal fibula. The medial malleolus suffers a vertical fracture as a result of further adduction pushing the talus onto the medial side of the joint, and the medial articular surface of the tibia may occasionally sustain an impaction fracture.

First to be harmed in pronation abduction are the medial tissues, which tighten. Either the deltoid ligament has ruptured or the medial malleolus has suffered an avulsion fracture. The syndesmotic ligaments are then either torn or their bony attachment sites are avulsed by the abduction force. The fibula fractures at or below the syndesmosis when the talus exerts continuous lateral stress, rupturing the

interosseous membrane up to the point of fracture. This fracture has a butterfly fragment or lateral comminution and might be transverse or oblique.

Ankle mortise injuries to the syndesmotic ligaments can be caused by the talus's external rotation or abduction. PER, PAB, and sporadically SER injuries (type-C and certain type-B injuries) are the most common conditions associated with this mechanism.²⁵

The sequence of wounded structure grows in a predictable manner with increasing force for a particular foot position and direction of the deforming force. Nevertheless, it's crucial to understand that the direction of deforming force in abduction and adduction fractures is translational as opposed to rotational. An abduction fracture occurs in the pronated feet and an adduction fracture in the supinated feet.²⁵

There are exceptions to the rule, and there could be more than one likely cause or an unusual mechanism for a particular injury pattern. It's also possible that multiple force vectors interact to cause the injury. If there was axial loading on the joint at the time of the injury, this could lead to varied impaction of the weight-bearing plateau. Large anterior lip fractures, posterior lip fractures, and transitional malleolar injuries with notable accompanying metaphyseal components appear to be mostly caused by this.²⁵

CLASSIFICATION:

Several different classification systems of ankle injuries exists, but those in current use are

- Anatomical types,
- Lauge – Hansen’s system,
- Danis-Weber system,

ANATOMICAL CLASSIFICATION:

A common way to characterize rotational ankle fractures is to look for malleolar fracture lines that involve the posterior, lateral, or medial malleoli, or more than one of these.²⁵

Mono-malleolar, bimalleolar, and tri-malleolar fractures are the three types of ankle fractures that may be distinguished only by anatomy. This is a widely used, simple descriptive system.²⁷

LAUGE-HANSEN’S SYSTEM:

Based on cadaveric research, this system identified four main patterns that were further separated into multiple stages by taking into consideration the foot's posture and the direction of the deforming force at the moment of damage.¹ In this categorization, the foot's position at the time of damage is represented by the first word, and the direction of the injurious force is represented by the second term.

LAUGE – HANSEN(L-H) CLASSIFICATION.

SUPINATION-ADDUCTION (SAD)

Medial displacement of talus occurred only in this type.

- Stage I - Transverse avulsion fracture of fibula distal to joint
- Stage II - stage I + vertical medial malleolus fracture

SUPINATION – EXTERNAL ROTATION (SER)

- Stage I - Disruption of anterior inferior tibiofibular ligament or avulsion of bone fragment from tibia or fibula.
- Stage II - stage I + short stable oblique fracture of distal fibula.
- Stage III - stage II + disruption of posterior inferior tibiofibular Ligament or posterior malleolus fracture.
- Stage IV - stage III + transverse medial malleolus fracture or Rupture of deltoid ligament.

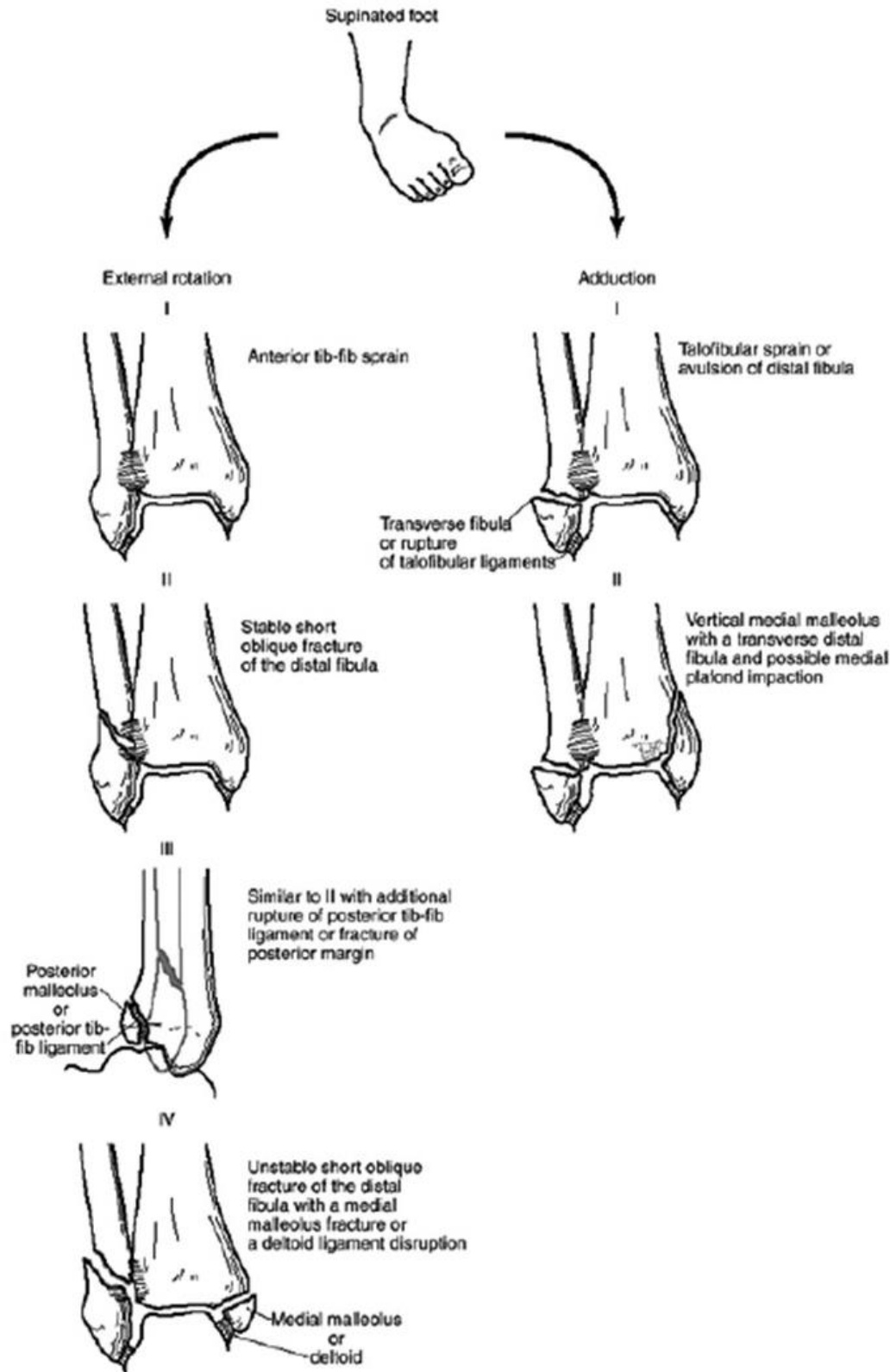


Fig. 11: SUPINATION INJURY OF ANKLE

PRONATION – ABDUCTION (PAB)

- Stage I - Transverse fracture of medial malleolus or rupture of deltoid ligament.
- Stage II - stage I + rupture of syndesmotic ligaments.
- Stage III - stage II + transverse or short oblique or laterally Communitied fibula fracture at or above the level of Joint.

PRONATION – EXTERNAL ROTATION (PER)

- Stage I - Transverse fracture of medial malleolus or rupture of deltoid ligament.
- Stage II - stage I + Disruption of anterior inferior tibiofibular ligament.
- Stage III - stage II + spiral fracture of fibula at or above the level of syndesmosis.
- Stage IV - stage III + disruption of posterior inferior tibiofibular Ligament or posterior malleolus fracture.

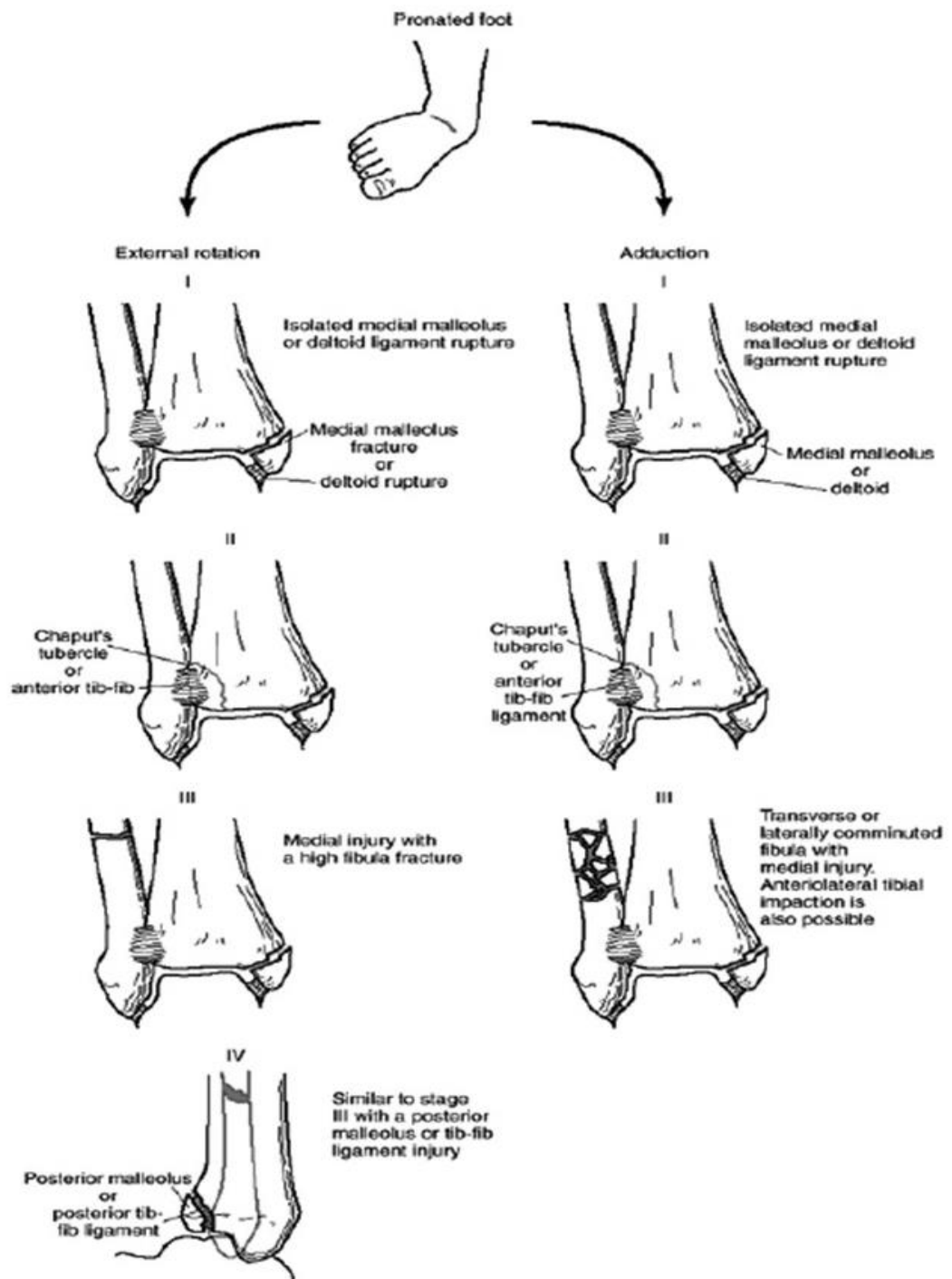


Fig. 12: PRONATION INJURY OF ANKLE

DANIS – WEBER CLASSIFICATION.

The degree of fibula fracture is the basis for this classification. The AO classification adds ligamentous injuries and medial side fractures to the Danis - Weber classification.^{28,29}

TYPE A: Infra-syndesmotic lesion

- A1. Isolated infra-syndesmotic lesion
- A2. A1 + medial malleolus fracture
- A3. A2 + posteromedial fracture.

In this syndesmotic ligamentous complex is always intact.

TYPE B: Trans-syndesmotic lesion

- B1. Isolated trans-syndesmotic fibular lesion.
- B2. B1 + medial lesion.
- B3. B2 + Volkmann's lesion.

The medial lesion includes a medial malleolus fracture, an anterior syndesmosis rupture, or a medial collateral ligament injury. The Volkmann's lesion is a fracture of the posterolateral aspect of the distal tibia. The interosseous membrane, as a rule, is intact.

TYPE C: Supra-syndesmotic lesion

- C1. Simple supra-syndesmotic lesion associated with or Without medial lesion and Volkmann's lesion.
- C2. Multi fragmentary diaphyseal fibula fracture. Other associated injuries like C1 are present.

-
- C3. Proximal fibula fracture with disruption of syndesmotic Ligament complex and interosseous membrane at least to the level of fibula fracture.

The severity of injury progressively increases from type A to type C

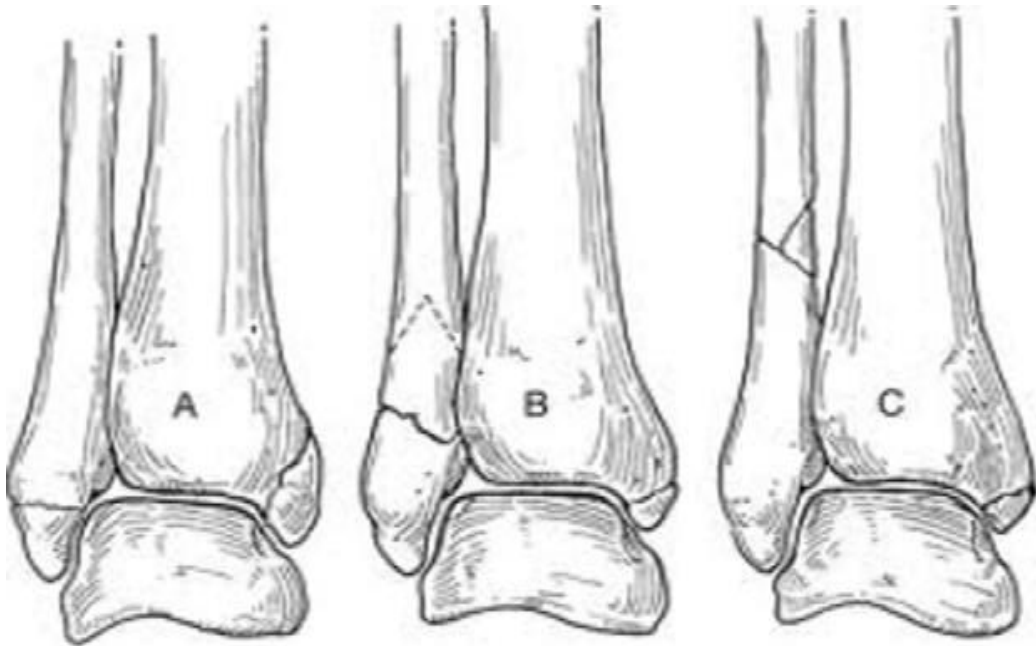


Fig. 13: DANIS WEBER CLASSIFICATION

MANAGEMENT

DIAGNOSIS:

History: Ankle fractures are typically caused by low-energy rotational stresses seen in sports or a slip during regular activities.

Only rarely is the mechanism of injury explained in a way that offers a clear picture of the direction and strength of the applied force as well as a helpful hint at the diagnosis. However, even with the use of mechanistic categories, the patient is rarely fully aware of the foot's position or the force that is deforming; instead, this information is best obtained via the x-rays.²⁵

It is also crucial to consider the leg's condition prior to the current injury. It is important to look for signs of vascular illness, venous stasis ulcers, claudication, neurological difficulties (diabetes mellitus), or chronic infection.²⁵

It is evident that systemic sickness affects both general management and, frequently, the choice of local treatment. Smokers are more likely to experience issues with fractures and wound healing. A person with limited weight bearing may not be able to cooperate if they are an alcoholic. Walking with crutches or a cast may be too much energy for a patient with cardiorespiratory disease.²⁵

PHYSICAL EXAMINATION:

The condition of the bones, ligaments, soft tissues, and neurovascular structures must all be determined by a thorough examination. It is important to check the lower leg as a whole, including the fibula.

A circumferential examination of the ankle is necessary to look for bone deformities, crushed, abraded, or swollen areas, and open or developing wounds. The

dorsalis pedis and posterior tibial pulses must be palpated as part of the vascular examination; any oedema or deformity may make this difficult.

Assessing the nerves that cross the ankle involves testing each sensory location for mild touch and pain perception. The saphenous nerve innervates the medial edge of the foot. The deep peroneal nerve is located in the dorsal webspace between the great and second toes. Most of the dorsum of the foot is sensed by the superficial peroneal nerve. The lateral heel and the lateral edge of the foot are supplied by the sural nerve. The lateral and medial plantar nerves, which are branches of the tibial nerve, innervate the sole. The Dorsiflexion and Plantar flexion of the toes are the only movements examined during the initial motor assessment; however, they should be precisely documented and graded.

Even if it could be challenging to evaluate, it is necessary to examine the function of the tendons that cross the ankle and then review it later, when a more comprehensive examination is possible. The Achilles tendon is examined using Thompson's test and by palpating it for tenderness or defect.

If a clear injury is found based on a physical examination or radiography, deferring examinations for stability and range of motion is advised. The average range of motion is between 30 and 45 degrees in plantar flexion and dorsiflexion, respectively. When assessing the ankle's range of motion, it is important to note that the tarsal and tarsometatarsal joints show a very high degree of dorsiflexion and plantar flexion. As Segal proposed, measuring the angle formed between the tibia and the foot's weight-bearing surface when the patient is performing maximum dorsiflexion yields a more accurate estimate of real ankle mobility. The angle created by the tibia and the heel's plantar surface alone is used to quantify plantar flexion. By calculating the angle between the leg and the surface the foot sits on, tibiotalar motion

can be distinguished more readily from that of more distal joints. Ankle motion is closely linked to inversion and eversion, so these should also be evaluated.²⁵

Acute stress testing is frequently challenging, necessitating the use of local or regional anaesthesia as well as analgesic premedication.

RADIOLOGICAL EXAMINATION:

Ankle normal radiography evaluation includes the AP, lateral, and 15-degree internal rotation (mortise) views. The antero-posterior x-ray is a very useful tool for determining the medial or lateral tilt, tibiofibular overlap, and tibiofibular clean space of the talus when the foot is tilted in the long axis.³⁰

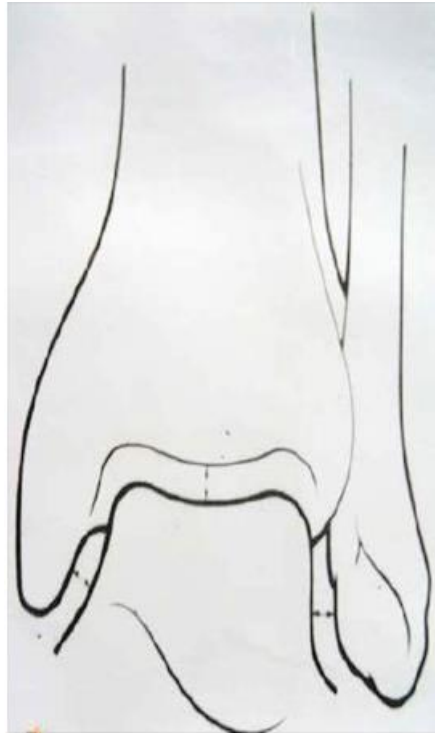
The talus dome should be centralized and aligned with the tibial plafond in the lateral x-ray. This view can be used to show fibula external rotation fractures, posterior tibial tuberosity fractures, and anteroposterior shift and avulsion fractures of the talus.

The foot is positioned on the table with the fifth metatarsal in approximately 15 degrees of internal rotation to get the anteroposterior projection in the mortise view. The assessment of talar displacement, talocrural angle, tibiofibular overlap, and medial clean space can all be done with this view.

RADIOLOGICAL ASSESSMENT OF REDUCTION:

1. Measurement of the clear space

The gap between the opposing articular surface of the talus and the inner surfaces of the medial and lateral malleolus is known as the clear space. Anteroposterior views provide a clearer image of the medial clear space, which is generally uniformly wide throughout. Typically, less than 2 mm is acceptable.



Medial, lateral and superior joint space of equal width

Fig. 14(a): ASSESSMENT OF REDUCTION

2. Assessment of talar shift

A vertical line drawn through the middle of the tibia should pass through the center of the talus when seen anteroposterior. If this line does not cross the talus center, the talus is moved medially or laterally. Lateral talar displacement is indicated by a medial clear gap greater than 5 mm. A vertical line drawn through the most superior portion of the talus dome in lateral view should cross the middle of the tibia. If not, there has been an anterior or posterior shift.

3. Assessment of talar tilt

The talar tilt is assessed by measuring the superior joint space on the medial and lateral borders of the joint. More than 2mm indicates talar tilt.

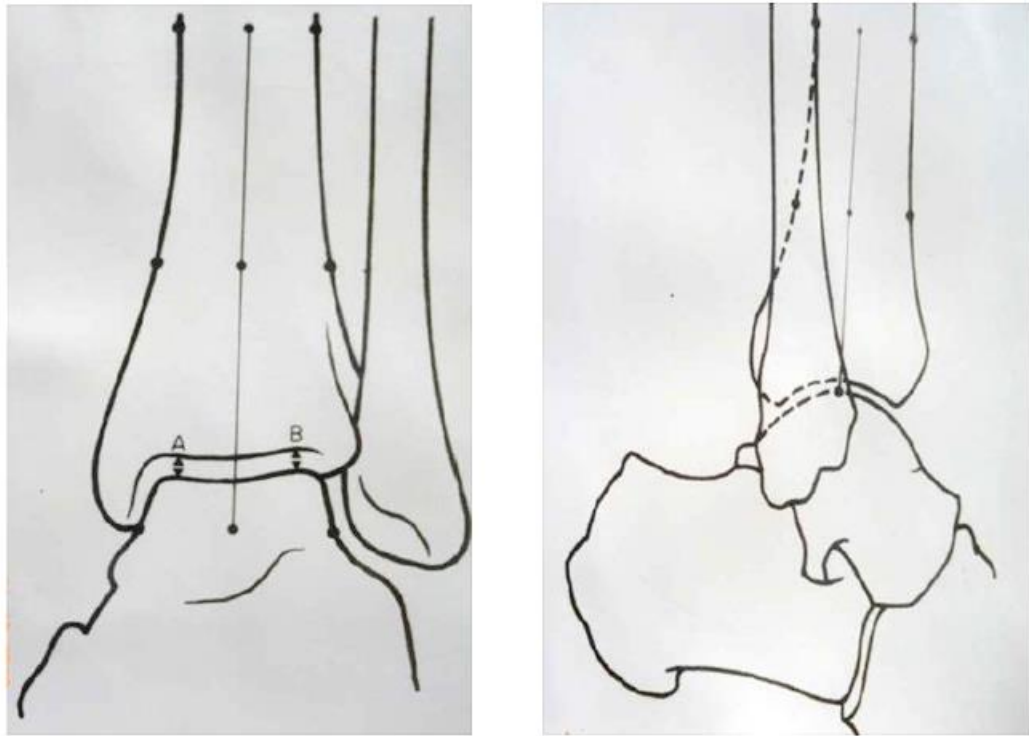


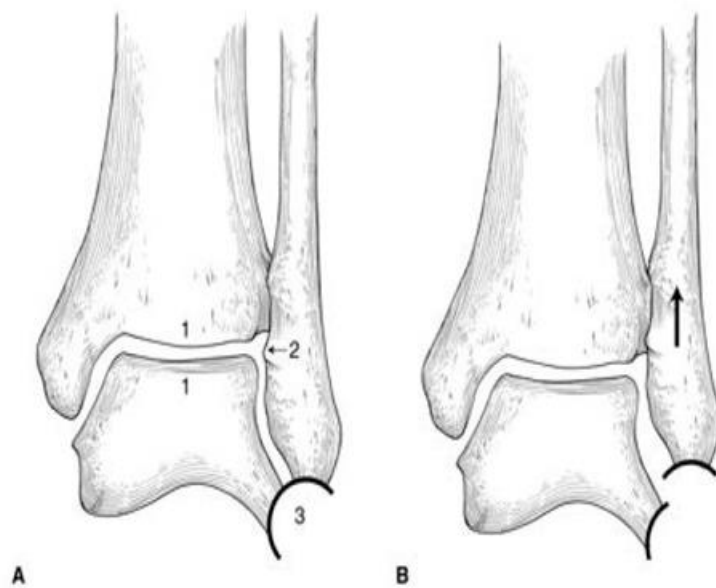
Fig 14(b): ASSESSMENT OF REDUCTION

4. Assessment of fibular length

Drawing the ankle's Shenton's line can be used to determine the fibular length.²⁷ The tibia's dense subchondral bone can be tracked across the syndesmotic gap to the fibula in mortise view, where a tiny spike is visible. Exactly at the level of the tibial subchondral bow, the spike points. Shenton's line is broken in fibular shortening. When the fibula appears out of length on an AP radiograph, the dime sign is an unbroken curve that connects the distal point of the fibula and the lateral process of the talus.^{31,32,7} Dime sign is absent in a fracture when the fibula is mal-reduced.

The angle formed by the tibial plafond's perpendicular line and the intermalleolar line is known as the talocrural angle. An $83^{\circ} \pm 4^{\circ}$ range is typical. This angle needs to be between 20 and 30 degrees from the uninjured ankle.

Since the patient is immobilized in a cast, it is challenging to define the boundaries of the bones. We require high-quality radiographs for all of these measurements.



A-Normal, B-Break in Shenton's line and Dime sign
Fig. 15(a): ASSESSMENT OF FIBULAR LENGTH

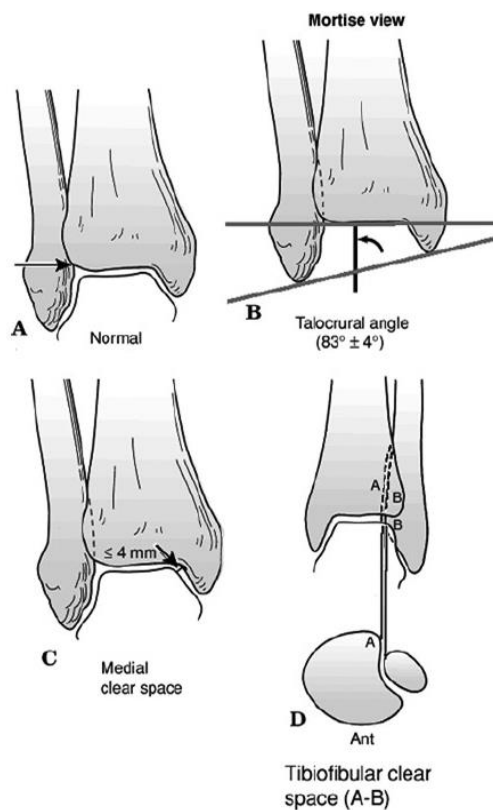


Fig. 15(b): ASSESSMENT OF FIBULAR LENGTH

TREATMENT

Achieving an anatomical reduction, maintaining it until the fracture heals, and getting the patient back to their pre-injury level of function with a painless, movable ankle are the objectives of treatment.²⁵

The degree of restoration of the ankle's anatomy directly correlates with the result. Over the past few years, there have been changes in the indications for both non-operational and operative treatment.²⁵

Non-operative treatment:

For un-displaced or stable fractures, non-operative treatment is recommended. For displaced fractures, surgical treatment is required for individuals who are not surgical candidates or when an anatomical reduction is achieved and sustained.²⁶

In cases of stable fractures, open reduction and internal fixation are employed, while closed reduction is used in cases of instability. When physiological stress is applied, a stable fracture is one that remains in place, unlike an unstable fracture. The stability of a fractured ankle is defined as its ability to sustain stress without displacing.

A thorough comprehension of the injury process and an evaluation of the damage's intrinsic stability are necessary for a successful closure reduction. Reversing the process of injury that resulted in the displacement and fracture pattern visible on the first radiographs is typically the best way to accomplish closed reduction. Instead of applying pressure directly to the malleoli, talus reduction pulls the malleoli back into alignment and preserves alignment.

- SAD fracture is reduced by abducting (everting) the hind foot.
- External rotation fractures at that level of the syndesmosis are reduced by gentle distraction, internal rotation and varus stress.

-
- PAB fractures are reduced by distraction and adduction.

The talus is moved medially or laterally from its natural location by at least 2 mm in unstable fractures. PER, abduction-external rotation, and syndesmotic disruption fractures are typically unstable and frequently require surgical stabilization.

To maintain reduction, proper moulding and casting techniques are crucial. Careful moulding and three-point attachment are crucial. For four to six weeks, stable or un-displaced ankle fractures can be treated with a functional fracture brace or a short-leg cast,

It could be challenging to accomplish or maintain a closed manipulation in some fracture patterns. Anatomically, a closed manipulation seldom diminishes the lateral malleolus, even if it frequently restores the talo-tibial connection. The lateral malleolus is unlikely to maintain the precise alignment of the talus when the cast is removed and normal weight bearing is restored due to the likelihood of partial shortening or malrotation. Repeated interventions and loss of reduction have been linked to inadequate outcomes. Osteoporosis and joint stiffness can also result from prolonged immobilization. As a result, open reduction and internal fixation are typically recommended.

Operative treatment:

The purpose of surgical treatment is to cure the fracture and restore normal function by achieving an anatomical reduction sustained by stable fixation. This objective is more important for young, healthy, and energetic people because minor anatomical alignment abnormalities are tolerated in older patients.²⁵

The operational approach is now the preferred treatment for all complicated and unstable ankle fractures. It provides the best chance for the best outcomes. Additional indications are :²⁵

- The inability to perform a closed reduction,
- Displaced or unstable fractures causing the talus to move or the mortise to enlarge by more than 1 to 2 mm,
- In open fractures.

As soon as possible, surgery is performed to prevent skin issues and subsequent swelling. It is advisable to undergo surgery either before or after the initial swelling has subsided, as ankle oedema can reach its maximum level within 1 to 7 days. Surgery should wait until the skin has healed if there has been a major soft tissue injury with noticeable swelling and blisters, as this is linked to a lower chance of anatomic reduction and worse outcomes.

The lateral side is treated before the medial side since the reconstruction of the fibula is prioritized. Sometimes, especially in severe fractures with comminution and discontinuity of the fibula, it may be required to treat the medial side first.²⁵

General Principles:

The lateral side is treated before the medial side because the repair of the fibula is given priority. Occasionally, treating the medial side first may be necessary, especially in cases of severe fractures with comminution and discontinuity of the fibula. Reduction and fixation on the lateral side have high importance since they are crucial to restoring the fibula's length.³³ Soft tissue interposition on the medial side might occasionally obstruct the anatomical reduction of the fibula. In such circumstances, the medial malleolus needs to be shortened and exposed prior to the fibula's complete fixation. Any little fracture fragments need to be extracted and the

joint surface examined. After reduction, K-wire or pointed reduction holding forceps can be used to temporarily stabilize fracture pieces.⁵ After that, the final fixing is completed. Fixation of the fibula requires the use of a well-contoured plate. The fibula's valgus bend is between 10^0 and 15^0 and is located around 3.5 cm above the tip of the lateral malleolus. The plate must be bent appropriately. To determine the precise valgus tilt of the fibula, an X-ray of the opposite ankle will be useful.

SURGICAL APPROACHES & FRACTURE FIXATION:

I. Lateral malleolus:

Since the displaced lateral malleolus fracture plays a vital role in maintaining tibiotalar alignment, the safe anatomic repair of this fracture is one of the most important stages in the operational management of a malleolar fracture.

Approach: Traditionally, a direct lateral approach over the fibula was used to reduce and stabilize distal fibula fractures internally. The dissection plane was located between the peroneus longus and brevis posteriorly and the peroneus tertius anteriorly. When fixing the anterior syndesmosis or a part of a Chaput's tubercle from the tibia's anterolateral corner, the normal lateral incision is shifted somewhat anterior.^{25,30}

Reduction and fracture fixation:^{25,30}

1. When fixing AO/OTA type B fractures, one or two lag screws or rush pin are positioned perpendicular to the fracture's line. Lag screws were used exclusively to treat an oblique fracture.
2. One-third of the tubular plate was shaped to meet the concave, slightly spiralling lateral side of the fibula, resulting in a more secure fixation. To

strengthen the fixation, the fracture site was compressed using an anterior proximal to posterior distal interfragmentary lag screw.

3. A one-third tubular plate was used to minimize and fix fractures above the syndesmosis. The level of the fracture determined the plate's position. The state of the soft tissues covering them and the degree of comminution.

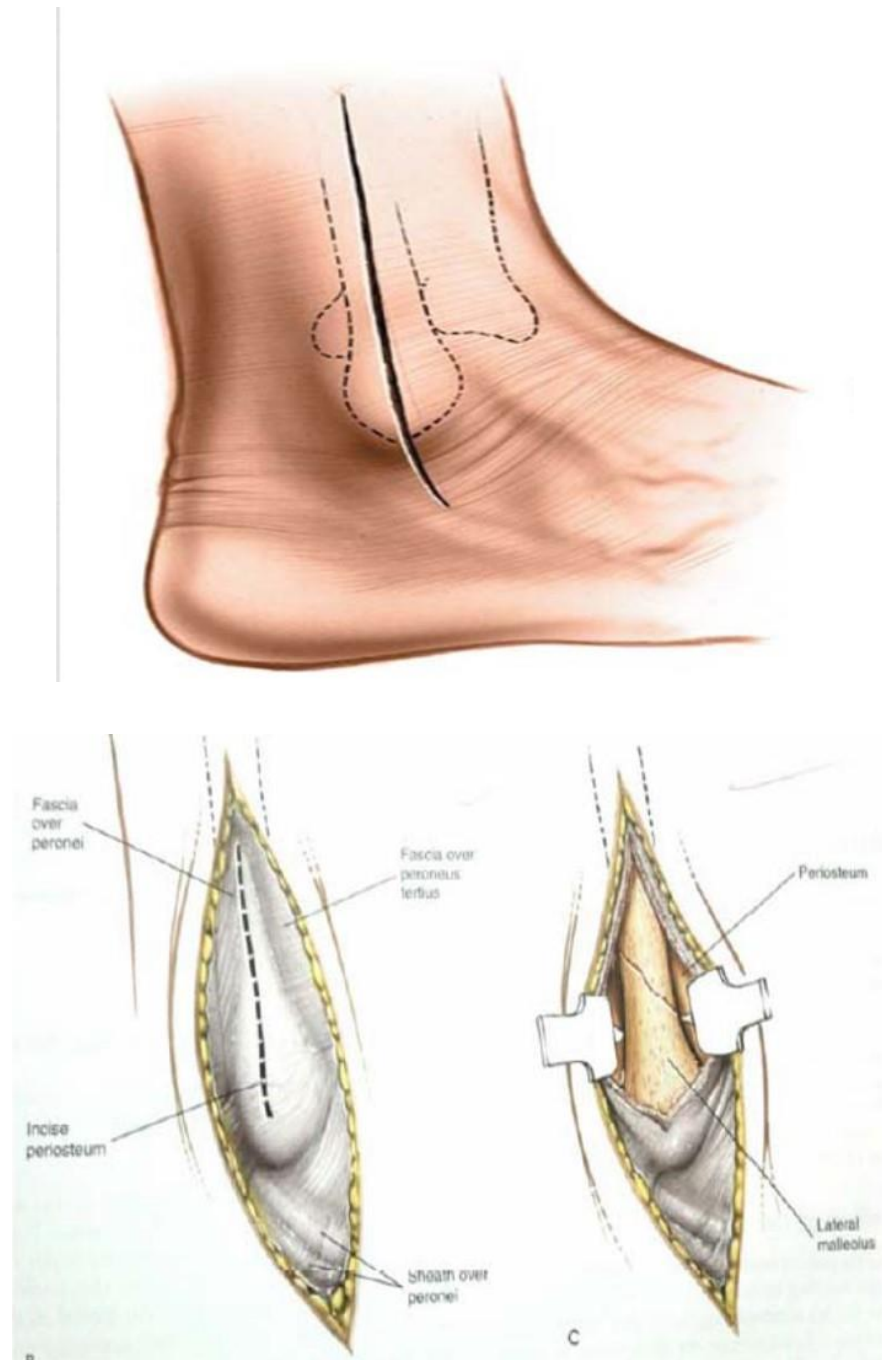


Fig. 16: APPROACH TO LATERAL MALLEOLUS

II. Medial Malleolar Fixation:

Approach: The medial malleolus, which is the focal point of the medial approach to the ankle, can be moved anteriorly to provide greater access to the joint or posteriorly to reveal the back of the tibia. Depending on how much exposure was required, a longitudinal or curvilinear incision was made.^{25,27}

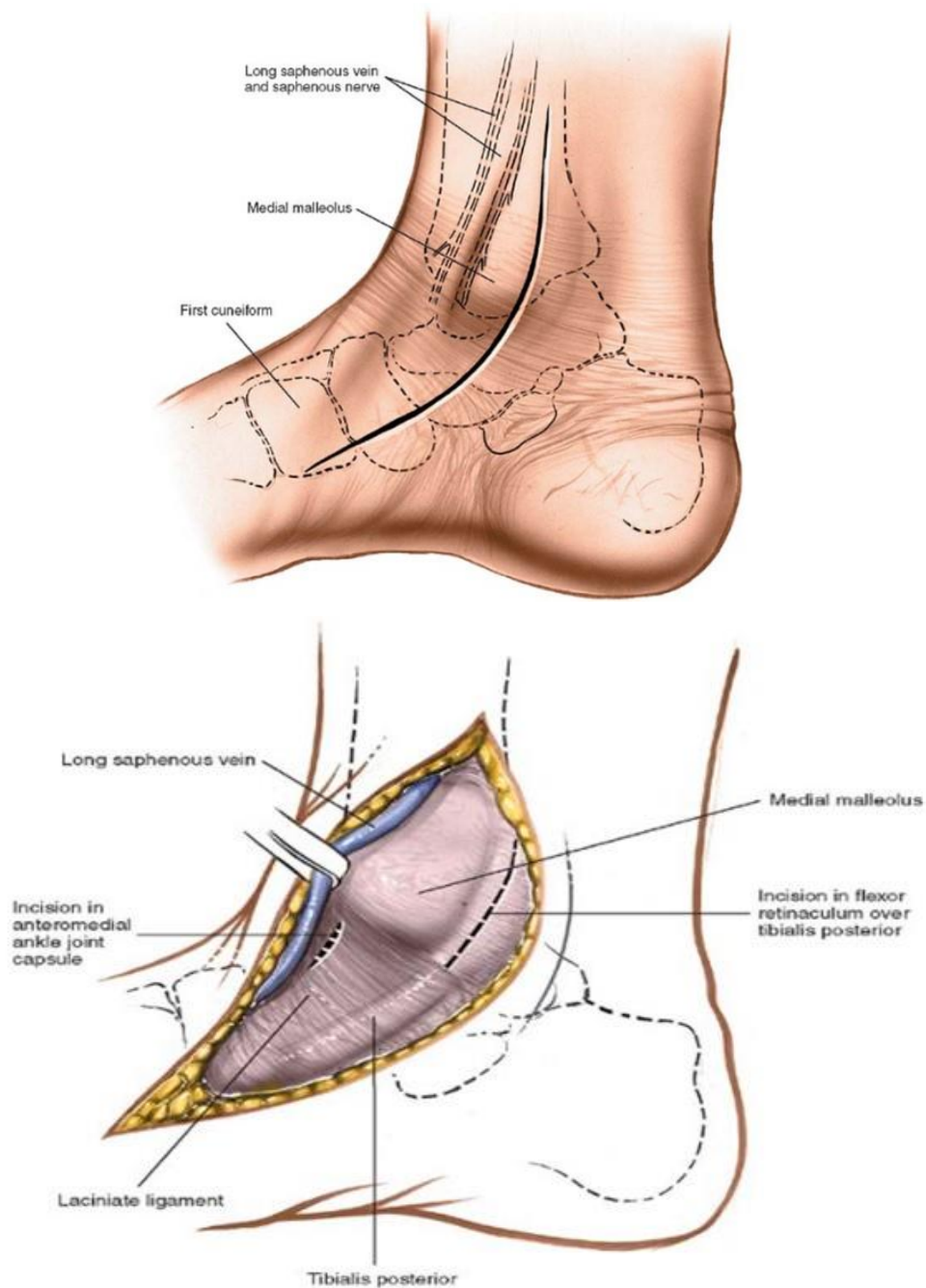


Fig. 17: APPROACH TO MEDIAL MALLEOLUS

Fracture fixation²⁵:

1. The best way to decrease medial malleolus avulsion fractures was to pull back the periosteum and associated fascia aggressively, exposing the anterior and medial sides of the fracture.
2. One K wire and a 2.0 mm or 2.5 mm drill bit were used to create a hole for a 4.0 mm partially threaded malleolar screw or cancellous screw for intermediate-sized fragments.
3. When it comes to larger fragments, two of these drills are employed for temporary fixing and are swapped out one at a time with partially threaded 4.0mm screws. Their threads must be positioned perpendicular to the fracture plane, and they must not cross the fracture to produce a lag effect.

Choice of Fixation:

1. Internal fixation of malleolar fractures is primarily accomplished with small fragment plates and screws, usually one-third semi-tubular plates with partially and fully threaded 3.5mm and 4mm screws. In rare instances, larger 3.5-mm reconstructive or Dynamic compression plates are needed for patients that are significantly complicated or to treat fibular malunion. The syndesmosis is transfixed using 4.5mm fully threaded cortical screws. Due to the fibula's lower rotational control and the inability to apply supplementary screw fixation for the syndesmosis, the use of intramedullary implants has been limited.
2. Ankle fracture implants made of bioabsorbable materials are the subject of much research. Potential benefits include avoiding the need to remove

hardware, lessening irritation from visible screws and plates, and enabling a progressive transfer of stress from the implant to the bone.

Complications:

The three main areas of concern for ankle injury sequelae are soft tissue issues, malunion, swelling, infection, and arthrosis (osteoarthritis).

Malunion:

A closed reduction that is insufficient or absent can result in the malunion of an ankle fracture. In cases where reduction is insufficient and not identified, or if fixation fails and malalignment results, ORIF may be followed. When a single point of fixation is employed, rotation may happen. The medial malleolus may shrink or rotate as a result of unrecognized communication, and the articular surface may not heal. According to reports, fibula malrotation and shortening are the most common types of ankle malunions. This can be the result of a bone quality issue or an uncooperative. Severe injuries involving bone loss, comminution, impaction, and obscured reduction land markings enhance the chance of insufficient reduction of an ankle fracture by a large margin. Degenerative changes, loss of joint function, and persistent symptoms can result from malunion of the bone or ligament and incongruity of the articular surface, which can also cause instability of the mortise.²⁵

Non union:

Most non-unions include the medial malleolus. Often treated closed at first, these are avulsion injuries that fail to join because of soft tissue obstructing the fracture, residual fracture displacement, or associated lateral instability that pulls on the fracture and creates shearing stresses from the deltoid ligament. It is rare for the lateral or posterior malleoli to not unite. If the bone is severely comminuted or

devitalized, the reduction is insufficient, or the fixation is insufficient, non-union may result from surgical treatment.²⁵

Wound Problems and Infection:

Approximately 3% of individuals experience marginal necrosis of the skin's margins following surgery. After internal repair, the open ankle fracture is most susceptible to infection. Paying close attention to the technical details of internal fixation and the manipulation of soft tissues can reduce the risk of infection.

Arthritis:

A shortened and malaligned lateral malleolus that permits the talus to shift laterally, extensive cartilage destruction at the moment of injury, or a combination of these variables can all lead to a painful arthrosis following an ankle fracture. The development of degenerative alterations is not completely stopped by anatomic reduction because blunt injuries to the articular surfaces cannot be repaired. The more severe the injury, the higher the chance of developing arthritis. Additionally, elderly patients showed a higher incidence, particularly in women who had osteoporosis. Taking into account the frequency of ankle ligament and bone injuries, the incidence of degenerative ankle disease is very low.²⁵

MATERIALS &

METHODS

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METHODOLOGY

Individuals who meet the inclusion criteria and are admitted to the orthopaedics department between September 2022 and December 2023 will be part of the study. They will undergo follow-up from the time of admission for at least six months after surgery.

- **Study Design:** A Cross Section Study.
- **Study Period:** September 2022 to December 2023
- **Statistical analysis:** MS-EXCEL and IBM-SPSS version 26
- **Sample size:** 30 patients

Sample size estimation: Based on the study done by Singh G *et al.*,²² p was taken as 77. Assuming an alpha error of 5% (95% confidence limit) and an absolute precision (d) of 20%, the minimum required sample size to assess post-surgery “Functional outcome of open reduction and internal fixation in bimalleolar fracture of ankle” patients was estimated to be 30.

The sample size was derived from the following formula:

$$\text{Sample size (n)} = \frac{Z^2(P*Q)}{d^2}$$

Where

Z is the critical value for 95% Confidence Interval.

D is the absolute precision.

P is the prevalence and q=1-p. = sample size 30

INCLUSION CRITERIA:

- Age group >18 years.
- Diagnosed with a closed bimalleolar fractures of ankle joint.

-
- Open type 1 (Gustilo – Anderson).

EXCLUSION CRITERIA:

- Open fracture type 2 ,3 (Gustilo – Anderson).
- Patient having compound injuries or having tibial pilon or trimalleolar fracture.
- Minimally displaced mono malleolar fracture.
- Unwillingness to participate in the study.

Before being enrolled in the study, all patients were informed about its objectives and the procedures that would be followed. A formal consent form was also acquired from each patient. A thorough history was taken from the patient and/or any witnesses upon admission in order to determine the extent of the trauma and the mechanism of harm. After that, a thorough survey was conducted to rule out any serious injuries, and the patients had a clinical assessment to determine their overall status. A thorough examination was performed to exclude fractures at further locations. Examining the injured ankle locally and looking for any subsequent clinical symptoms.

Inspection: Swelling of the ankle, any deformity, skin condition.

Palpation: Palpation of the ankle's skeletal components—the malleolar sections and the lower extremities of the tibia and fibula—looked for abnormal, uncomfortable mobility, displacements, and crepitus. The malleoli's relationship to one another was also observed. Pulsations from the Dorsalis pedis artery and Posterior tibial artery were monitored and recorded. Examined and noted the distal neuronal condition as well. Plain radiographs in the mortise, anteroposterior and lateral views were used to

assess ankle fractures. Using the Lauge–Hansen, the fractures were categorized. A below-knee POP slab applied and closed reduction were achieved.

Standard investigations were conducted. As soon as the patients' general condition stabilized and they were deemed surgical candidates, they were scheduled for surgery. The following were the standard investigations: Blood urea, Serum creatinine, RBS, Hb%, HIV, HBsAg, ECG, and urine for sugar.

Preoperative Preparation of Patients:

Patients were prepared as per the anaesthetist's orders; tetanus toxoid injection and lignocaine test doses were given the day before surgery, and an adequate amount of blood was arranged according to requirements. A written and informed consent for surgery was obtained.

Operative Technique:

The patient was positioned in a supine position and given either spinal or epidural anaesthesia. In every instance, a pneumatic tourniquet was used. Because the treatment was carried out in a bloodless environment, it was easier to define the fracture pattern and allow anatomical reduction

Post – Operative Protocol:

Hospital practice dictated the administration of parenteral antibiotics for seven days during the post-operative period. The sutures were taken out after 14 days, and a below-the-knee slab was put in for 4 weeks. Beginning on the first or second postoperative day, a non-weight-bearing gait was implemented. Following the removal of the slab, partial weight bearing was initiated (when clinical and radiographic symptoms of union were visible). It was recommended to perform active ankle exercises.

For a minimum of six months, case follow-up was conducted at regular intervals of six weeks. Every patient was asked questions regarding pain, analgesic use, stiffness, oedema, activities of daily living, walking assistance use, return to work, and sports participation at each assessment. During the examination, the ankle's range of motion, oedema, and discomfort were assessed. Anteroposterior and lateral radiographs of the ankle were obtained during the examination. The study made use of the subjective, objective, and radiographic criteria found in Baird and Jackson's ankle grading system. After each patient received an evaluation, scores were assigned.

STATISTICAL ANALYSIS:

MS-EXCEL was used to enter the data, while IBM-SPSS 26 was used for analysis. Frequency and percentages were utilized in the analysis of qualitative data. The standard deviation and mean were used to examine quantitative data. A p-value of less than 0.05 was considered statistically significant. The association was examined using the proper statistical techniques. Tables and graphs were used in the data presentation.

Baird and Jackson's Scoring System:

Scoring system for subjective, objective and radiographic criteria:

I. Pain:

- A. No Pain - 15
- B. Mild pain with strenuous activity - 12
- C. Mild pain with activities of daily living - 8
- D. Pain on weight bearing - 4
- E. Pain at rest - 0

II. Stability of ankle:

- A. No clinical instability - 15
- B. Instability with sports activities - 5
- C. Instability with activities of daily living to walk - 0

III. Ability to walk:

- A. Able to walk desired distances without limp or pain - 15
- B. Able to walk desired distances with mild limp or pain - 12
- C. Moderately restricted in ability to walk - 8
- D. Able to walk short distances only - 4
- E. Unable to walk - 0

IV. Ability to run:

- A. Able to run desired distances without pain - 10
- B. Able to run desired distances with slight pain - 8
- C. Moderate restriction in ability to run, with mild pain - 6
- D. Able to run short distances only - 3
- E. Unable to run - 0

V. Ability to work:

- A. Able to perform usual occupation without restrictions - 10
- B. Able to perform usual occupation with restrictions in some strenuous activities - 8.
- C. Able to perform usual occupation with substantial restrictions - 6.
- D. Partially disabled; selected jobs only - 3
- E. Unable to work 0

VI. Motion of the ankle:

- A. Within 100 of uninjured ankle - 10
- B. Within 150 of uninjured ankle - 7
- C. Within 200 of uninjured ankle - 4
- D. < 50% of uninjured ankle, or dorsiflexion < 50 - 0

VII. Radiographic result:

- A. Anatomic with intact mortise (normal medial clear space, normal superior joint space, no talar tilt) - 25
- B. Same as A with mild reactive changes at the joint margins - 15
- C. Measurable narrowing of superior joint space, with superior joint space >2mm, or talar tilt >2mm – 10
- D. Moderate narrowing of the superior joint space, with superior joint between 2 and 1 mm – 5
- E. Severe narrowing of the superior joint space, with superior joint space <1mm, widening of the medial clear space, severe reactive change - 0

INSTRUMENTS



SURGICAL PROCEDURE



MEDIAL MALLEOLUS



LATERAL MALLEOLUS

CASES

Case 2 :



PRE.OP



POST.OP



12 WEEKS

Case 9:



PRE.OP



POST.OP



18WEEKS

Case 20:



PRE.OP

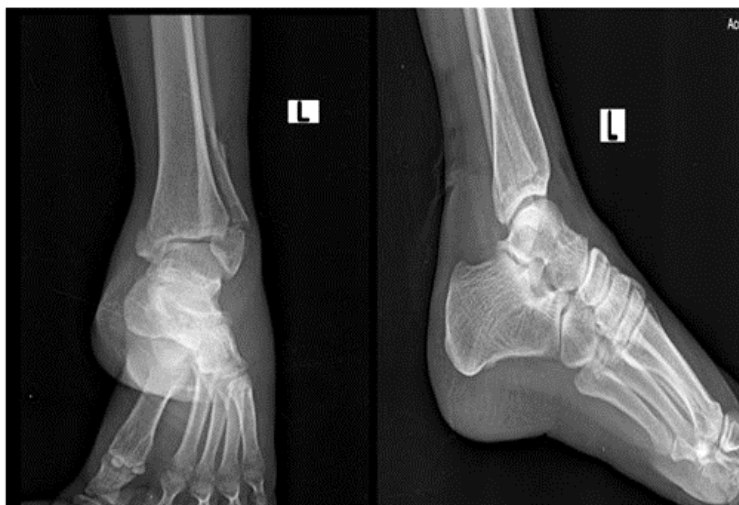


POST.OP



18 WEEKS

Case 27:



PRE.OP



POST.OP



12 WEEKS

RESULTS

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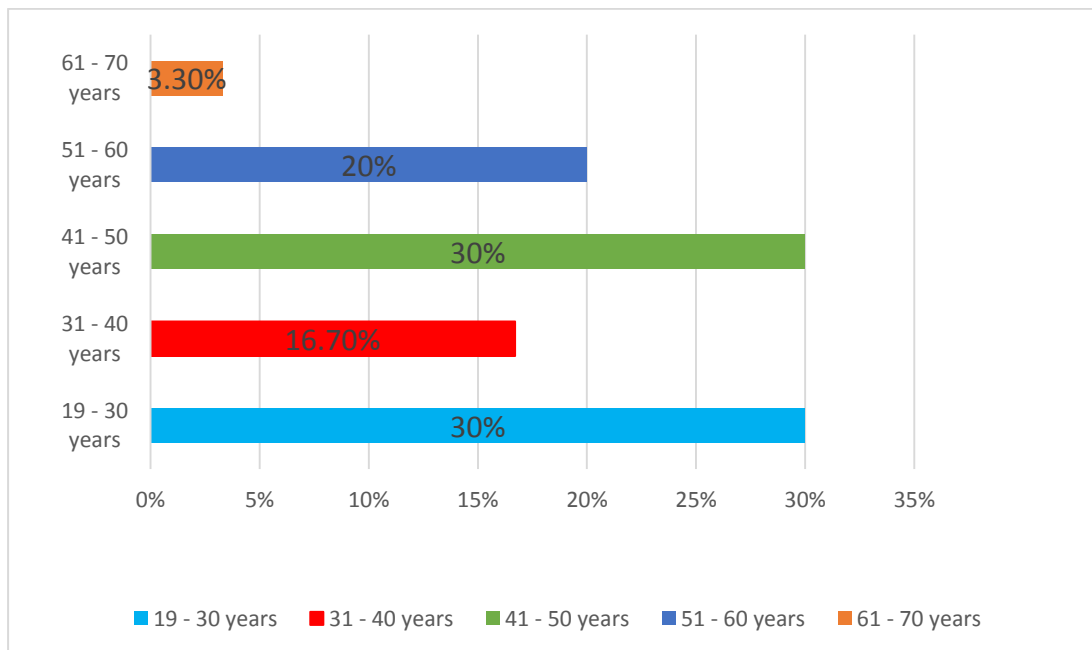
RESULTS

The present study has a diverse range of age groups ranging from 19 years to 70 years, of which the majority are between 19 and 30 years and 41 and 50 years, which is 30% each. Patients within the age range of 51–60 years are 20%, 31–40 years are 16.70%, and 61–70 years are 3.30%.

Table 1: Showing distribution of patient according to age

Age	No. of patients	Percentages (%)
19 – 30	9	30
31 – 40	5	16.7
41 – 50	9	30
51 – 60	6	20
61 - 70	1	3.3

Graph 1: Distribution of patient according to age

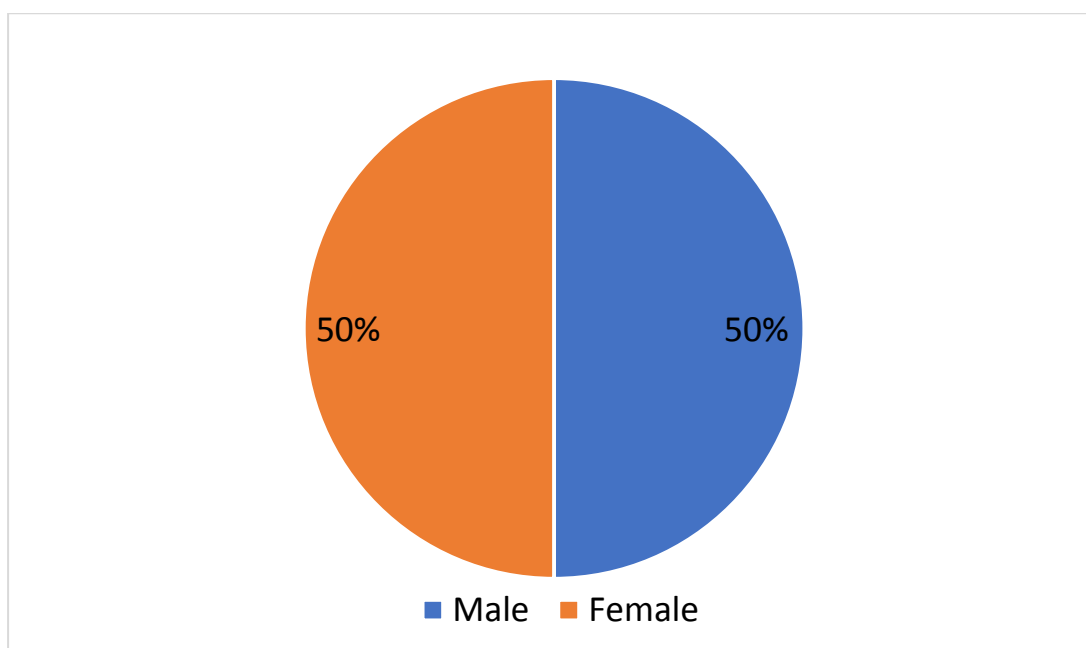


In the present study, the number of female and male patients is equally high, with 50% female patients and 50% male patients. There are a total of 30 patients, of which 15 are male and 15 are female.

Table 2: Showing distribution according to sex

Gender	No. of patients	Percentages (%)
Male	15	50
Female	15	50

Graph 2: Gender wise distribution

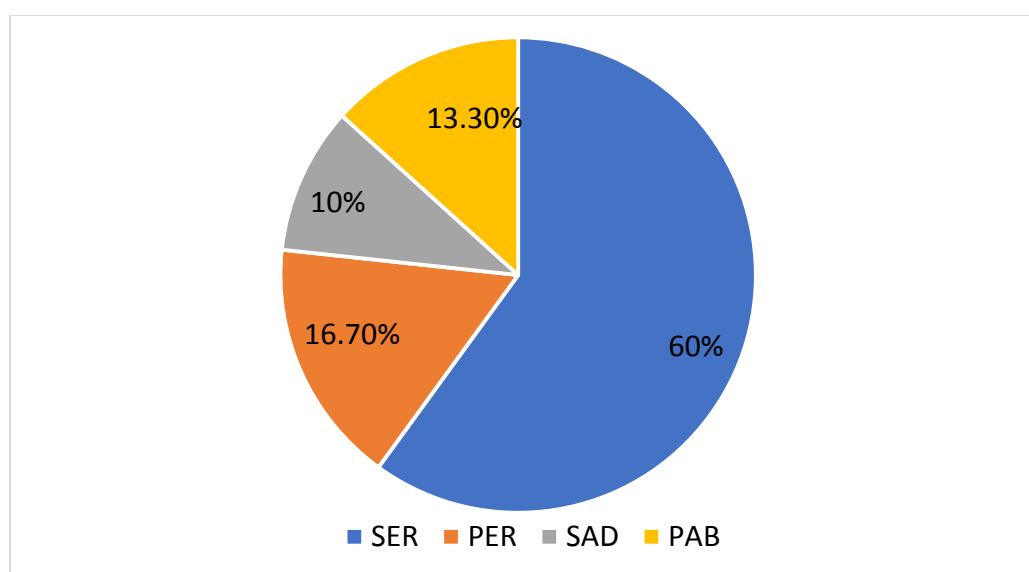


In the present study, patients were categorized into SER, PER, SAD, and PAB according to the L-H classification. 18 patients are under SER, which is 60% of the total study population; 5 patients under PER, with 16.7% of the population; 3 patients under SAD, constituting 10%; and 4 patients under PAB, comprising 13.3% of the study population. In the present study, the maximum number of patients were under SER and the minimum under SAD.

Table 3: Showing different bimalleolar injuries according to L-H classification

L-H classification	No. of patients	Percentages (%)
SER	18	60
PER	5	16.7
SAD	3	10
PAB	4	13.3

Graph 3: Percentage of different bimalleolar injuries according to L-H classification

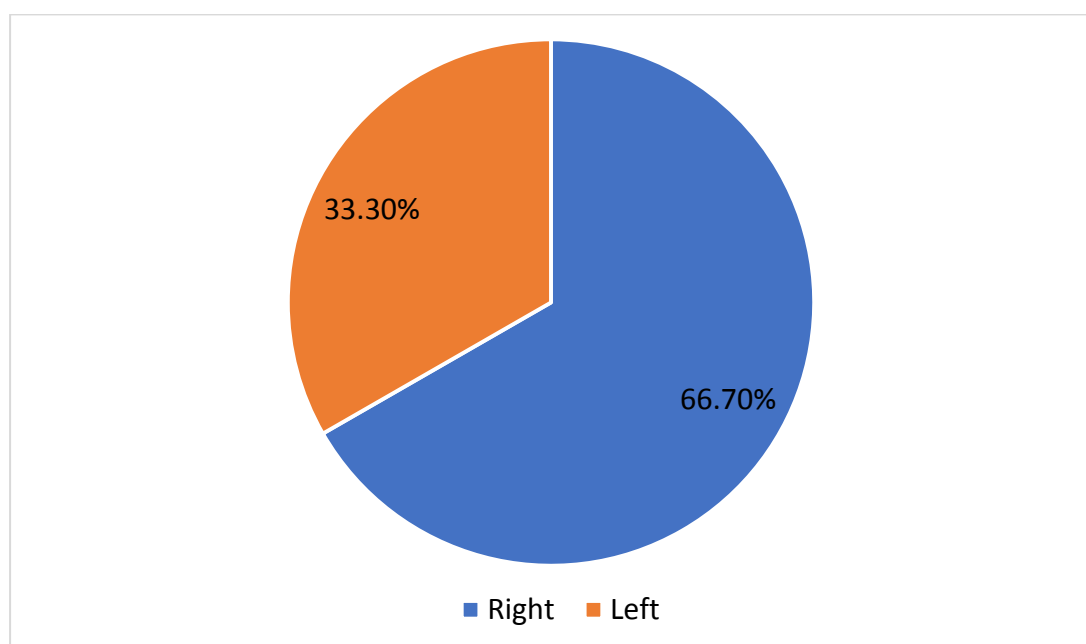


The present table represents the distribution of study participants according to side of injury, with 20 patients injured on the right side comprising 66.7%, whereas 33.3% of patients were injured on the left side.

Table 4: Showing Distribution of study participants according to side of injury

Side of injury	No. of patients	Percentages (%)
Right	20	66.7
Left	10	33.3
Bilateral	0	0

Graph 4: Showing percentage of distribution according to side of injury

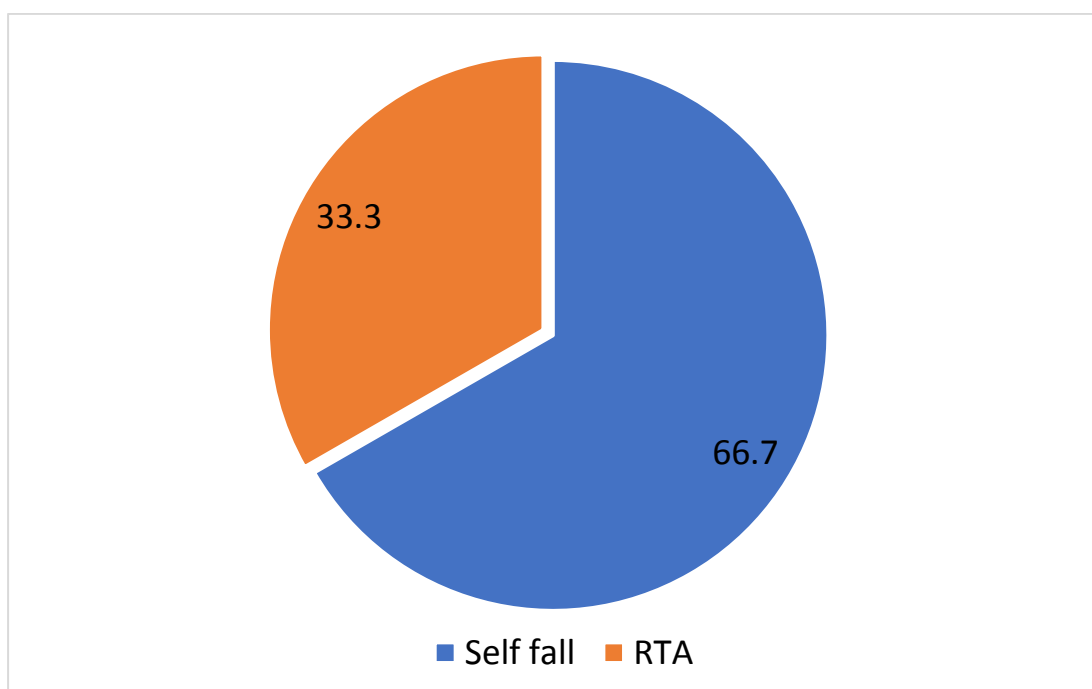


The present table describes the distribution of the participants according to mode of injury. Out of 30 patients, 20 were injured by self-falls, which is 66.7%, whereas 10 were injured by RTA, which constitutes 33.3%.

Table 5: Showing distribution of study participants according to mode of injury

Mode of injury	No. of patients	Percentages (%)
Self fall	20	66.7
RTA	10	33.3

Graph 5: Showing percentage of distribution according to mode of injury

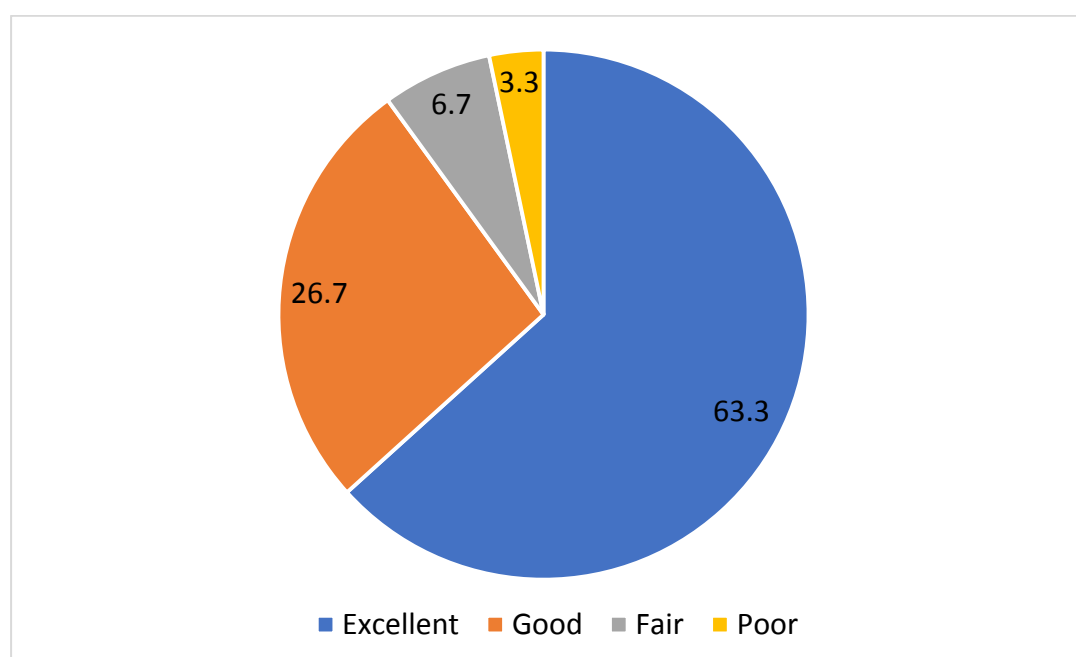


The present table describes the distribution of participants according to the Baird and Jackson scoring system for the present study population. 19 patients fall under the excellent category with 63.3%, 8 patients fall under the good category with 26.7%, 2 patients fall under the fair category with 6.7%, and 1 patient falls under the poor category, comprising a 3.3% population.

Table 6: Showing distribution of study participants according to scoring system

Baird and Jackson score	No. of patients	Percentages (%)
Excellent	19	63.3
Good	8	26.7
Fair	2	6.7
Poor	1	3.3

Graph 6: Showing percentage wise distribution of study participants

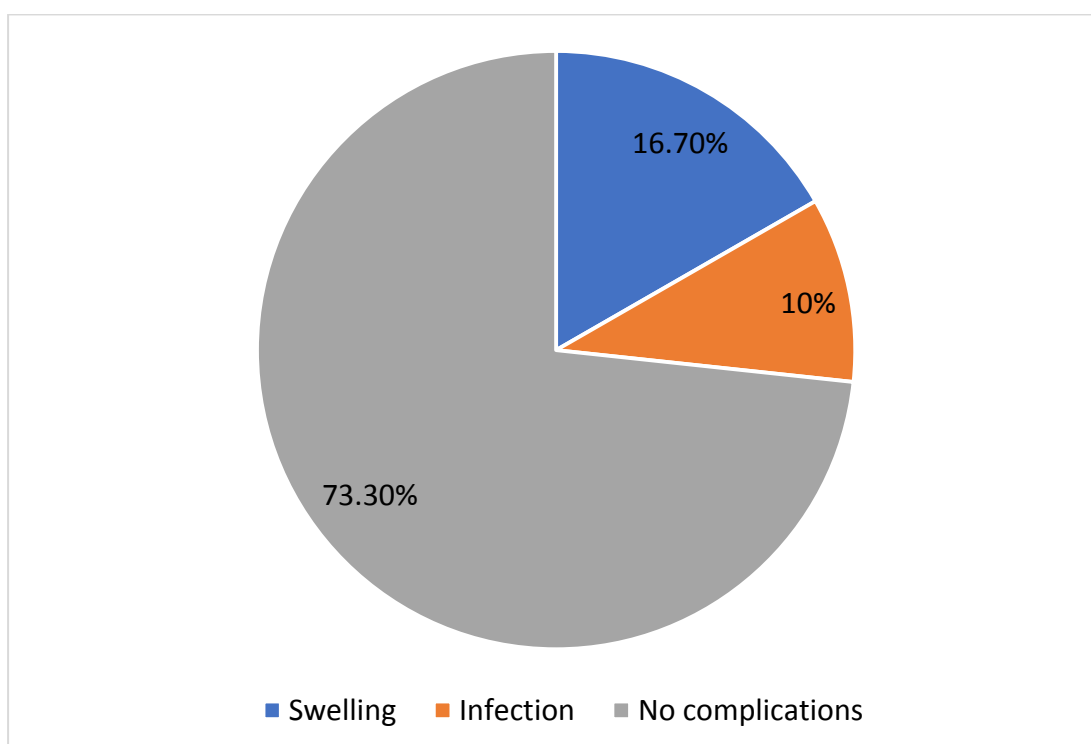


The present table represents the complications associated with a fracture. Of 30 patients, 22 have no complications, comprising 73.3%. 3 patients have infection, which is around 10%, and 5 patients have swelling, comprising 16.7%.

Table 7: Showing complications associated after fixation of fracture

Complications encountered	No. of patients	Percentages (%)
Swelling	5	16.7
Infection	3	10
No complications	22	73.3

Graph 7: Showing in percentages complications encounter



The present table describes the mean age and radiological union of the study population. The mean age is 40.77, and the standard deviation is 12.5. Radiological union was found in a minimum of 8 weeks and a maximum of 16 weeks. The mean value of the radiological union is 11.40, and the standard deviation is 2.4.

Table 8: Showing mean of age and radiological union

Parameters	Minimum	Maximum	Mean	SD
Age (years)	19	63	40.77	12.5
Radiological union (Weeks)	8	16	11.40	2.4

The present table shows the association between age and outcome (Baired and Jackson scores). Patients within the 19–30 age group: 8 patients had excellent scoring, comprising 26.7%, and 1 patient had good scoring, which was 1.3%, whereas there are no poor or fair-scoring patients between 19-30 years old. Patients within the 31–40 year age group: 4 patients had excellent scoring, comprising 13.3%; 1 patient had good scoring, which was 3.3%, whereas there are no poor or fair-scoring patients between 31 and 40 years old. Patients within the 41–50 group: 5 patients had excellent scoring, comprising 16.7%; 3 patients had good scoring, which was 10.0%. whereas there are 1 patient with poor scoring, accounting for 3.3%, and no patients with fair scoring between 41 and 50 years old. Within the 51–60 group, 2 patients had excellent scoring, comprising 6.7%, and 3 patients had good scoring, which is 10.0%. whereas there is 1 patient with a fair score, accounting for 3.3%, and no poor patient between 51 and 60 years old. Patients within 61–70 group 1 had a fair score of

3.3, whereas there were no poor-scoring patients as well as excellent, good-scoring patients between 61–70 years.

In the present study, 63.3% of patients showed excellent scoring, 26.7% had good scores, 6.7% had fair scores, and 3.3% had poor scores, with a chi square value of 23.09 and a statistically significant p value of 0.027.

**Table 9: Showing Association between Age and outcome
(Baired and Jackson score)**

Age	Baired and Jackson score				Total (%)	Chi-square	P-value
	Excellent	Good	Fair	Poor			
19 – 30	8(26.7%)	1(3.3%)	0(0.0%)	0(0.0%)	9(30.0%)	23.09	0.027
31 – 40	4(13.3%)	1(3.3%)	0(0.0%)	0(0.0%)	5(16.7%)		
41 – 50	5(16.7%)	3(10.0%)	0(0.0%)	1(3.3%)	9(30.0%)		
51 – 60	2(6.7%)	3(10.0%)	1(3.3%)	0(0.0%)	6(20%)		
61 – 70	0(0.0%)	0(0.0%)	1(3.3%)	0(0.0%)	1(3.3%)		
Total	19(63.3%)	8(26.7%)	2(6.7%)	1(3.3%)	30(100%)		

Table 10: Showing distribution of study participants according to various parameters

Parameter studied		No. of patients	Percentages (%)
Gender	Male	15	50
	Female	15	50
Side of injury	Right	20	66.7
	Left	10	33.3
	Bilateral	0	0
Mode of injury	Self fall	20	66.7
	RTA	10	33.3
Lauge- Hansen classification	SER	18	60
	PER	5	16.7
	SAD	3	10
	PAB	4	13.3
Baired and Jackson score	Excellent	19	63.3
	Good	8	26.7
	Fair	2	6.7
	Poor	1	3.3
Complications encountered	Swelling	5	16.7
	Infection	3	10
	No complications	22	73.3
Mean time of radiological union		12 weeks	

DISCUSSION



DISCUSSION

Ankle fractures make up approximately 9% of all fractures in adults. The preferred treatment for such injuries is open reduction with internal fixation. Nevertheless, surgery is not devoid of challenges, and its outcomes are not always desirable.³⁴

Ankle fractures are intra-articular fractures. Therefore, the most appropriate treatment for displaced and unstable injuries is anatomical reduction and stable fixation, mostly through open reduction and internal fixation.³⁵

Numerous factors influence the outcome of an ankle fracture, such as the degree of damage, the fracture's anatomical repair, any associated ligament and chondral injuries, post-operative rehabilitation plans, and co-morbid conditions. Even when surgical intervention is used to correct anatomical fractures, a significant percentage of patients do not demonstrate satisfactory results.³⁶

The management of ankle fractures has gradually changed as a result of advancements in biomechanics analysis, fixation methods, and the outcomes of research analysis. Anatomical repair of the damaged ankle and fracture union with painless, complete ankle motion are the objectives of treatment. A closed method of management is often inadequate for bimalleolar ankle fractures. Using the AO method and principles to treat malleolar fractures with precise ORIF resulted in increased percentages of excellent and good outcomes.³⁷

For ORIF of ankle fractures, various methods of surgical analgesia exist, including general anaesthesia, spinal anaesthesia, popliteal nerve block, and local anaesthesia with IV sedation. In the present study, spinal anaesthesia is used.

The present study has a diverse range of age groups ranging from 19 years to 70 years, of which the majority are between 19 and 30 years and 41 and 50 years, which is 30% each. Patients within an age range of 51–60 years are 20%, 31–40 years are 16.70%, and 61–70 years are 3.30%, which brings a mean age of 40.77 years, which is in accordance with the study by Gaurav *et al.*,³⁹ where the mean age was 46.775 with a standard deviation of 15.432 and the mean age is in contrast to the study done by Gangadhran *et al.*, where the youngest patient was 23 years and the oldest was 70 years old and the average age was 53.5 years.⁴⁰

In the present study, the number of female and male patients is equally high, with 50% female patients and 50% male patients. There are in total of 30 patients of which 15 patients are male and 15 patients are female where as a study by Gaurav *et al.*³⁹ noticed injury was more common in males 23 (57.5%) and females 17 (42.5%). In contrast to that, Gangadhran *et al.*⁴⁰ found in their study that the majority of the patients were females, with 25 (56%) patients and males, with 20 (44%).

According to Singh G *et al.*,²² males (58.33%) are more likely than females (41.66%) to be involved, and the right side (54.16%) is more likely than the left (45.83%). These findings are consistent with our research and the findings of Motwani and Maruthi, who found that 82.5% and 70% of their patients, respectively, were male.

The present study showed 20 patients were injured on the right side, comprising 66.7%, whereas 33.3% were injured on the left side. In accordance with our study, Gangadhran *et al.*⁴⁰ noticed the right ankle was involved in 26 (58%) patients and in 19 (42%) patients, the left ankle was involved. In contrast to our study, a study by Gaurav *et al.*,³⁹ stated that the left side was more commonly implicated,

accounting for 23 individuals (57.5%), while the right side included 17 patients (42.5%).^{39,40}

In the present study according to mode of injury, 20 patients were injured by self falls which is 66.7% whereas 10 patients were injured by RTA which constitutes 33.3%. Similar to our study Gangadhran *et al.*, stated that the major cause of fracture was fall by either twisting, stumbling or slipping in 32 cases (71%) and in 13 cases (29%), fracture was due to RTA whereas Gaurav *et al.*, stated that the leading cause of injury is road traffic accidents (72.5%), followed by twisting injuries (20%) and falls from height (7.5%) which is opposing present study.^{39,40}

In the present study patients were categorised into SER, PER, SAD, PAB according to Lauge- Hansen classification. 18 patients are under SER which is 60 % of total study population, 5 patients under PER with 16.7% of the population, 3 patients were under SAD constituting 10% and 4 patients under PAB comprising 13.3% of study population. In the present study, maximum number of patients were under SER and minimum under SAD. In par with the present study Gaurav *et al.*, found in his investigation that the most common injury pattern was SER (50%), followed by supination adduction (32.5%), PER (15%), and pronation abduction (2.5%). SER was discovered to be the most common, with a p-value < 0.0001 and a Chi-Square value of 27.467.^{39,40} The results are similar to a study by Gangadhran *et al.*

In the present study 63.3% patients showed excellent scoring, 26.7% with good scores, 6.7% with fair scores and 3.3% with poor scores with a chi square value of 23.09 and statistically significant p-value 0.027. The majority of patients in this study (83.33%) had an outstanding (43.75%) to good (39.58%) Braid and Jackson score at the end of six months, which is consistent with a study by Singh G *et al.*²²

Comparable outcomes were noted in other research by Shah, Arif, DeSouza et al., Beris et al., and Motwani.

In research by Dwivedi R *et al.*³⁴ the average AOFAS ankle-hind foot score was 89.86 (± 7.95) out of a maximum of 100, indicating good overall functional outcomes. The majority of patients reported no or occasional pain. Results for most of the patients ranged from excellent to good. Denis-Weber's classification suggests that less severe injuries produce better results. In Denis - Weber type A, every patient had outstanding results; in type B, 12 (85.71%) of 14 patients had excellent to good results; and in type C, 8 (80%) of 10 patients had excellent to good results.³⁴

Ankle fractures usually result in surgery only in cases of unstable ankle injuries. The AOFAS score was used to assess 32 patients who had ORIF for bimalleolar fractures in research by Dhoju *et al.*⁴¹ The AOFAS mean score of 90.56 ± 10.92 was achieved by most patients, which was considered outstanding. The Denis-Weber classification showed that less severe injuries had better results than severe injuries, although the difference was not statistically significant.

After surgery, 243 patients with ankle fractures were investigated by SM. Verhage *et al.*, with a mean follow-up of 9.6 years. The AOFAS score indicated that the results were outstanding. The three main AO groups did not significantly differ from one another, with the total mean AOFAS score being 95. For the AO A, B, and C groups, the mean AOFAS scores were 95, 95, and 94, respectively.⁴²

90% of the 232 patients with surgically treated unstable ankle fractures who had an AOFAS score of $\geq 90\%$ had a functional recovery, according to a study by Egol *et al.* One year after surgery, most patients recovered well, with little or no discomfort and few limits on their ability to do daily tasks. Although conservative and

surgical approaches yield similar functional results, a recent systematic review found that surgical treatment is helpful in achieving anatomical reduction and rigid surgical fixation, which may offer better protection against malunion, nonunion, and loss of reduction.⁴³

54 patients with ankle fractures were evaluated 14 months and 3 years following surgery in research by Nilsson *et al.* The Olerud-Molander Ankle Score (OMAS), which has a median of 75 at 14 months and 85 at three years, was used for assessment. Forty percent of the patients complained of instability and difficulty climbing stairs, and over half reported discomfort, stiffness, and edema. They came to the conclusion that the subjective outcomes were worse than anticipated after three years of surgical intervention for ankle fractures.⁴⁴

Miller *et al.* identified risk variables for wound complications following ankle ORIF. Patients who encountered wound difficulties were more likely to develop diabetes, peripheral neuropathy, wound-compromising drugs, open fractures, and postoperative non-compliance. The study found no correlation between wound complications and surgical scheduling at cutoffs of 3, 5, 7, and 10 days from injury to ORIF.⁴⁵

According to a recent study, patients who underwent surgery between eight hours and six days or beyond six days did not experience a longer postoperative stay than those who underwent surgery within eight hours of the injury.⁴⁶

Five years following the fixation of an ankle fracture, Shah *et al.* reported functional outcomes. They disclosed that there was no discernible effect of the surgical date on the functional result as determined by the OMAS and Short Form.⁴⁷

Schepers *et al.* found that patients who had surgery postponed by more than one day had a significant reduction in OMAS but no difference in the American Orthopaedic Foot and Ankle Society ankle-hind foot score or Visual Analogue Scale.⁴⁸ Naumann *et al.* found that surgery postponed by more than 6 days resulted in a lower functional outcome on the OMAS scale. Disparities in delayed surgical definitions and outcome assessment may explain the observed disparities.⁴⁶

Koval *et al.* analyzed the Medicare database and found a minimal incidence of problems in older individuals two years following surgery.⁴⁹

The present study represents the complications associated after fixtures of fracture. Of 30 patients, 22 patients have no complications, comprising 73.3%. Three patients have infection, which is around 10%, 5 patients have swelling, comprising 16.7%, which represents that there are very few complications in present study. A study by SooHoo NF *et al.*, which found rates of pulmonary embolism (0.34%), mortality (1.07%), wound infection (1.44%), amputation (0.16%), revision open reduction and internal fixation (0.82%), and other short-term complications was in line with the current investigation.¹⁴

The present study describes the mean age and radiological union of the study population. The mean age is 40.77 and standard deviation being 12.5. Radiological union was found in minimum of 8 weeks and maximum of 16 weeks. The mean value of radiological union is 11.40, and standard deviation is 2.4.

SUMMARY

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SUMMARY

The present study, titled “Functional outcome of open reduction and internal fixation in bimalleolar fracture of ankle,” was conducted in 30 patients with age group greater than 18years, diagnosed with a closed bimalleolar fractures of ankle joint (open type 1 Gustilo – Anderson) and admitted to the Orthopedics ward from the emergency and outpatient departments at the R.L.Jalappa Hospital and Research Centre associated with the Sri Devaraj Urs Academy of Higher Education and Research, tamaka, kolar.

Patients undergoing fixation using screws or plates for medial malleolus and fixation of lateral malleolus with plates or pin will be approached for the study after receiving approval from the institutional ethical committee and the necessary authorities. A pre-designed questionnaire will be used to collect sociodemographic and historical information after receiving written informed consent. The L-H classification system will be used for operative evaluation in our study. Following surgery, the functional outcome will be evaluated every six weeks for a total of six months using the Baird and Jackson criteria, and a follow-up x-ray will be taken to assess fracture union.

Statistical analysis was done, and the present study has a diverse range of age groups ranging from 19 to 70 years old, of which majority are within 19 - 30yrs and 41-50yrs old. The number of female and male patients are equally present, with 50% female patients and 50% male patients.

Patients were categorised into SER, PER, SAD, PAB according to Lauge-Hansen(L-H) classification. SER is majority, and PER, SAD, PAB are in descending order. Most of the injury occurred on the right side rather than the left side.

After the surgery using Baird and Jackson scoring, 19 patients fell into the excellent category with 63.3%, 8 patients fell into the good category with 26.7%, 2 patients fell into the fair category with 6.7%, 1 patient with poor category and comprised a 3.3% population.

Complications associated after fixation of fracture. Of 30 patients, 22 patients have no complications, comprising 73.3%. 3 patients have infection, which is around 10%. 5 patients have swelling comprising 16.7%.

The mean age and radiological union of the study population. Mean age is 40.77 and the standard deviation being 12.5. Radiological union was found in minimum of 8 weeks and a maximum of 16 weeks. The mean value of radiological union is 11.40, and standard deviation is 2.4.

Patients within the 19- 30 age group had excellent and good scoring, and there were no poor or fair scoring patients. Within 31-40 years old age group, the majority had excellent and good scoring, and there were no poor or fair scoring patients. 41-50 age group had excellent and good scoring only 1 patient had poor scoring. Within 51-60 group, the majority had excellent and good scoring, while there was 1 patient with fair scoring. Patients within 61-70 had a fair score; there were no poor scoring patients, as well as excellent, good scoring as well between 61-70years. The results showed highly significant excellent scoring with a p value of 0.027.

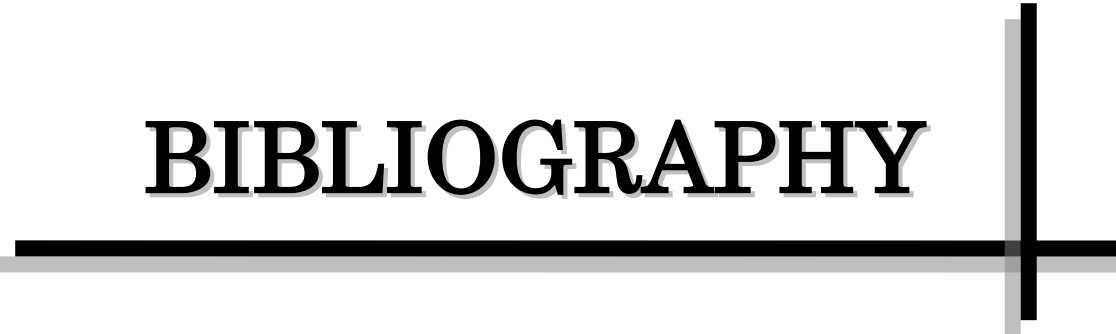
CONCLUSION

CONCLUSION

The following conclusions are drawn from present study

1. Bimalleolar injuries according to Lauge-Hansen(L-H) classification incidence of SER, PER, SAD, PAB is in descending order in present study.
2. Injury is noticed in right side majority than left side and most of the patients injured by self-fall rather than RTA.
3. After surgery, outcome was based on Baireid and Jackson scoring system and found that majority of patients have excellent scoring, some patients had good scoring, very few patients had poor / fair scoring showing statistically significant result.
4. In the present study very few complications were associated after fixtures of fracture which is infection and swelling of fracture site.
5. In the present study Radiological union was found in minimum of 8 weeks and maximum of 16 weeks with Mean value of radiological union is 11.40 weeks.

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ANNEXURE

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ANNEXURE – I
SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND
RESEARCH, TAMAKA, KOLAR - 563101.

PATIENT INFORMATION SHEET

**STUDY TITLE: “FUNCTIONAL OUTCOME OF OPEN REDUCTION AND
INTERNAL FIXATION IN BIMALLEOLAR FRACTURE OF ANKLE”**

Study location: R L Jalappa Hospital and Research Centre attached to Sri Devaraj Urs Medical College, Tamaka, Kolar.

Details- Patients admitted to the orthopedics ward from the emergency and outpatient departments at the R.L.Jalappa hospital and research centre associated with the Sri Devaraj Urs Medical College and SDUAHER university.

Patients in this study will have to undergo routine blood investigations (CBC, RFT, serum electrolytes, blood grouping, HIV & HBsAg), chest x ray, ECG and x-ray of anteroposterior view, lateral view and Harris mortise view of ankle.

Please read the following information and discuss with your family members. You can ask any question regarding the study. If you agree to participate in the study, we will collect information (as per proforma) from you or a person responsible for you or both. Relevant history will be taken. This information collected will be used only for dissertation and publication.

The expensive estimated for the patient for above procedure will be handled by the primary investigator.

All information collected from you will be kept confidential and will not be disclosed to any outsider. Your identity will not be revealed. This study has been reviewed by the Institutional Ethics Committee and you are free to contact the member of the Institutional Ethics Committee. There is no compulsion to agree to this study. The care you will get will not change if you don't wish to participate. You are required to sign/ provide thumb impression only if you voluntarily agree to participate in this study.

CONFIDENTIALITY

Your medical information will be kept confidential by the study doctor and staff and will not be made publicly available. Your original records may be reviewed by your doctor or ethics review board. For further information/ clarification please contact.

Dr. AKSHAY.P
DEPARTMENT OF ORTHOPAEDICS
SDUMC, Kolar
CONTACT NO: 9731366982

ಶ್ರೀ. ದೇವರಾಜ್ ಅರಸ್ ಅಕಾಡೆಮಿ ಆಫ್ ಹೈಯರ್ ಎಜುಕೇಶನ್ ಅಂಡ್ ರಿಸರ್ಚ್, ತಮಕಾ,

ಕೋಲಾರ- 563101.

ರೋಗಿಯ ಮಾಹಿತಿ ಹಾಳೆ

ಅಧ್ಯಯನದ ಶೀರ್ಷಿಕೆ : ಇದು ಪಾದದ ಭೈಮೆಲ್ಲಿಯೋಲಾರ್ ಮುರಿತದಲ್ಲಿ ತೆರೆದ ಕಡಿತ ಮತ್ತು ಅಂತರೀಕ ಸ್ವೀಕರಣದ ಕ್ರಿಯಾತ್ಮಕ ಫಲಿತಾಂಶ ಒಂದು ನಿರೀಕ್ಷಿತ ಅಧ್ಯಯನ.

ಅಧ್ಯಯನದ ಸ್ಥಳ : ಕೋಲಾರದ ತಮಾಕಾರ ಶ್ರೀ ದೇವರಾಜ್ ಅರಸ್ ವೈದ್ಯಕೀಯ ಕಾಲೇಜಿಗೆ ಲಗತ್ತಿಸಲಾದ ಆರ್.ಎಲ್. ಜಾಲಪ್ಪ ಆಸ್ಪತ್ರೆ ಮತ್ತು ಸಂಶೋಧನಾ ಕೇಂದ್ರ.

ವಿವರಗಳು : ಆರ್.ಎಲ್.ಜಾಲಪ್ಪ ತುರ್ತು ವಿಭಾಗದಲಿ ಪಾದದ ಭೈಮೆಲ್ಲಿಯೋಲಾರ್ ಮುರಿತ ರೋಗಿಗಳು, ಹಾಸ್ಪಿಟಲ್ ಮತ್ತು ರಿಸರ್ಚ್ ಸೆಂಟರ್, ಶ್ರೀ ದೇವರಾಜ್ ಅರಸ್ ಮೆಡಿಕಲ್ ಕಾಲೇಜ್, ತಮಕಾ, ಕೋಲಾರಕ್ಕೆ ನೊಂದಣಿ ಮಾಡಲಾಗಿದೆ.

ಈ ಅಧ್ಯಯನದಲ್ಲಿರುವ ರೋಗಿಗಳು ದಿನ ನಿತ್ಯದ ರಕ್ತ ತನಿಖೆಗೆ ಒಳಗಾಗಬೇಕಾಗುತ್ತದೆ (ಸಿಬಿಸಿ, ಆರ್.ಎಫ್.ಟಿ. ಸೀರಮ್, ಸೋಡಿಯಂ, ಪೊಟಾಶಿಯಂ, ರಕ್ತ ಗುಂಪು, ಎಚ್‌ಐವಿ ಮತ್ತು ಎಚ್‌ಬಿಎಸ್‌ಎಚ್), ಎದೆಯ ಎಕ್ಸ್‌ರೇ, ಇಸಿಜಿ ಮತ್ತು ಭುಜ-ಎಪಿ ಮತ್ತು ಎಕ್ಸ್‌ರೇ ಮತ್ತು ಆಕ್ಸಿಲರಿ ವೀಕ್ಷಣೆ)

ದಯವಿಟ್ಟು ಈ ಕೆಳಗಿನ ಮಾಹಿತಿಯನ್ನು ಓದಿ ಮತ್ತು ನಿಮ್ಮ ಕುಟುಂಬ ಸದಸ್ಯರೊಂದಿಗೆ ಚರ್ಚಿಸಿ, ಅಧ್ಯಯನಕ್ಕೆ ಸಂಬಂಧಿಸಿದಂತೆ ನೀವು ಯಾವುದೇ ಪ್ರಶ್ನೆಯನ್ನು ಕೇಳಬಹುದು. ಅಧ್ಯಯನದಲ್ಲಿ ಭಾಗವಹಿಸಲು ನೀವು ಒಪ್ಪಿದರೆ, ನಿಮ್ಮಿಂದ ಅಥವಾ ನಿಮ್ಮ ಕುಟುಂಬ ಸದಸ್ಯರಿಂದ ನಾವು ಮಾಹಿತಿಯನ್ನು (ಪ್ರೊಫಾರ್ಮಾದ ಪ್ರಕಾರ) ಪಡೆದುಕೊಂಡಿರುತ್ತೇವೆ. ಸಂಬಂಧಿತ ಇತಿಹಾಸವನ್ನು ತೆಗೆದುಕೊಳ್ಳಲಾಗುವುದು. ಸಂಗ್ರಹಿಸಿದ ಈ ಮಾಹಿತಿಯನ್ನು ಪ್ರಬಂಧ ಮತ್ತು ಪ್ರಕಟಣೆಗೆ ಮಾತ್ರ ಬಳಸಲಾಗುತ್ತದೆ.

ನಿಮ್ಮಿಂದ ಸಂಗ್ರಹಿಸಲಾದ ಎಲ್ಲಾ ಮಾಹಿತಿಯನ್ನು ಗೌಪ್ಯವಾಗಿಡಲಾಗುತ್ತದೆ ಮತ್ತು ಯಾವುದೇ ಹೊರಗಿನವರಿಗೆ ಬಹಿರಂಗಪಡಿಸುವುದಿಲ್ಲ. ನಿಮ್ಮ ಗುರುತು ಬಹಿರಂಗಗೊಳ್ಳುವುದಿಲ್ಲ. ಈ ಅಧ್ಯಯನವನ್ನು ಸಾಂಸ್ಥಿಕ ನೈತಿಕ ಸಮಿತಿಯು ಪರಿಶೀಲಿಸಿದೆ ಮತ್ತು ಸಾಂಸ್ಥಿಕ ನೈತಿಕ ಸನಿತಿಯ ಸದಸ್ಯರನ್ನು ಸಂಪರ್ಕಿಸಲು ನೀವು ಮುಕ್ತರಾಗಿದ್ದೀರಿ. ಈ ಅಧ್ಯಯನವನ್ನು ಒಪ್ಪಿಕೊಳ್ಳಲು ಯಾವುದೇ ಬಲವಂತವಿಲ್ಲ. ನೀವು ಭಾಗವಹಿಸಲು ಬಯಸದಿದ್ದರೆ ನೀವು ಪಡೆಯುವ ಕಾಳಜಿ ಬದಲಾಗುವುದಿಲ್ಲ. ಈ ಅಧ್ಯಯನದಲ್ಲಿ ಭಾಗವಹಿಸಲು ನೀವು ಸ್ವಯಂಪ್ರೇರಣೆಯಿಂದ ಒಪ್ಪಿಕೊಂಡರೆ ಮಾತ್ರ ನೀವು ಹೆಬ್ಬರಳು ಅನಿಸಿಕೆಗೆ ಸಹಿ/ಒದಗಿಸುವ ಅಗ್ಯವಿದೆ.

ನಿಮ್ಮ ವೈದ್ಯಕೀಯ ಮಾಹಿತಿಯನ್ನು ಅಧ್ಯಯನ ವೈದ್ಯರು ಮತ್ತು ಸಿಬ್ಬಂದಿ ಗೌಪ್ಯವಾಗಿಡುತ್ತಾರೆ ಮತ್ತು ಸಾರ್ವಜನಿಕವಾಗಿ ಲಭ್ಯವಾಗುವುದಿಲ್ಲ. ನಿಮ್ಮ ಮೂಲ ದಾಖಲೆಗಳನ್ನು ನಿಮ್ಮ ವೈದ್ಯರು ಅಥವಾ ನೈತಿಕ ಪರಿಶೀಲನಾ ಮಂಡಳಿಯು ಪರಿಶೀಲಿಸಬಹುದು. ಹೆಚ್ಚಿನ ಮಾಹಿತಿಗಾಗಿ/ ಸ್ಪಷ್ಟೀಕರಣಕ್ಕಾಗಿ ದಯವಿಟ್ಟು ಸಂಪರ್ಕಿಸಿ.

ಡಾ|| ಅಕ್ಷಯ್.ಪಿ

ಅಥೋರೈಟಿ ಇಲಾಖೆ,

SDUMC, ಕೋಲಾರ,

ಸಂಪರ್ಕ ಸಂಖ್ಯೆ : 9731366982.

ANNEXURE - II

INFORMED CONSENT FORM

Date:

I Mr./Mrs. _____ have been explained in my own understandable language, that I will be included in a study which is **“FUNCTIONAL OUTCOME OF OPEN REDUCTION AND INTERNAL FIXATION IN BIMALLEOLAR FRACTURE OF ANKLE”**

I have been explained that my clinical findings, investigations, postoperative findings will be assessed and documented for study purpose.

I have been explained my participation in this study is entirely voluntary, and I can withdraw from the study any time and this will not affect my relation with my doctor or the treatment for my ailment.

I have been explained about the interventions needed possible benefits and adversities due to interventions, in my own understandable language.

I have understood that all my details found during the study are kept confidential and while publishing or sharing of the findings, my details will be masked.

I have principal investigator mobile number for enquiries.

The expensive estimated for the patient for above procedure will be handled by the primary investigator.

I in my sound mind give full consent to be added in the part of this study.

Signature of the patient:

Name:

Signature of the witness:

Name:

Relation to patient:

ಮಾಹಿತಿ ಪಡೆಯುವ ಒಪ್ಪಿಗೆ ಪತ್ರ

ದಿನಾಂಕ:

ನಾನು ಶ್ರೀ. _____ಅನ್ನು ನನ್ನ ಸ್ವಂತ ಅರ್ಥವಾಗುವ ಭಾಷೆಯಲ್ಲಿ ವಿವರಿಸಲಾಗಿದೆ.
'ಇದು ಪಾದದ ಭೈಮಲ್ಲಿಯೋಲಾರ್ ಮುರಿತದಲ್ಲಿ ತೆರೆದ ಕಡಿತ ಮತ್ತು ಅಂತರೀಕ ಸ್ಥಿರೀಕರಣದ ಕ್ರಿಯಾತ್ಮಕ
ಫಲಿತಾಂಶ' ಎಂಬ ಅಧ್ಯಯನದಲ್ಲಿ ನನ್ನನ್ನು ಸೇರಿಸಲಾಗುವುದು.

ನನ್ನ ಕ್ಲಿನಿಕಲ್ ಅವಿಷ್ಕಾರಗಳು, ತನಿಖೆಗಳು, ಶಸ್ತ್ರಚಿಕಿತ್ಸೆಯ ನಂತರದ ಸಂಶೋಧನೆಗಳನ್ನು ಮೌಲ್ಯಮಾಪನ ಮತ್ತು
ಅಧ್ಯಯನ ಉದ್ದೇಶಕ್ಕಾಗಿ ದಾಖಲಿಸಲಾಗುತ್ತದೆ ಎಂದು ನನಗೆ ವಿವರಿಸಲಾಗಿದೆ.

ಈ ಅಧ್ಯಯನದಲ್ಲಿ ನನ್ನ ಭಾಗವಹಿಸುವಿಕೆಯು ಸಂಪೂರ್ಣವಾಗಿ ಸ್ವಯಂಪ್ರೇರಿತವಾಗಿದೆ ಎಂದು ನನಗೆ
ವಿವರಿಸಲಾಗಿದೆ ಮತ್ತು ನಾನು ಯಾವುದೇ ಸಮಯದಲ್ಲಿ ಅಧ್ಯಯನದಿಂದ ಹಿಂದೆ ಸರಿಯಬಹುದು ಮತ್ತು
ಇದು ನನ್ನ ವೈದ್ಯರೊಂದಿಗಿನ ನನ್ನ ಸಂಬಂಧ ಅಥವಾ ನನ್ನ ಕಾಯಿಲೆಗೆ ಚಿಕಿತ್ಸೆಯ ಮೇಲೆ ಪರಿಣಾಮ
ಬೀರುವುದಿಲ್ಲ.

ನನ್ನ ಸ್ವಂತ ಅರ್ಥವಾಗುವ ಭಾಷೆಯಲ್ಲಿ, ಮಧ್ಯಸ್ಥಿಕೆಗಳ ಕಾರಣದಿಂದಾಗಿ ಸಂಭವನೀಯ ಪ್ರಯೋಜನಗಳು
ಮತ್ತು ಪ್ರತಿಕೂಲತೆಗಳ ಅಗತ್ಯವಿರುವ ಮಧ್ಯಸ್ಥಿಕೆಗಳ ಬಗ್ಗೆ ನನಗೆ ವಿವರಿಸಲಾಗಿದೆ.

ಅಧ್ಯಯನದ ಸಮಯದಲ್ಲಿ ಕಂಡುಬರುವ ನನ್ನ ಎಲ್ಲಾ ವಿವರಗಳನ್ನು ಗೌಪ್ಯವಾಗಿಡಲಾಗಿದೆ ಮತ್ತು
ಸಂಶೋಧನೆಗಳನ್ನು ಪ್ರಕಟಿಸುವಾಗ ಅಥವಾ ಹಂಚಿಕೊಳ್ಳುವಾಗ, ನನ್ನ ವಿವರಗಳನ್ನು ಮರೆಮಾಚಲಾಗುತ್ತದೆ
ಎಂದು ನಾನು ಅರ್ಥಮಾಡಿಕೊಂಡಿದ್ದೇನೆ.

ವಿಚಾರಣೆಗಾಗಿ ನನ್ನ ಬಳಿ ಪ್ರಧಾನ ತನಿಖಾಧಿಕಾರಿ ಮೊಬೈಲ್ ಸಂಖ್ಯೆ ಇದೆ.

ಈ ಅಧ್ಯಯನದ ಭಾಗದಲ್ಲಿ ಸೇರಿಸಲು ನನ್ನ ಸಂಪೂರ್ಣ ಮನಸ್ಸಿನಲ್ಲಿ ಒಪ್ಪಿಗೆ ನೀಡುತ್ತೇನೆ.

ರೋಗಿಯ ಸಹಿ:

ಸಾಕ್ಷಿಯ ಸಹಿ:

ಹೆಸರು :

ರೋಗಿಗೆ ಸಂಬಂಧ:

ANNEXURE – III

**SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND
RESEARCH, TAMAKA, KOLAR - 563101.**

PROFORMA

Case No : _____

IP No : _____

**TITLE: “FUNCTIONAL OUTCOME OF OPEN REDUCTION AND
INTERNAL FIXATION IN BIMALLEOLAR FRACTURE OF ANKLE”**

1. BASIC DATA

Name : _____ Age/Sex: _____

Address : _____

Mobile No : _____

Date of Procedure : _____

Date of Admission/OP : _____

Date of Discharge : _____

Mechanism of injury:

- a) Inversion of the foot
- b) Eversion of foot
- c) Dorsiflexion of the ankle
- d) Plantar flexion of ankle
- e) Road traffic accident

History:

General physical examination:

Vitals: Pulse - _____

B.P - _____

RR - _____

Temp - _____

Systemic examination:

CVS - _____

RS - _____

PA - _____

CNS - _____

Preexisting systemic illness:

Diabetes/Thyroid disorder/TB/ anemia/ Hypertension/ malnutrition/others

Local examination:

Site of injury :

Right/left ankle :

Deformity :

Swelling around the ankle:

Bony tenderness:

Medial malleolus :

Lateral malleolus :

Condition of the skin :

Any associated injuries/fracture:

RADIOLOGICAL INVESTIGATIONS:

X-RAYS : Antero posterior view , Lateral view and Harris mortice view
taken preoperatively, postoperatively and follow up period.

2. DIAGNOSIS:**3. INVESTIGATIONS:**

CBC :

BT :

CT :

Blood grouping :

Blood urea :

Blood creatinine :

RBS :

HIV, HBsAg, HCV status:

4. TREATMENT:

OPERATIVE TREATMENT

1. Date of operation :
2. Anaesthesia :
3. Incision :
4. Implants used :
5. Duration of surgery :
6. Intra operative complications :

5. POST PROCEDURE

1. Antibiotics and Analgesic :
2. Suture removal date :
3. Date of pop cast :
4. Date of weight bearing :
5. Post operative complication :

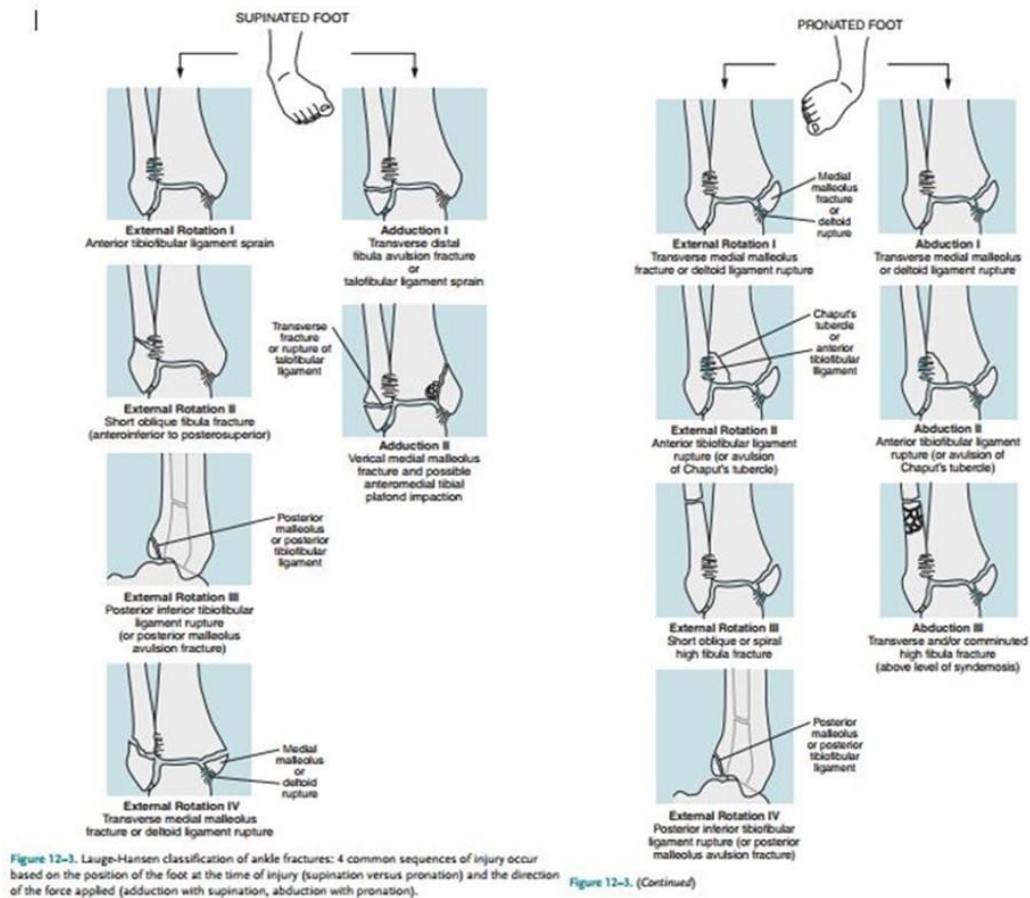
Complications:

Early :

Delayed :

Late :

Lauge - Hansen classification



BAIRD AND JACKSON SCORING SYSTEM

Scoring System for Subjective, Objective
Criteria points

I. Pain:

A. No pain	15
B. Mild pain with strenuous activity	12
C. Mild pain with activities of daily living	08
D. Pain on weight bearing	04
E. Pain at rest	00

II. Stability of ankle:

A. No clinical instability	15
B. Instability with sports activities	05
C. Instability with activities of daily living	00

III. Ability to walk:

A. Able to walk desired distances without limp or pain	15
B. Able to walk desired distances with mild limp or pain	12
C. Moderately restricted in ability to walk	08
D. Able to walk short distances only	04
E. Unable to walk	00

IV. Ability to run:

A. Able to run desired distances without pain	10
B. Able to run desired distances with slight pain	08
C. Moderate restriction in ability to run, with mild pain	06
D. Able to run short distances only	03
E. Unable to run	00

V. Ability to work:

A. Able to perform usual occupation without restrictions	10
B. Able to perform usual occupation with restrictions in some strenuous activities	08
C. Able to perform usual occupation with substantial restrictions	06
D. Partially disabled; selected jobs only	03
E. Unable to work	00

VI. Motion of the ankle:

A. Within 10° of uninjured ankle	10
B. Within 15° of uninjured ankle	07
C. Within 20° of uninjured ankle	04
D. <50% of uninjured ankle or dorsiflexion < 5°	00

VII. Radiological results:

a. Anatomic with intact mortise (normal medial clear space normal superior joint space, no talar tilt)	25
b. Same as A with mild reactive changes at the joint margins	15
c. Measurable narrowing of superior joint space, with superior joint space >2mm or talar tilt >2mm	10
d. Moderate narrowing of superior joint space with superior joint space between 2mm to 1mm.	05
e. Severe narrowing of superior joint space, with superior joint space <1mm, widening of medial clear space, severe reactive changes (sclerotic subchondral bone and Osteophytes formation)	00

RESULTS:

Maximal Possible Score	100
Functional Grading	Score
Excellent	96–100
Good	91–95
Fair	81–90
Poor	0–80

	6 weeks	12weeks	18 weeks	24weeks
Pain score				
Stability of ankle				
Able to walk				
Able to run				
Ability to work				
Motion of ankle				
Radiographic result				
Max Score(100)				

COMPLICATION IF ANY:

ASSESSMENT OF RESULT:

MASTER CHART

A decorative graphic consisting of a thick horizontal line and a thick vertical line intersecting at a right angle. The intersection is located to the right of the text 'MASTER CHART'. The lines are black with a slight gray shadow or offset, giving them a three-dimensional appearance.

ANNEXURE – IV MASTER CHART

Sl. No	Hospital No	Age (yrs)	Sex	Side	Mode of injury	Open/ closed	Lauge Hansen	MM#	LM#	Complication	Pain	Stability	Walking	Running	Work	Motion	Radiograph	Composite Score	Results	Union
1	86661	42	F	Right	Self fall	Closed	SER	CC Screw	Rush pin		15	15	15	10	8	10	25	96	E	12wks
2	82049	40	F	Right	Self fall	Closed	SER	CC Screw	Rush pin	Swelling	12	15	15	10	10	10	25	97	E	12wks
3	186723	63	M	Right	Self fall	Closed	SER	CC Screw	Plate	S.Infection	12	15	12	8	8	7	25	87	F	14wks
4	63086	47	F	Right	Self fall	Closed	SER	CC Screw	Rush pin		12	15	15	10	10	10	25	97	E	14wks
5	40934	45	M	Right	RTA	Closed	SAD	CC Screw	Plate		12	15	15	8	10	10	25	95	G	10wks
6	222349	45	F	Right	Self fall	Closed	SER	CC Screw	Rush pin	Swelling	15	15	15	10	8	10	25	98	E	12wks
7	124567	45	F	Right	Self fall	Closed	PAB	CC Screw	Plate		12	15	15	10	10	7	25	94	G	10wks
8	120974	40	F	Right	Self fall	Closed	PAB	CC Screw	Plate		15	15	15	8	10	10	25	98	E	12wks
9	232345	60	F	Left	Self fall	Closed	SER	CC Screw	Rush pin		12	15	15	8	10	10	25	95	G	14wks
10	110130	39	M	Left	Self fall	Closed	PER	CC Screw	Plate		15	15	15	10	8	10	25	98	E	8wks
11	112334	39	F	Left	Self fall	Closed	SER	CC Screw	Rush pin		12	15	15	8	8	10	25	93	G	10wks
12	216537	35	M	Right	RTA	Closed	PER	CC Screw	Plate	Swelling	15	15	15	10	8	10	25	98	E	8wks
13	129571	45	M	Right	Self fall	Closed	PER	CC Screw	Rush pin		15	15	15	10	8	10	25	98	E	16wks
14	227231	25	M	Right	RTA	Closed	SAD	CC Screw	Rush pin		12	15	15	10	10	10	25	97	E	12wks
15		55	F	Left	Self fall	Closed	SER	CC Screw	Plate	S.Infection	12	15	15	8	8	10	25	93	G	16wks
16		30	M	Left	Self fall	Closed	SER	CC Screw	Plate		15	15	15	10	8	10	25	96	E	8wks

17		60	F	Left	RTA	Closed	PER	CC Screw	Plate		15	15	15	10	8	10	25	98	E	10wks
18	282579	53	F	Right	Self fall	Closed	SER	CC Screw	Rush pin		12	15	12	8	8	7	25	87	F	12wks
19	341972	24	M	Left	RTA	Closed	SER	CC Screw	Plate	Swelling	12	15	15	10	10	10	25	97	E	10wks
20	353893	56	M	Right	RTA	Closed	SER	CC Screw	Plate		12	15	15	8	10	10	25	95	G	12wks
21	357825	22	F	Right	Self fall	Closed	PER	CC Screw	Rush pin		12	15	15	8	8	10	25	93	G	8wks
22	363062	51	F	Left	Self fall	Closed	SER	CC Screw	Rush pin		15	15	15	10	8	10	25	98	E	14wks
23		19	M	Right	Self fall	closed	PAB	CC Screw	Rush pin	Swelling	15	15	15	10	8	10	25	98	E	12wks
24	256729	23	M	Right	RTA	Closed	SER	CC Screw	Plate		12	15	15	10	8	10	25	98	E	8wks
25	351658	45	M	Right	Self fall	Closed	SER	CC Screw	Plate	S.Infection	15	15	15	10	8	10	25	98	E	12wks
26	347229	46	M	Right	RTA	Closed	SER	CC Screw	Plate		12	15	15	8	10	10	25	95	G	10wks
27	358563	29	F	Left	RTA	Closed	SER	CC Screw	Plate		15	15	15	10	8	10	25	98	E	12wks
28	217521	48	F	Left	Self fall	Closed	PAB	CC Screw	Rush pin		15	15	15	10	8	10	25	98	E	10wks
29	384503	24	M	Right	RTA	Closed	SAD	CC Screw	Rush pin		12	15	15	10	10	10	25	97	E	8wks
30	379617	28	M	Right	Self fall	Closed	SER	CC Screw	Rush pin		8	15	8	06	8	07	15	77	P	16wks

KEY TO MASTER CHART:

#	:	Fracture
CC screw	:	Cannulated cancellous screw
E	:	Excellent
F	:	Female
F	:	Fair
G	:	Good
LM	:	Lateral malleolus
M	:	Male
MM	:	Medial malleolus
P	:	Poor
PAB	:	Pronation-abduction
PER	:	Pronation-external rotation
RTA	:	Road traffic accident
S.Infection	:	Superficial infection
SAD	:	Supination-adduction
SER	:	Supination external rotation
wks	:	Weeks
yrs	:	Years