"A PROSPECTIVE STUDY OF FUNCTIONAL OUTCOME OF TIBIAL PILON FRACTURES TREATED WITH LOCKING COMPRESSION PLATE BY MIPPO TECHNIQUE (MINIMALLY INVASIVE PERCUTANEOUS PLATE OSTEOSYNTHESIS)"

By

DR.ARUN KUMAR YAMSANI

Dissertation submitted to

BLDE UNIVERSITY, VIJAYAPUR. KARNATAKA.

In partial fulfillment

Of the requirements for the degree of

MASTER OF SURGERY

IN

ORTHOPAEDICS

Under the guidance of

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DR. ARUN KUMAR YAMSANI

LIST OF ABBREVIATIONS USED

A/K	-	Above knee
AO	-	Arbeits gemeimchaft for osteosynthefiager
AP	-	Anteroposterior
ASIF	-	Association for the study of internal fixation
CT	-	Computed tomography
DCP	-	Dynamic compression plate
DOA	-	Date of admission
F	-	Female
FIG	-	Figure
L	-	Left
LCP	-	Locking compression plate
LP	-	Locking plate
LCDCP	-	Low contact dynamic compression plate
LISS	-	Less invasive stabilisation system
M	-	Male
MIPPO	-	Minimally invasive percutaneous plate osteosynthesis
OTA	-	Orthopaedic trauma association
ROM	-	Range of movement
R	-	Right
RTA	-	Road traffic accident
SD	-	Standard deviation

ABSTRACT

TITLE OF DISSERTATION: **A PROSPECTIVE STUDY OF FUNCTIONAL OUTCOME OF TIBIAL PILON FRACTURES TREATED WITH LOCKING COMPRESSION PLATE BY MIPPO TECHNIQUE (MINIMALLY INVASIVE PERCUTANEOUS PLATE OSTEOSYNTHESIS)**

ABSTRACT

INTRODUCTION:

Pilon fractures represent a significant challenge to most of the surgeons even today, accounting for 7-10% of all tibial fractures. The challenges are in the form of poor status of the soft tissue envelope, compound fractures and intra articular fractures. In the first half of the last century these fractures were deemed to be non amenable for surgical reconstruction. Conservative treatment by cast application led to prolonged immobilization, ankle and knee stiffness and arthritic changes there by affecting the quality of life.

For the past decade, plating using fracture reduction has been successful in treating complex fractures of the lower extremity especially distal tibia. The goal of this technique is to apply stable plate fixation while maintaining fracture biology and minimizing soft tissue problems.

In this region MIPPO (minimally invasive percutaneous plate osteosynthesis) technique is maximally indicated, as preservation of soft tissue integrity is critical; it reduces iatrogenic soft tissue injury and damage to bone vascularity as well as preserves the fracture hematoma. The anteromedial tibial cortex is subcutaneous and the soft tissue envelope is thin. Indirect reduction and percutaneous locked plating are useful in the management of distal tibia fractures because they do not require extensile exposure for reduction of the articular surface.

OBJECTIVE:

To study the functional outcome and duration of union in Tibial Pilon fractures treated with Locking Compression Plate by MIPPO technique.

METHODS:

The study was conducted between the period of December 2014 to January 2016 in Shri. B.M. Patil medical college, hospital and research centre, VIJAYAPUR. 25 patients with diagnosis of tibial pilon fractures were treated with locking compression plate by mippo technique. All fractures classified according to AO/OTA classification in adults aged 18 years and above of either sex were included in the study. All patients were followed up. With each follow up, clinical and radiological examinations were performed at 6 weeks, 3months and 6months.

RESULTS:

The study included 25 patients, 18 male and 7 female aged from 22 to 85 years with mean age of 42.3 years. The average time for fracture union in our series was 17.6 weeks.Our study had 20 (80%) patients without any complications and 5 (20%) patients had complications like superficial wound infection,deep wound infection,non union and ankle stiffness. Our study yielded excellent to good results in 80% of the cases.

CONCLUSION:

Tibial pilon fractures are best managed operatively. Optimal functional outcome is achieved by accurate anatomical reduction and secure fixation followed by early mobilisation.

MIPPO facilitates in early mobilization of the patient which helps in healing of the fracture and prevents joint stiffness. It promotes early union as it does not disturb anatomy and physiology of vascularity at the fracture site. MIPPO with a LCP is an excellent treatment option for tibial pilon fractures in terms of radiological and clinical union.

KEYWORDS : Tibial pilon fractures, locking compression plate,mippo technique

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INTRODUCTION

Pilon fractures represent a significant challenge to most of the surgeons even today, accounting for 7-10% of all tibial fractures.[1]

The challenges are in the form of poor status of the soft tissue envelope, compound fractures and intra articular fractures. In the first half of the last century these fractures were deemed to be non amenable for surgical reconstruction. Conservative treatment by cast application led to prolonged immobilization, ankle and knee stiffness and arthritic changes there by affecting the quality of life.[2]

For the past decade, plating using fracture reduction has been successful in treating complex fractures of the lower extremity especially distal tibia. The goal of this technique is to apply stable plate fixation while maintaining the fracture biology and minimizing soft tissue problems.[3,4,5]

Introduction of the locking compression plate was a revolution in the evolution of management of fractures where prolonged bed rest is avoided and return to work is satisfactorily helpful.[6]

Compared with a conventional plate, a locking plate imparts a higher degree of stability and provides better protection against primary and secondary losses of reduction and minimization of bone contact there by preserving periosteal blood supply. Locked plating in the distal tibia shaft fractures is superior to intramedullary nailing and plating is associated with less malalignment than intramedullray nailing.[7,8]

Locking plates (LPs) have the biomechanical properties of internal and external fixators, with superior holding power because of fixed angular stability through the head of locking screws ,independent of friction fit.[9]

In this region MIPPO technique is maximally indicated, as preservation of soft tissue integrity is critical; it reduces iatrogenic soft tissue injury and damage to bone vascularity as well as preserves the fracture hematoma. The anteromedial tibial cortex is subcutaneous and the soft tissue envelope is thin. Indirect reduction and percutaneous locked plating are useful in the management of distal tibia fractures because they do not require extensile exposure for reduction of the articular surface.

The anatomical locking plate for the distal tibia was developed to accomodate the need for the biological osteosnythesis of distal tibia fractures which can effectively preserve the blood supply of the fracture by MIPPO technique therefore reducing the incidence of non union, delayed union and soft tissue complications.[10]

AIMS AND OBJECTIVES OF THE STUDY

- To study the functional outcome and duration of union in Tibial Pilon fractures treated with Locking Compression Plate by MIPPO technique.

REVIEW OF LITERATURE

HISTORICAL REVIEW

Fractures have been recognized and treated as long as recorded history. History of fracture and its knowledge dates back to Egyptian mummies of 2700 BC.

For thousands of years the only option for the management of fractures was some form of external splintage. 5000 years ago, the Egyptians used palm bark and linen bandages for management of fractures. Clay and lime mixed with egg white were used, but the material most commonly used has been wood.

The first account of any internal fixtion was probably that with a brass wire by A.M. Icart in 1770, screw fixation by French surgeons Cucel and Rigaud in 1850 and plate fixation by Hansmann of Hemburg in 1886.Almost during the same time. A. Lambotte (1866 to1955), WA Lane (1856 to 1943), Sherman (1950) and Danis (1940) published their results using different plates with varying successrates. Robert Danis (1880 to 1969)must be regarded as the father of modern osteosynthesis since he was the first one to use a compression plate with Co-Apting screws and described the phenomena of 'Primary fracture healing' with peripheral callus. The concept was widely publicised and practiced worldwide by a group of such orthopadic surgeons,general surgeons and scientists forming an association in 1958, known by the name AO or ASIF .

The fear of 'Fracture Disease'a syndrome produced by prolonged immobilisation of fractured fragments was thus obviated. In 1969, the DCP was designed and it became the implant of choice for the next two decades. Clinical and laboratory observations however, revealed that stress protection under the plate led to osteoporosis and chances of re-fracture following its removal. LCDCP by AO/ASIF was introduced in early 90s and the emphasis shifted from mechanical fixation to biological fixation .

The recent introduction of LCP and point contact devices further reduces contact between the plate and the bone and has been found useful for osteoporosis and comminuted fractures.The LISS is being used to achieve minimally invasive percutaneous plate osteosynthesis (MIPPO) .

MIPPO technique is becoming a popular method of treating distal tibial fractures when soft tissue envelope is minimally disturbed.It is a good and safe technique for treating these injuries providing fracture healing, rapid recovery and avoidance of major complications.[11]

During the 1980s the AO/ASIF group started to work on new plate design to minimize disadvantages of plating with respect to cortical perfusion. To overcome the negative effects of compression forces on the periosteum, a new generation of plates were created. The key to these internal fixators is the locking mechanism of the screws in implant, which provides angular stability and technical details ensures that compression forces on the bone surface are not necessary to gain stability to bone implant construct and also provides excellent holding force even in osteoporotic bone.[12]

Olerud C and Molander H (1984) Proposed a scoring system for evaluating ankle fractures and they recommended for scientific investigations as even minor subjective differences in disability experienced by the patient are significantly separated.[13]

Helfet DL,et al (1997) Twenty patients with unstable intraarticular or open extraarticular fractures have been treated including 12 A-type, 1 B-type and 7 C-type fractures according to the A0 classification.Two fractures were open (both Gustilo Type I).Closed soft tissue injury was graded according toTscherne with 3 type CO, 7 type Cl, 7 type C2 and 1type C3. All fractures healed without the need for a second operation. Time to full weight-bearing averaged 10.7 weeks (range 8-16 weeks). Two fractures healed with >5 degree varus alignment and 2 fractures healed with >lo degree recurvatum. No patient had a deep infection. The average range of motion in the ankle for dorsiflexion was 14 (range O-30) and plantar flexion averaged 42(range 20-50').With longer follow-up and a larger number of patients, the authors felt confident that the minimally invasive technique for plate osteosynthesisfor the treatment of distal tibial fractures will prove to be a feasible and worthwhile method of stabilization while avoiding the severe complications associated with the more standard methods of internal or external fixation of those fractures.[14]

Redfern DJ,Syed SU, Davies SJM in 2004 reported the results of 20 patients treated by MIPPO for tibial pilon fractures. Their mean age was 38.3 years (range: 17—71 years). Fractures were classified according to the AO system, and intra-articular extensions according to Ruedi and Allgower. The mean time to full weight-bearing was 12 weeks (range: 8—20 weeks) and to union was 23 weeks (range: 18—29 weeks), without need for further surgery. There was one malunion, no deep infections and no failures of fixation. They concluded that MIPO is an effective treatment for closed, unstable fractures of the distal tibia, avoiding the complications associated with more traditional methods of internal fixation and/or external fixation.[15]

Egol KA, et al in the year 2004 reviewed the biomechanical principles that guide fracture fixation with plates and screws; specifically to compare and contrast the function and roles of conventional unlocked plates to locked plates in fracture fixation. They reviewed basic plate and screw function, discussed the design rationale for the new implants, and examined the biomechanical evidence that supports the use of such implants. Concluded that Locked plates and conventional plates rely on completely different mechanical principles to provide fracture fixation and in so doing they provide different biological environments for healing. Locked plates may increasingly be indicated for indirect fracture reduction, diaphyseal/ metaphyseal fractures in osteoporotic bone, bridging severely comminuted fractures, and the plating of fractures where anatomical constraints prevent plating on the tension side of the bone. Conventional plates may continue to be the fixation method of choice for periarticular fractures which demand perfect anatomical reduction and to certain types of nonunions which require increased stability for union.[16]

Hazarika S, et al in Sep 2006 showed results of a series of 20 patient of distal tibial fracture treated using locking compression plates through MIPPO technique. This approach aims to preserve bone biology and minimise surgical soft tissue trauma. This provided 87.5% of good to excellent results. Fractures were classified according to the AO system.[17]

Collinge C,et al (2007) This study evaluated clinical results and outcomes of a strict cohort of highenergy injuries of the metaphyseal distal tibia with minimal or no intra articular involvement treated using the minimally invasive plating.They concluded that minimally invasive medial plating will restore limb alignement and yield successful clinical outcome for high-energy metaphyseal fractures of the distal tibia.[18]

Hasenboehler E,Rikli D,Babst R(2007) Retrospectively evaluated the healing pattern and the clinical evolution of diaphyseal and distal tibial shaft fractures over two and a half years in 32 patients (6 females, 26 males). Fractures were classified according to AO classification and included all 42A-C, 43A-B and 43C1-2 types. For open fractures, Gustilo Anderson classification was used. Plates consisted of the 4.5 mm LCP and 3.5 mm LCP-Pilon form plate. Clinical and radiological assessment was performed at 6 weeks, and at 3, 6, 9,and 12 months. Two patients were lost to follow-up. Ten patients at 3 months, 23 at 6 months, and 27 at 9 months met the criteria for a healed fracture. Plate bending was observed in one patient and called for re-operation at 5 months. Two patients required re-operation at 13 months secondary to pseudoarthrosis. Though MIPPO seems more advantageous for soft tissue and bone biology, prolonged healing was observed in simple fracture patterns when a bridging plate technique was used.[19]

Leung F K, et al Nov 2009 showed that MIPPO LCP in treatment of tibial pilon fractures was excellent without any incidence of serious complications. In their study of 62 patients near anatomical reduction was achieved in 56 fractures and acceptable reduction in 6 fractures. The mean age of patients was 44 years and fractures classified according to AO classification. The mean healing time was 19.5 weeks.[20]

Fan Liu in the year 2009 concluded that LISS system fixation is adequate enough to maintain alignment and obtain union with a low incidence of complications even in patients with osteoporotic bone.[21]

Ronga M,et al(2009) They reviewed minimally invasive osteosynthesis of distal tibial fractures using locking plates and stated that management of distal tibia fractures can be challenging because of the scarcity of soft tissue ,their subcutaneous nature and poor vascularity and also mentioned the importance of locking compression plates in the treatment of distal tibia fractures using MIPPO technique where locking plates have the biomechanical properties of internal and external fixators ,with superior holding power because of fixed angular stability through the head of locking screws and independent of fraction fit.[22]

Gupta RK et al (2010) In a retrospective study of 80 patients with distal tibial fractures fixed with locking plate. They conclude that the treatment of distal tibial metaphyseal fractures with an LCP using the minimally invasive locking plate osteosynthesis (MIPPO) technique is a reliable alternative method of stabilisation. It decreases the incidence of complications of soft tissue and bone healing associated with the conventional methods of plating or external fixation of these fractures. Intramedullary nailing, though biological, suffers from a limitation of inadequate fixation due to a small distal fragment, even more so in the presence of comminution. A precontoured distal medial tibial LCP is a better tolerated implant in comparison to the 4.5-mm LC-LCP and metaphyseal LCP with respect to complications of soft tissues and bone healing and functional outcome, though its contour needs to be modified. Additional measures in the form of acute docking of the fracture, primary bone grafting and supplementary fibular fixation in comminuted fractures are recommended.[23]

Paluvadi SV, et al from May 2010 to May 2013 treated 50 patients of closed distal tibia fractures by MIPPO technique with a distal tibia locking compression plate. The mean age of the patients was 36yrs(20-56yrs).The majority of the fractures were extra articular fractures ie.AO/OTA 43-A (90%).The mean time for union was 21.4 weeks(range 16-32 wks) 5 patients(10%) encountered superficial infection which were managed with dressings and antibiotics.[24]

Vallier HA,Cureton BN, Patterson BM(2011) This study purposes were to compare plate and nail stabilization for distal tibia shaft fractures by assessing complications and secondary procedures. They concluded that high primary union rates were noted after surgical treatment of distal tibia shaft fractures with both nonlocked plates and reamed intramedullary nails. Rates of infection ,nonunion and secondary procedures were similar. Intramedullary nailing was associated with more malalignement than plating.[25]

Serban AL, et al from April 2012-July 2013 evaluated a study of 22 patients of tibial pilon fractures treated by MIPPO technique. There were 17 males and 5 females, mean age was 51yrs(31-68).All patients were fully weight bearing at 16 weeks(9-16 weeks) and radiological union was at 17 weeks(14-24 weeks).There were no cases of failure of fixation, malalignment. No significant complications was observed.[26]

Dr.Lokesh Holagundi, et al in May 2014 published the result of 30 patients of distal tibia fractures in which 15 patients were treated by IMIL nail and 15 patients treated by Plating with MIPPO technique. All the fractures were of extra articular type. They concluded that more malalignment (11.11%), delayed union (16.6%),non union (5.5%),secondary procedure (22.2%) done for the complications was more with nail, where as plate group never had malalignment, had one delayed union for which no secondary surgery done.[27]

Chandra Sekharam Naidu M,et al(2015) According to this study, 24 patients with fractures of the distal tibia which have undergone closed reduction through MIPPO techniques and application of the locking compression plates states that this technique has resulted in the strong and effective stabilization of these fractures. LCP does provide excellent stability and allows early range of motion at ankle.The closed reduction not only helps in achieving reduction in difficult situations, but also in rapid union, because it facilitates preservation of the blood supply to the fragment and helps to achieve near normal anatomical reduction of the fracture. Finally they conclude with their study of 24 patients with 24 fractures reviewed which included types A1, A2, A3 distal tibial fractures that results are comparable with earlier studies and showed 87% of good and excellent results.[28]

Shikhar Singh D,Manohar PV,Rajendra B (2015) In a prospective study of 30 patients fixed with MIPPO by locking compression plates. They concluded that MIPPO is an effective technique for the management of distal tibial fractures.it is minimmaly invasive though technically demanding, but preserves the biological environment by preserving the soft tissue with better outcome in terms of radiological and clinical outcome.[29]

ANATOMY

SURGICAL ANATOMY[30,31]

The tibia is an important weight bearing bone in the lower limb ,articulating with the femur proximally at the knee and distally with the talus at the ankle. It also has articulations proximally and distally with the fibula which lies posterolaterally .The fibula is also attached to the tibia along its length by the interosseous membrane .The tibia has proximal and distal metaphyses and a diaphysis spanning between them.

The tibial diaphysis has three surfaces, the posterior and lateral surfaces serving principally for muscular attachment. The medial surface is mainly subcutaneous consequently tibial fractures can easily perforate the skin and become open injuries. The medial surface extends beyond the tibial plafond to form the medial malleolus of the ankle.

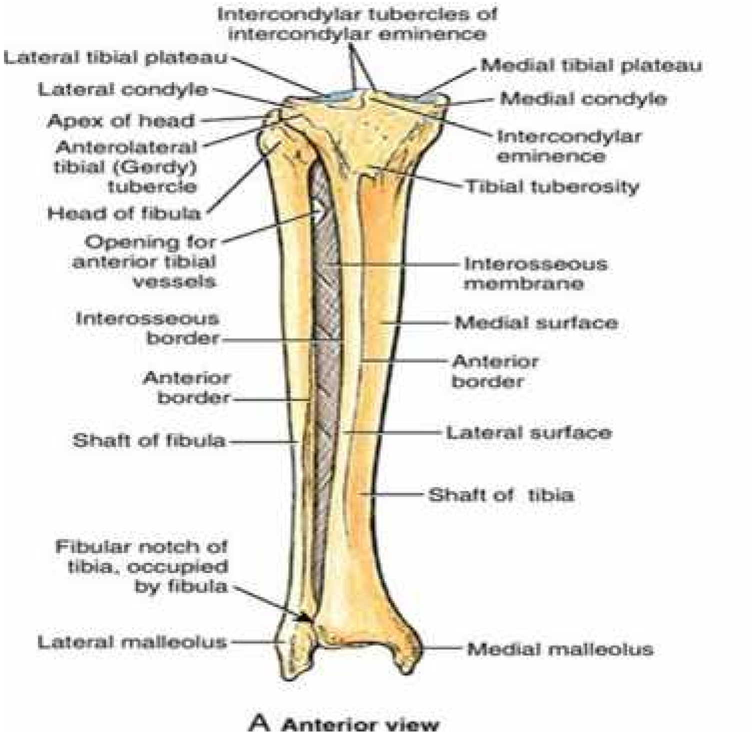
The tibial pilon comprises anatomically the distal end of the tibia including the articular surface.Its proximal limit is found approximately 8-10 cm from the ankle articular surfaces ,where the triangular section of the tibial diaphysis ,with its anterior crest,changes direction forming the Metaphysis.

As the diaphysis gives way to the distal metaphysis ,the triangular cross-section becomes more circular ,this means that intramedullary devices only develop an interference fit in the central few centimeters.

The diaphyseal cortical bone is thicker than in the metaphysis ,making screw fixation in the diaphysis more secure.

The distal metaphysis of the tibia has been defined by Muller as being within a square box ,the length of the sides defined by the widest portion of the tibial plafond.

Figure 1: Anatomy of Tibia



The leg is divided into 3 compartments:

1. Anterior Compartment:

It contains the Tibialis anterior, Extensor digitorum longus, Extensor hallucis longus and the Peroneus tertius muscles. They are enclosed in a relatively unyielding compartment made up of the tibia medially and fibula laterally, the interosseous membrane posteriorly and the tough anterior investing fascia which goes from the tibia. Both the artery and the nerve pass deep to the muscle near the ankle and the tendons are close to the tibia-and the fractures in this area may cause callus formation that comparatively restrict gliding of these tendons.

Because of the unyielding walls of anterior compartment, increased tissue pressure may result in anterior compartment syndrome. This may occur secondary to tibial fracture.

2. Lateral Compartment:

The Peroneus longus and brevis muscle runs in the lateral compartment. They protect the fibular shaft except near the ankle. Therefore, isolated fracture of the fibula owing to direct trauma is uncommon. The superficial peroneal nerve runs in between the Peronei and the Extensor digitorum longus in the inter muscular septum. Thus, the nerve is rarely involved in fracture of the fibular shaft although it is at risk in a fracture of the fibular neck. The ischemic changes in the lateral compartment are uncommon.

3. Posterior Compartment:

The muscles are Soleus, Gastrocnemius, Tibialis posterior, Flexor hallucis longus and Flexor digitorum longus. The Posterior tibial nerve, the Posterior tibial artery and its large branch Peroneal artery also run in the posterior compartment. They are well protected by these muscles. The symptoms of posterior compartment are less striking due to the fact it being more large and elastic.

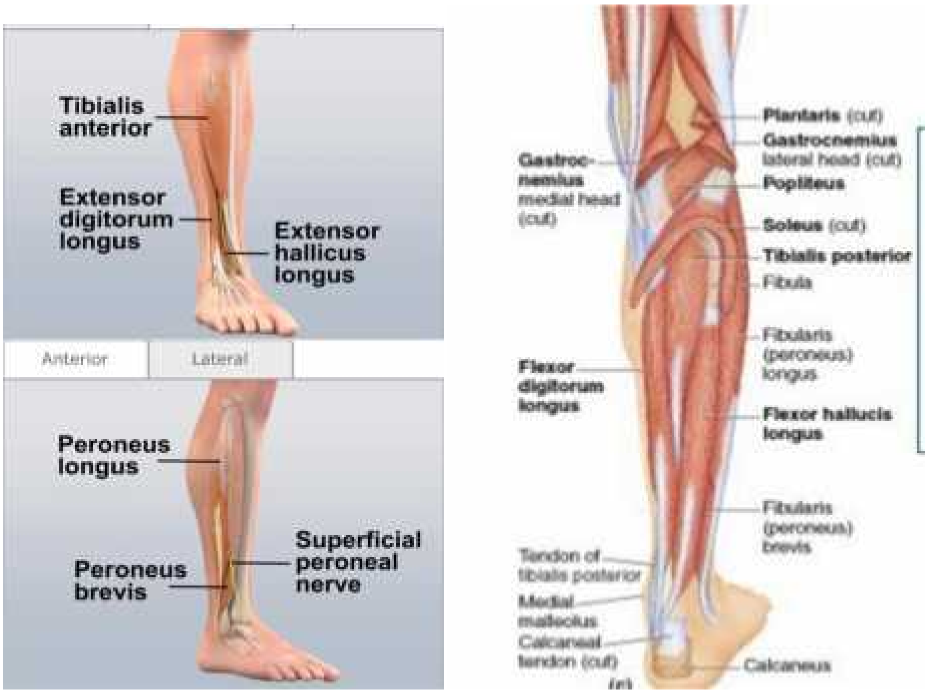


Fig 2:Compartments of leg

Shaft of the tibia:

The shaft of the tibia is a long tube of heavy bone, which is abruptly broadened at its upper end to support the condyles and is moderately expanded at its lower end to rest on the talus. The extremities are cancellous in structure and the cortex is thin but the main portion of shaft is composed of thick compact bone. In its upper portion the shaft is triangular on cross section and in its lower third it becomes more rounded or roughly quauadrilateral on cross section and is considerably narrowed. Consequently, the lower third is the weakest point in the shaft and it is here that the majority of fractures occur. The anterior border of crest is sharp in its upper two-third and is subcutaneous throughout its length. Above it begins lateral to the tubercle and extends downwards to the front of the internal malleolus. The internal border is more rounded and can be palpated throughout its extent. The posterior and lateral surfaces are covered by muscles. The high percentage of open injuries among fractures of the tibia is largely due to the fact that the anterior and medial borders and medial surfaces are subcutaneous.

Interosseous membrane:

This is a strong sheet of fibrous tissue, which closes the space between the tibia and fibula except at its upper end, where there is a small opening for the passage of the anterior tibial vessels. In fractures it prevents the separation of the bones unless it is extensively torn. Since the majority of its fibers run downwards and outward, the interosseous membrane serves to distribute indirect violence acting on the tibia to the fibula.

Muscles of the leg:

The muscles of the leg are divided into four groups; each of it is contained in a separate fascial compartment. The extensor group consisting of Tibialis anterior, Extensor digitorum longus, Extensor hallucis longus and Peroneus tertius, lies on the front of the leg. The abductor group, consisting of the Peroneus longus and brevis, is lateral to the extensor but lies anterior to the external intermuscular septum. The calf muscles or the Triceps surae group, consisting of the Soleus, Gastrocnemius and Plantaris, occupies the posterior compartment and beneath this group, separated from it by an intermuscular septum is the deep flexor group, which consists of the tibialis posterior, flexor digitorum longus and flexor hallucis longus. None of these muscles exert cross strains on the tibia and fibula and when these bones are broken, none of them tend to cause serious displacement other than to draw the lower fragments upwards.

Blood vessels and nerves:

The Anterior and Posterior Tibial and Peroneal arteries are the main blood vessels of the leg. The Anterior tibial artery is one of the terminal branches of the popliteal artery and passes forward through the opening in the interosseous membrane to reach the anterior compartment, where it passes downwards on the interosseous membrane to terminate in the Dorsalis pedis artery. The posterior tibial is the direct continuation of the Popliteal artery. It passes downward in the space between the deep flexor muscles and the calf muscles to terminate as the plantar arteries. The peroneal artery passes downward in close relation to the posterior surface of the tibia.

The tibial blood supply is derived from three main systems;

1. The epiphyseal and metaphyseal arteries.
2. The nutrient arteries.
3. Periosteal arteries.

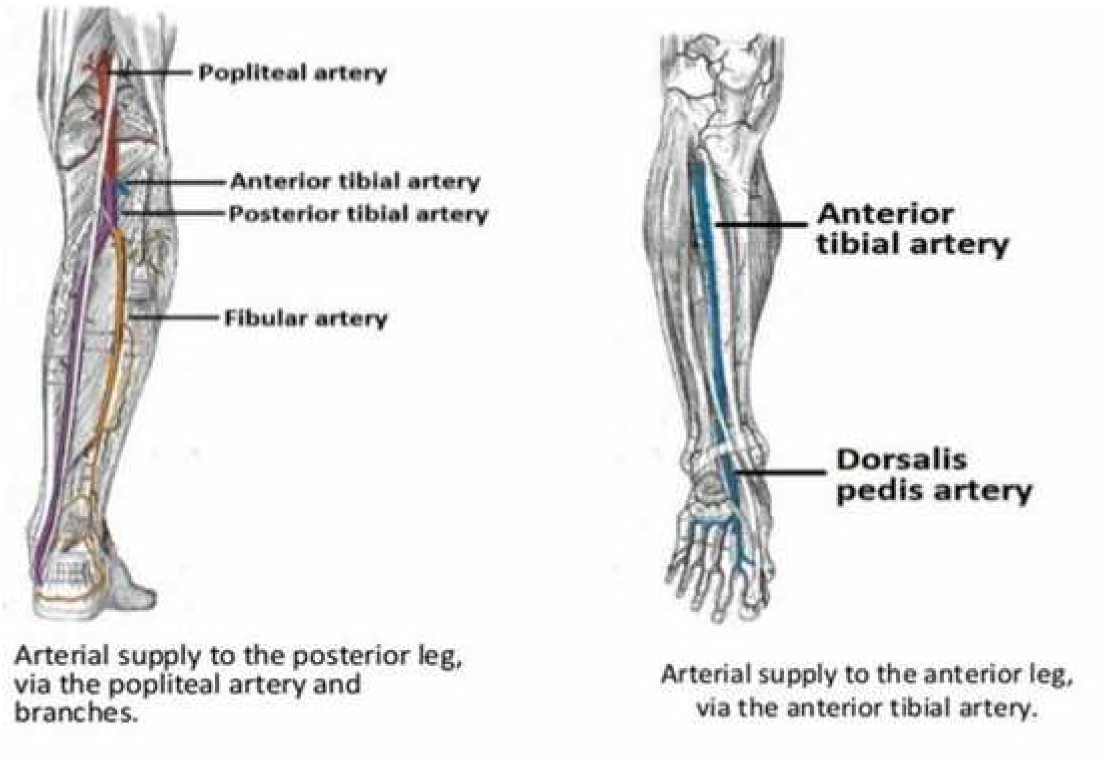


Fig 3: Arterial supply to leg

CLASSIFICATION OF TIBIAL PILON FRACTURES

To minimize complications and to optimize outcomes, the surgeon must accurately match treatment techniques with fracture types and soft tissue injury patterns. To do this, the injury in some way must be classified. The group into which, it is classified should give a guide to the risk of complications during treatment, so management strategies can be chosen that will minimize their occurrence and will optimize outcome. Experienced surgeons arrive at these decisions using a variety of data which obtain a feeling about the "personality" of the fracture.[32]

For many years, surgeons have formally classified fracture patterns of the distal tibia. More recently, investigators have attempted to classify the soft tissue injury.

The two main classification systems used for fractures of the tibial pilon are the Ruedi and Allgower system and the AO/Orthopaedic Trauma Association (AO/OTA) Fracture Classification System. Both are descriptive systems, with the severity of injury only being inferred. The Ruedi and Allgower system is moderately useful and divides fractures of the tibial plafond into three types based on the displacement and degree of comminution of the articular surface (Fig. 56-3). Type I fractures are intra-articular fractures without displacement. Type II fractures demonstrate displaced articular fragments without comminution. Type III fractures demonstrate displacement and comminution of articular fragments.[33]

The AO/OTA system is a more comprehensive classification scheme. Each bone is assigned a unique numerical designation and fractures are classified according to a consistent framework. The tibia is assigned the numeric code of 43. Injuries of the tibial pilon are then categorized as extra-articular (43 type A), partial articular (43 type B), or total articular (43 type C) (Fig. 56-4). Each type is then further divided into one of three groups depending on the amount of fracture comminution. Each of these, in turn, can be further divided into subgroups by other characteristics of the fracture, such as the direction, description, or location of a fracture line; the presence or absence of asymmetric metaphyseal impaction; and the location and amount of comminution.[33]

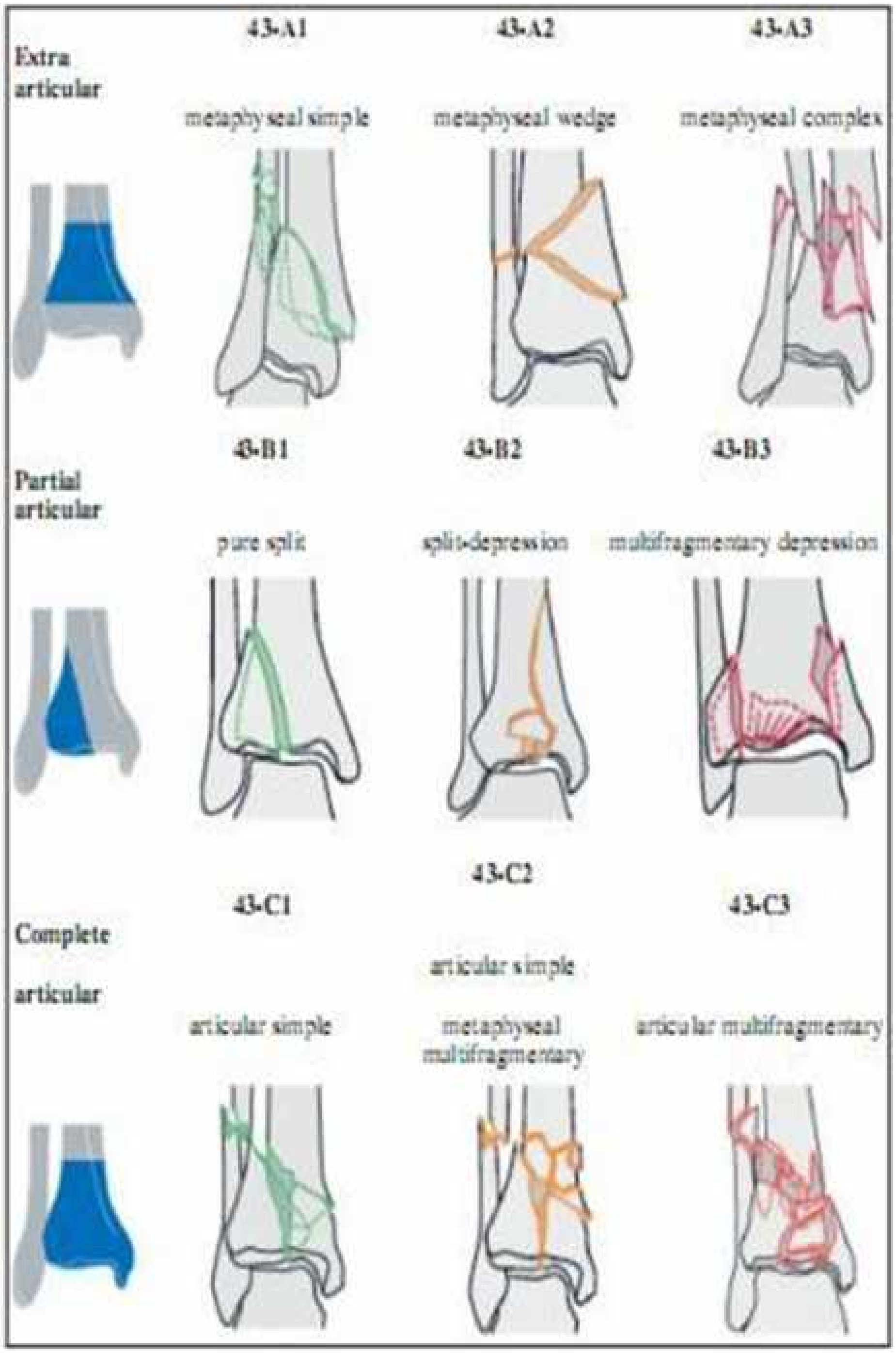


Fig 4 :Classification of Orthopaedic Trauma Association (AO/OTA)

A. Extraarticular, B. Partial articular, C.Complete articular.

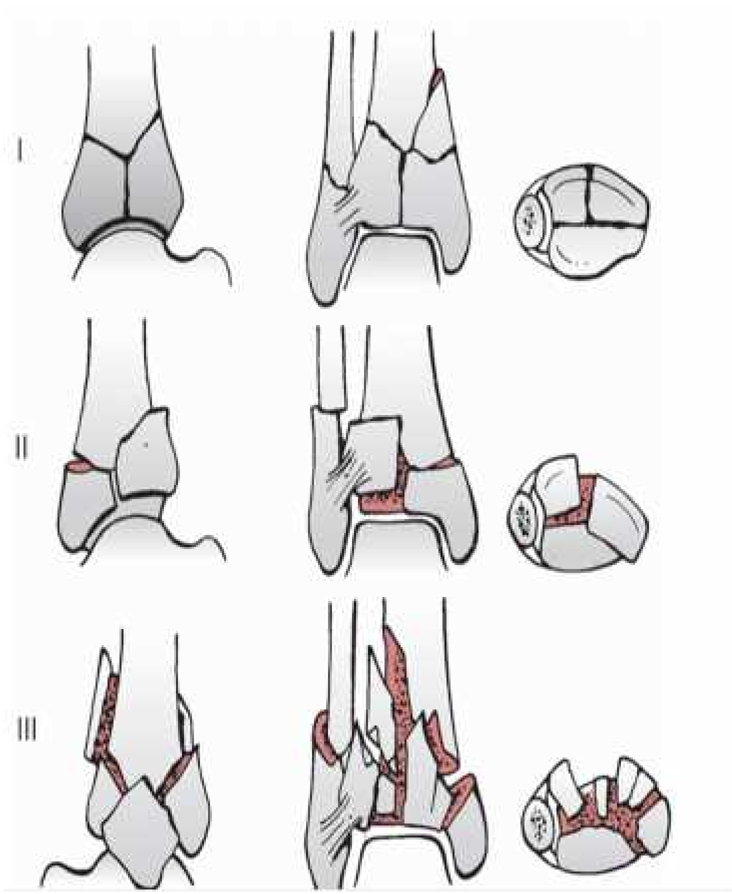


Fig 5: Ruedi- Allgower classification of tibial pilon fractures. Type I: cleavage fracture of the distal tibia without significant displacement of the articular surface. Type II: significant fracture displacement of the articular surface without comminution. Type III: Impaction and comminution of the distal tibial articular surface.

CLASSIFICATION OF SOFT TISSUE INJURIES [34]

Gustilo and Anderson in 1976 described their treatment of 1025 open fractures with application of a grading system that offered prognostic information about the outcome of infected fractures. In 1984, this system was modified and their results updated. The modified classification is based on the size of the wound, periosteal soft tissue damage, periosteal stripping, and vascular injury.

Grade I open fractures have a clean wound less than 1 cm long.

Grade II wounds the laceration is more than 1 cm long but is without extensive soft tissue damage, skin flaps, or avulsions.

Grade IIIA open fractures have extensive soft tissue lacerations or flaps but maintain adequate soft tissue coverage of bone, or they result from high- energy trauma regardless of the size of the wound. This group includes segmental or severely comminuted fractures, even those with 1-cm lacerations.

Grade IIIB open fractures have extensive soft tissue loss with periosteal stripping and bony exposure. They usually are massively contaminated.

Grade IIIC open fracture includes open fractures with an arterial injury that requires repair regardless of the size of the soft tissue wound.

MECHANISM OF INJURY[32]

Direct Injury:

These include five principal causes - falls, sports injuries, direct blows or assaults, motor vehicle accidents and gunshot injuries.

Falls may be simple fall on his or her height, fall down stairs or slopes, and fall from height.

The highest incidence is seen in motor vehicle accidents usually affecting the motor cyclists, pedestrians and automobile occupants.

Axial loading injuries:

Bone is viscoelastic, the rate of loading shifts the stress strain curve. Rapid axial loading absorbs and then at failure releases more energy. The released energy is imparted to the soft tissue. Part or the entire articular surface may be involved. The injury may be confined to an epiphyseal area just above the joint, it may involve the epiphysis and metaphysis or it may have an extension into the diaphysis. The precise direction of force and the position of the foot when it is applied lead to wide variation in fracture patterns.

INITIAL EVALUATION AND MANAGEMENT

History

A careful history of the mode of injury and mechanism of injury, the likelihood of associated injuries, and the presence of underlying medical conditions that can affect treatment or healing were ascertained.The mechanism of injury provided insight into the amount of energy imparted to the bone and soft tissue at the time of fracture, which was crucial for surgical planning and for advising the patient on prognosis. Details such as the height of a fall or the speed of a motor vehicle accident were therefore important. In open fractures, assessing the environment in which the injury occurred would guide antibiotic treatment.

Physical examination:

The patients were carefully examined for associated injuries. Once life-threatening injuries had been ruled out or adequately addressed, attention was focused on the ankle injury. Deformity of the leg,ankle and foot was often apparent on initial inspection. The neurological and vascular status of the foot were evaluated. When pulses were absent, the leg and ankle were realigned, and then the vascularity reassessed. Splinting the leg and ankle prevents further soft tissue trauma.

Open wounds were inspected to determine their extent and the amount of contamination. The condition of the skin was carefully examined, including the amount of swelling and the presence of fracture blisters. Tense soft tissue swelling was frequently present, and it was assessed by both inspection and palpation. The presence or absence of skin wrinkles has been recommended as one way to assess the degree of soft tissue swelling[35].The true extent of the soft tissue injury may not declare itself initially, so the leg and ankle must be frequently reassessed.

Fracture blisters are common and can be divided into two types: clear fluidfilled and blood-filled blisters. Histologically, both types are separations at the dermal-epidermal junction, but blood-filled blisters are deeper and indicate more severe soft tissue injury. There have been more wound complications when incisions are made through blood-filled blisters. Local bruising and ecchymosis indicate a greater degree of deep soft tissue damage. Although compartment syndrome is unusual, it should be considered, and the tenseness of the muscle compartments of the leg and foot should be routinely examined. Compartment syndrome is more common in plafond fractures with diaphyseal extension.[36]

Radiological investigations:

Standard radiographs are AP, lateral, and mortise views of the ankle. Repeat radiographs with the limb provisionally reduced provide more information about the fracture pattern and should routinely be obtained if the initial radiographs were taken with the talus widely displaced. Proximal extension of the fracture or suspicion of more proximal injury mandates that full-length tibia and fibula radiographs be obtained. Some surgeons find views of the contra lateral ankle helpful as a template for preoperative planning.[37]

Trispiral tomography has largely been replaced by CT scanning as the optimal adjunct to plain radiographs for further imaging of articular fractures of the lower extremity. It provides more information than plain films and frequently alters the surgical plan. Two-dimensional axial CT scanning helps to define the severity of the injury and aids with surgical planning.

METHODS OF TREATMENT[32]

Closed Treatment without Reduction :

Certain minimally displaced type A fractures or type C1 fractures may be treated in a cast or treated in an external fixator without reduction. True axially loading fractures of the distal tibia with metaphyseal and articular displacement are rarely indicated for this type of treatment.

External Fixation on the Same Side of the Joint :

A variety of external fixator constructs are available that stabilize distal tibia fractures externally on the tibial side of the joint only. These include classic Ilizarov ring wire fixators, hybrid fixators that combine pin fixation with wire fixation in various constructs, and pin fixators.

All these fixators have successfully decreased wound Complication rates compared with older plating techniques. The fracture healing rate has been generally high. 75% to 81% good and excellent results have been reported.

The advantage of this technique compared with cross-ankle external fixation techniques is that ankle joint movements are preserved, because all components of the external fixator are above the ankle joint. Olive wires attached to a ring can be used to assist in reducing and stabilizing articular fragments, thus potentially limiting soft tissue dissection.

Certain comminuted distal tibia fractures are not amenable to same-side external fixation. A high incidence of pin and wire complications, septic arthritis of the ankle secondary to wires in the distal tibia has been reported. These complications indicate that there is some risk with placing external fixator pins or wires in the zone of injury to stabilize high-energy distal tibia fractures

Open Reduction and Internal Fixation :

This technique, which used to be the gold standard, has fallen somewhat out of favor because of the severe complications reported in the early 1990s.

Open reduction and internal fixation in expert hands can be reasonably safe, with only a small rate of devastating complications. However, the surgical techniques and judgement required to obtain these results may not be widely applicable to all surgeons.

Open reduction and internal fixation with locking compression plates:

Locking plates (LPs) have the biomechanical properties of internal and external fixators, with superior holding power because of fixed angular stability through the head of locking screws ,independent of friction fit.[9]

Minimally invasive medial plating will restore limb alignment and yield successful clinical outcomes for high-energy metaphyseal fractures of the distal tibia. Despite the significant reoperation rate and prolonged time to union, most patients can expect a predictable return of function .Strong consideration should be given to adjunctive measures in at –risk patients , including those with highly comminuted fracture patterns , bone loss, or Type II or III open fractures.[38]

Intramedullary nailing:

Intramedullary nailing is widely accepted as the operative treatment of choice for most open and closed diaphyseal tibial fractures .The fixation of distal tibial fractures with intramedullary nails is associated with high union rates and offers a significant benefit in not disturbing the soft-tissue envelope at the fracture site .However the use of this technique in distal tibial fractures has historically been associated with reports of malunion often due to technical problems including difficult fractures reduction ,fracture propagation into the ankle joint,hardware failure and inadequate distal locking options.

COMPLICATIONS[39]

Malunion :

Some degree of malunion is common after high-energy comminuted fractures Angular malalignment is also possible because the metaphysis is usually completely separated from the shaft. The surgeon must strive to achieve accurate alignment of the plafond with the tibia and knee joint during the surgical procedure and then follow the patient closely to see that alignment is maintained until the fracture is healed.

Nonunion and Delayed Union:

The incidence of nonunion and delayed union after fractures of the tibial plafond has been variably reported in the literature. It appears to be about 5% regardless of the treatment method. The higher the energy of the fracture and the greater the soft tissue injury, the greater the incidence of delayed or nonunion will be. Prolonged non-weight bearing, which may delay healing, is often required in the postoperative period to prevent loss of fixation. Even though these fractures involve cancellous bone, the injury to the soft tissues and the comminution lead to devascularization of the fracture fragments. Aggressive soft tissue dissection compounds this devascularization. Soft tissue complications lead to further devascularization, infection, and bone loss and increase the chances of failures of healing.

Infection and Wound Breakdown:

This devastating complication must be avoided at all cost. The majority of infections and wound breakdowns have occurred in patients with closed fractures who underwent open reduction and internal fixation with plates and screws. The type of fracture has most frequently been the high-energy vertical compression injuries.

Attempts to decrease the incidence of this complication include long delays until surgical treatment with the use of a temporary spanning fixator, indirect reductions, percutaneous reductions, internal fixation with low-profile implants, the use of external fixation, the use of spanning fixation, and atraumatic soft tissue techniques.

Decreased joint Motion:

Decreased motion of both the ankle and the subtalar joint is common after tibial plafond fractures. The decreased range of motion that results is approximately the same regardless of the treatment techniques employed.

Ankle Arthrosis:

The quality of reduction is thought to affect the development of arthrosis. In addition, articular cartilage damage at the time of injury contributes to the development of arthrosis irrespective of the quality of articular reduction. Other contributing factors include avascular necrosis of subchondral bone fragments and infection, which can lead to rapid severe arthrosis. When rapid loss of articular cartilage occurs in the first 6 months after injury, infection should be considered.

LOCKED PLATE TECHNOLOGY

Introduction

Plating techniques remain the mainstay for managing most periarticular and selected long bone fractures. Recent concepts in plating are based on attempts to

- Minimize soft-tissue stripping
- Decrease the need for bone grafting
- Improve union rates

Locked plate technology

Locked plate technology concept [40]

Locking compression plate was devised by combining the features of a LC-DCP and a PC-Fix.[41] In Locked plate technology the locked plates the “internal external fixators”, does not rely on frictional force between the plate and the bone to achieve compression and provide absolute stability having the advantage that the local blood supply under the plate is preserved allowing a superior bone healing and minimal complications.

The locking plate behaves like an external fixator but without the disadvantages of an external system not only in the transfixion of the soft tissues, but also in terms of its mechanics and the risk for sepsis. It is actually more an “internal fixator”.[42]

Locked plating does not require that the plate be compressed to the bone, as the interface between the plate and screw is secured without this plate-bone compression

Locked plate technology the historical background [43,44]

Plates for internal fixation of fractures have been used for more than 100 years. Plating of fractures began in 1895 when Lane first introduced a metal plate for use in internal fixation.

The earliest ancestor of the locking plate is the monocortical fixator by Carl Hansman in 1886. It rapidly reached its final form in the hands of Paul Reinhold in France in 1931, then fell

After the Litos system then the Zespol the concept progressively cut itself a significant place in the osteosynthesis techniques beginning in 1995. This concept was developed independently and nearly simultaneously by Patrick Sürer system unchanged since its beginning, and by the Arbeitsgemeinschaft für Osteosynthesefragen, Association for the Study of Internal Fixation through many stages.

The Schuli locking nut systems were proposed in 1998 so that a common screw could be locked in a plate

The point contact fixator (PC-fix) followed by the Less Invasive Stabilization System (LISS) and the locking compression plate (LCP) with all its versions.

Today, locking screw technology is reportedly being used in 5–25% of all fractures

Locking mechanisms types [41,45]

There are two broad categories of locking plates: fixed-angle locking plates and variable-angle locking plates. In the latter, the screw can be locked with a certain clearance within a cone with an angle on the order of 1–15°.

Advantages of Locking compression plate [45]

Locking compression plate device offers potential biomechanical advantage over other methods by,

- Better distribution of forces along the axis of bone
- They can be inserted with minimal soft tissue stripping using minimally invasive percutaneous plate osteosynthesis (MIPPO)
- Substantially reducing failure of fixation in osteoporotic bones

- Reducing the risk of a secondary loss of intraoperative reduction by locking with screws to the plate
- Unicortical fixation option
- Better preservation of blood supply to the bone as a locked plating does not rely on plate bone compression
- Provide stable fixation by creating a fixed angle construct and angular stability
- Early mobilisation

Advantages over Conventional plate

- They maintain a certain elasticity to stimulate bone healing
- Less rigid than conventional plates
- The quality of the reduction is less vital, provided that the local soft tissues and therefore vascularization of the fragments are maintained intact
- The callus is a stress callus, secondary, as in nailed osteosynthesis

Locked Plating Disadvantages [45,46]

- Very expensive
- Constructs may be too rigid
- Some percutaneous applications be self-drilling, that must be unicortical or strips near cortex
- No tactile feedback on bone purchase
- They “allow you to stop thinking”
- Reduction must still be achieved, it is not magically achieved by locking implant

Biomechanics of Locked Plate Technology [47]

Strain theory is very important to the understanding and application of locking plates. Perren, in 1979, advanced the original argument that fractures will heal by primary bone healing, secondary bone healing or proceed to non-union. Fracture strain is calculated by fracture gap displacement divided by fracture gap overall length.

Low strain states (< 2%) – as present in absolute stability – will heal primarily – without callus formation.

Medium strain states (2–10%) – seen in relative stability – will heal with secondary bone healing and abundant callus.

High strain states (> 10%) typically proceed to non-union because the elasticity of fibrous tissue is required to accommodate the significant movement at the fracture gap

Ahmad *et al***.** studied on biomechanics of locking compression plate. Consistent results were achieved in LCP constructs in which the plate was applied at or less than 2mm from the bone.[48]

Egol *et al***.** conducted a study on Biomechanics of Locked Plates and screws and showed that Locked plates and conventional plates rely on completely different mechanical principles to provide fracture fixation and they provide different biological environments for healing doing so.[7]

Locking plate constructs are often long plates with relatively few screws used for relative stability, or short plates with multiple divergent screws used in juxta-articular fractures.

These plates provided stable fixation but many considered their use demanding and technically challenging requiring precise 3-dimensional alignment and careful preoperative planning. The working length of a plate should be 2–3 times the length of the comminuted segment.

Reducing the area of contact between plate and bone, as achieved by the LC-DCP design, significantly reduced the vascular changes caused by pressure With the locking head screws engaged in the plate, the plate is not pressed onto the bone. This reduces interference to the blood supply to the bone underlying the plate.

Loading forces are transmitted directly from the bone to the screws, then onto the plate, across the fracture and again through the screws into the bone. Friction between plate and bone is not necessary for stability.

The plate and screws provide adequate rigidity and do not depend on the underlying bone when using a locking reconstruction plate

On each side of the fracture, the screws are locked into the plate as well as into the bone. The result is a rigid frame construct with high mechanical stability

The typical torque applied to 3.5 mm screws is between 3 to 5 Nm (Newton meter) that resist axial loads as small as 500 N (125 lbs.). The screw with the greatest amount of force bears the greatest load. As long as the patient load does not exceed the frictional force of the plate to the bone and the axial stiffness of the screw or cortical bone at the fracture site, the construct is stable enough to allow healing

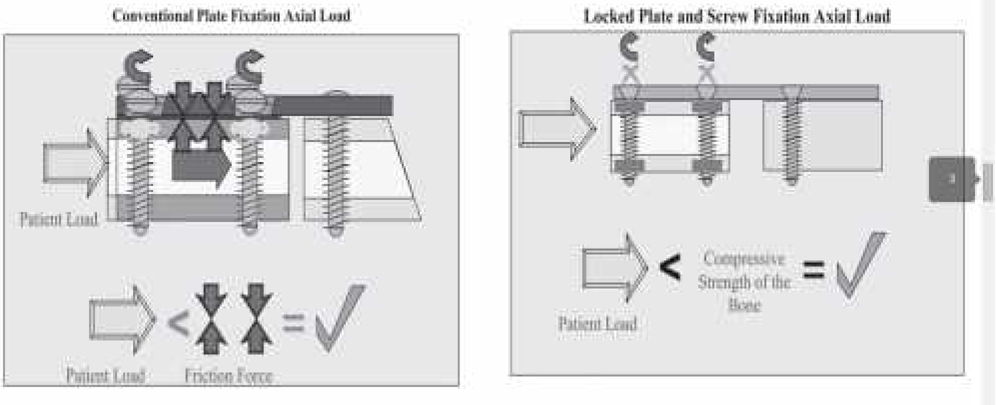


FIG. 1. Conventional plating with a fracture gap relies on the frictional force between the plate and the bone to resist axial load.

FIG. 3. Locked plating relies on the compressive strength of bone to resist the axial load.

Fig 6 : Axial load distribution in conventional and LCP

- **Bending[49,50]**

Bending tests require a fracture gap greater than zero. In locked plating, because the screws lock into the plate, they must all either fail simultaneously as the plate backs directly out Locking constructs give another “cortex” with the screw locking into the plate thus the failure will only occur if perpendicular forces to the plate overcome the compressive forces of bone surrounding all the screws and the construct moves as one unit, that is, the locking screws fails to neutralize bending loads.

- **Torsion[50]**

The torsional stability of a construct is more dependent on the number of screws rather than whether the screws are locked or conventional.

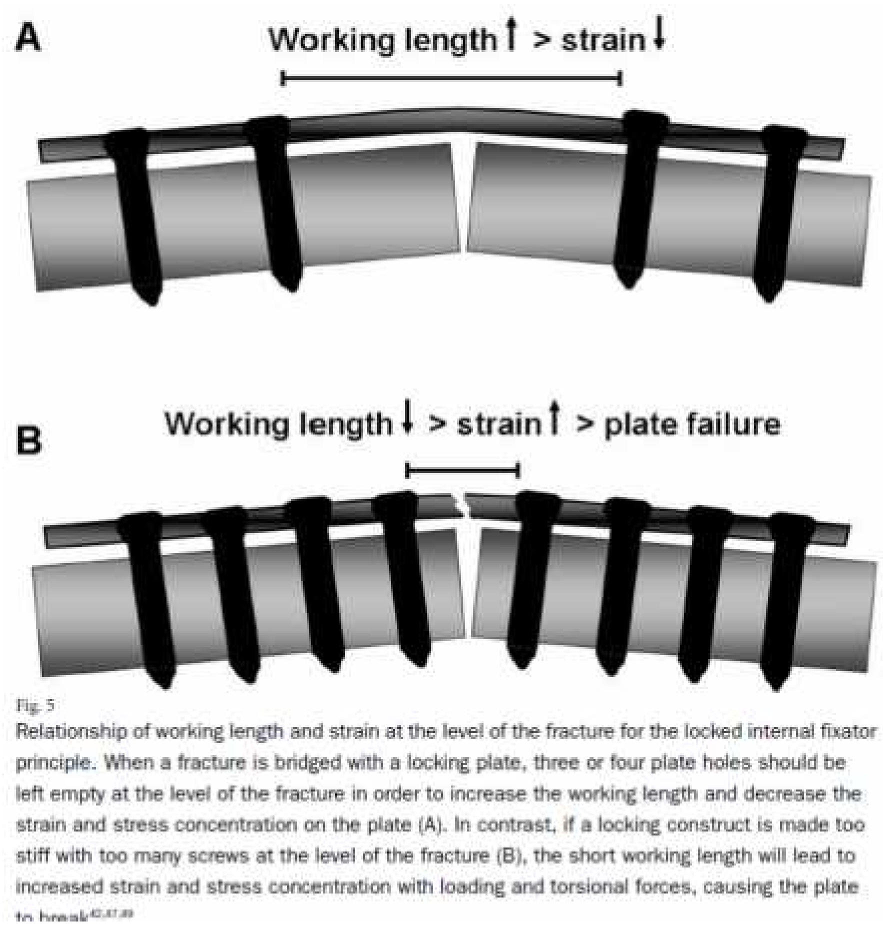


Fig 7: Relationship between working length and strain

Locking Screw Design[49,50]

- Threaded on the underside of head
- Larger core diameter which increases strength and dissipates load over larger area of bone
- Smaller thread pitch

Types of Locked Plate

Depending on the plate type the new implants in different plate functions of fixation:

- Neutralization plate (LCP)
- Locking compression plate (LCP)
- Internal fixator or “locked splinting” (LISS, LCP)
- “Antiglide” or buttress—(LCP)
- Bridging plate (LCP, LISS)

Indications for Locked Plate Fixation

- Biological Fixation
- Spanning Comminution
- Percutaneous Techniques in selected indications
- Implant as reduction tool
- Metaphyseal / Bicondylar Articular Fractures
- Short Articular Segment
- Periprosthetic Fractures
- Fractures in osteoporotic or pathologic bone
- Juxta-articular fractures Revision procedures

Indication	Biomechanical Principal	Technique	Bone Quality	Typical Anatomic Location
Comminuted shaft fractures	Bridging	Locked internal fixator	Normal or osteopenic	Femur, tibia, humeral shaft
Comminuted metaphyseal intra-articular fractures	Combination	Combined (Lag screws for articular fixation locking head screws for metaphyseal bridging)	Normal or osteopenic	Distal part of femur, distal part of tibia.
Short segment metaphyseal fractures	Bridging or Combination	Locked internal fixator	Normal or osteopenic	Proximal part of humerus, distal part of humerus , distal part of radius, proximal part of tibia.
Simple fractures in osteoporotic bone	Compression	Dynamic compression with eccentric screw placement or a compression device, locking head screws for shaft ; tension device with locking head screws only.	Osteopenic	Osteoporotic foream
Simple fractures in osteoporotic bone	Neutralization	Conventional lag screw, locking head screws for neutralization plate.	Osteopenic	Osteoporotic ankle.

Table 1: Some of LCP Uses

MATERIALS AND METHODS

This study was a prospective study done on 25 consenting cases of tibial pilon fractures admitted to Shri B.M. Patil Medical College, Hospital And Research Centre, Vijayapur during December 2014 To January 2016 chosen based on the inclusion and exclusion criteria

Patients were informed about the study in all respects and written informed consent will be obtained. The follow up period was 6 weeks, 3months and 6months.

INCLUSION CRITERIA

1. Patient aged 18 years and above.
2. Both extra articular and intra articular Tibial Pilon fractures.
3. All Tibial pilon fractures with or without fibula fracture.
4. Patients with Gustilo-Anderson classification type 1 and 2.

EXCLUSION CRITERIA

1. Patients below the age of 18 years.
2. Pathological fractures.
3. Associated neurovascular injury.
4. Patients with Gustilo-Anderson classification type 3.
5. Polytrauma.
6. Contralateral tibia fractures.
7. Patients medically unfit for surgery.

SAMPLING:

At 95% level of confidence, expected prevalence of Pilon fractures is 9.8%.[1]

The minimum sample size at 12% desired precision (i.e. margin of error) is 24 $\cong$ 25.

$$n = \frac{z^2 p(1-p)}{d^2}$$

where, z = 1.96 at 95% level of confidence.

p = prevalence

d = desired precision

STATISTICAL ANALYSIS:

Data will be analysed using following statistical method.

- Diagrammatic presentation.
- Percentages.
- Mean +/- SD

Initial Management of fractures:

Local examination of the injured extremity was observed for swelling, deformity and loss of function. Palpation revealed tenderness,crepitus and abnormal mobility at the fracture site. Distal neurovascular status was assessed by the posterior tibial artery and dorsalispedis artery pulsations, capillary filling, local temperature, pallor and paraesthesia.

Antero-posterior and lateral radiographs of the affected leg along with ankle were taken and the fracture patterns were classified based on the AO/OTA classification of fractures of distal tibia.CT scan was done in case of comminuted intra articular fractures.Arterial color Doppler was done to rule out any vascular injury wherever necessary.

The limb was then immobilized in an above knee Plaster of Paris slab till swelling subsided and definitive fixation with locking compression plate done.

Patients with open fractures were graded using the Gustilo Anderson classification. Type I and II open fractures were treated by cleaning of the wound with copious amount of normal saline, and Hydrogen peroxide, followed by painting of the skin around the wound with Povodine iodine and surgical spirit. This was followed by primary wound closure. The limb was then immobilized in an above knee Plaster of Paris slab till definite fixation was done.

INVESTIGATIONS

- X-ray of distal 1/3rd leg with ankle AP & Lateral views.
- Complete blood count.
- Bleeding time, Clotting time.
- Urine- Albumin, sugar and Microscopy.
- Random blood sugar, Blood urea and Serum creatinine.

- HIV and HbsAg.
- Blood grouping and Rh- typing.
- ECG.
- Chest X-ray- Postero-anterior view.
- Computed-tomography scan.
- Other specific investigations whichever needed.

Pre-operative Planning:

All the patients were taken for surgery after pre anesthetic checkup and routine hematological investigations.Appropriate informed and written consent was taken.A dose of tetanus toxoid and antibiotic(inj ceftriaxone 1gram intravenously 30 min before surgery) was given pre-operatively.Prepration of the part was done before a day of the surgery.Instruments and implants were checked and sterilized before hand.

OPERATIVE PROCEDURE:

Type of Anesthesia- spinal/ epidural

- Position-supine with affected leg elevated on a pillow/sand bag.
- Pneumatic tourniquet applied and time noted.

Fig 8: Patient position

Operative procedure of minimally invasive percutaneous plate osteosynthesis of tibial pilon fractures

- Anteroposterior and lateral radiographs had been obtained to establish the fracture pattern, classification and surgical planning.
- All operations were done under image intensifier.
- The plate was placed parallel to the tibia axial line on the medial surface of the operated leg.with the aid of fluoroscopy.
- An appropriate locking plate was selected based on its length and curve.There had to be atleast three holes on both sides of the fracture site.
- According to the plate location in vitro,two 3-4 cm longitudinal incisions were made in the skin beneath the two ends of the plate.
- One incision was at the midline of the medial malleolus,the other was made along the medial aspect of the tibia located at the proximal end of the

plate.

- An extraperiosteal,subcutaneous tunnel could then be fashioned between these two incisions using blunt dissection.the great saphenous vein was protected and the plate was inserted percutaneously from distal to proximal.
- The assistant applied traction to the operated leg to restore length and coronal alignment under fluoroscopy.
- When the reduction was achieved ,the plate position was adjusted and secured by passing Kirschner wires through the most proximal and distal holes.
- A second plate of similar size and length was placed using the same holes on the Kirschner wires. This acted as an external guide to localize the screw holes and skin incisions without need of fluoroscopic control.
- One proximal and distal screw was inserted. Additional screws were then applied using the same technique.
- At least 6 cortices were fixed on both fracture sides,and 7-8 cortices in patients with osteoporosis.

POST-OPERATIVE MANAGEMENT:

- The limb was kept elevated with pillows.
- Intravenous antibiotics were given for two days and then shifted to oral.
- Posterior splint given if protection of fixation was desired.
- Check x-ray was done on 2nd post-operative day.
- Active ankle and knee joint motion was allowed as soon as patient could tolerate pain.
- After the soft tissues healed and postoperative swelling was diminished,the patients were allowed nonweight-bearing ambulation with

crutches.

- Dressing was done on 2^{nd}, 5^{th} and 8^{th} post-operative day.
- Sutures were removed on 12^{th} post-operative day.
- Progressive weight bearing was allowed as tolerated by patient.
- Full weight bearing was permitted only after clinico-radiological evidence of union.
- wound healing was assessed in the outpatient clinic at 4 weeks, 8 weeks, 12 weeks, 24 weeks and 9 months postoperatively.Clinical evidence of infection ,incision breakdown,and skin necrosis was recorded.

FOLLOW-UP:

- Follow up evaluation is done at

  6 weeks,

  3 months,

  6 months.

- Radiological evaluation – Check X-distal 1 /3^{rd} leg with ankle Antero-posterior & lateral view at each follow up.
- Functional evaluation of results was done by **OLERUD and MOLANDER scoring system.[14]**

FUNCTIONAL RESULTS- Olerud & Molander scoring system was used in this study to assess the results.

Table 2: Olerud and molander scoring system

Parameter	Degree	Score
1. Pain	None While walking on uneven surface While walking on even surface outdoors While walking indoors constant and severe	25 20 10 5
2. Stiffness	None Stiffness	10 0
3. Swelling	None Only in evenings Constant	10 5 0
4. Stair-climbing	No problems Impaired Impossible	10 5 0
5. Running	Possible Impossible	5 0
6. Jumping	Possible Impossible	5 0
7. Squatting	No problems Impossible	5 0
8. Supports	None Taping, wrapping Stick or crutch	10 5 0
9. Work, activities of daily life	Same as before injury Loss of tempo Change to simpler job Severely impaired work capacity	20 15 15 0

FUNCTIONAL OUTCOME

Total points -100

- Excellent result above 90 points
- Good 61-90 points
- Fair 31 -60 points
- Poor below 30 points

Fig 9: OPERATIVE INSTRUMENTS

Distal Tibia Locking Compression Plates

Soft Tissue Instruments

Power Drill With K Wire

Locking Cancellous And Cortical screws

Drill Sleeve Applied To Locking Hole

Fig 10: MIPPO Technique

Painting And Draping

Minimal incision

Inserting plate subcutaneously in an extra periosteal fashion

Plate fixation with K wires

Proximal hole drilling

Proximal hole locking

Distal hole locking

C-arm image

Subcutaneous closure

Skin closure

OBSERVATIONS AND RESULTS

The present study consists of 25 cases of tibial pilon fractures(both extraarticular and intraarticular).All the cases were operated using locking compression plate by mippo technique. The study period was from December 2014 to January 2016.

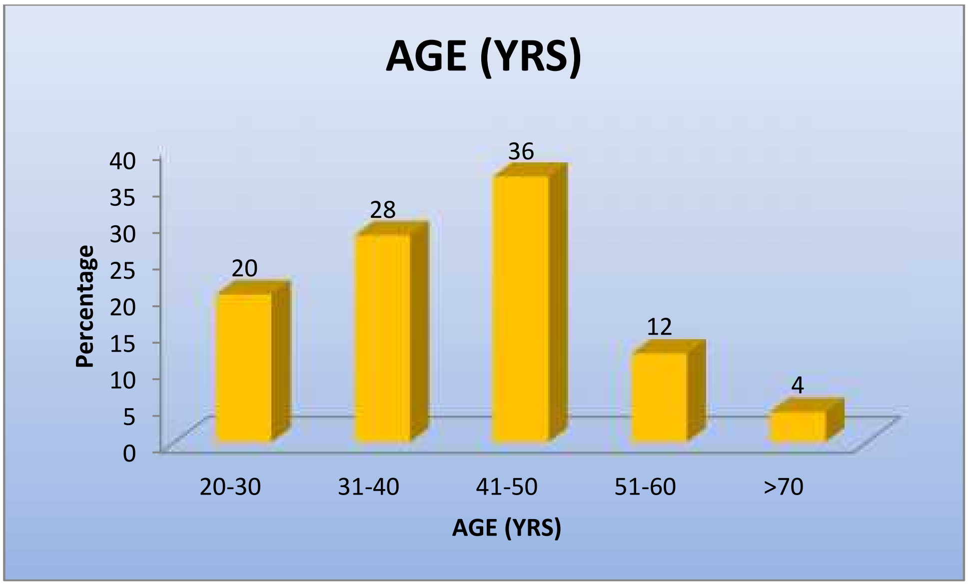
Functional results were evaluated based on classification system for result of treatment by Olerud & Molander scoring system.[14] All Patients were followed up at regular interval i.e.6 weeks, 3 months and 6 months. Out of 25 patients 18 were male and 7 were female. Age ranges from 22 years to 85 years. Mean age being 42.3 years.

Table No 3: Distribution of cases according to Age (yrs)

AGE (YRS)	N	Percentage (%)
20-30	5	20
31-40	7	28
41-50	9	36
51-60	3	12
>70	1	4
Total	25	100

Descriptive Statistics	Min	Max	Mean	SD
AGE (Yrs)	22	85	42.3	13.1

Graph 1: Distribution of cases according to Age (yrs)

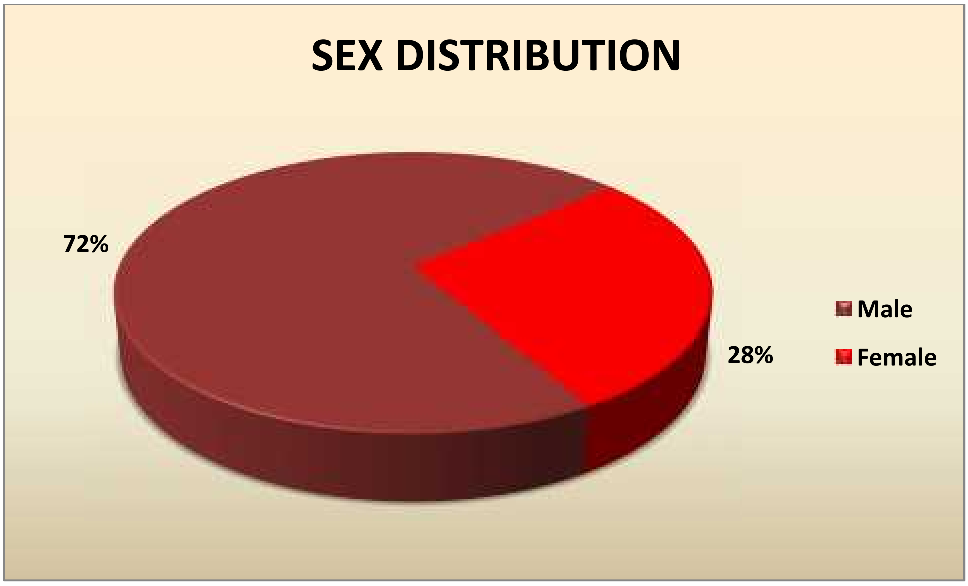


In the present study on evaluation of the age distribution we found that of the 25 cases in the study most patients belonged to the category 41-50 years (9 patients,36%) . The mean age being 42.3 years.

Table No 4 : Distribution of cases according to Sex

SEX	N	Percentage (%)
Male	18	72
Female	7	28
Total	25	100

Graph 2: Distribution of cases according to Sex

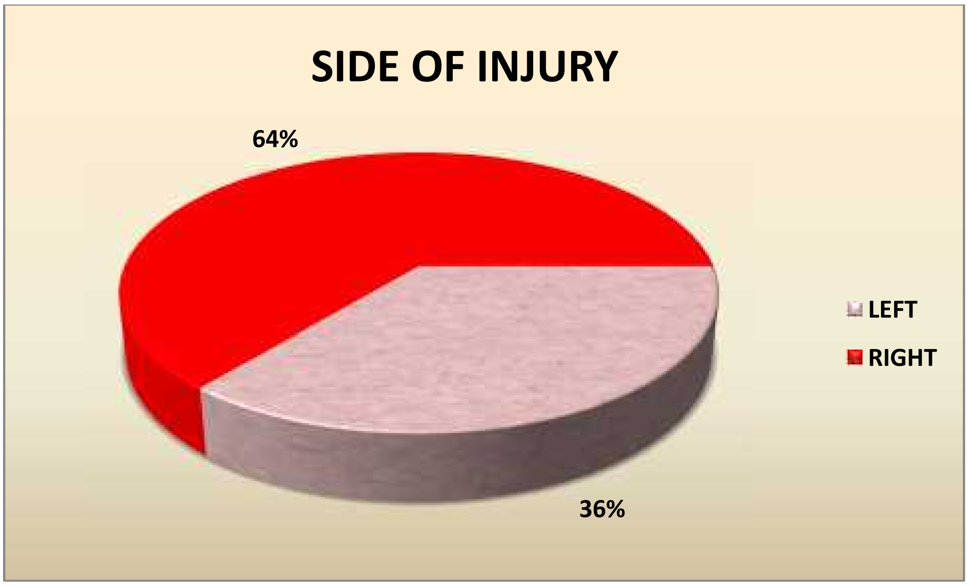


In the present study on evaluation of the sex distribution we found that of the 25 cases in the study most patients were males (18 patients, 72%) because of traveling and working in fields and factories.

Table No 5: Distribution of cases according to Side of Injury

SIDE OF INJURY	N	Percentage (%)
LEFT	9	36
RIGHT	16	64
Total	25	100

Graph 3: Distribution of cases according to Side of Injury

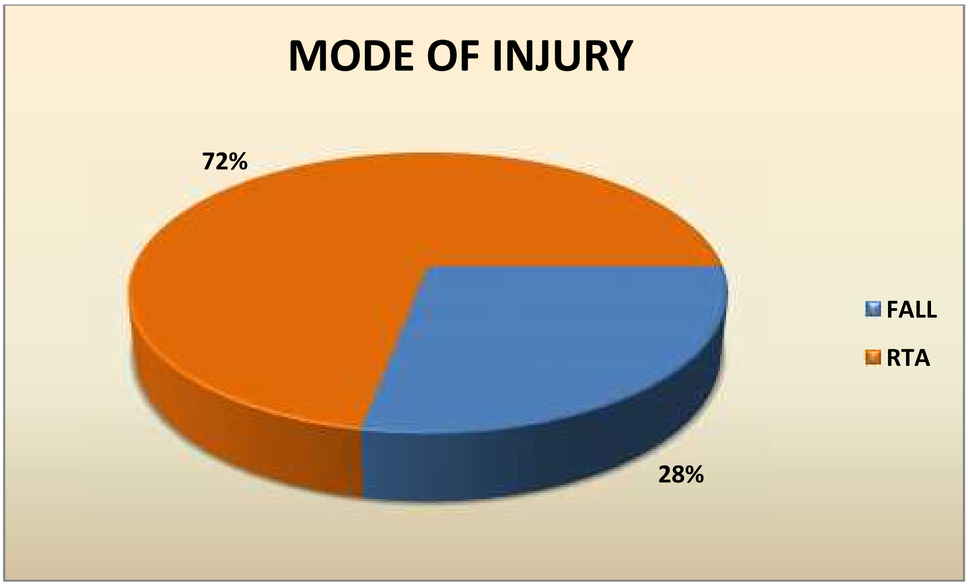


In the present study on evaluation of the side of injury we found that of the 25 cases in the study most patients had a right sided injury (16 patients, 64%).

Table 6: Distribution of cases according to Mode of Injury

MOI	N	Percentage (%)
RTA (High energy)	18	72
FALL (Low energy)	7	28
Total	25	100

Graph 4: Distribution of cases according to Mode of Injury

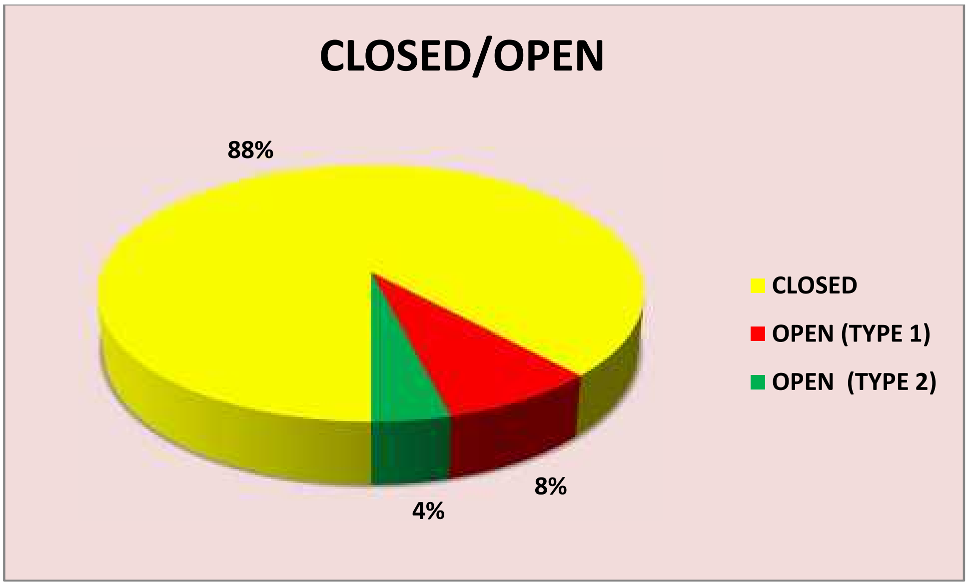


In the present study on evaluation of the mode of injury we found that of the 25 cases in the study most patients were injured by road traffic accidents (18 patients, 72%).

Table 7 : Distribution of cases according to Type of Injury (closed/open)

CLOSED/OPEN (Gustilo Anderson)	N	Percent
CLOSED	22	88
OPEN (TYPE 1)	2	8
OPEN (TYPE 2)	1	4
Total	25	100

Graph 5: Distribution of cases according to Type of Injury

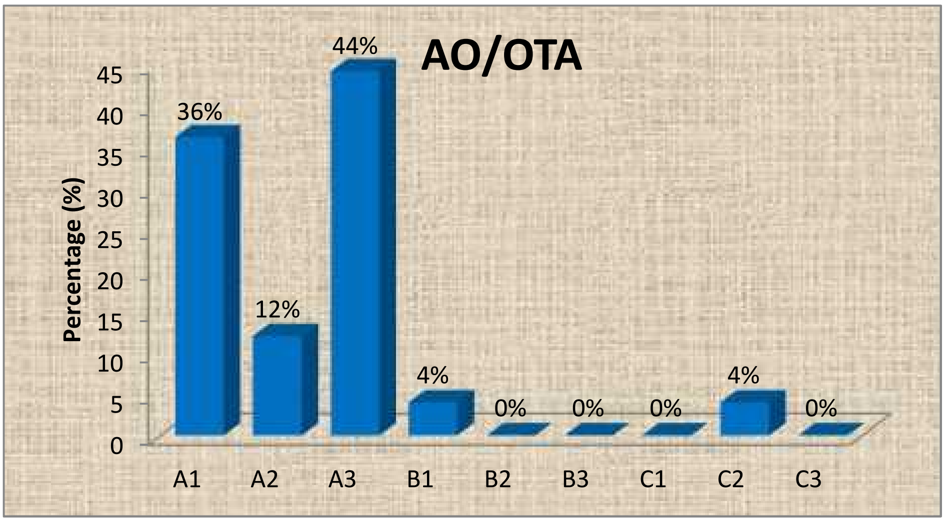


In the present study on evaluation of the type of injury we found that of the 25 cases in the study most patients were of closed injury (22 patients, 88%).

Table 8: Distribution of cases according to Fracture Classification (AO/OTA)

AO/OTA	N	Percentage (%)
A1	9	36
A2	3	12
A3	11	44
B1	1	4
B2	0	0
B3	0	0
C1	0	0
C2	1	4
C3	0	0
Total	25	100

Graph 6: Distribution of cases according to Fracture Classification (AO/OTA)

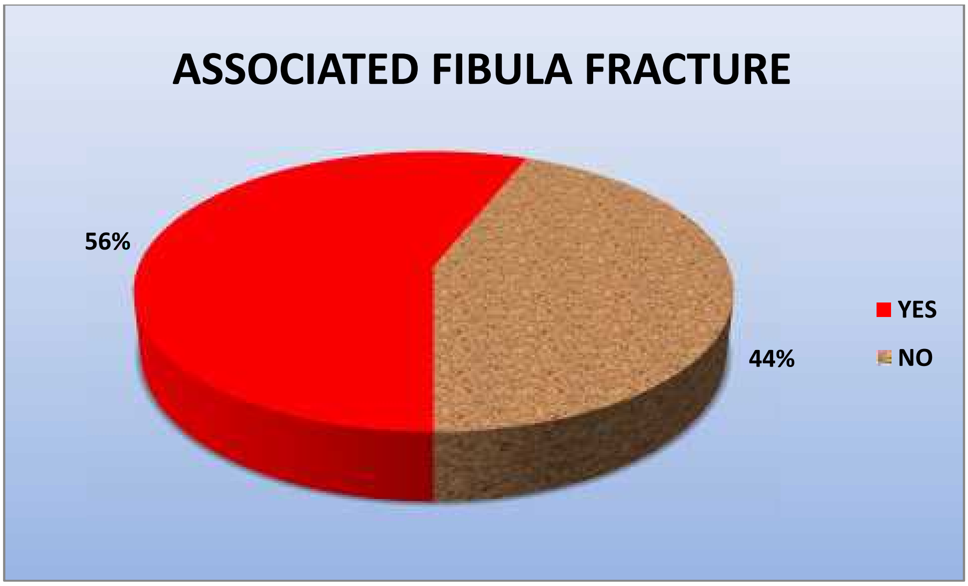


In the present study on evaluation of the type of fracture according to AO/OTA classification we found that of the 25 cases in the study most patients were of A3 type (11 patients, 44%)

Table 9: Distribution of cases According To Associated Fibula Fracture

ASSOCIATED FIBULA FRACTURE	N	Percent
YES	14	56
NO	11	44
Total	25	100

Graph 7: Distribution of cases According To Associated Fibula Fracture

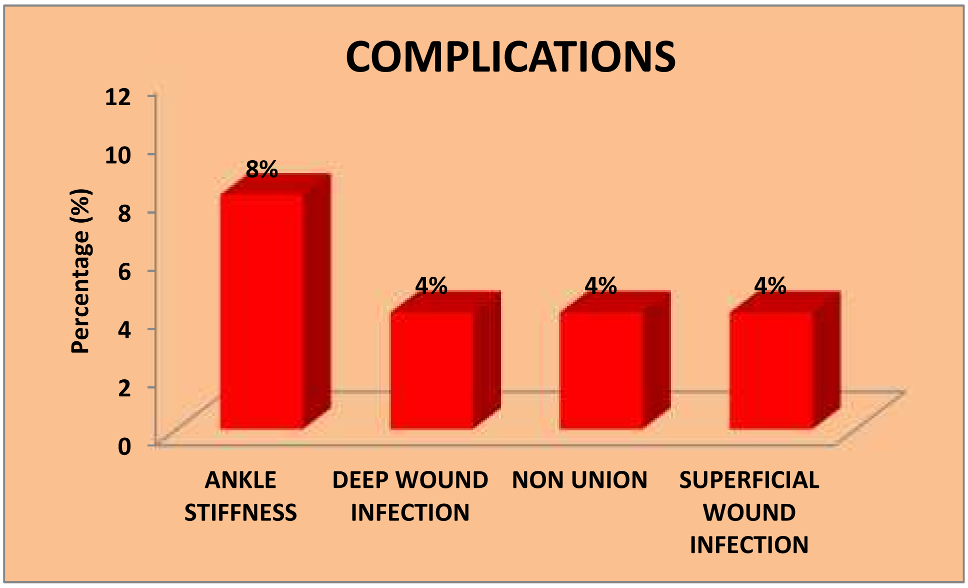


In the present study on evaluation of the cases with associated fibula fracture we found that of the 25 cases in the study 14 patients,56% were associated with lower third fibula fracture.

Table 10: Distribution of cases according to Complications

COMPLICATIONS	N	Percent
NIL	20	80
SUPERFICIAL WOUND INFECTION	1	4
DEEP WOUND INFECTION	1	4
NON UNION	1	4
ANKLE STIFFNESS	2	8
Total	25	100

Graph 8: Distribution of cases according to Complications



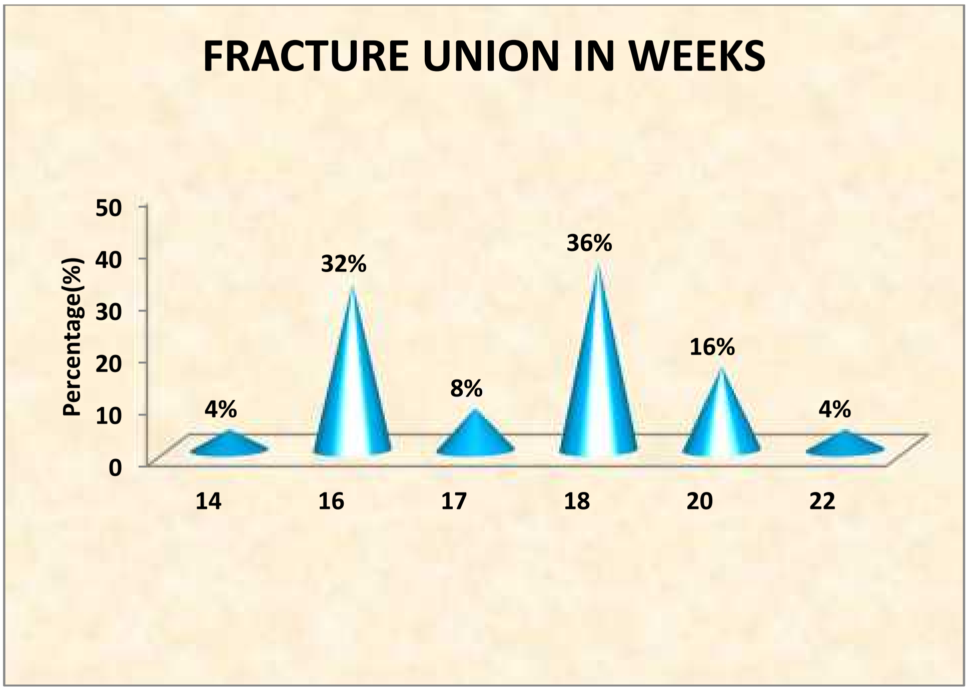
In the present study on evaluation of complications following surgery, 1 patient had superficial wound infection (4%) treated by dressings and antibiotics, 1 patient had deep wound infection (4%) treated by debridement and antibiotics according to culture and sensitivity reports, 1 patient had non union (4%) and was treated by replating with cancellous bone grafting from iliac crest, 2 patients had Ankle stiffness (8%) treated by physiotherapy and range of motion exercises, 20 patients had no complications (80%).

Table 11: Distribution of cases according to Fracture Union in Weeks

FRACTURE UNION IN WEEKS	N	Percentage (%)
14	1	4
16	8	32
17	2	8
18	9	36
20	4	16
22	1	4
Total	25	100

Descriptive Statistics	Min	Max	Mean	SD
FRACTURE UNION IN WEEKS	14	22	17.6	1.8

Graph 9: Distribution of cases according to Fracture Union in Weeks

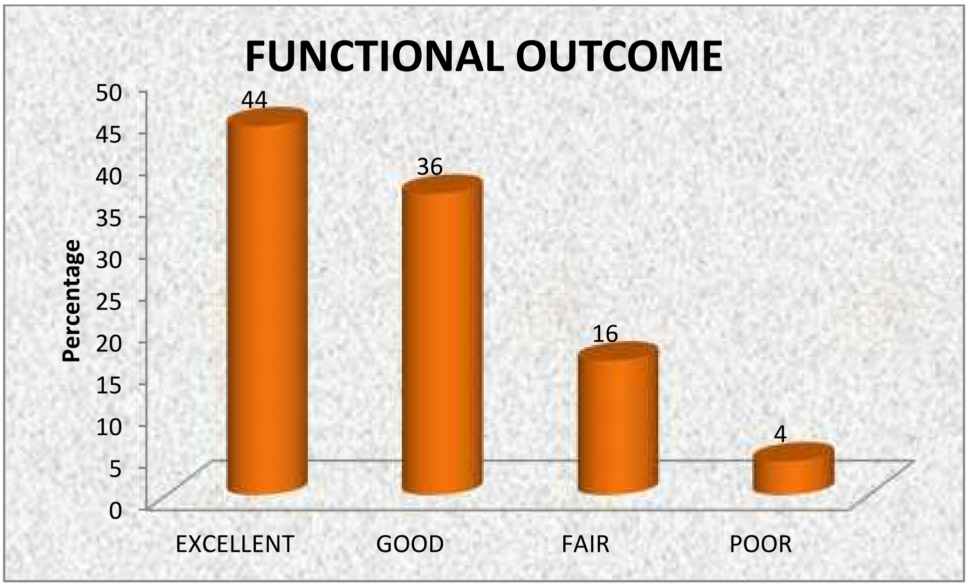


In the present study on evaluation of the duration taken for the fracture union most patients had fracture union in 18 weeks (9 patients, 36%), The mean duration for fracture union was 17.6 weeks.

Table 12: Distribution of cases according to Functional Outcome

FUNCTIONAL OUTCOME	N	Percent
EXCELLENT	11	44
GOOD	9	36
FAIR	4	16
POOR	1	4
Total	25	100

Graph 10: Distribution of cases according to Functional Outcome



In the present study on evaluation of the functional outcome of the fracture most patients had excellent results (11 patients, 44%).

Figure 11: CLINICAL PHOTOS AND RADIOGRAPHS CASE NO 1

Pre operative AP and Lateral view **Immediate post operative**

6 Weeks follow up **3 Months follow up**

6 Months showing union

Plantar flexion

Dorsi flexion

Full Weight Bearing

Squatting

CASE NO 2

Pre operative

Immediate post operative

6 Weeks follow up

3 Months follow up

6 Months union

Plantar flexion

Dorsi flexion

Full weight bearing

Squatting

CASE NO 3

Pre operative

Immediate post operative

6 Months union

Plantar flexion

Dorsi flexion

Full weight bearing

Squatting

COMPLICATIONS

Deep wound infection

Non union

DISCUSSION

Fractures of Tibial pilon are among the most difficult fractures to treat effectively. The status of the soft tissues, the degree of comminution sustained at the time of injury affect the long term clinical results. The goal of operative treatment is to obtain anatomic realignment of the joint surface while providing enough stability to allow early motion. This should be accomplished using techniques that minimize osseous and soft tissue devascularization in the hope of decreasing the complications resulting from treatment.

The present study was under taken to determine the efficacy of the locking compression plates and functional outcome in treatment of the tibial pilon fractures by mippo technique.

This study evaluated the results and compared them with those obtained by various other studies utilizing different modalities of treatment, our analysis is as follows

Age distribution:

- Majority of the patients in our study were in the age group between 41-50 yrs (36%) and age ranges were from 22 years to 85 years. Mean age being 42.3 years.
- In Gupta RK et al[23] the average age was 36 years ranging from 17-58 years.
- In Spagnolo R et al[51] the average age was 42.3 years ranging from 29 to 65 years.
- In Chandra Sekharam Naidu M et al[29] the average age was 40.8 years ranging from 22-58 years.
- The average age of patients in present study is comparable with the studies of Spagnolo R et al and Chandra sekaram naidu et al .

Sex distribution of patients:

- In our present study 18(72%) patients were male and 7(28%) were female.
- In Spagnolo R et al[51] 22 patients were male and 8 were female.
- In Hazarika S et al[17] out of 20 patients 16 patients were male and 4 patients were female.
- The sex distribution in our study is comparable with Spagnolo R et al and Hazarika S et al with most of the patients being of male gender possibly due to the fact of male dominance over the female in traveling, occupational injures etc., in India.

Mode of Injury:

- In our present study most of the cases 18 patients(72%) were due to road traffic accidents or high velocity trauma.
- In Gupta RK et al[23] out of 83 patients 86% of the patients were due to high energy trauma.
- In Spagnolo R et al[51] of 30 patients (100%) all of them were due to high velocity trauma.
- Thus the mode of injury in our study is similar with Gupta RK et al and Spagnolo R et al showing that most of the fractures are due to high energy trauma or road traffic accidents.

Fracture pattern:

- In present study of 25 patients 23 were of Type 43-A,1 patient of Type 43-B and 1 patient of Type 43-C.
- In Gupta RK et al[23] out of 80 patients 68 were of Type 43-A,8 patients of Type 43-B and 4 patients of Type 43-C.
- In Spagnolo R et al[51] out of 30 patients 18 were of Type 43-A, 7 patients

of Type 43-B and 5 patients of Type 43-C.

In all the studies most of the fracture pattern were of Type 43-A. The possible reason for this type of fracture pattern were,that most of the patients sustained injuries due to RTA where type A fracture patterns are more common. Type C fracture pattern were seen in patients who sustainted injuries due to axial loading(fall from height).

Fracture Union:

- In the present study on evaluation of the duration taken for the fracture union most patients (9 patients) had fracture union in 18 weeks (36%). The mean duration for fracture healing was 17.6 weeks
- In Gupta RK et al[23] the mean duration for fracture union was 19 weeks.
- In Spagnolo R et al[51] the mean duration for fracture union was 18 weeks.
- Therefore the mean duration for fracture union in our study is comparable with Gupta RK et al and Spagnolo R et al.

Functional Outcome:

- In present study 11 (44%) patients had excellent result and 9 (36%) patients had Good result and 4 (16%) patients had fair result and 1 patient (4%) had poor result.
- In Gupta RK et al[23] 25 (31.2%) patients had excellent result,38 (47.5%) patients had good result,9 (11.2%) had fair result,8 (10.1%) patients had poor result.
- In Spagnolo R et al[51] out of 30 patients 17 had excellent result,10 patients had good result and 3 cases had poor result.

- In Chandra Shekaram Naidu M et al[29] of 24 patients ,14 (58.3%) patients had excellent results, 5 (20.8%) patients had good results,4 (16.7%) patients had fair results,1 (4.2%) had poor result.
- Therefore the present study is comparable with the above studies with the most of the patients having excellent result.

In the present study we had 1 superficial wound infection (4%),1 deep wound infection (4%),1 non union (4%) and 2 cases of ankle stiffness (8%).

Dillin L et al[52] reported disastrous results when inadequate and unstable internal fixation was used to treat pilon fractures ,including a 36% of wound deniscence and 55% infection rate.

Helfet DL et al[14] reported 20% malunion rate in minimally invasive plate osteosynthesis of distal fractures of tibia.No patient had evidence of delayed wound healing,wound dehiscence,or deep infection.

Bourne and colleagues[53] studied 42 patients with tibial plafond fractures, 62% of whom were victims of high-energy trauma. Of the 16 Ruedi type III fractures treated by open reduction and internal fixation, only 44% had a satisfactory result. The majority of these fractures were complicated by nonunion (25%), infection (13%), and Arthrodesis (32%).

Ovadia and Beals[2] reviewed 34 fractures equivalent to Ruedi Type III treated with open reduction and plate fixation.Good to excellent results were achieved in only 47%. Complications were numerous and, although not sub classified according to fracture type, superficial infections or skinloss developed in 9 patients (11%), osteomyelitis developed in 5 patients (6%), 17 patients (12%)

required either ankle Arthrodesis or Arthoplasty.

Hazarika et al[17], in a series of 20 patient of distal tibial fracture treated using locking compression plates through MIPPO technique. This approach aims to preserve bone biology and minimise surgical soft tissue trauma. This provided

87.5% of good to excellent results.

Ozkaya U, et al, in a retrospective review of 22 patients with distal third tibial fractures were treated with titanium locking compression plates using minimally invasive technique with good biological fixation of distal tibial. A total of 81% of good to excellent outcome was assessed using American Orthopaedic Foot and Ankle Society score.

Vallier HA,Cureton BN,Patterson BM[25] this study purposes were to compare plate and nail stabilization for distal tibia shaft fractures by assessing complications and secondary procedures.They concluded that high primary union rates were noted after surgical treatment of distal tibia shaft fractures with both nonlocked plates and reamed intramedullary nails.Rates of infection ,nonunion and secondary procedures were similar.Intramedullary nailing was associated with more malalignement than plating.

Dr. Lokesh Holagundi, et al[27] in May 2014 published the result of 30 patients of distal tibia fractures in which 15 patients were treated by IMIL nail and 15 patients treated by Plating with MIPPO technique. All the fractures were of extraarticular type. They concluded that more malalignment (11.11%), delayed union (16.6%),non union (5.5%),secondary procedure (22.2%) done for the complications was more with nail, where as plate group never had malalignment, had one delayed union for which no secondary surgery done.[27]

Gupta RK et al[23] a series of 80 patients of distal tibial fractures treated fixed with locking plate by mippo technique and they reported 31.2% excellent result ,47.5% good result,11.2%fair result and 10.1% poor result.

CONCLUSION

Tibial pilon fractures are best managed operatively. Optimal functional outcome is achieved by accurate anatomical reduction and secure fixation followed by early mobilisation.

MIPPO facilitates in early mobilization of the patient which helps in healing of the fracture and prevents joint stiffness. It promotes early union as it does not disturb anatomy and physiology of vascularity at the fracture site.

MIPPO with a LCP is an excellent treatment option for tibial pilon fractures in terms of radiological and clinical union.

Post operative rehabilitation protocol in terms of non-weight bearing and achieving satisfactory range of motion needs to be strictly adhered to in comminuted fractures, in order to obtain optimal functional results.

SUMMARY

The study was a prospective study conducted on 25 consenting patients who presented with tibial pilon fractures admitted to Shri B.M. Patil Medical College, Hospital and Research Centre, Vijayapur during the period December 2014 to January 2016. The main purpose of the study was to evaluate outcome of the surgery of the study group; hence all the patients that included in the study are of the operative group. We have not included any conservatively managed group.

- The age distribution we found that of the 25 cases in the study most patients belonged to category 41-50 years (9 patients, 36%).
- The gender distribution we found that of the 25 cases in the study most patients were males (18 patients, 72%).
- The mode of injury we found that of the 25 cases in the study most patients were injured by road traffic accidents accident (18 patients, 72%).
- The side of injury we found that of the 25 cases in the study most patients had a right sided injury (16 patients, 64%).
- According to AO/OTA classification most patients were of type 43-A3 (11patients, 44%).
- 0f the 25 cases in the study most patients were of closed type (22 patients, 88%).
- The duration taken for the fracture union most patients had fracture union in 18 weeks(9 patients,36%) . The mean duration for fracture healing was 17.6 weeks.
- Complications following surgery, most patients had no complications. 1 patient had superficial wound infection (4%),1 patient had deep wound

infection (4%),1 patient had non union (4%) and 2 patients had Ankle stiffness (8%).

- The final outcome of the fracture evaluated using Olerud and Molander scoring system most patients had excellent results 11 patients (44%).

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ANNEXURE I

ETHICAL CLEARANCE

Institutional Ethical Committee
BIJAPUR-586 103.
OUTWARD
No. 564/14
Date 24/11/14
B.L.D.E.U's Shri B.M. Patil Medical College

B.L.D.E. UNIVERSITY'S
SHRI.B.M.PATIL MEDICAL COLLEGE, BIJAPUR-586 103
INSTITUTIONAL ETHICAL COMMITTEE

INSTITUTIONAL ETHICAL CLEARANCE CERTIFICATE

The Ethical Committee of this college met on 22-11-2014 *at* 3-30pm *to scrutinize the Synopsis of Postgraduate Students of this college from Ethical Clearance point of view. After scrutiny the following original/corrected & revised version synopsis of the Thesis has been accorded Ethical Clearance.*

Title A prospective study of functional outcome of tibial pilon fractures treated with locking compression plate by mippo technique (minimally invasive percutaneous plate osteosynthesis)

Name of P.G. student Dr Arun Kumar Yamsani
Dept of Orthopaedics.

Name of Guide/Co-investigator Dr Ashok. R. Nayak. Professor
Dept of Orthopaedics.

for
DR.TEJASWINI. VALLABHA
CHAIRMAN
INSTITUTIONAL ETHICAL COMMITTEE
BLDEU'S, SHRI.B.M.PATIL
MEDICAL COLLEGE, BIJAPUR.

Following documents were placed before E.C. for Scrutinization
1) Copy of Synopsis/Research project.
2) Copy of informed consent form
3) Any other relevant documents.

ANNEXURE II

B.L.D.E.U.'s SHRI B.M.PATIL MEDICAL COLLEGE HOSPITAL AND RESEARCH CENTER, BIJAPUR-586103

INFORMED CONSENT FOR PARTICIPATION IN DISSERTATION/RESEARCH

I, the undersigned,________________ , S/O D/O W/O ________________, aged ____years, ordinarily resident of ____________ do hereby state/declare that Dr. Arun Kumar Yamsani of Shri. B. M. Patil Mdical College Hospital and Research Centre has examined me thoroughly on ______________ at ______________ (place) and it has been explained to me in my own language that I am suffering from ________________ disease (condition) and this disease/condition mimic following diseases. Further Dr. Arun Kumar Yamsani informed me that he/she is conducting dissertation/research titled **"A Prospective Study Of Functional Outcome Of Tibial Pilon Fractures Treated With Locking Compression Plate By Mippo Technique"** under the guidance of Dr. Ashok. R. Nayak requesting my participation in the study. Apart from routine treatment procedure, the pre-operative, operative, post-operative and follow-up observations will be utilized for the study as reference data.

Doctor has also informed me that during conduct of this procedure like adverse results may be encountered. Among the above complications most of them are treatable but are not anticipated hence there is chance of aggravation of my condition and in rare circumstances it may prove fatal in spite of anticipated diagnosis and best treatment made available. Further Doctor has informed me that my participation in this study help in evaluation of the results of the study which is useful reference to treatment of other similar cases in near future, and also I may be benefited in getting relieved of suffering or cure of the disease I am suffering.

The Doctor has also informed me that information given by me, observations made/ photographs/ video graphs taken upon me by the investigator will be kept secret and not assessed by the person other than me or my legal hirer except for academic purposes.

The Doctor did inform me that though my participation is purely voluntary, based on information given by me, I can ask any clarification during the course of treatment / study related to diagnosis, procedure of treatment, result of treatment or prognosis. At the same time I have been informed that I can withdraw from my participation in this study at any time if I want or the investigator can terminate me from the study at any time from the study but not the procedure of treatment and follow-up unless I request to be discharged.

After understanding the nature of dissertation or research, diagnosis made, mode of treatment, I the undersigned Shri/Smt ______________________________ under my full conscious state of mind agree to participate in the said research/dissertation.

Signature of patient:

Signature of doctor:

Witness: 1.

2.

Date:

Place

FOR OPERATION/ANAESTHESIA

I___________________________Hosp. No.____________________in my full senses here by give my complete consent for_________________________or any other procedure deemed fit which is a diagnostic procedure / biopsy / transfusion / operation to be performed on me / my son / my daughter / my ward_____age under any anaesthesia deemed fit. The nature and risks involved in the procedure have been explained to me to my satisfaction. For academic and scientific purpose the operation/ procedure may be televised or photographed.

Date:

Signature/Thumb

Impression of Patient/GuardianName:

Author signature :

Designation:

ANNEXURE – III

SHRI B.M. PATIL MEDICAL COLLEGE, HOSPITAL AND RESEARCH CENTRE, BIJAPUR - 586103

PROFORMA

CASE NO. :

NAME :

AGE/SEX :

I P NO :

DATE OF ADMISSION :

DATE OF SURGERY :

DATE OF DISCHARGE :

OCCUPATION :

RESIDENCE :

Presenting complaints with duration :

History of presenting complaints :

Family History :

Personal History :

Past History :

General Physical Examination

Pallor:	present/absent
Icterus:	present/absent
Clubbing:	present/absent
Generalized lymphadenopathy:	present/absent
Built:	poor/moderate/well
Nourishment:	poor/moderate/well

Vitals

PR: RR:

BP: TEMP:

Other Systemic Examination:

Local examination:

Right/ Left Leg

Gait:

<u>Inspection</u>:

a) Attitude/ deformity

b) Abnormal swelling

- Site
- Size
- Shape
- Extent

c) Shortening

d) Skin

e) Compound injury if any

Palpation:

a) Local tenderness

b) Bony irregularity

c) Abnormal movement

d) Crepitus

e) Swelling

Movements:		Active	Passive
Ankle:	Plantar Flexion		
	Dorsi Flexion		
	Measurements: Shortening		Apparent:
			Real:

KEYS FOR MASTER CHART

IP No	:	Inpatient number
MOI	:	Mode of injury
M	:	Male
F	:	Female
RTA	:	Road traffic accident
DOS	:	Date of surgery
COMP	:	Complications

MASTER CHART

S No	NAME	AGE	SEX	IP NO	MOI	SIDE	CLASSIFICATION		DOS	ASSOCIATED FIBULA FRACTURE	FIBULA FIXATION	COMP	FRACTURE UNION IN WEEKS	RESULTS
							CLOSED/OPEN (GUSTILO ANDERSON)	AO /OTA						
1	SARUBAI	50	F	35201	FALL	RIGHT	CLOSED	A1	2-12-14	NO	NO	NIL	18	EXCELLENT
2	VANITA	30	F	38917	RTA	RIGHT	CLOSED	A1	26-12-14	YES	YES	NIL	16	EXCELLENT
3	SHIVALING	41	M	39138	RTA	LEFT	CLOSED	A2	5-1-15	NO	NO	NIL	14	EXCELLENT
4	DUNDAPPA	39	M	37678	RTA	RIGHT	CLOSED	A3	8-1-15	YES	YES	DEEP WOUND INFECTION	18	FAIR
5	SOMASHEKAR	38	M	4824	FALL	RIGHT	CLOSED	C2	16-2-15	YES	YES	NIL	20	GOOD
6	CHANNAPPA	55	M	7290	RTA	LEFT	CLOSED	A3	10-3-15	NO	NO	NIL	22	GOOD
7	JAVID NAIK	35	M	7900	RTA	LEFT	CLOSED	A1	25-3-15	YES	YES	NIL	18	EXCELLENT
8	SIDDLINGAPPA	29	M	13152	FALL	RIGHT	CLOSED	B1	27-4-15	YES	NO	ANKLE STIFFNESS	18	POOR
9	SHANKARGOUDA	50	M	13982	RTA	RIGHT	CLOSED	A1	8-5-15	NO	NO	NIL	16	EXCELLENT
10	MAMTAZ	40	F	16253	FALL	RIGHT	CLOSED	A3	27-5-15	YES	YES	NIL	18	FAIR
11	RAJESH	38	M	16759	RTA	RIGHT	OPEN (TYPE 1)	A1	29-5-15	NO	NO	NIL	17	GOOD
12	SANJAY	30	M	18786	RTA	LEFT	CLOSED	A1	16-6-15	YES	NO	NIL	18	EXCELLENT
13	GAYATRI	36	F	20478	FALL	LEFT	CLOSED	A2	30-6-15	NO	NO	NIL	16	GOOD
14	MANOHAR	45	M	21411	RTA	LEFT	OPEN (TYPE 2)	A3	10-7-15	YES	NO	ANKLE STIFFNESS	16	FAIR
15	ANAND	31	M	22141	RTA	LEFT	CLOSED	A1	14-7-15	NO	NO	NIL	20	EXCELLENT
16	SUDHA	47	F	21745	RTA	RIGHT	CLOSED	A3	24-7-15	YES	YES	NIL	17	GOOD
17	VASTALABAI	85	F	27315	RTA	RIGHT	CLOSED	A3	24-8-15	YES	YES	NIL	20	GOOD
18	SHARANAPPA	59	M	27241	RTA	RIGHT	CLOSED	A2	26-8-15	NO	NO	NIL	16	EXCELLENT
19	SHRISHAIL	45	M	24577	RTA	LEFT	CLOSED	A3	11-9-15	YES	YES	NIL	16	EXCELLENT
20	PRAVIN	30	M	29207	RTA	RIGHT	CLOSED	A3	16-9-15	NO	NO	NIL	18	GOOD
21	MEGHU LAMANI	56	M	33110	FALL	RIGHT	CLOSED	A3	12-10-15	YES	YES	NON UNION	16	FAIR
22	SIDDAPPA KOLLI	45	M	38440	RTA	RIGHT	OPEN (TYPE 1)	A3	28-11-15	YES	YES	SUPERFICIAL WOUND INFECTION	18	GOOD
23	SURESH	45	M	38157	RTA	LEFT	CLOSED	A3	4-12-15	NO	NO	NIL	20	GOOD
24	NAGESH	48	M	39247	FALL	RIGHT	CLOSED	A1	24-12-15	YES	NO	NIL	16	EXCELLENT
25	SRIDEVI	22	F	1445	RTA	RIGHT	CLOSED	A1	16-1-16	NO	NO	NIL	18	EXCELLENT