A CASE STUDY OF PERIARTICULAR FRACTURES OF THE TIBIA MANAGED *WITH BIOLOGICAL PLATE FIXATION*

DISSERTATION SUBMITTED FOR M.S. DEGREE (BRANCH II – ORTHOPAEDIC SURGERY) MARCH 2010

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MADURAI.

This is to certify that the Dissertation entitled “**A CASE STUDY OF PERIARTICULAR FRACTURES OF THE TIBIA MANAGED WITH BIOLOGICAL PLATE FIXATION** ’’ is a bonafied record work done by **Dr. K. senthil kumar** . in The Department of Orthopaedics, and Traumatology , Madurai Medical College, Madurai. Under the direct guidance of me

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DECLARATION

I **Dr.K. SENTHIL KUMAR**. Solemnly declare that the dissertation entitled "**A CASE STUDY OF PERIARTICULAR FRACTURES OF THE TIBIA MANAGED WITH BIOLOGICAL PLATE FIXATION** '' has been prepared by me under the supervision of my guide **Prof.Dr.V.Raviraman, M.S.Ortho, D.ortho,** Professor and Head of the Department. Department of Orthopaedics and Traumatology, Madurai Medical College and Government Rajaji hospital. Madurai. in the fulfillment of the regulation for the award of **M.S(Orthopaedic Surgery)** Degree Examination of the **Tamilnadu .Dr.M.G.R. Medical university**, Chennai to be held in march2010

The work has not formed the basis for the award of any other degree or diploma to me previously from any other university

Place

Time

I am deeply indebted to my beloved chief and my teacher, **Prof.Dr.V.Raviraman, M.S.Ortho, D.ortho**, Professor and Head of the Department. Department of Orthopaedics, Madurai Medical College, madurai for the able guidance , inspiration,and encouragement he rendered at every stage of this study

I am grateful to my beloved teachers **Prof .Dr.S.Shanmuganathan, Prof.Dr. P.V.pugalenthi Prof.Dr.R.sivakumar, Prof.Dr.A.Rajamani, Prof.Dr.T.Chandrprakasam** for their invaluable help and guidance rendered to me in preparing this dissertation

I express my heartful gratitude to my beloved teacher **Prof .M.C.Chidambaram and Prof .Dr. Malairaju** for his able guidance, inspiration, encouragement he has rendered at very stage of this study

I express my heartful gratitude to **Registrar Dr.K .Ravichandran, and Assistant professor Dr.V.R.Ganesan, Dr.M.N.Karthi, Dr.N.Thanappan, Dr.S.Ramanathan, Dr .B.Sivakumar,** for their valuable advice and help in carrying out this study

I sincerely acknowledge with gratitude the guidance and persistent encouragement given to me by **Dr.P.V.Thirumalaimurugan, Dr.K.P.Saravanakumar, Dr.J.manikandan,Dr.T.C.Premkumar, Dr.Duraimurugan**. and all our Assistant professors

My sincere Thanks to **Prof.Dr.S.M.Sivakumar , M.S. Dean ,**Madurai Medical College ,Madurai for permitting to utilize th clinical materials of the hospital.

I would like to thank my patients, friends, and collegues and family who have stood by me throughout this work and above all the GOD for his kindness throughout this study

CONTENTS

INTRODUCTION

Increased incidence of Road Traffic Accidents, Natural disasters, industrial accidents claim most of human mortality and morbidity..Of these fracture of proximal and distal tibia have historically been difficult to treat

Because of proximity of these fractures to the knee and ankle joint regaining full knee and ankle motion and function may be difficult soft tissue damage comminution fracture extension in to the knee or ankle joint lead to unsatisfactory results in many cases regardless of the treatment modality.

Better understanding of the injury patterns ,availability of better implants, concept of early surgical fixation and Early post operative mobilization of joint all have convincingly improved the functional out come of the patient to a large extent

. Main challenges encountered in the treatment of periarticular fractures of tibia are-

- These high energy fractures are associate d with extremely damaged soft tissue envelope leading to increased incidence of compound injuries which results in increased complications following open reduction. Also comminution of metaphyseal and articular surface makes anatomical reduction difficult. the resulting in congruency of articular surface leads to early secondary OA
- In metaphysic fixation is less satisfactory resulting in early loosening of implants

Initially conservative treatment with POP was advocated as treatment option but it lead to high incidence of malunion and stiffness of adjacent joins also prolonged recumbency resulted in high incidence of thromboembolic diseases and pneumonia.

Open reduction And internal fixation with plate osteosynthesis lead to skin necrosis and infection more then 40% of patients Intramedullary devices gives inadequate stability due to wide medullary cavity leading to implant failure and screw breakage.

Spanning external fixator are associated pin tract infection, vascular problem, and difficulty in maintain the articular alignment and lags interfragmentary compression Hybrid fixators are associated with less stable fixation, nonunion, pintract infection vascular injury

Biological plate fixation techniques. are based upon the principles of limited soft tissue stripping, maintenance of the osteogenic fracture hematoma, and preservation of vascular supply to the individual fracture fragments while restoring axial and rotational alignment, and providing sufficient stability to allow progression of motion, uncomplicated fracture healing, and eventual return to function. As such, the evolution of biological plating techniques has led to the development of low-profile, precontoured implants specifically intended for application in the proximal and distal tibia.

AIM

To discuss the management of periarticular fractures of tibia

To evaluate the advantage of biological plate fixation

To evaluate the functional and radiological,clinical outcome after biological plate fixation

REVIEW OF LITERATURE

There has been long debate in the management of periaritcullar fracture of tibia

Sarmiento et al. studied the influence of the fibula on the anatomical behavior of condylar fractures and suggested that fractures of the lateral condyle with associated fibular fractures had a tendency to collapse into valgus because of the loss of fibular support if managed conservatively

Moore, Patzakis, and Harvey reported a 23% incidence of infection in bicondylar tibial plateau fractures treated with dual plate fixation with extensile Mercedes incision

Watson reported increased deep infection in Schatzker type VI tibial plateau fractures treated with Ilizarov external fixation and also chance of septic arthritis

Marsh, Smith, and Do reported increased septic arthritis in 21 complex tibial fractures treated with monolateral external fixation.

Helfet et al in their study of distal tibial fractures treated with biological plating had no loss of fixation or evidence of hardware failure. There were isolated cases of delayed union, deformity and superficial cellulitis. All 20 cases showed union.

Radziejowski et al in their study of 22 cases of proximal tibial fractures have also shown good results with union occurring in 12 to 24 weeks.

Johner and Wruhs18 reported a significant increase in complications as progressively higher energy fractures are treated with open reduction and conventional internal fixation. Complications increased from 9.5% for torsional to 48.3% for comminuted fractures. Likewise the infection rate increased from 2.3% for torsional fractures to 10.3% for comminuted fractures. Also nonunion was twice common and infection five times more likely when open fractures were treated with plating.

Rozbruch et al using regression analysis, have shown that using a long plate as well as limiting the number of screws to no more than three on each side of the plate is agood predictor of success

In the study of Tahmasebi et al in which15 patients with closed comminuted fractures
tibia were treated through biological fixation, the mean time of union was 8.3 weeks for tibial fractures. There was no malunion, nonunion or complication, and theyfound this method to be useful.

Sarafan et al 9 showed that biological fixation is an appropriate method for closed comminuted
fractures of long bones, yet is not suggested in open fractures due to the high rate of infection

Michael P. Clare and Roy W. Sanders et alin 51 Cadaveric studies have previously described the somewhat tenuous vascular supply to the distal metaphysis, which, combined with inherent limitations in the surrounding soft tissue envelope, pose a risk of nonunion and have led to biologic” fixation techniques as good alternative

BIOMECHANICS

Use of LCP proximal tibial plate in biological fixation act as internal fixators because they control bone alignment in the manner of external fixators. Due to their angular stability, the plate–screw–bone complex does not depend on the friction at the implant–bone interface.

Long, spanning constructs across the fracture zone are advocated for these technologies with the need for fewer fixation screws, analogous to the principles of external fixators.

These plates should be held close to the bone—often with use of one or more initial non locked screws—before any locking screws are inserted. Locked screws do not provide interfragmentary compression.

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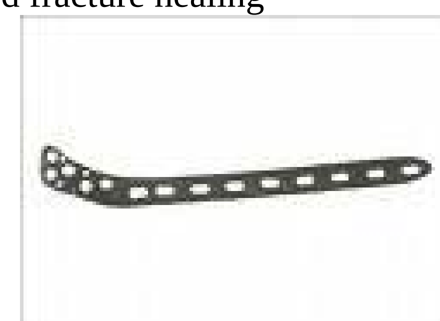
proximal tibial plate prevent varus collapse of the proximal articular fragment, The paucity of soft tissue complications is another advantage .

plates were thin and deformable to permit contouring to fit and a support patient's individual anatomy. They relied on accurate, stable reduction of metaphyseal fracture fragments for support

Laryn and rubin showed that cyclic axial loading of bone is essential for bone mass and remodeling , wolf et al demonstrated that axial micromotion at fracture site increased fracture healing



Distal end, with a thin profile ,is rounded and beveled for Percutaneous application

Compression screw hole will accommodate periarticular screws or conventional cortical screws

Elongated slot for maximum angulation of lag screw

An anatomic contour and thinner profile distally for minimal prominence on medial malleolus

Three distal locking screws diverge across the subchondral bone and are parallel to joint

3.5 mm Cortex and 4.0 mm Cancellous Bone Screws sit flush with plate

ANATOMY OF PROXIMAL AND DISTAL TIBIA

Bony articular surface of proximal tibia slopes inferiorly 10 degree from anterior to posterior .Between the medial and lateral tibial spine lies the intercondylar eminence which has medial and lateral tibial spines where cruciate lgt and menisci attached

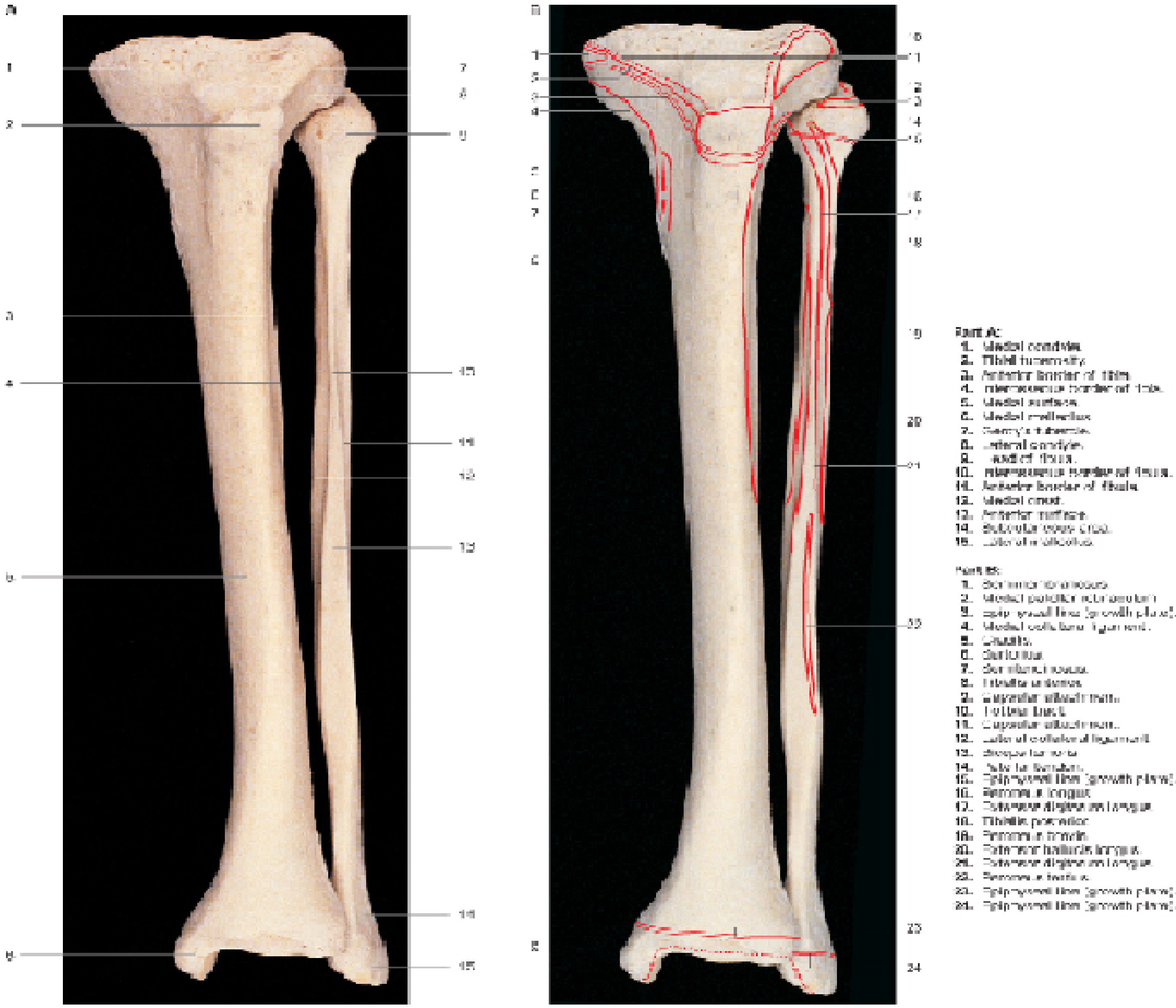
Tibial plateau is covered by hyaline cartilage 3mm thick on medial and 4mm on lateral side medial plateau is larger and concave, lateral is smaller and higher than medial and convex,. Outer portion of plateau is covered by fibro cartilage

Bony anatomy of ankle joint gives stability in dorsiflexion and mobility in plantor flexion .talor dome is wider anteriorly, as ankle dorsiflex the fibula rotates exrernallyto accomadate widened anterior surface of talus

The lower end of the tibia is formed by five surfaces: inferior, anterior, posterior, lateral, and medial. The inferior surface is articular, concave anteroposteriorly, and slightly convex transversely, dividing the surface into a wider lateral and narrower medial segment. The posterior border of the ankle joint is lower than the anterior border.

The medial surface of the distal tibial articulation is directed obliquely downward and inward. The medial surface is prolonged distally by the medial malleolus. The articular surface of the medial malleolus is comma shaped, with a larger surface anteriorly. The posterior border of the medial malleolus includes the groove for the tibialis posterior tendon.

The lower end of the fibula is a complex bony structure, giving rise to multiple ligaments and housing the lateral articular surface of the ankle. The distal fibula has two major surfaces, lateral and medial, which widen into the three-surfaced lateral malleolus at the level of the tibial plafond.


A
B
Part A:
1. Medial condyle.
2. Tibial tuberosity.
3. Anterior border of tibia.
4. Interosseous border of tibia.
5. Medial surface.
6. Medial malleolus.
7. Gerdy's tubercle.
8. Lateral condyle.
9. Head of fibula.
10. Interosseous border of fibula.
11. Anterior border of fibula.
12. Medial crest.
13. Anterior surface.
14. Subcutaneous area.
15. Lateral malleolus.
Part B:
1. Semimembranosus.
2. Medial patellar retinaculum.
3. Epiphyseal line (growth plate).
4. Medial collateral ligament.
5. Gracilis.
6. Sartorius.
7. Semitendinosus.
8. Tibialis anterior.
9. Capsular attachment.
10. Iliotibial tract.
11. Capsular attachment.
12. Lateral collateral ligament.
13. Biceps femoris.
14. Patellar tendon.
15. Epiphyseal line (growth plate).
16. Peroneus longus.
17. Extensor digitorum longus.
18. Tibialis posterior.
19. Peroneus brevis.
20. Extensor hallucis longus.
21. Extensor digitorum longus.
22. Peroneus tertius.
23. Epiphyseal line (growth plate).
24. Epiphyseal line (growth plate).

CLASSIFICATION OF PROXIMAL TIBIA FRACTURES

There are numerous classification systems that have been proposed to describe tibial plateau fractures .The majority of these systems are very similar, and each one recognizes wedge, compression, and bicondylar types. The Hohl classification was the first widely accepted description of tibial plateau fractures. Classifying these fractures into displaced and undisplaced types.

Moore expanded taking into account higher-energy injuries and resultant knee instability

MOORE CLASSIFICATION

Type I	Split fracture of the medial tibial plateau in the coronal plane
Type II	Entire Condylar fracture in which the fracture line begins in the opposite compartment and extends across the tibial eminence;
Type III	Rim avulsion fracture these fractures are associated with a high rate of associated neurovascular injury
Type IV	Rim compression injury that is usually associated with some type of contra lateral ligamentous injury
Type V	Four-part fracture in which the tibial eminence is separated from the tibial condyles and the tibial shaft

SCHATZKER'S CLASSIFICATION

Schatzker's classification of tibial plateau fractures is currently the most widely used classification.

Type I	pure cleavage fracture of the lateral tibial plateau (split fracture)
Type II	Cleavage fracture of the lateral tibial plateau in which the remaining articular surface is depressed into the metaphysis (split-depression)
Type III	Pure central depression fracture of the lateral tibial with an intact osseous rim.
Type IV	Medial tibial plateau fracture
Type V	Bicondylar fracture .
Type VI	tibial plateau fracture in which there is dissociation between the metaphysis and the diaphysis

Orthopaedic Trauma Association classification
the proximal tibia is denoted as segment 43 and is divided into three main categories. ---

- Type A fractures are extra-articular.
- Type B fractures are partial articular and are subdivided into three main categories

: B1 are pure splits,
B2 are pure depression,
B3 are split-depression.

- Type C fractures are complete articular fractures and are also subdivided into three subtype

Type 1 is articular and metaphyseal simple,
Type 2 is articular simple and metaphyseal multifragmentary,
Type 3 is articular multifragmentary

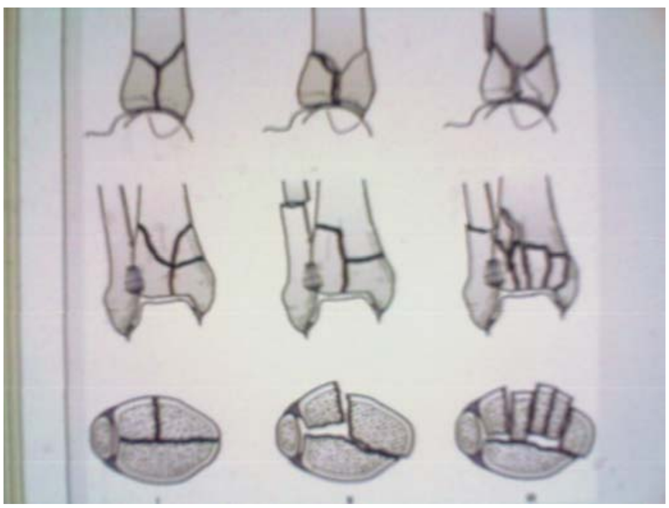
We followed the Schatzker's classification in the management

CLASSIFICATION OF DISTAL TIBIAL FRACTURES

REUDI AND ALLGOWER CLASSIFICATIOON

This classification separated axial loading fractures of the distal tibia into three types, based on the degree of comminution of the articular surface.

Type I	Un displaced cleavage fracture of the joint
Type II	Displaced but minimally comminuted fracture,
Type III	Highly comminuted and displaced fracture



AO/OTA CLASSIFICATION

AO/OTA classification system is now universally used for fractures of the distal tibia. In this system, distal tibial fractures are divided into the following categories:

- type A, nonarticular fractures;
- type B, partial articular fractures;
- type C, total articular fractures.

Each category is divided into three groups based on the amount of comminution

We followed the REUDI AND ALLGOWER classification in our study

MECHANISM OF INJURY

PROXIMAL TIBIA FRACTURE

The majority of tibial plateau fractures are secondary to high-speed motor vehicle accidents and falls from heights Tibial plateau fracture results from direct axial compression, usually with a valgus or varus (less common) moment, and indirect shear forces

The anterior aspect of the femoral condyles is wedge-shaped; with the knee in full extension, the force generated by the injury drives the condyle into the tibial plateau. The direction, magnitude and location of the force, as well as the position of the knee at impact, determine the fracture pattern, location, and degree of displacement.

Extra-articular fractures of the proximal tibia are usually secondary to direct bending forces applied to the metadiaphyseal region of the upper leg.

When a single compartment is involved in fractures of the tibial plateau, it is usually the lateral plateau .This involvement is due to the anatomic axis at the knee joint, normally 7 degrees of valgus, as well as to the predominance of injuries causing a lateral- to medial-directed force.

Patient factors such as age and bone quality also influence the fracture pattern. Older patients with osteopenic bone are more likely to sustain depression-type fractures because their subchondral bone is less likely to resist axially directed loads. In contrast, younger patients with denser subchondral bone are more likely to sustain split-type fractures and have an associated ligamentous disruption

DISTAL TIBIAL FRACTURE

Tibial plafond fractures are caused predominantly by axial loading, Bone is viscoelastic; the rate of loading shifts the stress-strain curve. Rapid axial loading, as in tibial plafond fractures, absorbs and then at failure, releases more energy. The released energy is imparted to the soft tissues. It is this energy release that leads to the severe soft tissue injury that occurs with tibial plafond fractures and results in tense swelling, fracture blisters, and complications of treatment.

Articular surface and metaphyseal comminution, joint impaction, proximal displacement of the talus, and severe associated soft tissue injuries characterize axial loading tibial plafond fractures Part of /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 the metaphysis, or it may have diaphyseal extension. The precise direction of force and position of the foot when it is applied lead to wide variation in fracture patterns. To be considered a tibial plafond fracture, there must be a fracture line traversing the weight-bearing articular surface of the distal tibia.

INVESTIGATIONS

Clinically PT may present with symptom and sign of fracture , neurovascular injury, shock,

A good quality X ray in two AP and Lateral view is a must to look for joint involvement

Radiographic evaluation includes the standard knee trauma series of an anterior-posterior, lateral, and oblique views Because of the 10 to 15 degrees posterior slope of the tibia's articular surface, these views may not be accurate in determining articular depression Therefore, a 10 to 15 degrees caudally tilted plateau view should be used to assess articular step-off

A physician-assisted traction view is often helpful in higher-energy fractures with severe impaction and metadiaphyseal fragmentation

Three dimensional CT may improve the understanding of fracture pattern but in our study we haven’t taken CT due to economical constraints

PRINCIPLES OF MANAGEMENT

There are lots of factors which play dynamic role in treatement of periarticular fractures

Such as

- amount of fracture displacement
- degree of comminution
- Extent of soft tissue injury
- Associated neurovascular injury
- Magnitude of joint involvement
- Degree of osteoporosis
- Associated injuries

The main goal of treatment is obtaining stable, aligned, mobile and painless joint

So the objectives of treatment of periarticular fractures are

- Obtain satisfactory reduction
- Maintain stable fixation
- Regain functional range of movements
- Avoid varus collapse of knee joint

METHODS OF TREATMENT

FRACTURE MANAGEMENT

In the past, major intra-articular fractures remained an unsolved problem, and disability in varying degrees after a major intra-articular fracture was considered unavoidable. Charnley recognized in 1961 that anatomic reduction and early motion were desirable in the treatment of intra-articular injuries, but the techniques of surgery and internal fixation available at the time made these objectives of treatment unattainable.

Attempts at early motion after internal fixation frequently resulted in pain because of instability, with resultant loss of fixation and varying degrees of malunion or nonunion.

Surgery combined with plaster immobilization resulted in even greater stiffness than plaster immobilization alone. .

The development by the AO group of atraumatic techniques of open reduction and stable fixation and new techniques and principles of internal fixation, new implants and instruments that permitted absolute stability of fixation and early motion without fear of displacement, malunion, or nonunion; However, as the severity of the skeletal injury increases, so does the concomitant injury to the soft tissue envelope. As surgical treatment became increasingly popular, high-energy fracture were often managed with large extensile approaches and internal fixation hardware. The usually lengthy operation and surgical approach through a tenuous soft tissue envelope, combined with the use of multiple implants, led to increased complication such as skin necrosis, infection, non union

For these more complex injuries, contemporary surgical techniques have evolved to include concepts such as indirect reduction, percutaneous plate fixation Newer devices such as cannulated screws, monolateral external fixators, anatomic periarticular plates, and external fixation techniques based on circular Ilizarov-type fixators with tensioned small wires have been used in concert with limited surgical approaches (guided by CT and careful preoperative planning) to achieve excellent results with fewer surgical complications.

When the soft tissues are significantly compromised, immediate exposure for internal stable fixation is risky, it may be safest to delay the entire open reduction and fixation procedure until the soft tissue envelope has recovered enough to tolerate exposure adequate for articular reduction and the chosen means of fixation. When the soft tissues have recovered sufficiently to allow a secondary procedure, delayed fixation can be accomplished through a safe operative corridor of healthy soft tissues.

The goals of treatment for any intra-articular fracture are to preserve joint mobility, joint stability, articular surface congruence, and axial alignment; to provide freedom from pain; and to prevent post-traumatic osteoarthritis.

VARIOUS TREATMENT MODALITIES

- conservative management
- open reduction and internal fixatoion with buttress plate
- Open reduction and internal fixation with locking compression plate
- Open reduction and internal fixation with cancellous screw
- Closed reduction and internal fixation with tibial locking nail
- External fixation using AO rod
- Ilizarov fixation
- Hybrid fixation
- **B**iological plating

CONSERVATIVE MANAGEMENT

Indication

- Undisplaced fracture with intact collateral ligament
- Fracture depression less than 5mm
- Elderly sedentary pt with depression <8mm
- Significant underlying medical disease

Goals of conservative treatement are

<7 degree of malalignment in frontal plane

<10 degree of malalignment in sagittal plane

Articular incongruity < 5mm

Limb shortening <1.5cm

Various method of conservative treatement are

- supramalleolar pin traction in BB splint
- closed reduction and above knee plaster application

SURGICAL MANAGEMENT

The goals of operative treatment are

Anatomical alignment

Stable fixation

Early motion

Early functional rehabilitation

Indication for operative treatment are

Displaced intra articular fractures

Open fractures

Pt with multiple injuries

Associated vascular injuries

Associated ligament injuries

Pathological fractures

Irreducible fractures

Unstable fractures

Timing of surgery

Compartment syndrome , neurovascular injury, open injury – emergency surgery

Other pt after stabilization of neurosurgical abdominal thoracic injuries

Surgery preferred as early as soft tissue swelling subsides and sin condition permits

The isolated complex tibial plateau fracture is not a life-threatening injury, and adequate time should be taken to evaluate the lesion thoroughly

BUTRESS PLATE

Plates shaped like an “L” or a “T” was designed to be used with these screws to provide buttress support on the lateral and medial side of the tibial plateau and to prevent collapse of one or both sides with angulations and shortening. The initial plates were thin and fairly deformable to permit contouring to fit and support a patient's individual anatomy. They relied on accurate, stable reduction of metaphyseal fracture fragments for support. They did not always fit the bone surface satisfactorily, and their fixation was compromised by screw loosening and plate deformation in the face of unsupported loading

BIOLOGICAL PLATING

Percutaneous plating, which is a more biologic approach, the plate is slide subperiosteally. This technique utilize the principles of bridge plating where the comminuted fragment left undisturbed and fracture hematoma preserved facilitating fracture union in by callus formation , minimal soft tissue damage results in decreased chance of skin necrosis and infection , use of locking plate act as internal fixator and increase the stability of fixation.

BIOLOGICAL PLATING are based on principles of limited exposure, indirect reduction methods and limited contact between bone and implant. As a result of these principles this technique, , avoid major soft tissue complications and shortened the length of the patient's stay in the hospital

DOUBLE PLATING

Double plating the tibial plateau due to an increase in soft tissue complications.

double plates are used for a bicondylar fracture if the far cortex has an unstable fracture pattern; the use of low-profile plates with minimal soft tissue devitalization through a separate incision is recommended

PRECONTOURED PLATES

Newer implant designs have introduced the concept of anatomically precontoured plates that are low profile and designed to fit the proximal tibia and reduce the late complication of prominent hardware. Being less malleable, they are more difficult to contour and thus may compromise the surgeon'"one-size-fits-all" plate has a potential drawback. ability to accommodate for patients with a different size or shape.

ANGULAR STABLE (LOCKING) PLATES

Angular stable plates are often referred to as internal fixators Long, spanning constructs across the fracture zone are advocated for these technologies with the need for fewer fixation screws, analogous to the principles of external fixators. Locked screws do not provide interfragmentary compression It prevent varus collapse of the proximal articular fragment, The paucity of soft tissue complications is another advantage

CANCELLOUS SCREW FIXATION

The trend has been to move toward smaller-diameter, fully threaded 3.5 mm lag screws placed in a configuration which allows the screws to be placed closed to the subchondral bone Insimple split fractures that are anatomically reduced by closed means or in the cases of depression fractures that are elevated percutaneously, large or small fragment screws can be used to stabilize the fractures.

EXTERNAL FIXATOR

External fixation can involve half-pins, thin wires, or a combination of the two (hybrid). a transfibular wire could potentially seed the knee joint if a pin tract infection were to develop Smooth wires should be placed parallel to the articular surface and below any percutaneously placed screws. External fixation does not reduce comminuted or depressed articular fragments, which need direct visualization and reduction. Only limited interfragmentary compression is possible without supplementary internal fixation. Stability may be inadequate unless a properly designed and applied external fixator is used. Pin tract infections, which may involve the fracture site or knee are possible, particularly when the fixator is placed close to the joint and into comminuted areas for optimal fracture stability. Patients sometimes have difficulty tolerating external fixators

ARTHROSCOPY

Arthroscopy has been applied successfully to certain tibial plateau fractures. It permits assessment and treatment of intra-articular soft tissue and joint surface injuries. Fluoroscopy is usually required as well, and open, but perhaps less extensive, incisions might be needed to provide stable fixation after an arthroscopically assisted reduction

PREOPERATIVE PLANNING

A distinction should be made between the degree of osseous depression of the articular joint surface (i.e., true joint depression) and the translational or axial displacement of an entire fractured condyle, as may be seen with a severely displaced lateral condyle.

Malalignment of the condyles in relation to the tibial shaft with subsequent shift of the mechanical axis is another prominent factor.because Future reconstructive procedures depend on correct maintenance of the mechanical axis..

Ligament Injuries

Ligament injury associated with plateau fractures has been diagnosed indirectly with stress radiographs and physical examination. With increasing use of more sensitive MRI and arthroscopy, associated ligament and meniscus injuries have been found in significant percentages of plateau fractures. These soft tissue injuries consist primarily of MCL lesions, meniscal injuries, and ACL disruptions..

Personality of the Injury

First, the patient-related factors: age, history of past health, concurrent health problems, occupation and leisure activities, and expectations of treatment results

Second are the injury factors. Here the surgeon must define carefully the injury to the soft tissue envelope, taking into consideration the location of the fracture and the condition of the skin in and around the proposed surgical exposure if surgery is contemplated. The open or closed nature of the fracture, the associated soft tissue and bone injuries, and the possibility of a concomitant neurologic or vascular deficit or an acute compartment syndrome must be determined

Third, the characteristics of the fracture itself must be defined with great care in order to classify it. Information regarding the depth of articular impaction, degree of condylar displacement, and amount of fracture line extension from the metaphysis into the diaphyseal region must be obtained from the plain radiographs, traction radiographs, and traction CT scans.

Fourth The degree of osteoporosis must be determined because the quality of bone is of paramount importance in judging the operability of the fracture.

Ffifth in defining the personality of the injury, the surgeon must evaluate the treatment team and the treatment environment.

With this insight, the surgeon is able to formulate a preoperative surgical plan that helps define the surgical tactic and outlines the expected difficulties of treatment. Ultimately, the same information manifests in the patient's prognosis.

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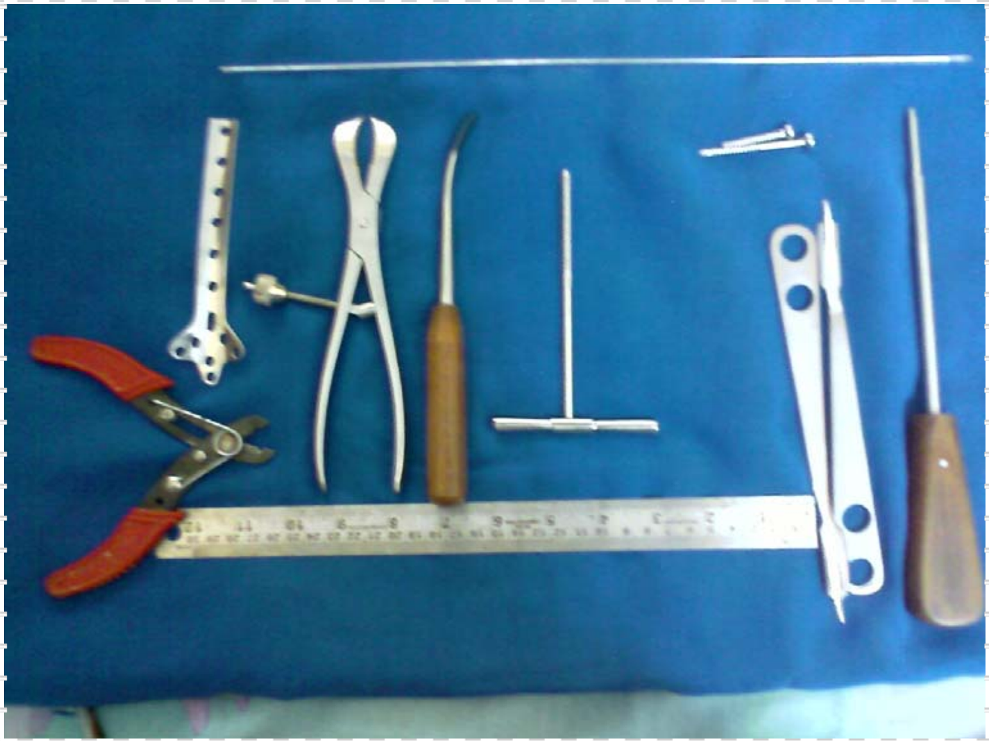
IMPLANTS AND INSTRUMENTS

Proximal tibial plate

distal tibial plate



4.5mm locking screw ,

4.5mm cortical screw

3.5mm locking screw

2mm kwire

3.2mm drillbit

2.7mm drillbit

4.5mm tap

3.5mm tap

Screw driver

Drill guide

Drill

SURGICAL TECHNIQUE

Open reduction and internal fixation of the articular plateau makes possible its anatomic reduction, after which proper length, axis alignment, and rotation may be restored with less invasive, more soft tissue-friendly techniques for the metadiaphyseal portion of the fracture and fixation.

The surgeon should develop a surgical tactic, which is a sequential plan for addressing the fracture with plateau fractures, one must ascertain whether impaction (manifested as articular depression) has occurred, where it has occurred, and to what extent. The surgeon determines where plates should be applied, and in what direction screws should be pointed.

The transaxial CT images are most helpful for analyzing these variables, but often the coronal or sagittal reconstructions demonstrate other issues, such as eminence and tubercle fractures and rotation of fragments. As the surgeon develops a concept of optimum fixation, he or she must determine how to achieve a safe surgical approach for both reduction and fixation. This is where soft tissue considerations come into play, and one may need to compromise fixation choice to avoid excessive risks of tissue injury.

The patient should be positioned supine on a radiolucent table. A cushion under the ipsilateral hip helps counteract the lower extremity's tendency to externally rotate while the surgeon works.. Antibiotics should be delivered within an hour before incision, and it is preferable to place a tourniquet high on the thigh to allow for the option of a bloodless field during at least part of the surgery

Choosing the type of surgical incision depends on access needs for reduction and fixation, modified as necessary by soft tissue condition.

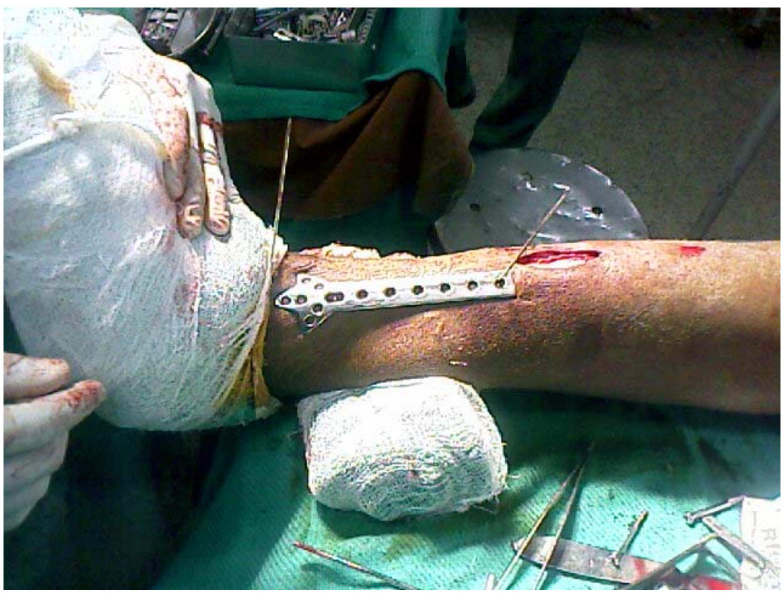
A C-arm image intensifier fluoroscope is used during surgery to assess fracture reduction and implant placement.

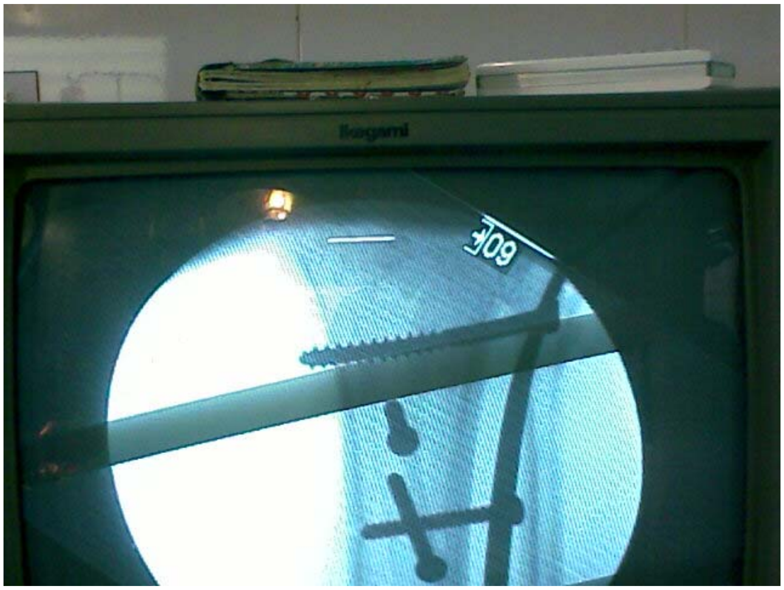
Surgery for nearly all tibial plateau fractures that warrant open reduction internal fixation can be enhanced by the use of an AO universal distractor

Biologic plating consist of precountouring the plate to shape of bone & entry point made at site remote from fracture site allow the plate to slide subperiosteally to cross the fracture zone indirect reduction is carried out under C-arm control & plate is fixed with main fragment of bone. the comminuted fragments are not fixed. Proximally and distally 3 to 4 bi cortical purchase obtained percutaneously under C -arm control

Articular alignment is obtained by using K wire as joy stick and provisionally fixed with K wire and the definite fixation using lag screw

K wire is used to fix the implant to the bone prior to screw fixation once reduction is achieved by restoring the length, restoring the axial, translational, and rotational alignment. Proximal and distal percutaneous screw fixation is done spanning the comminuted fragments





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COMPLICATION

Complications due to fractures

- infection
- vascular injuries
- nerve injuries
- nonunion
- malunion
- pulmonary complication
- missed ligamentous injuries
- knee stiffness

Complications of operative management

- incomplete reduction
- incongruent reduction
- skin necrosis
- implant infection
- implant prominence
- implant failure

INFECTON

The major drawback of operative fixation of preiarticular fracture of is infection however it should not exceed 5% , if develops appropriate antibiotic for 6 wk , wound drainage, aggressive irrigation are indicated, even in the presence of mild infection it is better to retain the implant because the stable infected fracture are better managed than unstable, however if implant is loose it should be removed

NONUNION

It is more common in conservatively teated fracture non union may also due to implant failure unstable fixation earlymobalization, treatement is difficult in the absense of infection repeat osteosynthesis is preferred

SKIN NECROSIS

One of the major complication is skin necrosis hence plate fixation done once soft tissue damage has been reduced by the end of first week. Minimal soft tissue handling is prerequisite to prevent skin necrosis , skin should raised as flap, low profile implant are prefferd

POST TRAUMATIC ARHTRITIS

The incidence of post traumatic arthritis is unknown , however incongruity of joint surface leads to arthritisthis complication is reduced by anatomical reduction

STIFFNESS

The most common complication is knee stiffness due to prolonged immobilization. Immobilization of fracture for more than 3 wk results in stiffness, early fracture fixation , meticulous soft tissue handling, early gentle mobilization reduce the knee stiffness

VASCULAR INJURY

The incidence of vascular injuries are 2-3% may be due to laceration , contusion,cclinical examination and early intervention is essential

EVALUATION OF OUTCOME

There are lots of scoring system we followed the rating system of knee

NEER RATING SYSTEM

CHARACTER	SCORE	DEFINITION
PAIN	4 3 2 1	No pain in all range of movements Pain with normal daily activity Minimal activity gives pain Pain at rest
MOVEMENT	4 3 2 1	Flexion >120; No FFD Flexion 90-120; No FFD Flexion 70-90; FFD10 Flexion <60 ;FFD>10
FUNCTION	4 3 2 1	Normal gait with full wt bearing Limp, but no restriction of activity Requires walking aid Cannot walk
SHORTENING	4 3 2 1	0-0.5cm 0.5-2.5cm 2.5-5.0cm >5cm
ANGULATION	4 3 2 1	None <10 10-15 >15
Excellent-16-20; good12-16;fair8-12;failure5-8		

TORNELTA et al scoring for distal tibia

GRADE	PAIN	ROM	AMGULATION
EXCELLENT	None	Dorsiflexion>5 Plantorflexion >30	<3
GOOD	Intermittent	Dorsiflexion 0-5 Plantorflexion 20- 30	3-5 valgus <3 varus
FAIR	Limiting daily activity	Dorsiflexion -5-0 Plantorflexion 15-20	5-8 valgus 3-5 varus
POOR	intractable	Dorsiflexion <-5 Plantorflexion <15	>8 valgus >5 varus

MATERIALS AND METHODS

The period of surgery and follow up extends from November 2007 to november2009

It includes periarticular fracture of proximal and distal tibia

Pathological fracture, compound grade 3 fracture, paediatric fracture were excluded

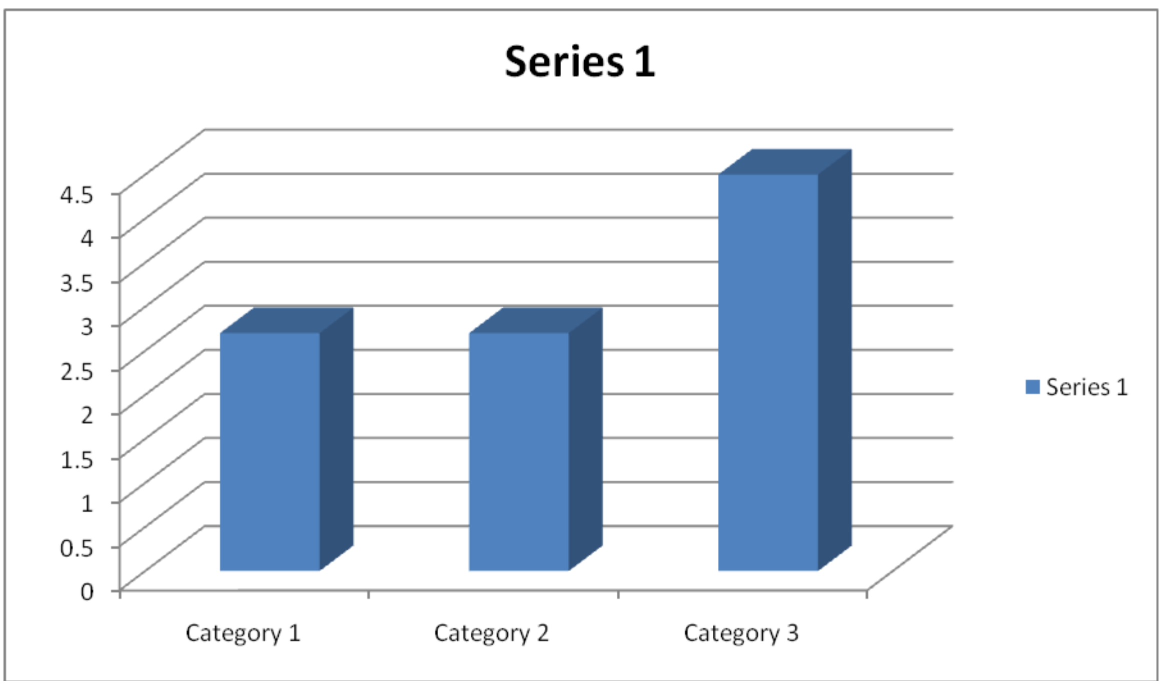
There are 11 cases include in this study The case were analyzed as per the following criteria

1	**Age distribution**
2	**Sex distribution**
3	**Mode of injury**
4	**Anatomy of injury**
5	**Time of union**

Age distribution

Age group varied from 35 to 57 yrs with mean age 48 yr

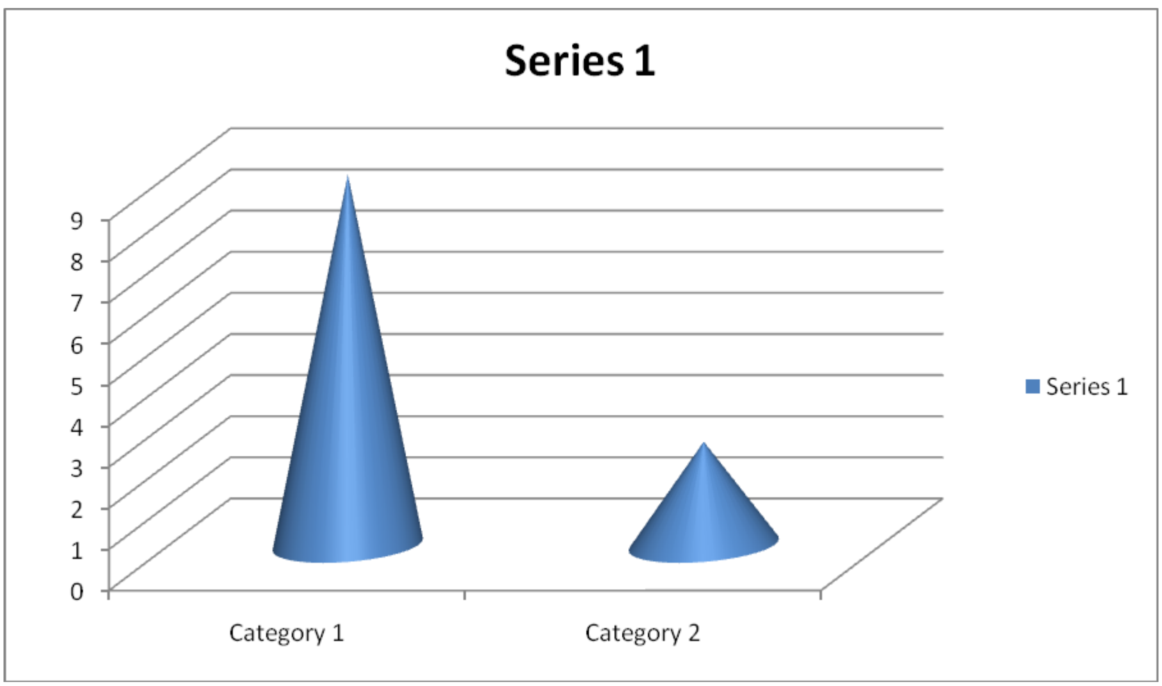
Age group	No of cases	percentage
30-40	3	25
40-50	4	33
50-60	5	42



SEX DISTRIBUTION

Among 11 case 9 were male 2 were female

SEX	No of cases	percentage
MALE	9	75
FEMALE	3	25



MODE OF INJURY

Common mode of injury RTA

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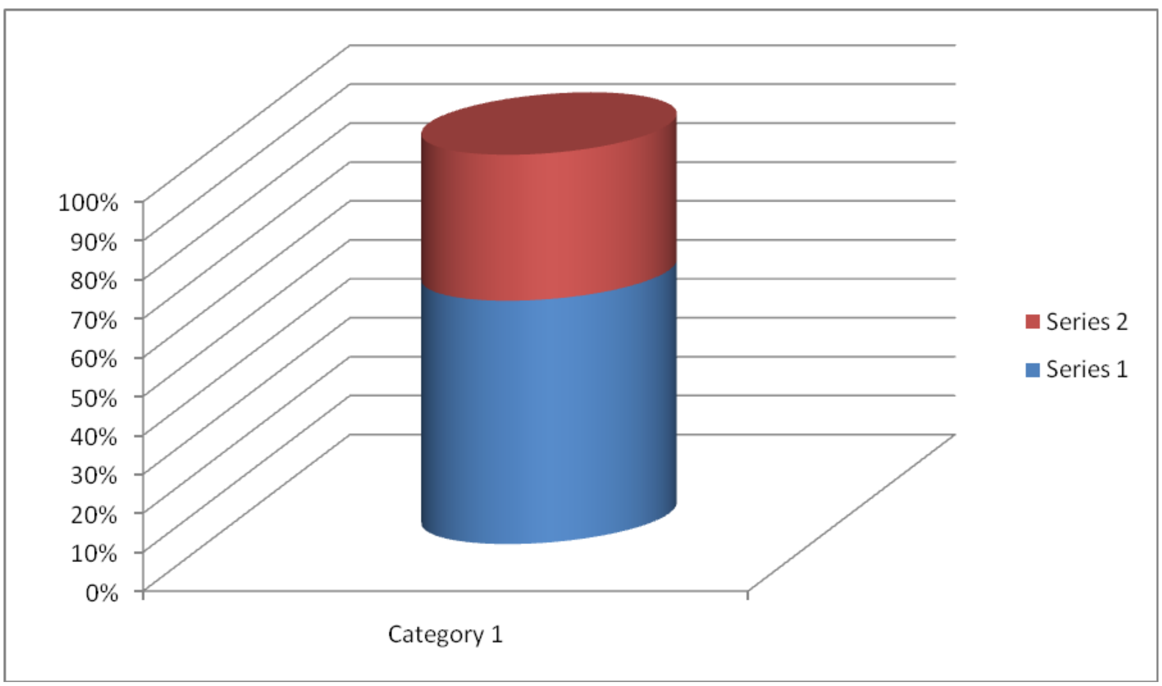
Mode of injury	No of cases	Percentage
RTA	12	100
FALL	0	0

ANATOMY

Site	No of cases	Percentage
Proximal	6	50
Distal	6	50



TIME OF UNION

Time of union	No of cases	percentage
4 month	3	25
4-6	6	50
>6	3	25

OBSERVATION

- 75% pt were from 40 -60 yr
- majority being male
- mean duration for surgery is 1 wk average time of union is 5 month average knee flexion is 90 degree anke 20 degree doersiflexion
- all case were road traffic accident
- the results were excellent in 33 percent good in 42% fair in 25%

PROCEDURE

Once the patient limb shows good soft tissue healing , edema subsided , in the absence of skin infection

The patient should be positioned supine on a radiolucent table. A cushion under the ipsilateral hip helps counteract the lower extremity's tendency to externally rotate while the surgeon works..

Antibiotics should be delivered within an hour before incision, and it is preferable to place a tourniquet high on the thigh to allow for the option of a bloodless field during at least part of the surgery

Choosing the type of surgical incision depends on access needs for reduction and fixation, modified as necessary by soft tissue condition. Anterolateral incision gives adequate soft tissue coverage , but incision is decided by fracture personality, the incision is away from fracture site

A C-arm image intensifier fluoroscope is used to assess fracture reduction and implant placement. The C-arm should be on the side opposite the injured extremity, so as to interfere less with surgical access. The C-arm should enter the field exactly perpendicular to the patient to aid the technician with orientation and avoid nonstandard oblique views.

Surgery for nearly all tibial plateau fractures that warrant open reduction internal fixation can be enhanced by the use of an AO universal distractor. This device functions like a jack to open the femorotibial joint, permitting visual inspection and removing femoral pressure on the tibial plateau.

Biologic plating consist of precountouring the plate to the shape of bone & entry point made at site remote from fracture site allow the plate to slide subperiosteally to cross the fracture zone indirect reduction is carried out under C-arm control & plate is fixed with main fragment of bone. the comminuted fragments are not fixed. proximally and distally 3to4 bi cortical purchase obtained percutaneously under C Arm control

K wire is used to fix the implant to the bone prior to screw fixation once reduction is achieved by restoring the length , restoring the axial , translational ,and rotational alignment . proximal and distal percutaneous screw fixation is done spanning the comminuted fragments

Post-operatively the limb was maintained in the elevated position with POP

Antero posterior and lateral views were taken at 2weeks, 6 weeks and 3 months post-operatively to assess healing and alignment.

12th day suture removed , 2nd wk gentle mobilization exercise stated wt bearing once clinical and radiological evidence of union is obtained

ANALYSIS OF FUNCTIONAL OUTCOME

There were 11 patient included in this study

Skin necrosis	1
Infection	1
varus angulation in distal tibia	2
delayed union	1
stiffness	3

OVER ALL RESULT

GRADING	NO oF CASES	PERCENTAGE
EXCELLENT	4	33
GOOD	5	42
FAIR	3	25

Mr Baskaran 44 /m sustained Road traffic accident
Schatzker's type VI Tibial plateau fracture

Pre op AP lateral view

Per op

Post op 2 wk

12 wk post op

Mr Pichai 51/m sustaine road traffic accident sustained proximal tibia fracture extra articular comminuted AO 43A2

2 wk post op

16 wk post op

Mrs Chinammal 56 female sustained road traffic accident extra articular comminuted distal tibia fracture

Pre op immediate post op

6 wk 12 wk

Mr sudalai 43/male sustained road traffic accident had extra articular distal tibia fracture

pre op

2 wk

12 wk post op

RESULTS

In our study we included 12patient 6 of them were proximal tibia fracture and 6 of them were distal tibia fracture 3were female 9 were male , mode of injury is road traffic accident we did surgery by 6th day to allow the edema to subside to give time for soft tissue damage two patient in proximal tibia and two pt in distal tibia had excellent results One pt developed skin necrosis later flap cover done since we immobilize the pt in POP three patient developed stiffness but later the had increased rang e of movements One patent developed infection which was controlled with higher spectrum antibiotic after pus culture sensitivity one pt had delayed union where we did a cancellous bone grafting as second stage procedure all pt showed union of fracture on an average of 5 month

DISCUSSION

The results of operative treatment are dependent on the severity of the initial injury and the quality and stability of the reduction. The mechanism of injury, the status of the soft tissues and the degree of comminution affect the long term clinical result .The mean interval for radiological union was 16 to 20 weeks in our study in accordance to previous study However, the most important factor is to achieve stable fixation and to allow early range of motion without unnecessary osseous and soft tissue devascularization

Biological plate fixation based on principles of limited exposure, indirect reduction, and limited contact between bone and implant. Bridge plating, preservation of fracture hematoma limited periosteal stripping

As a result of these principles this technique avoids major soft tissue complications. The bone healing was good to excellent with this type of fixation because the stresses were distributed over a longer segment of bone.

This technique can be used in fractures where locked nailing cannot be done like vertical slit and markedly comminuted fractures. There was rapid fracture consolidation due to preserved fracture hematoma

There was less incidence of infection due to limited exposure when compare to the open procedure where the is increase chance of infection. Less chance of implant exposure and soft tissue damage when compared to conventional open procedure

The complication of external fixator like pin tract infection, septic arthritis are nil

There were less chances of re fracture .due relatively rapid fracture healing due to preservation of soft tissue and vascularity of comminuted fracture fragment which is not so in conventional open procedure

There was no chance of vascular complication by carefully inserting the plate subperiosteally through limited incisions. There was no need of any sophisticated instrumentation and the method was less time consuming when compared to ilizarov or hybrid fixator

The LCP act as internal fixators in a bridging manner, thus resulting in secondary bone healing Thus, biological plate fixation for distal tibial fractures and proximal tibial fracture will prove to be a feasible and worthwhile method of stabilization while avoiding the severe complications associated with the other methods of internal or external fixation

The advantage of biological plate fixation are Minimally invasive procedure, Less skin and soft tissue demanding,
Preservation of fracture hematoma, Less incidence of infection
Increase union rate less incidence of neurovascular injury
And the disadvantage are Surgical expertise Increased cost C- arm availability

CONCLUSION

To summarize the advantage of biological fixation are

Minimally invasive procedure

Less skin and soft tisuue demanding

Preservation of fracture hematoma

Increased callus formation

Less incidence of infection

Increase union rate

Less incidence of neurovascular injury

Disadvantage are

Surgical expertise

Increased cost

C- arm availability

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Master chart

S. No	Name	Age sex	IP-NO	diagnosis	Treatment	Time of union	Range of mov F/E[PF/DF]	Complication	Result
1	Karuppiah	57/m	37894	Simple frscture proximal tibia	Biological plate fixation	9month	70	Delayed union	good
2	Rajammal	47/f	39040	Simple fracture proximal tibia	Biological plate fixation	5month	90	-	Excellent
3	Pichai	51/m	42987	Compound fracture proximal tibia	Biological plate fixation	51/2 month	90	-	excellent
4	Baskaran	44/m		Simpla fracture proximal tibia	Biological plate fixation	4month	80		Good
5	Palani	53/m	54398	Comp gr 1 fr proximaltibia	Biological plate fixation	7month	50	Stiffness	fair
6	Muniyamma	48/f	54782	Simple fr proximal tibia	Biological plate fixation	4month	80		Good
7	Muthuraman	52/m	43572	Simple frature distal tibia	Biological plate fixation	5onth	20 20	Infection	Fair
8	Chellapandi	38/m	12464	Simple frature distal tibia	Biological plate fixation	4month	20 20	Stiffness , varus angulation	Good
9	Kumar	34/m	54362	Simple frature distal tibia	Biological plate fixation	4month	20 40		Excellent
10	Chinammal	56/f	12456	Simple frature distal tibia	Biological plate fixation	5month	20 30		excelent
11	Sudalai	43/m	64324	Simple frature distal tibia	Biological plate fixation	5month	20 30	Stiffness varus angulation	good
12	Rajendran	35/m		Simple frature distal tibia	Biological plate fixation	6 1/2month	20 20	Skin necrosis	Fair

PROFORMA

NAME

AGE / SEX IP NO

INCOME

MODE OF INJURY

TYPE OF FRACTURE

ASSOCIATED FRACTURE

CO MORBID DISEASE

INVESTIGATION

TIME OF SURGERY

POST OPERATIVE CARE

COMPLICATION

MANAGEMENT OF COMPLICATION