DISSERTATION ON

Evaluation of Clinical and Functional Outcome Of Closed Reduction/Open Reduction and Internal Fixation with Intra Medullary Interlocking Nailing and '*Poller*' Blocking Screws in Tibial Metaphyseal Fractures

Submitted to

THE TAMILNADU
DR. M.G.R. MEDICAL UNIVERSITY
CHENNAI, TAMILNADU

As fulfillment of the regulations for the award of the degree

M.S. (ORTHOPAEDIC SURGERY)
BRANCH II

MADURAI MEDICAL COLLEGE

MADURAI

APRIL-2013

ACKNOWLEDGEMENT

I wish to express my sincere thanks to our Dean **DR.N.MOHAN M.S., F.I.C.S,,** Madurai Medical College, Madurai, for having allowed me to conduct this study.

It is my proud privilege to express my sincere thanks to my beloved and kind hearted Chief **PROF.DR.P.V.PUGALENTHI.,M.S Ortho.,D.Ortho.,HOD & Professor of Orthopaedics** & **Traumatology** Madurai Medical College and Govt Rajaji Hospital, for his total support in all my endeavours. I wish to express my sincere gratitude and heartfelt thanks to our **PROF&HOD** for his guidance and support during the conduct of the study.

I wish to express my sincere gratitude and heartfelt thanks to **PROF.DR.A.Rajamani M.S.Ortho.,D.Ortho., Professor of Orthopaedics Spine,** for his support and encouragement. I wish to express my sincere gratitude and heartfelt thanks to **PROF.DR.T.C.Chandra Prakasam M.S.Ortho.,D.Ortho., Professor of Hand surgery,** for his support and encouragement. I wish to express my sincere gratitude and heartfelt thanks to **PROF.DR.Shanmuganathan M.S.Ortho., D.Ortho., Professor of Orthopaedics & Traumatology** for his support and guidance.

I wish to express my sincere gratitude and heartfelt thanks to

PROF.DR.L.D.Thulasiram M.S.Ortho.,D.Ortho., for his support and encouragement

I wish to express my sincere gratitude and heartfelt thanks to **PROF.DR.R.Sivakumar M.SOrtho.,D.Ortho.,** for his support and encouragement. I wish to express my sincere gratitude and heartfelt thanks to my Co-Guide **Dr.T.C.Premkumar M.SOrtho.,D.Ortho.,** for his guidance,timely advice,support and encouragement.

I am deeply indepted to **Dr.Ravichandran M.S.Ortho., Dr.Ramanathan, M.S.Ortho., Dr. M.N.Karthi M.SOrtho., Dr.K.P.Saravanakumar M.SOrtho., Dr.P.V.Thirumalaimurugan M.S Ortho.,D.N.B Ortho., Dr.T.C.Premkumar. M.S.Ortho., D.Ortho., Dr.Pathiarasakmar M.S.Ortho., Dr.Maheshwaran. M.S.Ortho., D.Ortho., Dr,Saravanamuthu, M.S.Ortho., Dr.V.A.Prabhu M.S.Ortho Dr.Gnanaprakasm M.S.ortho., D.Ortho** for their immense help, continuous motivation, expert guidance, timely advice during the course of my study and for the preparation of this dissertation.

Last but not the least I sincerely thank all the patients involved in this study. Their co-operation and endurance has made this study a worthy one.

CERTIFICATE

Certified that the dissertation on **"Evaluation of Clinical and Functional outcome Of Open Reduction/Closed Reduction with Intra Medullary Interlocking Nailing and '*Poller*' Blocking Screws in Tibial Metaphyseal Fractures"** is a bonafide work done by **Dr.K.SHANMUGANATHAN,** Postgraduate, in the Department of Orthopaedic Surgery and Traumatology, Madurai Medical college. &Govt Rajaji Hospital, Madurai, under my guidance and supervision in fulfilment of the regulations of **The Tamilnadu Dr. M. G. R. Medical University** for the award of **M.S. Degree Branch II (Orthopaedic Surgery)** during the academic period of May 2010– April 2013

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DECLARTATION

I, declare that this dissertation "*Evaluation of Clinical and Functional Outcome of Open Reduction/Closed Reduction with Intra Medullary Interlocking Nailing and 'Poller' Blocking Screws in Tibial Metaphyseal Fractures"* has been conducted by me at the Department of Orthopaedic Surgery&Traumatology, Madurai Medical College & Govt Rajaji Hospital, Madurai, under the guidance and supervision of my respected Chief **PROF.DR. P.V.PUGALENTHI M.S.Ortho,D.Ortho,** Madurai Medical College& Govt. Rajaji Hospital, Madurai.

It is submitted as part of fulfilment of the award of the degree in M. S. Orthopaedic surgery for the April-2013 examination to be held under The Tamilnadu Dr. M. G. R Medical University, Chennai. This has not been submitted previously by me for the award of any degree or diploma from any other university**.**

Dr.K.SHANMUGANATHAN

M.S.ORTHO P.G.

TITLE PAGE

1. INTRODUCTION

Due to the increasing number of road traffic accidents, long bone fractures are more common nowadays. Fracture of tibia is one of the most commonly occurring fractures due its superficial location. Proper treatment of these fractures is paramount importance. Among the treatment of tibial fractures, the treatment of metaphyseal fractures of tibia remains challenging, because of the sagittal and coronal malalignment which is mainly due to the mismatch between medullary canal diameter between the two fragments of the metaphyseal tibial fractures and anatomy of the metaphyseal region. Establishment of length and prevention of the coronal, sagittal, rotational malalignment is the at most importance during fixation. The treatment options for the metaphyseal tibial fractures are conservative management, open reduction with plate osteosynthesis, external fixators and recently the intramedullary interlocking nailing. Each treatment has its own advantages and disadvantages. The conservative management has the high level complications. These are the delayed union, malunion, rarely non union. Due to the knee and ankle joints are having predominantly single plane functional movements the effects of the malunion and delayed union are high with secondary osteoarthritis of the joints. Then open reduction with plate osteosynthesis has its own complications of the delayed wound healing and delayed union particularly in case of the distal metaphyseal fractures, even though we can get

perfect anatomic reduction in this type treatment. The external fixation method having the complications of the post traumatic complications like high incidence of post traumatic joint stiffness. So nowadays most authors consider the intramedullary interlocking nailing is the most effective treatment of choice.Futher it is important to do advice early mobilisation of knee and ankle to achieve normal range of movements in the joints. It is possible only in intramedullary nailing only

Interlocking nailing of tibial fractures are most desirable because these are load sharing devices in compare to load bearing plate osteosynthesis implants. Biological fixation of the fracture is possible in the method of nailing without opening the fracture site, further it is possible to spare the extra osseous blood supply and we can avoid extensive soft tissue dissection. Nailing of metaphyseal fractures with short proximal or distal fragment is associated with an increase in malalignment particularly in coronal plane, so there is always a chance for mal union, rarely non union and need for secondary procedures to achieve union. The cause has been attributed to both displacing muscular forces and medullary canal anatomical factors. As there is always a mismatch between the diameters of the nail and the medullary canal, with no nail-cortex contact, the nail may translate coronally or sagittaly particularly in proximal tibial fractures. Due to this there is a increased stress on the locking screws to maintain fracture alignment after surgery, which further leads to periprosthetic fractures and implant failure. Various techniques have been recommended to

improve nailing procedures for the metaphyseal fractures these are, "*poller*" blocking screws, temporary unicortical plating, different nail designs with different proximal bends in case of proximal third fractures and fibular plating in case of distal third fractures.

Poller screws are named after a traffic guiding device used in European countries to guide the traffic on the roads. They are used for the following three purposes**:**

a) Achievement of the fracture alignment, by using screw as a reduction tool.
b) Improvement of the stability of the bone – implant Construct by reducing the medullary canal width.
c) Maintenance the fracture alignment till union with *poller* screws in situ

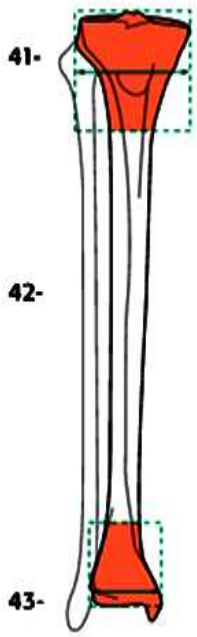
2. AIM OF THE STUDY

To evaluate the Clinical and Functional Outcome of Closed Reduction / Open Reduction and Internal fixation with Intramedullary Inter Locking Nailing and "POLLER" BLOCKING SCREWS" in Tibial Metaphyseal Fractures.

3. TIBIAL METAPHYSEAL FRACTURES

Anatomy of Tibia-Metaphysis

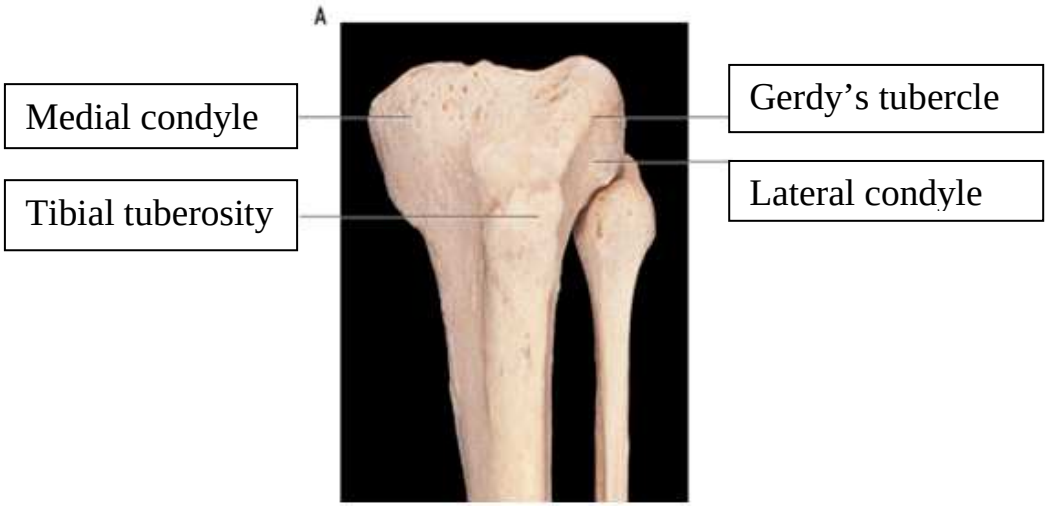
Shaft of tibia is triangular in cross section. It widens at both the proximal and distal metaphyseal region to articulate with the femur in the proximal part and with the talus and fibula in the distal part thereby support body's weight at the knee and ankle joint .Proximal and distal end of tibia is shaped like a rectangular box with a bony protuberance. Theses are forming the tibial condyles proximally and medial malleoli distally.

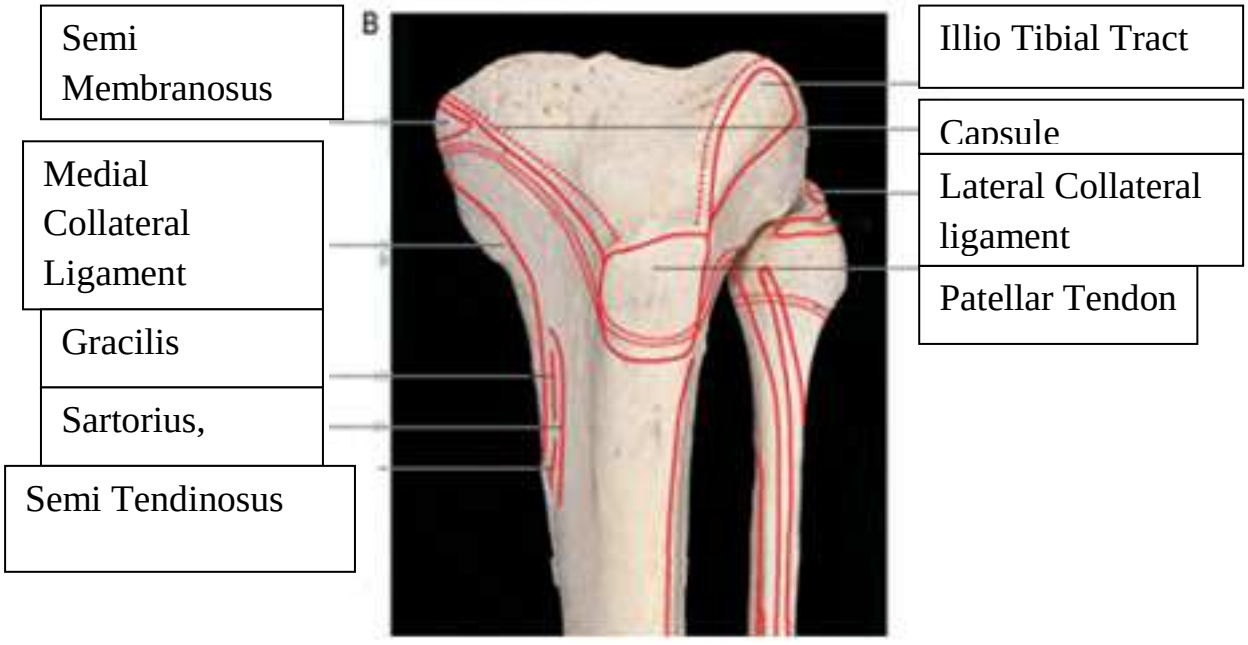


"Metaphysis of the tibia is defined as the area within a square, the sides of which are the same length as the widest part of the articular surface."

A*nterior* aspect of Proximal Metaphysis

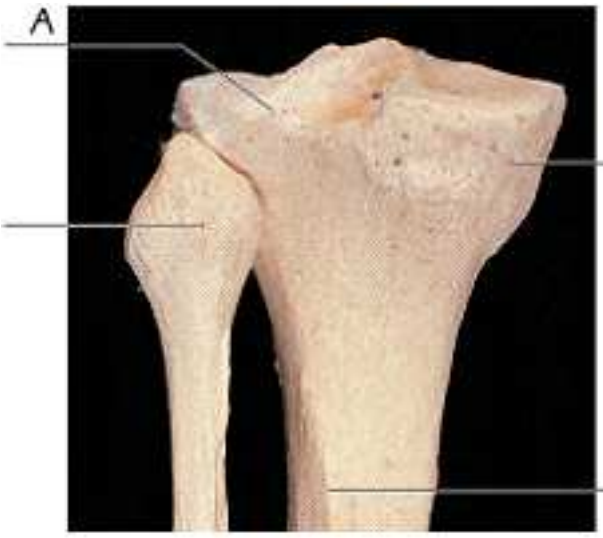
with attachments

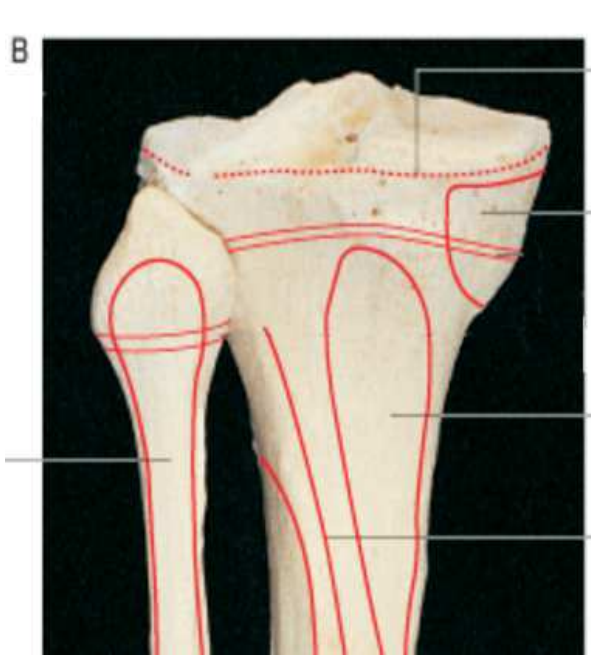




Posterior aspect of Proximal Metaphysis

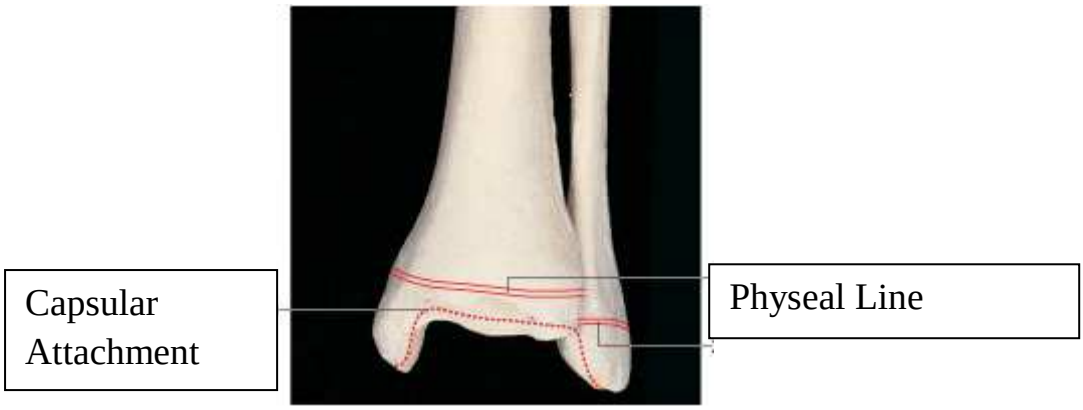
with soft tissue attachments





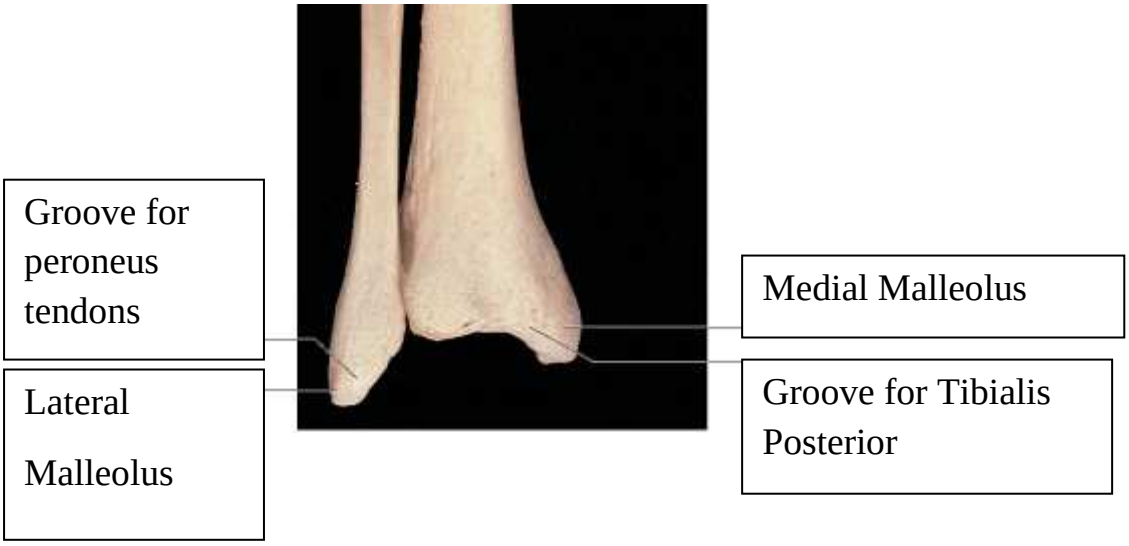
Anterior aspect of Distal Metaphsis

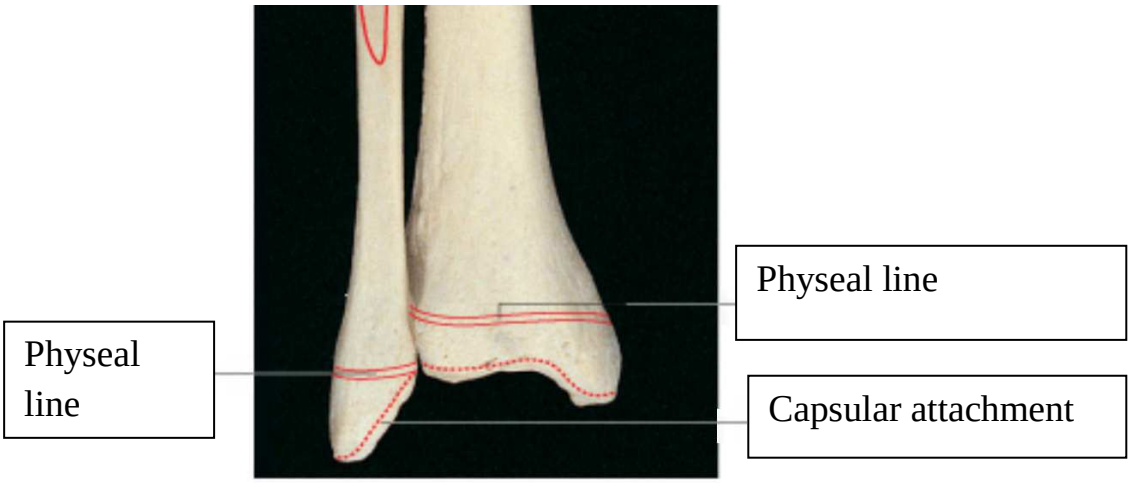
With soft tissue attachments



Posterior aspect of Distal Metaphysis

Soft tissue attachments





Vascular Anatomy

Proximal metaphysis is supplied by the metaphyseal vessels which are branches of the genicular artery anatomoses around the knee. Distal tibia is supplied by vascular anostomoses formed by the arteries arising from the both t anterior tibial and posterior tibia arteries which are located in periosteal region forming an anastomoses. There is a water shed area at the junction of the middle and distal third of the tibia. So whenever excessive soft dissection is being done in the distal tibia delayed union or the nonunion may occur.

Epidemiology of metaphyseal fractures

Incidence metaphyseal tibial fracture is currently in increasing trend. Tibial fractures are most common fractures in compare to all other long bones. The annual incidence of the tibial fractures is 26 fracture per 100000 population Proximal metaphyseal fracture contributes for the 7% of the tibial fractures There is increasing number of open fractures as the one third of the bone is superficial. Distal tibia fractures are extraarticular fractures of the metaphysis. In high violence injuries it may lead to intra articular tibial plafond or pilon fractures. One study reported incidence rates of metaphyseal ankle fractures that varied considerably by age and gender [1]. Incidence ranged from a low of 3 per 10,000 per year among 30 to 34-year-old women to a high of 28 per 10,000 per year among 15 to 19-year-old boys.

Mechanism of injury

Most commonly due to the road traffic accidents, direct trauma, gun shot injuries, fall from the height, sports injuries, Injuries always are to be assessed regarding the violence of the injry.The prognosis depends upon the soft tissue injury status. It is sufficient to say here that the more violent the trauma, the more likely the presence of major soft tissue damage.

Clinical evaluation

Diagnosis of the fracture is usually obvious. Evaluation regarding the compartment syndrome particularly in case of the proximal metaphyseal fractures has the paramount importance. The management options mainly depend on the soft tissue injury. The classical clinical symptoms of the compartment syndrome are pain out proportion, tense pulseless and paralysed limb, stretch pain. Compartment pressure should be usually monitored periodically. Compartment pressure more than 30mmHg or within the 30 mm

Hg of the diastolic pressure is the indication for the emergency fasciotomy. Always distal neurological status is to be evaluated .Common peroneal nerve injury is most common in case fracture neck of fibula when it is associated with proximal tibial metaphyseal fractures. Then the fracture pattern and displacements is to be assessed. Due to the gastronemius acting posteriorly, tibialis anterior acting anterolateraly and patellar tendon acting anteriorly, there is always a tendency for valgus and antecurvatum malalignment of the proximal fragment. Tibial fractures most commonly associated with the ligament injuries in the knee. So, clinical evaluation regarding the ligament is always important. Stability of the knee/ankle joint always is to be examined in the proximal/distal metaphyseal fractures respectively.

Radiological evaluation

Anteroposterior, lateral and the full length tibia views should be obtained to assess the bone as well as soft tissue status. Oblique radiographic views at 45 degree sometimes are required to detect a non displaced spiral fracture. Radiographs of the contra lateral tibia sometimes are necessary to evaluate the length in fractures with severe comminution or bone loss. Metapyhseal fractures always associated with extension of the fracture into the joint, So always the X ray views should include the knee and the ankle joints. CT is scan some time needed to assess the intra articular extension of the farcture.MRI scan also some time is needed to rule out the ligament injuries particularly in proximal tibial metaphyseal fractures

Classifications

There are TWO type of classifications:

I. **AO/OTA Classification**

II. **Taylor and Martin SUD classification**

In the AO/OTA classification, the metaphyseal regions are designed as follows:

Proximal metaphysis - 41

Distal metaphysis - 43.

AO/OTA Classification of proximal tibial metaphysis 41.

Type A - Extraarticular,

Type B - Partialy articular

Type C - Completely articular.

A – Extra articular fracture

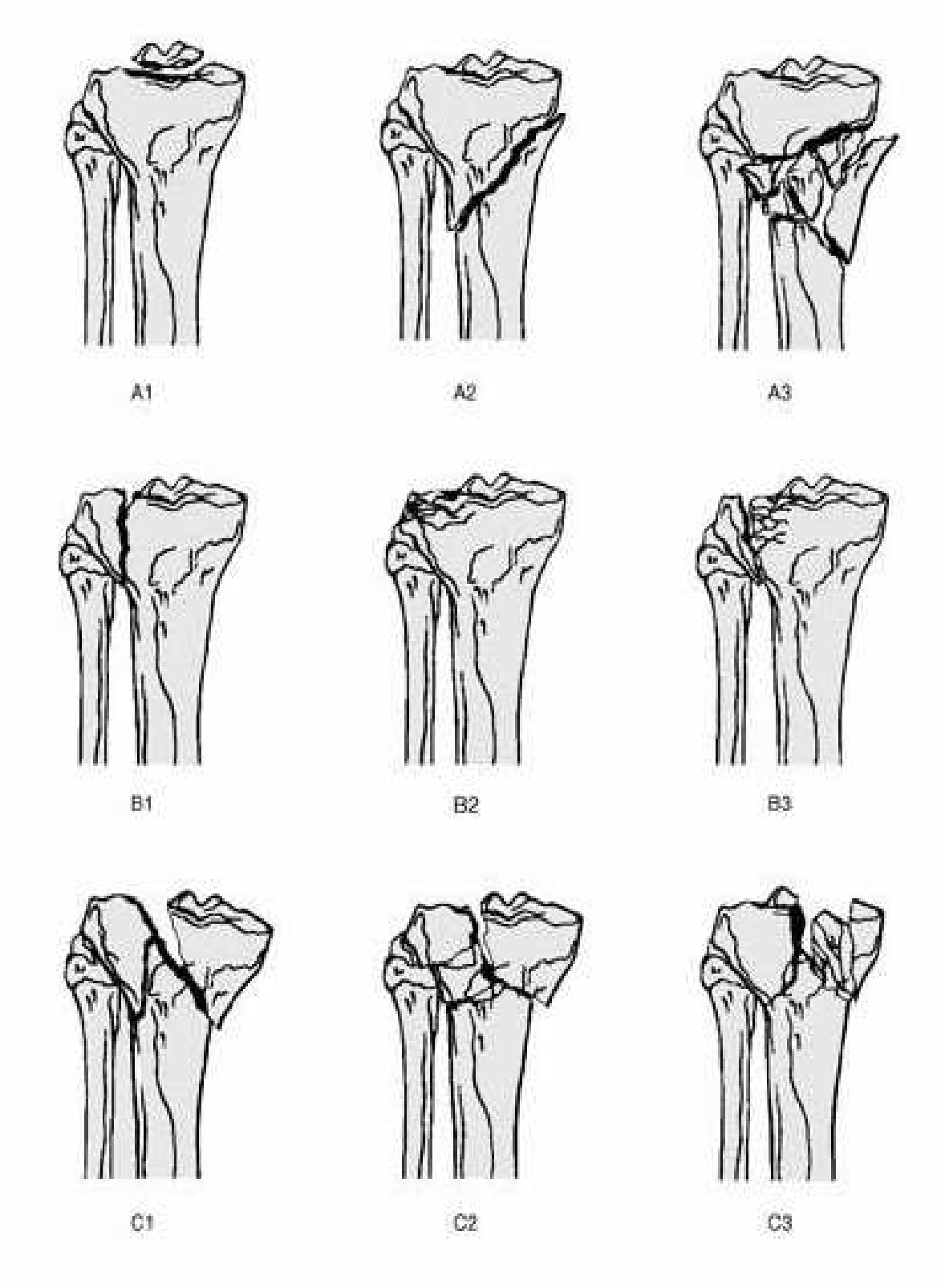
A1 – Extra articular, avulsion

A1.1 Of the fibular head

A1 .2 Of the tibial tuberosity

A1. 3 Of the cruciate insertion

AO/OTA Classification of proximal metaphyseal fractures



A2 - Extra articular fracture, Metaphyseal simple

A2 .1. Oblique in frontal plane

A2 .2. Oblique in sagittal plane

A 2 .3 .Transverse

A3 - Extra articular fracture, Metaphyseal multifragmentary

A3.1. Intact wedge

A3 .2. Fragmented wedge

A3.3. Complex

B – Partial articular fracture

B1 – Partial articular fracture, Pure split

B1.1 Of the lateral surface

B1 .2 Of the medial surface

B1.3 Oblique, involving the tibial spines and one of the surfaces

B2 - Partial articular fracture, Pure depression

B2.1 Lateral total

B2.2 Lateral limited

B2. .3 Medial

B3 - Partial articular fracture, Split depression

B3 .1 Lateral

B3.2 Medail

B3.3 Oblique, involving the tibial spines and one of the surfaces

C – Complete articular fracture

C1 – Complete articular fracture, articular simple, metaphyseal simple

C1.1 Slight displacement

C1.2 One condyle displaced

C1.3 Both condyles displaced

C2 - Complete articular, articular simple, metaphyseal multifragmentary

C2.1 Intact wedge

C2.2 Fragmented wedge

C2.3 Complex

C3 – Complete articular fracture, multifragmentary

C3.1 Lateral

C3.2 Medial

C3.3 Lateral and medial

2.AO/OTA Classification of Distal tibial metaphysis. 43.

A – Extra articular fracture

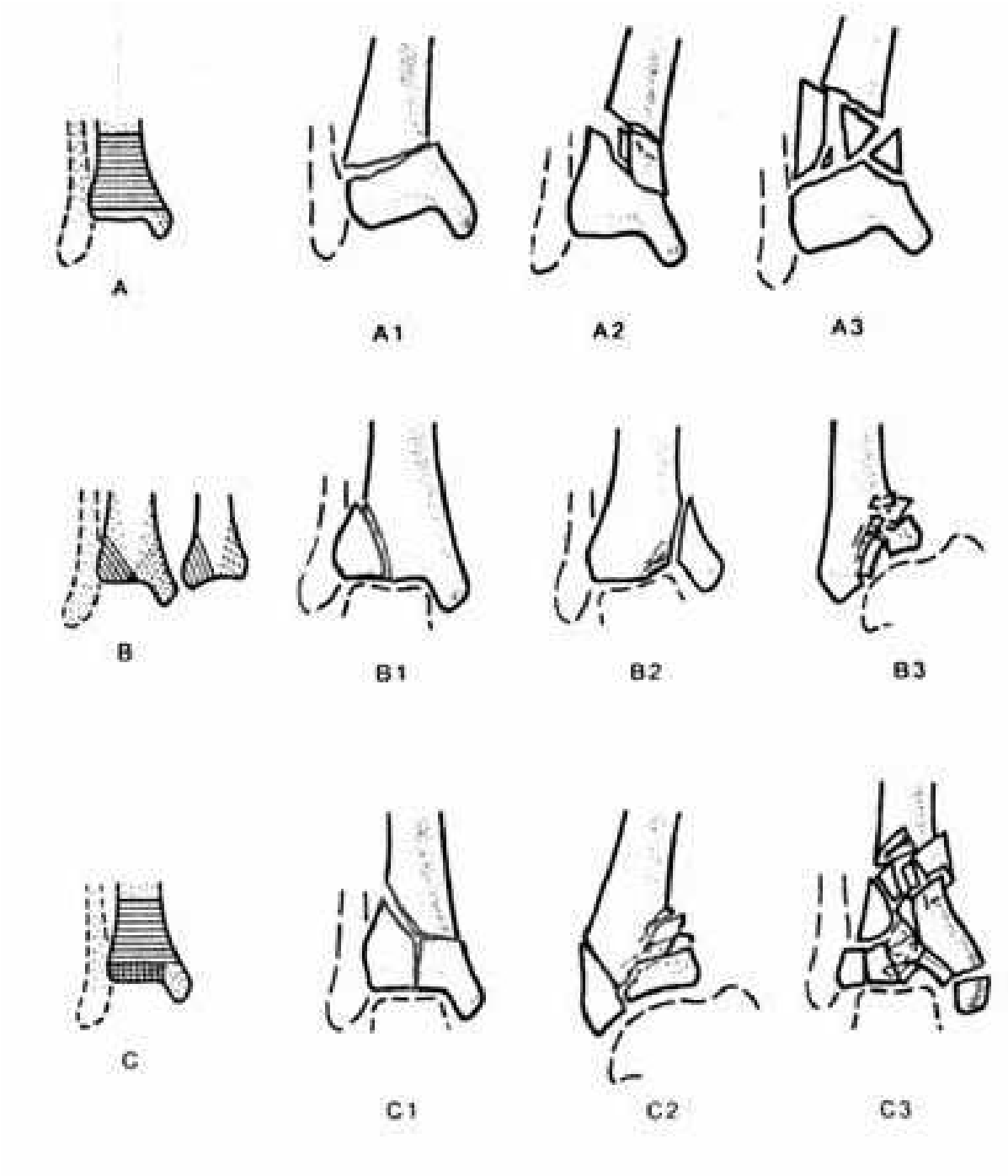
A1 – Extra articular, Metaphyseal simple

A1.1 Spiral

A1.2 Oblique

A1.3 Transverse

AO/OTA Classification of distal metaphyseal fractutres



A2 - Extra articular fracture, Metaphyseal wedge

A2.1 Posterolateral impaction

A2.2 Anteromedial wedge

A2.3 Extending into the diaphysis

A3 - Extra articular fracture, Metaphyseal complex

A3.1 Three intermediate fragments

A3.2 > 3 intermediate fragments

A3.3 Extending into the diaphysis

B – Partial articular fracture

B1 – Partial articular fracture, Pure split

B1.1 Frontal

B1.2 Sagittal

B1.3 Metaphyseal multifragmentary

B2 - Partial articular fracture, split depression

B2.1 Frontal

B2.2 Sagittal

B2.3 Of the central fragment

B3 - Partial articular fracture, multifragmentary depression

B3.1 Frontal

B3.2 Sagittal

B3.3 Metaphyseal multifragmentary

C – Complete articular fracture

C1 – Complete articular fracture, articular simple, metaphyseal simple

C .1 Without depression

C1.2 With depression

C1.3 Extending into diaphysis

C2 - Complete articular, articular simple, metaphyseal multifragmentary

C2.1 With asymmetric impaction

C2.2 Without asymmetric impaction

C2.3 Extending into diaphysis

C3 – Complete articular fracture, multifragmentary

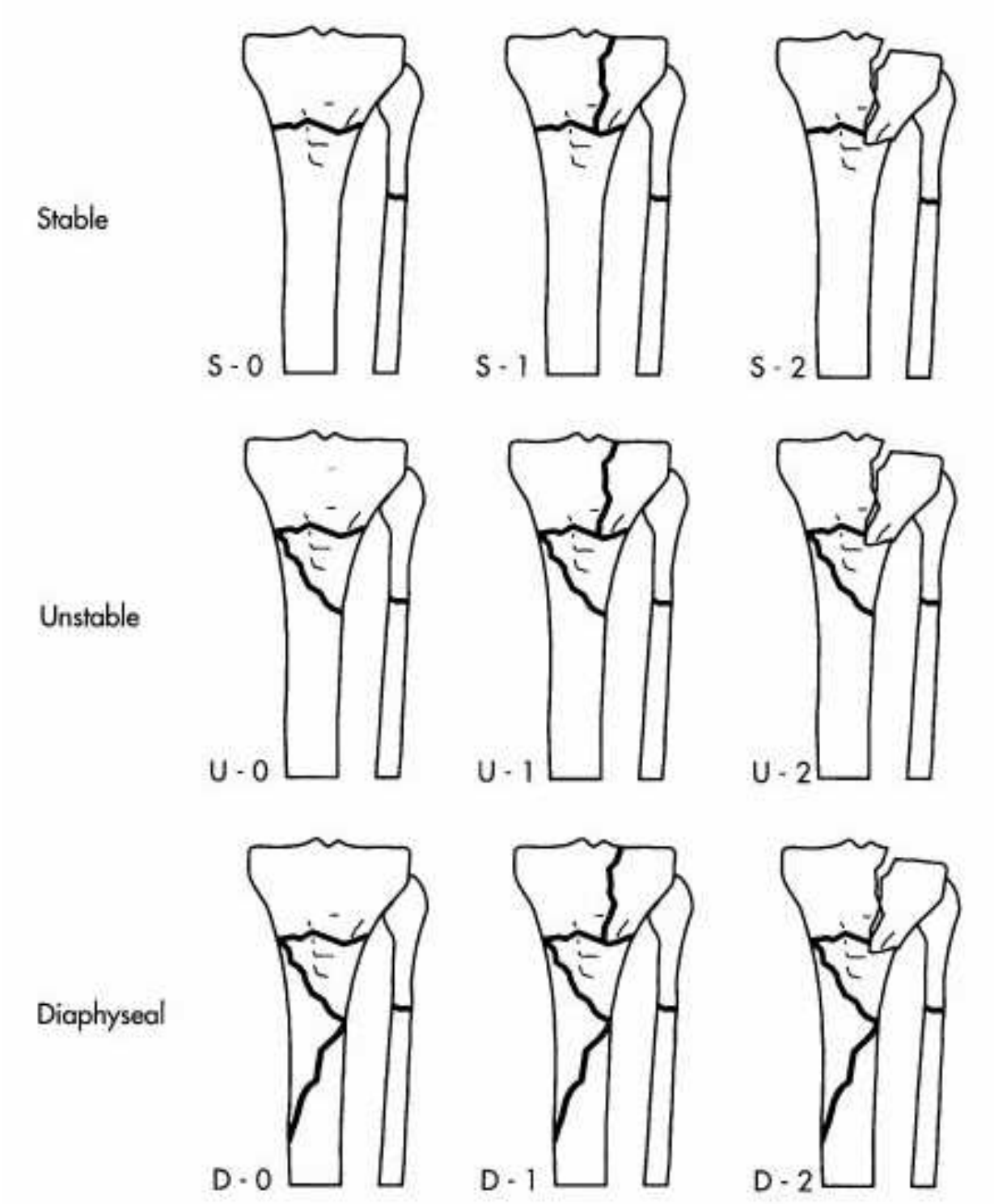
C3 .1 Epiphyseal

C3 .2 Epiphyseo - metaphysis

C3 .3 Epiphyseo - metaphyseo – diaphyseal

II. Taylor and Martin SUD classification of metaphyseal fractures

Taylor and Martin proposed a classification of metaphyseal fractures (**SUD**) in which the main fracture is characterised as *stable* **(S),** *unstable* **(U)** or with *diaphyseal extension* **(D).** These are further divided into three subtypes [4].


Stable
S - 0
S - 1
S - 2
Unstable
U - 0
U - 1
U - 2
Diaphyseal
D - 0
D - 1
D - 2

***S**-Stable*

S.0 - extra articular

S.1 - <2mm displacement

S.2 - >2mm displacement

***U**-Unstable*

U.0 - extra articular

U.1 - <2mm displacement

U.2 - >2mm displacement.

***D**-Diaphyseal Extension*

D.0 - extra articular

D.1 - <2mm displacement

D.2 - >2mm displacement

According to Taylor and Martin classification with progression from type' S' to type' D', treatment shifts toward external fixator and away from open reduction. Conversely with progression from subgroup '0' to subgroup' 2' open reduction is indicated.

Treatment options

The **GOALS** of the treatment:

- To obtain a healed, well-aligned fracture.
- To obtain a pain-free weight bearing.
- To obtain afunctional range of motion of the knee and ankle joints.

The optimal treatment method should assist in meeting these goals, while minimizing the complications, *especially infection*. The presence of hinge joints at the knee and the ankle allows no adjustment for rotatory deformity after fracture, and special care is necessary during reduction to correct such deformities

Treatment and prognosis depends on

1. **The state of the soft tissues:**

The risk of complications and the progress to fracture healing are directly related to the amount and type of soft tissue damage. Closed fractures are best described using Tscherne's method. For open fractures, Gustilo's grading is more useful. The incidence of severe soft tissue injury ranges from 1 percent in Gustilo-anderson type I to 30 percent for type IIIC.

2. The severity of the bone injury:

High-energy fractures are more damaging and take longer time to heal than low-energy fractures. This is regardless of whether the fracture is open or closed. Low energy injuries are typically closed or Gustilo I or II and spiral in which fracture union takes comparatively less time. High energy fractures are usually caused by direct trauma and tend to be open (Gustilo III A-C), transverse or comminuted with bone loos in which delayed union and non union are common complications.

3. **Stability of the fracture:**

It is considered when the weight bearing can be allowed. More stable fractures with less displacement can be managed conservatively. In case of internal fixation, stable fracture can be easily fixed which in turn avoid the unnecessary soft t tissue dissection. Severely comminuted fractures are the least stable of all, and the most likely to need mechanical fixation, soft tissue dissection.

4. Degree of contamination:

In open fractures this is an important additional issue. The limb should be carefully examined for signs of soft-tissue damage, bruising, severe swelling, crushing or tenting of the skin, and open wounds gas gangrene.

Treatment options

1. Conservative method
2. External fixator.
3. Open reduction with plate osteostnthesis
4. Open reduction/Closed reduction internal fixation with intramedullary interlocking nailing.

Conservative method

Indications:

1. Deblitated patients
2. Medical illness contraindicating the surgical treatment
3. Undisplaced or minimally displaced/minimally comminuted fractures

Demerits of conservative management:

1. High incidence of post traumatic stiffness
2. Mal union/Delayed union/Non union
3. Secondary Osteoarthritis of knee /Ankle joints

Sarmiento et al in 1989 concluded that bracing was contraindicated in fractures with excessive initial shortening or ones showing increasing angular deformity while in cast. Most series of closed treatment have reported 25 to 40% incidence of ankle and subtalar joint stiffness after prolonged casting and immobilisation.

External fixation

Indications:

- Compound fractures with severe contamination
- Fractures with acute compartment syndrome
- Severely comminuted / unstable fractures with articular extension with severe soft tissue damage.
- Fractures with very short proximal/distal fragments
- Polytrauma patients with haemodynamic instability

Methods:

- Hybrid fixator
- Knee spanning or ankle spanning external fixators
- Ilizarow external fixator

Hybrid external fixator:

As the metaphyseal fractures having the short proximal and distal fragments in proximal and distal metaphyseal fractures respectively, it is very difficult to put two pins in the longitudinal axis so the pins are inserted in the tranverse axis and a special ¾ or ½ ring is used to stablise the short fragment. Then the diaphyseal fragment is stabilised with longitudinal pins with AO rods. Then the two fragments interfixed with two more AO rods.

Demerits of external fixators:

- They are not a definitive treatment option.
- Exchange nailing or plating is to be done within 2-3 weeks otherwise pin tract infection will occur.
- Knee/ankle spanning leads to post traumatic joint stiffness in long standing cases

Rationale for open reduction in metaphyseal fractures

Fractures of the distal/proximal metaphysis are caused by compression associated with a rotation force. It often severely impact the metaphyseal bone, causing unacceptable axial malalignment. The result of uncorrected axial malalignment in the lower extremity imports an abnormal stress on the distal joint, which in time will destroy it. In the lower extremity, anatomical alignment is necessary to prevent these major forces of weight bearing from destroying the joint. Therefore, when these impacted fractures are reduced by closed

manipulation, an extremely large periarticular gap is formed. If treated non operatively, the distal/proximal fragment may tend to displace into that gap in the post reduction period, necessitating multiple reductions. Also, since the compression fractures has been disimpacted, and since cancellous bone heals poorly under such conditions, fracture healing may be delayed. This, in turn, will require prolonged immobilization of the limb, with resultant of poor post traumatic joint function. Sarmiento et al. and Waddell and Reardon reported ankle stiffness in 20% to 30% of patients who had closed treatment. Digby, Holloway, and Webb reported that 27% of patients treated conservatively were unable to run, even several years after the fracture had healed, because of ankle and subtalar stiffness. Angular deformity of more than 5 degrees occurs in 10% to 55% of fractures treated with a cast or brace, and shortening of at least 12 to 14 mm occurs in 5% to 27% of patient. Sarmiento's series of carefully selected fractures had the best results, whereas other series with more unstable fractures reported poorer results.

Methods of surgical management

1. Open reduction, internal fixation with plate osteosynthesis.
2. Closed reduction/open reduction with IMIL nailing.

1.Open reduction with plate osteosynthesis

Indications:

1. Metaphyseal fractures with very short proximal/distal fragment.
2. Metaphyseal fractures with intra articular extension

Advantages:

1. Anatomic reduction with stable fixation
2. Feasiblity of bone grafting
3. Fixed angle fixation,bicolumnar fixation
4. Maintenance the length& alignment.

High incidence of soft tissue complications in the range of 10 to 15% are reported in many series. But the recent advances in plating like indirect reduction and percutaneous plating (LISS- Less Invasive stabilisation System) is indicated in tibial metaphyseal fractures with periarticular metaphyseal comminution. The use of standard incisions according to Collinge and Sanders also improve the wound healing.

Locked compression plate:

The locked compression plate with MIPO(Minimally Invasive plate ostesynthesis) technique eliminates the soft tissue problems associated with open reduction and internal fixation. [12,13,14,15&16]..

Complications and disadvantages of plate osteosynthesis:

1. Soft tissue complications in conventional open reduction and plating
2. Development of superficial wound problems increases the risk deep infection six fold
3. Malalignment is more frequent in percutaneous plating than with other methods of fixation.
4. Fracture alignment could not be aided by the locked plate (no lag effect through the plate). It has to be restored before applying the plate[12].
5. Locked compression plating needs careful preoperative planning, if applied without following the principles of plating and the Order of putting the screws, failures are not uncommon[17].
6. Late pain may occur over the distal tibial and fibular plate or screws[1].

4. LITERATURE REVIEW

Intramedullary nailing

History:

The evolution of intramedullary nailing had started 500 years ago. In the good old days Aztecs used wooden intramedullary nails[19.] In 1916 Hey Groves introduced a solid nail for tibia[19].In, 1930 German Orthopaedician Gerhard Kuntscher invented the metalic intramedllary nail used for the femoral fractures. Kuntscher called it as elastic nail as it expands after the insertion. He did his first nailing in 1939 for subtrochantric fracture of femur. In 1950, he invented the technique of the medullary canal reaming and closed nailing. Now, this became as standard practice. In1950 Lottes one of the pioneers in tibial nailing developed a rigid nail fort tibia[20].In 1951 Herzog made a modification in the Kuntscher nail, by adding a proximal bend to simplify the nail insertion.Modney designed the first interlocking nail[4].Kuntscher also designed an interlocking nail (The Detensor nail, 1968) which was then modified by Klemm Schellumm initially and then by Kempf and Grosse later in 1972[4].In 1986 Bone & Johnson were the first to report interlocking nail in USA. They used Grosse Kempf interlocking tibial nail in 28 fractures of tibial shaft[20].Charnley in his text “closed treatment of common fractures” stated that the eventual solution to the tibial shaft fracture would be a non reamed intramedullary nail[5].

Of late, Comparative studies between conservative management and intramedullary nailing show superior results with intramedullary interlocking nailing than the conservative methods[17]. Bone et al.[18], in their prospective randomized series, stated only a 2% incidence of nonunion and malunion in nailing group when comparing with the 10% nonunion and 26% malunion rates in their conservatively managed group.

Principle of Intramedullary nailing:

As the nail extends from the one end of the bone to other end in the medullary canal, it act as an internal splint. It allows the axial forces to be transmitted to the opposed ends of the fragments. It prevents the angulation, translation,and to some extent rotatory movement. In this, the contact is occurring between the bone and the nail in the three points. The entry point, narrowest portion of the medullary canal(Isthmus) and at the cancellous epiphyseal bone at the opposite end are the three points.(*Three point fixation*).

Indications:

Conventionally interlocking nail is the gold standard treatment of the fractures in a zone of 5cm below the knee and 5cm above the ankle in fractures of tibia. As the fracture line extend into the metaphyseal zones of the tibia, the stability provided by any nail decreases precipitously[5.] Recently the indication of nailing is extended to the metaphyseal region also. Locked intramedullary nailing currently is considered the treatment of choice for most type I, type II, and type IIIA open and closed tibial shaft/metaphyseal fractures.

Advantages:

In intramedullary nailing the fracture haematoma and periosteal blood supply is not disturbed which leads to early fracture healing. Eventhough the entosteal blood supply is disturbed in the reamed nailing,it improve the periosteal blood supply. These are the load sharing devices in compare to plate which are load bearing devices. So there is no chance for periprosthetic osteopenia and periprothetic fractures

Procedure of intramedullary nailing tibia:

- Patients should be supine position.

    1. On traction table with knee in 90^0 flexion **or**
    2. On radiolucent table with knee fully flexed **or**
    3. On a padded knee support with the knee flexed as for as possible.

- Various approaches for the entry point of the nail are
    1. Medial para patellar.
    2. *Patellar tendon splitting.*
    3. Lateral para patellar.

Ptaellar tendon splitting approach:

Incision started from the inferior margin of the patella to anterosuperior aspect of tibia over the patellar tendon. After splitting the patellar tendon, extrarticular surface of tibia is exposed. Entry point of the nail made with bone awl. It should be medial to the lateral fibular margin confirmed under C-Arm.

This should be at the level of fibular head and 1.5cm from the joint line. Initially the bone awl should be pointed posteriorly, and then directed in line with the medullary canal or crest of the tibia. The medullary canal is reamed in incremental fashion, till 1.5 cm more than the measured nail size. Then the trial reduction is done. With maintaining the reduction the proposed sized nail is inserted and fixed with interlocking.

Reaming-Pathophysiology:

Local changes :

Reaming of the medullary canal is causing damage to the endosteal blood supply by the direct damage or by the intravasation of the marrow elements in to the vasculature. Various animal studies states that e it is reversible within 8-12 weeks. This disturbed blood supply may cause delay in the fracture healing.But the exraosseous blood supply increases and the vessels traverse into the endosteal region to revascularise the damaged endosteal vasculature.During the early weeks after trauma reaming may cause increasing risk of infection,especially in open tibial fractures. Because of infection rates as high as 21%.Due to the reaming the local temperature may be increased as high as 44.6 degree C. This leads to the cell enzymes to be damaged. The threshold value for the thermal osteonecrosis is 47 degree C for one minute which far high from proposed increase in temperature during the reaming.

General changes:

These include pulmonary embolisation, temperature related changes of the coagulation system and humeral, neural and inflammatory reactions. The development of post traumatic pulmonary failure following early femoral nailing in the multiply injured patients is associated with the reaming procedure.Wenda et al measuring intramedullary pressure intra operatively while doing the reaming, founded values between 420 - 1510 mm Hg with reaming procedures, as compared with 40-70 mm Hg in cases where solid nails were used without reaming.

Unreamed nailing advantages:

- Smaller diameter implants –Easy to insert
- Less heat induced cell death,osteonecrosis
- Less disturbances of the endosteal blood supply.
- There is also considerably less bone necrosis, which appears to be one of the risk factors for the development of post operative infection

The effect of diameter on endosteal vasculature and mechanical parameters studied in dog models by Hupel TM et al., following segmental osteotomy of the tibia. They concluded that a loose fitting nail did not affect cortical perfusion as much as tight fitting nail and it allowed more complete cortical revascularisation at 11 weeks post nailing. Further, the stiffness and load to failure were not found to be different.

Reamed nailing advantgages:

- Tight fit nail can be inserted which giving the more stable nail-bone construct(*Hupel et al*)
- Stable nail bone construct gives stable fixation.
- It increase the vascularity, perfusion of the periosteum and the surrounding muscles

Reamed versus undreamed nailing

Reaming increase the diameter of the medulary canal,thereby increasing the contact between the bone and the nail which inturn the stability of the nail-bone construct. Keating et al. reported a randomized, prospective study comparing reamed with unreamed locked nailing of open tibial fractures. Forty-seven nails were inserted after reaming, and 41 were inserted without reaming. The average time to union was 30 weeks for reamed nailing and 29 weeks for unreamed nailing, and there was no difference in functional outcome between the groups. Infection developed in two patients (4.3%) with reamed nailing and in one patient (2.4%) with unreamed nailing. 9% percent of fractures treated with reamed nailing did not unite compared with 12% of fractures treated with unreamed nailing. Nail failure occurred in two (4.3%) reamed nailings and one (2.4%) unreamed nailing, whereas screw breakage occurred in 9% of reamed nailings and 29% of unreamed nailings. Overall, there was no statistically significant difference in the results of treatment of open tibial fractures with reamed nailing and with unreamed nailing except for the higher incidence of

screw failure in the unreamed nailings. Problems with delayed union and hardware failure with the smaller implants used in unreamed nailing have led to emergence of the of reamed nailing in tibial fractures..

Blachut et al. also reported a randomized, prospective study comparing 73 fractures treated with reamed nailing with 64 fractures treated with unreamed nailing. There were no significant differences in infection (0% for reamed, 1.6% for unreamed), nail failure (1.4% reamed, 0% unreamed), malunion (4.1% reamed, 3.2% unreamed), or fracture union (95% reamed, 89% unreamed). Finkemeier et al., in a prospective, randomized study of 94 unstable tibial shaft fractures, found that for open fractures there were no significant differences between reamed and unreamed nailing in time to union or number of additional procedures required to obtain union. A higher percentage of closed fractures were healed at 4 months, however, after reamed nailing than after unreamed nailing. But there was no difference at 6 and 12 months. More secondary procedures were required to obtain union in fractures treated with unreamed nailing. Bhandari et al stated that in their meta analysis the reamed nailing potentially the 2/3 of the non union cases depending on the fracture characteristics and suggested that there is increased risk of implant failure in non reamed nailing when comparing to the unreamed nailing. *These authors concluded that reamed nailing of closed tibial shaft fractures led to earlier union without increased complications. These and other studies seem to indicate that fracture and soft-tissue characteristics are more important in*

determining fracture outcome than the choice of treatment. They recommended reamed nailing for most closed unstable tibial fractures

Application Intramedullary nailing in fractures of tibia:

Conventionally the intramedullary interlocking nailing is the treatment of choice in tibial fractures. More recent economic analysis of the management strategies of the closed and compound grade I fractures by Buses et al suggested that reamed intramedullary nailing is the treatment of choice. Economically this method has less financial burden to the society while the conservative methods causing higher financial burden with long duration of the treatment and less functional achievement.

Intramedullary interlocking for diaphyseal fractures:

The intramedullary interlocking nailing is gold standard method of the management, in diaphyseal fractures. Intramedullary nailing preserves the soft-tissue sleeve around the fracture site and allows early fracture healing and early mobilisation of the adjacent joints. The ability to lock the nails proximally and distally provides control of length, alignment, and rotation in unstable fractures and permits stabilization of fractures,

Intramedullary nailing in tibial metaphyseal fractures:

Intramedullary nailing is now widely accepted as a satisfactory treatment of choice for tibial metaphyseal fractures. But there are concerns about the use of this technique for fracture in proximal and distal metaphysis[21]. Preventing

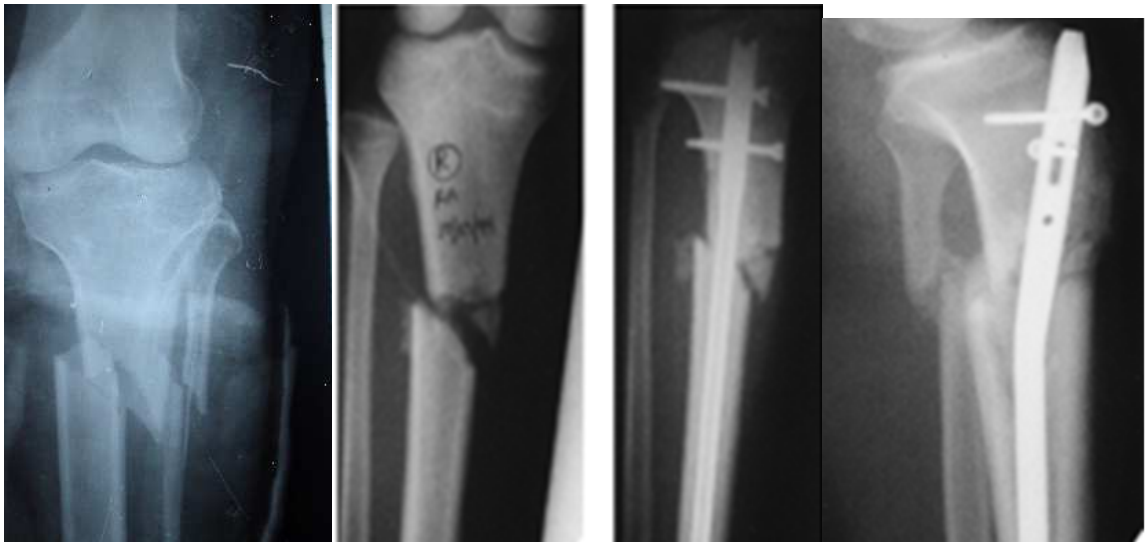
the malalignment of the fragment and maintenance of the reduction till union are the concerns here. Various supplementary procedures were used by different authors to effectively manage the metaphyseal fractures of tibia with intramedullary nailing.

Various methods to prevent the malalignment of fragments:

- ***'Poller' screws.***
- Unicortical plating.
- Lateral entry of nail.
- Proximal bend(*Herzog'bend*)**.**
- Fibular plating.

Proximal tibial metaphyseal fracture:

Due to the anterior pull of patellar tendon,posterior pull of gastronemius tendon and the discrepancy in the size of the nail and medullary canal diameter the short proximal fragment will go for malalignment. Antecurvatum and valgus deformities are the most common deformities**.** Other deformities are recurvatum and varus deformities.



Valgus and antecurvatum deformity not corrected by the nail fixation which could be corrected by the "poller" screws.

Biomechanism of deformities:

Valgus deformity results from the mismatch between the axis of the nail insertion and the anatomic axis of the distal segment that contains the isthmus of the medullary canal. This mismatch is primarily caused by use of a starting point that is located too far medially and to some extend by the shape of the proximal part of the tibia. The antero-posterior width of the tibia is much narrower on the medial half than in the lateral half, so the medial cortex of the tibia forces the nail laterally. During the procedure of tibial nailing, if a medial parapatellar incision is made and the patellar tendon is retracted laterally to expose the entry site in addition to the shape of the metaphysis, the valgus deformity occur. Furthermore in proximal metaphysis, the fracture begins in the lateral aspect of the proximal part of the tibia and extends medially and distally. Therefore, often there is no lateral cortex to help guide the nail distally and keep

the nail aligned properly. Once the nail engages the distal segment, valgus angulation occurs because of the mismatch between the so-called nail entrance angle and shape of the proximal tibial canal .The origin of the musculature of the anterior compartment also acts as a tether on the lateral tibial surface, which may contribute to valgus angulations if any gapping of the fracture occurs during the nailing procedure.

Antecurvatum deformity is due to four factors. These are the shape of the nail, an eccentric starting point and entrance angle of the nail, insertion of the nail with the knee flexed position of the knee and the deforming muscle forces. The shape of the nail, specifically the location of the proximal bend, contributes to anterior angulation and posterior translational deformities. When the fracture is proximal to the bend in the nail, it can displace up to 1 cm, with the distal fragment typically translating posteriorly. When the starting point is placed eccentrically at the edge of the articular surface this point may be anterior to the axis of the medullary canal in the sagittal plane. This eccentric entry of the nail also causes the antecurvatum deformity. Further the pull of patellar tendon anteriorly and the pull of the gastronemius posteriorly contributes the deformity. The other less common deformities are varus and recurvatum deformities.

What literature says?

In 1996,Tornetta et al advocated semi extended position to prevent the anterior translation and antecurvatum.In 1997 Buchler et al and Tembcke et al suggested lateral entry point to prevent the valgus deformity. In 2003 Laflamme et al proposed more oblique screws to maintain the alignment[33].In 2006 Sean E Nork suggested temporary unicortical plating to achieve alignment1. Laflamme et al and Sean E Nork explained the wedging effect, when the proximal bend is distal to the fracture site which leads to malalignment of the fragments. Hence they used nails with more proximal bend[33, 1.] In a biomechanical study, Henley et al. found that medial to lateral screws in one plane can allow the nail to slide on the screws, to centralise the nail in the medullary cavity. They also found that a nail with a proximal bend that is at or below the fracture site can cause anterior translation of the proximal fragment when the nail wedges against the cortex. Locking the nail proximally with the knee flexion causes extension of the proximal fragment owing to the pull of the patellar tendon. Lang et al. examined 32 proximal-third tibial fractures treated with locked nailing and reported angulation of more than 5 degrees in 84%, displacement at the fracture site of more than 1 cm in 59%, and loss of fixation in 25%, most often associated with a single proximal locking screw. Refinements in technique, including more precise placement of the entry portal and the use of some form of supplemental fixation such as blocking screws(*poller),* unicortical plates and two-pin medial external fixation, have

greatly reduced the frequency of this complication. Oh CW, Kim SJ[16] et al in the journal of Korean fracture society stated that the malalignment in proximal tibial fracture can be prevented by the use of '*poller*'blocking screws. Peter Schandelmaier, MD et al in 1997 with their OTA postars stated that *poller screws* are useful in preventing the malalignment in proximal metaphyseal tibial fractures.

Ricci et al. reported 12 proximal third tibial fractures treated with locked intramedullary nailing and 'poller' blocking screws. In this study they reported that malunion occurred in only one patient and concluded that the *poller screw* technique is most effective,simple method. In 1998,Andrew H Schmidt, MD, Christopher G Et al[17] stated that '*poller screws*' are the simplest technique to prevent malalignment in proximal tibial metaphyael fractures.In 1999, C.Krettek,C.Stephan et al stated that '*poller'* are useful in correcting the malalinment and to maintain the alignment till fracture union[18] in proximal and distal metaphyseal fractures.

Intramedullary interlocking nailing in distal metaphyseal fractures:

Due to various soft tissue deforming forces the short distal fragment will go for valgus or varus malalignment.

. 

Valgus deformity ***varus deformity***

What literature says?

Tarr et al. and Puno et al. demonstrated that distal tibial malalignment causes more morbidity than the more proximal malalignment. In 1995 Robinson et al used percutaneous large reduction forceps to achieve the alignment and maintain the same throughout the nailing procedure.He also resected the distal few millimetres of the standard AO nail They used the distal locking bolts as lag screw through the fracture site[41].

In 1997 Thompson KA et al and Weber TG et al showed excellent results when supplemented with fibular plating[40].In 2006 Kenneth A Egol et al advocated fibular plating and temporary unicortical plating[34]. Intramedullry nailing of more distal fractures is possible, but the ability to maintain a mechanically stable reduction becomes more difficult farther the fracture

extends distally. In his study of 63 patients, all but five had satisfactory clinical outcomes. In a biomechanical study, Gorczyca et al. determined that the fixation strength achieved in fractures 4 cm from the tibiotalar joint with a shortened nail (1 cm removed) was comparable to that of standard intramedullary nailing of fractures. .In 2003 James Kellam stated that fibular plating or 'poller screw' were effective as supplementary techniques in intramedullary nailing of distal tibial metaphyseal fractures[35]. In 1999,C.Krettek,C.Stephan et al stated that 'poller' screw method is useful, simple, less invasive than any other methods in correcting the malalinment and to maintain the alignment till fracture union[18] in proximal and distal metaphyseal fractures.In 2004 , Hans wernar stedfieild et al described the methods of using the 'poller screws' in distal tibial metaphyseal fractures[1]. In 2007 L Dodd et al stated that the 'poller screws' are the most useful and method in preventing the malalignment in open reduction and fixation of the distal tibial malunion, when comparing with other methods.

Poller screw

"Poller" screws derived their name from a traffic guiding device used in European cities as it guide and direct the nail in the centre of the medullary cavity. Originally they are 4.5 mm sized cortical screws. They can be used in anteroposterior direction in case of the coronal plane deformities or in mediolateral direction in case of sagittal plane deformities.

The 4.5 cortical screws designated as ***'Poller screws'***

Purposes Used for:

1. Achievment of the fracture alignment, by using screw as a reduction tool.
2. Improvement of the stability of the bone – implant construct by reducing the medullary canal diameter.
3. Maintainence of the fracture alignment till union with poller blocking screw preventing the displacement.

Biomechanism of function of poller blocking screw:

In **proximal mataphyseal** tibial fractures,the fracture is commonly oriented from *distal anterior to proximal posterior*. Nails used in proximal fractures are not forced anteriorly as occurred in case of midshaft fractures. Further disparity in the medullary canal diameter between the fragments and the anatomy of metaphysis leads nail to go eccentrically causing malalignment of valgus/varus or andrecurvatum/antecurvatum.In **valgus deformity** the poller screw applied **anteroposteriorly** on the concave side of deformity reduce the

medullary canal diameter and act as an substitute for the laterl cortex guiding the nail. Thus it guide the nail when the nail is displaced laterally due to the shape of the medullary cavity and more medial entry of the nail. In the **varus deformity** with the screw applied on the concave side of the deformity,it act as substitute for the medial cortex thereby centralise the nail in the medullary cavity.

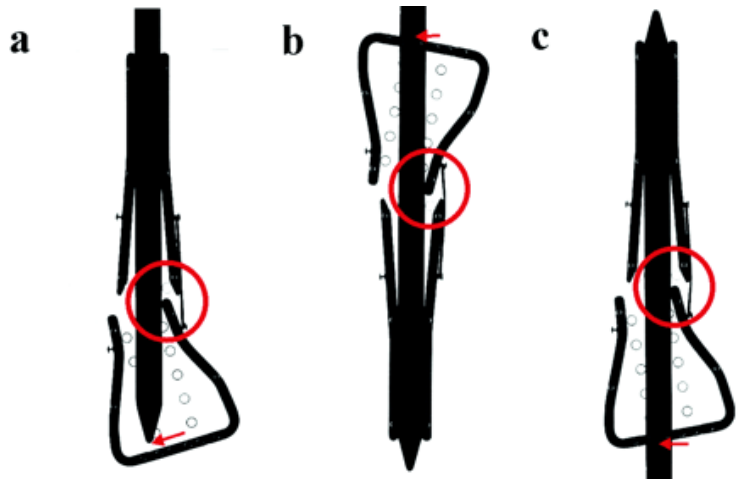
In **antecurvatum deformity, mediolaterally** placed poller blocking screw essentially functions as a substitute for anterior cortex, keeping the nail centrally in the medullary canal as it is maintained in a midshaft fracture. Thus, the blocking screw placed in the anterior half of the proximal part of the tibia in the sagittal plane blocks the nail from passing anteriorly and abolishing the extension and translational forces in antecurvatum deformitry.The reverse is applied for recurvatum deformity.

Similarly, in **distal metaphyseal** fractures as the nail passing into the short distal fragment the disparity in the medullary canal diameter between the short distal fragment and the long proximal fragment leads nail to go eccentricaly causing the malalignment. An ***anteroposterior*** poller screw placed laterally or medialy decrease the medullary canal diameter and act as substitute for the lateral/medial cortex, keep the nail at midline, and prevent valgus/varus deformity.

The rule of thumb for poller screw insertion

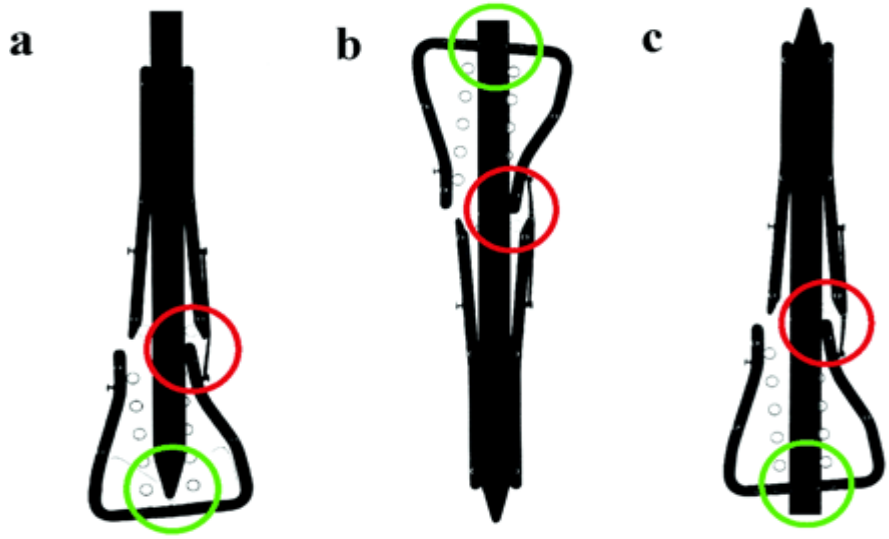
"At concave side of the deformity in the short fragment"

Demonstration of function of poller screw:

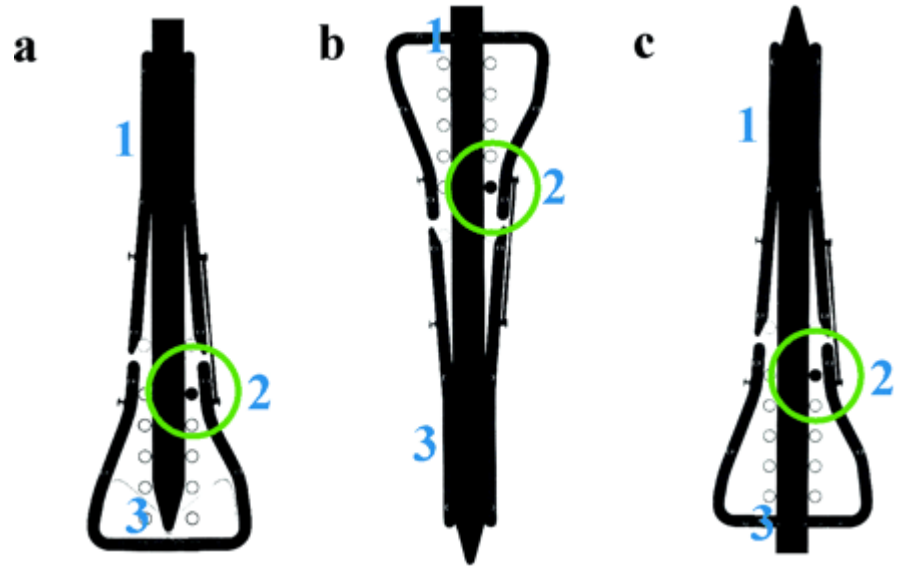


In the above model, Malalignment exists due to

1. Disparity in medullary canal diameter and Off center of the entry point of the nail



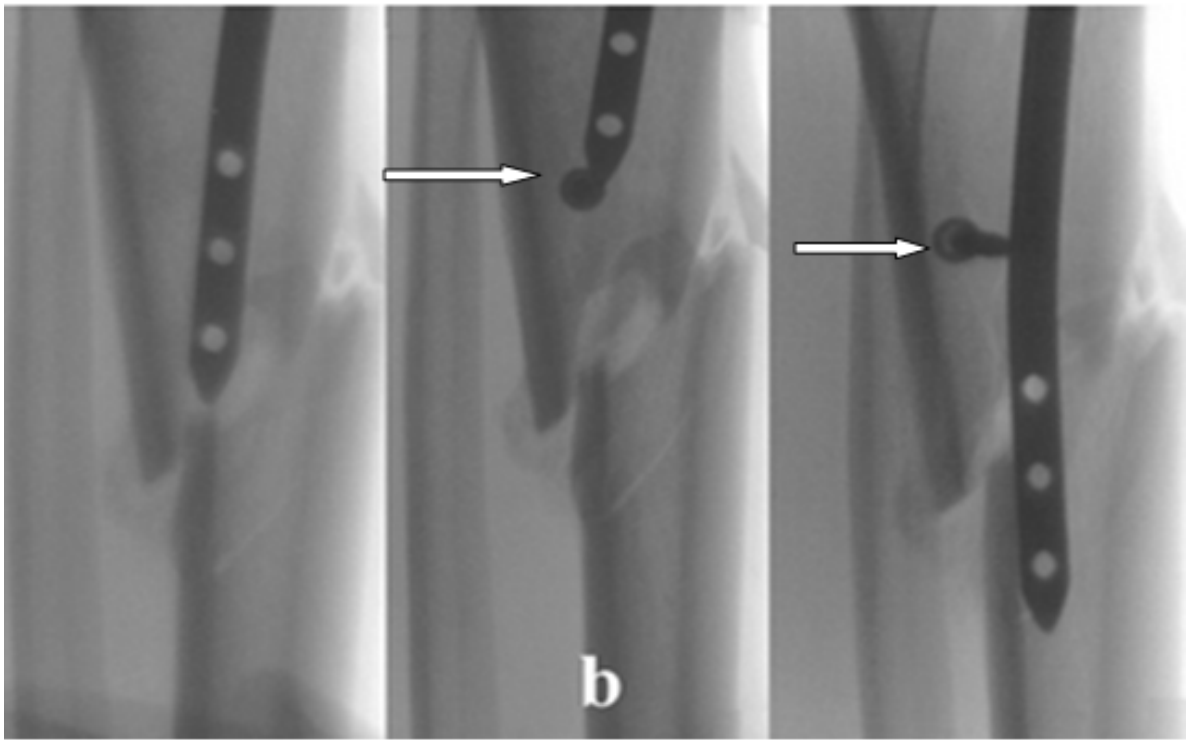
- Malalignment still is not corrected even tough the eccentric position and off center entry is corrected

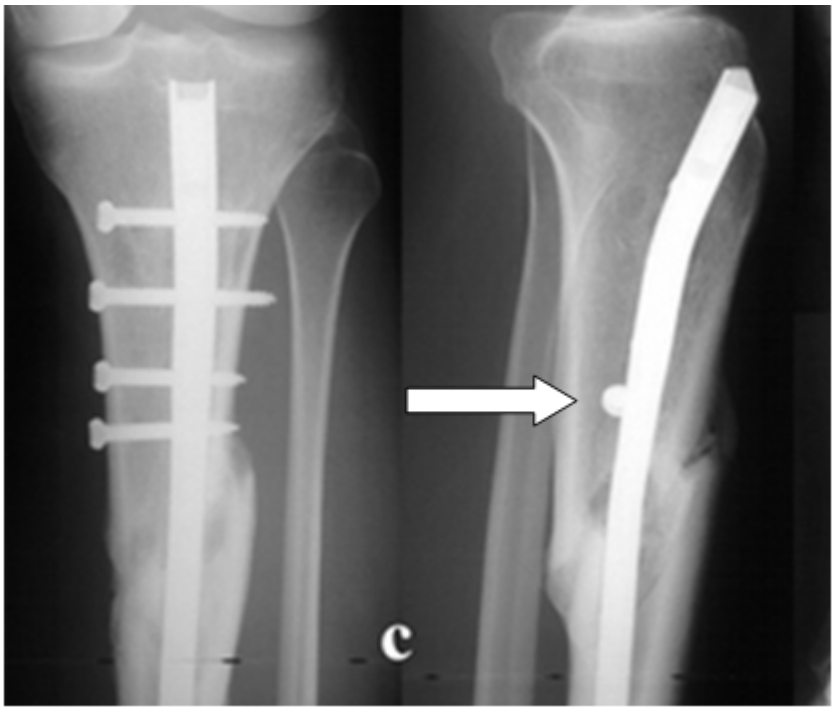


- The deformity is corrected with poller screw on the concave side of the deformity in the short fragment.
- **Demonstration of cases**

Proximal metaphysis

In recurvatum deformity:





The recurvatum deformity is corrected by the “poller” screw on the mediolateral plane posterior to the nail

In valgus deformity:

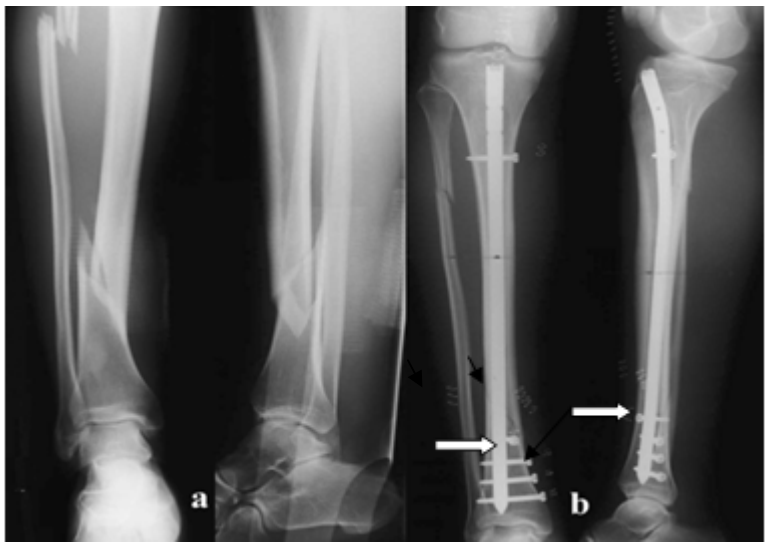
The valgus deformity is corrected by the anteroposterior poller screw at cancave side of the deformity lateral to the nail.

Distal metaphyseal fractures

In valgus deformity :

The anteroposterior “poller” screw is put on the lateral side of the nail on the concave side of the deformity.One additional screw also inserted on the medial side of the deformity.

In varus deformity:



The anteroposterior “poller” screw is put on the concave side of the deformity which is medial to the nail.

What literature says?

In 1994, Krettek et al is the first to describe the clinical applications of blocking screws. He termed it as “poller” screws. It is functioning by prevention of coronal and sagittal plane deformities of proximal and distal metaphyseal fractures of tibia during intra medullary nailing. The same technique can be used for femur and humerus fractures[22,23]. Ricci et al. reported the results of the use of poller blocking screws for twelve consecutive fractures of the proximal metaphysis of the tibia. All patients had <5° of malalignment except for one who had a 6° valgus deformity, Tornetta et al. reported on seventy-three proximal fractures for which they had used an algorithm for the application of the poller screws in metaphyseal fractures. In 2010 C.petrou,Baikousis stated that the distal tibial fractures within 5 cm of ankle treated with intramedullary inter locking nailing and ‘*poller’* blocking screw showed the result of acceptable radiographic alignment, which was defined as <5° of angulation in any plane, in 135 patients (950.The poller screw maintained the fracture reduction till union. Further they described that no non-unions or failures of the implant with the ‘poller’ screw.

5. MAIN OUTCOME MEASUREMENTS

Alignment and reduction of the fracture pre operatively, post operatively and at healing was the main outcome measured with an emphasis on maintenance of the reduction till union.

6. PATIENTS AND MATERIALS

This is a prospective study of 20 cases of tibial metaphyseal fractures treated with open reduction/closed reduction with statically locked intra medullary nailing an ‘ *poller screws’* between August 2010 and September 2012 at Govt Rajaji Hospital, Madurai Medical College.

Patients

Inclusion criteria:

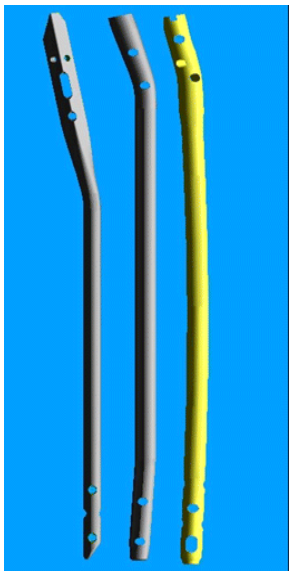
- Adult patients more than 20 years of age.
- Either proximal or distal metaphyseal fractures.
- Unstable, comminuted metaphyseal fractures of tibia with varying soft tissue injuries.
- Segmental fractures with involvement of metaphysis.

Exclusion criteria:

- Adolescent patients <20 yrs of age.
- Very minimally (or) undisplaced fractures.
- Tibial metaphyseal fractures involving the articular surface.
- Associated with previous anatomic deformities.
- Fractures with wound at the nail entry site.
- Compound Gr II, Gr III A-C

Materials

1. **Intramedullary inter locking nail (In varying sizes 9,10,11):**



2.“Poller” blocking screw:

Cortical screws in size of 4.5 mm,designated as “poller” screw

3. **Locking cortical screws in varying sizes:**

7. OPERATIVE PROTOCOL

Pre operative planning

- X ray of the injured leg in AP & Lateral views were taken.
- The fracture tendency for valgus or varus and antecurvatum or recurvatum deformity was noted.
- The angle of malalignment was measured.
- Fracture was classified according to AO and Taylar& martin SUD system
- Fracture location from the proximal or distal articular surface was measured.
- The length of fracture was also measured.
- The diameters of medullary canal at isthmus and at the level of fracture were measured.
- Appropriate length of the nail was measured in one of the following ways

    1. From the contralateral normal limb, from the tibial tuberosity to the medial malleolus.
    2. Inra operative clinical method

- Open fractures were dealt with according to AO principles.

Operative Technique

Methods:-

- All the cases were taken up for surgery under spinal anaesthesia.
- In three cases (*4 weeks, 5 weeks,5weeks old*) tourniquet was used in which open reduction and internal fixation was done with bone grafting

Technique:

Under spinal anaesthesia the patients were put in fracture table in supine position on a padded knee support with the knee flexed to< 30 degrees. For distal metaphyseal fractures the flexion maintained at 90 degrees.

Through the patellar tendon splitting approach incision started from the inferior margin of the patella to antero superior aspect of tibia. The patellar tendon splitting was done in line of the skin incision. Extra articular surface of the tibia exposed. Entry point was made with bone awl at a point proximally and laterally in case of proximal metaphyseal fractures. For distal metaphyseal fractures it was done as usually. This was made at a point of 1.5cm from the articular joint line. The bone awl initially pointed posteriorly, then directed in line with the medullary canal or crest of the tibia. Then the trial reduction was done under the C-Arm guidance. *The tendency of the fragment towards for which deformity is noted.*<u>*The poller screw is inserted under the C-Arm guidance according to the deformity ,at the concave side of the deformity in short fragment.*</u> Then the guide wire is passed and reaming was done. In proximal

metaphyseal fractures the reaming was done close to the anterior cortex. Reaming was done till 1mm higher than the proposed nail size. Then the proposed nail inserted and fixed with the static locking mode. *Additional poller screws was considered according to the correction deformities.*

Positions of poller screws

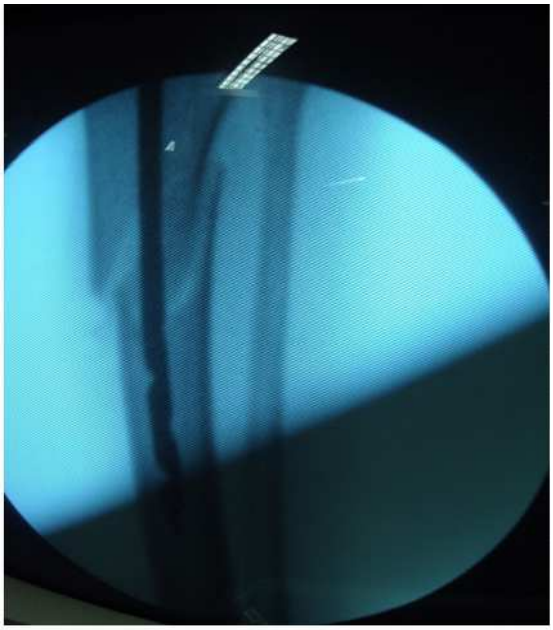
Proximal metaphyseal fractures*:*

Deformity	***Site of poller screw in short fragment***
Antecurvatum	Anterior to the nail
Recurvatum	Posterior to the nail
Valgus	Lateral to the nail, at concave side.
varus	Medial to the nail, concave side.

Intraoperative demonstration of cases:

Valgus deformity:

Valgus deformity in proximal metaphseal fracture.



The valgus deformity is still not corrected

Anteroposterior poller screw is applied on the concave side of the deformity

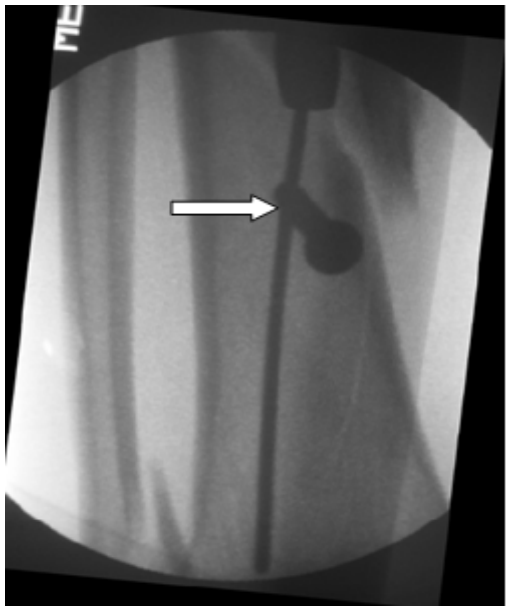
valgus deformity is corrected after inserting poller screw at concave side of the deformity lateral to the nail

Distal Metaphyseal fractures

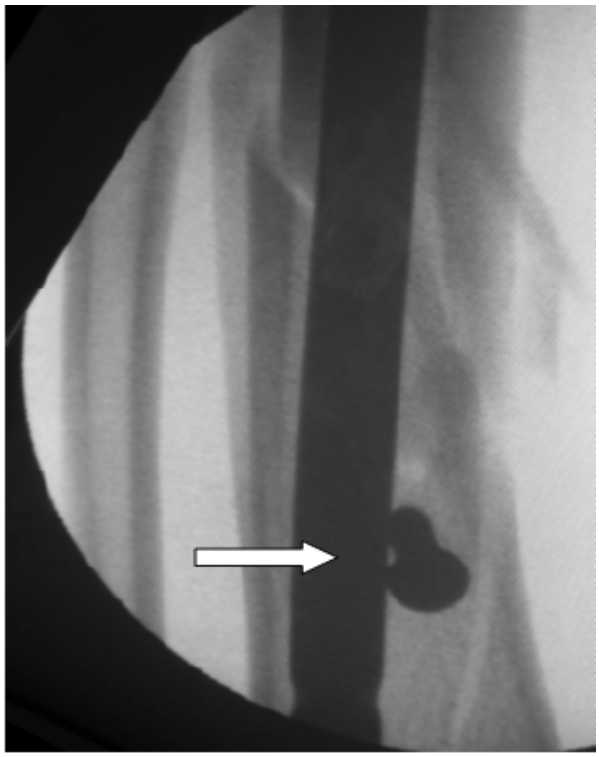
Deformity	***Site of poller screw in short fragment***
Valgus Deformity	Lateral to the nail
Varus Deformity	Medial to the nail

In varus deformity

Varus deformity exists without poller screw



Poller screw is inserted on the concave side of the deformity



The deformity is corrected with the poller screw.

According the deformities presented in the fractures, the poller screws were inserted in the all the patients in line with the above criteria. Additional poller screws were inserted according the correction of the deformities. In all the cases reamed nailing method was used. The medullary canal was reamed in incremental manner till 1mm higher than the measured nail size. All the nails were locked in static mode. The fracture alignment checked under the C-Arm.

8. POST OPERATIVE PROTOCOL

Table of the time related events

S.No	EVENTS	
1.	Passive knee/ankle mobilisation-	IInd POD
2.	Active quadriceps exercises	IInd POD or as soon pain subsides
5.	x-ray	- Immediate post op - 6 weeks - 12 weeks - 24 weeks
7.	Partial weight bearing-	When callus formation seen on X ray
8.	Full weight bearing-	At full union

EOT : wound Examination On Table.

POD : Post Operative Day.

Follow-up

All the fractures were followed up till union of fracture with clinical and radiological examination at 6 weeks 12 weeks and 24 weeks. The maximum follow up was 28 weeks for the one case which complicated with delayed union. On follow up axial alignment was assessed and functional analysis was quantified using Karlstorm-Olerud score.Varus and antecurvatum were expressed as positive values and valgus and recurvatum were expressed as negative values in the master chart.

Karlstrom-Olerud Score

1. Residual angulation: (0 to 3 points)

- 0° -- 0 point
- 1 to 3° -- 1 points
- 4 to 5° -- 2 points
- >5° -- 3 points

2.Fracture healing: (0 to 3 points)

- Union < 12 weeks -- 0 point
- Delayed union >12 weeks -- 1 point
- Delayed union requiring secondary procedures -- 2 points
- Non union > 6 months -- 3 points

3. Cast support: (0 to 1 point)

- No cast support -- 0 point
- Cast support -- 1 point

Outcome:

- 0 & 1 Points - Excellent
- 2 & 3 Points - Good
- 4 Points - Satisfactory
- 5 Points - Fair
- 6 & 7 Points - Poor

Patients were evaluated clinically and radiographicaly with the anteroposterior and lateral x rays according to the above karlstorm-Olerud scoring system.

In this study we have followed the definition of fracture union as follows "when patient was able to bear full weight on the injured limb without pain & support and when radiographs showed bridging callus in at least 3 cortices".

9. RESULT - ANALYSIS

Method Used

In our study, the test used for data analysis is ANOVA test. In this method, repeated measures designs allow their own subject to act as control This improves the precision of the experiment by reducing the size of the error variance on many of the F-tests[24]. In our study there was no control group. So the ANNOVA test is chosen for our study.

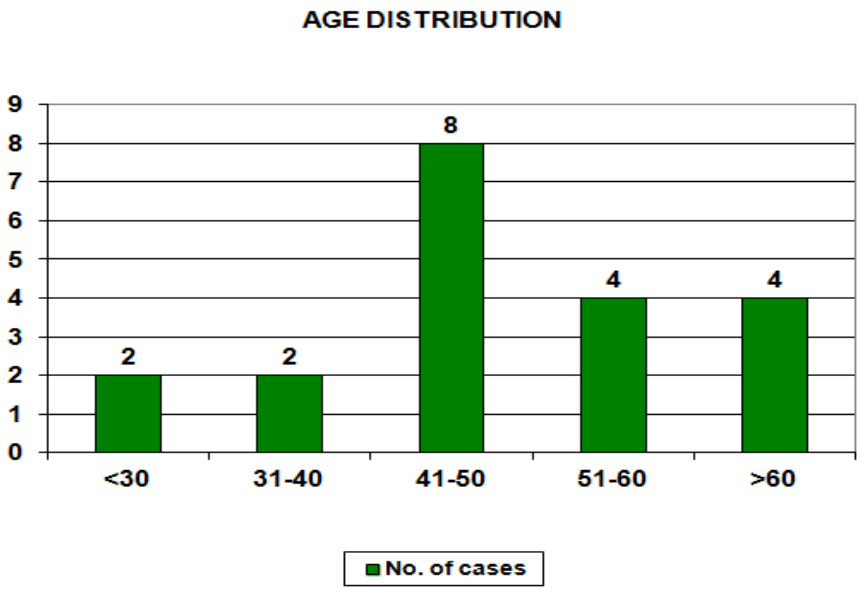
Multiple measurements are made on the same individual at different point of times[24]. In line with this, the variables in our study were the angle at the fracture site measured within the same subjects at different point of times. Because few extreme values of variables of normal distribution should not mislead the interpretation of analysis[24,] 95 % upper and lower confidence limits were preferred over range to express the variables.Karlstorm-Olerud score which was used to asses the functional outcome is an independent measurement, not influenced by other co-morbid conditions and associated injuries[25].

Data analysis

Age Distribution:

Table-1

Age	No. of cases	Percentage
<30	2	10%
31-40	2	10%
41-50	8	40%
51-60	4	20%
>60	4	20%

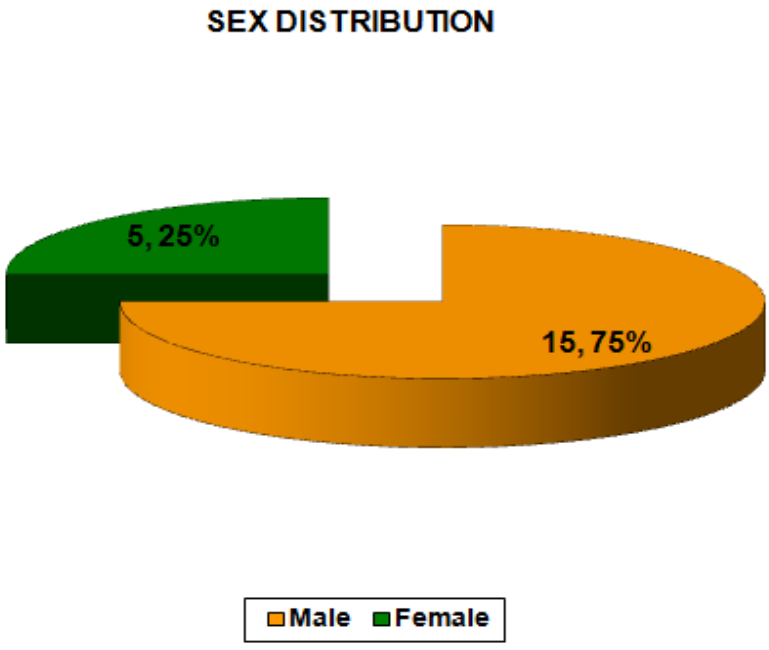


Sex Distribution:

Table-2

Sex	No.of cases	Percentage
Male	15	75%
Female	5	25%
	20	100%

There were fifteen male and five female patients with the average age of 49.5 years,with 95% lower confidence limit(LCL) of 47.5years,and 95% upper confidential limit(UCL) of 52.6 years.

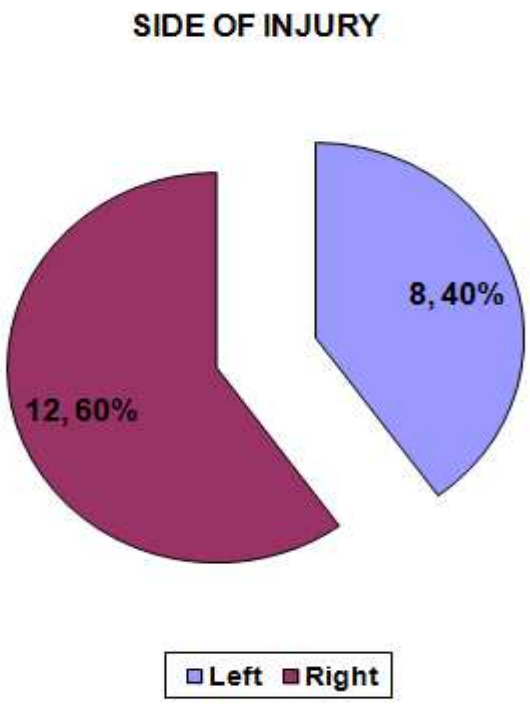


Side of the Injury:

Table-3

Side	No. of cases	Percentage
Left	8	40%
Right	12	60%
Total	20	100%

The injury is right side in 12 cases and left side in 8 cases

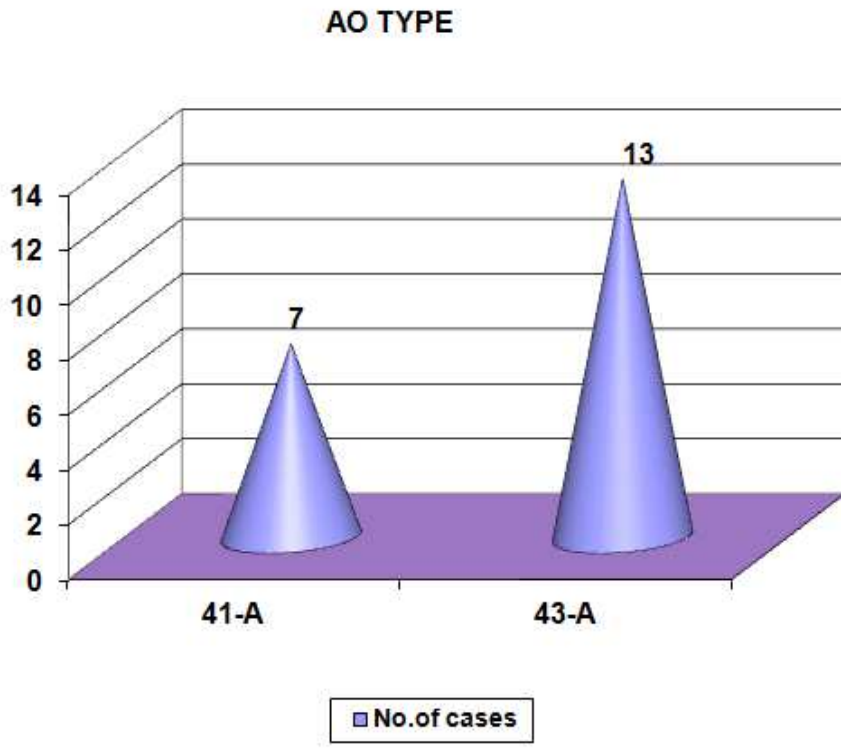


Fracture Pattern-AO type:

Table-4

AO Type	No.of cases	Percentage
41-A	7	35%
43-A	13	65%
Total	20	100%

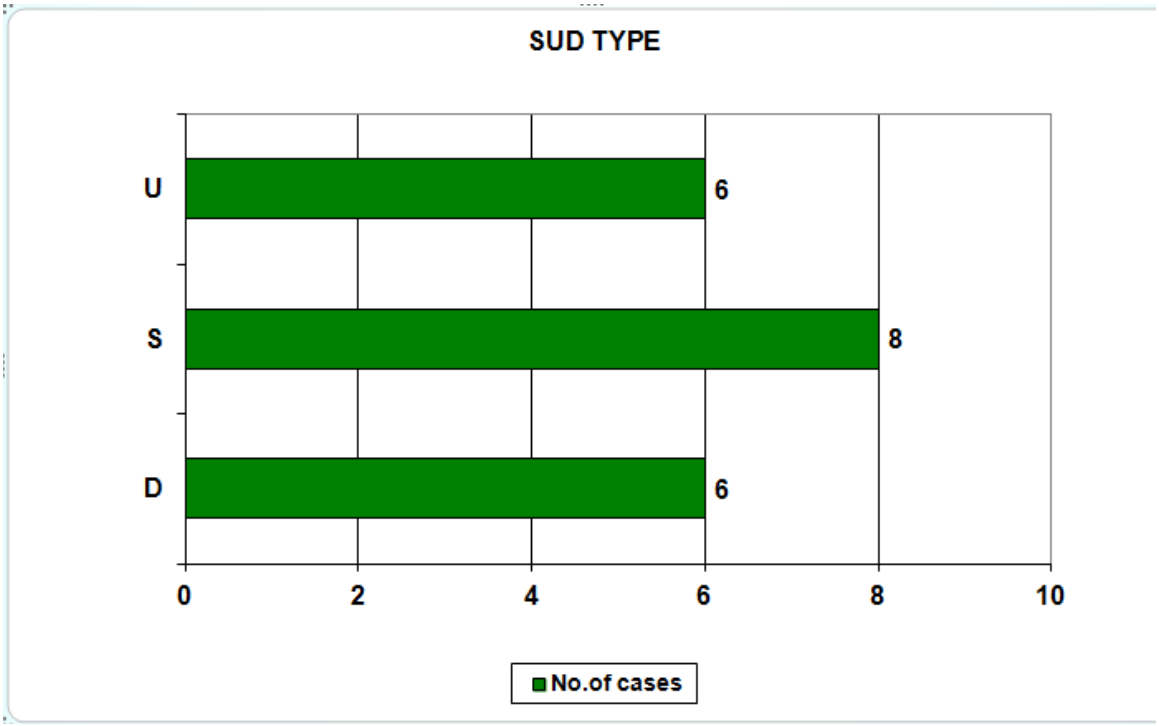
There were predominantly 13 distal metaphyseal fracture.



Fracture Pattern-Tayler and Martin SUD type:

Table-5

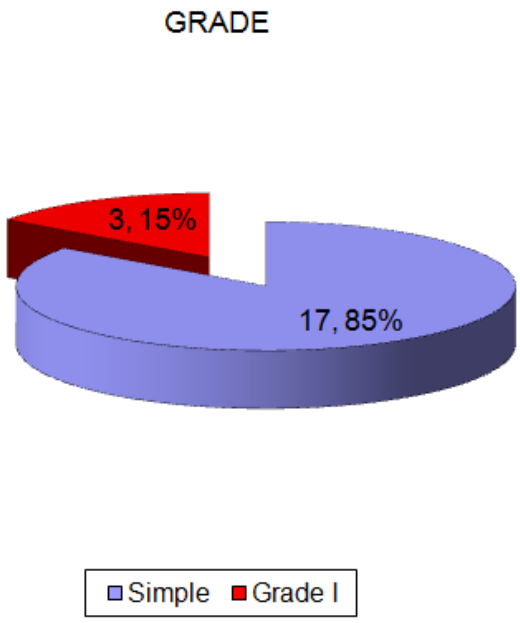
SUD Type	No.of cases	Percentage
S	8	40%
U	6	30%
D	6	30%
Total	20	100%



Gustilo-Anderson Pattern of fractures:

Table-6

Grade	No. of cases	Percentage
Simple	17	85%
Grade I	3	15%
Total	20	100%

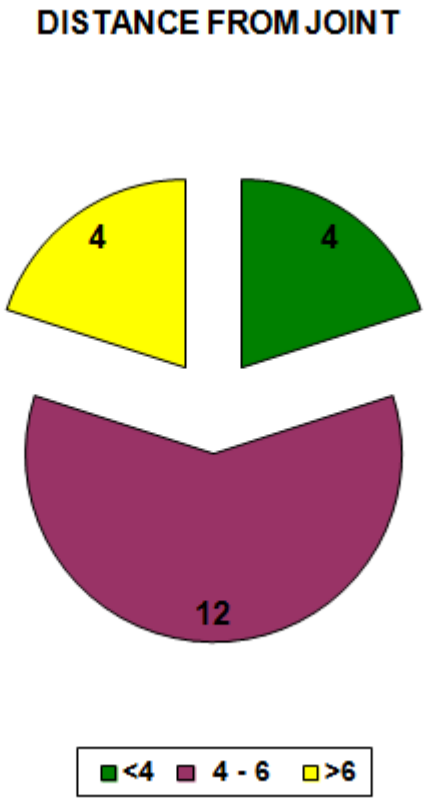


There were 17 simple fractures and 3 comp.Gr-I fractures.

Distance from the Joint at which fracture occurred:

Table-7

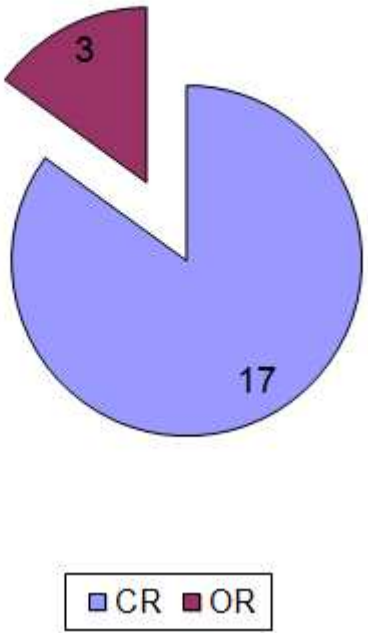
Distance from joint	No.of cases	Percentage
<4cm	4	20%
4-6cm	12	60%
>6cm	4	20%
Total	20	100%



Open reduction/Closed reduction:

Table-8

Reduction	No.of cases	Percentage
Closed reduction	17	85%
Open reduction	3	15%
Total	20	100%



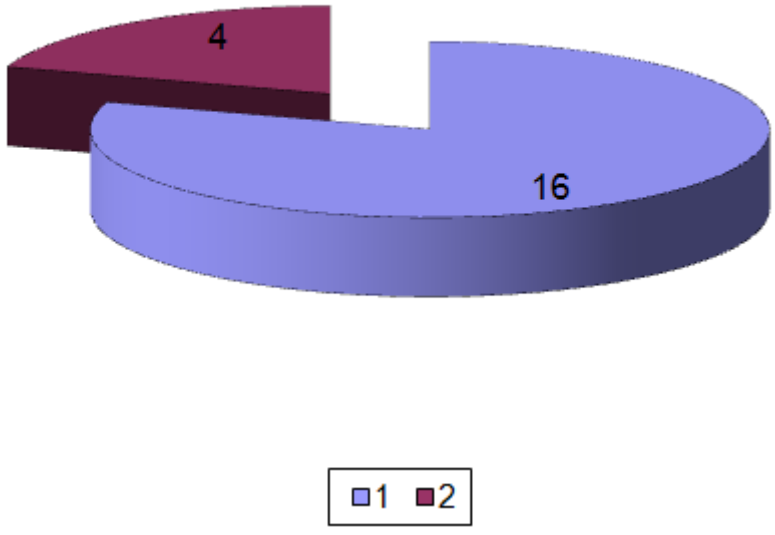
Among the 20 cases 3 cases were undergone open reduction

Number of Poller Screw:

Table-9

No.of poller screw	No.of cases	Percentage
1	16	80%
2	4	20%
Total	20	100

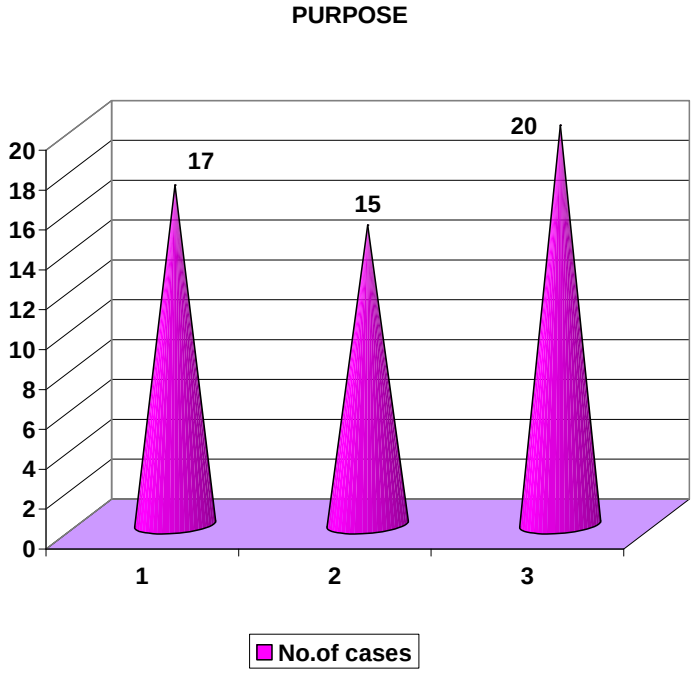
4 Cases needed one additional *poller* screw



Purpose of the Poller Screw:

Table- 10

Purpose	No.of cases	Percentage
1	17	85%
2	15	90%
3	20	100%
Total	20	100%



Purpose of the poller screw used:

1. Achievement of the fracture alignment, by using poller screw as a reduction tool(**In 17 cases**)
2. Improvement of stability of the bone – implant construct by reducing the medullary canal diameter(**15)cases**)
3. Maintenance of the fracture alignment till union with poller blocking screw preventing displacement(**20cases**)

Medullary canal diameter:

Table-11

Medullary	Mean	SD	95% LCL	95% UCL
Isthmus	9.90	0.64	9.41	10.42
Fracture level	18.15	4.86	17.24	19.10

At the isthmus level, the mean diameter of the medullary canal is 9.9cm and at the fracture level is 18.15cm.The mean length of distal metaphysis is 4.2cm.The mean length of the proximal metaphysis is 6.2 cm. The mean time for fracture union is 14.85 weeks. (95% lower confidential limit is 14.1 weeks,95% upper confidential limit is 15.6 weeks). The p value is <0.001(<0.05). It is significant when compared.

Karlstrom-Olerud Scoring

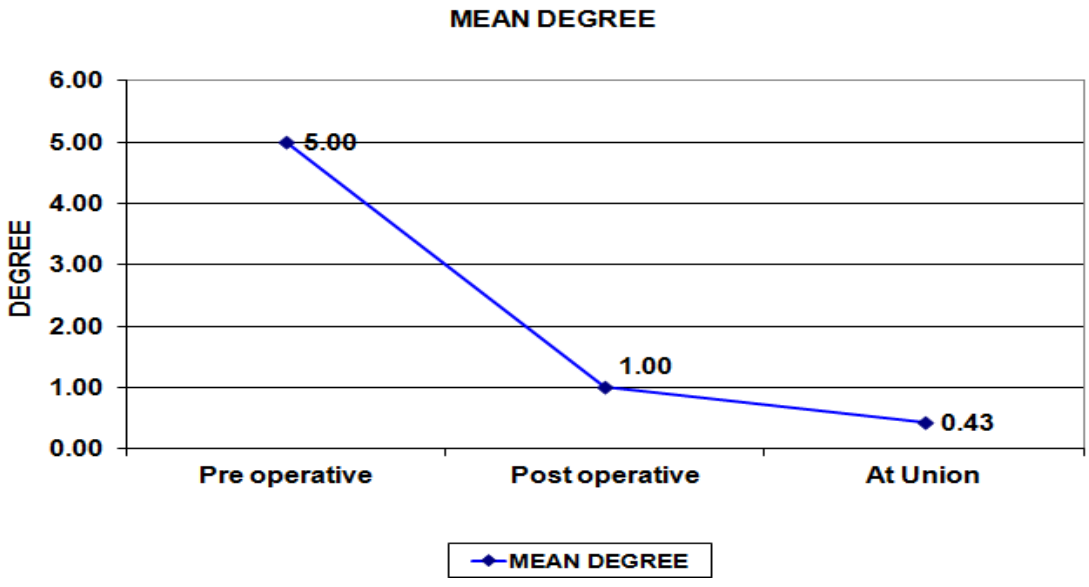
I.Residual angulation

- **Antecurvatum / Recurvatum(7 legs having the deformity):**

Table – 12

	N	Mean	SD	95% LCL	95% UCL
Pre operative	7	5	2.31	4.75	5.26
Post operative	7	1	1.92	0.95	1.05
At Union	7	0.43	1.13	0.41	0.45

Post operative mean residual antecurvatum/recurvatum alignment is 1(one) degree (95 % LCL is 0.95 degrees,95% UCL is 1.05 degrees) when compare to the preoperative mean value of 5 degree(95% LCL 4.75degrees,95% UCL is 5.26 degrees).The P value was 0.04 which was (< 0.05)statistically significant.

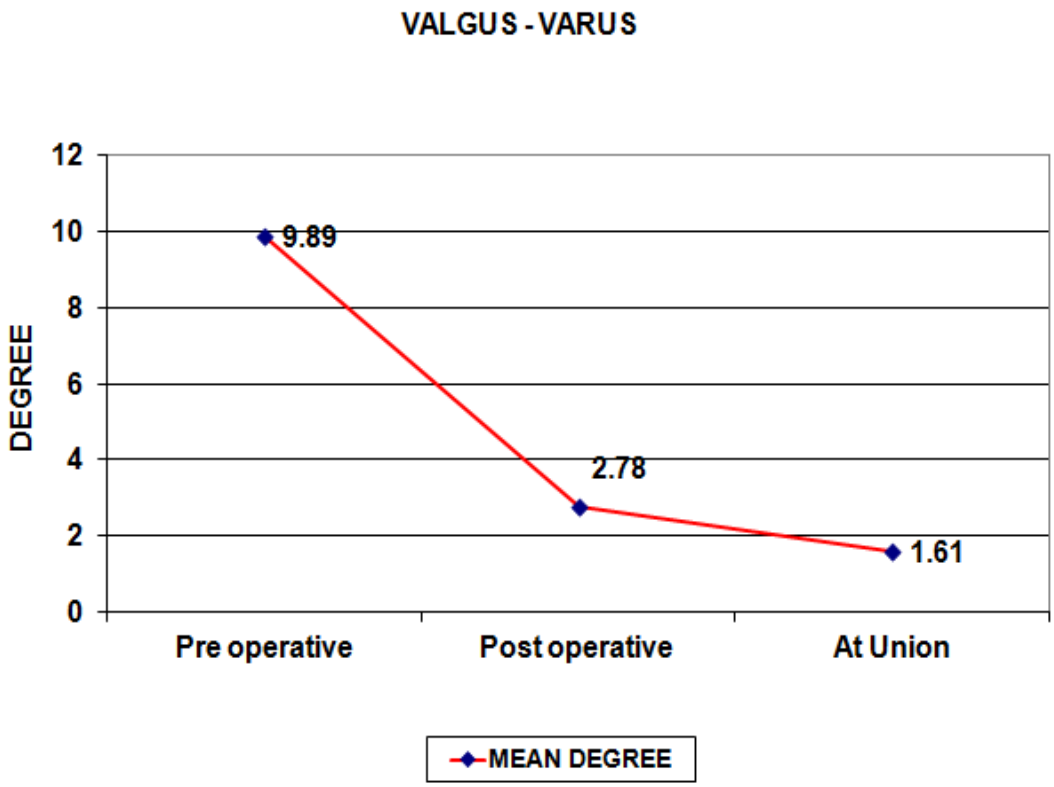


- **Varus/Valgus angulation:(18 legs having the deformity)**

Table – 13

	N	Mean	SD	95% LCL	95% UCL
Pre operative	18	9.89	6.16	9.39	10.41
Post operative	18	2.78	3.65	2.64	2.93
At Union	18	1.61	2.38	1.53	1.69

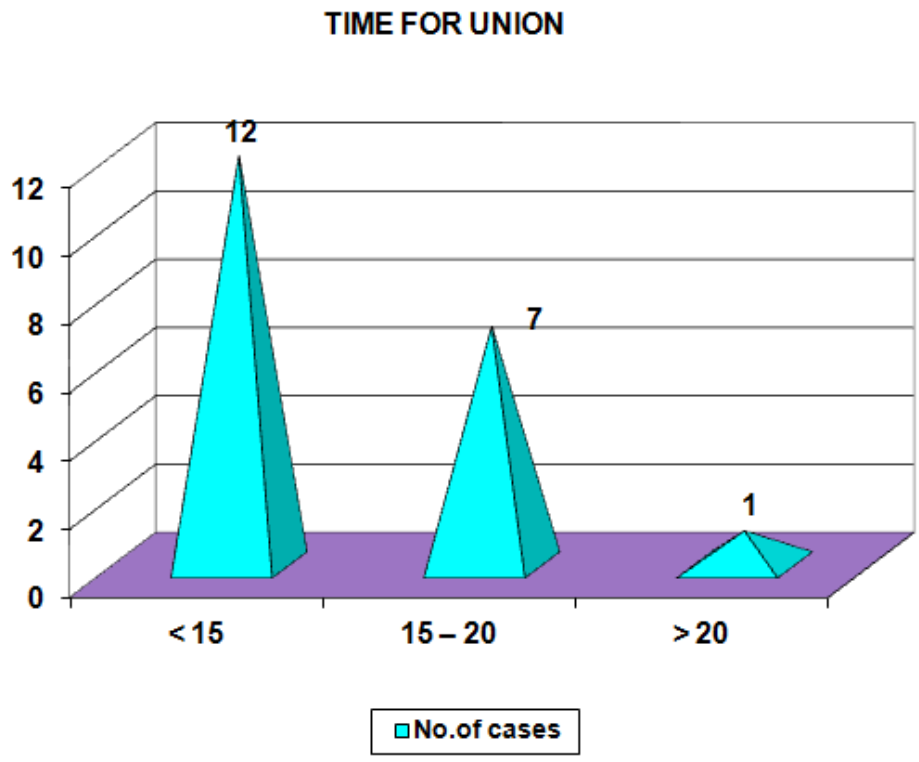
Post operative residual mean varus/valgus alignment is 2.78 degree (95 % LCL is 2.64 degrees,95% UCL is 2.93 degrees) when compare to the preoperative mean value of 9.89 degree(95% LCL 9.39 degrees,95% UCL is 10.41 degrees).The P value is 0.02 (<0.05) which is statistically significant.



II. Time taken for fracture union:

Table - 14

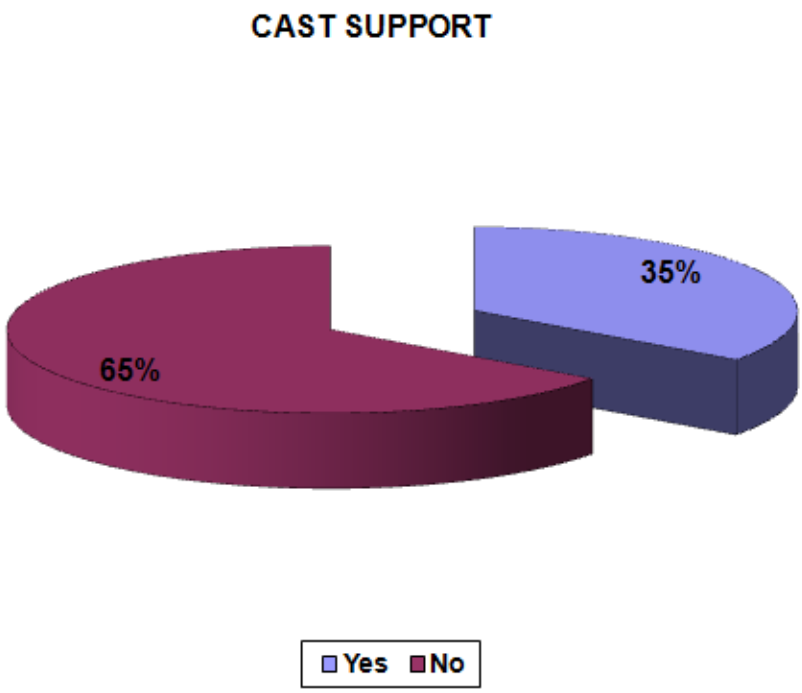
Time for union	No.of cases	Percentage
< 15 weeks	12	60
15 – 20 weeks	7	35
> 20 weeks	1	5
Total	20	100



III. Cast support:

Table-13

Cast support	No.of cases	Percentage
Yes	7	35%
No	13	65%
Total	20	100%



Karlstorm-Olerud Scoring:

Table - 15

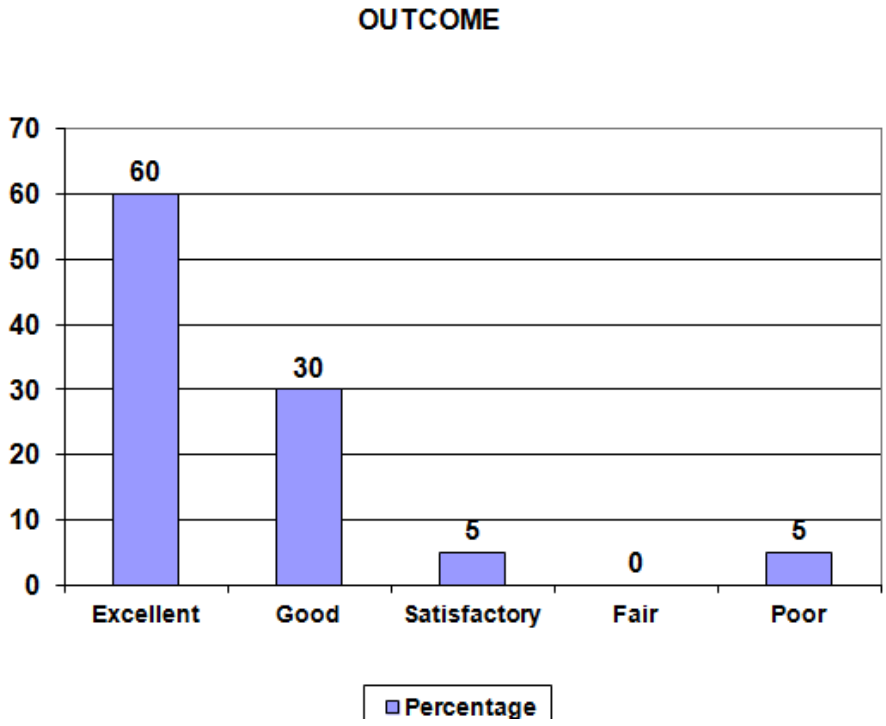
Score	No.of cases	Percentage	Remarks
0 , 1	12	60	Excellent
2, 3	6	30	Good
4	0	0	Satisfactory
5	1	5	Fair
6	1	5	Poor

The Karlstrom-Olerud score in 12 patients is Excellent, in 6 patient is Good, in One patient is satisfactoryand in One patient is Poor. 95% of the patients are having the excellent to satisfactory outcome.

Outcome:

Table - 16

Outcome	No.of cases	Percentage
E	12	60%
G	6	30%
S	1	5%
P	1	5%
Total	20	100%



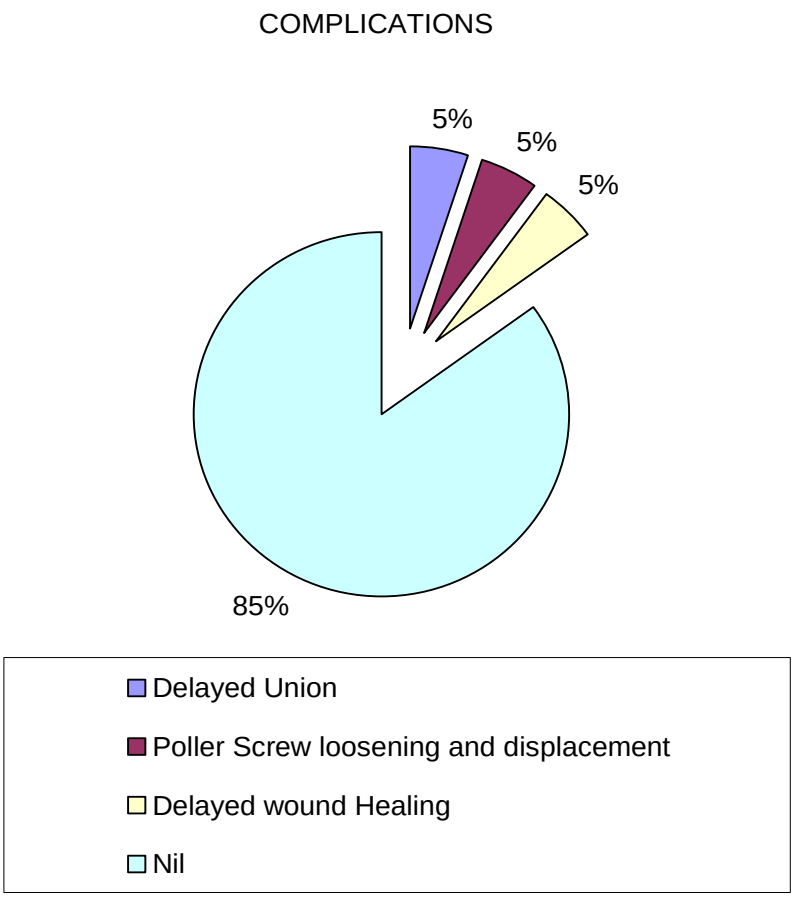
Complications:

Poller screw related complication occurred in only one case in which screw displaced distally due to loosening. No other poller screw related complication occurred in our study, Post operatively one case was complicated with delayed surgical wound healing. In this wound gap was at the subcutaneous level only. We have done minimal wound debridement and daily saline dressing. At the end of 4 weeks wound healed well. No complication like compartment syndrome, nail breakage or screw breakage occurred in our study.

Complications:

Table-17

Complications	No.of cases	Percentage
Delayed Union	1	5%
Poller Screw loosening and displacement	1	5%
Delayed wound Healing	1	5%
Nil	17	85%
Total	20	100%



In our study one case reported with delayed union. The cause of the union was due to a locking screw at the fracture site. The screw was subsequently removed and secondary bone grafting was done .Cast support given for 4 weeks.

10. DISCUSSION

In 1984 Sarmiento et al described the criteria for the judgment of fracture union

- Patient should be able to bear weight without pain.
- There should not be any clinically detectable movements across the fracture site.
- There should be visible bridging callus across the fracture on plain radiograph.

However in case of the open reduction this criterion doesn't hold good. In 1985, Panjabi et al described that cortical continuity was the best predictor of mechanical strength and the author suggested that measurement of number of cortices bridged with callus formation was the most reliable measure to assess fracture healing. In our series, we have fixed the criteria as follows,

"The union was defined as achieved when the patient was able to bear weight in the injured leg without pain and when the radiograph showed bridging callus in at least three cortices".

The metaphyseal fracture are having the coronal and sagittal malalignment due to the disparity in the medullary canal diameter of the proximal and distal fragments and due to anatomy of the medullary canal particularly in case of the proximal metaphyseal fractures. Various authors had advocated various

methods. Buehler KC et al and Lembcke O et al described the proximal and lateral entry point in proximal third fractures. Use of semi extended position was proposed as a solution by Tornetta P III1.Temporary unicortical plating with or without medial femoral distracter was used efficiently to achieve reduction in proximal third fractures by Sean E Nork et al. Dunbar RP et al. modifications in nail designs including different proximal bends and more oblique screws have also been put forth as effective solutions1[33].

In distal third fractures, 'poller screws', the fibular plating and cutting the distal few millimetres of nail distal to the distal screw hole allows two cross locking screws in the distal fragment. One cross locking screw across fracture site acts as lag screw. The use of large reduction forceps, temporary unicortical plating, percutaneous manipulation with shanz pins,and femoral distracter were described as the supplementary procedures used to achieve the alignment[31,32,34,35,36,37,38,39,40,41,42].In our study we taken the method of using of the poller screw in metaphyseal fracture. This is a simple and less invasive procedure to correct both the proximal and distal metaphtseal fracture alignments. Without correcting the deformities malnunion of these fracture will occur, which is having the functional implications on the nearby joints. So these complications are to be avoided. The acceptable range of malunion and shortening is controversial. Trafton's recommendation is generally agreed by many authors. As per Tafton's recommendation the acceptable malalignment is less than 5 degrees of varus-valgus angulation, 10 degrees of anteroposterior

angulation, and 10 degrees of rotation and 15mm of shortening[4]. According to the criteria in our study we encountered two cases with malunion of proximal metaphyseal fracture.No case of malunion in distal metaphyseal fractures.

In our study we studied the disparity between the diameters of medullary canal at the level of isthmus (i.e. maximum possible nail size) and at the fracture site in all cases. We found that there was a significant p value <0.001 ($p < 0.5$) which is significant in comparing the diameter. We found that the mean diameter of medullary canal at the level of isthmus was 9.90 mm compared to 18.25.2mm at the level of fracture site. This mismatch in the medullary canal diameter is the cause for the malalignment in intramedullary nailing. We have measured the average distance between the fracture and joint line, thereby measured the average length of the metaphysis. In our study, the mean length of proximal metaphysis was 6.2 cm and of distal metaphysis was 4.2 cm. So it is suggested that even the very short fragment in metaphyseal fractures can be fixed with intramedullary interlocking nailing successfully.

Krettek et al in 1999 is the first author to publish about the *poller* in metaphyseal fractures. He created bone implant constructs (BIC) in fresh cadaveric tibiae and demonstrated in distal BICs that the addition of blocking screws decreased the average deformation of the BICs 57% [p<0.0001] and in proximal BICs the addition of blocking screws decreased the average deformation of BICs 25% [p<0.0001] [46,47.]

We emphasized that the use of *poller* screw as reduction tool was proved in our study by the repeated measures ANOVA test with 95% of Excellent to satisfactory outcome which is better the values given by the C.Krettek et al. The C.Krettek et al showed the result of 94 % excellent to satisfactory outcome. In our study, the mean postoperative mean varus/valgus angulation is 2.78 degrees in comparing to the mean preoperative varus/valgus of the 9.89 degrees and postoperative mean antecurvatum/recurvatum deformity is1 degree(one) in comparing to the preoperative value of the 5 degrees. The screws improved the stability of the nail-bone construct in 15 metaphyseal fractures. In our study there was only one case with poller related complication which was due to the loosened screw displaced distally. No case is reported with lose of alignment during the follow up period otherwise the screw maintained the alignment till union. After nailing, secondary procedure was required in only one case to achieve union (5%).The case was diagnosed as delayed union at 24 weeks post operatively due to the cause of a screw at the fracture site. This case required the screw removal and secondary bone grafting. The poller screws usually applied in anteroposterior direction as the coronal plane malalignment is more prone to occur than the sagittal plane. In case sagittal plane deformities is expected to occur mediolateral screw also was inserted, even in single patient. In one patint we have applied both antero posterior and mediolateral screws to prevent both the varus and recurvatum deformity**.**In another patient with varus deformity two screw were inserted. The reduction was ensured in two planes

with C-Arm after placing the poller screws and before applying the locking screws.

In our study, fibular fracture was associated with 18 patients. Two cases were isolated tibia fractures. It was at the same level of tibial fracture in 13 cases, distal to tibial fracture in 1 patient. Only one patient with (2/13) unfixed fibular fractures occurring at the same level of tibial fractures were malaligned, which is not significant.

We found that intramedullary interlocking nailing when done with poller blocking screw, fibular fracture level did not influence the stability of the nail-bone construct or the final outcome. When comparing the effectiveness of the poller blocking screw to other methods described by the various authors it is stated that poller screws are technically easy, reproducible, do not require any special instrumentation and do not need any special design modifications in the nail. In this procedure there is no need to do excessive soft tissue dissection or additional hardware like unicortical plating or fibular plating. There is no significant increase in radiation exposure for applying poller screws. .We had excellent to satisfactory outcome in 95% of patients by Karlstrom-Olerud scoring which is better than the results of C.Krettek et al with 94%excellent .

11. CONCLUSION

We conclude that the surgical management of, *open reduction/closed eduction with intra medullary interlocking nailing and poller screws in tibial metaphyseal fractures*

- Is effective in achieving the fracture alignment with poller screw acting as a reduction tool
- Gives improved stability of the bone – implant construct, with the poller screw functionally reducing the medullary width.
- Maintains the fracture alignment till union, preventing loss of initial reduction with poller blocking screw in situ.

ANNEXURE

12. BIBLIOGRAPHY

1. Sean E Nork, David P.Barei, Thomas A schildhauer et al Intramedullary nailing of proximal quarter tibial fractures J orthop Trauma. Volume 20, number 8, sep 2006:523-8
2. C Krettek , C Stephen, P Schandelmaier et al. The use of poller screws as blocking screws in stabilizing tibial fractures with small diameter intramedullary nails. JBJS(Br) 1999; 81-B: 963-8.
3. Mueller ME, Nazarian S, Koch P, Shatzker J. The comprehensive classification of fractures of long bones: Berlin etc, Springer Verlag, 1990.
4. Campbell's Operative orthopedics 10th edition,2003: volume 3, 2671-73,2705,2754-57, 2760.
5. Rockwood and Greens Fractures in Adults, 4th edition,1996: volume2, 2140-41, 2155-61.
6. Digby JM, Hollowary GMN, Webb JK. A study of function after tibial cast bracing. Injury 1982-83, 14:432-9.
7. Haines JF, William EA, Hargadon ES. Is conservative treatment of tibial fractures justified? JBJS(Br) 1984;66-B:84-8.
8. Bruce French and Paul Tornetta. High energy tibial shaft fractures. Orthopedic Clinics of North America. Vol 33(1):jan 2002;211-230.

9. Cole PA, Zowodzki M, Krejor PJ. Less invasive skeletal stabilization system for fractures of proximal tibia-Indications, surgical technique and preliminary results of UMC clinical trial. Injury 2003, 34A: 16-29.

10. Im GI, Tae Sk. Distal metaphyseal fractures of tibia: a prospective randomized trial of closed reduction and intramedullary nail versus open reduction and plate and screws fixation. J Trauma. 2005 Nov ; 59(5): 1219-23.

11. Bono CM, Levine RG,Rao JP,Behran FF.. J Am Acad Orthop Surg 2001; may-jun;9(3):176-86.

12. Christoph Sommer. Biomechanics and clinical application principles of locking plates. 20 Suomen Orthopedia Ja Traumatologia; vol 29:1.2006.

13. B.Kish, M.Markucheich, I.Engel, N.Hiram , M.Nyska. Locked compression plate- New concept for long bone fracture fixation- our experience. JBJS(Br) vol 87(B) issue suppl III,381,2005.

14. Jan Lindahl. LCP in treatment of proximal tibial fractures in 2006. 32 Suomen Orthopedia Ja Traumatologia1.2006.

15. Krettek C. Concepts of minimally invasive plate osteosnthesis. Injury 1997, 28 (suppl I):1-6.

16. Ricci WM, Rudzki JR, Borrelli Ur. Treatment of complex proximal tibia fractures with less invasive skeletal stabilization system. J Orthop Trauma 2004, 18:521-527.

17. Sommer C, Babit R, Muller M, Harson B. Locking compression plate loosening and plate breakage- A report of four cases. 2004, 18(8); 571-577.

18. Brown OL, Dirschl Dr, Obremskey WT. Incidence of hardware – related pain and its effect on functional outcomes after open reduction andinternal fixation of ankle fractures. J Orthop Trauma. 2001May; 15(4): 271-4.

19. Textbook of orthopedics and trauma, G S Kulkarni. 1st edition , 1999: volume 2:1421,2150.

20. Bone LB, Johnson KD. Treatment of tibial fractures by reaming and intramedullary nailing. JBJS(Am) 1986;68-A:877-87.

21. Court Brown CM Christie J, McQueen MM. Closed intramedullary tibial nailing: Its use in closed and type I open fractures. JBJS (Br) 1990;72-B:605-11.

22. Krettek C, Schandlmaier P, Tscherne H. Nonreamed interlocking nailing of closed tibial fractures with severe soft tissue injury. Clin orthop1995;315:34-47.

23. Krettek C, Rudolf J, Schandelmaier P et al Unreamed nailing of femoral shaft fractures: operative technique and early clinical experience with the standard locking option. Injury 1996;27:233-54.

24. Number Crancher Statistical System, Kaysville Utha. 2004. www.NCSS.com

25. Karstrom G, Olerud S. Fractures of tibial shaft, a clinical evaluation of treatment alternatives. Clin Orthop 1974; 105:82-115.

26. Lang GJ, Cohen BE, Bossse MJ, Kellam JF. Proximal third tibial shaft fractures. Shouldthey be nailed? Clin Orhtop Relat Res 1995 jun; (315): 64-74

27. Freedman EL, Johnson EE. Radiographic analysis of tibial fracture malalignment following intramedullary nailing. Clin Orthop Relat Res 1995 Jun;(315):25-33.

28. Ahler J, Von Issendorff WD. Incidence and causes of malalignment following tibial intramedullary nailing. Unfallchirurgie 1992; 18: 31-6.

29. Mosheiff R, Safran O, Segal D et al. The unreamed tibial nail in the treatment of distal metaphyseal fractures. Injury Feb 1999;30(2): 83-90.

30. Chen AL, Tejwari NC, Joseph TN et al. The effect o distal screw orientation on the intrinsic stability of a tibial intramedullary nail. Bull Hosp Joint Dis 2001; 60: 80-83.

31. Sean E Nork, Alexandra K, Schwartz et al. Intramedullary nailing of distal metaphyseal tibial fractures. JBJS (Am) 87 A-6, June 2005:1213-1221.

32. Gorczyca JT, McKale J, Pugh K, Pienkowski D. Modified tibial nails for treating distal tibia fractures. J Orthop Trauma . 2002 Jan ; 1691): 18-22.

33. Laflamme Gy, Heimlich D, Syephen D, Kreder HJ, Whyne CM. Proximal tibial fracture stebility with intramedullary nail fixation using oblique interlocking screws. J Orthop Trauma. 2003 Aug; 17(7): 496-502.

34. Kenneth A Egol, Russell Weisz, Rudi Hiebert et al. Does fibular plating improve alignment after intramedullary nailing of distal metaphyseal tibia fractures? J Orthop Trauma 2006,20: 94-103

35. James Kellam, MD Commentary & prospective on “Effect of fibular plate fixation on rotational stability simulated distal tibial fractures treated with intramedullary nailing by Anantkumar” eJBJS 2003.

36. Weber TG, Harrington RM, Henley MB, Tencer AF. The role of fibular fixation in combined fractures of the tibia and fibula: a biomechanical investigation. J Orthop Trauma 1997 Apr ; 11(3):206-11.

37. Strauss EJ, Alfonso D, Kummer FJ, Egol KA, Tejwani NC. The effect of concurrent fibular fracture on the fixation of distal tibia fractures: a laboratory comparison of intramedullary nails with locked plates. J Orthop Trauma 2007 Mar;21(3):172-7.

38. Richter D, Ostermann PA, Ekkernkamp A, Hahn MP, Muhr G. Distal tibial fracture- an indication for osteosynthesis with the unreamed intramedullary nail? Langenbecks Arch Chir Suppl Kongressbd. 1997; 114:1259-61.

39. Richter D, Ostermann PA, Laun RA, Ekkernkamp A, Hahn MP, Muhr G. Ankle para-articular tibial fracture. Is osteosynthesis with the unreamed intramedullary nail adequate? Chirurg. 1998 May; 69(5):563-

40. Thomas KA, Bearden CM, Gallagher DJ, Hinton MA, Harris MB. Biomechanical analysis of nonreamed nailing after simulated transverse fracture and fibulectomy. Orthopedics. 1997 Jan; 20(1):51-7.

41. Robinson CM, McLauchlan GJ, McLean IP et al. Distal metaphyseal fractures of tibia with minimal involvement of ankle, classification and treatment by locked intramedullary nailing. JBJS(Br) 1995;77:781-7

42. Tyllianaki N, Megas P, Giannikar D et al.interlocking intramedullary nailing in distal tibial fractures. Orthopedics 2000; 23: 805-8.

43. Van derSchoot DK, Den Outer AJ, Bode PJ et al. Degenerative changes at the knee and ankle related to malunion of tibial fractures. 15-year follow up of 88 patients. JBJS(Br) 1996 Sep;78(5):722-5.

44. Puno RM, Vaughan JJ, Stetten ML, Johnson JR. Long term effects of tibial angular malunion on the knee and ankle joints. J Orthop Trauma 1991;5(3):247-54.

45. Kyro A. Malunion after intramedullary nailing of tibial shaft fractures. Ann Chir Gynaecol 1997;86(1):56-64.

46. Krettek C , Theodore Miclau, Jurgen MannB et al The mechanical andclinical efficacy of blocking screws in stabilizing tibia fractures with short proximal or distal fragments using small diameter intramedullary

nails. OTA 1997 posters- Tibial fractures

47. Krettek C, Miclau T, Schandelmaier P et al. The mechanical effect of blocking screws in stabilizing tibia fractures with short proximal or distal fragments after insertion of small diameter intramedullary nail. J Orthop Trauma 1999; 13: 550-3.

48. Ricci WM, O'Boyle M, Borrelli J, Fractures of the proximal third of the tibial shaft treated with intramedullary nails and blocking screws. J Orthop Trauma. 2001 May;15(4):264-70

49. Ai J, Li P, Han Y. Effect of blocking screws on breakage of interlock ingintramedullary nails. Zhongguo Xiu Fu Ching Jian Wai Ke Za Zhi 2007. Mar;21(3): 282-4. (Abstract from www. ncbi.nlm. nih.gov/entrez).

50. Outcome measures in orthopaedics and orthopaedic trauma, 2nd edition, 2004, 280-83.

51. Oh CW, Kim SJ, Jeon IH et al. Treatment of proximal shaft fractures of tibia with intramedullary nail: analysis according to AO classification and the poller screw. Korean Fracture Soc , 2004 Apr; 17(2):133-13

52. Wasudeo M Gadegone and Yogesh S Salphale, Dynamic osteosynthesis by modified Kuntscher nail for the treatment of tibial diaphyseal fractures Journal of Orthopaedics.

53 Milind Chaudhary, Centre for Ilizarov Techniques; Govt Medical College, Akola - 444 001 and Jaslok Hospital, Mumbai, Limb lengthening over a nail can safely reduce the duration of external

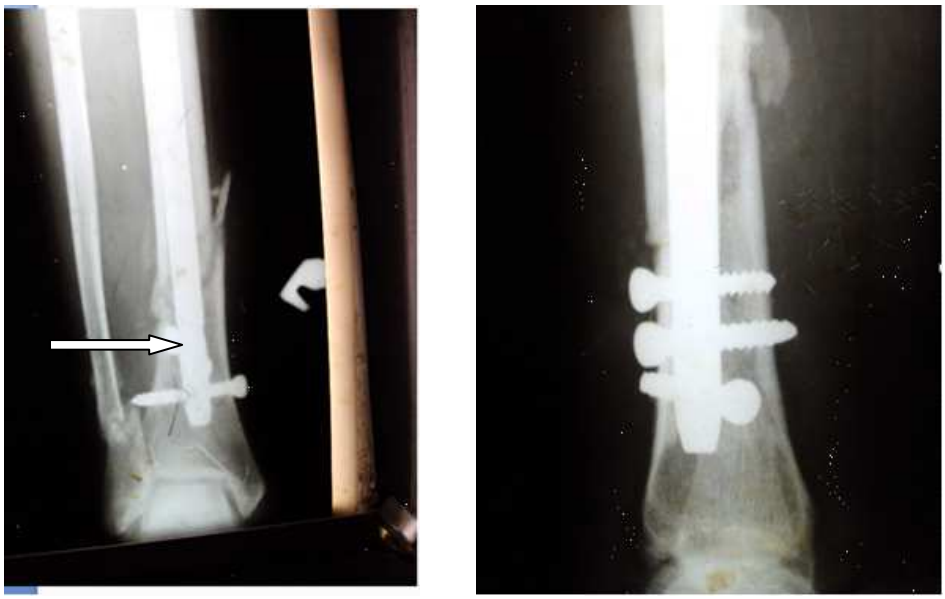
fixation.India Indian journal of orthopaedics Year : 2008 | Volume : 42 | Issue : 3 | Page : 323-329.

54. Pankaj, Amite MS, MRCSEd; Malhotra, Rajesh MS; et al Penetration of the Distal Femoral Anterior Cortex During Intramedullary Nailing for Subtrochanteric Fractures Journal of Orthopaedic Trauma : April 2006 - Volume 20 - Issue 4 - p 29.

13. CASE ILLUSTRATIONS

Case No:1

Valgus deformity



Valgus deformity corrected with anteroposterior poller screw at the concave side of the deformity, lateral to the nail

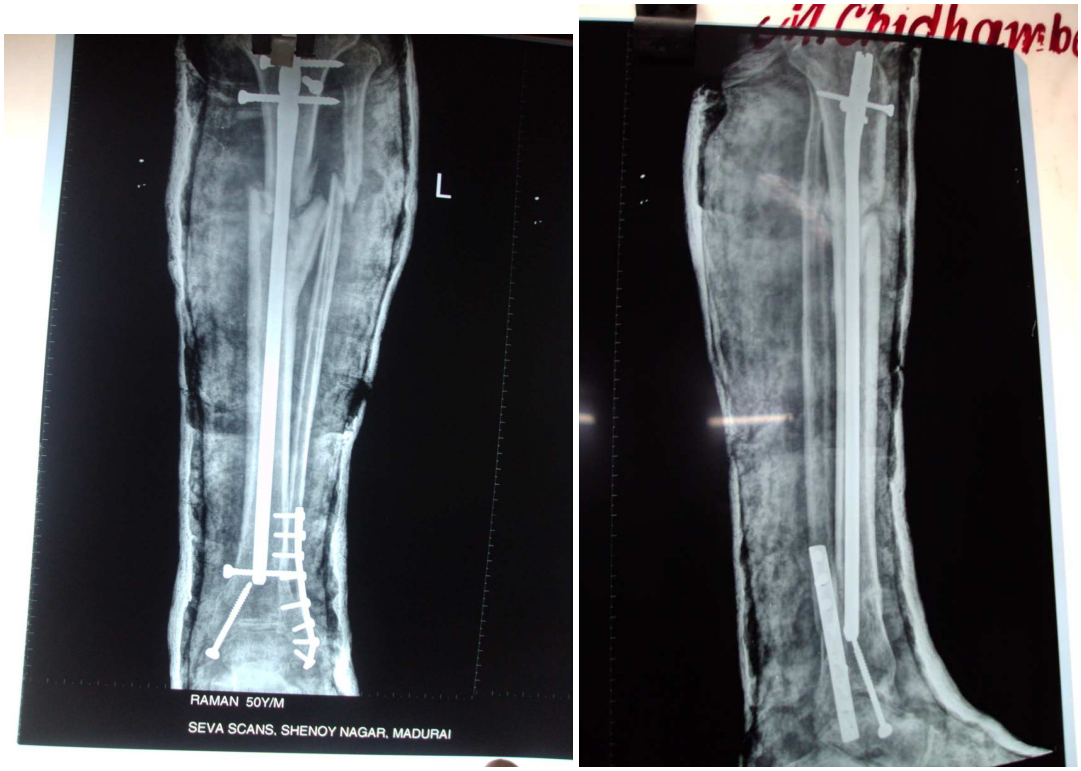
12 weeks follow up with signs of fracture union

With good range of functional outcome

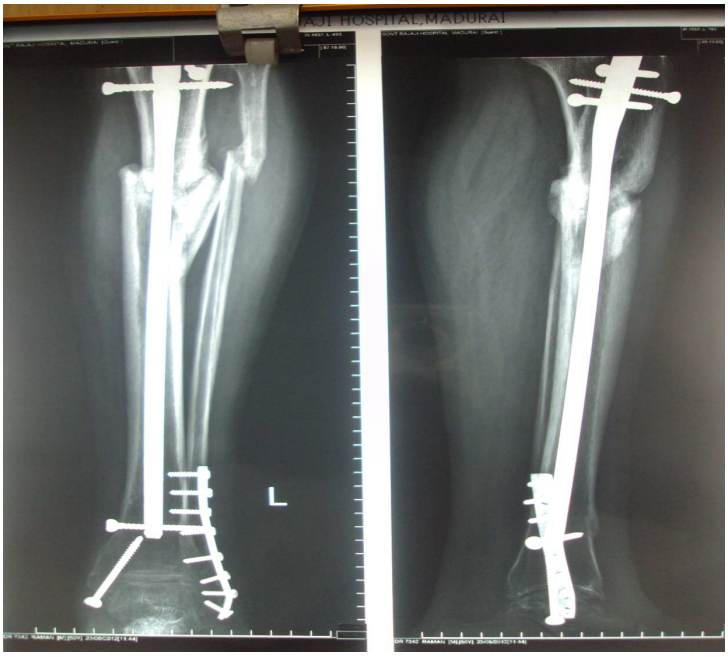
Case No:2

Valgus deformity of the proximal metaphysis

Valgus deformity corrected with anteroposterior poller screw on concave side of the deformity lateral to the nail



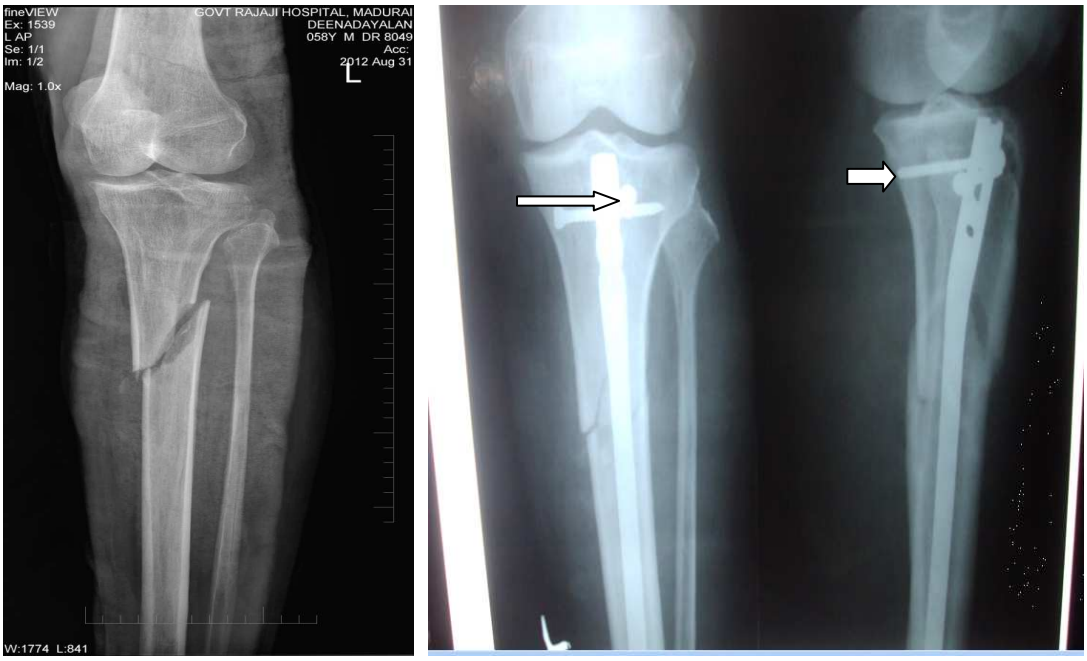
6 Weeks follow up with signs of Union



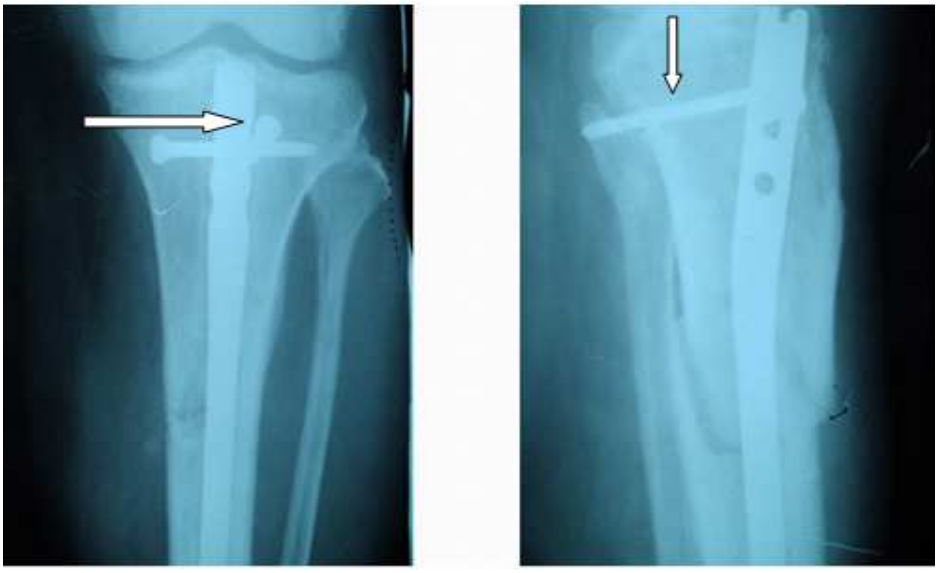
12 weeks follow up with bone union

With good funtional achievement

Case 3

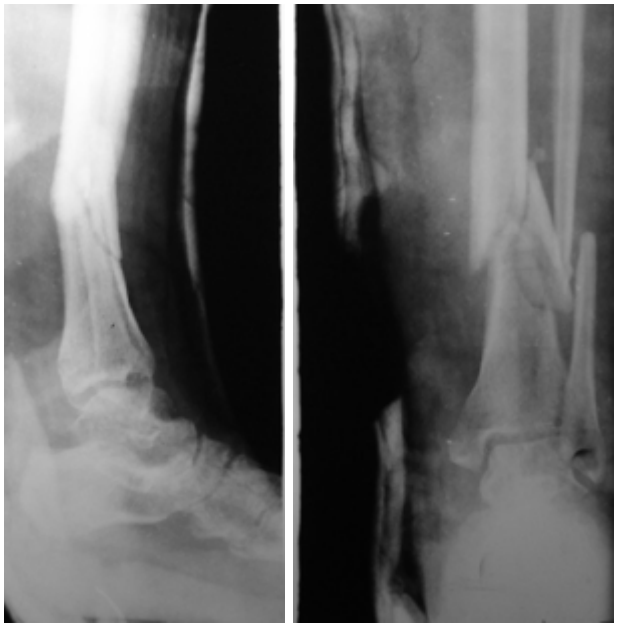


Valgus deformity corrected with anteroposterior poller screw on the concave side of the short fragment

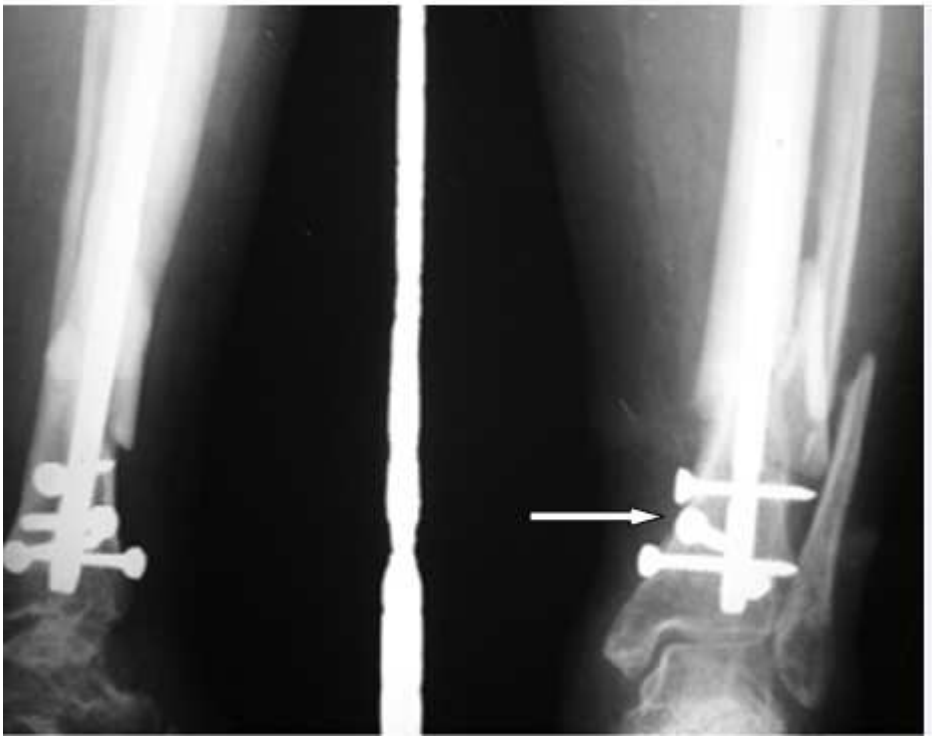


12 weeks follow up signs of fracture union

Case 4:



Varus deformitry



Varus Deformity is corrected with poller screw on the concave side in short fragment

10 weeks follow up signs of fracture healing

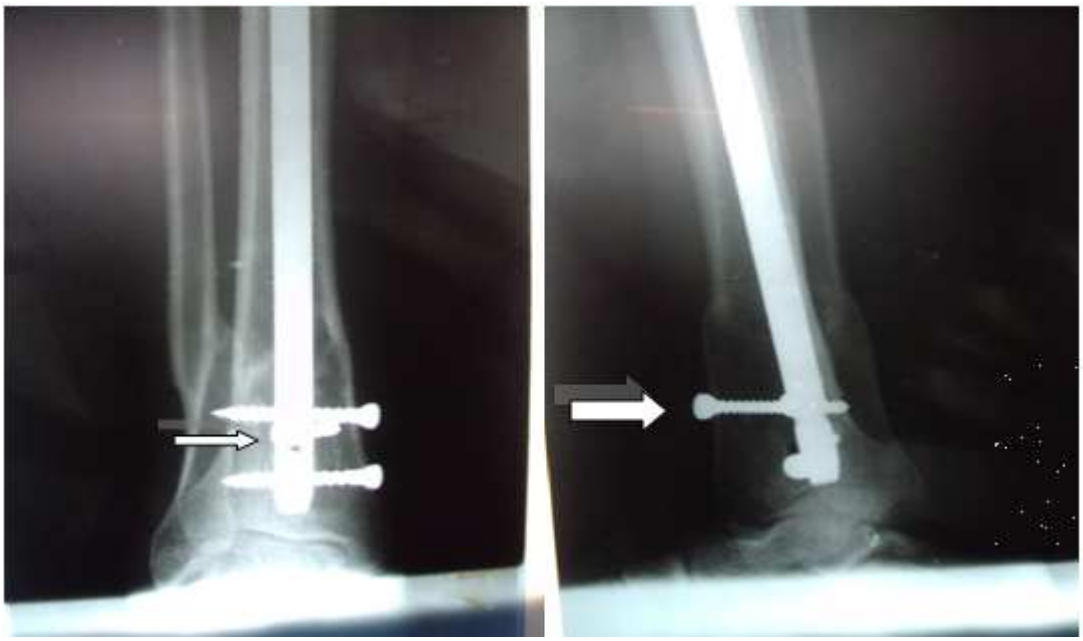
With good functional achievement.

Case 5

Varus deformity corrected with anteroposterior poller screw at medial side of the nail

6 weeks follow up with poller screw insitu maintaining the reduction

12 weeks follow up x ray



24 weeks follow up with fracture union

With good clinical and functional achievement

CASE 6

Varus Deformity

Varus Deformity corrected with anteroposterior poller screw on the concave side of the short fragment

24 Weeks with signs of delayed union .

14.PROFORMA

SI.NO :

Patient Name :

Age/sex : IP No:

Occupation : DOA :

Address : DOI :

DOS :

DOD :

Contact No :

Diagnosis

……

Mode of injury : Side : Right/Left

Fracture classification

- AO
- Taylor & Martin
- Simple
- Compound /Grade

Fracture Pattern

	Distance from tibial Plateau / Plafond	Length of fracture	Comminution	Preop Angulation Varus / valgus andAnte/Recurvatum	Post op	At union
Proximal/ Distal 3rd						

Medullary canal Diameter:

1. Proximal metaphysical Level
2. IsthmusLevel
3. At the fracture Level
4. Distal metaphysic Level

Level of Fibular Fracture

Any associated injuries :

X- ray of Fracture Part – AP :

- Lateral :

Pre-Operative Soft tissue Status :

Interval between injury & surgery :

Any comorbidities :

Type of Surgical treatment : CRIF / ORIF :

Tourniquet duration :

Anaesthesia : Surgery duration :

Nail size : Approach :

No of screws used

Proximal Locking :

Distal Locking :

Poller Screws :

Purpose of Poller Screw

1. To Control the nail during insertion
2. To correct alignment after nail insertion
3. To Maintain alignment or to improve the stability of implant complex

In Post Operative Period,

- Weight bearing started on : Antibiotic Duration
- Knee & Ankle Mobilisation on : Oral
- Cast Support : Yes/No Parental
- E O T 1. :
- E O T 2. :
- Post – Operative X-ray :

Immediate :

6 weeks :

12 weeks :

6 Months :

- Post -Operative Soft tissue status :
- Time Taken for Fracture Union :
- Complication If Any :
- Secondary procedures :
- Final outcome :

:

15. CONSENT IN TAMIL

ழிமீலீணீலீஉ ஜீணீஜீபீ; ழீயீமீஹ்; ளீஷ்;கீளீ; ஜ்ரீ;நிழீஹ்; ரீதீமீளீ;

ரிபீ;ஞிவீஹுக:

யீலீஹ்; ஸ்சீளீ;நி ரிஷ்ஜீமீலிபீயி கூஃலீவீஹ்மீஜீரீழீ;ழீஜீபீலீசீளீ;> ளீஷ்;கீளீ; நீணீஹுழீ;ழீஜீஹ்; ,ஹ்றிமீ;யி யீறிழிஷ்ஃ மீஜீளிமீழீபீலீசீளீ; கூஷிஷ்;ரீலியீஜீஷ்யி. ,ழீபீலீஹ்; யீலீஹ்; மீறீரீ;ரீழீஷ்;தி ரீணீபீ;ரீறீலீளீஹ்; வீமீழீ;ழீஜீஹ்றிரீ;ரீழீலீஹ்; %றீ;லியீ;யீலீஹ்ஜீசீளீ;> யீஞீயீ;யீலீஹ்ஜீசீளீ; %றீ;லி ,கீயீ;யீளீ; கூஷிஷ்;ரீறீஜிளீ;> ஸ்சீளீ;நியீஉ; ழிழீணீ;ளீலீபீளீ; (Disuse Osteoporosis) கூஷிஷ்;ரீறீ மீலீணீ;ரீ;நிஉ;உயி. னீகீவீமீ கூஃஜீயீஜீகூஃ;வீகூஃணீஜீஹ்;ஹ்லீளீஹ்; ளீலீஜியீ;யீறீ;லி %ஹ்ளீ; கூஃஜீயீஜீகூஃ;வீகூஃ ழிளீஷ்ஸீயீலீஉ;ஷிளீ; ழிரீலீயி ஸ்சீளீ;நியீஉ;> ளீலீஷ்ஜீ ழிகூஃஹுஜிளீ; (Malunion), ழிகூஃலீஹுளீஹ்; ழிரீலீயீஜிளீ; (Non Union) ழீலீளீழீளீலீயீ ழிகூஃஹுஜிளீ; (Delayed Union) மீலீணீ;ரீ;நிஉ;உழீலீயீ ளீஹ்றிழீ;யிமீபியீஉ; ஸ்லிழீ;யியீ; $ஷ்ஜீபீலீபியீஉ;. ,ழீ;ழீவீயீணீ ரீஜீபீ; மீஜீவீஉஜியீவீஉ கூஃளீலீஉஜீரீ;ரீழீஷ்;யீலீயீ ளீழீவீஹுஉ னீஹுஸி ,ஹுலீ[லீ[ஜீ ளீஹ்றிழீ;யிமீளீவீபீணீஜீஹ்; னீகீவீமீ கூஃஜீயீஜீகூஃ;வீகூஃணீஜீபீ; %ஹ்ளீ; யீலீஹ்; ஸ்சீளீ;ரீஜீஷ்;திஉ; யீளீ;ரீஜீ வீமீழீ;யி (Intramedullary Nailling) னீகீவீமீ கூஃஜீயீஜீகூஃ;வீகூஃ ஸீகூஃணீ;ணீரீ;ரீலியீஜீஷ்யி. ழிமீலீணீலீஉஜீயீஉஜீபீ; மீஹ்ஞியீ;யீலீயீ ஜ்ஹ்றி விணீ;ஜிளீ; மீறீழீ;ழீரீ;ரீலியீஜீபீ;ஷ்யி.

விணீ;மீஜீபீ; ழிமீலீயீ;யீளீ;:

,மீ;ழீ விணீ;மீஜீபீ; %ஹ்ளீ; யீலீஹ்; னீகீவீமீ கூஃஜீயீஜீகூஃ;வீகூஃ ஸீகூஃணீ;ணீரீ;ரீறீ;லி> ஸ்சீளீ;நியீ;திஉ; யீளீ;ரீஜீ வீமீழீ;யி ஸ்சீளீ;நியீஉ; ழிமீஹுலீயீ;யீரீ;ரீறீ;லி (Closed Reduction/ open Reduction intramedullary nailing) னீகீவீமீ கூஃஜீயீஜீகூஃ;வீகூஃ

ஸ்கூஸ்ணீ;ணீர்;ர்லியீஜீஷ்யி. ,ழீபீலீஹ்; மீஜீவீஹுமீஜீஹ்; ழிமீலீண்ணீலீஷ ஜீயீஷ ; ,ண்ஹர்;யீ ர்திதீயீஜீஷ்யி. (Early Mobilisation) ,ழீபீலீஹ்; %றீ;லி ,கீயீ;யீளீ;> (Post traumatic stiffness) ழீமீஜீபியீ;யீர்;ர்லியீஜீஷ்யி. ர்ஷ்ஜீமீ;யி ழிர்லீபீ ஸ்சீளீ;நியீஷ ; மீஜீவீஹுமீஜீஹ்; ழிகூஹ்றிமீழீஷ்;தி மீஷ்ஜீமீவீயீ ஸ்கூஸ்ணீ;ணீர்;ர்லியீஜீபீ;ஷ்யி.

ர்ஹீ;ழியீஷ்;ர்ழீஷ்;யீலீபீ ழீதிழீஜீயீஷ ;:

- 20 மீண்ழீஜீஷ்;தி ழிளீஷ்;ர்றீ;றீமீபியீஷ ;
- யீலீஹ்ஜீபீ; ழிளீஹ்; ர்விபீர்;ர்திழீஜீ ளீஷ்;கீளீ; (Proximal metaphysis), யீறிஷ்;ர்விபீர்;ர்திழீஜீண்ணீஜீஹ்; (Distal metephysis) ஸ்சீளீ;நி ர்ஷ்ஜீஜி கூஷிஷ்;ர்றீ;லி திவீஷ்மீ;ழீ ண்ஷ ஜி ளீறீ;லிளீ; கூஸ்வீழீர்; ர்திழீஜீ யீலீண்ணீளீ; கூஷிஷ்;ர்றீ;றீமீபியீஷ ;
- மீலீறீர்றீ;றீ ,ஹிழீண்ணீ ளீஷ்;கீளீ; %வீஷ மீஹுளீ;நி ழிமீலீண்ணீ; ,ஹ்;ஹ்லீழீமீபியீஷ ;
- யீலீஹ்; நீவீறீமீ;யி 10° ண்ஷ ஜியீ;தி ளீறீ;லிளீ; யீலீஹ்; ழியீலீக்ஷ்ஹ்லீயீ நீஷ ;ஷ மீபியீஷ ;.

ர்ஹீ;ழியீஷ்;ஷ் ழீதிழீஜீண்ணீஷ்;ஷ் மீஜீவீஹ்:

- 20 மீண்ழீஜீஷ்;திறீ;ர்றீ;றீமீபியீஷ ;
- யீலீஹ்; ர்ஷ்ஜீஜிறீபீ;> ண்ழீஜீயீளீலீயீ கூஸ்வீழீண்ணீஜீஷீர்;நி ளீஷ்;கீளீ; ,ஹுழீ;ழீயீ;திஷ்லீண்ணீ; ர்லீழீஜீர்;நியீஷிறீபீ; நீஷ ;ஷ மீபியீஷ ; Compound Grade (III A, B & C)
- ஸ்சீளீ;நி ர்ஷ்ஜீமீலீஹ்; ர்ஷ்ஹ்ர்;யீலீஹ்; %றீ;லி ர்திழீஜீ (Knee Joint) ர்லீழீஜீயீ;யீர்;ர்றீ;றீமீபியீஷ ;
- யீலீஹ்; ர்ஷ்ஜீமீலீஹ்; யீஞீயீ;யீலீஹ்; (Ankle Joint) %றீ;லிர்;ர்திழீஜீ ர்லீழீஜீயீ;யீர்;ர்றீ;றீமீபியீஷ ;

❖ ளீணீயீ;யீ ளீஹிமீ;ழீஜீவீபீ நீறீஹ்; னீஉமீஜீஹ்; ழீலீஹீ;யீஜீ ஸீயீலீஉ;உ ரிதீணீலீழ் னீஉஜியீ;தி ழிமீலீணீ; நீஉ;உமீபியீஉ;.ஸ்சீளீ;நி ரிஷ்ஜீஜி ஷிஷ்;ரீறீ;றீ யீலீஹ்ஜீஹ்; ரீஜீஷ்மீஜீ சிபீளீ; நீஉ;உமீபியீஉ;.

விணீ;ஜி மீவீறீரிவீஷ்:

னீகீவீமீ ஷீஜீயீஜீஷீ;வீஷீணீஜீபீ; ழிரீலீயி> யீலீஹ்; ரிஷ்ஜீமீ;யி ழியீலீஷீஹ்லீயீஜீ நீஉ;உ ஸ்சீளீ;ரீஜீவீபீ ணிகூ;யீழீஜீபி (C-Arm) ரீறீளீ; %ஹ்ளீ;> ழிமீஞூலீயீ;யீஜீ (Closed Reduction) ஸ்சீளீ;ரீஜீபீ; நீறீ;நிஷ்ளீலீயீ யீளீ;ரீஜீ வீமீயீ;திளீ; ஸீரீலீளியி நீவீறீமீ;ழீ ஸ்சீளீ;நிழீ; யிகூ;லியீஉஜீஹ்; ஷீஜீபீ;பீ ரீதிழீஜீணீலீபீயி (short fragment), ழியீலீஷீஹ்லீயீ ழிரீலீமீவீழீ (Valgus/ Varus/Ante/ Recurvatum) ழீலியீ;திளீ; ஸீரீலீஹிறீ;லி ழீலிளீ;நி];யீ;ஹி (“Poller” Blocking Screw) ஸீரீலீஹிழீ;ழீரீ;ரீலியீஜீஷ்யி. ழிளீசீளீ; ழிளீஷ்;நிஷ்ரிளீ; யீறிஷ்;நிஷ்ரிளீ; Locking Screw நீழீமீஜீகிறீபீ; யீளீ;ரீஜீ (IMIL) மீஜீவீஹ்ரீ;ரீலிழீ;ழீரீ;ரீலியீஜீஷ்யி. ரீஜீஷ்தி னீகீவீமீ ஷீஜீயீஜீஷீ;வீயீ;தி ரீஜீபீ; ,ஞூகூ;றீலீளீ; னீஹ்;ஹ்யி %பீ;ஷ்லீளீ; மீலீஉ; ரிறீ;தீயீ;யீலீஹ்;> யீஞீயீ;யீலீஹ்; னீவீஷீஜி ரீணீஜீஷ்;ஷீஜீயீஉ; (Knee, Ankle Mobilisation Exercises) ஸீஷீணீ;மீழீஷ்;தி ழிமீலீணீலீஉஜீயீ;தி னீஷ்ஜீஜிகீழீ;ழீரீ;ரீலியீஜீஷ்யி. ரீஜீபீ; 12–14ளீ; மீலீஉ; னீகீவீமீ வீழீணீஹ்; ரீஜீலீஜீயீ;யீரீ;ரீறீ;லி ழிமீகீ ரீஜீஞூஷீ;ஷீவீபீயீஉ; ,ஹ்;வீஹ்ஸீணீபீ;ஷ்லீஹ்; ழிமீலீணீலீஉஜீ மீறிறீ;தீஷ்;தி னீஞிரீ;ரீரீ;ரீலிமீலீபி. ரீஜீஷ்தி> விஷ்லீளீ; மீலீஞூழீ;ழீஜீஹ்; ஜ்ஹி x- ray கிளீ;> 12மீயி மீலீஞூழீ;ழீஜீஹ்; ஜ்ஹி X-ray கிளீ; ஸ்லிழீ;யி 6 ளீலீழீழீழீ;ஜீஹ்; ஜ்ஹி X-rayஜிளீ; ஸ்லிழீ;யி ரீலீஜீழிஷீலீழீஜீயீ;யீரீ;ரீலியீஜீஷ்யி. ,ழீ;ழீவீயீணீ X-ray ரீலீஜீழிஷீலீழீவீபீயீஉ; ழிளீஷ்;ஸீயீலீஉ;ஷிளீ; ஸீரீலீளியி ஸ்சீளீ;நி ழிஷீஹிளீ; னீஉமீஜீவீபீ (Callus formation) ஸீரீலீஹிழீ;யி ழிமீலீணீலீஉஜீணீலீபீமீபி ஸ்வீறீ ஸீரீலீஹிமீ;யி மீவீறீ ரீணீஜீஷ்;ஷீஜீ (Weight Bearing) ழிளீஷ்;ஸீயீலீஉ;உ னீஷ்ஜீஜிகீழீ;ழீரீ;ரீலியீஜீஷ்லீபி.

ஸிரீலீயிமீலீபீ விரீழ்;யியீஉ; – னீகீவீமீ கூழ்ஜீயீஜீகூழ்;வீகூழ்ணீஜீபீ; ழிரீலீயி

- னீகீவீமீ கூழ்ஜீயீஜீகூழ்;வீகூழ்ணீஜீபீ; ழிரீலீயி ஸியீலீலியீ;யீரீ;ரீலிளீ;> ளீணீயீ;யீ ளீஹ்றிமீ;ழீஜீபீலீஹ்; ஜ்மீ;மீலீவீளீ ளீவ்ஷ்;கீளீ; %கூழ்;ஸிழீஜீகூஷ்வ்ஷ்ஹ்; கூஷிவ்ஷ்;ரீறீஹ்ஹ்லீளீ;.
- விவ்ஷ்வீமீ கூழ்ஜீயீஜீகூழ்;வீகூழ்ணீஜீபீ; ழிரீலீயி கூஷிவ்ஷ்;ரீலிளீ; ,ஹூழீ;ழீரீ; ழிரீலீயீ;தி நீணீஜீஹ்றியீ;தி விரீழ்;ழீலீயீ ரிதீணீஹ்ஹ்லீளீ;.

ஸிரீலியிமீலிபீ விரீழ்யியீவ ; – னீகீவீமீ கூழ்ஜீயீஜீகூழ்;வீகூழீயீ;தி ரீஜீஷ்தி

- யீஜீஹ்ரிளீஜீ ஸிழீலிஷ்;ஷ் கூழிஷ்;ரீறீஹ்லிளீ; (Post op infection)
- னீகீவீமீ கூழ்ஜீயீஜீகூழ்;வீகூழீயீ;தி ரீஜீஷ்தி $றீ ஸ்சீளீ;நியீவ ; ழிகூழ்ஹுலிளீஹ்; ழிரீலியீஹ்லிளீ;.(Non – Union)
- ழீலிளீழீளீலியீ ஸ்சீளீ;நியீவ ; ழிகூழ்ஹுஹ்லிளீ;.(Delayed Union)
- னீதீரீறீ;றீ யீலிஹ்; னீதீரீறீலிழீ யீலிவீஹ்ற் மீஜீறீ ஸ்சீளீ;நி ரிஷ்ஜீமீஜீபீ; ழீபீ;வீளீவீணீ ஸிரீலிஹ்ரிழீ;யி திறீ;வீறீணீலியீ வியீஹ்ற்லிளீ;. (Limb shortening)
- ,ழீ;ழீவீபீ யீலிஹ்ஹுகூழ்ஜீயீவ லிஹ்; ளீகீ னீகீவீமீ கூழ்ஜீயீஜீகூழ்;வீகூழீ $றீ ழிழீவீமீரீ;ரீறீஹ்லிளீ;.

,மீ;ழீ னீகீவீமீ கூழ்ஜீயீஜீகூழ்;வீகூழீணீஜீபீ; கூழீலீழீயீ $கீயீவ ;

- ,மீ;ழீ னீகீவீமீ கூழ்ஜீயீஜீகூழ்;வீகூழீணீஜீஹ்; நீவீறீமீ;ழீ ஸ்சீளீ;ரீயீவ ; மீஜீவீஹ்ஹுமீஜீஹ்; ழிகூழீஹ்ரிளீ; மீவீயீணீஜீஹ்; ஸ்சீளீ;நியீ;தி்வ ; யீளீ;ரீஜீ வீமீழீ;யி னீகீவீமீ கூழ்ஜீயீஜீகூழ்;வீகூழீ ஸீகூழீணீ;ணீரீ;ரீலியீஜீஷ்யி.
- ,ழீபீலிஹ்; ழிமீலிணீலிவ ஜீயீவ ; மீஜீவீஹ்ஹுமீஜீழிஹ்ழிணீ னீமீஹ்றிவீறீணீ யீலிஹ்; ரிறீ;தீ> யீஞீயீ;யீலிஹ்; வியீஜீணீமீஷ்;வீஷ் னீவீகூழீழீ;யி (Early Mobilisation) ,ணீஹ்றீ;யீ ரிதீயீஜீஷ்யி. ,ழீபீலிஹ்; னீகீவீமீ கூழ்ஜீயீஜீகூழ்;வீகூழீயீ;தி ரீஜீஷ்தி கூழிஷ்;ரீலிளீ;. ரிறீ;லி ,கீயீ;யீளீ; ழீமீஜீயீ;யீரீ;ரீலியீஜீஷ்யி.
- ,மீ;ழீ னீகீவீமீ கூழ்ஜீயீஜீகூழ்;வீகூழீ %ஹ்ளீ;> யீலிஹ்; ழீலிளீழீளீலியீ ழிகூழீஹ்ரிழீஹ்;. (Delayed Union) ளீலிஷ்ஜீ ழிகூழீஹ்ரிழீஹ்; (Mal union) > ஸ்சீளீ;நியீவ ; ழிகூழ்ஹுலிளீஹ்; ழிரீலிதிழீஹ்; (Non union) வியீஜீணீவீமீ ழீமீஜீபியீ;யீரீ;ரீலியீஜீஷ்யி.

னீகீவீமீ கூழ்ஜீயீஜீகூழ்;வீகூழீணீஜீபீ; ரீலிழீயீஹ்ரீ;யீவ ;

- ழிமிலீணீலீஉ ஜீணீலிபீமீபி திவீஷ்மீ;ழீயி %பீ;கீ ளீலிழீழீ;ழீஜீஷ்;தி யீலீஹ்;யீஉ ; சிபீ;ஷ்ஜீ மீறீயீ;யீ ,ணீஹ்லீயி\

விஹ்லீணீ;கூழீ;கூழீஜீயீ;யீலிபீ ரீகூஷ்ரீ;ரீறீ;றீமீலிறீலி:

- னீவீபீழீ;யியீ; யீஹ்றிமீஜீயீஷ்ஷிளீ; ளீஹ்றிழீ;யிமீளீவீபீணீஜீழிஹ்ழிணீ ,ஹ்றிரீ;ரீழீலீஹ்; ,மீ;ழீ விஹ்லீணீ;கூழீ;கூழீஜீயீ;தி னீஹ்லகூழீஜீறீளீ; ,ஹ்றிமீ;ழிழீலி ழிமீஷ்ஷ் ழீபீஜீ மீரீலீஜீறீளீ; ,ஹ்றிமீ;ழிழீலி ஸ்மீ;ழீ மீஜீழீஜீ நீழீமீஜீகிளீ; ஸ்ரீஷ்ரீ;ரீறீமீஜீஹ்;வீஹ்.

,ஹ்யீகூழீஜீணீ ழீபீ;வீளீ:

ழிமிலீணீலீஉ ஜீணீஜீபீ; ழீபீஜீரீ;ரீறீ;றீ விழிஹ்லீலீயீ;யீஜீணீ ழீயீமீஹ்;யீவீஉ விணீ;ஜி ளீஹ்றிழீ;யிமீபி ளீஷ்;கீளீ; சிஷ்ஜீணீபியீஉ ; ,ஹ்யீகூழீஜீணீளீலீயீ வீயீணீலீஷ்மிலீபியீஉ ;.

வீயீஸீணீலீரீ;ரீஹ்;யீஉ ;:

,மீ;ழீ விணீ;மீஜீபீ; ஙபி னீஹ்றீ;யீளீலீமீழீஷ்;தி நீஹ்றீ;யீஉ ; ழீபீஜீரீ;ரீறீ;றீ நீறீஹ்ற்; மீஹ்ற் ழீயீமீஹ்;யீவீஉ நீரீழிணீலீயீஜீழீ;யி ஸீயீலீஉ ;உ ஜிளீ;> னீமீஷ்;வீஷ் ஸீமீஉ ஜீரீ;ரீலிழீ;ழீஜிளீ; னீழீஜீயீலீஹ்ளீஉ ஜீரீ;ரீழீஷ்;யீலீயீ மீறிஹ்றீ;யீஉ ; னீஹ்;ஹ்யி நீஹ்றீ;யீஉ யி கூழீறீ;றீரீ;நி+பிமீ ரீஜீஹ்ழீஜீமீஜீழீஜீ ,மீ;ழீ ஜ்ரீ;ரீழீஹ்ற்; ரீதீமீழீ;ழீஜீஹ்ற்; வீயீஸீணீலீரீ;ரீளீஜீறீ;லி ழிழீழீஜீணீஜீறீ ழிமீக்ஷ்;லிளீ;.

MASTER CHART

S. No	Age	Sex	AO Type	SUD type	Side	Simple /Comp	Distance from Jt.Line (In cm)	Length of Fracture (cm)	Fibula Fracture Level	Reduction CR/OR	No of Poller Screw	Purpose	Nail Size	Medullary Canal Diameter		Locking Screws		Antecurvatum / Recurvatum			Valgus/ Varus			Complication	Cast Support	Wound Healing	Bearing	Time For Union	Score	Outcome
														Isthmus level (mm)	Fracture Level (mm)	Proximal	Distal	Pre Op	Post Op	At Union	Pre Op	Post Op	At Union							
1	27	M	43-A	S	R	S	4	2	S	CR	1	1,2,3	9/340	10	16	1	2	0	0	0	5 +	-4	0	Nil	No	Good	6	12	1	E
2	45	M	43 -A	S	R	S	4.5	0.5	P	CR	1	1,3	9/360	10	17	1	2	0	0	0	7 +	0	4	Deleyed union	Yes	Good	12	28	6	P
3	23	M	41 -A	D	R	Gr-I	6.5	9	S	CR	1	1,2,3	9/340	11	22	1	2	4 +	0	0	-	-	-	Nil	No	Good	8	12	0	E
4	52	F	43 -A	S	R	Gr-I	5.5	2.5	D	OR	1	2,3	8/340	9	16	1	2	0	0	0	-15	-2	3	Nil	Yes	Good	8	12	3	G
5	45	F	43 -A	U	R	S	3	4.5	I	CR	1	1,3	8/320	9	18	1	2	0	0	0	5 +	5 +	4 +	Nil	Yes	Good	10	14	2	G
6	70	F	43 -A	U	R	S	4	2	P	CR	1	1,3	9/340	10	17	1	2	0	0	0	6 +	0	0	Nil	Yes	Good	10	16	2	G
7	50	M	43 -A	D	L	S	7	2	S	CR	1	1,2,3	9/360	10	18	2	1	0	0	0	-4	3 +	2 +	Nil	No	Good	10	14	3	G
8	34	F	43 -A	S	R	S	3	4	S	CR	1	1,2,3	8/340	9	18	2	1	0	0	0	-18	-4	-3	▲	No	Good	8	12	1	E
9	70	M	41 -A	U	L	S	5	*	S	CR	2	1,2,3	9/360	9	22	2	1	4	2	0	16	3 +	0	Nil	No	Good	8	16	1	E
10	35	M	43 -A	U	R	S	3	2.5	S	CR	2	1,2,3	9/360	10	15	2	1	0	0	0	-18	-3	0	Nil	Yes	"D"	10	12	1	E
11	80	M	41 -A	D	L	S	5	3.5	S	CR	1	1,2,3	9/360	10	30	2	2	10 +	5 +	3 +	-18	13 +	8 +	Nil	No	Good	8	18	4	S
12	45	M	41 -A	D	L	S	6	*	S	CR	1	1,2,3	9/360	10	28	2	2	3 +	0	0	18 +	10 +	5 +	Nil	No	Good	9	16	3	G
13	48	M	43 -A	D	R	S	5	*	S	CR	1	1,2,3	10/360	11	24	1	2	0	0	0	5 +	0	0	Nil	Yes	Good	10	16	1	E
14	42	F	43 -A	S	R	S	3.5	2.5	S	CR	1	1.2.3	9/360	10	16	1	1	0	0	0	-4	0		Nil	No	Good	6	14	1	E
15	62	M	43 -A	S	L	Gr-I	4	1.5	P	CR	1	1,3	9/360	10	15	1	2	0	0	0	-5	0	0	Nil	Yes	Delayed	10	16	2	G
16	58	M	41 -A	D	R	S	8.5	3	P	CR	1	1,3	9/380	11	14	2	1	5 +	0	0	-	-	-	Nil	No	Good	8	16	1	E
17	45	M	43 -A	U	L	S	4	2.5	S	CR	2	1,2,3	9 / 360	10	16	2	2	0	0	0	6 +	3 +	0	Nil	No	Good	6	13	1	E
18	58	M	41 -A	S	L	S	6	3	I	CR	1	1,3	8/360	10	18	1	2	4 +	0	0	-4	0	0	Nil	No	Good	6	13	1	E
19	60	M	41 -A	U	L	S	7	3	S	OR	2	2,3	9/360	10	12	2	1	5	0	0	-6	0	0	Nil	No	Good		14	1	E
20	50	M	43 -A	S	R	S	4.5	1	S	OR	1	2,3	8/360	9	11	1	2	0	0	0	-18	0	0	Nil	No	Good	10	13	1	E

Key to the Master chart.

“*”- Segmental fracture tibia

“I” – Isolated fracture tibia

“+” - Varus

“- “ –Valgus

“+” –Antecurvatm

“-“-Recurvatum

- 

Poller screw loosening and distal displacement.

“D”-Delayed wound healing.

Ref. No. 14290 /E4/3/2012

Govt. Rajaji Hospital,
Madurai.20. Dated: . 12.2012

Institutional Review Board / Independent Ethics Committee.
Dr. N. Mohan, M.S., F.I.C.S., F.A.I.S.,
Dean, Madurai Medical College &
Govt Rajaji Hospital, Madurai- 625020.
Convenor
grhethicssecy @gmail.com.

Sub: Establishment-Govt. Rajaji Hospital, Madurai-20-
Ethics committee Meeting- approval -regarding.

The Ethics Committee meeting of the Govt. Rajaji Hospital, Madurai was held at 10.00 am to 12.30.Pm on 10.12.2012 at the Surgery Seminar Hall, Govt. Rajaji Hospital, Madurai. The following members of the committee have attended the meeting.

1.Dr. V. Nagarajan, M.D., D.M (Neuro) Ph: 0452-2629629 Cell.No 9843052029	Professor of Neurology (Retired) D.No.72, Vakkil New Street, Simmakkal, Madurai -1	Chairman
2. Dr.Mohan Prasad , M.S M.Ch Cell.No.9843050822 (Oncology)	Professor & H.O.D of Medical Oncology(Retired) D.No.72, West Avani Moola Street, Madurai -1	Member Secretary
3. Dr.L. Santhana Lakshmi,MD Cell.No 9842593412	Associate Professor of Physiology/V.P Madurai Medical College	Member
4. Dr. Parameswari M.D (Pharmacology) Cell.No.9994026056	Director of Pharmacology Madurai Medical College	Member
5. Dr.Moses K.Daniel MD(Gen.Medicine) Cell.No 09842156066	Professor & H.O.D of Medicine Madurai Medical College	Member
6. Dr.D. Soundara Rajan,MS(Gen.Surgery) Cell.No 9842120127	Professor & H.O.D of Surgery Madurai Medical College	Member
7. Dr.Angayarkanni MD(O&G) Cell.No 9443567724	Professor & H.O.D of O&G Madurai Medical College	Member
8. Dr.P.V. Pugalenthi M.S, (Ortho) Cell.No 9443725840	Professor & H.O.D Ortho Madurai Medical College	Member
9. Dr. M. Sundarajan M.S., Mch Cell.No 9994924369 (Neuro Surgery)	Professor (Neuro Surgery) Madurai Medical College	Member
10 Thiru..Pala. .Ramasamy , BA.,B.L., Cell.No 9842165127	Advocate, D.No.72.Palam Station Road, Sellur, Madurai -2	Member
11. Thiru. P.K.M. Chelliah ,B.A Cell.No 9894349599	Businessman, 21 Jawahar Street, Gandhi Nagar, Madurai-20.	Member

The following Project was approved by the committee

Name of P.G.	Course	Name of the Project	Remarks
Dr. K. Shanmuganathan	PG in M.S Ortho, Medical College Madurai-20.	Evaluation of clinical and functional outcome of open Reduction/closed reduction with intramedullary Inter Locking Nailing with"POLLER" BLOCKING SCREWS in Proximal or Distal Metaphyseal Fractures of Tibia.	Approved

Please note that the investigator should adhere the following: She/He should get a detailed informed consent from the patients/participants and maintain Confidentially.

1. She/He should carry out the work without detrimental to regular activities as well as without extra expenditure to the institution to Government.
2. She/He should inform the institution Ethical Committee in case of any change of study procedure site and investigation or guide.
3. She/He should not deviate for the area of the work for which applied for Ethical clearance. She/He should inform the IEC immediately, in case of any adverse events pr Serious adverse reactions.
4. She/he should abide to the rules and regulations of the institution.
5. She/He should complete the work within the specific period and apply for if any Extension of time is required She should apply for permission again and do the work.
6. She/He should submit the summary of the work to the Ethical Committee on Completion of the work.
7. She/He should not claim any funds from the institution while doing the word or on completion.
8. She/He should understand that the members of IEC have the right to monitor the work with prior intimation.

Member Secretary **Chairman**

DEAN/Convenor
Govt. Rajaji Hospital,
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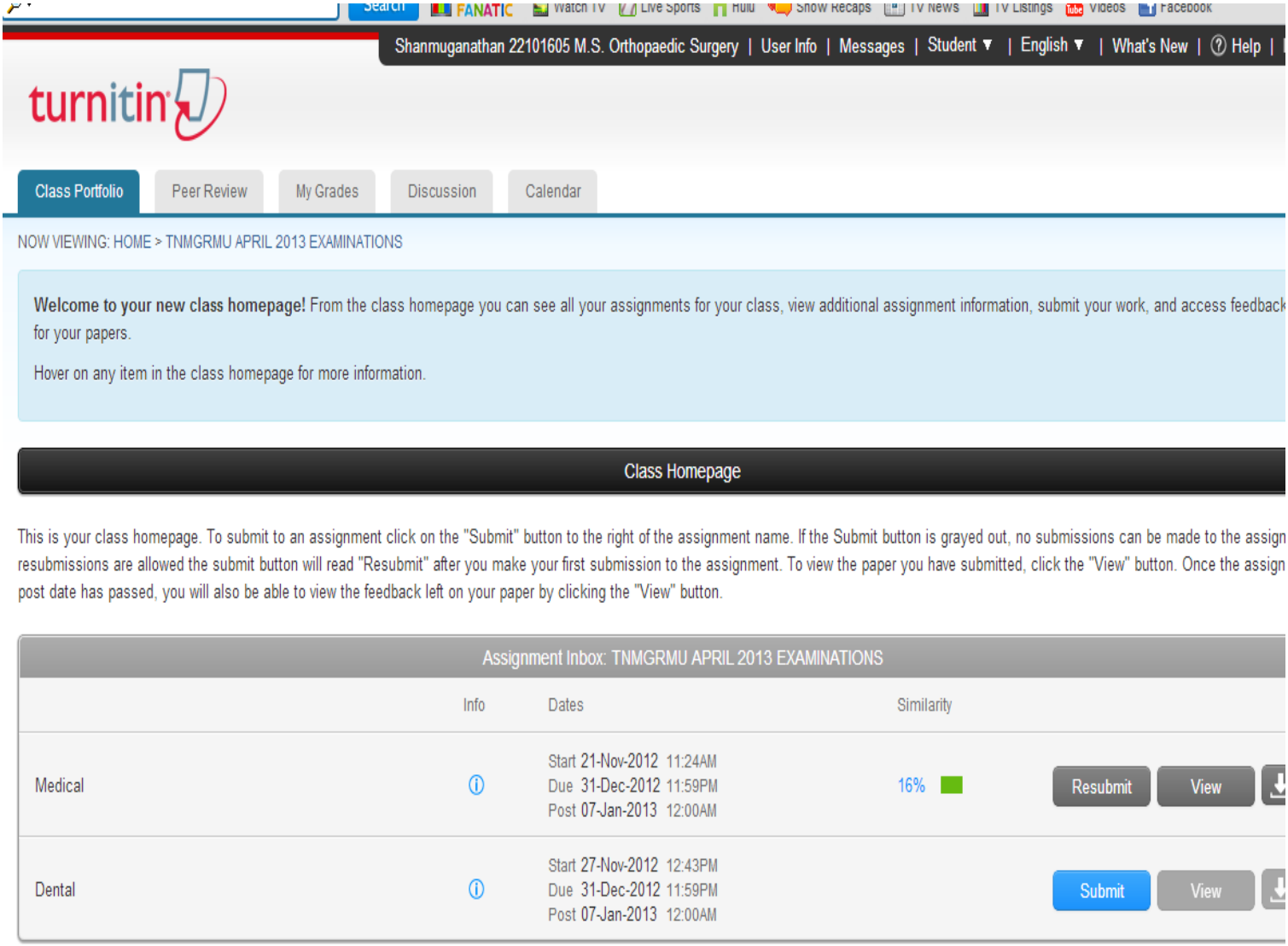
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