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Dr. Vishnu Vikraman Nair
Junior Resident, Department of
Orthopaedics, MGM Medical
College, Kamothe Navi Mumbai,
Maharashtra, India

Dr. Sarabjeet Singh Kohli
Professor, Department of
Orthopaedics, Mgm Medical
College, Kamothe Navi Mumbai,
Maharashtra, India

Dr. Nilesh Vikshwakarma
Assistant Professor, Department
Of Orthopaedics, MGM Medical
College, Kamothe, Navi
Mumbai, Maharashtra, India

Dr. Kathan Talsania
Senior Resident, Department of
Orthopaedics, MGM Medical
College, Kamothe, Navi,
Mumbai, Maharashtra, India

Functional outcome of extra-articular proximal tibia fractures treated by MIPPO

Dr. Vishnu Vikraman Nair, Dr. Sarabjeet Singh Kohli, Dr. Nilesh Vikshwakarma and Dr. Kathan Talsania

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Abstract

Introduction: Increased incidence of road traffic accidents, natural disasters, and industrial accidents claim most of human mortality and morbidity. These injuries commonly involve long bones, especially the tibia due to its subcutaneous location. Tibial diaphyseal fractures are the most common, followed by proximal tibial fractures. The treatment of proximal tibial fractures changed dramatically in 1969 following the study by Reudi and Ailgower (1) where 75% patients after internal fixation of tibia fractures were pain free and had good functional outcome at 4 years follow up. The following widespread use of internal fixation led to an increase in major complications like malunions (42%), superficial infections (20%), nonunion (18%), and osteomyelitis (17%). This led to a search for newer techniques which led to lesser soft tissue damage and yielded better results. Amongst these techniques was biological minimally invasive percutaneous plate osteosynthesis (MIPPO). In the 1990's Krettek et al popularized the Minimally Invasive Percutaneous Plate Osteosynthesis (MIPPO) technique in which conventional plates were placed through a small incision and slid through a subcutaneous tunnel. Biologically friendly plating and minimally invasive plating continues to remain popular today. This study compares MIPPO in extra articular proximal tibia fractures, in terms of functional outcome, union rate and time and the various complications associated with each group.

Aims and objectives

1. To evaluate the clinical and functional outcome in Extra-articular Proximal tibial fracture treated with Minimally Invasive percutaneous plate osteosynthesis.
2. To study range of motion at the knee joint postoperatively.
3. To study the complications, if any with Proximal tibia fracture fixation.

Inclusion criteria

1. Patients with closed extra-articular proximal tibia fractures with age of more than 18 years.
2. Both male and female patients.

The exclusion criteria

1. Fracture associated with knee dislocation
2. Pathological fractures
3. More than 6 weeks Old untreated fractures
4. No other associated lower limb fracture
5. Age more than 80 years

Results and observation: In this study we have taken follow up data of 30 patients with 25 males and 5 females. Most patients were males between 31-50 years of age. RTA was the highest reason for incidence of these fractures. Majority of patients were discharged within 10 post-operative days. Five patients developed infections which increased their hospital stay upto 16 days. On 6 weeks follow up there was only one case of nonunion out of the 30 patients, all of the 29 other fractures united within 6 weeks radiologically and clinically.

Total 30 patients were evaluated postoperatively thoroughly for functional outcome using The Knee.

Society Score which showed 24 patients (80%) had excellent and 6 patients (20%) had good objective knee society score. 23 patients (76.6%) had excellent, 5 patients (16.66%) had good and 2 patient (6.66%) were each of poor and fair functional knee society score.

Conclusion: In this study, we found that extra-articular proximal tibia fractures treated with MIPPO plating gave an excellent functional outcome with minimal soft tissue stripping and better healing of the surgical site wound. There was only one case of delayed union and this directly tells us how superior a MIPPO plating technique is in comparison to long incisions.

Keywords: MIPPO, proximal tibia, fractures, outcome, extra-articular

Introduction

Increased incidence of road traffic accidents, natural disasters, and industrial accidents claim most of human mortality and morbidity. These injuries commonly involve long bones, especially the tibia due to its subcutaneous location. Tibial diaphyseal fractures are the most common, followed by proximal tibial fractures. The treatment of proximal tibial fractures changed dramatically in 1969 following the study by Reudi and Ailgower (1) where 75%

Corresponding Author:
Dr. Vishnu Vikraman Nair
Junior Resident, Department of
Orthopaedics, MGM Medical
College, Kamothe Navi Mumbai,
Maharashtra, India

patients after internal fixation of tibia fractures were pain free and had good functional outcome at 4 years follow up. The following widespread use of internal fixation led to an increase in major complications like malunions (42%), superficial infections (20%), non-union (18%), and osteomyelitis (17%). This led to a search for newer techniques which led to lesser soft tissue damage and yielded better results. Amongst these techniques was biological minimally invasive percutaneous plate osteosynthesis (MIPPO).

The subcutaneous location of the proximal tibia, its poor blood supply and sparse muscle cover anteriorly leads to complications such as delayed union, non-union, infection and wound dehiscence, which can be challenging to tackle as a surgeon.

As these fractures are notorious to reduce, align, and stabilize, several modalities of treatment were advocated in the past. One of the most common methods used to be closed reduction and casting, followed by functional bracing. However, discouraging results led to the trend of External fixator application, which dramatically improved short term results. The long term complications, however, like pin tract infections, frame failure, mal-union, non-union, compartment syndrome, and the necessity of secondary procedures diverted many surgeons away from the external fixator route. In the late twentieth century ring fixator was invented by Prof. Gavril A. Ilizarov, which proved to be very useful in treating these fractures. However, they had their own problems like high learning curve, pin tract infection, knee stiffness etc. To achieve union many procedures are recommended such as closed reduction and cast, open reduction and internal fixation, intramedullary nailing, hybrid or ring external fixation

In the 1990's Krettek *et al.* popularized the Minimally Invasive Percutaneous Plate Osteosynthesis (MIPPO) technique in which conventional plates were placed through a small incision and slid through a subcutaneous tunnel. Biologically friendly plating and minimally invasive plating continues to remain popular today.

IM Nailing frequently results in misalignment, melanin and pain in the knee. While tibial plating provides the benefit of anatomic reduction, it is associated with the risk of wound dehiscence and infection because of the relative lack of soft tissue cover.

This study compares MIPPO in extra articular proximal tibia fractures, in terms of functional outcome, union rate and time and the various complications associated with each group.

Aims and objectives

To evaluate the clinical and functional outcome in Extra-articular Proximal tibial fracture treated with Minimally Invasive percutaneous plate osteosynthesis.

To study range of motion at the knee joint postoperatively.

To study the complications, if any with proximal tibia fracture fixation.

Review of literature

1. In a Cadaveric study by Farouk, O., ^[1] in 1997 The results of this preliminary study demonstrate that the conventional lateral plating technique disrupts the blood supply, essential for fracture healing, more than a minimally invasive approach using a percutaneously inserted plate. This improved blood supply may translate into improved rates of union, decreased rates of grafting, and decreased incidences of non-union, refracture, and infection. Further clinical study of the MIPO technique is

necessary to establish its indications and efficacy in treating fractures of the tibia or other long bones.

2. In a study by Stephen M Black ^[2] in January 2006, MIPPO is to be a highly useful technique which not only aids in screw hole location but also significantly reduces the operation time and the use of intra-operative fluoroscopy. The proximal holes can be located in thin patient by palpation through the skin. A similar sized LCP placed over the skin helped localise the hole in the inserted plate (Mirror plate technique). Only in an overweight or obese patient, was C-arm assistance necessary to localise the locking hole.
3. In 1984, Olerud and Molander ^[3] developed a scoring system to counter the inevitable difficulty in comparison of such studies, and made a system that tested against a linear analogue scale, the limitation in range of motion against loaded dorsal extension, the presence of osteoarthritis and the presence of dislocations on radiographs. This led to even minor subjective difficulties faced by patients to be significantly separated, and allowed for much easier and more scientific comparison of results presented by different authors.
4. In a literature by Michael Wagner in 2003 ^[4]. The internal fixation of bone fractures or osteotomies with the LCP system will be the new standard for fixation with plates and screws from the AO/ASIF. This new plate and screw system uniquely combines the benefits of both the conventional technique (compression method) and of the bridging the fracture zone in the MIPO technique. (Internal fixator method). Using the LCP in the conventional technique (compression method principle of absolute stability), it is similar to the technique using standard plate and screw system. In the bridging, we use the LCP in the internal fixator method (principle of relative stability) with locking head screws. Using these different principles of fracture treatment leads to different types of fracture healing.
5. In a study by Borg, T, In. 2003 ^[5] their conclusion was Percutaneous plating of fractures in the proximal tibia is a relatively atraumatic procedure, and a good alignment can be achieved. Fixation with long titanium plates allows postoperative weight-bearing, and most patients return early to pain-free walking without external support. Stress-induced pain around the plate after fracture healing requires plate removal in some patients. An advantage over nailing methods is that the knee is uninjured by the surgery.

The mechanisms of injury resulting in proximal metaphyseal tibial fractures usually are of high energy injury and they not only create complicated comminuted fractures but also extend the injury to soft tissues. So open reduction and internal fixation of these fractures were associated with wound dehiscence, skin sloughing, mansion, infection, implant failure. Further in patients with soft tissue dehiscence and infection leading to osteomyelitis 16.6% had amputation. Hansmann from Hamburg did the first plate osteosynthesis in the year 1886. During the 1950's the AO / Association for the Study of Internal Fixation standardized the use of plating systems. Then the main goal of fracture treatment was to restore the function of the injured limb by providing the bone with primary strength through stable internal fixation. This resulted in a decrease of limb deformities and joint stiffness. The original AO/ASIF technique was based on the compression principle using plates and screws. The dynamic

compression plates provided axial compression of the fracture. Thus perfect fracture reduction and compression using lag screws resulted in primary bone healing without visible callus. So, even the smallest fragments were reduced to restore the exact anatomy, often damaging the vitality of bone and soft tissues. This highly traumatic technique ultimately resulted in delayed bone healing, nonunion, and increased chances of infection.

This led to a change over from the concept of absolute stability to a newer concept of bridge plate which provides relative stability. The smaller fracture fragments are left untouched and bridged by anchoring the plate only to the proximal and proximal main fragments. Lag screws are not used to achieve inter fragmentary compression. Hence the fracture unites by secondary bone healing with the production of thick external callus.

Preserving the circulation at the fracture zone was the main concern than achieving anatomical reduction and stable fixation. Ganz named this newer technique as biological plate osteosynthesis.

This indirect reduction technique with bridging stabilization did not expose the fracture site and hence was less traumatic and more biological resulting in good bone and soft tissue healing.

Materials and Methods

Type of study

Prospective

Time of study

From January 2020 to March 2020

Place of study

Department of orthopaedics, Mahatma Gandhi Mission's medical college and hospital, Navi Mumbai

Sample size

30

Source of data

The data will be obtained from patients getting admitted to MGM hospital NAVI MUMBAI.

Inclusion criteria

1. Patients with closed extra-articular proximal tibia fractures with age of more than 18 years.
2. Both male and female patients.

The exclusion criteria

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2. Pathological fractures
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Discussion

In this era, high velocity trauma and industrial accidents lead to increased number of tibia fractures. Tibial metaphyseal fractures are still a huge topic of debate among orthopedic surgeons [6]. Diaphyseal tibial fractures are comparatively easier to manage and unite in comparison to metaphyseal proximal tibia fractures. Prompt diagnosis, thorough pre-operative assessment of the bony and soft tissue trauma [7, 8], adequate soft tissue monitoring and resuscitation, anatomic reduction and sound fixation allowing early joint movement

and intensive rehabilitation [9] are mandatory for good clinical results [10, 11]. Cancellous bone supply is one of the major reasons due to which the nonunion rates are very less in proximal tibia fractures. Incidence of infection/wound dehiscence/malunion/early arthritis up to 20-50% esp. in high energy cases [12] have been reported.

Over time we have seen that the locking construct of the locking plates was sometimes too stiff to allow any motion at the fracture site becoming a nonunion generator. In addition, newer techniques such as "hybrid" plating (use of both locking and non-locking screws in a single construct) and far cortical locking (obtaining purchase in far cortex while bypassing proximal cortex) have evolved to combat these problems sometimes seen with locking.

Results and observation

In this study we have taken follow up data of 30 patients with 25 males and 5 females. Most patients were males between 31-50 years of age. RTA was the highest reason for incidence of these fractures. Majority of patients were discharged within 10 post-operative days. Five patients developed infections which increased their hospital stay upto 16 days. On 6 weeks follow up there was only one case of nonunion out of the 30 patients, all of the 29 other fractures united within 6 weeks radiologically and clinically.

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