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Minimally Invasive Plate Osteo Synthesis (MIPO) For Proximal Fractures of The Tibia: A Biological Approach

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Abstract

Introduction: Proximal tibial fractures constitute a grossly heterogeneous group of bony injuries. Inevitably, their management varies and depends mainly on the fracture pattern and the condition of the surrounding soft tissues.

Objectives: To study functional outcome of fracture proximal tibia treated with upper tibial anatomical plate with Minimal invasive plate osteosynthesis.

Methodology: The study included 25 cases of fracture of proximal tibia presenting to the emergency. The results were compiled and analyzed using Rasmussen Clinical Assessment Score.

Results: Our results in minimally invasive percutaneous plate osteosynthesis technique is in par with the literature. There is no significant difference in the functional outcome between single plating in our study and dual plating of other studies at midterm follow up. Choice of the procedure/implant should be based on the fracture pattern, bone quality and intraoperative fracture reduction.

Discussion: Intraarticular tibial plateau fractures are complex fractures accounting for about 1.2% of all fractures. They affect knee function and stability which results in considerable morbidity. These fractures are caused by high velocity injuries and often associated with severe comminution and soft-tissue damage. The goals of treatment are to restore joint congruity, limb alignment and early mobilization of joint.

Conclusion: Stable internal plate fixation without damaging the soft-tissue envelope is very difficult to achieve, only fair results are seen in 20% to 50% in these fractures.

Keywords: Anatomical plate, Intraoperative fracture reduction, Minimal invasive plate osteosynthesis, Proximal tibial fracture, Tibial plateau fractures

Introduction

Proximal tibial fractures constitute a grossly heterogeneous group of bony injuries. Inevitably, their management varies and depends mainly on the fracture pattern and the condition of the surrounding soft tissues. Modifications and improvements of intramedullary nailing techniques have contributed to its establishment as reliable treatment option for the management of extra-articular proximal tibial fractures.1 Minimally-invasive plate osteosynthesis (MIPO) with new locking plates is mostly used now–a–days for the management of intra- and extra-articular fractures of the proximal tibia. Preservation of soft tissue, fracture hematoma and periosteal compression are the key to good results in proximal tibial fracture management.[2] Indirect reduction technique was introduced by Mast et al. (1989)3 and others. It was an attempt to decrease surgical dissection by relying on ligamentotaxis, blind repositioning of fragments, reduction aids such as the distractor and other methods to maintain soft tissue integrity and preserve bony perfusion. Krettek et al. (2001)4 popularized minimally invasive plate osteosynthesis techniques [MIPO] using conventional implants placed through small incisions and sub muscular tunnels. Minimally invasive techniques avoid the long incisions and extensive soft tissue stripping which are associated with conventional techniques. The preservation of periosteal blood supply allowed by MIPO offers a clear biological advantage over traditional plating, because it reduces iatrogenic damage to surrounding soft tissues.[5] High energy complex tibial condyle fractures being intra-articular are usually associated with injury to ligaments, capsule, and other soft tissues around the joint.[6] non-operative procedures like cast, braces, or traction are complicated by intrinsic risks of poor functional results and extended hospital stay. The angle-stable interface between the screws and the plate allows placement of the plate without any contact to the bone with the advantage of preserving the periosteal blood supply and bone perfusion. Thus, there is significantly less soft tissue dissection resulting in the preservation of the hematoma and local blood supply that enhances the healing of the fracture.[7]

Objectives

Study Functional outcome of fracture proximal Tibia treated with upper Tibial anatomical plate with Minimal invasive plate Osteosynthesis.

Methodology

This study was carried out prospectively in the Department of Orthopaedics, Sardar Patel Medical College and Associate Group of Hospitals Bikaner with 25 cases of fracture of proximal tibia presenting to the emergency. The results were compiled and analyzed using Rasmussen Clinical Assessment Score.

In this prospective study we included both male and female patients between age groups 20 to 60years with closed tibial fractures with varying degrees of displacement and comminution up to 14 days old fracture and were ready to give consent were included in the study.

All patients were evaluated clinically and radiologically before and after surgery, followed up at a regular interval for 6 months postoperatively.

.Patients attending Trauma casualty were undergone for primary survey and patient categories according to triage system in Green, Yellow and Red from severity of the patients. Selection of patients were done randomly according to the criteria mentioned above. Patient was considered for operation once swelling and pain subsided. Until then Groin to toe posterior slab was applied or if necessary, patient's limb was kept on Bohler

Braun Splint and sometimes distal tibial skeleton traction was also used along with analgesics.

A complete and thorough examination of the patient along with the associated injuries was performed. The neurovascular status of the limb was assessed. The necessary x-rays (AP/Lat/Oblique) and CT scans were done whenever required.

Patient's Intravenous sample was taken for various tests e.g. Complete Blood Counts, Fasting Blood Sugar, Liver Function Test, Renal Function Test, Viral Markers (HIV, HBsAg, HCV). After all routine investigations patient was undergone for pre-aesthetic check-up. Intravenous fluids, analgesics, and antibiotics were administered as per protocol. Tetanus prophylaxis as per requirement was administered. During Surgery the patient was placed in the supine position and a sponge pack/sandbag was kept under the ipsilateral gluteal region in order to prevent external rotation of the lower limb. A pneumatic tourniquet was applied. The affected limb was scrubbed, paint with povidone iodine and draped aseptically.

Before surgery, the appropriate length of precontoured plate was checked. The fractures were temporarily reduced with or without a distractor and a bone reduction forceps and K-wire. If necessary, the intraarticular fracture was reduced and fixed with screws. A 4-5cm linear incision over anterolateral aspect of proximal tibia wasmade. A 2-3-cm incision over the distal end of the plate was also given.

A submuscular plane of the lateral side was developed under the anterior compartment muscles and the selected plate was slid under the muscles. To prevent malalignment of the plate on the shaft of the tibia, the plate was control by working through these two incisions and assistance was temporarily provided by percutaneous K-wires through screw holes at each end. The fracture site was not exposed and anatomic reduction of individual fragments was performed. The location of the plate was evaluated by fluoroscopy in the coronal and sagittal planes.

Two Post-operative X-rays were taken at right angled. Patients were started with Quadriceps exercises and active toe movements were started as soon as spinal anaesthesia effect weaned off.

The patients were regularly follow-up on an OPD basis and were assessed both clinically and radiologically. Patients were allowed partial weight bearing from one month of surgery in stable fracture pattern and increased weight-bearing thereafter on the subsequent follow-ups.

All long-term complications like non-union, malunion, angular deformity, implant breakage, shortening, or infection were recorded. The patients were under follow up to 6 months.

Patients were regularly followed up on the OPD basis at 1.5,3,6 months. Partial weight bearing started at 4th week, post operatively and full weight bearing started at 12th week post operatively.

Final assessment of the cases was done after 6 months on the basis of Clinical outcome. Analysis of functional score using Rasmussen Clinical Assessment Score.

Discussion

Intraarticular tibial plateau fractures are complex fractures accounting for about 1.2% of all fractures.[8] They affect knee function and stability which results in considerable morbidity. These fractures are caused by high velocity injuries and often associated with severe comminution and soft-tissue damage. The goals of treatment are to restore joint congruity, limb alignment and early mobilization of joint.[9-11] Stable internal plate fixation without damaging the soft-tissue envelope is very difficult to achieve,[12] only fair results are seen in 20% to 50% in these fractures.[13] Open reduction and internal fixation (ORIF) with plates and screws enables

direct fracture visualization, reduction, and fixation, but there is high risk of soft tissue injury, stiffness and deep infection.[14] The hybrid external fixator avoids soft tissue problems, but risks malalignment, pin tract infections and poor patient compliance.[15] The concept of preserving the blood supply and atraumatic surgical technique led to the development of biological fixation techniques. Using this technique, soft tissue damage is reduced and shows higher union rate.[16-19] The development of locking implants has allowed the use of minimally invasive technique for unilateral plating[16] with improvementin handling the soft tissue.[20] Laterally placed locking plates provide better stability in the presence of complex proximal 1/3rd tibia fracture with metaphyseal comminution and serves as an alternative to medial plate or external fixator for additional support of the medial column when a non-locking plate is used for bicondylar fractures.[21,22] This plate allows fixation through single incision which avoids wound dehiscence, infection and prolonged immobilization associated with extensile approaches.[23-26] MIPPO enables indirect fracture reduction and percutaneous sub muscular implant placement.[99] Favourable outcome is not due to MIPPO but due to less extensive dissection of soft-tissue envelope and devitalisation of fracture fragments.

Mean time of hospital stay was from admission to surgery was 8 days, surgery to discharge 7 days, total stay in hospital mean was 14 days. We have evaluated the patients using Rasmussen score which is a subjective score. All these fractures were treated by plate either medial or lateral (23 lateral and 2 medial). In case of type V and type VI fractures, if needed the opposite condyle was fixed with percutaneous cancellous screws. mean Rasmussen score was found to be 26.24 and average range of knee flexion was found to be 120.8 degrees. Of which thirteen patients had excellent, eleven had good results and only one had fair results. This is comparable with both of Hasnain Raza et al and Mohamed Abd Allah El-Soufy et al. Choice of the procedure/implant should be based on the fracture pattern, bone quality and intraoperative reduction.

Conclusion

Our results in minimally invasive percutaneous plate osteosynthesis (MIPO) technique are in par with the literature. Choice of the procedure/implant should be based on the fracture pattern, bone quality and intraoperative fracture reduction.

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Legend Figures and Tables

Fig. 1: Pre-operative X-Ray

Fig. 2: Post-Operative X-Ray

Fig. 3: Minimal skin incision for Proximal Tibia Fracture

Table 1: Distribution of cases according to affected side

Age Group	Affected Side			
	Male (N=22)		Female (N=3)	
	Right	Left	Right	Left
20–30	4	4	0	1
31–40	2	6	0	2
41–50	5	1	0	0
Total	11	11	0	3
Percentage	50	50	0	100

Table 2. Rasmussen Clinical Assessment Score

Rasmussen Score	No. of patients	Percentage
Excellent (27-30)	13	52
Good (20-26)	11	44
Fair (10-19)	1	4
Poor (<10)	0	0
Total	25	100