

Clinical and Radiological Evaluation of Patients of Proximal Tibial Fractures Treated with Long Proximal Tibial Locking Plate by Minimally Invasive Plate Osteosynthesis Technique

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Abstract

Introduction: Treatment of proximal tibial fractures is challenging because of limited soft tissue cover and less vascularity. Open reduction and internal fixation with plate can result in extensive devitalization of soft tissue leading to wound healing problems. Minimally invasive plate osteosynthesis (MIPO) is a new technique which is becoming widely accepted for treatment of periarticular fractures.

Aims and Objectives: To evaluate functional and radiological outcome in proximal tibial fractures treated with MIPO.

Materials and Methods: In this, 32 patients of proximal tibial fractures with diaphyseal extension or comminution were included. These fractures were treated with long proximal tibia locking plate by MIPO technique. They were followed up to 1 year post-operatively for assessing function and radiological outcome using modified Rasmussen's functional and radiological scores, respectively.

Results: This study included 32 patients of proximal tibia fractures treated with MIPO technique. Of the 32 case, 12 patients (37.5%) had excellent result, 14 (43.75%) had good, four (12.5%) were fair, while two (6.25%) had poor function outcome. For the radiological assessment, there were three patients (9.37%) with excellent result, 24 (75%) with good, three (9.37%) with fair, while two (6.25%) with poor result.

Discussion: Proximal tibial fractures are seen in high energy trauma which is associated with soft tissue injury and sometimes neurovascular injuries too. MIPO technique maintains a biological favorable environment for healing by reducing soft tissue trauma caused by surgical exposure.

Conclusion: Treatment by MIPO technique after improvement of the soft tissue condition gives good results from radiological as well as functional point of view. The use of long plates spanning the length of the fracture also gives adequate stability to allowing for fractures union and soft tissue healing.

Key words: Biological plating, Fractures, Minimally invasive plate osteosynthesis technique, Proximal tibia

INTRODUCTION

Treatment of proximal tibial fractures is challenging because of limited soft tissue cover and less vascularity. There are

various treatment options for these fractures starting from closed reduction with casting to open reduction and internal fixation with plate. Open reduction and internal fixation with plate can result in extensive devitalization of soft tissue leading to wound healing problems. In our study, we managed these fracture by minimally invasive plate osteosynthesis (MIPO) technique with plates.

MIPO is a new technique which is becoming widely accepted for treatment of periarticular fractures in which we reduce and stabilize the fracture without opening the fracture site with minimum incision, providing a favorable

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environment for fracture healing, which is also called as biological fixation.

Aim and Objectives

1. To evaluate functional outcome in proximal tibial fractures treated with minimally invasive plate osteosynthesis
2. To evaluate radiological outcome in proximal tibial fractures treated with minimally invasive plate osteosynthesis.

MATERIALS AND METHODS

This prospective study was conducted from May 2015 to June 2017. In this, 32 patients of proximal tibial fractures with diaphyseal extension or comminution were included. Open fractures, fracture with neurovascular injury, pathological fracture, and fracture in immature skeleton were excluded. Fracture was classified by Schatzker Classification.

After written informed consent, patients were operated under spinal anesthesia. Tourniquet was applied to upper thigh. Tibial incisions taken are proximal and distal to fracture site. Reduction was achieved by indirect reduction techniques with help of pointed reduction forceps, external fixator in some cases. Long plate slid through tunnel spanning entire length of the fracture. Each side fixed with minimum six cortices. Wound closed in layers. Intravenous antibiotics were given 1 pre-operative and 5 post-operative days. Static quadriceps and ankle range of motion exercises started first post-operative day and knee range of motion started from second post-operative day onward. Post-operative X-ray taken on day 2 and patients were discharged after 6 days. All patients were followed up after 15 days for suture removal, 1 month, 6 weeks, 3, 6, 9, and 12 months. X-rays were taken at each follow-up and union was assessed. Function outcome was assessed using modified Rasmussen criteria for clinical assessment and radiological outcome was assessed using modified Rasmussen criteria for radiological assessment.

RESULTS

In our study, 32 patients of proximal tibia fractures were included and treated with MIPO technique after indirect reduction of fractures. There were 10 females and 22 males with mean age of 45.12 years. Right tibia was involved in 19 cases while left was involved in 13 cases. Ten patients had intra-articular fractures, and 22 had extra-articular proximal tibial fractures. Mean time for operation was 8 days, delay attributed to skin and soft tissue conditions. Mean operative time was around 67 min. Radiological union was achieved in all cases with a mean for union

being 18 weeks. All patients were followed for minimum period of 1 year for functional assessment. There were 2 superficial wound infections which resolved after debridement and intravenous antibiotics.

Radiological and functional results were classified in four categories as per modified Rasmussen criteria. Of the 32 case, 12 patients (37.5%) had excellent result, 14 (43.75%) had good, four (12.5%) were fair, while two (6.25%) had poor function outcome. For the radiological assessment, there were three patients (9.37%) with excellent result, 24 (75%) with good, three (9.37%) with fair while two (6.25%) with poor result (Tables 1-4) and (Figure 1).

DISCUSSION

Proximal tibial fractures are seen in high energy trauma which is associated with soft tissue injury and sometimes

Table 1: Modified Rasmussen criteria for clinical assessment

| Parameters | ??? |
|-----------------------------------------------|-------|
| Pain | |
| None | 6 |
| Occasional | 5 |
| Stabbing pain in certain position | 3 |
| Constant pain after activity | 1 |
| Significant rest pain | -3 |
| Walking capacity | |
| Normal walking capacity for age | 6 |
| Walking outdoor for more than 1 h | 5 |
| Walking outdoor 15 min to 1 h | 3 |
| Walking <15 min | 1 |
| Walking indoor only | 0 |
| Wheelchair or bed ridden | -3 |
| Knee extension | |
| Normal | 4 |
| Lack of extension <10° | 2 |
| Lack of extension >10° | 0 |
| Lack of extension >20° | -2 |
| Total range of motion | |
| Full | 6 |
| At least 120° | 5 |
| At least 90° | 3 |
| At least 60° | 1 |
| <60° | -3 |
| Stability | |
| Normal stability in extension and 20° flexion | 6 |
| Abnormal stability in 20° flexion | 4 |
| Instability in extension <10° | 2 |
| Instability in extension >10° | 0 |
| Power of quadriceps | |
| Grade 5 | 2 |
| Grade 3-4 | 1 |
| Grade <3 | -2 |
| Maximum score | 30 |
| Excellent | 28-30 |
| Good | 24-27 |
| Fair | 20-23 |
| Poor | <20 |

Table 2: Modified Rasmussen criteria for radiological assessment

| Parameters | ??? |
|-------------------------|------|
| Articular depression | |
| None | 3 |
| <5 mm | 2 |
| 6-10 mm | 1 |
| >10 mm | 0 |
| Condylar widening | |
| <5 mm | 2 |
| 6-10 mm | 1 |
| >10 mm | 0 |
| Varus-valgus angulation | |
| None | 3 |
| <10° | 2 |
| 10° to 20° | 1 |
| >20° | 0 |
| Osteoarthrosis | |
| None/no progress | 1 |
| Progression by 1 grade | 0 |
| Progression by >1 grade | -1 |
| Maximum score | 10 |
| Excellent | 9-10 |
| Good | 7-8 |
| Fair | 5-6 |
| Poor | <5 |

Table 3: Clinical assessment by modified Rasmussen criteria

| Clinical result | Number of cases (%) |
|-----------------|---------------------|
| Excellent | 12 (37.5) |
| Good | 14 (43.75) |
| Fair | 4 (12.5) |
| Poor | 2 (6.25) |
| Total | 32 (100) |

Table 4: Radiological assessment by modified Rasmussen criteria

| Clinical result | Number of cases (%) |
|-----------------|---------------------|
| Excellent | 3 (9.37) |
| Good | 24 (75) |
| Fair | 3 (9.37) |
| Poor | 2 (6.25) |
| Total | 32 (100) |

neurovascular injuries too. Proximal fractures extending into diaphysis involves a lot of soft tissue injury. Open reduction and internal fixation of such fractures with plates can achieve good anatomical reduction but causes extensive periosteal stripping along with soft tissue dissection and drains the fracture hematoma;¹ thus, compromising the blood supply of fracture fragments and resulting in complication such as infection (8.3-23%)^{2,3} delayed unions, nonunion (8.3-35%),^{4,6} and wound healing problems leading to multiple surgeries.



Figure 1: Fracture of proximal tibia fixed with long proximal tibia locking plate with good anatomical reduction by minimally invasive plate osteosynthesis technique

This mechanical concept of fixation by absolute stability is being replaced by the new biological concept of indirect reduction and relative stability using minimally invasive approach.⁷

MIPO technique maintains a biological favorable environment for healing by reducing soft tissue trauma caused by surgical exposure.⁸ However, MIPO technique does not allow reduction by direct vision so intraoperative fluoroscopy is necessary for achieving good reduction and alignment.⁹

In this study, the average time for union was 18 weeks which is comparable to other studies on MIPO plating.¹⁰⁻¹² Excellent to good outcome seen in 24 (81.25%) patients, which is comparable to similar other studies conducted by Rambold (93%), Seppo (86%), and Joseph Schatzker (86%).¹²

CONCLUSION

Fractures of the proximal tibia are the result of high-energy trauma. They involve a lot of soft tissue injury. This compromised soft tissue condition should be considered while treating them. Treatment by MIPO technique after improvement of the soft tissue condition gives good results from radiological as well as functional point of view. The use of long plates spanning the length of the fracture also gives adequate stability to allowing for fractures union and soft tissue healing.

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