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A prospective study on functional outcome of distal tibia fracture treated with minimally invasive technique using locking compression plate

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Abstract

Background and Aim: Distal third tibia fractures accounts for about 7-9% of all lower extremity fractures. The treatment of distal tibia fractures is challenging, because of limited soft tissue coverage and poor vascularity. In the present study our aim is to assess the clinical and functional outcome of distal third tibia fractures treated by Minimally invasive percutaneous plate osteosynthesis.

Materials and Methods: A total of 40 patients with distal tibia fracture was treated in this study from December 2018 to January 2020. TWS Scoring system was used to evaluate the functional outcome.

Results: Majority of the study population (21, 52.5%) were belonging to the excellent outcome category, followed by good category among (14, 35.0%).

Discussion: MIPPO technique offers biological advantage by preserving periosteal blood supply and it provides good stability to fracture site. Complication rate is less compared to other procedure.

Keywords: Distal tibia fractures, MIPPO – minimally invasive percutaneous plate osteosynthesis, TWS-teeny & wiss score

Introduction

Distal tibial fractures are one of the most common lower limb injuries that occur as a result of high velocity insult [1]. About 10-13% of fractures of Tibia, occur in its distal aspect with associated soft tissue loss. The involvement of articular surface, soft tissue injury and compromised vascular supply account for the morbidity due to distal tibial fractures [2,3].

Effective management of distal tibial fractures are of high demand these days, probably due to the rising trend of high velocity injuries, most commonly the road traffic accidents. The treatment plan and prognosis depend on the pattern or complexity of the fracture, associated soft tissue damage and bone quality [4].

Distal tibial fractures are difficult to reduce and stabilize owing to their inadequate soft tissue coverage and precarious vascular supply. The classic osteosynthesis by metallic plated, intramedullary osteosynthesis or external fixation were observed to result in more post-operative local complications like non-union, mal-union, infections, delayed healing etc [5].

After analysing various studies done to assess the outcomes of distal tibial fractures, we have observed that Minimally Invasive Percutaneous Plate Osteosynthesis (MIPPO) has been widely practiced recently to treat fractures involving the shafts of long bones due to its procedural benefits and better clinical outcomes. [6-8] The technique gained its popularity due to reduced soft tissue disruption, conservation of hematoma at the fracture site and conservation of vascular supply to fracture fragments.

In this technique, distinct above and below incisions to the fracture site were made to insert the plate percutaneously. This technique includes limited opening reducing and internally fixing of displaced fracture fragments done through small incisions, followed by MIPPO of tibia using various commercially available plates [9,10].

Minimally invasive techniques are superior in excluding disruption of soft tissues and unwanted periosteal stripping when it comes to distal tibia fracture management. However, complications like non-union, malunion, wound infection, delayed union etc are also commonly seen in patients managed using these techniques [11].

Methodology**Study Subjects**

Patients with distal tibia fracture (both intra and extra articular) presenting to the emergency room in Shri Sathya Sai Medical College and Research Institute, Ammapettai were involved in this study.

Study Design

Prospective Descriptive study.

Study Setting

Department of Orthopaedics, Shri Sathya Sai Medical College and Research Institute, a Tertiary Care Hospital, Ammapettai in Chengalpattu District.

Department of Orthopedics, Shri Sathya Sai Medical College and Research Institute, A Tertiary Care Hospital, Ammapettai in Chengalpattu District.

Sampling Procedure

Sampling was done conveniently among patients who present to emergency room with distal tibia fractures and giving a valid consent for willingness towards surgery.

Inclusion Criteria

- i. Age group of the study: 18 to 60 years of age.
- ii. All cases of distal tibia fractures.
- iii. Both sexes

Exclusion Criteria

- i. Fracture treated with native management.
- ii. Pathological fractures.
- iii. Polytrauma.
- iv. Segmental fractures.
- v. Severe medical comorbid conditions.

Sample Size

Sample size calculations were done based on previous studies, prevalence value is 90%.

36 patients in the study with 10% considerable dropouts, sample size was 40. $n = 4Pq/L^2$ Where P is 90%, q is 100-90 = 10, L is Precision error 10%

$$n = \frac{4 \times 90 \times 10}{10^2}$$

$$n = \frac{3600}{100}$$

$$n = 36 \text{ (10\% non-response error)}$$

$$n = 36 + 3.6 = 39.6$$

$$n = 40$$

Study Procedure

Collection of data of patients presenting with distal tibia fractures are the history, clinical examination, Investigations which were necessary for anaesthetic fitness and radiological investigations like X-ray & CT plain of Tibia and its distal articulating surfaces. And the requirements for surgery such as Cortical screw, cancellous screw and locking plate. Post Operative treatments including routine antibiotics and analgesics, evaluation by xrays and physiotherapy and functional rehabilitations.

Evaluation of outcome

Patients were clinically and radiologically evaluated during post operative follow up period using Teeny & Wiss criteria.

Ethical consideration

Institutional Ethical Committee approval was obtained before the start of the study. Informed and written consent form each participant was obtained.

Study Period: 18 months

September 2018 – IRC & IEC approval.

December 2018 to June 2020 – Data Collection (18 months)

July 2020 to October 2020 – Write up and submission.

Statistical Methods**Descriptive Statistics**

Numerical variables like age, time from injury to surgery, time for union and TWS score are represented in mean, median, mode and standard deviation. Categorical variables like gender, side of involvement, mode of injury, presence of skin necrosis and complications and outcome grading are represented in frequencies and percentages. Pie-charts and bar diagrams are used as appropriate.

Inferential Statistics

When a Numerical variable is associated with the Numerical variables such as Pearson's correlation test is used after checking for normality. When a Categorical Variable is associated with a categorical variable, the variables are represented in both by tables and bar diagrams. For test of significance, chi-square test is used. Fisher's exact test is used when more than 20% of the cell values have expected cell value less than 5. The cell values while for applying chi square and fisher's exact test were very low. P-values less than 0.05 were considered statistically significant. Data was entered in MS excel sheet and analysed using SPSS software version 16.

Results

Age: The mean age and SD of the study population is 40.45 and 8.64 respectively. The median and mode of the study population are 40 and 45 respectively. The minimum and maximum values of age of the study population was 24 and 60 respectively. Majority of the them, 17 were belonging to 31-40 age category followed by 41-60 category among 13.

Gender and Side of Involvement: Of the study population, 21 were males and 19 were females. 25 were having involvement of the right side and 15 were having involvement of the left side. The most common cause of the injury is road traffic injury among 32.

Time between injury and surgery: The mean time interval between the time of injury and surgery in days and standard deviation are 3.6 and 1.99 respectively. The median and mode of the time interval between injury and surgery are 3 and 2 respectively. The minimum and maximum values of the time interval between time of injury and surgery are 1 and 10 respectively.

Time taken for union: The mean time taken for union in weeks and SD are 15.7 and 2.5 respectively. The median and mode of the time taken for union in weeks are 15 and 15 respectively. The minimum and maximum values of the time taken for union in weeks are 1 and 10 respectively.

Complications: Of the study population, 3 developed skin necrosis and infection. Among the study population only one developed associated complication.

Teeny & Wiss score: The mean SD of TWS are 90.85 and 7.54 respectively. The median and mode of the TWS score are 93.5 and 95 respectively. The minimum and maximum values of the TWS are 69 and 99 respectively. Majority of the study population 21 were belonging to the excellent outcome category, followed by good category among 14.

Correlation and association: When age, time taken between injury to surgery in days and time taken for union in weeks were correlated with TWS score. All the variables were showed significant negative correlation with p-value less than 0.001. The cell values while for applying chi square and fisher's exact test were very low. In spite of the gender and side of involvement did not show any significance. However, the mode of injury was associated.

Discussions

The sole purpose of the study is to assess the time taken for union, outcome of functionals and complications in a patient with distal tibia fractures. And also the successiveness of the minimally invasive techniques using locking compression plates [16].

The main objective of our study series was to evaluate the clinical / functional outcome, post-operative complications, duration for healing/union of distal tibial fracture and effectiveness of the treatment using the minimally invasive techniques.

With the practice of minimally invasive techniques for the management for fractures of distal 1/3rd tibia, the iatrogenic impairment to blood supply of the bone was observed to be greatly reduced. Hence the blood supply of extra-osseous part of the bone was preserved and so was the haematoma at fracture site. Thus this technique proved to be physiologically friendly resulting in faster and stable fixation.

This prospective study series involved 40 patients who presented to the emergency room with distal 1/3rd tibia fractures at Orthopaedics Department, Shri Sathya Sai Medical College and Research Institute, Chengalpattu District, Tamil Nadu. The eligible patients were treated using MIPPO with LCP. The patients were then evaluated using Teeny & Wiss criteria in the post-operative follow-up period to assess their functional outcome [12].

While comparing the mean age of patients presenting with distal Tibial fractures, we found that, ranging between 23 and 70 years of age. [17] The study also observed that the most common age of presentation of the fracture was 31-40 years of age. These observations were in par with the study conducted by Cory collinge *et al.* Thus observing these previous study series conducted by various study groups, we concluded that middle-aged adults were more prone for distal tibial fractures [13].

In our study, there were 21 male patients (52.5%) and 19 female patients (47.5%). Most patients, 25 patients (62.5%) presented with injury to right tibia while 15 patients (37.5%) had injury of the contralateral side [15]. Most patients, 32 patients (80%), included in the study had history of high velocity injury caused by road traffic accidents [14].

Our observations were quite comparable to the ones made by JJ Guo *et al.*, in which they observed a male predominance of 50%; Mauffrey C *et al.*, with male predominance of 66% and Somasekhar *et al.* with male predominance of 75%. Male

dominance over females in areas of travel, occupational or domestic injuries might account for this observation of male dominance of distal tibial fractures in India.

Conclusion

Majority of the study population, 17 (42.5%) were belonging to 31-40 age category followed by 41-60 category among 13 (32.5%). Of the study population, 21 (52.5%) were Males and 19 (47.5%) were Females. The most common cause of injury is road traffic injury among 32 (80%).

The mean Time taken For Union in weeks and standard deviation are 15.7 and 2.5 respectively. Of the study population, 3 (7.5%) developed Skin Necrosis and Infection. Among the study population only one developed associated complication. The average and Standard deviation of Teeny & Wiss Score are 90.85 and 7.54 respectively. Majority of the study population (21, 52.5%) were belonging to the excellent outcome category, followed by good category among (14, 35.0%).

When age, Time taken between Injury To Surgery in days and Time taken For Union in weeks were correlated with TWS score, All the variables were showed significant negative correlation with p- value less than 0.001. The cell values while for applying chi square and fisher's exact test were very low. In spite of that, gender and side of involvement did not show any significance. However, the mode of injury was associated.

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