

A STUDY OF CLINICAL AND RADIOLOGICAL OUTCOME OF PROXIMAL THIRD TIBIAL FRACTURES MANAGED BY LOCKING COMPRESSION PLATE

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ABSTRACT

BACKGROUND

There has been a disturbing rise in the number of road traffic accidents ever since the advent of high-speed transportation, with an increased number of orthopaedic related problems. Proximal tibia has a vital role in the stability and proper knee function as it transmits the body mass through the knee joint and leg. Proximal tibial fractures result from axial compressive forces, usually with a valgus or varus moment and indirect shearing forces. The main aim of operative management of proximal tibial fractures is to achieve an acceptable good knee functional outcome, which can be achieved by proper anatomical restoration of articular surfaces, ligamentous stability, proper mechanical axis and a functional pain-free range of motion of knee. Locking Compression Plates have become an important tool in the management of these complex fractures.

MATERIALS AND METHODS

The current designed work is on proximal tibial fractures that were treated with a locking compression plate (LCP). This was carried out in the department of orthopaedics at Kurnool Medical College, Kurnool in between Nov 2016 and Nov 2018. Approval was obtained from the hospital ethical committee. During the study, 20 patients with proximal tibial fractures were taken into account and treatment was given by locking compression plate fixation and followed for 6 months.

RESULTS

Excellent to good results were obtained in 90% of the cases and poor to fair results in 10% of the cases. 1 patient had an infection (5%) which healed with appropriate antibiotics, 1 patient had deep vein thrombosis (5%) which was treated conservatively, and 2 patients had knee stiffness (10%) at the end of final follow up.

CONCLUSION

Open/closed reduction and internal fixation of closed tibial plateau fractures with locking compression plate is an effective method of treatment provided there is no extensive soft tissue injury. Locking compression plate provides good angular stability and is very useful in treatment of these complex fractures.

KEYWORDS

Proximal Tibial Fractures, Locking Compression Plate, Tibial Plateau Fractures, MIPPO.

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BACKGROUND

There has been a disturbing rise in the number of road traffic accidents ever since the advent of high-speed transportation, with an increased number of orthopaedic related problems. Proximal tibia has a vital role in the stability and proper knee function as it transmits the body

mass through the knee joint and leg. Due to the subcutaneous location of the anteromedial surface of the tibia, fractures of the proximal tibia, in particular, are complicated to treat. There is a high incidence of open fractures in the proximal tibia compared to fractures of other long bones. The majority of the proximal tibial fractures are secondary to insult due to high-speed road traffic accidents and fall from height. These fractures result from axial compressive forces, usually with a valgus or varus moment and indirect shearing forces.

The main aim of operative management of proximal tibial fractures is to achieve an acceptable good knee functional outcome, which can be achieved by proper anatomical restoration of articular surfaces, ligamentous stability, proper mechanical axis and a functional pain-free

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range of motion of knee. The incidence of non-union, mal-union, and infections are quite high in multiple reported series causing compelling long-term disability. More awareness has been paid to the conditions of the soft tissue surrounding the bone. Soft tissue amicable approaches and minimally invasive techniques have shown improved outcomes. Treatment of these fractures using minimally invasive percutaneous plate osteosynthesis (MIPPO) techniques minimise the injury to soft tissues and preserve the vascular integrity of fracture fragments.

Locking plate fixation has become a popular modality of treatment of proximal tibial fractures over the last ten years. This type of fixation along with the biological advantage of percutaneous techniques has resulted in good union rates.

Aims and Objectives

1. To study the clinical and radiological outcome of using locking compression plate in proximal tibial fractures.
2. To study the post-operative complications following surgery.

MATERIALS AND METHODS

The current designed work is on proximal tibial fractures that were treated with a locking compression plate (LCP). This was carried out in the department of orthopaedics at Kurnool Medical College, Kurnool in between Nov 2016 and Nov 2018. Approval was obtained from the hospital ethical committee. Patients with proximal tibial fractures were taken into account and treatment was given by LCP fixation. Necessary information was gathered from the patients during their stay in the hospital and also during follow up at regular intervals for 6 months.

Inclusion Criteria

1. Age between 20 and 65 years
2. History of trauma (road traffic accidents, fall from height)
3. Unicondylar, bicondylar and metaphyseal fractures of the proximal tibia

Exclusion Criteria

1. Paediatric proximal tibial fractures
2. Gustilo Anderson compound grade 2 and compound grade 3 fracture

Sample Size

20 cases.

Sample Procedure

A prospective study. Patients are followed up periodically post operatively for 6 months.

Patients Are Assessed By

Modified Rasmussen's Criteria for Clinical Assessment.¹

Methodology

Cases were seen first in the casualty or outpatient department, OPD. After the primary survey, the history of

patients was gathered. Following this, the local and general examination was done. Other system Injuries associated with the fractures was adequately treated by concerned specialists of other departments. Patients with hypovolemic shock were given Intensive care according to ATLS guidelines. After the patient's general condition was stable, appropriate radiological investigations were taken. Advanced investigations such as CT scan were carried out whenever it was required.

The patients were operated at the earliest possible time based on their general condition, skin condition and the amount of oedema. In case if the surgery was delayed, the fracture was immobilised using a long leg posterior splint. All surgeries were performed under C-arm image intensifier guidance. Fractures were fixed with either MIPPO technique or by open reduction and internal fixation with LCP. The operative procedure is as follows-

- Type of anaesthesia: Spinal anaesthesia/ General anaesthesia
- Povidone-iodine scrubbing was done to the limb.
- A pneumatic tourniquet was applied after exsanguination and time were noted.
- Povidone-iodine painting and draping of the part were done.
- With the anterolateral approach, intra-articular fractures were exposed and reduced anatomically, whereas extra-articular fractures were managed through MIPPO technique.
- The suitably sized plate was taken after achieving appropriate and acceptable reduction and then fracture was stabilised using cortical and locking screws. Cortical screws were placed before inserting locking screws.
- On an average 50 minutes (range, 40-60 minutes) was taken for surgery in case of MIPPO technique and 75 minutes (range, 60-90 minutes) for open reduction and internal fixation.
- The major intra-operative problems were encountered in cases of comminuted fracture. They were first tried for reduction by MIPPO technique and later were converted to open reduction after unsuccessful attempts.
- Tourniquet was released, and hemostasis was secured.
- The wound was closed after keeping suction drainage tube.

Post-Operative Regimen

After obtaining rigid internal fixation postoperatively, drains were removed, and the patients were mobilised. An immediate postoperative x-ray was also done. Continuous passive motion mobilisation was done for the 1st 24 hours. The range of active motion allowed during 2nd to 5th day was 0 to 20^o, from the 5th day onwards the range of active motion was gradually increased to 90^o or more. After removing suture, if complications were not there, between 12th and 14th day, full range of movements were allowed. Antibiotics were administered intravenously for 48 hours in case of closed fractures and more as in case of compound

fractures. Analgesics were administered until the pain was relieved adequately.

During discharge, patients were advised to do active quadriceps exercises, early active knee mobilisation and non-weight bearing crutch walking. External support was given in comminuted fractures with unstable fixation, in the form of a posterior slab. After confirming the healing process clinically and radiologically, mobilisation of the knee was started.

Follow Up

Follow up was done at 6 weeks, after removing suture. During the follow-up, patients were clinically examined. X-ray was taken to look for signs of fracture union and loss of reduction if any. The second follow up was done at 12 weeks, during which one more x-ray was done, and clinical evaluation of union was carried out. Based on the clinical and radiological signs of union patients were allowed partial weight bearing and gradually were progressed to full weight bearing. Partial weight bearing was delayed until 6 – 8 weeks and full weight bearing were allowed if signs of fracture union were seen after 12-16 weeks. The patients were then followed up at 6 months during which time the anatomic and functional evaluation was done using the Rasmussen’s functional grading system.

RESULTS

Age Group (years)	No. of Cases	Percentage
18 – 30	6	30%
31 – 40	5	25%
41 – 50	5	25%
Above 50	4	20%

Table 1. Age Distribution

Sex	No. of Cases	Percentage
Male	17	85%
Female	3	15%

Table 2. Sex Distribution

Mode	No. of Cases	Percentage
RTA	19	95%
Fall (Height)	1	5%

Table 3. Mode of Injury

Side	No. of Cases	Percentage
Right	15	75%
Left	5	25%

Table 4. Side of Involvement

Type	No. of Cases	Percentage
Closed	17	85%
Open Type I	3	15%

Table 5. Type of Fracture

Duration (Days)	No. of Cases	Percentage
0-2	11	55%
3-5	7	35%
Above 5	2	10%

Table 6. Duration Between Injury and Surgery

Range of Motion	No. of Cases	Percentage
90 Flexion and Below	1	5%
>90 – 1200	7	60%
ABOVE 1200	12	35%

Table 7. Range of Motion

Duration of Fracture Union

Most of the proximal tibia fractures were united by 12-15 weeks ranging from 12-24 weeks with an average union time of 14.25 weeks.

Result	No. of Cases	Percentage
Excellent	12	60%
Good	6	30%
Fair	1	5%
Poor	1	5%

Table 8. Functional Results Based on Rasmussen’s Functional Grading System

Complications

- Early:** Superficial infection – 1 case (5%)
 Deep vein thrombosis – 1 case (5%)
- Late:** Stiffness of the knee - 2 cases (10%)

One case succumbed to superficial skin infection which was apparent 2 days after the surgery. Thorough debridement and regular dressings were done. Cultures were taken, and appropriate antibiotics were administered. The infection controlled in 3 weeks and the patient did not suffer from any other complication thereon and had an acceptable range of motion of the knee.

2 patients suffered from complications of the stiffness of knee joint due to poor postoperative compliance of the patients. One patient suffered from DVT and was treated by medications alone which subsided gradually.

DISCUSSION

Proximal tibia fractures represent a series of soft tissue and bony injuries that cause permanent disabilities. They have many challenges during treatment like instability, comminution of fractures, displacement and extensive soft tissue injuries. Restoring the congruity of joint, alignment of the limb to normal position, achieving the stability of the knee and functional range knee motion are the main goals of treatment. Some of the main demerits of non-operative treatment include inadequate reduction of articular surface and ineffective limb alignment control. A further prolonged period of hospitalisation and recumbence are not cost-effective in today’s health care scenario.

Series	Female	Male
Prasad et al ²	17.5%	82.5%
Mankar et al ³	21.3%	78.7%
Dendrinios et al ⁴	25%	75%
Barei et al ⁵	37.3%	62.7%
Delamarter and Hohl ⁶	24.1%	75.9%
Present Study	15%	85%

Table 9. Comparison of Sex Distribution

Series	Average (Yrs.)
Lee et al ⁷	42
Mankar et al ³	42
Porter ⁸	47
Patil et al ⁹	43.4
Dendrinios et al ⁴	39
Present Study	40.5

Table 10. Comparison of Age Distribution

Series	RTA	Fall from Height	Others
Dendrinios et al ⁴	79.2%	16.7%	4.1%
Barei et al ⁵	51.9%	30.1%	18%
Yin et al ¹⁰	59%	41%	0%
Kim et al ¹¹	80%	16.7%	3.3%
Patil et al ⁹	63.4%	23.3%	13.3%
Present Study	95%	5%	0%

Table 11. Comparison of The Mode of Injury

Series	Right	Left
Wang et al ¹²	60%	40%
Patil et al ⁹	63.4%	36.6%
Present Study	75%	25%

Table 12. Comparison of The Side of Involvement

Series	Mean Union Time (weeks)	Range (Weeks)
Lee et al ⁷	18	12-28
Wang et al ¹²	15	12-22
Yin et al ¹⁰	11.9	9-16
Prasad et al ²	14	8-22
Present Study	14.25	12-24

Table 13. Comparison of Time of Union

Complications

The infection rate was 5%. Antibiotics were administered for a prolonged period to treat infections over time. The outcome of the patients was fairly good. There was no case where implants had to be taken out due to infection. Stiffness was observed in 2 cases (10%) at the final follow-up. One elderly patient suffered from DVT of the leg which was managed medically.

Series	Infection	DVT	Others
Barei et al ⁵	12%	20%	0%
Lee et al ⁷	8%	0%	4%
Yin et al ¹⁰	12.9%	0%	0%
Patil et al ⁹	7%	0%	17%
Present study	5%	5%	10%

Table 14. Comparison of Complications

Functional Results

90% of the functional evaluation results were good to excellent, and that of 10% was poor to fair. It was reported in 1960 by Rambold¹³ that internal fixation of tibial plateau fractures and early mobilisation contributes to good anatomical and functional results. In 1990 Dennis Jensen¹⁴ achieved good results by surgical treatment of proximal tibia fractures. Chaix et al¹⁵ presented 86% good to excellent results by surgical means of treatment. Lee et al⁷ reported good to excellent results by surgical means of less invasive stabilisation system treatment. Feng et al¹⁶ described good results when fixed with LCP in comparison with dynamic compression plate (DCP) with an added benefit of less invasive surgery. Kim et al¹¹ reported good results with MIPPO technique in the management of open proximal tibial fractures with adequate soft tissue coverage.

The period of immobilisation was again individualised depending on the security of rigid fixation and other circumstances demand. The benefits of early knee motion include - decreased knee stiffness and enhanced cartilage healing (regeneration). However, these benefits are to be cautiously balanced by risks, including loss of fracture reduction, failure of internal fixation and compromised ligament and soft tissue healing.

CONCLUSION

From the present study, it was concluded that road traffic accidents or high-velocity injuries are the most common cause of these fractures (95%). These high-velocity injuries are associated with more severe or comminuted fracture patterns. Most of these injuries occur in younger and active age groups (55% in 18-40 years age groups). These fractures have a predominance of male sex (85%) and right side (75%). The main aim of surgical treatment includes precise reconstruction of the articular surface with an elevation of the depressed bone fragment in case of intraarticular fracture, bone grafting in case of bone loss and stable fragment fixation allowing early range of movement. Preoperative soft tissue status and their repair at the right time significantly change the outcome. All fractures united well in time (before 6 months). No non-union. Infection plays an essential role in influencing the result of the surgical outcome. Period of joint immobilisation plays a significant role in the result. ORIF with LCP seems to be good implant choice in proximal tibia fractures including difficult fracture situations.

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