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Research Article

Study on Surgical Management of Distal Tibial Fractures by Locking Compression Plates (LCP)

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Abstract: ***Introduction:*** Fractures of the distal tibia are one of the most commonly fractures encountered in orthopaedic practice accounting for 7-10% of all tibial fractures. They represent a significant challenge to most of the surgeons. Most common method of management is by internal fixation using locking compression plate. ***Aim:*** To evaluate the effectiveness, functional results and complications following internal fixation of distal tibia fractures by locking compression plates (LCP). ***Materials and methods:*** In this study, 20 patients of distal tibia fractures treated surgically following internal fixation by LCP plating, studied between January 2019 to March 2020 in department of orthopaedics, Prathima Institute of Medical Sciences, Nagnoor, Karimnagar, and Telangana. All cases treated surgically by LCP plating using standard surgical technique and postoperative protocol. ***Results:*** High energy trauma (RTA) accounted for 80% of cases. Surgeries were performed within one week average. Radiological union seen in 16 weeks (range 14-18 weeks) average. weight bearing started from 12 weeks (Range 10- 14weeks). Ankle stiffness noted in 5% of cases. There were 4 cases of superficial infections, 2 patients with deep infection got treated with antibiotics and debridement. Functional results done according to Olerud and molander scoring system. 70% of patients achieved excellent to good results, 30% patients shows fair to poor results. ***Conclusion:*** Locking compression plate has better functional outcome, has the advantage of rigid fixation even in osteoporotic fractures and better angular stability.

Keywords: Distal tibia fracture, Internal fixation, LCP plating.

INTRODUCTION

Distal tibial fractures represent a significant challenge to most of the surgeons even today, accounting for 7-10% of all tibial fractures [1]. The challenges are in the form of poor status of the soft tissue envelope, compound fractures and intra articular fractures. In the first half of the last century these fractures were deemed to be non-amenable for surgical reconstruction. Conservative treatment by cast application led to prolonged immobilization, ankle and knee stiffness and arthritic changes there by affecting the quality of life [2]. For the past decade, plating using fracture reduction has been successful in treating complex fractures of the lower extremity especially distal tibia. The goal of this technique is to apply stable plate fixation while maintaining the fracture biology and minimizing soft tissue problems [3-5].

Introduction of the locking compression plate was a revolution in the evolution of management of fractures where prolonged bed rest is avoided and return to work is satisfactorily helpful [6]. Compared with a conventional plate, a locking plate imparts a higher degree of stability and provides better protection against primary and secondary losses of reduction and minimization of bone contact there by preserving periosteal blood supply.

The soft tissues around the ankle and distal tibia are easily compromised by trauma and subsequent fracture fixation posing a definitive challenge in healing of wounds post-operatively in compound fractures. Most widely used classification for compound fractures is Gustilo Anderson Classification. AO/OTA classification has been most accepted classification for fracture in the literature. It allows not only descriptive, but also treatment guidelines for each defines fracture type.

Aims and objectives: To evaluate

1. Effectiveness of LCP.
2. Time for union
3. Range of motion at ankle joint.
4. Complications

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PATIENTS AND METHODS

This study includes 20 patients of distal tibia fractures admitted in department of orthopedics, Prathima Institute of medical sciences, Nagnoor, Karimnagar, Telangana, from January 2019 to march 2020. Data collected from patient records and during follow up visits. All the relevant x-rays taken at the time of admission. AO classification and Gustilo Anderson classification system was used. After getting fitness mostly all cases operated within 1 week.

Inclusion criteria

1. Age more than 18 years.
2. Distal tibial fractures with or without associated fibular fracture.
3. Closed and open grade 1, 2 Gustilo Anderson.
4. Distal tibial fractures with or without associated malleolar fractures.

Exclusion criteria

1. Patients with neurological injuries.
2. Gustilo Anderson grade 3 and fracture dislocation cases.
3. Associated compartment syndrome.
4. Medically unfit for surgery.
5. Coexisting upper third and middle third fracture of tibia.
6. Pathological fractures.
7. Patients treated with external modalities like hybrid external fixators and Ilizarov fixators.
8. Implants used are other than locking compression plates.

Surgical procedure

Under spinal anaesthesia, and strict aseptic precautions, parts prepared using sterile technique. Tourniquet was not used in all cases. Depending on fracture pattern approach was selected. Minimally invasive anterior approach to distal tibia and ORIF were used. Fracture site approached and reduced. Reduction confirmed under c-arm guidance and fixation done using distal tibia locking compression plate. Wounds closed and dressings done on 2^{nd} 5^{th} 8^{th} days

Follow Up

Regular follow ups done in every 6 weeks intervals up to fracture union after that once in 3 months up to 1year period. Functional evaluation done using Olerud and molander scoring system [7]

RESULTS

- A total of 20 patients with distal tibia fractures were studied. All these patients were available for follow-up. Following factors were observed and tabulated as follows:
- Age distribution: average age is 53yrs.
- Sex distribution: 65% are males 35% are females.
- Side distribution: 60% involving left side 40% involving right side limb.
- Majority of the cases mechanism of injury is RTA (80%), 20% fall at home
- 80 % of the cases are closed injuries and 2o% is open injuries.
- 40 % of the cases we used MIPPO technique of plating, 60% of the cases open reduction and internal fixation was done.
- 85% Cases there is associated fibula fractures and in 20% cases there is malleoli involvement
- Types of fracture by AO; mostly belongs to A3 (25%) and B3 (25%) type.
- Functionally 55% of cases are exellent, 15%cases are good, 15% are fair, 15% are poor according to Olerud and molander scoring system.
- Average time to union is 16weeks

Table-1: complications

complications	No of patients	%
superficial infection	4	20
deep infection	2	10
varus malunion	3	15
delayed union	2	10
stiffness of ankle	1	5

Table-2: showing comparison of age distribution

Study	Min Age (in yrs)	Max Age (in yrs)	Average (in yrs)
Chandra shekaram naiudu M *et al.* [16]	22	58	40.8
J zou *et al.*[13]	36	54	46
Serban Al *et al.* [14]	31	68	51.7
Present study	34	75	53

Table-3: showing comparison of sex distribution

Study	Male percentage	Female percentage
Andrew grose *et al*. [18]	67	33
Hazarika S *et al*. [8]	80	20
Serban Al *et al*. [14]	77	23
Present study	65	35

Table-4: showing Comparison of mechanism of injury

Study	High energy trauma	Low energy trauma
Andrew grose *et al*. [18]	58%	42%
Gupta RK *et al*. [11]	86%	14%
Spagnolo R *et al*.[19]	100%	-
Present study	80%	20%

Table-5: showing comparison of clinical type with other studies

Study	Closed (%)	Open(%)
Heather A vallier *et al*. [12]	70%	30%
Hazarika S *et al*. [8]	60%	40%
Present study	80%	20%

Table-6: comparison of fracture pattern with other studies

Study	Average fracture union
Im GI *et al.* [20]	20 weeks
Serban AL *et al*. [14]	16 weeks
Chandrashekaran naidu M *et al*. [16]	16 weeks
Present study	16weeks

Table-7: Showing comparison of fracture union with other studies

Study	A1	A2	A3	B1	B2	B3	C1	C2	C3
Andrew Grose *et al.* [18]	5	5	7	2	4	6	6	12	64
Gupta RK *et al*.[11]	18	26	24	2	3	3	2	2	-
Serban AL *et al*. [14]	-	-	7	-	5	-	4	4	2
Present study	4	2	5	-	2	5	-	-	2

Table-8: showing comparison of superficial infections

NAME OF AUTHOR	YEAR	NO. OF CASES
J.ZOU *et al*.[13]	2013	2 (4.8%)
GULABI *et al.* [29]	2016	2 (9.1%)
PRESENT STUDY	2020	4 (20%)

Table-9: showing comparison of deep infections

NAME OF AUTHOR	YEAR	NO. OF CASES
WANG CHENG *et al.* [21]	2010	1 (7%)
PRESENT STUDY	2020	2 (10%)

Table-10: Showing comparison of functional results

STUDY	ACCEPTABLE	NOT ACCEPTABLE
Ruedi allgower 22	74 %	26%
Mast *et al.* [23]	78 %	22%
Im GI *et al*. [20]	88 %	12%
Present study	70%	30%

Fig-1: Showing preoperative, followup radiographs and scar images

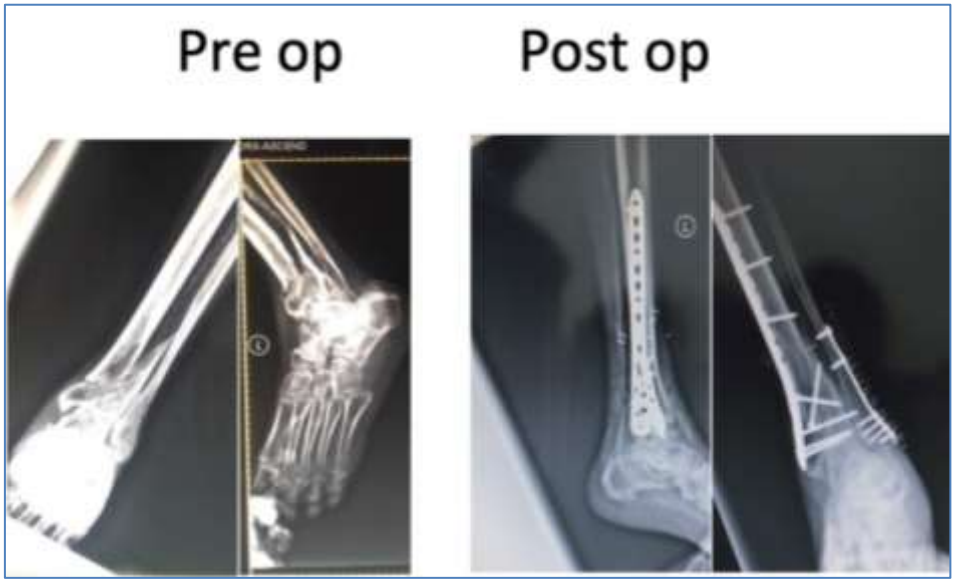

Fig-2: Preoperative and post-operative radiographs

Complications

Complications are listed in Table 1

DISCUSSION

- The age of patients in the present study ranged from 34 to 75 years with an average of 53 years which are comparable to Serban Al *et al.* [14]. Comparison with other studies shown in table 2
- In the present study, male preponderance is seen (65%), which is comparable to Andrew grose *et al.* [18]. The male dominance over female is due to high rate of travelling and occupational injuries in males. Comparison with other studies shown in table 3
- Comparison of mechanism of injury is shown in table 4; our study is comparable to the Gupta RK *et al.* [11].
- The present study had 80% of closed fracture cases .This was comparable to studies conducted by Heather A vallier *et al.* 12 who had 70% of closed fractures showing that closed fractures are more common than open fractures. Comparison with other studies shown in table 5
- In the present study the most common pattern of fracture is A3 and B3 accounting for 25%

each. From above study's we can observe that no similitudes between any two, the reason might be inter observer variations in reading the x-rays. Comparison with other studies shown in table 6

- In Im GI *et al*. [53] the mean duration of union of fracture was 20 weeks.
- Study conducted by Serban AL *et al*. [14] and Chandrashekaran naidu M *et al*. [16] had mean duration of fracture union was 16 weeks this pattern is similar to the findings observed in the present study.
- Rate of union for MIPO is slightly earlier than OPEN group and this is due to biological fixation concept of mipo technique which involves preservation of vascular integrity of the fracture ends, no periosteal stripping as well as preservation of osteogenic fracture haematoma. Comparison with other studies shown in table 6
- In the present study 4 cases had superficial infection treated by dressing and culture specific antibiotics. The high rate of infection may be because of improper dressings at rural remote areas. Comparison with other studies shown in table 8.
- Deep infection is managed by debridement and iv antibiotics. The results from present study are comparable to study conducted by WANG CHENG *et al*. [21], also had 7% of deep infection.
- Comparison with other studies shown in table 9
- The excellent and good results have been tabulated as acceptable and the fair and poor results as not acceptable for easier comprehension. The results in our study are near normal to the Ruedi Allgower group. Comparison with other studies shown in table 10
- The present study encountered 2 cases of (10%) delayed union. ZOU.*et al*. [13] in his study encountered three (7.1%) delayed union cases. GULABI *et al*. [17] in his study encountered two (9.1%) cases of delayed union. Our study is comparable with Gulabi *et al*. [17].
- In the present study 15% of cases had malunion which is more than ZOU. *et al*. [13] and GULABI *et al*. [17], which had 9.6% and 9.1% respectively in mippo group. The difference is due to the small sample size of the present study and combing mippo and open LCP plating techniques in the study.

CONCLUSIONS

- In the present study 70% has Excellent to Good functional outcomes, suggesting that locking compression plate has better functional outcome when compared with buttress or recon plates which are used previously.
- OPEN group has high complications like superficial infection and deep infection and high iatrogenic trauma to the skin
- Union of fracture is earlier in MIPO group and has risk of malunion.
- In 80% 0f the cases there is association of fibula fracture needing additional plate which impacts the wound gaping issue in distal tibia cases.
- Management of distal tibial fractures is challenging because of involvement of articular surface and scarcity of soft tissue and prone for infections.
- LCP has advantage of rigid fixation even in osteoporotic fractures and better angular stability but has the disadvantage of cold welding and hard of implant removal.

Merits of the study

- All the fractures are treated by locking compression plates so that results are comparable.

De merits of the study:

- Open Gustilo Anderson grade 1, 2 are combined with closed fractures and treated by same LCP implant which caused the poor result outcome.
- Mippo technique of plate insertion combined with open reduction and internal fixation method which resulting in variable results in wound complications.
- Sample size is low and not used supracutaneous method of LCP which might have higher advantage over routine pre contoured LCP with mippo or open methods.

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