Research Paper Medical Science

Study of Results of Minimal Invasive Plate Fixation in Metaphyseal Fracture of Tibia in Adult

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ABSTRACT

Modern way of living has lead to increased incidence of comminuted fractures of bones. This is due to the ever increasing vehicular traffic and industrial activity Management of these fractures by itself is challenging. In this we have studied 40 patients with complex metaphysical tibia fracture and treated by minimal invasive procedure. We have studied the operative time, technique and various post operative outcomes (mobilization time, callus time etc.).At the end of study we have concluded that minimal invasive procedure is treatment of choice for close tibia metaphyseal fracture due to its early post operative mobilization and early callus formation.

KEYWORDS

INTRODUCTION

Old concept of AO/ASIF to treat comminuted fractures was by anatomical reduction and absolute stability by plating to produce impressive post operative X-rays. But various studies have shown that this type of management leads to bad or worse results and is associated with complications like delayed union and non-union. The well known Swiss Surgeon Fehr instance stated in 1960.

"In no area of surgery so many mistakes have been made as in operative fracture fixation"

- After encountering such problems, a new novel concept was developed. In this concept, the fracture hematoma and soft tissue attachment of the comminuted fragments are not disturbed, there by preserving the osteogenic capacity and vascularity of the fragments. The fracture site is stabilized by fixing the plate to the proximal and distal major fragments by minimal soft tissue dissection. This leads to secondary healing using principal of relative stability by technique called "MINIMALLY INVASIVE PLATE OSTEOSYNTHESIS".

AIMS AND OBJECTIVES

Aim of the study is to analyse and observe retrospectively and prospectively the results of management of metaphyseal fractures of tibia by a novel concept of Minimally Invasive Plate Osteosynthesis (MIPO) in respect to

- Operative technique
- Stability of fixation
- Clinical and radiological union
- Post-operative range of motion
- Time for mobilisation
- Early and late complication related to technique and implant
- Advantage and disadvantage of MIPO technique
- Establish method & protocol to achieve best functional results with minimal complications

MATERIAL AND METHODS

40 patients who have sustained fractures of upper or lower end tibia including a case of grade II compound injury were treated by employing the concept of Minimally Invasive Plate Osteosynthesis during period of May2011 to July 2013 at our hospital and they were followed up at regular interval with minimum six month up to two years.

The patients were received in trauma ward and after initial hemodynamic stabilization and treatment for associated injuries; they were assessed clinically and radiologically for definitive treatment.

Each fracture is classified by using AO Fracture classification system. This system is easily recordable and reproducible. It accurately describes the extensiveness of the fracture. Data collected include age, length of hospital stay, use of antibiotics, pattern and site of the fractures, type of fixation, complications, and outcomes. Outcome measurements were determined using the TEGNER LYSHOLM KNEE SCORING SCALE and OLERUDE & MOLANDER SCORING SYSTEM FOR ANKLE.

Selection Criteria:

: Inclusion criteria:

- patient above 18 years
- Metaphysical fracture of tibia treated with MIPO
- Closed \OGI\OGII

Exclusion Criteria:

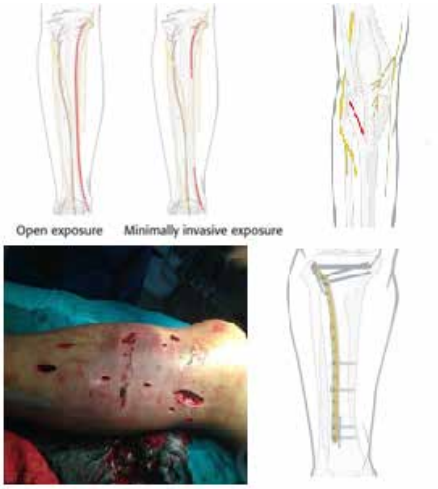
- patient <18 years
- Grade III open Fracture
- Associated vascular injury or Compartment Syndrome
- Pathological Fracture
- Delayed Surgery with other complication

DEFINITIVE MANAGEMENT AND SURGICAL TECHNIQUE

With the patient positioned supine on a radiolucent table, antibiotic prophylaxis is administered and standard intraoperative fluoroscopy is used throughout the procedure.The whole of operative limb was cleaned. The injured limb and the non-injured limb are prepared and draped above the knee, thus allowing intraoperative alignment to be checked against the normal limb. Tourniquet inflated when it is feasible.

Plate length was selected according to zone of injury and number of screw was selected to keep Screw Density as near as 0.5.

Skin incision for proximal tibia(Figure 1)



For anterolateral approach identify Gerdy's tubercle. Make a straight incision about 5cm in length starting posterior to Gerdy's tubercle and running distally and anteriorly. For anteromedial approach 5 cm incision put on medial condyle of tibia and subcutaneous tunnel prepare.

Closed reduction of the fracture was done. For proximal tibial fractures the antero medial/anterolateral approach was used. A 2 cm incision was made proximal to the fracture site and a subcutaneous tunnel was created with the help of a periosteal elevator.

Skin incision for distal tibia (Figure 2)



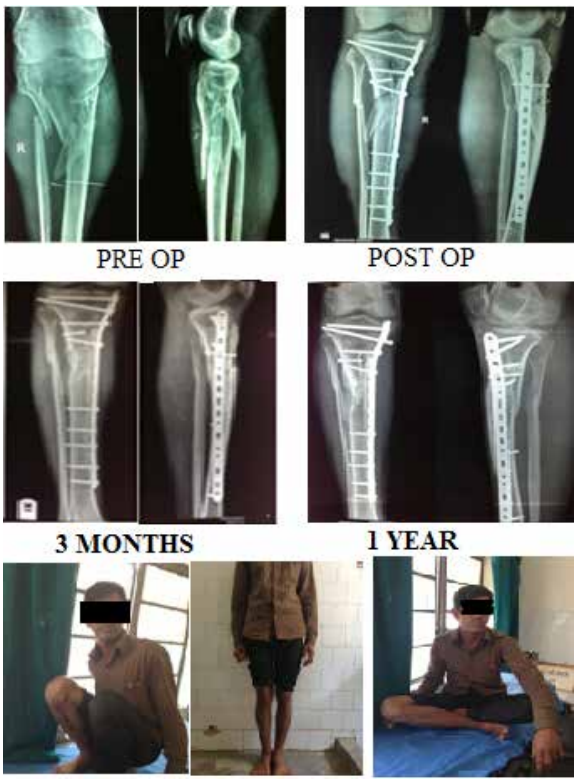
Perform a straight, or slightly curved skin incision on the medial aspect of the distal tibia. The length of the incision varies from 3-5 cm, depending on the type of the planned plate. The incision stops distally at the tip of the medial malleolus.

The standard approach for the MIPO technique is medially. The articular fracture component is not exposed, and is reduced either by indirect maneuvers using ligamentotaxis, or by the applicationof percutaneous reduction forceps, or directly by the percutaneously inserted lag screws.

The appropriate length of the plate (T- buttress or a locking compression plate) was determined by placing a plate along the anterior aspect of the leg and adjusting it so that under fluoroscopy the proximal end of the plate is just below the joint line and the distal end extends at least three screw holes beyond the distal limit of the tibial fracture. The plate was then slid subcutaneously across the fracture site to reach distal fragment. Another 2 cm incision was given distally where the plate ended. This plate was then contoured precisely to conform to the condyle and proximal metaphyses and secured to the condyle with appropriate locking /cortical /cancellous screws of sufficient length.

An LP is then passed along the tunnel, bridging the fracture site. The plate has to be long enough to bridge the metaphyseal zone and to allow at least two bicortical screws insertions proximal to the fracture. Kirschner wires can be used to secure, through the ad hoc holes proximal and distal to the fracture, the plate to the bone before screw insertion.

Case 1(Figure 3): 30 years old male patient having right side upper end tibia fracture treated with 16 hole LC-DCP by MIPO technique having full range of movment and fracture united with in 4 month



Case 2(Figure 4): 20 years old male patient having right side upper end tibia fracture treated with 10 hole Lateral pariarticular tibial plate having full range of movment and fracture united with in 4months



OBSERVATIONS AND RESULTS

- **AGE AND SEX:**

Total 40 patients were included in study among 7 are female and 33 are male and majority of the patient are in young and adult age group.

- **AVERAGE HOSPITAL STAY:**

Average hospital stay in our study is 9 days. But one patient requires longer stay of more than one month due to uncontrolled diabetes leading to post operative infection.

- **MODE OF INJURY:**

In our study 80% of patient were of road trafic accident and very few patient were having other mode of injury

- **TIBIA FRACTURE AND IT'S REGION AND TYPE(Table 1):**

	SITE	JOINT	COMMUNITION	
			YES	NO
Right(30)	Proximal Tibia(22)	IA	5	2
		EA	6	9
	Lower End(8)	IA	3	-
		EA	2	3
Left(12)	Proximal Tibia (8)	IA	-	1
		EA	3	4
	Lower End(4)	IA	1	-
		EA	2	1

- **ASSOCIATED INJURY:**

Almost 50% of patient have other bony injury along with tibia fracture.Most of the lower end tibia fracture were associated with fracture of fibula except one.

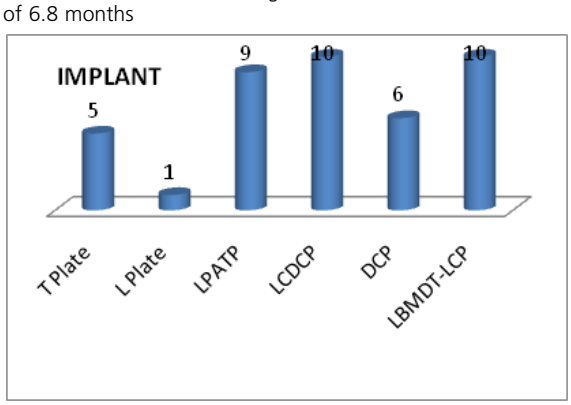
- **TIME INTERVAL OF INJURY AND SURGERY:**

Average time interval of injury and operation in our study is 2.7 day.Among 40 patients 8 patients were operated on same day of injury if their blood investigation were normal and local condition is favourable for minimal inasive pocedure.

Other patient were operated in routine operation list after anesthetic and medical fitness.Two pateint was delayed more than 6 days due to medical problem.

- **IMPLANT AND PLATE SCREW DENSITY(PSD)(Chart 1):**

In Our study Average PSD is around 0.6 which is near to the ideal PSD of 0.4 to 0.5 with average union time of upper end tibia of 4 months and average union time of lower end tibia of 6.8 months



Most of the plate use for extra articuler fracture were use as bridge plate with indirect reduction with traction without disturbing fracture site environment to provide biological fixation and relative stability.

For intra articuler fracture Anatomical readuction done wich require either inter condyler compression or butressing of condyle and rigid fixation along with absolute stability achieved.

One lower end tibia fracture was fix with interfregmentary screw and neutralizing plate was put.

- **TIME OF IMMOBILISATION AND PHYSIOTHERAPY(Table 2):**

In our study more than 70% patients had started mobilisation with in 10 days of opertion.

	PWBW	FWBW
Proximal Tibia Fracture	2.32months	4.23 months
Distal TibiaFracture	2.79 months	5 months

- **AVERAGE TIMING FOR CALLUS AND UNION(Table 3):**

	CALLUS	UNION
Proximal TibiaFracture	8.6 wks	4 months
Distal TibiaFracture	11.33 wks	6.8 months

- **EARLY AND LATE COMPLICATION:**

✶ **EARLY:**

Among 28 patient operated for upper end tibia plating two got infection in early post operative period which was not controlled by debridment or higher antibiotic and ultimately require early removal of implant.In that one pateint has non union and known case of diabetus who has under gone revison surgery form of illizarrow.

One patient has partial Common peroneal nerve palsy but recovered with physiotherapy.

One patient has implant failure with in 7 days of operation due to fall while mobilisation and require revision of plating.

In lower end tibia among 12 patient only one patient has wound dehicsence and require plastic coverage.

✶ **LATE:**

Three patients underwent removal of implants due to impingment of plate over the skin.

Three pateints have stiffness of knee joint leading to restricted knee movements.

One patient developed valgus demormity after starting weight bearing walking.

One patient had breakage of implant after 1 year who was advisedfor removal of implant.

One patient has delayed union with fracture gap seen more than six month and required revision surgery with bone grafting

- **FINAL OUTCOME(Table 4 & 5):**

TEGNER LYSHOLM KNEE SCORING SCALE		
>90	18	Excellent
84-90	7	Good
65-83	1	Fair
<65	2	Poor

OLERUD AND MOLENDAR ANKLE SCORING SCALE		
91-100	5	Excellent
61-90	7	Good
31-60	-	Fair
0-30	-	Poor

• **AO FRACTURE CLASSIFICATION AND OUTCOME(Table 6):**

	TYPE	OUTCOME(NO)			
		Excellent	Good	Fair	Poor
Proximal Tibia 4-1	A2	10	1	-	1
	A3	5	4	1	1
	C1	1	-	-	-
	C2	2	1	-	-
	C3	-	1	-	-
Distal Tibia 4-3	A2	3	1	-	-
	C2	1	3	-	-
	C3	1	3	-	-

DISCUSSION

Treatment of comminuted fractures by minimally invasive plate osteosynthesis technique has became a reliable procedure with encouraging results. In our study 40 cases of metaphyseal tibia fracture were managed by this technique.

Our study 75% patient are having injury on right side and 75% having extra articular metaphseal fracture which were good case for minimal invasive procedure.

From study data we can say that more than 50% patient had other associated injuries like head injury or other bone fracture considering them as polytrauma so in that case mipo technique is use full to prevent blood loss and reduce operative time. It also shows that multiple injuries are associated with ligament laxity and communition of fracture In our study 70% fracture were fixed with bridge plate fixation principal which is one of the core part of MIPO technique and in our study PSD is average 0.6 which is comparable to study of Tong &Bavonratanavech,(2007) who recommended it to be around 0.5 to 0.4 Study data shows that 82% patient were mobilized within 10 days of operation in form of knee and ankle mobilization without weight bearing walking as early mobilization was one of the aims of MIPO technique.

In our study 90% patient of proximal tibia fracture operated by MIPO technique has mean union time 16 wks which comparable to Jain D et al. Results of proximal tibial fractures managed with periarticular locking plates: A series of 34 cases having mean union time of 17.6 weeks. For lower end tibia mean union time is also 6.8 months which is comparable to other study.

From study data observation we can say that extra articular fracture without communtion has better outcome than any other fracture type.

Summary and Comparisons of the outcome of some of the published series of patients treated with MIPO technique, since 1997(Table 7 & 8)

COMPARISION OF PROXIMAL TIBIA STUDY							
Publication	Year	Fracture Site	No Of Fracture	Plate Used	Over All Complication	Successful Outcome	Revision Surgery
Chang-Wug Oh et al., Acta Orthopaedica46	2007	Proximal Tibia	23	LC-DCP and/ or LCP	4(17.39%)	100%	0%
OUR STUDY	2013	Proximal Tibia	28	DCP,LC-DCP,T and L Periarticular Plate	8(28.5%)	100%	2(7%)

COMPARISION OF DISTAL TIBIA STUDY							
Publication	Year	Fracture Site	No Of Fracture	Plate Used	Over All Complication	Successful L Outcome	Revision Surgery
Krackhardt et al., Arch Orthop Trauma Surg37	2005	Distal Tibia	71	DCP and LC-DCP	15(21.12%)	84.5%	11(15.4%)
OUR STUDY	2013	DISTAL TIBIA	12	ANATOMICAL LOWER END TIBIA PLATE ,DCP and LC-DCP	4(33.33%)	100%	2(16%)

CONCLUSION

- MIPO technique helps to conservation of bone perfusion and protection of the soft tissue envelope plate and do not disturb endosteal blood supply as compare to inter locking nail so meduallry callus form and help in union
- Smaller incisions, lesser soft tissue dissection, lesser bleeding and strong implant construct allows us to do internal fixation even in compound fracture type 1 and 2 where otherwise, we have to wait for a long time in case of traditional plating.
- Technically this procedure has learning curve with increase fluoroscopy time during operation.
- There are fewer incidences of delayed union and non-union. There is a decreased need for bone grafting and incidence of infection is less due to limited exposure.
- Removal of implant after minimal invasive procedure is also easy n require Minimal soft tissue dissection
- Simple fracture treated by bridge plate MIPO lead to prolong time for full weight bear due to delayed callus formation so in that case compressive plating is advisable.
- MIPO using locking plates is particularly effective in managing fractures of osteoporotic bones

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