

Study of Results of Minimal Invasive Percutaneous Plate Osteosynthesis in Fracture of Upper Tibia

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Abstract: Introduction: Modern way of living has lead to an increase vehicular accidents and industrial injury. Management of these fractures are challenging. Considerable advances in the methods of internal fixation and newer innovations in implants and operative technique help to meet such challenging tasks. 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. After encountering such problems, a novel concept was developed. In this concept, the fracture hematoma and soft tissue attachment of the comminuted fragments are not disturbed, which preserve the osteogenic capacity and vascularity of the fragments Aims & Objectives: Aim of the study is to analyse and observe retrospectively and prospectively the results of management of fractures of tibial plateau by a novel concept of Minimally Invasive Percutaneous Plate Osteosynthesis (MIPPO) in respect to operative technique, clinical and radiological outcome. Method: 30 cases of tibial plateau fractures treated with MIPPO technique were reviewed. Result: 95% of the patients have excellent to good Tegner Lysholm Knee Score without any revision surgery. Complication included 1 superficial wound infection and 1 delayed union. Average radiological union is 16 weeks, which is comparable to clinical union. Conclusion: By this technique we can get very good functional outcome irrespective of type of fracture and without soft tissue injury. After encountering such problems, a novel concept was developed. In this concept, the fracture hematoma and soft tissue attachment of the comminuted fragments are not disturbed, which preserve the osteogenic capacity and vascularity of the fragments [R Bhesaniya, Natl J Integr Res Med, 2018; 9(1):36-40]

Key Words: Minimally invasive plate osteosynthesis, Tegner Lysholm Knee Score, upper tibia fracture

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Introduction: Modern way of living has lead to an increase vehicular accidents and industrial injury. Management of these fractures is challenging. Considerable advances in the methods of internal fixation and newer innovations in implants and operative technique help to meet such challenging tasks. 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. Although excellent result was frequently reported, poor result with skin slough off, wound dehiscence and infection were associated with traditional open reduction operative technique¹.

After encountering such problems, a novel concept was developed. In this concept, the fracture hematoma and soft tissue attachment of the comminuted fragments are not disturbed, which preserve 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, a technique called "Minimally Invasive Percutaneous Plate

Osteosynthesis"². This leads to secondary healing using principal of relative stability.

Methods: 30 cases of tibial plateau fractures were studied retrospectively and prospectively at department of orthopedic surgery at Smt. S.C.L. general hospital, Ahmadabad. The study was conducted with the approval of ethics committee of the institution and prior consent of patients was taken. There were 26 males and 4 females with majority of the patients were young adult and sustained injury due to RTA.

Open fracture Gustilo Anderson type-I and all closed fracture of proximal tibia were included. Exclusion criteria were patient <18 years, Associated neurovascular injury or Compartment Syndrome.

Once the patient was admitted, x-rays were taken (AP and lateral), posterior AK slab was given for support and analgesics and anti-inflammatory drugs were given. All the associated injuries were treated accordingly. Type of fracture was decided according to SCHATZKER's classification³. Line of treatment was decided according to the type of fracture, degree of displacement and depression, and general condition

of patient. Data collected include age, length of hospital stay, pattern and site of the fractures, type of fixation, complications, and outcomes. Outcome measurements were determined using the Tegner Lysholm Knee Scoring Scale⁴.

Duration of follow up ranged from 6 months to the 12months. None of the cases had defaulted. All displaced, depressed fractures were operated upon to achieve anatomical reduction, rigid internal fixation and early mobilization. Partial weight bearing was started between 10-12 weeks while complete weight bearing was started approximately between 14-16 weeks.

Operative technique: With the patient positioned supine on a radiolucent table, antibiotic prophylaxis is administered and standard intra-operative fluoroscopy is used throughout the procedure. The whole operative limb was cleaned. Great care should be taken to ensure that the fracture could be clearly visualized on antero-posterior and lateral views. The injured limb and the non-injured limb are prepared and draped above the knee, thus allowing intra-operative 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^{5,6}.

Skin incision for proximal tibia: For anterolateral approach, identify Gerdy’s tubercle. Make an incision about 5cm in length starting posterior to Gerdy’s tubercle and running distally and anteriorly(fig-1). For anteromedial approach 5 cm sized incision put on medial condyle of tibia (fig-2). A subcutaneous tunnel was created by periosteal elevator. Closed reduction of the fracture was done under IITV guidance.

Fig 1: incision of antero-lateral approach



Fig 2: incision of antero-medial approach



The appropriate length of the 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. Pre-contoured plate was used to conform to the condyle and proximal metaphysis and secured to the condyle with appropriate locking /cortical /cancellous screws of sufficient length and distal minimum 3 bicortical screw.

Post-operatively limb was immobilized in knee brace. Gradual only passive knee movement is encouraged as tolerable to patient and depending upon the fixation for the first 4 – 8 weeks.

Every 4 weeks patients were followed up for x-ray and when there were signs of callus formation, which was average 10 weeks, partial weight bearing walking started. Union was noted on an average 16 weeks after which full weight bearing walking was encouraged. Postoperative outcome was measured with TEGNER LYSHOLM KNEE SCORING SCALE at minimum of 1-year follow up.

Table 1: Tegner Lysholm Knee Scoring Scale

>90	20	Excellent
84-90	7	Good
65-83	1	Fair
<65	2	Poor

None of the case had major infections or soft tissue problem, wound were nicely healed and skin sutures were removed in 12 days post operatively. Two cases

had superficial blister formation and infection post operatively.

Observation and Results: Average hospital stay in our study is 12 days. But Three patient requires longer stay of more than one 20 days due to uncontrolled diabetes leading to post operative infection. In our study 75% of patient were of road traffic accident and very few patient were having other mode of injury

Table 1 : Time Interval Of Injury And Surgery

Days	1-3 Days	4-6 Days	>6 Days
No. Of. Patients	20	6	4

In Our study Average PSD is around 0.5, which is the ideal PSD of 0.4 to 0.5 with average union time of upper end tibia of 4 months. We have started immediate post-operative quadriceps exercises and ankle toe mobilization exercise. And after depending upon fixation and local condition of operative site, we have gradually started knee bending exercises. Average timing for callus is 10 weeks and for union is 16 weeks.

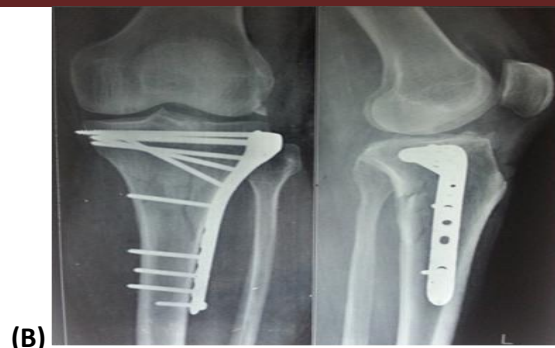
Among 30 patients one got infection in early post-operative period, which was controlled with higher antibiotic and ultimately require grafting. One patient had partial Common peroneal nerve palsy but recovered with physiotherapy. Three patients have impingement of plate over the skin; two patients have stiffness of knee joint leading to restricted knee movements. One patient has delayed union with fracture gap seen more than six month.

Final Outcome: Among 30 patient 20 has score more than 90, which shows excellent result. Two patients show less than 65 and show poor result as one of them was infected and other had same limb open grade femur fracture. Other shows satisfactory response. (Fig-3, A to G)

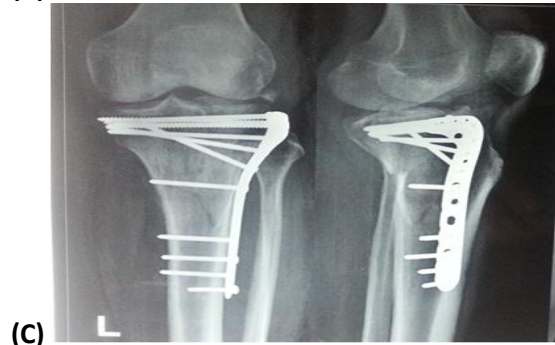
Fig-3: (A): pre-op x-ray; (B): post-op x-ray;(C): 4 month follow up;(D): final follow up;(E),(F),(G): clinical result



(A)



(B)



(C)



(D)



(E)



(F)



(G)

Discussion: The management of complex multifragmentary fractures has continually been a problem for the orthopedic surgeons. They have been treated by conservative methods earlier in the form of casts or traction but poor results with regard to joint motion and prolonged recumbency were the problems. Closed methods have also been condemned for the treatment of bilateral extremity fractures and in the multiply injured person^{7,8}. Conventional plating in which the fragments of the broken bone were put together like doing the jigsaw, irrespective of the soft tissue attachments also led to a lot of problems like non union, delayed union, increased chances of implant failure, etc. With view of this biological plating techniques were introduced for treating such fractures. Interlocking nailing is also an established method in the treatment of comminuted diaphyseal fractures. Extended indications also cover the proximal and distal metaphyseal fragments. Minimally invasive plate osteosynthesis is on the contrary the treatment of choice in periarticular multifragmentary fractures. No special instrumentation is required. It can be used in the transition zone fractures where interlocking nailing is very demanding.

Johner and Wruhs⁹ reported a significant increase in complications as progressively higher energy fractures are treated with open reduction and conventional internal fixation. Complications increased from 9.5% for torsional to 48.3% for comminuted fractures. Likewise the infection rate increased from 2.3% for torsional fractures to 10.3% for comminuted fractures. Also nonunion was twice common and infection five times more likely when open fractures were treated with plating.

The poor results of anatomic reduction and rigid fixation led to the development of biological fixation, where anatomic reduction is not the aim. Biological fixations are those in which blood supply to the fracture fragment were maximally preserved and

minimal soft tissue damage to assist the physiological process of bone healing⁷.

Radziejowski et al¹⁰ in their study of 22 cases of proximal tibial fractures treated with minimally invasive method have also shown good results with union occurring in 12 to 24 weeks.

These are indirect fracture reduction techniques and they maintain fracture alignment by plating without compression. Operative exposure and soft tissue stripping are minimized with preservation of the vasculature and periosteum. The technique of biologic plating aimed to improve rates of fracture union, decrease the use of supplementary bone grafting, and decrease the incidence of complications such as infection or re-fracture. The philosophy is therefore similar to that of intra medullary nailing. The mechanical features of bridge plating cause indirect bone healing and relative stability.

Vecseiet al¹¹ presented their series of 158 fractures of the tibia all long comminuted, treated with closed interlocked nailing. The complications observed were nail fracture (0.6%), infection (3.8%) and pseudoarthrosis (0.6%).

Klemm and Borneret al⁷ studied 401 complex tibial fractures treated with interlocked nailing. Overall 94.3% of them were judged to have excellent or good results. Delayed union or non-union requiring bone grafts occurred in 0.7% of cases with deep infection developing in 2.2% cases.

Pradymna P Pai Raiturker and AA Salukhe studies 16 cases of the multi-fragmentary periarticular fracture of the tibia found 93.75% excellent and good functional result with 100% union of the fracture by the period of 24 weeks. In his series 83.3% had full weight bearing in 23 weeks period.¹²

Thus the results of the present short series in the treatment of high energy tibial fractures are better as compared to that for conventional plating techniques. Minimally invasive plate osteosynthesis, on the contrary, is the treatment of choice in periarticular multifragmentary fractures. Equally good results as far as union and early mobilization are possible.

Advantages of MIPPO: 1. Simple technique and easy to master. Learning curve short. 2. No need of

additional expensive instrumentation. **3.** Improved rates of fracture union. **4.** Decreased infection rate. **5.** Decreased need for bone grafting. **6.** Ideal technique for dealing with the multiply injured patients. **7.** Early mobilization of the extremity possible, **8.** Decreased incidence of refracture after plate removal.

With longer follow-up and a larger number of patients, it seems that the minimally invasive technique of plate osteosynthesis for the treatment of multifragmentary fractures of the lower extremity will prove to be a feasible and worthwhile method of stabilization. It has been rightly said by well known anatomist R Schenk (1997), "If the fracture surgeon does something 'LOGICAL' then 'BIO' will do the rest"¹³.

Conclusion: Minimal invasive plate osteosynthesis is a method of the treatment of the tibial fractures. It is technically simple, easier to master; need no additional expensive instruments, cheaper to the patient and early mobilization of the patients. It has excellent results in term of rate of fracture union, infection and need no bone grafting. It is a ideal technique for the multiply injury patient and multi-fragmentary fracture at or around the joint.

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Conflict of interest: None
Funding: None
Cite this Article as: R Bhesaniya , B Dalal. Study of Results of Minimal Invasive Percutaneous Plate Osteosynthesis in Fracture of Upper Tibia. <i>Natl J Integr Res Med</i> 2018; 9(1):36-40