MINIMAL INVASIVE PERCUTANEOUS PLATE OSTEOSYNTHESIS OF FRACTURE OF TIBIA

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Abstract

A prospective study of minimally invasive plate osteosynthesis of the 30 fracture tibia was done at Koshi zonal hospital. Out of 30 fractures 29 cases had single tibia fracture and one case had bilateral fracture of the tibia. 21 cases had lower 3rd fracture, 6 cases had middle 3rd fracture and remaining cases had fracture at the upper 3rd of the diaphysis and diaphysio-metaphysial area of the tibia. All were treated with biological platting technique by indirect reduction and minimal opening at fracture site to see the perfect reduction and minimal opening at the introduction site of the plate. All cases were united. 62.7% cases showed radiological union 14 to 18 weeks and remaining 33.0 % showed in between 20-24 weeks period.93% cases had full weight bearing in 24 weeks. One case required bone grafting and partial fibulectomy. None of the cases had complication except superficial infection of 2 cases. Range of motion of knee and ankle were excellent. Functional outcome of the long-term result were excellent to good in 93.40% and fair result in 2 cases.

Keywords

Minimal invasive-percutaneous plating-easier and cost effective.

Introduction

Proximal and distal tibial fractures were traditionally treated by open reduction and internal fixation through the standard antero-lateral approach. Now a day's majorities ware treated by the intra medullary devices. Close intra medullary nailing requires image intensifier. The new "minimal invasive "internal fixation technique has been developed in an effort to devascularised the bone less than the traditional method.[1]

Fracture of the distal tibia is notoriously difficult to treat and the traditional method of fixation was often fraught to be soft tissue complication and non union and delayed union In 1905, Lambotte called such fracture "fracture de,l epiphyse" and was perhaps the first to perform the Open reduction and internal fixation to treat this type of fracture.[2]. Although excellent result was frequently reported poor result with skin slough off, wound dehiscence and infection were associated with traditional open reduction operative technique[3]. To obtain the minimal insult at surgery modern biological principles have evolved that emphasizes the meticulous soft tissue dissection, limited stripping of the

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fracture fragment and periosteum, indirect reduction technique and adequate fixation[4]. Minimal invasive percutaneous plate osteosynthesis (MIPPO) was developed in response to the disappointing result following traditional method of surgical stabilization fracture of the tibia and its complications[5]. Percutaneous plating is advantageous because it minimizes the soft tissue damage and devascularisation of the fracture fragment.

Biological fixation principles were echoed on the 60th decades but had gained popularity on 1980,s. Biological technique is those in which blood supply to the fracture fragment were maximally preserved and minimal soft tissue damage to assist the physiological process of bone healing[6]. Biological principles can be summarized as

- Reposition and realigning by manipulation at a distance to the fracture site preserving soft tissue (Indirect reduction technique)
- Leaving comminuted fragment out of the construct while preserving their blood supply.
- Use of the low elastic modulus, biocompatible materials and
- Limited operative exposure.

Minimally invasive percutaneous plate osteosynthesis is one such method in which plate is introduced percutaneouly and fixed proximal and distal to the fracture percutaneouly.

Materials and Methods

All the cases had been studied at department of orthopedic Koshi Zonal hospital since Jestha 2058 to Jestha 2061. Patient was randomly selected. Open fracture Gustilo Anderson type I and all close fracture of diaphysis of tibia were included. In this series none of the intra-articular fracture was included. Duration of follow up ranged from 6 months to the 24th months. None of the cases had defaulted.

All the cases were received either via the casualty department or the routine OPD of the orthopedic. All were admitted and routine investigation like CBC, hemogram, urea creatinin, blood sugar, blood grouping and HIV and HBsAg test were done. Standard Anterior posterior and lateral view x-rays at the fracture site and chest x-ray was taken routinely. Injured limb was kept elevated in Brown Bohler frame with skin traction. All fracture were diaphysial fracture with following location.

Lower 3rd	21
Middle 3rd	6
Upper 3rd	3

Table 1

Male female ratio of the patients is 2:1 (19 male and 10 female). Average age is 34.9 years and age range from 23 to 62 years.

Cause of the injury was as follows:

Etiology	No. of cases	Percentage
Road Traffic Accident	15	49.5
Fall from height	7	23.1
Slip in the ground	8	26.4

Table 2

Age and sex distribution of the injury victims

Age range	Male	Female
<30	8	3
31-40	6	5
>41	7	1
	21	9

Table 3

Injury surgical intervention is not more than 2 weeks. Majority of the patients were referred from the district hospital and PHC so all of them were brought to hospital after 24 hours of injury.

Injury surgical intervention interval **Injury**

surgery interval	No. cases	Percentage
Less than 24 hours	2	6.6
2-6 days	12	39.6
7-14 days	13	42.9
> Than 2 weeks	3	9.9

Table 4

After thorough pre operative preparation and written consent; patients were subjected for operative treatment. All patients had spinal anesthesia. After thorough cleaning and preparation part was draped aseptically. Tourniquet was applied and prophylactic antibiotic Cefaxone 1 gm was given intravenous before tourniquet was applied. About 1-1.5cm incisions were given at the fracture site and fracture was reduced by longitudinal traction and counter traction by the assistants. With this incision fracture reduction was visualized and maintained the reduction. Appropriate length of the broad DCP or LCDCP were selected, contoured according to the surface of the bone and slipped subcutaneously at the medial surface of the tibia by making the incision at the distal or proximal end of the plate. Plates were contoured according to the need by bender. Screws were applied percutaneouly at its holes. Minimum six cortices on either side of the fracture were applied. Then the tourniquet was deflated and haemostasis done and wound closed with 2- 3 sutures at the site of incisions. Blood loss was measured by volume of suction bottle and sponge weight. If there is a lateral malleoulus fracture, concomitant lateral malleoulus was fixed at time. Routinely posterior slab was applied about a week and slab was removed afterward and started the ROM exercise of the knee and ankle

Figure 1(Per-operative)

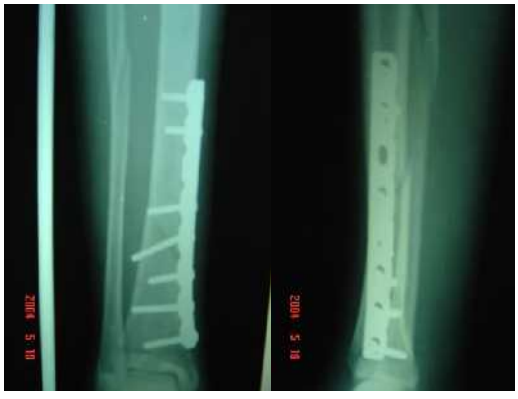

Figure 2(Pre-operative)

Figure 3(Post-operative)

Blood loss was maximum of 30ml per operatively.
Operative interval was as:

Time	No. of case	Percentage
Within 45 minutes	6	19.8
Within 60 minutes	19	62.7
More than 60 minutes	5	16.5

Table 5

Patient was discharged the next day of operation and follow up at a weekly interval till six weeks. ROM exercises were done at the physiotherapy from the 2nd week of operation. Routine post operative check x-ray AP and Lateral view was done before discharge. Routine follow up x-ray was done in every 4 weeks interval and checked for the radiological callus formation and stability of the fracture and implants. No weight bearing is allowed unless there is sign of healing started and stable fixation. Bilateral non-weight bearing crutch walking is allowed from the 2nd weeks of the operation. Toe touching was allowed after the six weeks of operation.

Time interval of radiological healing of the bone

Period of week	No. of cases	Percentage
14-18	19	62.7
19-23	10	33.0
24-30	1	3.3

Table 6

In one case there was distraction and no signs of healing with repeated swelling at the site of the fracture fixation at the 18 weeks period so partial febulectomy and corticocancellous graft were done. Within 14 weeks post operative period bone healing occurred and weight bearing started after the 18 weeks.

Figure 5(After 6 weeks)

Fig (After 3 months & 6 months)

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

In this series total number of the patients were 29 with 30 tibial diaphysial fractures. Average age of the patient was 34.9 years and range from 23 to 62 years. Male are predominantly victims (M:F 2:1) More than 73%(22 patients) patients were under the age of 40 years. Around 50% patients are due to road traffic injury and remaining are due to other injuries. In this series, one patient had Gustilo type I open fracture and remaining are of close fracture and two cases had associated lateral malleoulus fracture and one person had bilateral tibial fracture. Average injury surgical intervention time is 10.1 days with 82.3 % were operated upon the 6-14 days time (table 5). The average operative time was 58.6 minutes with 82.5 % had operating time less than 60 minutes.

All the fractured healed and 62.7 % healed within the 14-18 weeks interval and 96% healed within the 23 weeks period. Average period of healing is 17.23 weeks.

More than 92 % of the patient achieved the full weight bearing without crutches within the 23 weeks period.(Table 7). Average period of full weight bearing is 20.3 weeks time.

Time interval of full weight bearing.

Time interval	No. of cases	Percentage
14-18 weeks	7	23.1
19-23 weeks	21	69.3
24-30 weeks	2	6.6

Table 7

The average hospital stay was about 14.23 days. None had postoperative complication except the superficial infection in 2 patients. Patient was discharged at the second day of operation.

Function result was assessed on the point rating system of AO. The bases are pain, function, work ability, joint mobility, and radiological and gross appearances.

Functional-outcome

Rating	No. of cases	Percentage
Excellent	17	56.1
Good	11	36.3
Fair	2	6.6
Poor	0	0

Table 8

In this rating system long term (More than 3years) functional outcome was satisfactory. 93.4% excellent and good and remaining 6.6% had fair long term functional outcome result. None had the restriction of the ROM of the ankle and knee joint.

Discussion

Management of the tibial diaphysial fracture is complex and still controversy. Traditional open reduction and internal fixation had lots of complication due to poor soft tissue coverage extensive periosteal stripping during operation. So the biological fixation technique had been introduced to reduce these complications. Patients had been treated with conservative methods like cast or traction but poor result with regards to the joint motion and prolong recombency[7].

Interlocking nailing is a established method in the treatment of the diaphysial fracture of tibia. But it needs special instrument and

image intensifier. Most of the zonal and regional hospital may not have that of facilities. Again it is costly and technical expertise counts the IMILnailing and cannot be used in the metaphysical diaphysial junction area [8]

It was shown that femoral arterial supply was less disruption in MIPPO than the traditional technique so it is a biological than the tradional[9].

Helfet et al in their studies of 20 distal tibial fractures by MIPPO found excellent result with no nonunion and hardware failure[10]. He recommends the plate osteosynthesis for the distal tibial fracture[10]

Pradymna P Pai Raiturker and AA Salukhe studies 16 cases of the multifragmentary 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[11.]
Johner and Wruhs reported significant high rate of complication in case of the comminuted fracture (48.3%) to the torsional (9.5%) fracture. Similarly infection rate increased as the velocity of injury increased[12].

Klemm and Borner et al. reported 401 complexes tibial fracture treated with intramedullary interlocking nailing.93.3% had excellent and good results with 99% union[8]. but in Vesei et al.found 3.8% infection and 0.6% pseudoarthrosis and nail failure[13].

In the present series only diaphysial close fracture were studies because of the constraints of the physical facilities of our hospital set up. No peri-articular multifragmentary cases were included. Though interlocking intramedullary nailing is the established method of treatment tibial diaphysial fracture, MIPO has cost effective, easier and no need of the special instruments and C-arm. The overall result is recommendable for the surgeon working at the poor set up and facilities hospital.

Summary and Recommendations

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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