Mini-open reduction and intramedullary interlocking nailing of fracture shaft of tibia without an image intensifier

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ABSTRACT

Intramedullary interlocking tibial nailing is usually performed using an image intensifier. But being expensive, it is not available in the most of the hospitals of resource-poor countries of the world. The purpose of this study is to analyze the results of interlocking nailing without the use of an image intensifier. This is the retrospective study of 55 diaphyseal tibial fractures treated with minimally open reduction and internal fixation with interlocked intramedullary nail fixation. The proximal locking of the nail with the screws was made using external jig and for the distal locking direct visualization of the hole was carried out. There were 15 females and 40 males. The average age in years was 32 with a range of 18 to 64 years. The surgical approach was medial parapatellar. The average follow up period was 4 months. This period ranged from 3 months to 14 months. The union time in an average was 4 months. The complication mainly was distal screw loosening leading to valgus deformity and shortening in 1 case. It is, therefore, concluded that interlocking intramedullary nailing can be performed with proximal and distal locking accurately without the use of an image intensifier.

Keywords: Fracture tibia, intramedullary, interlocking, mini-open reduction, external jig.

INTRODUCTION

Intramedullary interlocking (IMIL) tibial nailing is the leading modality of treatment of diaphyseal tibial fractures.[1-3] It has biological and biomechanical advantage over plate osteosynthesis.[4] Various studies regarding the safety and effectiveness of closed intramedullary interlocking nailing have been done.[5-8] The C-arm image intensifier is used for closed reduction, closed nailing, locking bolts proximally and distally.[9-11] The C-arm image intensifier is expensive and is not readily available in most of the hospitals of resource-poor countries of the world.[12] Similarly, the imaging facility is rarely available even in the operation theatre of the tertiary level public hospitals in Nepal. So it was not surprising that it was not available in Bheri and Lumbini zonal hospitals also. Even though, minimally open reduction and IMIL nailing was done with or without peroperative X-rays. Hence we decided to see the results of these cases of minimally open reduction and internal fixation with the interlocked intramedullary nailing without using conventional image intensifier. The period of case collection was 3 years from 2003 to 2006. There were 15 females and 40 males. This study was done to study the rate of healing and complications like wound infection, mal-union and nonunion, etc.

MATERIAL AND METHODS

This is a retrospective study carried out in the department of orthopaedics of Bheri and Lumbini zonal hospitals in Nepal. The inclusion criteria were displaced closed fracture shaft of tibia treated with mini-open reduction and intramedullary interlocking nailing and those who were in regular follow up for fourteen months or the fracture was united which was earlier were included in the study. Only 55 cases met the criteria and they were included in the study.

SURGICAL TECHNIQUE

Spinal or general anaesthesia was given and patient was placed supine on the operation table. Cephazoline 1 gm intravenously, as a prophylaxis for infection, was given to all cases. A sand bag is placed beneath the distal thigh to flex knee 30 degree. Thigh is supported with the sand bags. The limb is prepared and draped with the standard aseptic technique. A thigh tourniquet was routinely applied.

The fracture site was opened with the anterolateral approach with the 3 to 5 cm skin incision centering over the fracture site. The fracture site was washed or curetted to visualize the anterior aspect of the fracture ends. The elevation of periosteum was avoided. The fracture ends were reduced by traction and external manipulation. The table was folded or the knee was flexed with lowering the table to flex the knee at 110 degrees. A longitudinal incision, 5cm long, was made medial to the patellar tendon and the patellar tendon was retracted laterally. The medullary canal was opened with the curved bone awl in the mid line just proximal to the tibial tubercle

behind the patellar tendon. Bone awl was tilted into the axis of the tibia at an early stage to avoid penetrating the posterior cortex. A guide wire was inserted and conformed by visualizing through the fracture site. The medullary canal was reamed with the reamer up to 10 mm diameter nail of proper length. Indian make implants and instrument sets with some indigenous modification were used. The tibial nails of 9mm diameter used. The preoperatively planned length of the nail was reconfirmed according to the reamer size and guide wire. The proximal bolts are inserted first. To insert the proximal bolts after drilling with the standard drill, the near cortex was drilled with 5 mm drill bit. For the distal bolts, small nick was given with the help of Distal Aiming Device. Soft tissue was retracted with the fine retractors and drilled with the standard drill and try to visualize the hole of the nail with the use of fine suction tube. If it was not in the centre of the hole of the nail the anterior cortex was drilled with 5mm drill bit. If there was difficulty in localizing the hole of the nail, a K-wire was used as a marker and per-operative check X-rays were done. The wounds were thoroughly irrigated and closed.

RESULTS

A total of 55 cases, forty males and fifteen females, were evaluated at two weeks, six weeks, twelve weeks, six months and nine months or till the fracture was united. The follow up period ranged from three months to fourteen months. The age ranged from eighteen years to sixty five years. The average age was 32 years. The timing of surgery ranged from two days to two weeks and averaged 5 days. The operating time ranged from 45 minutes to 2.25 hours. The mean of operating time was one hour.

The patients follow up was continued for the period of fourteen months or till the fracture union. The diaphyseal tibial fractures of fifty three patients united before six months. Two fractures were gone into delayed union one of which united after dynamization and partial weight bearing. Another one required nail exchange and bone grafting which was united in fourteen months. The average time of union was four months.

The other complications like infections were encountered. There were 8 superficial and 5 deep infections out of 55 patients. The superficial infections were treated with appropriate antibiotics for two weeks and deep infections were treated for three to six weeks. None of them developed chronic osteomyelitis. All the fractures united without deformities except one who had loosening of distal screws leading to 10 degree of valgus and 2 cm shortening malunion.

Table-1: Mode of injury

Type of injury	Male	Female	Total (%)
Fall	14	8	22 (40.0)
Vehicular	24	7	31 (56.4)
Physical assault	2	0	2 (3.6)
Total	**40**	**15**	**55 (100.0)**

Table-2: Site distribution

Site distribution	No. of patients	Percent (%)
Proximal third	16	(29.0)
Middle third	25	(45.5)
Distal third	14	(25.5)
Total	**55**	**(100.0)**

Table-3: Pattern of fracture

Fracture pattern	No. of patients (%)
Transverse	11 (20)
Oblique	31 (56.4)
Spiral	13 (23.6)
Total	**55**

DISCUSSION

Tibial shaft fractures are common since they account for 9.0% of all fractures.[13] Intramedullary nailing has become a popular and effective procedure for the treatment of most fractures of the tibial diaphysis. Interlocking nails are commonly performed using an image intensifier.[9-11] These are expensive and are not readily available in most resource-poor countries of the world.[12] Various studies to avoid the image intensifier has been tried.[12-17] The Mini-open reduction and intramedullary interlocking nailing using external jigs and direct visualizing the hole for locking bolts technique avoids radiation hazards.[16] So based on these reasons minimally open reduction of the fracture and intramedullary interlocking (IMIL) tibial nailing with locking of bolts by external jigs had been carried out at Bir Hospital with equally good success rate, but not reported. This retrospective study was carried out in the peripheral Hospitals, Bheri and Lumbini Zonal hospitals. There were 55 tibial diaphyseal fractures of fifty five

Table-4: Radiological findings: follow up at 3 months

Radiological findings	No. of patients (%)
No callus	3 (5.5)
Visible callus one side	5 (9.1)
Visible callus both sides	35 (63.6)
Union	(21.8)
Total	**55 (100.0)**

Table-5: Radiological findings at six months

Radiological union	No. of patients (%)
Fracture united	53 (96.4)
Delayed union	2 (3.6)
Total	**55 (100.0)**

patients including 15 females and forty males. The age of the patients ranged from 18 years to 64 years. The average age is 32 years. The vehicular accident injury was the commonest mode of injury consisting of 56.5 percent (n=31). The other mode of injury were 40 percent (n=22) due to fall and 4 percent (n=2) due to physical assaults. The commonest site of fracture is the middle third 45.5 percent (n=25), proximal third 29 percent (n=16) and distal third 25.5percent (n=14). The commonest pattern is oblique consisting of 56 percent (n=31), transverse 20 percent (n=11). The timing of surgery ranged two days to two weeks. The average timing was 5 days.

The fracture united in an average of 16 weeks (4 months), ranging from 12 weeks (3 months) to 14 weeks (4.5 months).

In this series 96 percent (n=53) fracture tibia united in an average of 16 weeks. Two fracture tibias (4.0%) had delayed union. One of which united after dynamization. Another one turned into non-union which was treated with nail exchange and bone grafting. This fracture also united in fourteen weeks. The complication like infection was encountered consisting of 15 percent (n=8) superficial infection and 4 percent (n=2) deep infection. The superficial infections were treated with appropriate antibiotics for the period of two weeks. The deep infections were treated with antibiotics for 3 to 6 weeks. None of the patients developed chronic osteomyelitis. The complication mainly was distal screw loosening leading to valgus deformity and shortening in one case (2.0%). The results are comparable with the other series.

It is, therefore, concluded that interlocking intramedullary nailing can be achieved without the use of image intensifier once the surgeon develops a reasonable experience with the use of distal aiming device and direct visualizing the hole of the nail.

Table-6: Comparison of union with other series

Authors	n	Union	Non-union
Alho A et al2	98	15 wks	2 % (n=2)
Court-Broun *et al*[5]	50	15.4 wks (unreamed) 22.8 wks (reamed)	10 % (n=5)
Court-Broun *et al*[7]	125	16.5 wks	2 % (n=2)
Ikem *et al1*[2]	40	3 months	5 % (n=2)
Anglen *et al1*[8]	45	34.5 wks (reamed) 22.6 wks	13 % (n=6)
In this series	55	16 wks	2 % (n=1)

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