Experience in the management of distal third tibia and fibula fractures by interlocking intramedullary nail in Community Based Medical College Hospital

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Abstract

Objective: To determine the effect of interlocking intramedullary nail in treatment of tibia and fibula fractures and analyze its efficacy by clinical and radiological parameters.
Methods: From August 2015 to September 2017, in Community Based Medical College Hospital, Orthopedics department, 15 patients with tibia and fibula fractures were managed by open reduction and interlocking nail and each case was followed up for 7 months. The cases were assessed clinically and by radiology.
Results: There were 13 males and 2 females involving 10 right legs and 5 left legs. Ages of patients ranged from 17 years to 60 years with mean age 36.13 years and standard deviation 11.813 years. The location of fractures was 1 upper, 2 middle and 12 lower. There was association of 1 fracture femur right side.
Conclusion: Use of interlocking intramedullary nail in management of tibia and fibula fractures was good in majority of cases.

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Introduction

A human being has two legs. The leg is the lower part of the lower limb between the knee joint and the ankle joint, essential for supporting the body in squatting, sitting, standing position, for hop, step and jump, for walking, running, climbing and for different sports and gymnastics. State of inertia and motion, both are impossible without leg. Bones of legs are patella, tibia and fibula. A fracture is a break in the continuity of bone, which may be complete, or occasionally may be incomplete. The three fundamental principles of fracture treatment are reduction, immobilization and preservation of function. Reduction must be qualified by the words 'if necessary'. Reduction may be carried out by closed manipulation, by mechanical traction with or without manipulation and by open operation. When operative reduction is resorted, the opportunity should always be taken to fix fragments internally to ensure that the position is maintained. Six methods of internal fixation of fractures are: plate and screws, intramedullary nail (without and with locking screws), sliding screw-plate and screws, condylar screw plate, tension band wiring, transfixion screws or Kirschner wires. Immobilization must be qualified by the words 'if necessary'. Immobilization is done to prevent displacement or angulation of the fragments, to prevent movement that might interfere with union and to

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relieve pain. Immobilization is done by a plaster of Paris cast or other external splint, by external fixation and by internal fixation. We have to keep in mind that union cannot be imposed but may have to be encouraged. Where bone is a plant, with its roots in soft tissues, and when its vascular connections are damaged, it often requires, not the technique of a cabinet maker, but the patient care and understanding of a gardener. The tibia is the large weight bearing medial bone of the leg. It articulates with the condyles of the femur and the head of the fibula above and with the talus and the distal end of the fibula below. Vast surface of tibia is covered only by skin and superficial fascia. The fibula is the slender lateral bone of the leg. It takes no part in articulation of knee joint, but below it forms the lateral malleolous of the ankle joint. It takes no part in the transmission of body weight, but it provides attachment for muscles. Fractures of the tibia and fibula are common. If only one bone is fractured, the other acts as a splint, displacement is minimal. Fractures of the distal third of the shaft of tibia are prone to delayed union or malunion. This can be because of the nutrient artery is torn at the fracture line, with a consequent reduction in blood flow to the distal fragment. It is also possible that the splint like action of the intact fibula prevents the proximal and distal fragments coming into apposition. Based on the clinical anatomy, we have opted for operative reduction and immobilization by internal fixation by interlocking intramedullary nail. Intramedullary nail is excellent for many fractures of long bones. It is regularly used for fracture of tibia. The original Kuntscher-type nail designed for the femur was hollow and of clover-leaf section. This type has been replaced by newer more versatile locking nail with a rounder cross-section, which offers notable advantages. These have transverse holes at both ends, allowing the insertion of transfixion (locking) screws through bone and nail under image intensifier radiographic control. Improved results of the treatment of fractures owe much to rehabilitation which is achieved through active use and active exercise the purpose is to preserve function while uniting and to restore it to normal while united.[1-3]

Materials and Methods:

A descriptive type of prospective study was done in Community Based Medical College Hospital, Orthopedics department from August 2015 to April 2018. The cases were tibia and fibula fractures managed by open reduction and internal fixation by interlocking nail. 15 patients were selected. Sampling technique was convenient type of non-probability sampling. Each case was followed up for 7 months. Instrument of data collection was history taking by a pre-tested questionnaire and Hospital records on admission and during stay. Evaluation was assessed clinically and by radiology. Efficacy of operation was assessed by Karlstrom-Olerud evaluation parameters during postoperative follow-up visits.

Results:

From August 2015 to September 2017 in Community Based Medical College Hospital, Orthopedics department, 15 patients with tibia and fibula fractures were managed by open reduction and internal fixation by interlocking nail and each case was followed up for 7 months. Among them there were 13 males and 2 females, involving in 10 right legs and 5 left legs. Mode of injury was Road Traffic injury in majority of cases (13/15) (86.67%). Ages of injured persons ranged from 17 years to 60 years with mean age 36.13 years and standard deviation 11.813 years.

Fractures were 1 upper, 2 middle and 12 lower. There was 1 case of old fracture. All the fracture cases were closed fracture. There was one case of associated femur fracture right side. Closed intra-medullary nailing was done in all 15 cases of which 9 patients had no other fixation than tibia nail. Mean operation time was 90.67 minutes (range 85 minutes to 100 minutes). There was no wound problem. Most of the cases (13/15) (86.67%) united successfully. Prevalence of nonunion was (1/15) (6.67%) and prevalence of mal-union was (1/15) (6.67%). Mal-union happened in the case of old fracture (1/1) (100%). Postoperative angle deformity (mean 3.38 degree) and postoperative recurvatum (mean1.487 degree) were acceptable. Efficacy of operation was assessed by Karlstrom-Olerud evaluation parameters during postoperative follow-up visits. We followed up the cases up to 7 months (First follow-up at the end of 3 months, second follow-up at the end of 6 months and final follow-up at the end of 7 months with advise they can come any time in case of any inconvenience). Karlstrom-Olerud score was good in (14/15) (93.33%) of cases.

Table I shows age and sex distribution of patients.

Table I: Age and Sex distribution of patients

Age group	Sex		Total
	Male	Female	
15-24 years	2	0	2
25-34 years	5	0	5
35-44 years	2	1	3
45-54 years	4	0	4
55-64 years	0	1	1
Total	**13**	**2**	**15**

Table II shows fracture sides and sites of leg.

Table II: Fracture sides and sites of leg

Fracture of bone	Side						Total
	Right			Left			
	Upper	Middle	Lower	Upper	Middle	Lower	
Tibia	1	0	0	0	1	0	2
Fibula	0	0	0	0	0	0	0
Both tibia and fibula	0	0	9	0	1	3	13
Total	**1**	**0**	**9**	**0**	**2**	**3**	**15**

Table III shows fixation of bone

Table III: Fixation of bone

Bone fixation	Frequency	Total
Tibia alone	9	60.00
Both tibia and fibula	6	40.00
Total	**15**	**100.00**

Table IV shows input and outcome variable of operation.

Table IV: Input and outcome variables

Parameter	Mean	Standard deviation	Range
Operation time	90.67 minutes	4.169	85 minutes to 100 minutes
Union time	21.87 weeks	1.959 weeks	20 weeks to 28 weeks
Angulation	3.38 degree	0.0775 degree	3.3 degree to 3.5 degree
Postoperative recurvatum	1.487 degree	0.0743 degree	1.4 degree to 1.6 degree

Table V: Distribution of complication

Status	Frequency	Total
Varus/vulgus angulation $>5^0$	0	0.00
Wound problem	0	0.00
Mal-union	1	6.67
Nonunion	1	6.67
No complications	13	86.67
Total	**15**	**100.00**

Table VI shows Karlstrom-Olerud evaulation patrameters.

Table VI: Karlstrom-Olerud evaluation parameters

SL. No.	Measure	3 points	2 points	1 point
1	Pain	No	Little	Severe
2	Difficulty in walking	No	Moderate	Severe limp
3	Difficulty in climbing stairs	No	Supported	Unable
4	Difficulty in previous sports	No	Some sports	Unable
5	Limitation at work	No	Moderate	Unable
6	Status of skin	Normal	Various colors	Ulcer/fistula
7	Deformity	No	Little up to 7^0	Remarked $>7^0$
8	Muscle atrophy	<1cm	1-2cm	>2cm
9	Leg length discrepancy	<1cm	1-2cm	>2cm
10	Loss of motion at knee joint	$<10^0$	10^0-20^0	$>20^0$
11	Loss of motion at subtalar joint	$<10^0$	10^0-20^0	$>20^0$

Table VII shows the Karlstrom-Olerud score result.

Table VII: Karlstrom-Olerud score

Score	Frequency	Percentage
Excellent	0	0.00
Good	14	93.33
Bad	1	6.67
Total	**15**	**100.00**

Discussion:

In this study, the sample size was 15, male female ratio 13:2, mean age 36.13 years with standard deviation 11.813 years. 2 had tibia fractures and 13 had both tibia and fibula fractures. Cases were managed by open reduction and internal fixation by interlocking nail. Intra-medullary nailing was done in all 15 cases of which 9 patients had no other fixation than tibia nail. Mean operation time was 90.67 minutes (range 85 minutes to 100 minutes). There was no wound problem. Mean union time 21.87 weeks, mean varus/vulgus angulation 3.38 degree, mean postoperative recurvatum 1.487 degree which were acceptable. Most of the cases (13/15) (86.67%) united successfully.

Prevalence of mal-union was 6.67% and nonunion 6.67%. Efficacy of operation was assessed by Karlstrom-Olerud evaluation parameters during postoperative follow-up visits. We followed up the cases up to 7 months (First follow-up at the end of 3 months, second follow-up at the end of 6 months and final follow-up at the end of 7 months with advise they can come any time in case of any inconvenience). Karlstrom-Olerud score was good in (14/15) (93.33%) of cases.

In a study for the treatment of distal tibial fractures for plating versus intramedullary nailing 14 patients were treated with plate fixation and 13 patients were treated with IM nailing. Comparison was done by postoperative radiographic deformities, functional results (Iowa ankle scores), and symptoms (Olerud and Molander ankle scores). All fibular fractures were first stabilized with plate fixation. The tibial fractures were treated with a locked IM tibial nail. All fractures had healed at final follow-up (mean, 33 month). Mean union times were 27.8 week (range, 18-36 week) in group A and 22.6 week (range, 18-30 week) in group B (P<0.05). Mean postoperative valgus angulations were larger in group B (3.7 degrees) than in group A (0.5 degrees) (P<0.05). Prevalence of mal-union was (3/13) (23.08%).

However, mal-unions did not differ between groups (P<0.05). Functional results and postoperative symptoms were similar. Both plate fixation and shortened IM nailing were effective for treating distal tibial metaphyseal fractures. In the group where intramedullary nailing was done male female ratio was 8:5, mean age 48.2 yrs with standard deviation 19 years and post-operative recurvatum was 1.7 ± 2.6.[4] In a study 20 consecutive cases of distal tibial metaphyseal fractures were treated with statically locked inttramedullary nailing with supplementary

blocking screw. Male female ratio was16:4, mean age 35 years and mean union time was 11.5 weeks. Mean varus/vulgus alignment was 10.3 degrees preoperatively and 1.7 degrees immediately postoperatively and was maintained till union. Post-operative recurvatum was -0.1 to 0.5 degrees.[5] In an Indian study for the management of fractures of distal third tibia by interlock nailing sample size was 60, male female ratio 48:12, age ranged from 25 to 50 years (mean age 35 years), mean union time was 18 weeks, varus/vulgus angulation was ± 1.5 degrees, post-operative recurvatum was -0.1 to 0.3 degrees. 40 patients had no other fixation besides tibia nail, 20 patients had fibula fixation. Prevalence of mal-union was (3/60) (5%).[6] In a cadaver study, seven matched pairs of embalmed human cadaveric legs and sixteen fresh-frozen human cadaveric legs were tested. Fibular plate fixation increased the initial rotational stability after distal tibial fracture compared with that provided by tibial intramedullary nailing alone. However, there was no difference in rotational structural stiffness between the specimens treated with and without plate fixation as applied torque was increased.[7] In a study, sample size was 15, male female ratio 9:6, distal tibial fractures were treated with a reamed intramedullary nail. All patients had returned to normal activities of daily living. Eleven patients could perform all leisure activities with no symptoms and three had only minor discomfort, which did not preclude sport. All fractures united, 12 uneventfully and three after a secondary surgical procedure. Union time was between 12 weeks to 20 weeks. Three patients (20%) had malalignment defined as varus-valgus angulation or recurvatum of 5 degrees or greater. This mal-union happened as they had not fixed the lower third fibula fracture.[8] In a study, 47 fractures on 47 patients 21 patients were treated with non-reamed, interlocking intramedullary nailing, and 26 patients were treated with wide or narrow dynamic compression plates on fibula. In the group of patients treated with fibula fixation, the average healing time was 14.6 weeks.

In the group of patients treated without fibula fixation, the average healing time was 14.3 weeks. In the group of patients treated with fibula fixation a significantly smaller proportion of valgus angular deviation (6.3%) was observed compared to the group of patients treated without fibula fixation (32.3%).[9] 52 patients suffering from fractures of the distal tibial metaphysis (40 closed, 12 open) were treated with an unreamed tibial nail using distal locking. In 13 patients an additional percutaneous inter-fragmentary fixation was also applied. 22 patients underwent an additional operation in order to facilitate bone union (dynamization, bone grafting and/or fibulectomy). In 50 of the 52 patients the fracture united with a very good range of knee and ankle motion (successful functional outcome 96.15%). Mean union time was 15.3 weeks. In 2 patients non-union with breakage of the UTN (2/52) (3.85%) occurred and in two open fractures post-operative infections were observed (2/12) (16.67%).[10] 73 patients suffering from fractures of distal part of tibia were treated with interlocking inttramedullary nail. Mean patient age was 39.8 years and mean union time was 4.2 months. (70/73) (95.89%) had successful union with good functional outcome.[11] 36 patients treated with reamed intramedullary nailing with use of either two or three distal interlocking screws. 10 fractures with articular extension were treated with supplementary screw fixation prior to the intramedullary nailing. Mean union time was 23.5 weeks. Acceptable radiographic alignment, defined as <5 degrees of angulation in any plane, was obtained in thirty-three patients (92%).[12] 20 patients with distal tibial metaphyseal fractures were treated by closed reduction and internal fixation with a shortened

tibial interlocking nail. Mean union time was 17.2 weeks. All patients received regular post-operative radiographic check-up and the ankle function was evaluated with the Iowa Ankle-Evaluation rating system. Successful outcome was 100%.[13] 63 patients with fractures of distal tibial metaphysis, with or without minimally displaced extension into the ankle joint were managed by statically locked intramedullary nailing. There were few intra-operative complications. At a mean of 46 months, all but five patients had a satisfactory functional outcome. The poor outcomes were associated with either technical error or the presence of other injuries.[14]

Conclusion

Open reduction and internal fixation by the use of interlocking intramedullary nailing for the management of distal third tibia fracture yielded good result. Simultaneous fibula fixation with plate or square nail is very effective for stability of reduction.

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