



TIBIAL DIAPHYSEAL FRACTURES; EVALUATION OF MANAGEMENT TREATED BY POP CAST VERSUS INTRAMEDULLARY NAILING IN TERMS OF TIME OF UNION.

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ABSTRACT... Objectives: To evaluate the management of tibial diaphyseal fractures treated by POP cast versus intramedullary nailing in terms of time of union. **Design of study:** Randomized controlled trials. **Setting:** Department of Orthopaedic, Allied / DHQ Hospital, Faisalabad. **Duration of Study:** Six months (01-08-2013 to 31-01-2014). **Materials and Methods:** 80 patients fulfilling the inclusion and exclusion criteria were included in the study. After laboratory and radiological assessment, the patients in Group 1 were treated by long leg cast. The patients in Group 2 were treated with intramedullary interlocking nail. The patients were followed on OPD basis. **Results:** 80 patients divided into 2 groups. Each group had 40 patients. Mean age of patients was 30.99 ± 8.092 years. There were total of 65% males and 35% females in this study. According to geometry of fractures simple transverse fractures were 47.5%, spiral fractures were 17.5%, oblique fractures were 25% and segmental fractures were 10%. There were 71.25% closed fracture and 28.75% type I open fractures. Mean time of union was 23.86 ± 5.48 weeks in group 1 while in group 2, mean time of union was 18.35 ± 4.12 weeks. P-value was 0.001 which is statistically significant. **Conclusion:** It is concluded that reamed intramedullary interlocking nailing is a good mode of internal fixation comparing with conservative management of close reduction and POP cast in both close and type I open fractures in terms of union.

Key words: Plaster of Paris cast (POP cast), intramedullary interlocking nail, union.

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INTRODUCTION

The tibia is the strongest weight-bearing bone of the lower limb of the human body and receives up to 4.7 times body weight of axial force.¹ Tibia is exposed to frequent injuries because of its location as one third of its surface is subcutaneous.²

Fracture of tibial shaft is the commonest diaphyseal fracture in adults, 50% occur with motor vehicle accident, followed by sports injuries while 24% of the fractures are open injuries.³ Complications such as compartment syndrome, neurovascular injury and infection might add to this burden. Later non-union, delayed union and mal-union may be included in complications.⁴ There are different operative and non-operative methods for treatment of the fractures of tibia. The non-operative methods are cast splintage or Plaster of Paris (POP) or functional bracing. It is

an effective method but it has higher incidence of ankle stiffness delayed union, mal-union and non-union.⁵ The operative method includes a variety of procedures like external fixation, open reduction and internal fixation using Dynamic Compression Plate (DCP) and intramedullary (IM) nailing. The external fixation results in pin-tract infection and sometime osteomyelitis of tibia the bone.⁶ Due to these problems a new technique intramedullary interlocking nailing was developed that minimize the chances of post operative infection, promotes early union, regain early activity and reduce exposure and operative trauma.⁴ According to a study mean time of union is 26 ± 9 weeks (16-52) treated by POP cast and mean time of union is 18 ± 10 weeks (12-52) treated by intramedullary nailing.⁷

There is a study in India stating that there is no

difference in long term functional outcome after nailing or POP cast in tibial diaphyseal fractures.⁸ POP cast is mostly in practice. Now a day, management of tibial diaphyseal fractures with locking intramedullary nailing has gain a great popularity for treating closed tibial shaft fractures and also for treating open tibial shaft fractures. We therefore undertook this study to compare the two modalities in our scenario so that nailing could be recommended as preferred method of treatment.

MATERIALS AND METHODS

Study Design

Randomized controlled trial

Settings

The study was conducted in Orthopedics Department of Allied and DHQ Hospital Faisalabad.

Duration of Study

Six months (01-08-2013 to 31-01-2014)

Sample Size

By using WHO sample size calculator for 2 means

Test value of POP mean = 18⁷

Anticipated POP mean = 26⁷

Pooled standard deviation = 9.51

Power of study = 90 %

Level of significance = 5%

Sample size = 80 (40 in each group)

Sampling Technique

Non-probability consecutive sampling

SAMPLE SELECTION

Inclusion Criteria

All the patients with following common properties were included in the study.

Patients of both gender and age group >18 and <70 yrs.

Location of fracture (fracture 7 cm below the knee joint and 4 cm above the ankle joint) confirmed on X-rays.

Patients with close diaphyseal fracture of tibia and type 1 open fractures (Gustilo Anderson classification) confirmed clinically.

Duration of fracture (less than one week).

Exclusion Criteria

Patients with following properties were excluded from the study.

Patients with type 2 & 3 open fractures (Gustilo Anderson classification) confirmed clinically.

Patients with pathological fracture confirmed on X-rays.

Poly-trauma patients confirmed clinically.

Infected implants confirmed clinically.

Data Collection Procedure

After the approval of the study from hospital ethical committee informed consent was taken from all the included cases. History was taken from all the included patients. Complete physical examination was done. Blood tests were sent to the hospital laboratory and radiographs of the fractured leg were done. The preoperative treatment included stabilization of patient in the form of blood transfusion. All the cases were operated by senior registrar or above level rank. Initially all the patients were stabilized with long posterior splint with knee in 10-15° of flexion and ankle at 90°. Patients were divided randomly into two groups by using computer generated random number table.

Group 1

This group included patients treated with long leg cast after closed reduction. Long leg cast was applied from mid-thigh to metatarsal heads using Plaster Of Paris (POP) after 3-5 days to allow early swelling to diminish.

Group 2

This group included patients treated with open reduction and intramedullary nailing. Stable fractures of the isthmus (transverse and short oblique, un-comminuted fractures) may be treated without locking screws. Fractures proximal to the isthmus required two proximal locking screws, and more distal fractures should be locked with two distal screws. All unstable

fractures should be locked with two screws distally and two proximally to maintain length and prevent rotation. Most fractures were locked statically. Postoperative radiographs were done. Patients were followed on OPD basis. Time of union was calculated from time of injury up till union in weeks. Information was collected on a Performa specifically designed for this study and included demographic details and postoperative outcome was reported by team.

Data Analysis Procedure

All the collected data was entered and analyzed on SPSS 10. Descriptive statistics was calculated for all the variables. Mean and standard deviation were calculated for quantitative variables like age and time of union. Frequency and percentages were calculated for all qualitative variables like sex, side of fracture etc. Independent sample t-test was used to compare mean time of union in both groups. P-value less than 0.05 were taken as significant. The effects like age, gender, site of fracture, and duration were controlled by stratification.

RESULTS

There were a total of 80 cases fulfilling the inclusion criteria, divided into two groups, that is Group 1 (POP cast group) and Group 2 (intramedullary nail group). Each group contained 40 cases. In POP cast group after initial back slab and satisfactory post-reduction radiographs, long leg complete cast was applied after 3-5 days.

Mean age of patients was 30.99 ± 8.092 years. Among the patients youngest was 16 years old while oldest one was 45 years of age (Table-I).

Particular	Minimum	Maximum	Mean	Std. Deviation
Age	16	45	30.99	8.092

Table-I. Age distribution

There were total of 52 (65%) males and 28 (35%) females in this study. In Group-1 there were 27 (67.5%) males and 13 (32.5%) female while in Group-2 there were 25 (62.5%) males and 15 (37.5%) females (Table-II).

Group	Sex		Total
	Right	Left	
Group 1 (POP Cast)	25 (62.5%)	15 (37.5%)	40 (100%)
Group 2 (IM Nail)	16 (40.0%)	24 (60.0%)	40 (100%)
Total	41 (51.3%)	39 (48.8%)	80 (100%)

Table-II. Sex distribution

According to geometry of fractures simple transverse fractures were 38 (47.5%), spiral fractures were 14 (17.5%), oblique fractures were 20 (25%) and segmental fractures were 8 (10%) (Table-III).

Fracture Pattern	Frequency		
	Total	Group 1	Group 2
Simple transverse fractures	38 (47.5%)	27 (67.5%)	11 (27.5%)
Spiral fractures	14 (17.5%)	4 (10%)	10 (25%)
Oblique fractures	20 (25%)	7 (17.5%)	13 (32.5%)
Segmental fractures	8 (10%)	2 (5%)	06 (15%)
Total	80 (100%)	40 (100%)	40 (100%)

Table-III. Fracture pattern frequency

There were 57 (71.25%) closed fracture and 23 (28.75%) type I open fractures (according to Gustilo and Anderson classification) (Table-IV).

Fracture type	Group 1	Group 2	Total	Percentage
Closed	33	24	57	73.25%
Open (type 1 open)	07	16	23	28.75%
Total	40	40	80	100%

Table-IV. Closed and open fracture frequencies

Outcome of the patients was based on mean time of union in each group. Group 1 results showed that out of 40 patients, 38 patients treated with POP cast showed the sign of union and 2 of them did not show any sign of union. Mean time of union was 23.86 ± 5.48 weeks. While in Group 2 out of the total 40 patients, 39 have the union and only 1 showed no sign of union. Mean time of union in this group was 18.35 ± 4.12 weeks

(Table-V). P-value was 0.001 which is statistically significant.

Union/Non-Union Time	Group		Total
	Group 1 (POP cast)	Group 2 (IM Nail)	
Union	38	39	77
Non-Union	2	1	3
Mean Time of Union (weeks)	23.8684	18.3500	-
S.D of mean time of Union	5.48793	4.12342	-

Table-V. Average and standard deviation of union time in group 1 and group 2

DISCUSSION

In this study patients with tibial diaphyseal fractures were divided into two groups on treatment basis. In Group 1 patients were managed with long leg POP cast with knee at 10-15° flexion and ankle at 90° dorsiflexion for 6-10 weeks and then Patellar Tendon Bearing (PTB) cast applied to encourage flexion at knee and partial weight bearing and walking. In GROUP 2, patients with tibial diaphyseal fracture, open or closed, were managed with open or closed reduction and intramedullary nailing. In Group 2 the tibial fractures were managed using 'reamed intramedullary nail'. Stable fracture at the level of isthmus were treated without locking screws, while unstable fractures proximal and distal to the isthmus were treated with both proximal and distal inter locking screws.

In this study mean age was 30.99 ± 8.092 year, youngest patient was 16 years old while oldest one was 45 years of age. In POP cast group mean age was 31.13 years with minimum age 18 years and maximum was 45 years. In intramedullary nail group mean age was 30.85 with minimum age being 16 years and maximum age 45 years. While there is a study conducted at Department of Orthopedics, Christian Medical College, a tertiary medical centre located in Ludhiana, Punjab, India, where the mean age in POP cast group was 36.2 ± 15.4 years and mean age in intramedullary nail group was 39.3 ± 13.9 years, having older group as compared to this study. This study contains younger age groups which may be due to more

traumas in young age in this setting. Similarly another study conducted at Tampere University Hospital, Finland, having older age groups with the mean age 37.4 ± 14.5 years in POP cast group and 44.7 ± 12.9 years intramedullary nail group.⁹

As far as gender is concerned there were 52 males and 28 females in this study. In Group-1 there were 27 males and 13 females. In Group-2 there were 25 males and 15 females. The participation of females was more in this study as compared to a prospective study conducted in the Department of Orthopedics, Christian Medical College, where there were 31 males and only 3 females in POP cast group, and 28 males and only 6 females in intramedullary nail group.⁷ This difference of female participation may be due to either more trauma in females in this study setting or some reluctant behavior of female participants in other study. There were a good proportion of males and females participants in this study.

There were 38 (47.5%) simple transverse fractures, 14 (17.5%), spiral fractures, 20 (25%) oblique fractures and 8 (10%) segmental fractures showing that majority of the fracture were simple transverse fractures as compared to a study conducted at Department of Orthopedics, Christian Medical College, India.⁷

In Group 1 mean time of union was 23.86 ± 5.48 week while in Group 2 mean time of union was 18.35 ± 4.12 weeks. Batt V et al. conducted a study at Department of Orthopedics, Christian Medical College, India, and comparing mean time of union in tibial diaphyseal fractures treated with POP cast versus the patients treated with intramedullary nail. There were total 68 patients with 34 patients in each group. They found mean time of union in POP cast group was 23.1 ± 8.5 weeks and mean time of union in intramedullary nail group was 21.3 ± 11.1 weeks. Fracture united sooner in the intramedullary nail group possibly due to early weight bearing.⁷

In another study conducted at Tampere University Hospital, Finland by Toivanen JAK et al., 33 fractures were treated with an intramedullary nail and 54 with a plaster cast. Mean time of union

was 19 ± 6.65 weeks in POP cast group while in intramedullary nail group mean time of union was 12 ± 4.39 weeks. There was significantly shorter healing time and sick leave time tips the scale in favor of intramedullary nailing in the treatment of fracture of shaft of tibia.¹¹

Intramedullary nailing is a popular technique for the fixation of both closed and open tibial fractures.¹⁰ Intramedullary reaming allows the insertion of larger diameter and tighter-fitting nails which offer better bending and rotational stability.¹¹ Reaming technique is used in this study. Court-Brown et al. found that reamed nails in type I closed tibial fractures result in rapid union and less additional surgery than unreamed nails.¹² Blachut et al. reported a trend toward improved union with reamed nailing for closed tibial fractures with significantly more screws failed in unreamed (16%) than in reamed (2.7%) nailing.¹³ Deting Xue et al. concluded that reamed intramedullary nailing had a lower risk of nonunion in closed tibial fractures.¹⁴

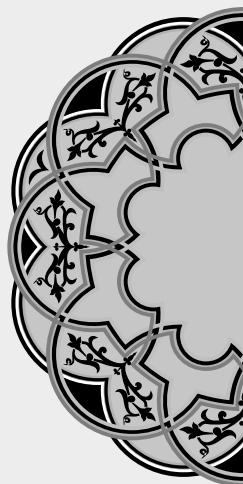
CONCLUSION

Open tibial shaft fracture is a common fracture among the young age with high energy trauma and old age with low energy trauma. On the basis of this study it is concluded that reamed intramedullary interlocking nailing is a good mode of internal fixation comparing to the conservative management of closed reduction and POP cast bracing in both the closed and type I open fractures of tibia in terms of time of union as tibial fractures heals more rapidly in intramedullary nail group and it allows early weight bearing, minimum off work period and early return to the daily routine activities. According to this study intramedullary interlocking nailing should be recommended as primary treatment option for closed or type 1 open tibial fracture.

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*“Life is ten percent what happens to us
and ninety percent how we respond to it.”*

Charles Swindoll

AUTHORSHIP AND CONTRIBUTION DECLARATION

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