

Evaluation of the Outcome of Ilizarov External Fixator in Tibial Non-union

K M Badar Uddin ^{*1}, MD. Rukanuddawla Khan², Swarupananda Chakraborty³,
Asho Tosh Nath⁴, Sheikh Kawsar Mahmood⁵, Khandoker Muhammad Mazher⁶

Abstract

Introduction: Tibial non-union ranges from 2-10% of all tibia fractures. Infection, deformity, shortening, bone loss, joint stiffness and disability complicate the non-union. Ilizarov method addresses all the above problems simultaneously and offers a panacea for infected non-unions. This study was conducted to evaluate the impact on overall outcome of ilizarov external fixator in tibial non- union. **Materials and Methods:** This prospective study was carried out at the Department of Orthopedic Surgery at Chittagong Medical College Hospital, Chittagong from June 25, 2018 to June 24, 2019. Results were analyzed according to ASAMI scoring system at the end of study by using windows based computer software devised with SPSS-23. **Result:** Out of 12 cases, 11cases (91.7%) were male and only 1 case (8.3%) was female. Mean (\pm SD) age was 27.58 ± 5.62 years. Excellent bony result was obtained in 16.7%, good in 50%, fair in 16.7% and poor in 16.7% of patients. Two (16.7%) patients had excellent, 4 (33.3%) patients had good, 3 (25%) patients had fair and 3 (25%) patient had poor functional outcome. **Conclusion:** Treatment of non-unions of Tibia with Ilizarov ring fixation is effective. However, larger randomized control trial is required to generate more valuable conclusion.

Keywords: Ilizarov external fixator, tibial non-union.

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*1. Corresponding Author:

Dr. K M Badar Uddin

MBBS, MS (Orthopedic Surgery)
Junior Consultant
Upazilla Health Complex
Chokoria, Cox's Bazar, Bangladesh.
Contact: 01817202928

2. Dr. Md Rukanuddawla Khan

MBBS MS, Resident
Department of Orthopaedic Surgery
Chittagong Medical College Hospital
Chittagong, Bangladesh.

3. Dr. Swarupananda Chakraborty

MBBS, MS (Orthopedics)
Junior Consultant
Upazilla Health Complex
Boalkhali, Chattogram, Bangladesh.

4. Dr. Asho Tosh Nath

MBBS, MS (Orthopaedic Surgery)
Medical Officer
Department of Orthopaedics and Traumatology
Chittagong Medical College Hospital
Chittagong, Bangladesh.

5. Dr. Sheikh Kawsar Mahmood

MBBS, MS(Orthopedic Surgery)
Assistant Registrar
Department of Spine Surgery
Chittagong Medical College Hospital
Chittagong, Bangladesh.

6. Dr. Khandoker Muhammad Mazher Ali

MBBS, MS(Orthopedic Surgery)
Medical Officer
Khagrachari Sadar Hospital
Khagrachari, Bangladesh.

Introduction:

The tibia is a weight bearing long bone, the anterior third of which is placed subcutaneously in the leg throughout most of its length, where it is covered only by skin and a thin layer of subcutaneous tissue, with no muscle cuff around¹. Tibia fractures are treated medically, and healthcare use depends on treatment options, which, in turn, vary by injury type and severity and the presence of complications². Fracture nonunion (sometimes referred to as “delayed union”) is a common complication of a tibia fracture; it indicates that fracture healing is not happening in a timely fashion³. Non-unions put additional burden on the patient because they prolong the disability and are associated with substantial pain⁴. Tibial non-unions are estimated to constitute 2-10% of all tibial fractures. The development of a tibial nonunion is related most often to the type and degree of injury, but several additional factors may predispose a patient to a tibial nonunion, such as the degree of fracture comminution and bone loss, whether the fracture is open, and the degree of soft-tissue injury. Subsequent complications, such as infection or compartment syndrome may play a role⁵. Various treatment methods are aimed at tibial non union like extensive debridement and local soft-tissue rotational flaps, packing the defect

with antibiotic impregnated beads. Papineau type open cancellous bone grafting, tibiofibular synostosis cancellous allograft in fibrin sealant mixed with antibiotics, and/or free microvascular soft-tissue and bone transplants. All these treatments have variable rates of success and failure, are limited in their ability to re-establish extremity length and correct deformity. The main surgical principle in the management of diaphyseal bone infection is thorough debridement of all nonviable tissue. The resulting potential shortening, instability or bone loss creates a formidable situation to overcome with standard grafting and stabilization techniques³. Application of the techniques of Ilizarov provides ability to correct deformities, eliminate prolonged pre and postoperative intravenous antibiotic therapy, regenerate new bone tissue without the use of bone grafts, progressively lengthen the extremity, and allow weight bearing during the treatment period⁶. The stability of the fixation and provision for bone transport allows bridging of bone defects, limb lengthening, early weight bearing ambulation and joint mobilization⁷.

Materials & Methods:

In this prospective clinical (hospital based longitudinal) study 12 cases of tibial non union were enrolled in the Department of orthopedics and traumatology of Chittagong Medical College Hospital (CMCH) from June 25, 2018 to June 24, 2019. All the patients were selected according to inclusion criteria, through counseling with patients and his/her relatives. Patients were managed with Ilizarov method. Data were collected by taking detailed history, clinical examination, investigations, operative details and postoperative outcome with predesigned data collection form. Results were analyzed according to ASAMI scoring system at the end of study by using windows based computer software devised with SPSS-23.

Radiological results according to ASAMI Group Grade Criteria

Grade	Criteria
Excellent	Union, no infection, Deformity < 7 deg, Limb length discrepancy < 2.5 cm
Good	Union + any two of the following; absence of infection, < 7 deg deformity and limb length discrepancy of 2.5 cm
Fair	Union + one of the following; Absence of infection, < 7 deg deformity and limb length discrepancy of 2.5 cm
Poor	Non-union/re-fracture/union + infection + deformity. 7 deg + limb length discrepancy 2.5 cm

Functional results according to ASAMI Group

Grade	Criteria
Excellent	Active, no limb, minimum stiffness (loss 15 degree knee extension/ 15 degrees dorsiflexion of ankle), no reflex sympathetic dystrophy (RSD), insignificant pain
Good	Active with one or two of the following limp, stiffness, RSD, significant pain
Fair	Active with three or all of the following limp, stiffness, RSD, significant pain
Poor	Inactive [unemployment or inability to return to daily activities due to injury]

Results:

In the present study, out of 12 cases, 8 (66.7%) were in <30 years age group. Mean (\pm SD) age was 27.58 \pm 5.62 years. Eleven cases (91.7%) in the study were male and only 1 case (8.3%) was female (Table I).

Table I: Age and sex distribution of the respondents. (n=12)

Age (years)	Number	percentage
<30 years	08	66.7%
\geq 30 years	04	33.3%
Sex		
Male	11	91.7%
Female	01	8.3%

* Mean (\pm SD) age was 27.58 \pm 5.62 years. Age range was 18-38 years. Average duration of application of Ilizarov ring fixator in months was 7.67 (\pm 1.30). In majority of the cases (n=8) external fixator held for a time period of 7-8 months. In 2 cases fixator was held for 6 months and in other 2 cases it was held for 10 months (Table III).

Table II: Duration of Ilizarov ring fixator application on responding patients (n=12)

Duration of Ilizarov ring fixator application	Number	Percentage
6 month	02	16.66 %
7 month	04	33.337 %
8 month	04	33.33%
10 month	02	16.66%

After ring removal deformity >7 degree, limb length discrepancy >2.5 cm, inactivity, limping, stiffness and significant pain was observed in 33.3%, 58.3%, 16.6%, 66.6%, 33.4% and 66.6% respectively. None of the patients had reflex sympathetic dystrophy.

Table III: Outcome after removal of the ring among respondents (n=12)

Parameter	Number	percentage
Deformity		
\leq 7 degree	8	66.6%
>7 degree	4	33.3%
Limb length discrepancy		
\leq 2.5 cm	5	41.6%
>2.5 cm	7	58.3%
Activity		
Active	10	83.33%
Inactive	2	16.66%
Limping		
Yes	8	66.6%
No	4	33.3%
Stiffness		
Yes	4	33.4%

Parameter	Number	percentage
No	8	66.6%
Pain		
Significant	8	66.6%
Insignificant	4	33.4%
Reflex sympathetic dystrophy		
Present	0	0%
Absent	12	100%

For bone results 4 criteria were evaluated: Union, deformity, infection, limb length discrepancy (ASAMI Group Grade Criteria). Out of 12 patient's excellent bony result was obtained in 16.7%, good in 50%, fair in 16.7% and poor in 16.7% of patients.

Grade	Number	Percentage
Excellent	02	16.7%
Good	06	50%
Fair	02	16.7%
Poor	02	16.7%

Table IV: Radiological findings of the responding patients at last follow-up (n=12)

Grade	Number	Percentage
Excellent	02	16.7%
Good	04	33.3%
Fair	03	25%
Poor	03	25%

The functional results were based on 5 criteria (ASAMI Group Grade Criteria). Based on these criteria 2 (16.7%) patients had excellent outcome, 4 (33.3%) patients had good outcome, 3 (25%) patients had fair outcome and 3 (25%) patient had poor outcome

Table V: last follow-up functional results of the responding patients (n=12)

Result	Number	Percentage
Satisfactory (Excellent, Good & fair)	09	75%
Unsatisfactory (Poor)	03	25%

Out of 12 patients 9 (75%) had satisfactory outcomes and rest of the 3 (25%) patients had unsatisfactory outcomes.

Table VI: Final outcome among the responding patients

Discussion:

In the present study, mean (\pm SD) age of the 12 patients was 27.58 ± 5.62 years with a range of 18-38 years. Average age of the patients in the study of Madhusudhan et al. (2008) was 37.2 years with a range of 20 to 52 years⁸. Out of 12 patients, 11 were male and 1 was female, may be due to more outdoor activities of the males and hence making them more prone to trauma. This demographic characteristic were in agreement with Reddy et al. 2018; Sakale et al. 2018; Haque et al. 2013; Bansal et al. 2014 studies carried out in and around our Bangladesh^{9,10,11,7}. Average duration of application of Ilizarov ring fixator in months was 7.67, whereas Bansal et al. (2014) reported average of 5.51 months⁷. In majority of the cases, external fixator held for a time period of 7-8

months which is comparable to Meleppuram, et al. 2017; Sen et al. 2006 studies^{12, 13}. For bone results, 4 criteria were evaluated: Union, deformity, infection, limb length discrepancy (ASAMI Group Grade Criteria). Out of 12 patients, excellent bony result was obtained in 16.7%, good in 50%, fair in 16.7% and poor in 16.7% of patients. The corresponding values in another study (Reddy et al. 2018) were Excellent: 10 (66%), Good: 2 (13.2%), Fair: 1 (6.6%), Poor: 2 (13.2%)⁹. The functional results were based on 5 criteria (ASAMI Group Grade Criteria). Based on these criteria 2 (16.7%) patients had excellent outcome, 4 (33.3%) patients had good outcome, 3 (25%) patients had fair outcome and 3 (25%) patient had poor outcome. The corresponding values in another study (Reddy et al. 2018) were excellent: 9 (59.4%), good: 2 (14.76%), fair: 1 (6.6%), poor: 3 (19.8%)⁹. In this current study though bone results were better than functional results. It shows excellent bone does not guarantee good function outcome. The functional result is affected by the soft tissue and neurovascular structures. Moreover longer time is required for better functional outcome.

Conclusion:

This study suggested that treatment of non-unions of Tibia with Ilizarov fixation is effective achieving good radiological and functional results. However, our study lacks a direct comparison with any other treatment options, further randomized controlled trials are needed to draw more valuable information.

Conflict of Interest: None.

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