MEDICO RESEARCH CHRONICLES
ISSN NO. 2394-3971
DOI No. 10.26838/MEDRECH.2022.9.3.594
Contents available at www.medrech.com

EVALUATION OF ILLIZAROV TECHNIC IN TREATING TIBIAL OPEN FRACTURES: AN OBSERVATIONAL STUDY

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ARTICLE INFO

Article History
Received: March 2022
Accepted: May 2022
Key Words: Illizarov, Open fractures, Tibia, Fixator, Proximal, Distal.

ABSTRACT

ORIGINAL RESEARCH ARTICLE

Introduction: Illizarov technique is a versatile method of treating open tibial fractures after debridement and open reduction. Tibial open fractures are usually classified into Type I, II, IIIA, IIIB and IIIC. Illizarov method has many advantages and features for such fracture treatment. But in Bangladesh, we have not enough research-oriented information regarding this treatment method.

Aim of the study: This study aimed to assess the Ilizarov technique in treating tibial open fractures.

Methods: This observational prospective study was conducted in the Department of Orthopedics of TMSS Medical College, Bogura, Bangladesh and 3 associated private clinics during the period from January 2018 to December 2021. In total 23 patients with tibial open fractures were confirmed as the study subjects. Before starting this 3 year in3-yeartion, proper written consent of the participants was taken and this study was approved by the ethical committee of the mentioned hospital and clinics. A semi-structured; pre-designed questionnaire was used in collecting patient data. All the data were processed, analyzed and disseminated by using MS Office and SPSS version 23.

Results: In this study, we found highest 65% of participants were injured from road traffic accidents (RTA) followed by 26% from general falls and the rest 9% from a sports injury as the mode of injury. The total treatment duration with the fixator was 12-23 weeks with an average of 16 weeks. The operation time ranged from 90 minutes to 120 minutes. As per the Karlstrom and Olerud criteria, the highest 70% of patients got 'excellent' results. Besides this, 17%, 9% and 4% of patients got 'good', 'fair' and 'poor' results respectively.

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Conclusion: In our study, we found some excellent features the of Ilizarov induced method in the treatment of open fractures of tibia. We would like recommend more use of Ilizthe arov technic in the field of Orthopaedics.

2022, www.medrech.com

I INTRODUCTION

Open tibial fractures are a very common occurrence in orthopaedicedic arena. Illizarov technique is a versatile method of treating open tibial fractures after debridement and open reduction. It has many good features. Open tibial fractures are usually classified into Type I, II, IIIA, IIIB and IIIC. Tibial fractures are the most common long bone fractures, with around 25% being open fractures[1]. The management of such fractures can be complex because of the relative lack of soft tissue coverage and blood supply of the tibial shaft[2]. Advanced bone reconstruction, as well as soft tissue coverage, is generally required to achieve bone and soft tissue healing[3]. The rate of complications associated with open tibial fractures is high and non-union, infection, and limb loss are the major causes of morbidity[4]. Because of low facilities and lack of medical instruments, in several developing countries, the selection of each method may differ.[5] Now a day, external fixators like Ilizarov external fixatorares applied extensively in developing countries but the rates of mal-union and infection are proportionately higher.[6] Withan AO external fixator, the efficacy of treatment in two studies were reported to be 20-31%.[7] Open fractures are divided into three major categories, depending on the mode of injury, soft tissue damage, and degrees of skeletal involvement.[8] Type I open fracture is characterized by a puncture wound around 1cm or less in diameter and is relatively clean in condition. Type II open fracture has laceration more than 1 cm long and less than 10 cm, without extensive soft tissue, flaps, or avulsion, with a minimal to moderate crushing component. Type III open fracture is one that involves extensive damage to the soft tissue, including muscles, skin and neurovascular structures. The type III open fractures are further divided into three subtypes. Type IIIA indicates open fracture with adequate soft-tissue coverage of a fractured bone despite extensive soft tissue laceration or flaps, or high-energy trauma (gunshot and farm injuries) regardless of the size of the wound[9]. Type IIIB indicates open fracture with extensive soft-tissue loss and periosteal stripping and bone damage, usually associated with massive contamination[10] which will often need further soft-tissue coverage procedure. According to Trafton[11], complications in treating such cases include deep infection, delayed union, non-union, acute/chronic osteitis, ostiomyelitis, loss of alignment in cast or brace, mal- union, and fixation problems. A Russian physician, Gavril A Ilizarov, devised this method of treatment of open fractures of tibia for the first time. The Ilizarov ring supports transfixional K-wire or ikzarov wire pins, which can be fixed at the many holes site on the 360-degree ring. It has two or more connected rings that form a frame of the apparatus. The rings bear supplementary part of the frame necessary for dynamic bone treatment.[12] They are basically elastic type of external fixator and allow axial micro-motion that is conductive to healing of fractures and regenerate. Forces acting in the circular fixator are in a plane. It is a multilevel and multi-planner fixator. The circumferential rings of ilizarov distribute stresses more evenly across the fracture or osteotomy sites. Therefore, three dimensional corrections become possible in this method. The major objective of this study was to assess the Ilizarov technique in treating open tibial fractures.

II METHODOLOGY & MATERIALS

This observational prospective study was conducted in the Department of Orthopedics of TMSS Medical College, Bogura, Bangladesh and 3 associated private clinics during the period from January 2018 to December 2021. In total 23 patients with tibial open fractures were confirmed as the study subjects. Before starting this 3 year's intervention, proper written consent of the participants was taken and this study was approved by the ethical committee of the mentioned hospital and clinics. A semi structured; pre-designed questioner was used in collecting patient data. As per the exclusion criteria of this study, patients with pathological fractures, closed fracture and type IIIC fractures were rejected from this study. The fractures were evaluated by AP and Lateral X-ray. Fractures were classified according to the Gustilo's fracture classification. These fractures were managed provisionally in long leg posterior slab or long leg posterior cast with a window for dressing changes. Necessary fluids and electrolytes replacement or whole blood transfusion were given as per requirement of each patient. Definitive treatment of fracture was done as routine case usually in a week. Patients were operated under general or spinal anaesthesia as per need. Pre-assembly of the frame was done one day prior to surgery. Distance between the rings was adjusted according to the fracture geometry. Fracture with minimal comminution and length loss less than 1cm was usually managed with a four-ring frame, more complex fracture needed a greater number of rings. Wires were fixed to the rings with ring fixator bolt after tensioning up to 90-110 kg using a dynamometer. The rings were kept 2 finger breadths from skin all around. Reduction was checked with C-arm image intensifier on the table and adjustments done according at the same setting. The pin tract wounds were dressed by povidone iodine solution (10%) and covered with pad. Pin site was cleaned everyday with spirit or povidone iodine (10% solution). When clot and crust was present, weak solution of hydrogen peroxide (H_2O_2) was applied to remove it. When pin tract wound was inflamed or discharge was present, oral antibiotics were given. Partial weight bearing with axillary crutch was allowed as soon as the patient could tolerate the pain. The frame and wire were checked whenever the patients complained of pain, stability. Tension of the wire was checked and retensioning was done as per need. Check X-ray was taken on first or second postoperative day and reduction was checked.

Image: (a) Radiologically healed fracture (b) Application of Ilizarov

Equinus deformity was prevented by active and passive movement of ankle. If ankle movement was painful, foot was supported with a slipper or boot cast tied to the last ring.

The patients were followed up at an interval of 2 weeks for a minimum period of 8 weeks, thereafter every month for 3 months and subsequently 3 monthly till a period of 1 year. Check-radiographs were taken on the next day and then at 6th week, 12th week and 36th week. The patients were assessed clinically for the range of movement of the knee and ankle respectively, pain at the fracture site, anterior knee pain, ankle joint symptoms, infection, muscular atrophy, clinical union, difficulty in walking and performing daily routine. At the end of follow-up period, the results were grouped into excellent, good, fair and poor using modified criteria of Karlstrom and Olerud.

III RESULTS

In this current study, among total 23 participants 74% (n=17) were male and the rest 66% (n=6) were female patients. In analyzing the ages of the participants, we found 43% were form 18-30 years' age group which was the highest number from a single age group. Then 30% were from 31-40 years', 13% from 41-50 years', 9% from 51-60 years and the rest 4% from >60 years' age groups. We found the highest 65 (n=15) percentage of participants were injured from road traffic accidents (RTA) followed by 26% from general falls (falls from height) and the rest 9% were from sports injury as the mode of fractures. The highest, 57% patients were with type II open fracture followed by 30% with type I and 13% with type III A open fracture. In this study, among total 23 patients, the highest 61% patients had middle location fractures followed by 26% had proximal location and 13% had distal location fractures. In analyzing the patterns of open fractures, we observed the highest, 52% patients had comminuted fractures followed by 22% had transverse, 13% had oblique, 9% had spiral and the rest 4% had segmental open fractures. Among total study population, the highest 61% had the right-side open fractures whereas the rest 39% had the left side open fractures. The treatment duration with the fixator was 12-23 weeks (average 16). In total 11 patients wore a PTB cast for an additional period of four weeks. The operation time ranged from 90 minutes to 120 minutes (Average 104 minutes). The time to union varied from 21 to 28 weeks. The average time of union was 21 weeks for Type I, 22.5 for Type II and 27 for Type IIIA open fractures. There was no intraoperative complication. As for the postoperative complications, local pain with motion and local oedema were seen in 2 cases and painful tenting of skin in cases. Delayed complications included pin tract infection in 5 cases, loss of 80 ankle dorisflexion in 3 cases and shortening of 1 cm was seen in 1 case. No case developed deep infection, non-union or unacceptable malunion. As the final outcomes, according to the Karlstrom and Olerud criteria the highest 70% patient got 'excellent' result. Besides this, 17%, 9% and 4% patients got 'good', 'fair' and 'poor' results respectively.

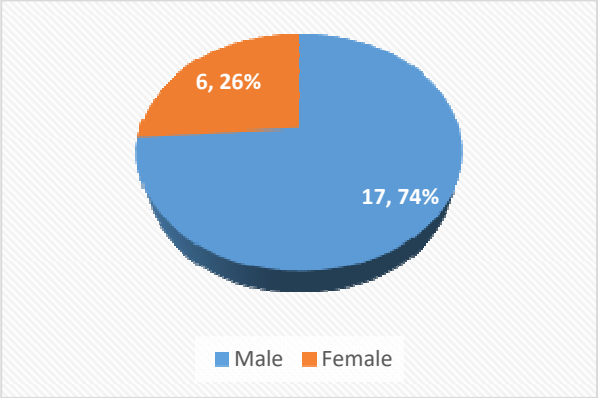

Figure I: Gender distribution of participants (N=23)

Table I: Age distribution of participants (N=23)

Age (Years)	n	%
18-30	10	43%
31-40	7	30%
41-50	3	13%
51-60	2	9%
>60	1	4%

Table II: Distribution of 'mode of injuries' of fractures (N=23)

Mode of injury	n	%
RTA	15	65%
Falls	6	26%
Sports injury	2	9%

Table III: Distribution of types of open fractures (N=23)

Types	n	%
Type I	7	30%
Type II	13	57%
Type IIIA	3	13%

Table IV: Distribution of locations of fractures (N=23)

Locations	n	%
Middle third	14	61%
Proximal third	6	26%
Distal third	3	13%

Table V: Distribution of patterns of fractures (N=23)

Patterns	n	%
Comminuted	12	52%
Transverse	5	22%
Oblique	3	13%
Spiral	2	9%
Segmental	1	4%

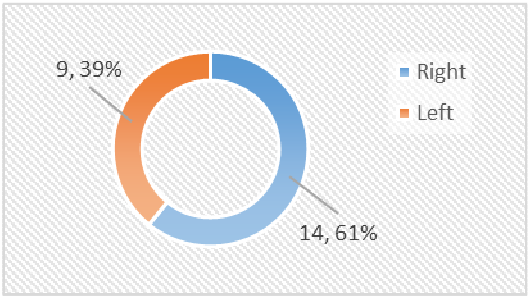

Figure II: Distribution of sides of fractures (N=23)

Table VI: Karlstrom and Olerud criteria level (N=23)

Satisfaction level	n	%
Excellent	16	70%
Good	4	17%
Fair	2	9%
Poor	1	4%

IV DISCUSSION

The aim of this study was to assess the Ilizarov technique in treating tibial open fractures. The major challenges of the management of open tibial fractures are managing skin, soft tissues and the severity of the bone damage. In this study, there were 74% male and 26% female participants. The sex incidence was neare about similar to that of Tucker[13] where number of males was 23 (88.5%) and female were 3 (11.5%). In their study, Shtarker H et al[14] also reported male preponderance over female. In our study, we found 61% had fractures in the middle third, 26% in the proximal third and 13% in the distal third. This finding is comparable to that of Shtarker et al[14] who reported 81.3% middle third, 15.7% proximal third and 3.1% lower third. In our study, there were 52% comminuted, 22% transverse, 13% oblique, 9% spiral and 4% segmental. This finding is near about similar to the finding of Shtarker et al[14] who found 20 cases (62.5%) in regard to comminuted fractures. The period between admission and Ilizarov ring fixation varied from 2 to 12 days with the average of 7 days in generally. The average operating time varied from 90 to 120 minutes. The finding was slightly lesser than that of Tucker[13] who reported that the operating time varied from 120 minutes to 210 minutes. The partial weight bearing on crutches was started on the very next day or on the 3rd day and full weight-bearing after 2 to 3 weeks. This is comparable to that of Dagher and Ronkoz[9] who reported that partial weight bearing was begum within 1st week of operation and full weight bearing after 2 to 3 weeks. When using a uniplanar external fixator, Court-Brown et al[10] postponed weight bearing until the fixator was removed. In our study, the patients were discharged from the hospital on an average on the 5th post-operative day. The average duration of hospital stay in this intervention was 12 days. In our study, the Ilizarov external fixator was removed after an average of 17 weeks (ranging from 12 to 22 weeks) which is in line with that of Shtarker et al[14] removed on an average of 16 weeks (ranging from 11-21 weeks). Shtarker et al[14] reported that, the time to union was 21.5 weeks. Keating[15] reported that, the average time to union in reamed and unreamed locking intramedullary nailing in a series was 28 and 21 weeks for type I open fractures, respectively; 28 and 27 weeks for type II open fractures; 34 and 31 weeks for type IIIA open fractures. Weight-bearing, to some degree, stimulates bone healing. Hulth[16] reported that the current concept of fracture healing was based on two variables namely blood supply and stability. The aim of this study was to evaluate the Ilizarov technique in treating open fractures of tibia. The results of this current study may be considered as satisfactory. As per the Karlstrom and Olerud criteria, the highest 70% patient got 'excellent' result. Besides this, 17%, 9% and 4% patients got 'good', 'fair' and 'poor' results respectively.

V CONCLUSION AND RECOMMENDATIONS

In our study, we found some excellent features of Ilizarov induced method in the treatment of tibial open fractures. So Ilizarov technic may be choice of better option for treating tibial open fractures.

REFERENCES

1. Court-Brown CM, McBirnie J. The epidemiology of tibial fractures. J Bone Joint Surg Br. 1995; 77: 417-21.
2. Tornetta P, Bergman M, Watnik N, Berkowitz G, Steuer J. Treatment of grade-IIIb open tibial fractures. A prospective randomized comparison of external fixation and non-reamed locked nailing. J Bone Joint Surg Br. 1994; 76: 13-9.
3. Hutchinson AJP, Frampton AE, Bhattacharya R. Operative fixation for complex tibial fractures. Ann R Coll Surg Engl. 2012; 94:34-8.
4. Gustilo RB, Anderson JT. Prevention of infection in the treatment of one thousand and twenty-five open fractures of long bones: retrospective and prospective analyses. J Bone Joint Surg Am. 1976; 58: 453-8.
5. Wani N, Baba A, Kangoo K, Mir M. Role of early Ilizarov ring fixator in the definitive management of type II, IIIA and IIIB open tibial shaft fractures. Int Orthop 2011; 35:915-23. [20445978] [http://dx.doi.org/10.1007/s00264-010-1023-7]
6. Hasankhani E, Payvandi MT, Birjandinejad A. The Ilizarov ring ex-internal fixator in complex open fractures of the tibia. Eur J Trauma 2006; 32:63-8. [http://dx.doi.org/10.1007/s00068-005-0031-6]
7. Papaioannou N, Mastrokalos D, Papagelopoulos PJ, Tyllianaksi M, Athanassopoulos J, Nikiforidis PA. Nonunion after primary treatment of the tibia fractures with external fixator. Eur J Orthop Surg Traumatol 2001; 11:231-35. [http://dx.doi.org/10.1007/BF01686895]
8. Gustilo RB. Management of open fractures, in Gustilo RB (Ed.). Orthopaedic Infection, diagnosis and treatment, 1st edition (Philadelphia:WB Saunders Company, 1989) 87-89.
9. Paul, H Kim; Seth, S Leopold (9 May 2012). "Gustilo-Anderson Classification". Clinical Orthopaedics and Related Research. 470 (11): 3270–3274. doi:10.1007/s11999-012-2376-6. PMC 3462875. PMID 22569719.
10. "Ovid: Externer Link". ovidsp.tx.ovid.com. Retrieved 2017-11-10.
11. Trafton PG. Tibial shaft fractures, in Browner BD, Jupiter JB, Levine AM, Krettek C (Eds.). Skeletal trauma: basic science, management and reconstruction, 4th edition, Vol. 2 (Philadelphia: Saunders, 1998) 2319-2451.
12. Golyakhovsky V, Frankel VH. Operative manual of Ilizarov techniques, (New Delhi: Jaypee Brothers, 1986).
13. Tucker HL, Kendra JC, KInnebrew TE. Management of unstable open and closed tibial fractures using Ilizarov method, Clinical Orthopaedics and Related Research, 280, 1992, 125-135.
14. Shtarker H David, R, Stolero J, Grimberg B, Soundry M. Treatment of open tibial fractures with primary suture and Ilizarov fixation, Clinical Orthopaedics an Related Research, 335, 1997, 268-274.
15. Keating JF, Obrier PF, Blachut PA, Meck RN, Broekhuse HM. Locking intramedullary nailing with and without reaming for open fracture of the tibial shaft, The Journal of Bone and Joint Surgery, 79 A, 1987, 334-341.
16. Hulth A. Basic science and pathology, the current concept of fracture healing: Clinical Orthopaedics and Related Research, 249, 1989, 265-285.