

Evaluation of Ilizarov Technique in the Treatment of Open Fractures of Tibia: A Prospective Observational Study

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Abstract

Original Research Article

Background: Open fracture of the tibia is a very common occurrence in the orthopedic treatment arena. Ilizarov method is comparatively a newer method for the management of open fractures of the tibia after debridement and open reduction. In Bangladesh, we do not have enough research-oriented data regarding the effectiveness and outcomes of the Ilizarov technique. **Aim of the study:** The aim of the study was to assess the effectiveness and outcomes of the Ilizarov technique in the treatment of open fractures of the tibia. **Methods:** This was a prospective cross-sectional study that was conducted in the Department of Orthopedics, Northern International Medical College Hospital, Dhaka, Bangladesh from June 2021 to 21 July 2022. In total 39 patients with tibial open fractures were enrolled in this study as the study subjects. A convenient purposive sampling technique was used in sample selection. Well-known Karlstrom and Olerud criteria were used in assessing the outcomes of this treatment procedure. All the demographic, as well as clinical information, was recorded. All data were processed, analyzed and disseminated by using the MS Office program. **Results:** The male-female ratio of the participants was 1.6:1. The highest number of patients (49%) were with type II open fracture followed by 36% with type I and 15% with type III open fracture; 64% patients had middle location fractures. In the highest number of patients (79%) road traffic accidents were the mode of injury. According to the Karlstrom and Olerud score, among the total of 39 participants, the functional outcomes were found excellent in 72% (n=27), good in 18% (n=6), fair in 8% (n=2) and poor in 3% (n=1). **Conclusion:** Ilizarov technique is an effective technique for the management of open fractures of tibia. Prompt healing, less blood loss and patient convenience are the potential features of the Ilizarov technique.

Keywords: Ilizarov, Fixator, Tibial fractures, Proximal, Distal Orthopedics.

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1. INTRODUCTION

Tibial fractures are the most common long bone fractures in the body [1]. Ilizarov technique is comparatively a newer method that has many benefits. The rings of Ilizarov bear a supplementary portion of the frame that is necessary for dynamic bone treatment [2]. Open fractures are very common in this bone, particularly in the middle third of its length [3]. The treatment of open fractures of tibia is very common but there is controversy among the orthopedic surgeons on the procedure [4]. Nowadays, non-surgical procedures like using casts, braces and interventional attempts such as inserting the plate, intramedullary nailing, as well as external fixators, are used for the management of open fractures of the tibia [5]. Because of low instrumental facilities and for lack of medical devices in developing countries, the selection of every method for such treatment may differ [6]. In recent times, in developing countries, external fixators like Ilizarov or AO external fixators are used extensively but the rates of mal-union

as well as infection are relatively high [7]. With AO external fixator, the effectiveness of treatment management in two studies was reported to be 20-31% [8]. Agreeing to Trafton [9], complications include acute or chronic osteitis or osteomyelitis, deep infection, delayed union, malunion, non-union, loss of alignment in cast or brace, and fixation problems. A Russian physician, Gavril A Ilizarov, devised this treatment method for open fractures of the tibia. The ring of Ilizarov supports transfixional K-wire or haft pins, that can be fixed at various hole's site on the 360-degree ring. It has two or even more related rings that form a metallic frame of the apparatus. The objective of this current study was to assess the effectiveness and outcomes of the Ilizarov technique in the treatment of open fractures of the tibia.

2. METHODOLOGY

This prospective cross-sectional study was conducted in the Department of Orthopedics, Northern

International Medical College Hospital, Dhaka, Bangladesh from June 2021 to 21 July 2022. In total of 39 patients with tibial open fractures were enrolled in this study as the study subjects. A convenient purposive sampling technic was used in sample selection. Properly written consent was taken from all the participants before data collection. The whole intervention was conducted following the principles of human research specified in the Helsinki Declaration [10] and executed in compliance with currently applicable regulations and the provisions of the General Data Protection Regulation (GDPR) [11]. Well-known Karlstrom and Olerud criteria [12] were used in assessing the outcomes of this treatment procedure according to the exclusion criteria of this study, patients with closed fractures, pathological fractures and type IIC fractures were excluded. All the demographic and clinical information of the participants was recorded. All data were processed, analyzed and disseminated by using the MS Office program.

3. RESULT

In this prospective study, among the total of 39 participants, 62% were male and the rest 38% were female. So, the male-female ratio of the participants was 1.6:1. Three-fourths of our participants were between the age of 18 and 40 years. In total 41% were from 18-30 years and 36% were from the 31-40 year’s age group. As per the distribution of our patients based on the type of open fracture, we observed that the highest number of the cases (49%) were with type II open fracture followed by 36% with type I open

fracture and the rest 15% with type III open fracture. On the other hand, among our total participants, the highest number of patients (64%) had middle location fractures followed by 23% had proximal location and the rest 13% had distal location fractures. Among the majority of our patients (56%), comminuted fractures were found. In analyzing the mode of injuries among our participants, we observed that in the majority of the patients (79%) road traffic accidents (RTA) was the mode of injury followed by 13% from sports injury and the rest only 8% were from general falls. As per the Karlstrom and Olerud score distribution we observed that, among the total of 39 study people, the functional outcome was found ‘excellent’ in 72% (n=27), ‘good in 18% (n=6), ‘fair’ in 8% (n=2) and ‘poor’ in 3% (n=1) cases.

Table 1: Distribution of participants as per gender, (N=39)

Gender	n	%
Male	24	62%
Female	15	38%

Table 2: Distribution of participants as per age, (N=39)

Age (Year)	n	%
18-30 yrs.	16	41%
31-40 yrs.	14	36%
41-50 yrs.	5	13%
51-60 yrs.	3	8%
>60 yrs.	1	3%

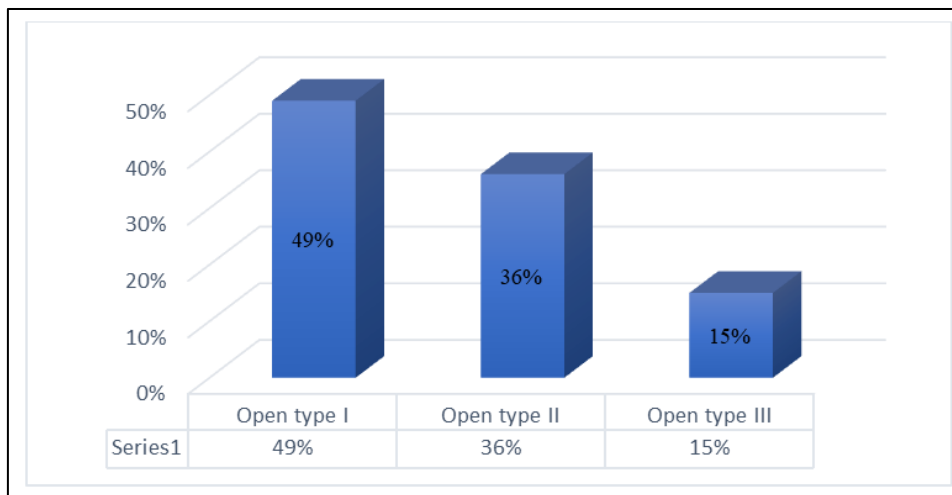


Figure I: Distribution of participants as per open fractures types, (N=39)

Table 3: Distribution of participants as per patterns of open fractures, (N=39)

Patterns	n	%
Comminuted	22	56%
Transverse	7	18%
Oblique	6	15%
Spiral	3	8%
Segmental	1	3%

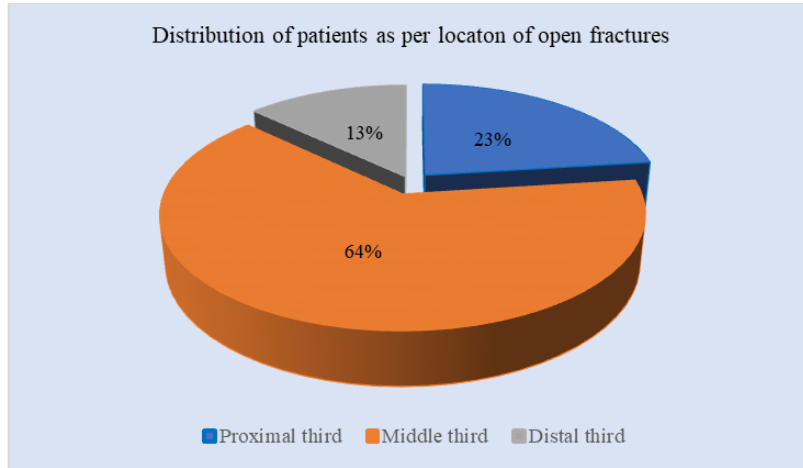


Figure II: Distribution of participants as per locations of open fractures, (N=39)

Table 4: Distribution of participants as per patterns, (N=39)

Patterns	n	%
Comminuted	20	51%
Transverse	8	21%
Oblique	6	15%
Spiral	4	10%
Segmental	1	3%

Table 5: Distribution of participants as per mode of injury, (N=39)

Mode of injury	n	%
Road traffic accident	31	79%
Sports Injury	5	13%
Falls	3	8%

Table 6: Distribution of participants as per Karlstrom and Olerud criteria level, (N=39)

Satisfaction level	n	%
Excellent	28	72%
Good	7	18%
Fair	3	8%
Poor	1	3%



Picture I



Picture II

4. DISCUSSION

This study aimed to assess the effectiveness and outcomes of the Ilizarov technique in the treatment of open fractures of the tibia. Among our participants, 62% were male and the rest 38% were female. So, the male-female ratio of the participants was 1.6:1. Three-fourths of our participants were between the age of 18 and 40 years. Shtarker *et al.*, [13] also found male preponderance over the female participants in their study. We found among the total of our participants, 64% had fractures in the middle third, 23% in the proximal third and 13% in the lower third. This finding was also similar to that of Shtarker *et al.*, who found 81.3% in the middle third, 15.7% in the proximal third and 3.1% in the lower third. In our study among the total cases, there were 58.33% comminuted fractures, 13.89% oblique, 8.33% spiral and 7.78% segmental fractures and those findings were similar to the results of some other studies [13, 14]. However, in our study, Ilizarov ring fixation had to be delayed from 2-12 days from the date of injury because of our insufficient operating days as well as facilities for emergency Ilizarov ring fixation. The average operating time varied from 90 minutes to 120 minutes. The finding was slightly lesser than that of Tucker [14] who found that the operating time varied from 120 to 210 minutes. In our study, the partial weight bearing on the crutches was started on the next day or the 3rd day; full weight bearing was started after 2-3 weeks. This was comparable to that of another study conducted by Wani, Naveed *et al.*, who reported that partial weight bearing was begun within the first week of their operation and full weight bearing after 2-3 weeks [15]. In our settings, the average time of clinic-radiological union was 24.5 weeks ranging from 21 to 28 weeks. Tucker reported the range of time to union as 12 to 47 weeks, with an

average of 24.5 weeks [14]. Keating *et al.*, [16] found that the average time to union in reamed as well as unreamed locking intramedullary nailing in a series was 28 as well as 21 weeks for type I fractures, respectively; 28 and 27 weeks for type II fractures; 34 and 31 weeks for type IIIA fractures. Hulth *et al.*, [17] reported that the present concept of fracture healing was based on two different variables namely blood supply and stability. In our study, there were 3 (8%) pin tract infections, manifested by erythema, pain, and small purulent discharge by the pin sites. As per the Karlstrom and Olerud score distribution we observed that, among the total of 39 study people, the functional outcome was found 'excellent' in 72% (n=27), 'good' in 18% (n=6), 'fair' in 8% (n=2) and 'poor' in 3% (n=1) cases. In another study conducted by Thayur R *et al.*, [18] among a total of 22 cases, there were 3 'good', 4 'fair' and 2 'poor' bony results and 1 'good', 3 'fair', and 2 'poor' functional results. In another similar study, it was also reported that the functional outcome is predetermined by the condition of the nerves, muscles, joints, and vessels [19].

Limitation of the study:

This was a single-centered study with small-sized samples. Moreover, the study was conducted over a very short period. So, the findings of this study may not reflect the exact scenario of the whole country.

5. CONCLUSION & RECOMMENDATION

As per the findings of this current study, we can conclude that, among the total open fractures of the tibia, the frequency of type II open fractures is usually higher than any other type. Middle-location fractures are very common among such occurrences. Ilizarov technique is an effective technic for the management of

open fractures of the tibia. Prompt healing, less blood loss and patient convenience are the potential features of the Ilizarov technique. For getting more specific results, we would like to recommend conducting similar studies in several places with larger-sized samples.

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