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Illizarov Surgery in Nonunion of the Shaft of Tibia Fracture: Treatment Procedure and Functional Outcome among Patients Attending in a Tertiary Care Hospital

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Abstract **Original Research Article**

Background: Non-unions of the Tibia fracture is basically an orthopedic critical condition when the level of acute inferior wall NTF habitually depends on the infarct associated artery patients having surgery depression. Non- unions of the tibia, predominantly found in the distal third of the bone, are comparatively common in most clinical cases. ***Methods:*** This study was a hospital based, retrospective, descriptive study, which was conducted at the department of Orthopedics in NITOR, Bangladesh. This study was conducted during the period of May 2021- June 2022. The total sample size for this study was 52. ***Result:*** Most of the respondents 18(34.6%) were aged from 21-30 years and followed by 7(13.5%) were <20 years, 14(26.9%) were 31-40 years, 10(19.2%) were 41-50 years and 3(5.8%) were >50 years. Most of the respondents 35(67%) were male where only 17(33%) were female. 31(60%) cases found with right sided nonunion and 21(40%) cases with left sided nonunion. Atrophic nonunion was found in 19(36.5%) cases, hypertrophic nonunion in most 27(51.9%) cases and the rest 6(11.5%) had oligotrophic nonunion. A1 type of nonunion was seen in 19(36.5%) cases and followed by A2.2 in most 27(51.9%) cases, B2 in 4(7.7%) cases and B3 in 2(3.8%) cases. 30(57.7%) cases showed excellent outcome whereas 18(34.6%) cases had good outcome, 3(5.8%) cases showed fair outcome and only 1(1.9%) case had poor outcome. ***Conclusion:*** Ilizarov external fixator is best suitable for treating infected non-union of tibia for its steady mechanical environment, conveyance bone, correct defects, and allow weight bearing during the treatment course.

Keywords: Illizarov surgery, nonunion shaft, Tibia fracture.

INTRODUCTION

Non-unions of the Tibia fracture is basically an orthopedic critical condition when the level of acute inferior wall NTF habitually depends on the infarct associated artery patients having surgery depression. Non-unions of the tibia, predominantly found in the distal third of the bone, are comparatively common in most clinical cases [1-4]. But, treating this complex disease is a severe therapeutic challenge for the orthopedic specialists [1-3, 5-14]. Non-unions of the tibia may be related with some factors such as low-density bone tissue, bone loss, adjacent soft-tissue damage, limb shortening, limb deformities, and joint contractures. These factors may severely affect the progress of treatment outcome and raise the risk of treatment failure [1–5, 7–22]. The tibia has a large hypodermic border and often weakens blood supply.[23] Soft-tissue damage during injury and additional disruption of soft-tissue in the course of internal fixation may interrupt the blood supply, with a harmful consequence on fracture healing. It allows the recognition of density, disruption, bone-lengthening, and deformity correction. It is a valid alternative treatment compared to internal fixation, especially when internal fixation can be complicated by bone loss, deformity, or failure of previous internal fixation [24]. Treatment of bone infection after intramedullary nailing generally comprises some surgical procedures, comprising removal of fixation devices, radical bone debridement along with reaming of the canal, deep tissue sampling, removing infected bone and

supplement of local antibiotic delivery systems. In such cases, Ilizarov external fixator is predominantly suitable inspite of having major defects in soft tissue, which are frequently treated with musculocutaneous flaps. However, eventual bone gap filling is possible via bone replacements that might be resulted from biological products like demineralized bone matrix, platelet-rich plasma, hydroxyapatite, adjunction of growth factors, or synthetic ingredients including calcium sulfate, tri-calcium phosphate ceramics, bioactive glasses, or polymer-based alternatives [25]. Bioactive glasses are considered to be biocompatible, osteoconductive which offer a permeable structure with antibacterial possessions promoting their resumption and bone ingrowth [26]. Hence, this disease can increase the risk of long-bone infected nonunions where Ilizarov technique can bring the difference between limb recover and elimination. Hence, this study aimed to detect and analyze the tibial shaft fractures treated with Illizarov surgery and to measure post- operative functional outcomes.

OBJECTIVE OF THE STUDY

The objective of this study was to detect and analyze the tibial shaft fractures treated with Illizarov surgery and to measure post-operative functional outcomes.

MATERIALS AND METHODOLOGY

This study was a hospital based, retrospective, descriptive study, which was conducted at the department of Orthopedics in NITOR, Bangladesh. This study was conducted during the period of May 2021-June 2022. The total sample size for this study was 52.

Inclusion Criteria:

- Patients with nonunion shaft of tibia and treated with Ilizarov surgery.

Exclusion Criteria:

- Patients who were referred for salvage treatment after failed plating or intramedullary nailing were excluded.
- Patients having fractures with articular involvement or segmental bone loss were also excluded.

All the study patients were selected after reviewing the hospital's Ilizarov surgery in nonunion of the tibia fracture nominal register. The data required for the purpose of this study was age, gender, diagnosis, date of admission, type of nonunion, side of nonunion etc. Patients were hospitalized 10 days (7–14 days) on average. The distraction was completed as 1 mm per day, including probable limb length, vascular or neural compromise, and contracture of the nearby joint followed. Spasms of the vessels occurred Very rarely. All patients were given a course of sensitive antibiotic for upto 2–4 weeks in arterial route. They were motivated to bearing limited weight with crutches, isometric muscle; also joint range of motion exercises was adviced on the 2nd day after operation. These postoperative follow up helped in minimizing the soft tissue contractures. Moreover, Ilizarov ring fixator was managed for twice during distraction to merge the union. The quantity of disruption and bone formation was measured with follow-up. The fixator was removed when the patient was able to walk without having any pain.7 at last follow-up, the patients gait; limb length discrepancy and range of movement of the adjacent joints were assessed. The course in the hospital and treatment given were recorded properly. The statistical analysis was done using the statistical tool SPSS version 21.

RESULT

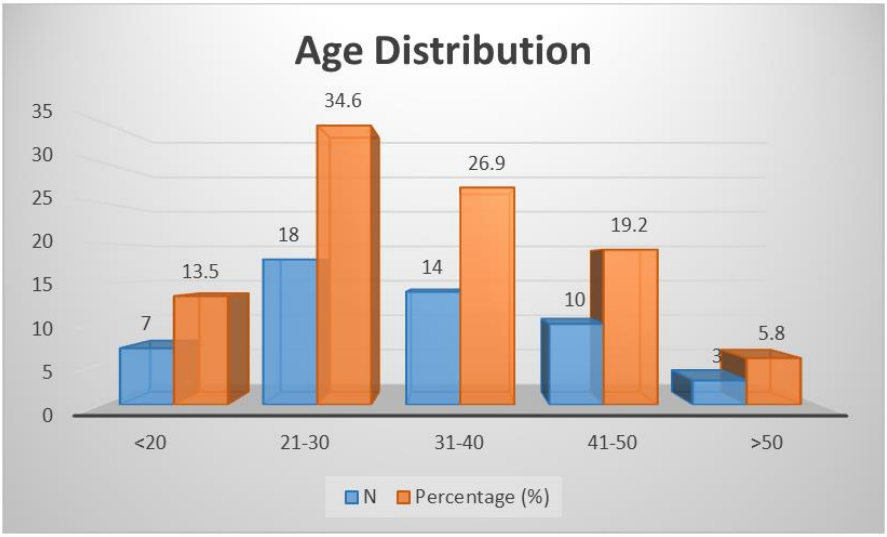

Figure I: Age Distribution of the Study People

Figure 1 shows the age distribution of the study people. Most of the respondents 18(34.6%) were aged from 21- 30 years and followed by 7(13.5%) were <20 years, 14(26.9%) were 31-40 years, 10(19.2%) were 41-50 years and 3(5.8%) were >50 years.

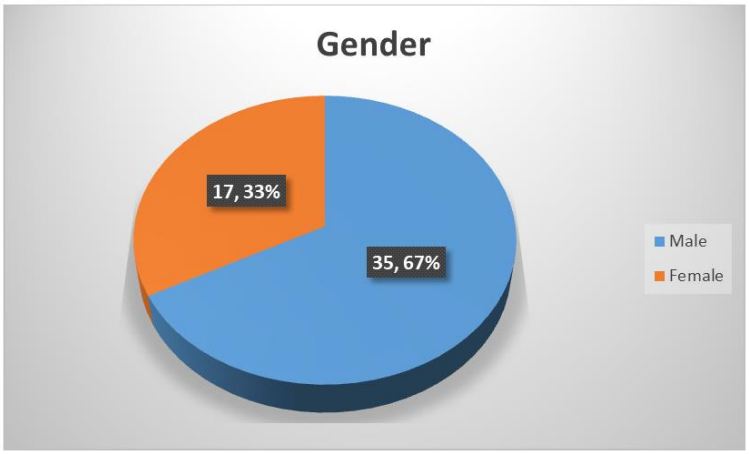

Figure II: Gender Distribution of the Study People

Figure II shows the gender distribution of the study people. Most of the respondents 35(67%) were male where only 17(33%) were female.

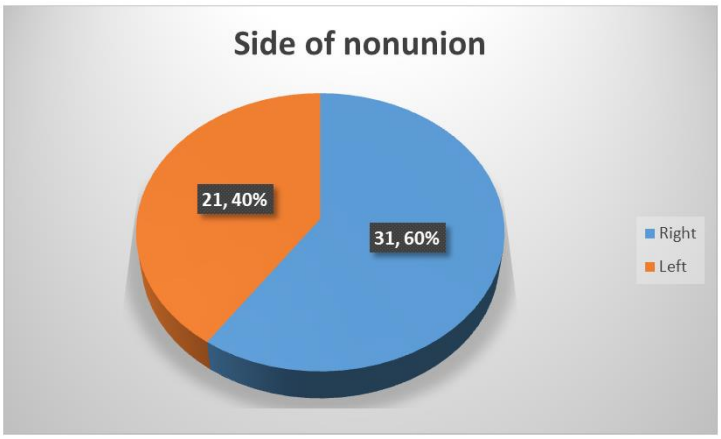

Figure III: Side of Nonunion

Figure III shows the side of nonunion. 31(60%) cases found with right sided nonunion and 21(40%) cases with left sided nonunion.

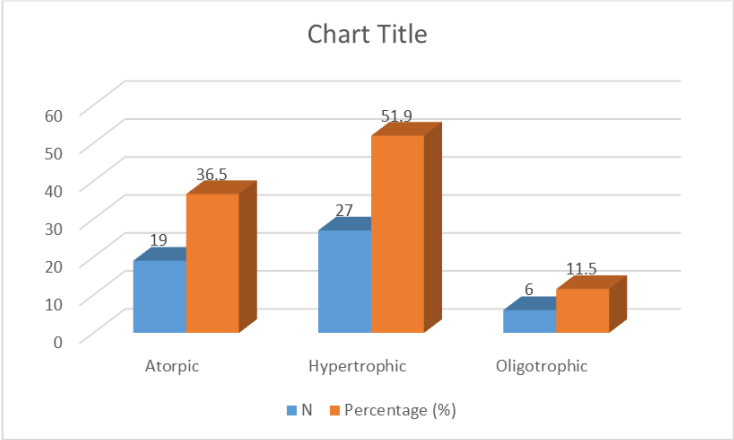

Figure IV: Type of nonunion according to weber classification

Figure IV shows the type of nonunion according to weber classification. Atrophic nonunion was found in 19(36.5%) cases, hypertrophic nonunion in most 27(51.9%) cases and the rest 6(11.5%) had oligotrophic nonunion.

Table I: Type of nonunion according to Paley's classification

Type of nonunion	N	Percentage (%)
A1	19	36.5
A2.1	0	0.0
A2.2	27	51.9
B1	0	0.0
B2	4	7.7
B3	2	3.8

Table I shows the type of nonunion according to Paley's classification. A1 type of nonunion was seen in 19(36.5%) cases and followed by A2.2 in most 27(51.9%) cases, B2 in 4(7.7%) cases and B3 in 2(3.8%) cases.

Table II: Treatment outcome

Treatment Outcome	N	Percentage (%)
Excellent	30	57.7
Good	18	34.6
Fair	3	5.8
Poor	1	1.9

Table II shows the treatment outcome. 30(57.7%) cases showed excellent outcome whereas 18(34.6%) cases had good outcome, 3(5.8%) cases showed fair outcome and only 1(1.9%) case had poor outcome.

DISCUSSION

For orthopaedic surgeons, management of non-union with large bony defects is a challenging task. Numerous ways are available to treat them, for example, with ring fixators, modified arbeitsgemeinschaft für osteosynthesefragen (AO) fixators or specialized intramedullary nails. However, for complex nonunions in which defect is >4cm, Ilizarov fixator offers a greater treatment technique. The Ilizarov technique has been used worldwide for over several last decades in treating of extensive fractures with soft tissue loss, bone nonunion, and in other symptoms. Nonunion of shaft tibia is more common in comparison to nonunion of other long bone as there are deficiency of soft tissue adjacent to the tibia and the hypodermic nature of the tibial fractures being complex. Although there are numerous modalities for treating of aseptic nonunion of shaft tibia ilizarov external fixator in treatment of choice and a useful modality of treatment which the current orthopaedics literature has recorded widely with muliple results [27-29]. In this study, most of the respondents 34.6% were aged from 21-30 years and followed by 13.5% were <20 years, 26.9% were 31-40 years, 19.2% were 41-50 years and 5.8% were >50 years [figure I]. Lukasz Szelerski et al., in their study assessed 102 patients from 11–77 years where the mean ±SD age was 46.5±17.35 years [30]. Most of the respondents 67% were male where only 33% were female [figure II]. In contrast to this present study, Ashraful MD et al., in their study found 26 male and 14 female patients [31]. 60% cases found with right sided nonunion and 40% cases with left sided nonunion [figure III]. This result was supported by the study of Dr. Kumar S et al., [32]. Atorpic nonunion was found in 36.5% cases, hypertrophic nonunion in most 51.9% cases and the rest 11.5% had oligotrophic nonunion [figure IV]. In the study of Dr. Kumar S et al., atorpic nonunion was found in 37.14% cases, hypertrophic nonunion in most 51.43% cases and the rest 11.42% had oligotrophic nonunion [32]. According to paley's classification, A1 type of nonunion was seen in 36.5% cases and followed by A2.2 in most 51.9% cases, B2 in 7.7% cases and B3 in 3.8% cases [table I]. Sahu and Ranjan in their study reported 25 cases with A1 nonunion and followed by 15 cases of A2, 15 cases of B1 and 5 cases of B2 [33]. 57.7% cases showed excellent outcome whereas 34.6% cases had good outcome, 5.8% cases showed fair outcome and only 1.9% case had poor outcome [table II]. Gianluca Testa et al., in their study found 61.5% cases with excellent outcome whereas 34.6% cases had good outcome, 3.9% cases showed fair outcome and there were no cases with poor outcome [34].

CONCLUSION

Ilizarov external fixator is best suitable for treating infected non-union of tibia for its steady mechanical environment, conveyance bone, correct defects, and allow weight bearing during the treatment course. The main advantage of the ilizarov technique is timely weight bearing after operation, movements of adjacent joint is stimulated and decreases edema and joints painfulness. The Ilizarov technique offers a better extent of correction in post tramatic defects and helps in

improved posttraumatic limb shortening than to the results achieved with other internal osteosynthesis procedures. Also, Ilizarov technique has advantage that fixator assembly can be further adjusted in wards. Early ambulation and weight bearing lessens the hospital stays and patient can be discharged early with better outcome and treated on OPD basis. Hence, Ilizarov method is highly effective in the treatment of instabilities in tibial fracture healing.

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