

Research Article

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Management of Forearm Bone Gap Non-Unions by Ilizarov Technique

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Abstract

Purpose of the study: Proper treatment of forearm bone gap non-union should achieve both biological stimulation of the bone and elastic mechanical stability. The use of Ilizarov technique enhances the healing of a non-union providing osteogenic, osteoconductive and an optimal stability of Ilizarov fixation. We retrospectively reviewed 26 patients affected by forearm bone non-union and treated with Ilizarov fixation.

Materials and Methods: 26 patients were treated for gap non-unions of forearm bones with Ilizarov compression distraction device from 2000 to 2015 in BARI-ILIZAROV ORTHOPAEDIC CENTRE.

Results: All the difficult non-unions healed in a mean of 7 months ranging from 5 to 12 months. At the latest follow up forearm function were satisfactory.

Conclusion: The Ilizarov compression distraction device is a fantastic tool in promoting the healing of forearm non-unions, even the bones are very atrophic.

Keywords: Forearm bone non-union; Distraction osteogenesis; Ilizarov Techniqu

Introduction

Different factors like fracture location and complexity, patient characteristics and surgical intervention are involved in the development of forearm bone non union [1,2]. Radius and ulna non-unions are usually associated with complex injury, inadequate initial reduction, unstable fixation. Anatomical and functional relationships between radius and ulna are so peculiar that it represents a sophisticated functional unit. That's why fractures of the radius and ulna should be considered like articular fractures [3].

The function of the forearm is to assist the hand in space positioning and to support the hand movements. Pronation and supination of the forearm occurs at the radio humeral, proximal radio ulnar, and distal radio ulnar joints. Failure of the relationship between radius and ulna due to changes in the length impairs the forearm function and the ability to position the hand in space. When non-union occurs in the forearm bones it impairs forearm, elbow and wrist motion. In these cases fracture healing

is a necessary condition to recover a physiological function the upper limb.

Based on the characteristic of the bone ends, aseptic non-union can be distinguished into atrophic and hypertrophic [4]. Adequate treatment of forearm bone non-union must be considered providing with biological stimulation and elastic mechanical stability by Ilizarov technique. Ilizarov fixator has osteogenesis, osteo conduction, osteo induction, mechanical properties and vascularity [5].

Autologous bone graft is the transplantation of bone of the same individual from an anatomical donor site to one receiver. Compared to auto graft, allograft are easier to use, require less surgical time and are potentially unlimited in amount, although allograft presents disadvantages such as higher risk of infection, viral disease transmission and the need of a bone bank available to the hospital [6,7].

The aim of this study was to show the treatment of gap non-unions of forearm bones by Ilizarov technique through distraction osteogenesis without bone grafting. We retrospectively reviewed 26 patients determining the use of Ilizarov in terms of

- A. Rate of healing of non-unions without grafting.
- B. Time of healing and
- C. Functional results

Materials and Methods

From 2000 to 2015 a total of 26 patients have non unions of forearm bones with Ilizarov compression-distraction device. We consider a non-union "Arrest of bony fractures repair process with the formation of fibrous or cartilaginous tissue in between the main fragments and fracture has remain un-united for 6-9 months due to mechanical or biological failure judged by clinical and radiological evidence".

Exclusion criteria were

- a. Presence of other fractures in the same limb at the time of the primary forearm injury and
- b. Septic non-union.

The initial treatment of the fracture which evolved into non-union consisted of open reduction and internal fixation with plate and screws, intramedullary rods, external fixation or cast immobilization (Table 1).

Table 1: Fracture and treatment.

Fracture	Treatment
Initial fracture	05
Radius	06
Ulna	15
Initial treatment	
Plate and screw fixation	10
Intramedullary rod	05
External fixation	02
Cast immobilization	09

We treated all the 26 patients by Ilizarov technique. All patients were checked monthly until there was radiological evidence of bone healing. To evaluate the time of healing of the fractures, a combined clinical and radiographic assessment was used. The clinical parameter evaluated were

- a. Absence of pain or tenderness on palpation
- b. Absence of pain or grip strength
- c. Full range of motion at the adjacent joint.

The x-ray parameters used were-

- i. New regenerate bone formation

- ii. Bridging of the fracture seen at three cortices and
- iii. Obliteration of the fractures line or cortical continuity.

Non-union evolved in radius done in 5 patients, in ulna 6 patients, and non- union of radius and ulna evolved in 15 patients (Table 2).

Table 2: Non-union characteristics.

Type of non-union	Atrophic gap non-union	Hypertrophic non-union
Radius	4	1
Ulna	5	1
Radius & Ulna	13	2

Results

No per-operative complications occurred. There was no early or late infection. All the non-unions healed. Average time of healing of non-union was 7 months, ranging from 5-12 months (Figures 1-4). Patients resumed ADLs (activity of daily living) 12 days after surgery with Ilizarov apparatus (Figures 5-8).



Figure 1A & 1B: 6 years old atrophic non-union of both radius and ulna (left side) and Distraction by two rings for release of soft tissue contractures.

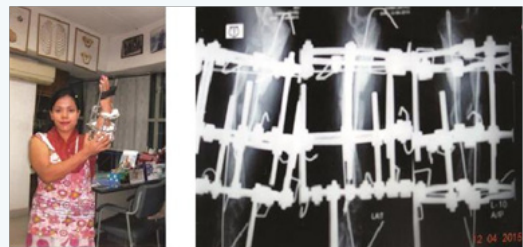


Figure 2A & 2B: Clinical appearance of the patient with Ilizarov fixator in the left forearm and Distraction osteogenesis by Ilizarov technique.

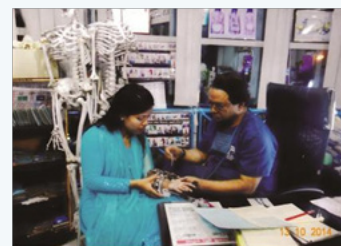


Figure 3: Regular follow up of the patient.



Figure 4: Clinical appearance of the patient after 9 months with good hand function and Patients resumed ADLs (activity of daily living) 12 days after surgery with Ilizarov apparatus.



Figure 5: Deformed left forearm before surgery.

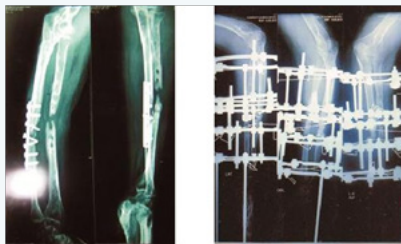


Figure 6a & 6b: Non-union left ulna with implant failure, atrophic gap non-union left radius; During treatment with Ilizarov apparatus.



Figure 7a & 7b: Ilizarov in the left forearm; Full function with straight left forearm.



Figure 8: Final radiograph after 7 months; excellent union.

Discussion and Conclusion

Non-union of forearm bones are difficult to treatment. Ilizarov fixation technique in forearm bone non-union have been shown to be secure to achieve new regenerate bone in the big gap union of radius and ulna by distraction osteogenesis. In atrophic non-union our goal must be the restoration of a good biological environment. Han et al. [8], and Jupiter [9] reported higher success rates using vascularised bone graft which requires longer surgical time and specialized equipment. But Ilizarov compression-distraction technique [10] requires a demanding post-operative care. Higher success rate was achieved in forearm alignment and function with Ilizarov technique. 5 cm and more gaps with atrophic non-union of forearm bones are difficult to treatment without Ilizarov technique. We found the excellent rate of gap healing and no rate of infection in our series due to distraction osteogenesis.

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