ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

A Study On Segmental Loss Of Long Bones TreatedBy Ilizarov Ring Fixation.

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ABSTRACT

Bone loss management of long bones is a challenge to any orthopedic surgeon. In many cases it may be associated with sepsis, shortening, deformity, non-union etc., and complicate the situation. To analyse the effect of distraction osteogenesis in cases of segmental bone loss due to Trauma, Tumors and Post Infective Sequalae. This is a study to evaluate the patients with segmental loss of long bones managed by distraction osteogenesis using Ilizarov ring fixators at Department of Orthopedics Venkateshwara Medical College Hospital & Research Centre, Ariyur, Pondicherry August 2021 to October 2021 A total of 20 patients with segmental bone loss were included in this study.14 patients have completed the treatment. Other 6 patients have completed the bone transport and waiting for consolidation and ring removal. The follow-up period ranged from 2 ½ months to 8 months. The results were assessed according to Dror Paley's assessment criteria listed below. The results were divided into bony and functional. For bony results 4 criteria were evaluated-union, infection, and deformity and leg length discrepancy. An excellent bony result was one with union without infection, deformity less than 7 degrees and length discrepancy less than 2.5 cm. A good result was union plus any two of the other. A fair result was union plus one of the other. The poor result was non-union of re-fracture or none of the others. In the present scenario, the available solutions for large segmental long bone defects with or without shortening are external fixations like Ilizarov ring fixator or the dynamic axial fixator system. Of these two, Ilizarov method is cheaper and provides better all-around stability as compared to the unilateral frame of dynamic axial fixator system. This can be used simultaneously for deformity correction and in conditions with poor skin with adherent scars on the deformed bone

Keywords: Ilizarov fixator, Tibia non-union, Gap non-union, Three-ring Ilizarov frame.

https://doi.org/10.33887/rjpbcs/2023.14.5.8

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ISSN: 0975-8585

INTRODUCTION

Bone loss management of long bones is a challenge to any orthopaedic surgeon. In many cases it may be associated with sepsis, shortening, deformity, non-union etc., and complicate the situation [1]. In the pastmany techniques were used to manage this clinical problem and mostlyended in amputations. A breakthrough technique invented by Prof. Ilizarov using his unique ring fixator addresses all the above mentioned complications simultaneously [2]. The history of orthopaedics has many milestones based on different new principles in patient management to relieve the sufferings due to many diverse orthopaedic problems. Thomas splint for femur fracture, Kuntcher's intramedullary nail for femur fracture, John Charnley's principles of low friction arthroplasty, and Rigid fixation of AO group are few of them [3]. In patients with bone loss initial management like fracture stabilization and primary soft tissue cover can be managed extremely well with modern techniques, the problems of subsequent bridging or regenerating areas of skeletal loss with viable bone while maintaining limb length and alignment for satisfactory function remains a substantial challenge to orthopaedic surgeon [4]. In cases of trauma, bone loss can occur at the time of injury or during subsequent debridement. The decision to salvage the limb demands considerable experience [5]. A recent multicentric prospective evaluation was not able to validate the clinical usefulness of any of the lower extremity injury severity scores like MESS (mangled extremity severity score), PSI (predictive salvage index), LSI(limb salvage index), NISSSA (nerve injury, ischemia, soft tissue injury, skeletal injury, shock, age), or HFA 97 (Hannover fracture scale) etc. in general, segmental defects more than 2 cm are unlikely to heal spontaneously with skeletal stabilization alone [6].

MATERIALS AND METHODS

This is a study to evaluate the patients with segmental loss of long bones managed by distraction osteogenesis using Ilizarov ring fixators at Department of Orthopedics Venkateshwara Medical College Hospital & Research Centre, Ariyur, Pondicherry August 2021 to October 2021.A total of 20 patients with segmental bone loss were included in this study. Males were 15 (14 yrs. – 68 yrs.) with a mean age of – 34.8 yrs. Females were 5 (12 yrs. -53 yrs.) with a mean age of 36 yrs. 14 patients have completed the treatment. Other 6 patients have completed the bone transport and waiting for consolidation and ring removal. The follow-up period ranged from 2 ½ months to 8 months. The etiology of bone defect was post traumatic bone loss in 13 cases, post tumour resection bone defect in 6 cases, and post infective sequalae in 1 case. 2 cases had initial treatment with ORIF, 1 with plate osteosynthesis (case no:11) and another with intramedullary interlocking nail (case no: 14) elsewhere and referred for bone loss management. In post-traumatic cases intercalary bone defect ranged from 7 cm to 15 cm with an average of 9.3cm. This bone loss includes the gap created both during trauma and subsequent wound debridement and resection of necrotic bone. In post tumour resection cases the defect ranged from 4.5cm to 20cm with an average of 10.6 cm. In post infective sequealae the bone loss was 3 cm.The site of bone loss was distal femoral in 5 cases, tibial in 14 and mid tibial with deformity in one case. After Ilizarov fixation 16 cases were treated by bifocal osteosynthesis and 4 cases were treated by trifocal osteosynthesis. Corticotomy was done along with Ilizarov fixation in 13 cases in the same sitting and as a separate procedure in other 7 cases. Corticotomy was delayed in these cases due to poor skin condition. Post corticotomy latency period (the duration between corticotomy and beginning of distraction) extended between 4 days to 17 days with an average of 11.1 days. The delay in distraction in one case (case no: 12) was due to osteoporosis. The corticotomy sites were, proximal tibial in 10 cases, proximal femoral in 1 case, distal tibial in 4 cases, proximal tibial with mid femoral in 3 cases, proximal and distal tibial in one case and proximal tibial with mid fibular in one case.

Rate of Distraction

1 mm per day (0.25 mm / 4 times per day) in most of the cases. During transport in few cases the rate had to be slowed down to ½ mm per day based on regenerate formation. In one case of deformity (post infective squealed) the rate was increased to 2mm per day as the regenerate formationwas faster.

Radiological Evaluation

All patients had fortnightly clinical and radiological evaluation during the distraction period. After the end of distraction, evaluation was done monthly depending on the desired objectives and patients' cooperation.

ISSN: 0975-8585

RESULTS

The results were assessed according to Dror Paley's assessment criteria listed below. The results were divided into bony and functional. For bony results 4 criteria were evaluated-union, infection, and deformity and leg length discrepancy. An excellent bony result was one with union without infection, deformity less than 7 degrees and length discrepancy less than 2.5 cm. A good result was union plus any two of the other. A fair result was union plus one of the other. The poor result was non-union of re-fracture or none of the others. In our study union was achieved in all 14 cases that have completed treatment. No cases had discharging sinus after treatment. Two cases had varus deformity of leg of less than 7 deg. 3 cases had shortening of less than3 cm. According to the system of evaluation of bony results 10 cases had excellent, 4 had good, and 1 had poor results. None of the patients had reactivation of infection at regenerate site. Functional results were based on 5 criteria's: Significant limp, equinus, rigidity of the ankle, soft tissue dystrophy, pain and inactivity. An excellent was active individual with none of the other four criteria. A good result was activeindividual with one or two of other four criteria's. A fair result was active individual with 3 or 4 of other criteria. An inactive individual was considered as a poor result regardless of other criteria.

Table 1: Bony Results

Results	No of patients	Percentage
Excellent	10	66%
Good	4	26%
Fair	-	-
Poor	1	5%

In our study 2 cases had significant limp, 3 had equine's deformity, 2 had knee stiffness and 5 had ankle stiffness. Soft tissue dystrophy and pain was present in 2 cases. 1 patient was inactive after the treatment who is on compression assembly for union of fracture site. 3 patients had pedal edema. According to this system, excellent results in 3, Good results in 11, poor resultin 1 in completed cases.

Table 2: Functional Results

Results	No of patients	Percentage
Excellent	4	26%
Good	10	66%
Fair	-	-
Poor	1	5%

In spite of excellent bony result in most of the cases (10 cases) thefunctional results were less than that (good results in 11 cases) due to presence of other associated injuries, number of previous surgeries, muscleand scar adhesion to bone, grossly influenced the functional outcome.

Table 3: Complications

Complication		
Problems	**Obstacles**	**Complications**
Axial Deviation (2)	Wire cut through (1)	Joint stiffness (7)
Poor quality regenerate (3)	Skin invagination (9)	Significant pain (2)
Transient pain (in all)		Edema(2)
Transient Edema (in all)		
Pin tract infection (8)		
Parasthesias (1)		

In our study, there were no intraoperative complications such as neurovascular damage due to pin insertion. There was no compartment syndrome due to corticotomy. The common problem encountered was pintract infection. Four patients had grade I pin tract infection, 5 cases had grade II pin tract infection. Infection was managed with oral antibiotics and local care. Loosening of K wire was seen in 2 cases which were treated by exchange of wires. 9 cases needed realignment of the fixator due to the

malalignment of bone ends. Premature consolidation of regenerate was present in one case which was managed by recorticotomy and accelerated transport. In two more cases recorticotomy was needed due to irregular follow up in one and improper technique in the other. Delayed consolidation was seen in 2 cases in one due to osteoporosis and another because of Diabetic Mellitus. 4 cases had delayed union at the regenerate docking site which was treated with bone grafting. 3 cases had equinus deformity for which closed Tendo Achilles lengthening done. 2 cases had significant limp, 2 had knee stiffness and 5 had ankle stiffness.

DISCUSSION

Reconstruction of segmental loss of long bones remains a difficult problem. We have found that the Ilizarov ring fixation to be effective in the treatment of long bone segmental loss, as it allows for the simultaneous treatment of bone loss, infection, non-union deformity, articular and limb function, weight bearing and osteoporosis.9 of the 20 patients had pin tract problems in our study. Four had Grade I infection, five had Grade II infection. None of the patient had Grade III pin tract infections. 6 wires had to be removed and exchanged because of pin loosening and infection. Our results were compared with Dror Paley's results [7]. Three patients develop equinus deformity of ankle during distraction and required extension of the construct across the joint and gradual stretching of the Tendo Achilles. In two cases of FFD knee, one required extension of fixator with hinge for correction, the other patient required only physiotherapy [8].Two patients had persistent pedal edema even after removal of the apparatus. There were no serious neuro vascular complications. There was delayed consolidation of regenerate requiring slowing down of the distraction rate to 0.5mm per day in two patients due to Diabetes mellitus in one case and osteoporosis in the other [9]. Three patients required recorticotomy following failed coticotomy due to irregular follow up in one, accelerated callus formation in the next and poor local conditions in the third. Four patients required bone grafting at the regenerate docking site for delayed union [10]. The results of this series were compared with Dror Paley's results in his series of 25 patients. Pin tract infection was frequent in both series. In our series 4 patients (20%) had Grade I and 5 patients (25%) had Grade II pin site infection. Dror Paley's has reported 20% incidence of Grade I and 10% of Grade II infections, 3.5% of Grade III pin tract infection. There were no Grade III infections in our series. There were no intra operative or post operative nerve injuries in this series, as compared to Dror Paley's series with one intra operative sensory nerve injury which had recovered fully [11]. There were no incomplete corticotomies in this series whereas there were 3 instances of incomplete corticotomies in Dror Paley's series.3 (16%) cases required correction of equinus deformity of ankle by extension of fixator (foot assembly) and in 2 cases (10%) of knee flexion deformity one required extension of fixator with hinges in our series. Dror Paley has reported joint contractures in 3 patients (10%), one treated non-operatively and the other two operatively [12]. Delayed consolidation of regenerate docking site required bone grafting in four cases (25%) in our series. Dror Paley has reported bone grafting in all his cases. There are no serious vascular complications in our series as compared to Dror Paley's series.[13] Over all, there were 92% satisfactory bony and functional results in our series, as compared to 90% in Dror Paley's series [14,15].

CONCLUSION

In the present scenario, the available solutions for large segmental long bone defects with or without shortening are external fixations like Ilizarov ring fixator or the dynamic axial fixator system. Of these two, Ilizarov method is cheaper and provides better all-around stability as compared to the unilateral frame of dynamic axial fixator system. This can be used simultaneously for deformity correction and in conditions with poor skin with adherent scars on the deformed bone. Bone grafting is not necessary in all the cases. This system allows weight bearing during treatment period thus decreasing disuse osteoporosis and soft tissue dystrophy. The size of bone defect is not a limitation for reconstruction by distraction osteogenesis. However, there are certain disadvantages like bulky apparatus, prolonged treatment time, neurovascular complications, pin tract infections, muscle and joint contractures. Good compliance and cooperation from the patient is needed during the entire treatment period. The surgeon has a steep learning curve. But if the established principles are strictly followed, then the **Ilizarov ring fixation and distraction osteogenesis** is the safest, simplest, most economical and effective method for the management of segmental long bone defects due to variety of causes.

ISSN: 0975-8585

REFERENCES

[1] Alfonso JE, Regazzoni P. Bridging bone gaps with the Ilazarov technique. Biological principles. Clin Plast Surg 1991;18(3): 497-504.

[2] Bosse MJ, Mackenzie et al, A prospective evaluation of the clinical utility of the lower limb injury severity scores. JBJS A 2001.83-A3-14.

[3] Brustscher R, Rath BA, Ruter A, Peren SM. The role of corticotomy and osteotomy in the treatment of bone defects usingthe Ilizarov technique; J Orthop Trauma 1993;7(3):261-269.

[4] Calhoun JH, Fan Li, Ledbette BR, Gill CA. Biomchanics of the Ilizarov Fixator for Fracture Fixation. Clin Orthop 1992; 280:15-22.

[5] Cattaneo R, Catagni M, Johnson EE. The treatment of infected Non-unios and Segmental Defects of the Tibia by the Methods of Ilizarov. Clin Orthop 1992; 280:143-152.

[6] Charles T Price et al. Limb lengthening by callotasis for children and adolescents. CORR 1990;250 : 105-111.

[7] Cierny G III, and Zorn KERN. Segmental Tibial Defects; Comparing Conventional and Ilizarov Methodologies. Clin Orthop, 1994;01: 118-123.

[8] Eldridge JC. Problems with Substantial Limb Lengthening. Orthop Clin North Am 1991;22(4):625-631.

[9] Fishchgrund J, Paley D, Suter C. Variables Affecting Time to Bone Healing during Limb lengthening. Clin Orthop 1994; 301:31-37.

[10] Fleming J, Paley D, Kristiansen T, Pope M. A biomechanical analysis of Ilizarov External Fixator. Clin Orthop. 1989;241: 95.

[11] Garcia-Cimbrelo E. Ilizarov Technique-results and difficulties. Clin Orthop 1992; 283:116-123.

[12] Golyakhovsky V. Clin Orthop 1992;280: 7-10.

[13] Goodship AE, Kenwright J. The influence of induced micromotion upon the healing of experimental tibial fractures. J Bone Joint Surg 1985;67B: 650-5.

[14] Green SA. Editorial Comment. Clin Orthop 1992;280: 2-6.

[15] Green SA. Management of segmental Defects by the Ilizarov Intercalary Bone Transport Method. Clin Orthop 1992; 280: 136-142.