EVALUATION OF MANAGEMENT OF TIBIAL NON-UNION DEFECT WITH ILIZAROV FIXATOR

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Background: Tibial bone defect lead to limb shortening and functional deficit and needs proper treatment. There are various treatment modalities for bone defect in long bone to restore length and function of the limb, i.e. bone grafting, vascularised bone graft, allograft and bone transport. Bone transport can be done through fixators (uniplaner or ring) and intramedullary nail system. This study was conducted on management of tibial non-union with Illizarov external fixator. **METHOD:** This descriptive study was performed on 58 patients in Agency Headquarter Hospital, Bajawar and Lady Reading Hospital, Peshawar, from January 2000 to January 2006. Patients of either gender with age between 9 to 58 years, having nonunion (clean and infected nonunion) in tibia with defect of 2 to 7cm due to trauma or firearm injury were included in the study. These patients were followed up upto one year. Outcome measures were according to the classification of Association for the Study and Application of the Method of Ilizarov (ASAMI), which is based on radiological (defect filling) and clinical (functional) findings. **RESULTS:** Out of 58 patients, 44 (75%) were male and 14 (25%) were female. Mean age was 30 years (9 to 58 years). 38 (65.52%) patients had infected non-union while 20 (34.48%) had clean non-union. Right tibia was involved in 32 patients (51.17%) and left was involved in 26 (44.83%) patients. The cause of initial trauma was road traffic accident in 27 patients (46.55%), firearm injury in 23 patients (39.65%) and a simple fall in 8 patients (13.79%). The length of average bone defect was 2.90 cm (200-7.00cm). Radiological results were excellent in 33 (58.89%) patients, good in 12 (20.68%) patients, fair in 8 (13.79%) patients and poor in 5 (8.62%) patients. The clinical results were excellent in 33 patients (56.89%), good in 18 patients (31.05%), fair in 4 (6.89%) patients and poor in 3 patients (5.17%). **CONCLUSION:** Ilizarov ring fixator is excellent treatment modality for tibial non-union with a defect, regarding bone union, deformity correction, infection eradication, limb length achievement and limb function but this needs prolonged learning curve for fresh orthopedic surgeons.

Key words: Tibia; Nonunion; Bone Transport; Ilizarov fixator

INTRODUCTION

Tibia is the most exposed bone in the body and vulnerable to trauma and therefore its fractures are common among the long bone fractures[1]. Tibia is the common site of non-union in long bone fractures[2.3].

Management of non-union with bony defect in long bones is a challenging problem for orthopedic surgeons. There are various techniques to fill the defect in long bones, i.e. cancellous bone grafting for small defect [4], vascularised fibular grafts, allografts and papineau technique of bone grafting[5] for larger bone defects.

When the defect is more than 4cm then it needs bone transport. Bone transport can be done by ring fixators, modified Arbeitsgemteinschaftfur Osteosynthesefragen (OA) fixators or specialized intramedullary nails. The ring fixators, i.e. Ilizarov fixator was developed by Gavriil Abramovich Ilizarov in Kurgan, Western Siberia, USSR in 1951 for the fixation of fractures[6]. Ilizarov's greatest contribution, however, was pioneering the sense of bone and soft tissue regeneration under tensile forces and this is called theory of tension stress[7-9]. Ilizarov treated non-union and bone defect by this method based on biologic principles. The Ilizarov fixator, while treating non-union or bone defect, has the advantages that the chances of angular or rotational deformities are less and can be easily corrected in case of deformity. This device provides good stability and early weight bearing. The disadvantages are that it is cumbersome, difficulty in dressings of the wounds, needs expertise & is an expensive device. Segmental bone transport or distraction osteogenesis is slow, control and gradual stretching of the callus to fill the bony gap after low energy subperiosteal corticotomy. The transport can be mono or bifocal.

This study was designed to assess the outcome of bone transport in tibial non-union with the help of Ilizarov fixators.

MATERIAL AND METHOD

This descriptive study was performed on 58 patients in Agency Headquarter Hospital, Bajawar and Lady Reading Hospital, Peshawar,

from January 2000 to January 2006. Patients of either gender with ages between 9 to 58 years, having nonunion with or without infection with defect in tibia of 2 to 7cm due to trauma or firearm injury were included in the study.

Hybrid Ilizarov fixators of Russian make were used in all cases. All the procedures were done under general or spinal anesthesia with antibiotic prophylaxis. Proper wound debridement was done in infected non-union cases. Antibiotic protocol was followed according to culture and sensitivity when required.

The protocol of treatment was based by following the principles of Ilizarov and co-workers:

1. Preservation of blood supply both to the limb as well as the fracture site.
2. Preservation of osteogenic tissue (periosteum, endosteum and marrow).
3. Functional activity 1of limb.
4. Early mobilization.

The hypertrophic non-union was managed with distraction while the atrophic non-union was managed under the removal of soft tissues; it was approached for establishing first the compression than distraction at the non-union.

After the application of each fixator, radiographs were taken. Accurate measurements were made of the pin location and pin length. Moreover, location of the fixator bars, adequacy of fracture reduction and the subsequent duration of external fixator were noted. All factors were correlated with eventual time to union and the presence of mal-union. If X-ray showed incorrect positioning of the pin/fragments, immediate correction was made to avoid later on difficulties. Physical therapy was continued throughout the treatment duration and pin-site dressings were changed daily. The fracture union, complications and functional recoveries were also recorded. A policy of early bone grafting was followed whenever it was considered necessary and it was employed within 10 to 12 weeks of time.

Patients were followed up for one year. Outcome measures were according to the classification of ASAMI, which is based on radiological (defect filling) and clinical (functional) findings.

RESULTS

Out of 58 patients, 44 (75%) were male and 14 (25%) were female. Mean age was 30 years (9 to 58 years). 38 (65.52%) patients had infected bone defect (non-union) while 20 (34.48%) had clean bone defect. Right tibia was involved in 32 (51.17%) patients and left was involved in 26 (44.83%) patients. The cause of initial trauma was road traffic accident in 27 (46.55%) patients, firearm injuries in 23 (39.65%) patients and simple fall in 8 (13.79%) patients. The average length of bone defect was 2.90 cm (200-7.00cm). Radiological result was excellent in 33 (58.89%), good in 12 (20.68%), fair in 8 (13.79%) and poor in 5 (8.62%) patients. Clinical result was excellent in 33 (56.89%), good in 18 (31.05%), fair in 4 (6.89%) and poor in 3 (5.17%) patients. There was no case of late osteomyelitis. Limb length inequality was observed in 2 patients and maximum discrepancy was 9mm while 14 patients (87.5%) had no shortening.

There was an average bone defect of 2.68cm (1.2-7 cm) and the overall success rate was 93%. The average bone length achieved was 2.5 cm (1-7.5 cm). The total duration of treatment was an average of 138 days (61-276 days).

DISCUSSION

Management of tibial non-union has been described by various authors and it is agreed that various approaches have been adopted by the orthopedic surgeons for such challenging issue under the medical ethics and as per needs of the patients concerned.

There are different types of fixators used for bone transport to fill the bony defects. Ilizarov fixator is most commonly used for bone transport. In the study by Paley D et al, [10] 25 cases of tibial non-union were treated with Ilizarov fixators which shows excellent bone results in 18 cases, good in 5 and fair in 2 based on union, persistent infection in 3 cases, deformity in 4 and limb shortening in 1 case. Functional results were excellent in 16 cases, good in 7, fair in 1 and poor in 1 based on return to daily activities, limp in 4 cases, equinus in 5 cases, dystrophy in 4 cases, pain in 4 cases and amputation for neurogenic pain in 1 case.

In another study[11] on 17 patients with tibial pseudoarthrosis, 14 cases had full union, 1 patient was still using orthosis and 3 patients were in need of re-operation with bone transplantation. Mean time of treatment was 5.2 months (2-11.5 months) while the overall treatment time was 9.8 months (3-19 months). In this study the Ilizarov method of treatment of pseudoarthrosis had a good stimulation of healing but experience with fixator system and

aggressive treatment of various minor complications are essential for successful outcome.

Our study shows comparable results with international literature.

CONCLUSION

Ilizarov ring fixator is excellent treatment modality for tibial non-union with a defect, regarding bone union, deformity correction, infection eradication, limb length achievement and limb function but this needs prolonged learning curve for fresh orthopedic surgeons.

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