

Bifocal bone transport (Trifocal distraction compression) with Illizarov external fixator for defective bone loss in tibia

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Objective: To assess the outcome of bifocal bone transport (trifocal distraction compression) for defective bone loss in tibia.

Methodology: This prospective study was conducted at department of orthopedic surgery, Dow University of Health Sciences/Civil Hospital, Karachi, Pakistan from 2000 to 2015. It included 15 patients with traumatic bone loss and infective nonunion with bone loss in tibia. Patients with bone loss in tumors were excluded from the study.

Results: Out of 15 patients, 12 were male and 3 female. Bone loss was 12 cm in 8 patients, 15 cm in 4 and 10 cm in 3 patients. All were treated with bifocal bone transport (trifocal distraction compression). Total duration of treatment in transport and consolidation was around 15 months in 8 patients, 17 months in 4 patients and 1

year in 3 patients. Additional bone graft was placed in four patients. Pin track infection was universal problem in all patients. There was no major complication. Union was achieved in all cases. Functional and radiological outcome was assessed on ASAMI scoring and showed excellent result in 12 and good in 3 patients.

Conclusion: Bifocal bone transport (trifocal distraction compression) was excellent procedure and decreased the time of bone transport. The placement of the fixator was less as compared with the unifocal bone transport in large defects. However, close monitoring is required and may need additional bone graft at distraction and compression site. (Rawal Med J 201;41:209-211).

Key words: Bifocal, trifocal distraction compression, bone transport, bone loss, Illizarov.

INTRODUCTION

Ilizarov apparatus is considered as revolutionary method for the limb salvage.¹ This technique was started in Kurgan, Russia. Illizarov technique can be used for the bone transport, lengthening, shortening, compression at nonunion site and deformity correction. Bone loss can be result of high velocity trauma,² congenital bone deficiency, tumor and osteomyelitis. Posttraumatic bone and soft tissue loss in the lower extremity is difficult problem for orthopedic surgeon.³ Bone defects can be filled with cancellous, corticocancellous bone graft, vascularized and nonvascularized fibular graft,^{4,6} open papineau technique⁵ and allograft. Advantages of bone transport with Illizarov are minimal soft tissue trauma, slow bone transport, gradual deformity correction.^{7,8} Disadvantages are long duration of fixator application, pin track infection, readjustment of fixator and frequent visit.^{9,10} The objective of our study was to assess the outcome of bifocal bone transport (trifocal distraction compression) for

defective bone loss in tibia.

METHODOLOGY

This prospective study was conducted at department of orthopedic surgery, Dow University of Health Sciences/Civil Hospital, Karachi, Pakistan from 2000 to 2015 and included 15 patients with traumatic bone loss and infective nonunion with bone loss in tibia. Patients with bone loss in tumors were excluded from the study. All were treated with bifocal bone transport (trifocal distraction compression). Total duration of treatment in transport and consolidation, complications, functional and radiological outcome was noted.

RESULTS

Out of 15 patients, 12 were male and 3 female. Bone loss was 12 cm in 8 patients, 15 cm in 4 and 10 cm in 3 patients. Total duration of treatment in transport and consolidation was around 15 months in 8 patients 17 months in 4 patients and 1 year in 3 patients.

Table. Baseline characteristics and outcome.

	Age	Sex	Bone loss (cm)	Total Duration (Months)	Additional procedure	ASAMI Functional outcome	ASAMI Radiological outcome
1	18	M	12	15	Gastrocnemius Flap	Excellent	Excellent
2	21	M	12	15	No	Excellent	Excellent
3	36	F	12	15	No	Excellent	Excellent
4	17	M	15	17	No	Good	Good
5	29	M	10	12	Bone graft	Good	Good
6	41	M	12	15	Solues flap	Excellent	Excellent
7.	30	F	12	15	Bone graft	Excellent	Excellent
8.	50	M	12	15	No	Excellent	Excellent
9.	45	M	15	17	Bone graft	Good	Good
10.	19	M	12	15	No	Excellent	Excellent
11.	33	F	10	12	No	Excellent	Excellent
12.	20	M	15	17	No	Excellent	Excellent
13.	24	M	10	12	Bone graft	Excellent	Excellent
14.	28	M	12	15	No	Excellent	Excellent
15.	19	M	15	17	No	Excellent	Excellent

Additional bone graft was placed in four patients. Two patients had medial head gastrocnemius and soleus flap. Pin track infection was universal problem in all patients. There was no major complication. Union was achieved in all cases. Functional and radiological outcome was assessed on ASAMI scoring that shows excellent in 12, good in 3 patients (Table).

DISCUSSION

In our study, union was achieved in all patients. Functional and radiological outcome was excellent in 12 and good in 3 patients. A study from Sheffield, at a mean follow-up of 24 months, all 16 had excellent or good results with union of the fracture, correction of deformity and normal or near normal leg length without any major complications.¹¹ Mean treatment times were 16 months for bone transport and 9.8 months for compression-distraction and bone transport was more complicated, requiring an average of 2.2 additional operations compared with only one for compression-distraction.¹¹ Other researchers reported similar results.^{12,13}

Another study included 19 patients with mean tibial bone defect of 10 cm and functional results were graded as twelve excellent, six good, and one poor.¹⁴

Another study of 20 patients with average follow up of 18 months showed overall success rate of 95%.¹⁵ Bifocal compression and distraction can provide limb salvage in challenging cases.¹⁶

A study from Peshawar, Pakistan on 58 patients, with length of average bone defect of 2.90 cm (200-7.00cm) showed radiological results to be 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.¹⁷ 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%).¹⁷ A study from India included 22 patients of infected nonunion and Illizarov fixator was kept for an average period of 303.7 days reported excellent result in 16 patients, good in eight, fair in four and poor in two.¹⁸

Twenty-two infected nonunions treated by radical resection and bone transport technique according to Ilizarov with a minimal follow-up period of 2 years and mean length of the bone defect was 7.7 cm. The mean time from the transport procedure to frame removal was 14.5 months. In 15 cases the docking site needs bone graft and 5 had fracture at docking site. Overall success rate was 91%. They recommend revision of the docking site at the end of

the bone transport procedure with or without bone grafting is recommended.¹⁹ Another study reported 32 tibial non-unions with open injury with mean segmental defect of 7.7 cm (3.5 to 14 cm) reconstructed successfully with bifocal and trifocal bone transport. The mean external fixation time was 7.56 months. The mean time required for consolidation of regenerate bone was 4.5 month [2 months-6 months].²⁰

CONCLUSION

Bifocal bone transport (trifocal distraction compression) was excellent procedure and decreased the time of bone transport. The placement of the fixator is less as compared with the unifocal bone transport in large defects. However, close monitoring is required and may need additional bone graft at distraction and compression site.

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