ILIZAROV TREATMENT OF NON UNION TIBIA WITH BONE LOSS

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ABSTRACT: Non-union of tibia with bone loss is common problem which is difficult to manage. Union can be achieved with bone grafting but correction of shortening is difficult with bone grafting alone. Bilocal distraction compression osteosynthesis is a good modality of treatment for this problem. Patients' acceptance of this cumbersome frame for a prolonged period of time is a concern. 20 cases of non-union with bone loss more than 1 cm were treated with bilocal distraction compression osteosynthesis. 19(95%) cases got union. 14 (70%) had excellent bone result and 15(75%) cases had excellent functional result. 20(100%) had excellent or good patient acceptability. Complications are minor and a few. Tibial non-union with bone loss can be treated with Ilizarov method very effectively and acceptability of the treatment by local population is good.

KEY WORDS: Tibial non union with bone loss, Ilizarov method.

INTRODUCTION: Non union is complete cessation of the biological process of fracture healing.¹ Though it is diagnosed on clinical and radiological findings; there is no clear criterion for the diagnosis of non union. In 1986, for the purposes of testing bone healing devices, a U.S. Food and Drug Administration panel defined non union as " established when a minimum period of 9 months has elapsed since injury and the fracture shows no visible progressive signs of healing for 3 months"¹. Non union is classified in various ways. It can be atrophic or hypertrophic type. Atrophic type is produced by biological failure and hypertrophic type by mechanical failure or instability. Present day high energy trauma leading to open fracture is an important cause of infected non union. AO classified infected non union into 1. Quiescent (dry, non draining for more than 3 months) 2. Active infection without drainage and 3. Infection with drainage.² Active infection with or without drainage is not suitable for internal fixation without prior control of infection. Active infection is diagnosed by local inflammatory signs, sequestrum or lytic area in x-ray and raised TLC, ESR CRP. Non union can also be classified according to bone loss ³. Type A is without bone loss or with bone loss of less than 1 cm. Type B is non union with bone loss more than 1cm. Type B is further classified into B1- bone defect, no shortening. B2- shortening, no bony defect. B3- bony defect and shortening. Management of type B non union is a challenging problem.

Gavril A Ilizarov of Kurgan in erstwhile USSR invented distraction histogenesis, corticotomy and a versatile ring fixator more than 50 years back ^{4, 5, 6}. We came to know that bone has unlimited power to regenerate after this breakthrough. Corticotomy is a low energy osteotomy done with a thin osteotome preserving medullary vessels and periosteum. But recently it has been shown that medullary blood vessels are not important and type of osteotomy has a little effect on bone regeneration.⁷ Distraction is usually done after a latency period of 7 to 10 days at the rate of 0.25mm every 6 hrs. With this technique limb lengthening and filling of bone defect becomes much easier. Bone loss can manifest as defect, shortening or both as mentioned in type B non union. Grafted bone takes a long period to become a mechanical load bearer. Ilizarov treatment is used by many authors in such cases ³. Type A non union can be managed without corticotomy and bone transport. This

method is called mono local osteosynthesis⁵. This type can also be treated with IM nail or plate osteosynthesis. Larger defect is treated with bilocal distraction –compression osteosynthesis. In this method corticotomy is followed by distraction till the limb length is equalized. This is also known as bone transport. In this modality of treatment bone grafting is not used. The osteogenic stimulus is provided by the distraction at the osteotomy site, done above or below the non union site. This treatment significantly increases the blood flow to the region. The corticotomy of the ilizarov is analogous to conventional bone grafting.³

This study is to assess the result of bilocal distraction compression osteosynthesis in tibial non union with bone loss and acceptability of this method to the local population. Cases with aseptic or quiescent type² of infection were included; cases with active infection were excluded.

MATERIALS AND METHODS: 20 cases of type B (Paley D et al classification) ³ non union tibia with bone loss more than 1 cm were included. 6(30%) cases were of type B1, 4(20%) cases were of type B2 and 10(50%) cases were of type B3. 4(20%) cases were female and 16(80%) cases were male. Mean age was 37.8 years (range 22-57yrs). Mean age of the fracture was 39.4 months (12-60 months). Mean bone loss was 3.6cm (range 1.5-5cm). 8(40%) were aseptic type and 12 (60%) cases were quiescent infection. Patient with active infection draining or not, are excluded from this study. None of the patients were of hypertrophic type. Patients with anticipated poor co-operation, complete posterior tibial nerve injury with insensitive sole, limb with severe vascular injury with absent anterior and posterior tibial artery pulsation were also excluded.

All the patients were treated with bilocal distraction compression osteosynthesis following the method described by G A Ilizarov⁵. External bone transport was used in all the cases. Corticotomy was done at the proximal metaphyseal area distal to the tibial tubercle with a thin osteotome. Distraction was done after a latency period of 7-10 days at the rate of 0.25mm 6hrly. When the gap is small i.e. less than 3cm, docking was done at the same sitting (acute docking). When the gap is large i.e., more than 3 cm bone transport was done first and docking was done as a second procedure as acute shortening will cause crowding of the soft tissue. Limited open procedure at the non union site was performed in all the cases, in the form of decorticating the fracture ends, opening of the medullary canal and reshaping the ends to give stability. Compressing at the docking site was at the rate of 0.25mm on alternate days. This rate was used by other authors also.^{1, 5} Accordion method of compression and distraction cycle at the non union site was not used in this study. Patients were trained to do the pin site dressing. Weight bearing was encouraged from the first week of the surgery. Serial radiographic examination was done during the follow up period to see the regeneration and consolidation of the corticotomy area, correction of length and bony union. If the non union does not show the features of a stable union within a period of 6 months, it is considered as delay in consolidation³. When the regenerated bone at the corticotomy site is consolidated and non union site does not show a stable union, it is also considered as delay in the consolidation and bone grafting is considered indicated.

Functional results were based on five criteria as described by Paley et al³. (a) Significant limp (b) Equinus rigidity of the ankle. (c) Soft tissue dystrophy (skin hypersensitivity, insensitivity of the sole or decubitus ulcer) (d) Pain (e) Inactivity (unemployment because of the leg injury or inability to return to daily activities because of the leg injury). An excellent result was an active individual with none of the five criteria; a good result was an active individual with one or two of the

five criteria; a fair result was an active individual with three or four of the five criteria or an amputation. An inactive individual was considered a poor result regardless of the other criteria. Patient acceptability of the treatment is graded using the criteria designed by the authors in the table 1. Maximum score is 10. 10-8 excellent, 7-5 is good and 4 or less than 4 is poor.

RESULT: 19 (95%) cases got united. Mean duration of hospital stay was 17.7 days (range 10-38 days). Mean duration of use of fixator was 8.4 months (range 5-18 months).

15 cases (75%) had excellent functional result, 3 cases (15%) had good functional result and 2 cases (10%) had poor functional result. These 2 cases refused further treatment and did not come for follow up.

15 patients (75%) had excellent patient acceptability result and 5 (25%) had good patient acceptability result.

Complications are shown in table 2.

DISCUSSION: Tibial non union is usually not an isolated problem. It is associated with infection, bone defect, shortening, soft tissue dystrophy, disuse osteoporosis, equinus deformity, angular deformity and neuro vascular damage. Conventional internal fixation with bone grafting can achieve union, but it is almost impossible to address all associated problems simultaneously. Ilizarov treatment is an excellent treatment modality for this complex orthopaedic problem. Reports in western literature are limited, perhaps because of poor patient acceptance of this cumbersome frame for a prolonged period of time. 95% union rate of this study is comparable to 94% and 93% of other series.^{10, 11} Average union times i.e. time in the frame is 8.4 months (5-18months) which is shorter than 13.6 months (6-31months) of Paley D et al series³ the reason perhaps being, the cases in this series had less shortening. Bone result and functional results are comparable to other studies^{3, 10, 11}. Local population acceptance of the treatment modality is excellent or good in 100%. It is an important finding. Though the frame is cumbersome and treatment period is prolonged, patients accepted this treatment without much complain probably because of the long period of non union and repeated failed surgeries.

CONCLUSION: Tibial non union with bone loss can be treated with Ilizarov bilocal distraction compression osteosynthesis very effectively. Acceptability of the method to the local population is good.

Fig 1. Pre operative X Ray

Fig 2. Post operative X Ray during distraction

Fig 3. X Ray after removal of the frame

ORIGINAL ARTICLE

Sl. No.	Criteria	Score
1	Walking aid used	
	Two Crutches	0
	One Crutch	1
	Walking Stick	2
	No Walking Stick	3
2	Readiness to show the device to other	
	Confined to Home	0
	Moves freely in the public places	3
3	Obstruction to normal activities as described by patient.	
	Severe	0
	Moderate	1
	Mild	2
4	Readiness to undergo the same treatment again	
	Yes	2
	No	0

TABLE 1: PATIENT'S ACCEPTABILITY CRITERIA

Sl. No.	Complication	No. of cases	%
1	Pin Tract Infection	6	30
2	Valgus procurvatum at corticotomy site.	2	10
3	Incomplete corticotomy.	0	0
4	Premature Consolidation at Corticotomy Site	0	0
5	Delayed Consolidation of Regenerated Bone	0	0
6	Compartment Syndrome	0	0
7	Neurovascular Injury	0	0
8	Loss of Ankle Motion more than 10 degree in one direction	12	60
9	Wire Breakage	2	10
10	Delayed consolidation of non union site needing bone grafting	4	20
11	Refracture at the non union site	0	0

Table 2: COMPLICATIONS

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