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Original Research Article

Outcome of Ilizarov assisted ankle arthrodesis

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ABSTRACT

Background: Among the various techniques used for ankle arthrodesis, Ilizarov technique has various advantages along with the potential for treating complex and failed cases.
Methods: Eleven cases were undertaken for ankle arthrodesis using the Ilizarov fixator. Two rings were applied along the tibia and one at the talus/calcaneum. The articular cartilage was denuded, and dynamic compression applied. The clinical, functional and radiological outcome were evaluated. The goal was a stable fusion with a well aligned foot.
Results: The mean follow-up period was 95 weeks. Fusion was achieved in all cases with no major complication. Only one case had a residual deformity. The average time interval for the ankle fusion was 140.8±25.7 days. The postoperative modified American Orthopaedic Foot and Ankle Society (AOFAS) Hindfoot score was 67.5±9.6 points.
Conclusions: Ilizarov assisted ankle arthrodesis aids in early weight bearing, better alignment, and has good functional outcomes even in cases with previously failed procedures. It has the advantage of postoperative readjustment of the arthrodesis without the need of any second procedure with no major complications.

Keywords: AOFAS, Ankle, Arthrodesis, Ilizarov, Ring fixator

INTRODUCTION

Role of ankle arthrodesis as a salvage procedure for chronic ankle arthritis or instability is well known. It provides a pain-free and stable ankle joint. Numerous techniques are followed worldwide to achieve an ankle fusion, each one with its advantages and disadvantages.[1]

The Ilizarov method has found numerous applications in the field of orthopaedics since its inception and can be said as one of the greatest contributions to treating bone pathologies.[2] The Ilizarov technique has well established itself in the treatment of difficult non-unions. It has also been widely applied in the management of many others difficult diseases. The Ilizarov fixator is useful for ankle arthrodesis in cases with infection, bone defects, poor bone quality and in cases with a need for early weight bearing.[1] However, factors affecting the success or failure of the ring fixator in ankle arthrodesis are not well defined.[3]

With this background, we wanted to study the role of Ilizarov techniques in cases requiring ankle arthrodesis in our institute.

METHODS

Patients who underwent ankle arthrodesis in our institute from August 2013 to August 2016 for different indications using the Ilizarov apparatus were undertaken for the study. Our primary aim was to achieve a stable fusion and optimal ankle alignment.

Inclusion criteria

Patients requiring ankle arthrodesis due to long-standing arthritis of the ankle joint, due to chronic instability, as a

salvage procedure for neglected malunited distal tibial articular fractures, and other valid indications were included in this study.[4]

Exclusion criteria

Patients unwilling to undergo the procedure, unfit to undergo surgery, with poor compliance, with concomitant significant ipsilateral foot injuries, and with impaired limb vascularity and innervation were excluded.

Pre-operative evaluation

Patients were counselled that the goal of this surgery is to achieve a painless and stable foot through ankle fusion and after taking informed consent they were enrolled in the study. Complete history taking, and thorough clinical evaluation was done in each case to judge the severity of the disease. The patients were evaluated radiologically with x rays of the involved ankle in two orthogonal views (Figure 1). Parameters such as ankle deformity, weight-bearing status, the presence of infection, the status of soft tissue and limb shortening were taken into consideration. Necessary pre-operative blood investigations, chest radiograph, ECG and other relevant investigations required for anaesthetic fitness were also done. Planning about the size of fixator and position of rings was done.

Figure 1: Pre-operative clinical photograph and X-ray.

Surgical technique

After administration of anaesthesia, the patient was positioned supine with a sandbag under the ipsilateral buttock. No tourniquet was used. The Ilizarov rings were applied in the distal third of tibia, mid shaft of tibia and a third ring applied at the talus level with 2-3 cross wires each through safe neurovascular corridors. A trans calcaneal half ring and plate construct was used for tibio-calcaneal arthrodesis. An additional drop wire was passed through the metatarsals and secured with the frame to maintain the plantigrade position. The image intensifier was used for confirming the position of rings. Through a small incision the articular surface was denuded of the cartilage covering. The foot was held in the desired position and the rings were interconnected to produce a stable rigid fixator construct (Figure 2). Compression was applied between the 2nd ring and the trans-talar/trans-calcaneal rings so that the raw bone surfaces were approximated. The wound was closed with interrupted skin sutures and dressings were applied at the wound sites.

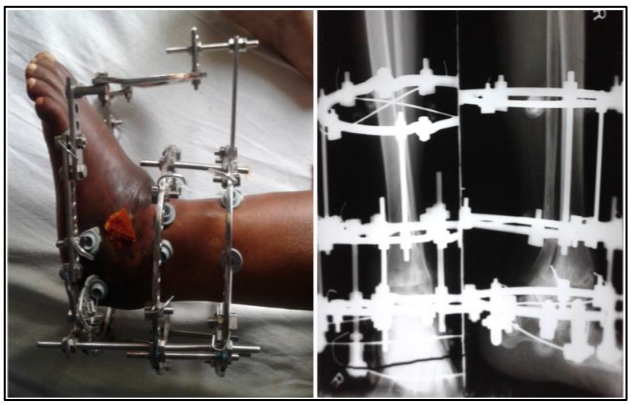

Figure 2: Post-operative clinical photograph and X-ray showing the Ilizarov construct.

Post-operative period and follow-up: Institutional protocol for antibiotics and analgesics were followed. Postoperatively, the limb was kept elevated and active movements of the knee and toes were encouraged. The patients were allowed to bear weight with crutch support from 2nd day postoperatively which was gradually increased as tolerated by the patient.

Figure 3: Clinical photograph after removal of fixator showing well-aligned foot.

Patients were trained about the pin site care. Compression was applied across the joint at the rate of 1mm per day for next 10 days and patients were discharged after removal of sutures. The initial follow-up was done at 2 weeks post discharge and then they were examined at 2 weekly intervals till there was radiological evidence of bridging trabeculae across the joint. On the appearance of bridging trabeculae in three out of four cortices, the fixator was removed, and the patient was allowed a

walking cast. The cast was removed after 3-4 weeks (Figure 3, Figure 4).

Figure 4: X-ray after removal of fixator showing fused Tibio-talar joint.

During follow-up, clinical evaluation of the limb was done focusing on pain, deformity, infection, and shortening. Any specific complaints of the patient such as pain, discharge at pin site, tingling or numbness of the foot, etc. were adequately addressed. Modified American Orthopaedic Foot and Ankle Society (AOFAS) Hindfoot Score was used for evaluation of the functional outcome.[5]

RESULTS

A Total of 11 patients (8 males, 3 females) were undertaken in the study with mean follow-up of 95 weeks duration. (Table 1) The average age of the study population was 48.9±7.5years. The primary indication was pain in 10 cases and instability in one case. Seven cases were due to post-traumatic malunion, one case each due to a comminuted talus fracture, chronic secondary arthritis and a failed ankle arthrodesis with active infection and an intramedullary nail in situ (Figure 5). Pre-existing deformities were present in 8 cases. Five of the eleven cases were unable to bear weight pre-operatively. The median preoperative interval was 180 days (range 7 days- 6 years).

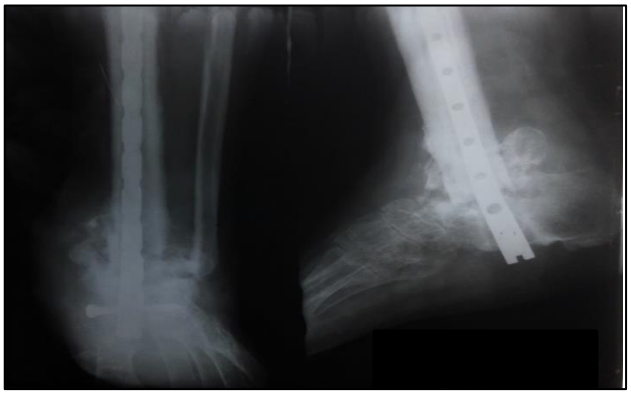

Figure 5: Failed ankle arthrodesis with active infection and an intramedullary nail in situ.

All the cases underwent tibio-talar fusion and one case was undertaken for tibio-calcaneal fusion (Figure 6). The average time interval for the ankle fusion was 140.8±25.7 days (Table 2).

Table 1: Details of the patients undertaken in the study.

Patient name	Age (years)	Sex	Indication	Pre-op infection	Pre-op deformity	Pre-op weight bearing status	Pre-op interval (days)
MA	49	M	Malunited bimalleolar fracture	-	+	+	270
MS	48	M	Infected failed arthrodesis	+	+	-	360
SK	53	F	Comminuted Talus fracture	-	-	-	7
TP	55	M	Neglected Plafond fracture	-	+	-	45
KK	60	M	Fracture dislocation of ankle	-	+	-	77
HK	48	M	Malunited fracture ankle	-	+	+	180
LB	50	M	Comminuted Plafond fracture	-	+	-	31
MB	34	F	Fracture dislocation of ankle	-	+	+	54
SS	38	M	Chronic Instability	-	-	+	430
SQ	48	F	Malunited fracture dislocation	-	+	+	221
SM	55	M	Secondary arthritis	-	-	+	2380

There was no residual infection in any case. The average residual shortening after removal of fixator was 2.6cm. The patients resume complete weight bearing at an average of 164 days. The mean duration to return to their activities was found to be 186 days. The postoperative modified AOFAS Hindfoot score was 67.5±9.6 points.

The foot was well-aligned in 10 cases. One case had a residual valgus deformity. Four cases had pin site infections which responded well to aggressive pin site care and oral antibiotics with no long-term sequelae. No major complications were encountered during the follow up period.

Table 2: Results of the patients undertaken in the study.

Patient name	Follow up (weeks)	Fusion interval (days)	Weight bearing (days)	Resume activities (days)	Residual Shortening (cm)	Residual deformity	Pin Tract infection	modified AAOFAS score*
MA	60	159	180	202	2.5	nil	-	67
MS	116	197	220	237	3.4	nil	+	51
SK	90	100	121	138	4.6	nil	-	53
TP	81	150	176	203	2.8	nil	-	81
KK	90	144	165	187	3.2	nil	+	68
HK	137	122	144	165	3.1	valgus	-	64
LB	73	123	144	163	2.1	nil	+	67
MB	94	120	150	175	2.5	nil	-	74
SS	120	133	154	181	1.5	nil	-	81
SQ	124	146	170	192	1.7	nil	-	66
SM	64	155	180	203	1.5	nil	+	71

*Modified American Orthopaedic Foot and Ankle Society (AOFAS) Hindfoot Score

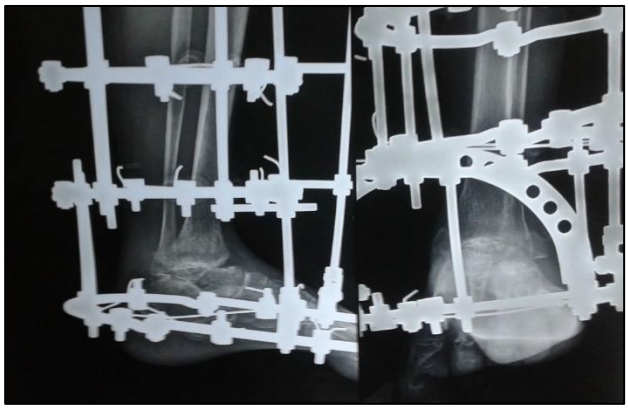

Figure 6: Post-operative X-ray of case undertaken for Tibio-calcaneal fusion.

DISCUSSION

The present study was conducted at a tertiary care facility over a period of four years where cases which underwent ankle fusion for various indications using the Ilizarov apparatus were prospectively studied for the outcome evaluation. Among the varied modalities being used for ankle arthrodesis, Ilizarov fixator offers many advantages over the conventional methods. Ilizarov apparatus to have advantages of stable fixation, respect for soft tissues, the possibility of postoperative alignment 'fine-tuning'.[6] It has found its place in literature for difficult situations with a vascular compromise of the talus, poor soft tissue viability, and presence of infection.[6] Author found in one of his cases with previously failed and infected ankle arthrodesis Ilizarov technique yielded a successful fusion. It is recommended for established problematic joint arthrodesis scenarios such as Charcot joint disease.[7]

In present study, the patients were allowed to bear weight as tolerated during the postoperative period. This is one of the unique advantages of Ilizarov fixator which reduces the burden on the society during the treatment period.[6,8] Resistance to bending, shear and torsion forces along with the dynamic axial compression permits weight bearing in the fixator construct.[1] In present study, the patients were able to return to their activities by 186 days.

The mean duration to achieve fusion in present study was 140.8 days. Johnson et al reported average fusion interval of 3.5months. They reported a higher duration of 7 months for cases with infection.[9] In present study the one case with previously failed and infected ankle arthrodesis the fusion interval was 197 days.

The mean modified AOFAS Hindfoot score was 67.5 out of 86(range 51-81), similar postoperative AOFAS scores are reported in the literature (AOFAS score 67.9), Eylon et al (65 out of 86) and Rochman et al (65 out of 86).[6,10,11] In present study we couldn't assess the preoperative AOFAS Hindfoot scores in all patients. Several studies report a statistically significant difference between the preoperative and postoperative AOFAS Scores by the use of Ilizarov fixator.[12-14]

The average postoperative shortening was found to be 2.62cm in present study. Simultaneously proceeded with tibial lengthening along with ankle arthrodesis.[15] Ilizarov fixator for ankle arthrodesis in cases with bone loss and shortening.[16,17] Fragomen et al found no supplementary effect of simultaneous lengthening over the joint fusion.[18]

The Ilizarov frame is versatile and can be used with varied techniques. It was described the use of Hybrid Ilizarov fixator for joint arthrodesis as rewarding.[19] Biomechanical stabilization properties of the Ilizarov fixator is comparable with the arthrodesis intramedullary nails.[20] Several advantages of Ilizarov over internal fixation including higher fusion rate, lower misalignment, and lower adjacent joint arthritis rates.[21] Ilizarov

technique has been an alternative to amputations for difficult cases.[17]

CONCLUSION

Author concluded that Ilizarov assisted ankle arthrodesis aids in early weight bearing, better alignment, and has good functional outcomes even in cases with previously failed procedures. It has the advantage of postoperative readjustment of the arthrodesis without the need of any second procedure with no major complications. Author has a small sample size. Further elaborate case-control studies are needed to compare the outcome of Ilizarov assisted ankle arthrodesis with other established techniques.

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