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Case Report

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Tibial deformity correction by Ilizarov method

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ABSTRACT

The case series illustrates the correction of bony deformities of the tibia through a percutaneous osteotomy and gradual distraction with the Ilizarov apparatus in order to restore shape and function of the lower limb. A total of 13 cases of tibial deformity which were gradually corrected by the Ilizarov method were included in the study. The plane and degree of deformity was calculated by Drorr Paley's method. The tibial deformity was gradually corrected in all patients by the Ilizarov method. Hinges were appropriately placed usually at the level of deformity (CORA). In most of the cases percutaneous osteotomy was done at the level of CORA. In juxta-articular deformities, hinges were placed at the level of CORA but the osteotomy was done at different levels. The mean tibial varus in 12 patients was 24 degrees (range of 18 to 34 degrees) and one patient had a tibial valgus of 22 degrees which was corrected to restore a 90 degree medial proximal tibial angle. No healing problems in the regenerate except for one probable hypertrophic non-union. None of the patients with a tibial varus developed any neurological deficit or compartment syndrome following correction.

Keywords: Tibial varus deformity, Ilizarov ring fixator, Gradual correction

INTRODUCTION

The Ilizarov ring fixator is a powerful tool for correcting tibial deformities by allowing for the gradual correction of multiplanar deformities and limb-lengthening through one osteotomy site. The power of the frame lies in its control over the final limb length and alignment and in its ability to correct a residual deformity. The stability of this multiplanar circular fixator permits early weight-bearing and provides an ideal environment for both new-bone formation and soft-tissue healing.[1] Deformity correction of the tibia requires a thorough knowledge of normal anatomical alignment and rotation. Usually, the contralateral limb can be used as a reference. Anteroposterior and lateral radiographs of both the lower limbs will guide management and provide a template for pre-operative planning. Gradual correction and lengthening with the Ilizarov apparatus uses the principle of distraction osteogenesis. Following the osteotomy and application of the Ilizarov apparatus there is a latency phase of seven to ten days when no distraction is done. After the latency phase, bone and soft tissue are gradually distracted at a rate of 1 mm per day in four divided increments. This time period of the correction and lengthening is called the distraction phase. Bone growth which is seen during the distraction gap is called the regenerate. The time from the end of distraction until bony union is called the consolidation phase.[2]

In this study we looked at a series of cases where tibial deformity was gradually corrected by the Ilizarov method. The case series illustrates the correction of bony deformities of the tibia through a percutaneous osteotomy and gradual distraction with the Ilizarov apparatus in order to restore shape and function of the lower limb.

CASE PRESENTATIONS

Present study was done at Department of Orthopaedics, Sri Ramachandra Medical College and Research Institute, Sri Ramachandra University, Chennai, India during January 2015 to December 2016. A total of thirteen cases of tibial deformity which were gradually corrected by the Ilizarov method were included in the study. Out of the thirteen cases, twelve cases were of tibial varus deformity and one case had a tibial valgus deformity. Preoperatively, all patients included in this study lower limb deformity were thoroughly assessed radiologically and the center of rotation of angulation (CORA) was estimated from radiographs using the malalignment test proposed by Paley et al.[3] Patients were treated with an Ilizarov external fixator. The deformity correction was performed with Ilizarov hinges which were appropriately placed usually at the level of deformity (CORA) using an image intensifier. In most of the cases percutaneous osteotomy was done at the level of CORA. In juxta-articular deformities, hinges were placed at the level of CORA but the osteotomy was done at different levels. In all cases fibular osteotomy/fibulectomy was done to enable correction of deformity. The deformity was corrected gradually after operation with the Ilizarov apparatus using the principles of distraction osteogenesis.

Inclusion Criteria included all cases which were gradually corrected following percutaneous osteotomy at or near the site of deformity using the Ilizarov apparatus. Exclusion Criteria include (1) Lax unions and infected non-unions where the deformity was acutely corrected after opening, freshening and debridement of the fracture site (2) When the deformity was acutely corrected by wedge osteotomies.

In our study we looked at a series of Thirteen cases were tibial deformities was gradually corrected by the Ilizarov method. Twelve of the patients were found to have tibial varus, this was the more common deformity and the most disabling deformity. One patient was suffering from a tibial valgus deformity as a result of post osteomyelitic sequelae leading to proximal tibial valgus and shortening.

Tibial varus was the most common deformity seen in twelve patients, and was the results of various causes. Six patients had a resulting tibial varus following trauma. Among these six cases of post-traumatic tibial varus, four were due to malunions and two patients had stiff nonunion where the fracture site was not opened. Three patients had tibial varus as a result of skeletal dysplasia, of which growth modulation had failed in two cases. Two patients were suffering from physeal injury. And one patient had osteoarthritis of the knee with resulting severe genu varum.

The mean tibial varus in 12 patients was 24 degrees (range of 18 to 34 degrees) and one patient had a tibial valgus of 22 degrees which was corrected to restore a 90 degree medial proximal tibial angle. No healing problems in the regenerate except for one probable hypertrophic non-union.

Case 1: 20 year old male with post-traumatic (post physeal injury) right tibial varum for which corrective osteotomy of the right tibia was done after the plane and degree of deformity was calculated to be 32 degrees by Drorr Paley's and application of the Ilizarov ring fixator which was kept for five months (Figure 1).

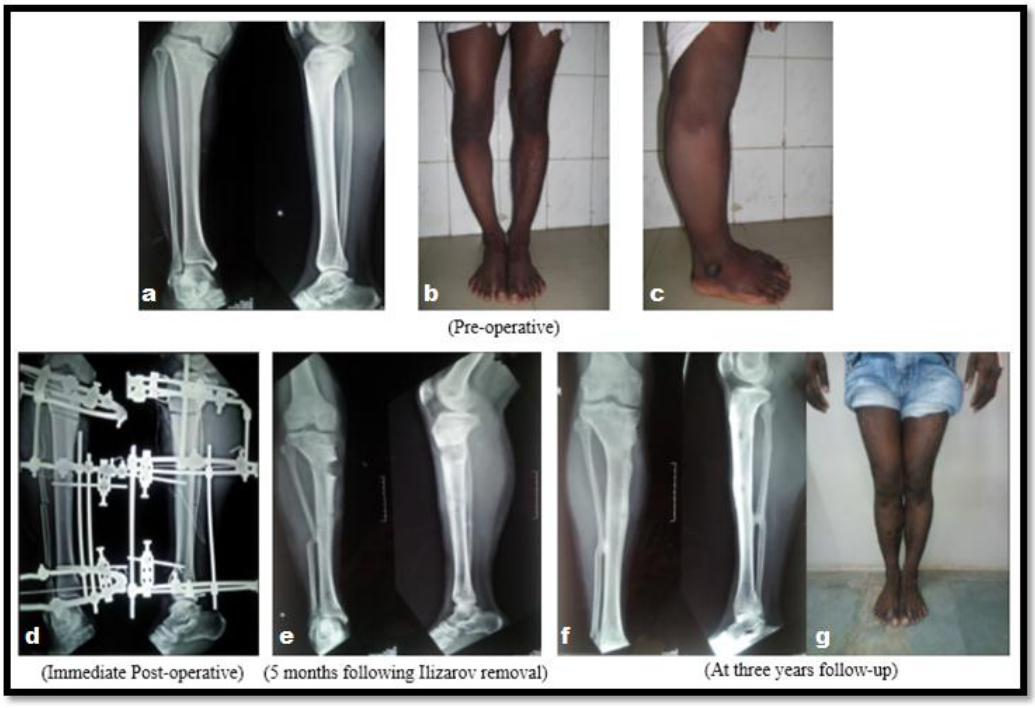

Figure 1: Case of post-traumatic right tibial varum for which corrective osteotomy was done.

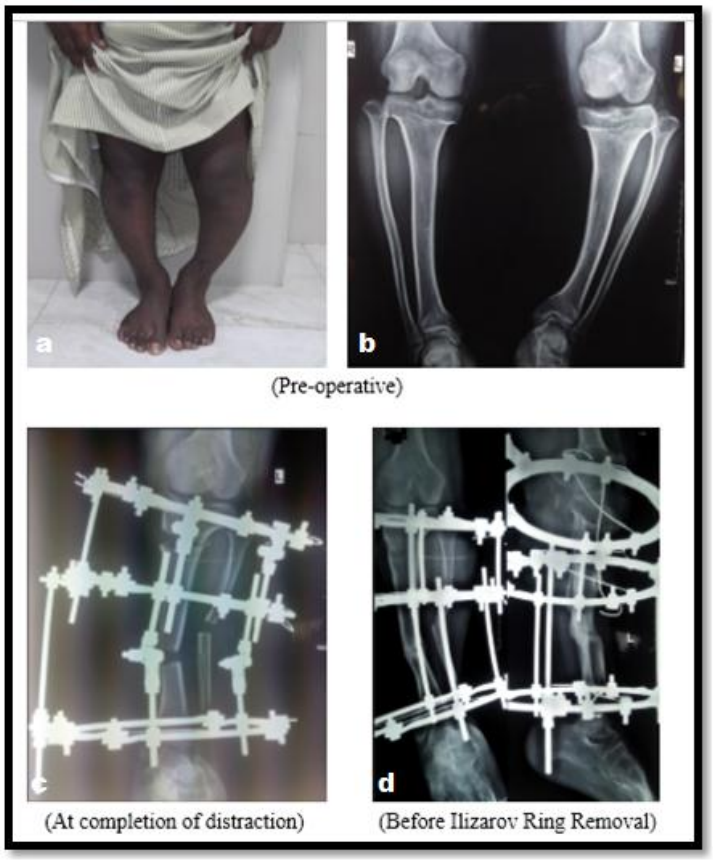

Figure 2: Case of Achondroplasia for which left tibia vara for which corrective osteotomy was done.

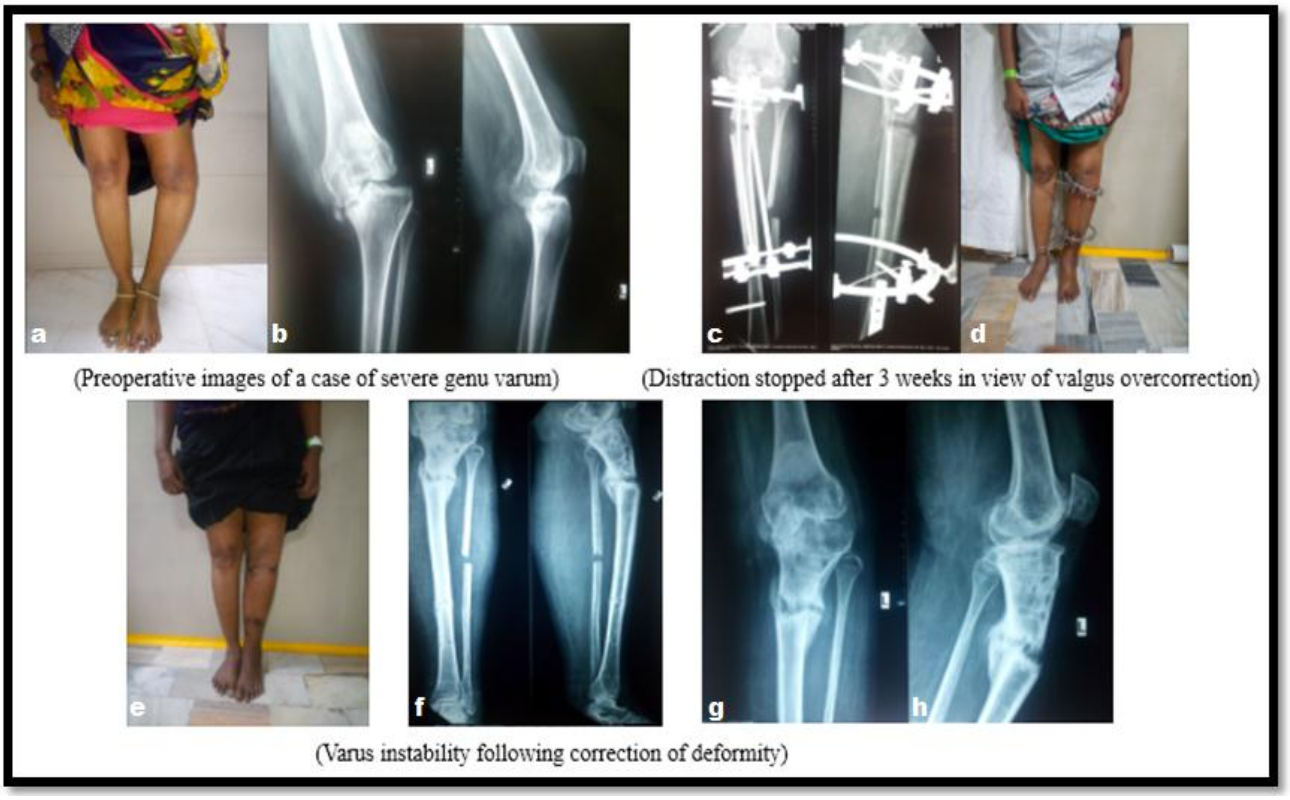

Figure 3: Case of severe genu varum from osteoarthritis considered to be a failure as there was varus instability following correction of the deformity.

Case 2: 18 year old male suffering from Achondroplasia resulting in left tibia vara calculated to be 20 degrees by Drorr Paley's, for which he subsequently underwent corrective osteotomy of the left tibia and application of the Ilizarov ring fixator. Distraction was started five days after the application of the Ilizarov and the distraction was continue for twenty days (Figure 2).

Complications

One patient included in the study, a 45 year old female, who was suffering from severe genu varum from osteroarthritis was considered to be a failure as there was a varus instability following correction of deformity. This was most likely due to under correction of the deformity or attenuation of lateral collateral ligament. For this patient distraction was started five days after application of the Ilizarov apparatus and was stopped three weeks in view of suspected valgus overcorrection. But inspite of valgus over correction, she had a varus instability with pain on weight bearing after removal of Ilizarov fixator. There was a doubt as to whether proximal tibial osteotomy site was developing a hypertrophic non-union. As she was having a persistent painful knee, she was advised constrained total knee replacement with a tibial stem (Figure 3).

DISCUSSION

Twelve out of the thirteen cases tibial deformity were able to be gradually corrected following application of the Ilizarov apparatus. The hinges were appropriately placed usually at the level of deformity (CORA). In most of the cases percutaneous osteotomy was done at the level of CORA. In juxta-articular deformities, hinges were placed at the level of CORA but the osteotomy was done at different levels. Similarly in three post-traumatic patients, osteotomy was done away from the CORA in view of poor skin condition at level of the CORA. In all cases fibular osteotomy or fibulectomy was done as correction of most tibial deformities relies on a mobile fibula.

The mean tibial varus in 12 patients was 24 degrees (range of 18 to 34 degrees) and one patient had a tibial valgus of 22 degrees which was corrected to restore a 90 degree medial proximal tibial angle. No healing problems in the regenerate except for one probable hypertrophic non-union (Illustrative case 3). This may probably represent instability of the fixator even though the single ring proximal to the osteotomy site was stabilized with two kirschner wires and two conical schantz screws.

Gradual distraction was preferred to protect the surrounding soft tissue and neurovascular structures from the harms of acute distraction and lengthening. Study by Matsubara H et al compared the effects of acute correction with gradual correction and suggested that gradual resulted in a smaller incidence of complications. Those patients who had acute correction had a higher incidence of damage to the surrounding soft tissues. Acute correction is also blamed for producing a sudden gap between bone fragments and interfering with the sequence of callus formation.[4]

None of the patients with a tibial varus developed any neurological deficit or compartment syndrome following correction. None of the patients with a tibial varus required any further need of subsequent lengthening procedures following removal of the Ilizarov apparatus. The only patient with a proximal tibial valgus of 20 degrees as a sequela of proximal tibia osteomyelitis had an excellent correction of the deformity. He had an initial shortening of 8cms. The regenerate was distracted after correction of the deformity to restore the length. But after about 5cms of lengthening, the patient had developed sensory blunting over the dorsum of the foot.

The reliability of the use of the Ilizarov ring fixator in gradually correcting tibial deformities in a single staged procedure without the need of additional limb lengthening procedures was studied by Kawoosa et al, were eight patients suffering from tibial deformities with associated shortening were managed with gradual distraction with the Ilizarov apparatus after conventional corticotomy provided excellent results with deformity correction without additional limb lengthening procedures. Exact limb lengthening was achieved in all eight patients with shortening preoperatively.[5]

CONCLUSION

The Ilizarov apparatus has been successful at correcting the deformity as well as stabilizing the bone after the deformity has been corrected. The advantages of gradual correction of the deformity over acute correction include a lower risk of neurovascular and soft-tissue compromise, and precise control over the final alignment. Proper technique for pin and wire insertion, including strict adherence to anatomic safe zones, is important to the success of the Ilizarov apparatus.

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