

Single Stage Tibial Osteotomy and Long Stem Total Knee Arthroplasty to Correct Adverse Consequences of Unequal Tibial Lengthening with an Ilizarov Circular Fixator

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What to Learn from this Article?

Complication of non compliance in a case of deformity correction using Ilizarov fixator

Abstract

Introduction: Correction of limb alignment or length discrepancy by circular external fixation is an accepted technique which relies on the correct biomechanical application of the frame and precise corrections which are frequently delegated to the patient to perform. Errors can occur in the execution of the correction by the patient and may result in significant deformity that requires remedial intervention.

Case Report: A 67 Caucasian female underwent multifocal limb reconstruction of the lower limb utilising a complex Ilizarov frame. Attendance at follow-up visits did not occur and the patient presented at 6 months with severe deformity due to incorrect execution of the correction protocol which resulted in a 45 degree varus deformity of the tibia. Subsequent correction via acute tibial osteotomy and stabilisation with a stemmed total knee replacement resulted in a good outcome.

Conclusion: Patient compliance with post-operative management is paramount with distraction osteogenesis and should be ensured prior to embarking on lengthening or deformity correction.

Keywords: Ilizarov; Patient Compliance; Adverse event; Complex primary knee arthroplasty.

Introduction

Limb lengthening according to the technique of Ilizarov is well established [1,2]. To achieve lengthening of bone, daily equal lengthening of threaded rods is necessary. Frequently, patients are taught to perform these adjustments themselves and are discharged home with regular clinical and radiological follow up to ensure correct lengthening and to supervise consolidation of regenerate. Deformity correction and lengthening can be

performed with either the traditional Ilizarov circular frame, or alternatively by hexapod fixators (e.g. Taylor Spatial Frame, Smith & Nephew TN, USA; Ortho-SUV Frame, Pitkar, Pune, India) which permit the simultaneous correction of multiplanar deformities [1]. The correction protocol inherent with hexapod fixators is more complex and takes longer to teach.

Patient errors are common in medicine[3]. Buetow et al have suggested multiple different types of error which can be made by

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Figure 1: Initial radiograph showing severe tibiotalar osteoarthritis.



Figure 2: Initial radiograph showing severe tibiotalar osteoarthritis.



Figure 3: Initial frame.



Figure 4: Initial frame.

patients, including errors of comprehension and adherence [4]. In the performance of daily lengthening of an external fixator, multiple different errors can combine to produce an unexpected outcome.

Incorrect adjustment of circular external fixation can have severe consequences [1]. A case is here described of a patient who both incorrectly adjusted a multifocal tibial Ilizarov fixator, and failed to attend for ongoing supervision, with a subsequent severe deformity developing which required a complex solution in the form of an acute osteotomy of the tibia with a stemmed total knee replacement tibial component to correct the unwanted deformity.

Case report

A 67 year old Caucasian woman with a history of epilepsy was admitted for complex reconstruction of the lower limb, secondary to spastic cerebral palsy. Five centimetres of true shortening in the tibia were associated with midfoot and hindfoot deformities and severe tibio-talar osteoarthritis (Figs 1 and 2). A multifocal Ilizarov circular frame was constructed, with a proximal lengthening segment to address limb length inequality; a hindfoot segment to perform tibiotalar arthrodesis for severe degeneration and a forefoot segment to achieve acute derotational correction of a midfoot deformity (Figs 3 and 4). The post-surgical period was complicated by an episode of respiratory embarrassment due to pneumonia which required short term ventilation. Subsequent recovery appeared to have occurred, and the patient and her husband were formally instructed in the correct method and rate of adjustment to achieve proximal lengthening.

The patient failed to attend for regular follow-up, and represented at six months following index surgery complaining of worsening deformity. On examination, the proximal threaded rods of the circular fixator were bent and severe valgus deformity was apparent within both the frame and the limb. On questioning, it

became apparent that the patient's husband had been lengthening the medial aspect of the frame and compressing the lateral aspect.

At this juncture, the regenerate, midfoot and hindfoot arthrodeses were deemed consolidated (figs 5-7), and the patient refused further frame treatment to correct the inadvertent proximal tibial deformity. Due to severely symptomatic pre-existing osteoarthritis of the knee, and a prior plan to perform total knee arthroplasty at a later juncture, a single stage intervention was proposed, utilising a stemmed total knee replacement and a simultaneous closing wedge osteotomy of the tibia to correct deformity and provide primary stability.

At surgery, a standard medial parapatellar approach to the knee was performed, and the incision carried distally to the level of the metaphysis of the tibia. Due to severe intra-articular contracture, an extensile approach was performed via an osteotomy of the tibial tuberosity [5]. Standard femoral preparation was carried out. A separate lateral incision was used to perform a fibular osteotomy. An acute closing wedge osteotomy of the tibia was performed and the tibia realigned. Utilising intramedullary guidance, the tibia was prepared appropriately, and a tibial component with a canal filling stem used to bridge the osteotomy, correcting the deformity and simultaneously compressing the osteotomy (Figs 8 and 9). The tibial tuberosity was reattached with a large fragment screw. Uneventful osteotomy union subsequently occurred by three months post-operatively (Fig 10). Knee range of motion at final follow-up was 0-5-105 and no instability was reported by the patient.

Discussion

Patient compliance with the corrections necessary for Ilizarov reconstruct of limb segments is critical. In circumstances whereby hospitalisation for the duration is not possible or refused, strict adherence to the provided instructions is paramount. In North



Figure 5: Fully united ankle fusion.



Figure 6: Consolidated regenerate with severe deformity.



Figure 7: Consolidated regenerate with severe deformity.



Figure 8: Appearance post osteotomy and total knee arthroplasty



Figure 9: Appearance post osteotomy and total knee arthroplasty



Figure 10: Fully united and consolidated osteotomy.



America and Europe, it is commonplace for patients treated with circular external fixation to return to home after initial hospital admission, and this requires regular monitoring. Careful teaching and counselling of the patient to perform the correct frame adjustments are necessary. Regular follow-up is a critical part of management. With failure of the patient to attend for regular follow-up, complications can occur with the planned deformity correction.

The discovery of distraction osteogenesis by Ilizarov is assigned to a serendipitous occasion whereby a patient applying frame compression over a fracture inadvertently applied slow distraction [2]. This case displays the obverse scenario, whereby a most deleterious situation arose due to incorrect frame adjustment was compounded by non-compliance with hospital attendance.

The use of knee arthroplasty to correct moderate deformity is well recognised. Intra-articular deformity is frequently corrected during standard primary total knee arthroplasty. Mild extra-articular deformity can be corrected through intra-articular bone

resection [6,7]. Severe extra-articular deformity can be addressed by acute osteotomy and the use of stemmed prostheses [8], although this requires a significant degree of skill to accurately perform to achieve the correct referencing of the peri-articular segments given that neither intra- or extramedullary alignment can be achieved until after the osteotomy is performed. Severe joint contracture is frequent in these patients, and thus the soft tissue balancing of the arthroplasty can be difficult [8].

Conclusion

This case highlights the importance of patient education, compliance and regular attendance at follow-up visits to ensure satisfactory progress of the limb reconstruction. One solution to the unwanted effects of incorrect tibial deformity correction is presented here, however the acute correction by closing wedge osteotomy necessary for single stage reconstruction reduces the degree of length obtained by distraction histiogenesis.

Clinical Message

Lack of patient compliance with circular external fixation can cause severe and unexpected consequences which can require very significant intervention to address.

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