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Original Article

Simultaneous femoral and tibial lengthening in combined congenital complete fibular hemimelia and congenital short femur using Ilizarov ring external fixator

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ABSTRACT

Purpose: The combination of fibular hemimelia with congenital short femur worsens the limb length discrepancy which requires extensive femoral and tibial lengthening.

Patients and methods: Eight patients having unilateral lower extremity shortening presented to the National Institute of Neuromotor System, Egypt, between September 2008 and September 2010 and underwent single session femoral and tibial lengthening using Ilizarov ring external fixator technique.

Consolidation of the femoral and tibial required length gain was evident in the radiographic follow-up.

Conclusion: Extensive limb length discrepancy can be managed by simultaneous femoral and tibial lengthening.

Level of evidence: The study is type IV clinical evidence.

1. Introduction

Congenital fibular partial or complete deficiency or hemimelia exists in three types ranging from type I or fibular shortness, type II or partial fibular deficiency, to type III or complete fibular absence[1] which is frequently associated with femoral shortness, anterior tibial bowing, knee valgus, ankle instability and equinus, foot valgus deformity and/or malformation, and limb length discrepency.[2]

The combination of type III complete fibular absence with Aitken class A congenital short femur with contained femoral head in the acetabulum,[3] worsens the limb length discrepancy which may exceed 12 cm and require extensive femoral and tibial lengthening.[4] Isolated lengthening of either the femur or the tibia separately requires multiple operations for lengthening achievement in several sittings which adds to the psychological and economic burden. The use of Ilizarov ring external fixator corticotomy distraction technique enables to restore the extremity length as well as to correct the deformity in a single sitting.[5,6]

The objective of treatment of such cases is to implement simultaneous femoral and tibial lengthening to restore limb

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Table 1 – Case evaluation.

Case no.	Age (years)	Gender	Side	Total shortness (cm)	Femoral shortness (cm)	Tibial shortness (cm)	Equinus deformity
1	15	Female	Left	9	3	6	10°
2	14	Female	Left	8	2	6	15°
3	18	Male	Left	10	4	6	20°
4	17	Female	Left	12	5	7	25°
5	17	Female	Left	11	4	7	20°
6	15	Male	Right	8	3	5	15°
7	18	Female	Left	12	5	7	25°
8	18	Female	Left	10	4	6	20°

equality and gait, to correct deformities, to shorten the treatment period, and to minimize the problems.

2. Patients and methods

Eight consecutive patients having unilateral lower extremity shortening caused by combined complete fibular hemimelia (type III) and congenital short femur (Aitken class A); with stable hip, knee, and ankle joints, no coxa vara, no genu valgus as evident clinically and by plain radiography, no foot malformation but with equinus deformity; presented to the National Institute of Neuromotor System, Imbaba, Egypt, between September 2008 and September 2010. The results of this group after at least two years follow-up were reported in September 2013 and revised in December 2013 using previous medical records, history, and physical and imaging examinations. The study fulfilled the Egyptian's ethics code of research.

2.1. *Inclusion criteria*

Only cases of combined complete fibular hemimelia (type III) with congenital short femur (Aitken class A), in absence of hip, knee, or ankle instability, hip or knee deformity, or foot malformation, above 14 years of age were included.

2.2. *Exclusion criteria*

Other cases of limb length discrepancy, types I or II fibular hemimelia, or types of fibular hemimelia not associated with congenital short femur, or associated with hip, knee, or ankle instability, coxa vara, or genu valgus, or foot anomaly, and cases less than 14 years of age were excluded.

2.3. *Evaluation of cases*

The age ranged from 14 to 18 years, with the mean age 16.5 years. They were 6 females and 2 males. The left lower limb was short in 6 female patients, but the right one was short in one of the male patients. The lower limb shortness ranged from 8 to 12 cm, with the mean shortness 10 cm, both femoral (mean 3.75 cm) and tibial (mean 6.25 cm) contribution (Table 1).

2.4. *Previous treatment*

All cases received conservative treatment for several years in the form of high heel ankle/foot orthoses (AFO) to achieve limb length equalization, but no previous surgical interference.

2.5. *Imaging studies*

Anteroposterior and lateral weight-bearing plain radiographies pelvis to feet, with the short limb supported by appropriately sized wooden blocks, were taken prior to surgery to view the bony deficiency, deformity, and limb shortness (Fig. 1). Computerized tomography (CT) scanographies were taken to reveal the mechanical limb axes, and to accurately measure the amount of the limb shortness (Fig. 2).

2.6. *Preoperative fixator construct*

Five appropriately sized rings of Ilizarov external fixator, two for the lower thigh and three for the leg, were assembled to the patient and prepared prior to surgery.

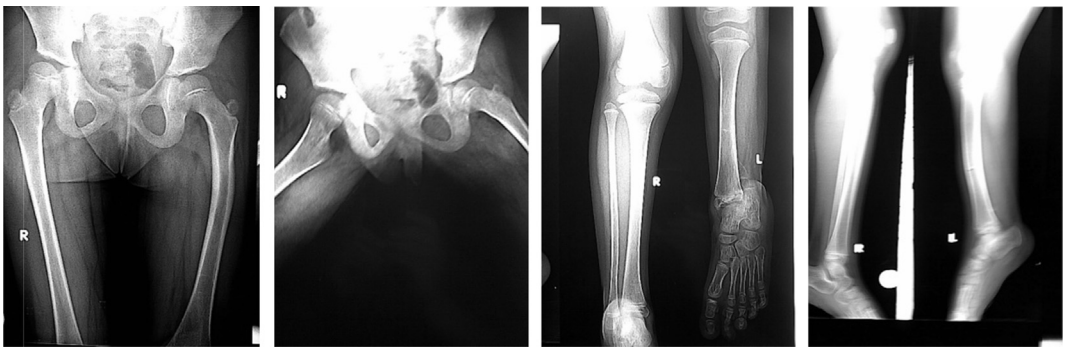

Fig. 1 – Preoperative anteroposterior and lateral weight-bearing plain radiographies pelvis to feet.