Both Femur and Tibial Shortening Caused from Hemihypertrophy Treated Simultaneously with Two Antegrade Precice Nails

Metin Kucukkaya*
Florence Nightingale Hospital, Istanbul, Turkey

Abstract

Hemihypertrophy is a genetic disorder characterized by overgrowth of one-half of the body in comparison with the other half. Overgrowth may affect only one part of the body such as the legs and arms. Furthermore, hemihypertrophy may proportionally affect both femur and tibia and may also affect malleolar height. Lengthening of both femur and tibia using external fixators is troublesome. New-generation lengthening nails have clear advantages for correcting deformities and lengthening the lower limb.

This section presents a 22-year-old female patient with shortening of the femur and tibia on the left side caused by hemihypertrophy on the right side. The patient was treated simultaneously with two antegrade Precice (Ellipse Technologies, Irvine, California, USA) internal lengthening nails for both femur and tibia.

1 Brief Clinical History

A 22-year-old female was admitted with a 6 cm limb length discrepancy (LLD) on the left side. Hemihypertrophy was diagnosed on the right side at 7 years of age. The LLD increased as she grew. She had 3 cm shortening of the femur, 2 cm shortening of the tibia, and 1 cm shortening of malleolar height. She could walk on her toes without using a shoe lift; however, she complained of limping and back pain after walking. No deformity or soft tissue contracture was observed on the lower limbs.

2 Preoperative Clinical Photographs and Radiographs

See Fig. 1.

3 Preoperative Problem List

• A total of 6 cm LLD on the left side consisted of 3 cm of femoral shortening, 2 cm of tibial shortening, and 1 cm of malleolar shortening.

4 Treatment Strategy

Antegrade application of lengthening nails in both femur and tibia at the same stage.

*Email: mkucukkaya@yahoo.com
Simultaneous gradual lengthening of both femur (3.5 cm) and tibia (2.5 cm).

5 Basic Principles

The LLD was determined from the physical examination and plain radiographs. The malalignment test (Paley 2002) and the “end point first method” (Thaller et al. 2014) were used for preoperative planning.

Femoral lengthening using an intramedullary nail occurs along the anatomical axis. It results in coronal plane translation of the knee relative to the mechanical axis. To prevent malalignment, the distal fragment should be translated laterally during the index operation. However, this correction can only be performed using a retrograde nailing technique. Preoperative planning of this case revealed that 3.5 cm femoral lengthening would not create an important deviation on the mechanical axis. Therefore, an antegrade nailing technique was preferred to avoid knee penetration.

6 Images During Treatment

See Fig. 2
Fig. 2  (a) Tibial nailing was performed with the patient in the supine position on a radiolucent operating table with the knee in a semi-flexed position. (b) Antegrade nailing of the femur was performed with the patient in the lateral decubitus position. Note that two parallel 6 mm Schanz pins were inserted into the proximal and distal segments before the osteotomy. (c) The anteroposterior X-rays of both femur and tibia during the early postoperative period. (d) Clinical pictures during the distraction period. Note the knee function. (e) Distraction of the Precice internal lengthening nail using external remote controller. (f) Long-standing radiograph after a total of 6 cm of lengthening. Note that pelvic balance was gained
Fig. 3 (a) Anteroposterior and lateral X-rays after consolidation of both the femur and tibia. (b) Long-standing radiograph after the 6 cm lengthening at 6 months. (c) Clinical photographs after treatment. (d) Note the knee function
7 Technical Pearls

7.1 For Tibial Nailing
- A transverse incision at the lower pole of the patella was used for tibial nailing.
- A tourniquet was used during initial exposure and the fibular osteotomy.
- The entry point for tibial nailing and the osteotomy level were planned preoperatively. The tibial osteotomy was performed 10 cm below the joint line.
- A fibular osteotomy was performed after inserting and locking the nail to prevent malrotation.

7.2 For Femoral Nailing
- A longitudinal 2 cm incision was used for the antegrade femoral nailing.
- Two parallel 6 mm Schanz pins were inserted into the proximal and distal segments before the osteotomy to prevent malrotation of the femur after the osteotomy. The first Schanz pin should be placed at the level of the lesser trochanter, and it should be placed posterior to the reamer and nail passage.
- Distraction was started on postoperative day 5 and was performed at 0.6 mm/per day in two equal increments in both the femur and tibia.

8 Outcome Clinical Photographs and Radiographs
See Fig. 3.

9 Avoiding and Managing Problems
- A tourniquet should not be used during reaming of the canal because of the risk of thermal necrosis.
- Excessive reaming and high-speed reaming of the medullary canal using a rigid reamer can cause necrosis of the bone and result in poor bone regeneration at the distraction site.
- Use of a tibiofibular screw to stabilize both the proximal and distal tibiae-fibulas will prevent distal migration of the proximal fibula and will prevent proximal migration of the distal fibula. It will ensure that the fibula separation and lengthening will equal the tibial lengthening. This was not done in this case but is routinely recommended by the editor (comment by S. Robert Rozbruch, MD).

10 Cross-References
- Combined Deformities of the Femur and Tibia with 9 cm Shortening Treated with a Retrograde Femoral Motorized Lengthening Nail and a Tibial Plate
- Femoral Shortening (14 cm) and Deformity Treated with Two Consecutive Retrograde Fitbone Applications
- Ipsilateral Secondary Hip Osteoarthritis and Leg Length Discrepancy: Treated Simultaneously with Total Hip Replacement and Motorized Lengthening
References and Suggested Reading
