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Case Report

Correction of multiple complex lower limb deformities by intramedullary nailing

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KEYWORDS

long bone multiple post-traumatic axial deformities
long bone osteotomies
cuneiform and open wedge osteotomy
intramedullary nailing

ABSTRACT

A female patient presented to our institution suffering from long bone post-traumatic multiple deformities. Her walking was limited, painful and teetering. It had worsened over the past months. The right leg was shortened by 6 cm compared to the contralateral. The right femur was 18° varus, the right tibia was 16° valgus, the left tibia was 12° varus. Both knee joints showed marked radiographic signs of osteosclerosis. After a thorough study with simulations using paper models, we carried out three osteotomies, two open wedge and one cuneiform, stabilizing them with intramedullary nails. We conducted the operation in two stages, in order to avoid an excessive surgical stress that could give rise to complications such as DVT, fat embolism, and respiratory insufficiency. This allowed a rapid recovery of her weight bearing and walking capacity, reducing significantly also the leg length discrepancy. She progressed uneventfully to healing of the osteotomy sites and she returned to her previous occupation.

Introduction

The management of post-traumatic deformities of the lower limb, can be challenging even in the most experienced hands [1,2].

In most cases these patients are treated with corrective osteotomies using internal or external fixator devices. The treatment course can be prolonged and such complications may arise as pin track infections, pain, swelling of the limb, angular deformities, neurovascular damage, contractures of the soft tissue and psychological disturbances [3,4].

Intramedullary nailing allows a rapid recovery of the weight bearing and gait pattern and return to work with a low complication rate [5,6]. However, in the case of multiple osteotomies, proper management of timing of intervention is mandatory in order to reduce the development of fat embolism syndrome (FES), deep vein thrombosis (DVT) and pulmonary complications [7–11].

Case report

More than 10 years ago a female patient was hit by a car. She sustained then diaphyseal fractures multifragmented of the right femur, left and right tibia. The treatment was non-operative and she was kept in bed more than 18 months.

At presentation in our clinic it was noted that the fractures were fully consolidated but with complex multiple deformities (Fig. 1). The right femur was 18° varus, the right tibia was 16° valgus, the left tibia was 12° varus. The right leg was shortened by 6 cm compared to the contralateral. Walking was limited, painful and teetering.

Both knee joints showed marked signs of osteosclerosis (Fig. 2).

Walking capacity had significantly reduced the last 2 years due to increased pain. Treatment options were discussed with the patient and she was not keen to be managed with external fixators.

It was decided to proceed with corrective osteotomies using intramedullary nailing. The right leg was shorter by 6 cm compared to the left (5 cm charged to the right femur, 1 cm to the right tibia) (Fig. 3). Because of the combination of multiple complex deformity associated with a significant shortening, we decided to run a simulation of surgery using paper models (Fig. 4).

Despite the open wedge osteotomy, the length of the right leg turned out not to be fully restorable. A shortening greater than 1 cm would have remained. We informed the patient who gladly accepted. We decided to split the correction of deformities in two different surgical sessions. In this way two major advantages were thought to be beneficial:

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Fig. 1. Clinical deformity.

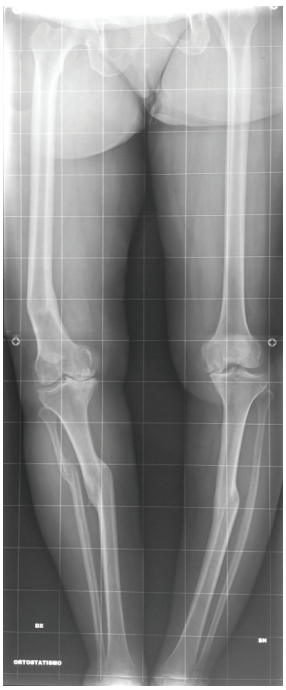

Fig. 2. Initial X-ray: right femur 18° varus, right tibia 16° valgus, left tibia 12° varus.

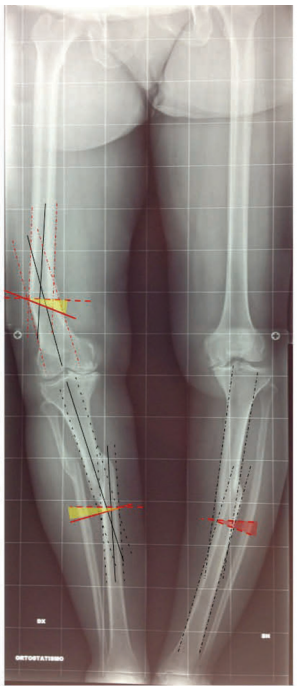

Fig. 3. Osteotomies study: anatomic location, type angle.

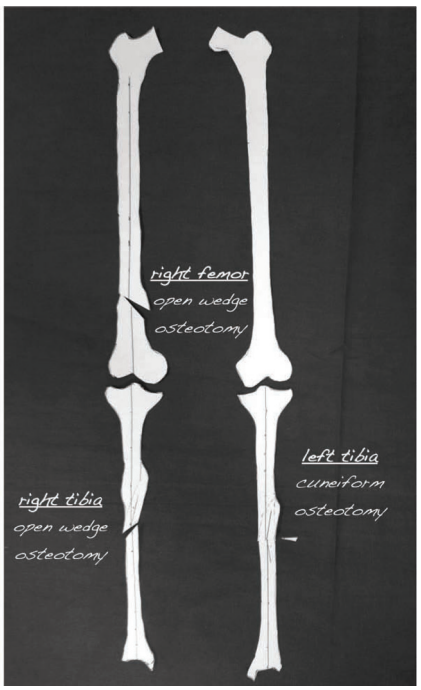

Fig. 4. Simulation on paper models. Goals: axial correction and restoration of length.

1. The reduction of risk of complications associated with intramedullary nailing as DVT, fat embolism, respiratory insufficiency [7-11].
2. Performing in a single session only the two osteotomies of the right leg, would have allowed us to assess the real lengthening obtained, so that, we could then be able to recalculate accurately the extension of the cuneiform osteotomy to be performed on the left side.

Initially, we performed two open wedge osteotomies of the right femur and tibia. A partial osteotomy of the fibula, due to its deformity, was necessary in order to be able to realign the right tibia. The open wedge osteotomies were grafted with autologous bone graft from the pelvis. Fluoroscopy images during surgery and post-operative films revealed a perfect realignment of the femur, tibia and the overall mechanical axis on the right side, (Figs. 5 and 6).

Afterwards, it was possible to re-measure the obtained length of the right limb and then to recalculate the correct angulation of the cuneiform osteotomy to be performed on the left side (Fig. 7).

Three weeks later we performed the cuneiform osteotomy of the left tibia. A partial fibulectomy was necessary in order to be able to obtain a correct realignment of the tibia (Fig. 8).