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Malalignment in intramedullary nailing. How to achieve and to maintain correct reduction?

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ABSTRACT

Intramedullary nailing has become the standard for the treatment of long bones diaphyseal fractures. Modern techniques of locking have further enlarged the primary indications to more proximal and distal fractures relying upon a former correct alignment. Nevertheless, residual deformities are not rare as once the nail has left the narrow diaphyseal canal and comes into the wider metaphysis, it may follow an unwished trajectory. There is also a chance for malreduction in diapyhseal fractures. The more complex the fracture is, the more difficult its reduction, not only for the alignment of the proximal or the distal part of bone in relation to the diaphysis, but also correct rotation and length. In this paper, we analyze recommended techniques to achieve accurate bone fracture reduction, to avoid post-operative deformities combined with correct implant insertion.

Introduction

Since the introduction, in the forties of the last century, of reaming by Gerard Kuntscher, and of locking by Grosse and Kempf in the seventies, intramedullary nailing has become the standard for the treatment of long bones diaphyseal fractures [1–3]. Modern techniques of locking have further enlarged the primary indications to more proximal and distal fractures [4,5].

Proximal and distal fractures reduction and osteosynthesis of long bones by intramedullary nailing relies upon a former correct alignment of the implant into the diaphyseal canal. Nevertheless, flexion, extension, varus or valgus residual deformities are not rare as once the nail leaves the narrow diaphyseal canal and comes into the wider metaphysis, it may follow an unwished trajectory. There is also a chance for malreduction in diapyhseal fractures. The more complex the fracture is, the more difficult its reduction, not only for the alignment of the proximal or the distal part of bone in relation to the diaphysis, but also correct rotation and length.

As these deformities may be severe even in younger patients (Fig. 1), new techniques have been developed for trying to avoid deformities and to achieve accurate bone fracture reduction and correct implant insertion [6]. These techniques are either implant-related or non-implant related (Fig. 2).

Non-related to implant techniques

Accurate fracture reduction is a guarantee for correct alignment, proper implant insertion, and better prognosis for fracture healing. Hence, fracture reduction is the desirable aim that any surgeon has planned while surgically treating a long bone fracture. Fracture reduction may be very difficult, mainly if displacement requires aggressive reduction techniques. Surgeons always try to preserve tissues viability and vascularization of fracture site by atraumatic manipulation of bone fragments. For that purpose, indirect reduction techniques are preferable. However, open reduction should definitely be performed if closed techniques fail.

Indirect reduction

Non-invasive

Indirect reduction preserves bone ends and causes little damage to the surrounding tissues. Indirect reduction includes non-invasive and invasive approaches.

The most classical indirect reduction method by a non-invasive approach is the use of a traction operating table. Traction tables provide continuous excellent traction in the diaphyseal axis achieving correct alignment and maintaining the proper position of bone fragment while the guide penetrates for nailing and actual implant insertion. Traction by operating tables has the advantage that no person needs to do any efforts, avoiding fatigue. Nonetheless, combination of this axial traction with varus, valgus, flexion, extension or even rotation maneuvers, may become a quite

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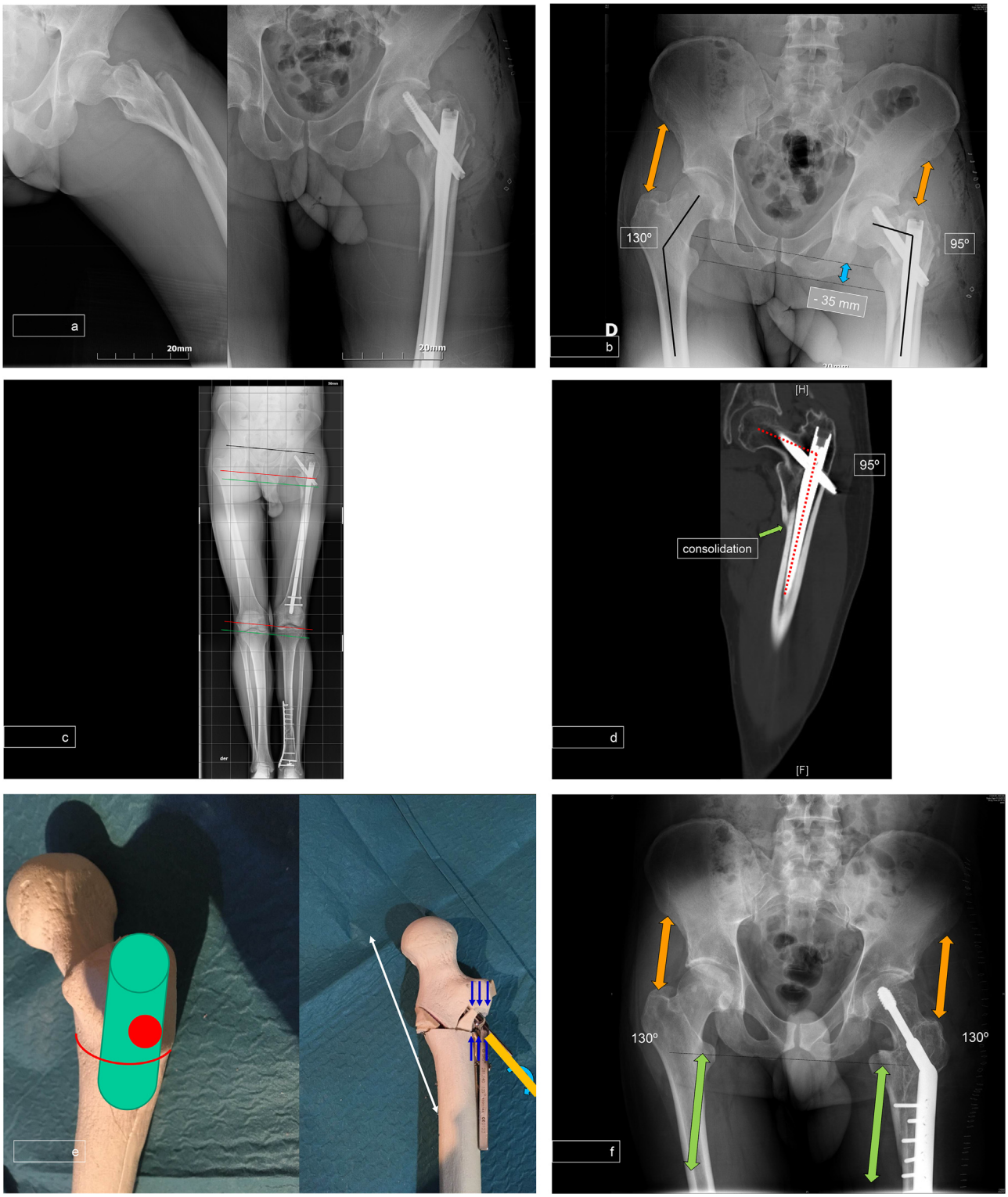

Fig. 1. Incorrect reduction and osteosynthesis of a proximal femoral fracture treated with nailing.
a. A 35 year old patient suffered a car crash sustaining a left trochantero-diaphyseal fracture. He was treated at the emergency trauma department with closed reduction and nailing.
b. The patient recovered well but presented a residual left coxa vara of 35° (130−95° = 35°), provoking limb shortening of 35 mm and as the tip of the greater trochanter was closer the pelvis bone, also a gluteus medius and minor insufficiency with limp.
c. Apart from the deformities described, left extremity looked normal.
d. Consolidation was fully achieved 5 months later as assured by CT-scan.
e. Plans for coxa vara correction were made. Valgus osteotomy was a challenge as the tip of the greater trochanter presented a hole as a consequence of the entry point for nailing. In fact the whole greater trochanter was already very weak because of the former nailing, together with further weakness expected to have in its lateral part because of the new osteosynthesis device for osteotomy synthesis entry point.
f. Finally valgus osteotomy was successfully performed although osteosynthesis was thought not to be as robust as in a normal case. The patient was kept without weight bearing for 4 months.