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Case Report

Overlapping intramedullary nailing after failed minimally invasive locked plating for osteoporotic distal femur fractures – Report of 2 cases

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ARTICLE INFO

Article history:

Accepted 12 January 2015

Keywords:

Distal femur
Osteoporotic fracture
Failed MIPO
Overlapping IM nailing

ABSTRACT

Minimally invasive plate osteosynthesis (MIPO) using a locking plate has been widely used for distal femur fractures in the elderly with osteoporosis and yielded favourable results. However, implant failure and subsequent periplate fracture have still occurred owing to the controversy of concepts regarding locked plating. The treatment after failed MIPO in elderly patients is very challenging and has been not yet addressed definitely in the literature, although several options can be considered. We report the successful outcomes of two cases treated with overlapping intramedullary (IM) nailing for implant failure and periplate fracture after MIPO for osteoporotic distal femur fracture, along with simple tips of distal interlocking of IM nail.

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Introduction

Distal femur fractures in the elderly with osteoporosis are complicated because poor bone quality makes screw purchase and fixation less secure, presenting many clinical challenges to orthopaedic surgeons [1–3]. Minimally invasive locked plating with use of angularly stable locking compression plate (LCP) has become an integral tool for achieving secure fixation in osteoporotic distal femur fractures with improved biomechanical performance and resulted in favourable outcomes [3–8]. However, despite the considerable evolution of implant and plating technique for osteoporotic distal femur fracture, complications such as implant failure and periplate fracture have still occurred [9]. The treatment of these complications after minimally invasive plate osteosynthesis (MIPO) in the elderly is rather challenging due to preexisting fracture of distal femur, poor bone quality, existing of previous implant, and the risk of reoperation. Although it has been not yet addressed in the literature and various treatment options may be considered, overlapping intramedullary (IM) nailing with retention of the plate and distal screws can be a useful alternative in view of achieving secure fixation through less

invasive approach without reduction loss of established main fracture of distal femur as much as possible. We present the favourable outcomes of two cases treated with overlapping IM nailing after failed MIPO for osteoporotic distal femur fracture, along with simple tips of distal interlocking of IM nail and associated procedures.

Report of the cases

Case 1

A 74-year-old female patient sustained a closed distal femur fracture (OTA, 33-A1) due to a ground-level fall and underwent closed reduction and MIPO with a 14-hole LCP (Zimmer® Periarticular Locking System, Warsaw, IN) at our hospital (Fig. 1A and B). Her T-score at the contralateral proximal femur was –3.7 and she had regularly taken an anti-osteoporotic drug for 1 year. She slipped indoors 6 weeks after her operation and sustained femur refracture around the proximal end of the plate and the outermost locking screw (Fig. 1C). This periplate fracture was regarded as a stress riser fracture occurring due to the proximal outermost bicortical locking screw that acts as a stress riser [10]. We decided to perform overlapping antegrade IM nailing with plate and distal screws left in situ to make a firmer construct and avoid the reduction loss of distal fracture fragments purchased by distal locking screws. In this patient, a non-anatomical long hip nail (Intertrochanteric-Subtrochanteric Nail System, long version;

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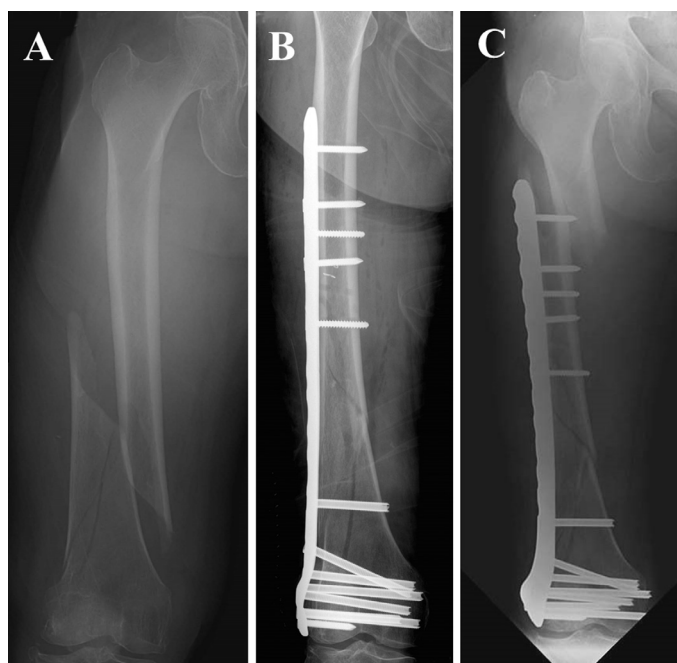


Fig. 1. (A) Radiograph of a distal femur fracture after a ground-level fall. (B) Postoperative anteroposterior radiograph after closed reduction and minimally invasive locked plating. (C) 6-week postoperative radiograph showing a stress riser fracture around the outermost locking screw after fall down injury.

Zimmer) was selected. Preoperatively, fluoroscopic study proceeded after overlapping IM nailing using a plastic femoral model on the right side (Synbone model 2420, Malans, Switzerland) and the nail of 300 mm in length, the shortest nail manufactured (Fig. 2A). Fluoroscopic lateral view demonstrated that the dynamic and static interlocking holes of the nail coincide with the proximal second and third hole of a LCP, respectively, by internally rotating the nail and tilting C-arm upward by 10° (Fig. 2B). It was ascertained that the proximal first, second and third holes of a LCP would be feasible for distal interlocking through these holes by internally rotating the nail by 10°, considering the anatomy of the distal femur and the correct positions of the two implants (Fig. 2C). Accordingly, the length of the nail, of which the distal tip passed

over the proximal third hole of a LCP at least, was decided on preoperative templating (11 mm in diameter × 300 mm in length). After removal of all 5 proximal screws through the previous stab wounds, standard IM nailing was performed. Next, we easily proceeded with distal interlocking using a 4.5 mm cortical screw at the proximal third hole of the LCP through a dynamic hole of the IM nail by internally rotating the IM nail by about 10° using a perfect circle fluoroscopically guided technique (Fig. 2D). Then, 5 percutaneous cerclage wirings were performed for proximal fixation of the LCP at overlapped area between the nail and LCP. Unicortical screw was insufficient for secure fixation due to short working length in osteoporotic bone and another locking attachment was unavailable in this kind of LCP. Therefore, we used only cerclage wirings for attachment of plate to the bone.

At 2-year follow-up, she showed full range of motion (ROM) of the right knee joint and ambulated independently without any assistive device, along with a complete union seen on radiographs (Fig. 3).

Case 2

A 64-year-old female patient sustained a closed distal femur fracture (OTA, 33-A2) due to a ground-level fall and underwent closed reduction and MIPO with a 7-hole LCP (DePuySynthes, Oberdorf, Switzerland) at our hospital (Fig. 4A and B). She was relatively obese with a body mass index of 31 kg/m² and had regularly taken an anti-osteoporotic drug for 2 years (T-score, -3.1). She slipped indoors 1 month after her operation and sustained implant failure with breakage or pull-out of 4 proximal locking screws and subsequent fracture (Fig. 4C). This implant failure was caused by insufficient fixation of proximal fragment secondary to the use of short plate and unicortical locking screw in osteoporotic bone [3,11]. We decided to perform overlapping IM nailing with plate and distal screws left in situ. In this patient, an anatomical femoral nail (Sirius Intramedullary Femur Nail System; Zimmer) was selected. On preoperative fluoroscopic study performed after overlapping IM nailing using an anatomical femoral nail of 300 mm in length in a plastic femoral model, it was demonstrated that the IM nail would be positioned posterior to the plate due to its anterior curvature of the nail and the position of the LCP (Fig. 5A and B). So, we confirmed that distal interlocking would be easily done at both static and dynamic holes without plate

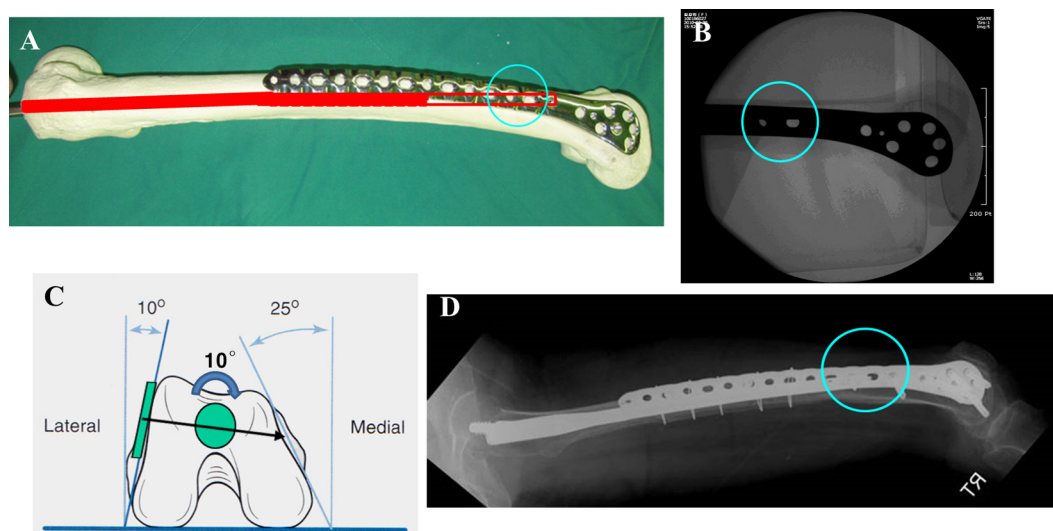


Fig. 2. (A) Photo showing the relationship between a locking plate and a non-anatomical long hip nail after overlapping IM nailing in a plastic femoral model. (B) Fluoroscopic lateral view. (C) Schematic drawing showing the anatomy of distal femur and the correct positions of the two implants. (D) Postoperative lateral radiograph showing distal interlocking at the third hole of a plate through the dynamic interlocking hole of the nail.

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