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Case Report

Management of infected non-union of subtrochanteric fracture: Two cases

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ABSTRACT

Infected non-union of subtrochanteric fractures is challenging to treat. We experienced two cases and had good clinical results. Treatment strategy comprised debridement without hesitation after considering later limb lengthening; insertion of the proximal lateral bone edge spike into the distal bone marrow cavity until achieving medial-side bony contact and holding good alignment to compensate for the medial-side bone loss, according to the modified Dimon method; and internal fixation with an angled plate in the decubitus position. The angle of the angled plate should be directed toward the abundant cancellous bone using preoperative computed tomography. Residual limb shortening after ORIF was improved by limb lengthening.

Introduction

Subtrochanteric fractures are known for intraoperative difficulties with reduction and high rates of postoperative complications including non-union [1]. Although achievement of bone support and maintenance of good alignment are key features of treatment, high-energy trauma sometimes causes a comminuted fracture. Further, infected non-union causes bone loss after achieving eradication of the infection with bone debridement [2]. The initial comminuted fracture and bone debridement sometimes cause bone loss on the medial side. We herein describe the surgical strategy for treatment of infected non-union of subtrochanteric fractures with medial-side bone loss.

Case 1

A 19-year-old man had left subtrochanteric fracture in a traffic accident. According to the AO classification, the diagnosis was 32C3i (Fig. 1). Initial surgery was performed with a short proximal femoral nail. One month after the operation, he developed methicillin-resistant *Staphylococcus aureus* (MRSA)-infected non-union of the subtrochanteric fracture. Two debridement procedures and application of vancomycin-impregnated cement beads eradicated the infection 7 months after the initial surgery. However, medial bony support loss was present. Hence, according to the modified Dimon method, open reduction and internal fixation (ORIF) with en bloc iliac bone transportation was performed in the lateral decubitus position [3]. We chose a compression hip screw because abundant cancellous bone was positioned at the superior part of the femoral head. Nine months after the definitive surgery, radiographs showed bony union. Two years after the definitive surgery, the plate was removed and limb lengthening was performed with a circular external fixator because of limb shortening. Eight years after the definitive surgery, he enjoyed running.

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Fig. 1. Radiographs in Case 1.
[a] Anteroposterior (AP) radiograph of the left subtrochanteric fracture. [b] AP radiograph after surgery. [c] AP radiographs after debridement. [d] AP radiograph after definitive surgery. [e] AP and lateral radiographs demonstrating fracture union 2 years after the definitive surgery. [f] AP and lateral radiographs of the proximal femur obtained at the final follow-up.

Case 2

A 24-year-old man had right subtrochanteric fracture in a traffic accident. According to the AO classification, the fracture was diagnosed as 32B3a. Initial surgery was performed with a long-type CHS at another hospital (Fig. 2). Seven months after the initial surgery, he was invited to our hospital and diagnosed with MRSA-infected non-union of a subtrochanteric fracture. Implant removal and four debridement procedures and application of vancomycin-impregnated cement beads eradicated the infection 15 months after the initial surgery. He also had loss of medial bone support. According to the modified Dimon method, ORIF using a 95° dynamic condylar screw in the lateral decubitus position was performed. We chose the plate because abundant cancellous bone was present at the inferior part of the femoral head. Five months after ORIF, radiographs showed bony union. Two years after ORIF, the plate was

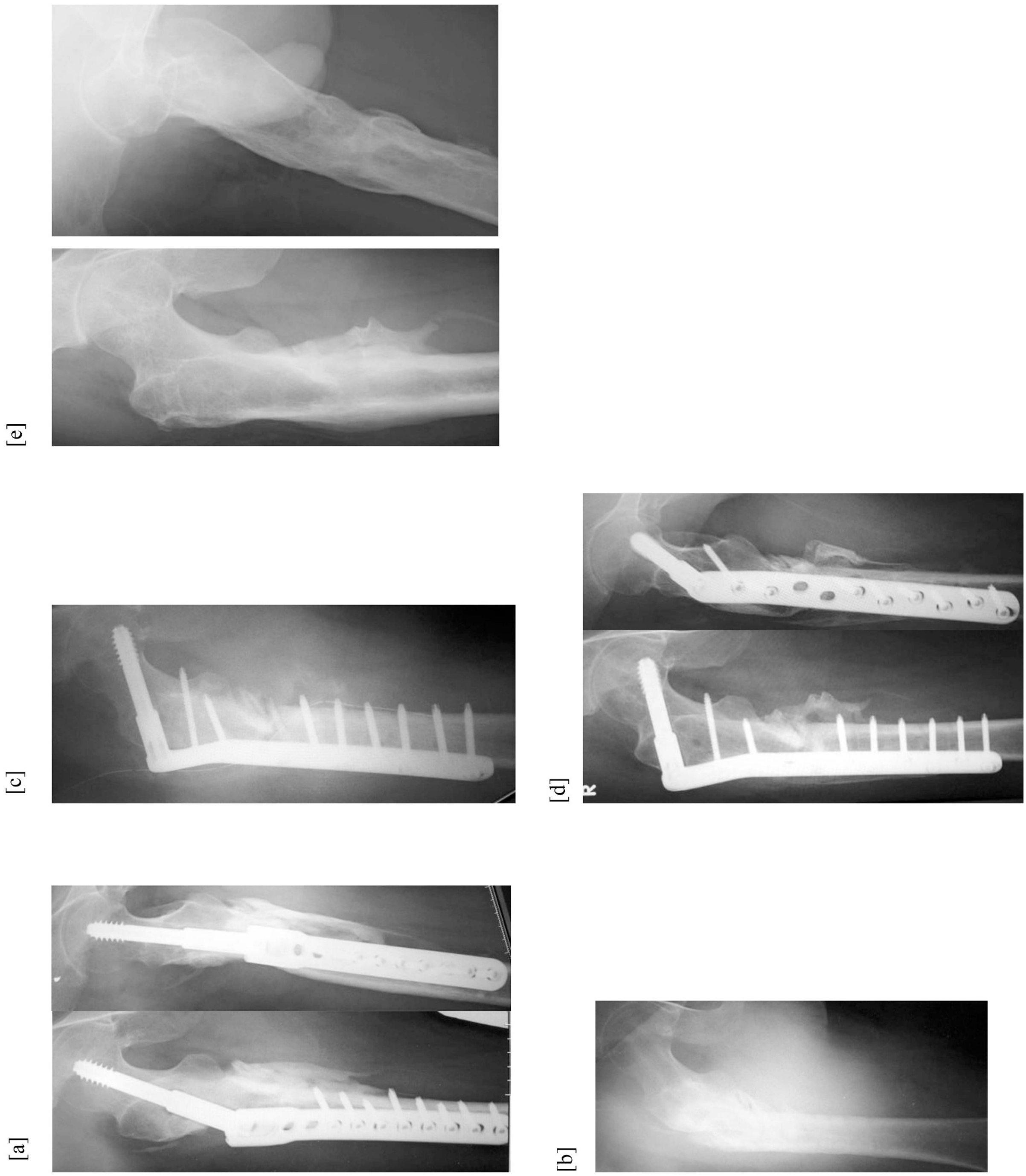

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Fig. 2. Radiographs in Case 2.
[a] Anteroposterior (AP) and lateral radiographs before debridement, 2 years after the initial surgery. [b] AP radiograph after removal of the implant. [c] AP radiograph after the definitive surgery. [d] AP and lateral radiographs obtained 6 months after the definitive surgery demonstrating fracture union. [e] AP and lateral radiographs of the proximal femur obtained at the final follow-up.

removed and limb lengthening at the right distal femur was performed similarly to Case 1. Seven years after ORIF, he enjoyed marathon events.

Discussion

Bone support on the medial side and maintenance of good alignment are two of the most important aspects of surgery for subtrochanteric fractures [4]. However, in cases of infected non-union of subtrochanteric fractures, debridement sometimes causes medial-side bone loss. In cases of infected non-union of diaphyseal fractures, bone resection and distraction osteogenesis with an external fixator is an effective treatment strategy. However, during treatment around the joint, including the metaphysis, bone resection makes it difficult to preserve the native joint. Distraction osteogenesis using an external fixator is also difficult because there are limitations of the available area in which to insert the half-pins to the proximal bone fragment. Therefore, we used the modified Dimon method [3]. The original Dimon method involves insertion of the proximal medial bone edge spike into the distal bone marrow cavity to achieve bony contact and sustained axial force. In our cases, however, the proximal lateral bone edge spike was inserted into the distal bone marrow cavity until achieving medial-side bony contact (Fig. 3). The inserted side of the bone spike is reversed. Hence, we called our method the modified Dimon method.

Choosing the optimal implant type is also important. A long femoral nail is the first choice for subtrochanteric fractures because of its biomechanical advantage, which reduces the bending moment compared with extramedullary devices [5]. Shukla et al. [6] reported good clinical results of subtrochanteric fracture treatment with cephalomedullary nails. However, they mentioned that the presence of severe comminution can lead to fracture collapse into varus despite adequate open reduction. Medial bone loss makes it

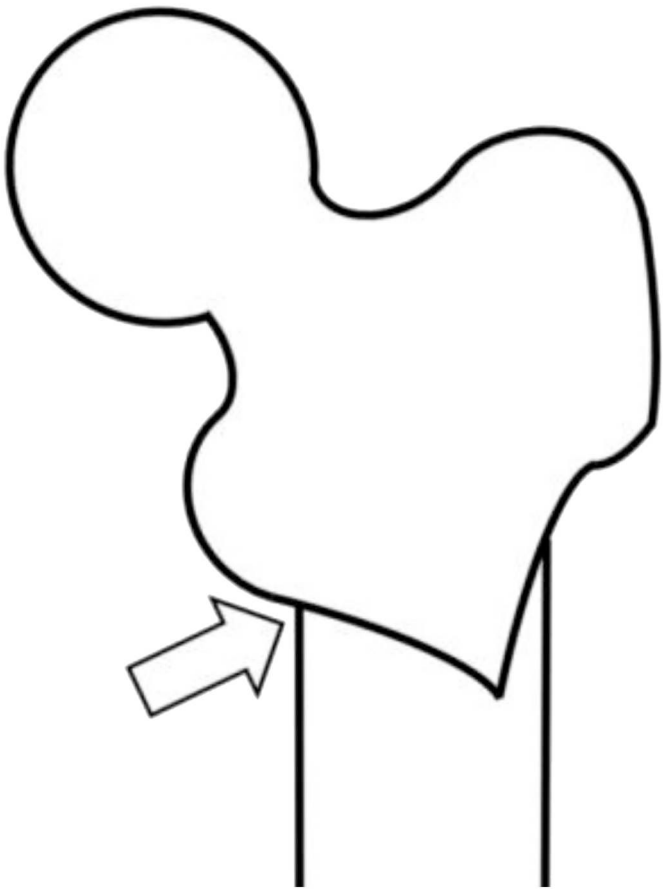

Fig. 3. Illustration of modified Dimon method.
The proximal lateral bone edge spike was inserted into the distal bone marrow cavity until achievement of medial-side bony contact. The arrow indicates the medial bony contact.

challenging to use intramedullary nailing because inserting the nail while maintaining good reduction is difficult. Therefore, we chose plate fixation.

Plate selection is another issue. We used different angled plates in the treatment of Cases 1 and 2. Proper use of an angled plate depends on the residual bone stock of the femoral head after removing the initial lag screw. The angle of the angled plate should be directed toward the abundant cancellous bone. Therefore, preoperative computed tomography and surgical planning are mandatory.

Conclusion

We have herein described the treatment strategy for infected non-union of subtrochanteric fractures. The modified Dimon method and ORIF with an angled plate yielded good clinical outcomes.

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Declaration of competing interest

None.

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