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Case Report

Closed reduction and minimally invasive surgical treatment of type IIIa fragility fractures of the pelvis associated with ipsilateral periprosthetic femur fracture: A case report

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ABSTRACT

Patients with fragility fractures of the pelvic ring (FFP) are elderly and, from the perspective of surgical invasion, percutaneous and stable fixation may be a superior surgical method than open reduction and internal fixation (ORIF). While in the case of FFP type IIIa, ORIF, as a rule, typically requires open reduction of the displaced ilium via an anterior intrapelvic approach and/or lateral window of the ilioinguinal approach. We have reported here the case of an 89-year-old woman who suffered from FFP type IIIa with ipsilateral periprosthetic femur fracture that was surgically treated. The iliac fracture was approached in a minimally invasive manner using the traction operation while preparing for femoral shaft fracture surgery, which did not require open reduction, and showed favorable outcomes.

Introduction

Fragility fractures of the pelvic ring (FFP) are a type of fragility fracture that has been increasingly reported in recent years, particularly in the aging society. Data calculations based on the Finnish National Hospital Discharge Register in Finland indicate that the number of vulnerable FFP will increase by 2.4-times in 2030 compared with 2013 data [1]. The classification of FFP was first published in 2013 by Rommens and presented with the recommended treatments as well as classifications of the fracture types [2]. As per Rommens' FFP classification, there are four major types: Types I and II are non-displaced types and types III and IV are the displaced types. FFP type IIIa refers to displaced unilateral iliac fracture and anterior disruption. Open reduction and internal fixation (ORIF) of the dorsal disruption on the ilium using bridging plates via the ilioinguinal approach and/or anterior intrapelvic approach is required and hence recommended [2].

In contrast, patients with FFP are usually elderly and, from the perspective of surgical invasion, if percutaneous and stable fixation is to be realized, this surgical method is superior to ORIF.

In a case of displaced iliac fracture and ipsilateral periprosthetic femur fracture, the iliac fracture was reduced in a minimally invasive manner using the traction operation while preparing for femoral shaft fracture surgery. We have reported here a case in which an operative treatment for FFP type IIIa was possible with a small incision, which did not require open reduction, and showed favorable

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outcomes.

Case presentation

A 90-year-old woman (height 160 cm, weight 60 kg) presented with a pelvic fracture and a right femur fracture around the stem of hemiarthroplasty after falling from a standing height in her nursing home. Plain radiographies and computed tomography (CT) examinations performed at a previous hospital helped diagnose the patient with FFP type IIIa (the right ilium and right pubic ramus fractures) and right periprosthetic femur fracture (hemiarthroplasty after femoral neck displaced fracture, Vancouver classification [3] type B1). The left hemipelvis was proximally displaced and externally rotated, and the acetabulum was medially displaced (Fig. 1). The patient was transferred to our hospital for surgery. At that time, the young adult mean value of dual-energy X-ray absorptiometry of the left femur was 55%. The patient's medical history included hypertension, right femoral neck fracture, and geriatric osteoporosis. She was prescribed a selective estrogen receptor modulator for osteoporosis treatment. Her American Society of Anesthesiologists Physical Status classification was 2.

The patient underwent both fracture surgeries at 6 days post injury. The patient positioning was supine on the traction table. Femoral fracture reduction was performed by longitudinal traction, slight external displacement of the distal bone fragment, and internal rotation obtained by internally rotating the right lower leg. First, the polyethylene tape (5-mm width Nesplon tape) was fastened to the distal portion of the stem at the level of the spiral fractured section. The tape was tightened with 50-N force to compress and fix the fractured section. The plate (Zimmer Biomet NCB periprosthetic distal femur plate for the left side) was applied to the lateral side of the femur, crimped on the bone with other polyethylene tape at the level of lesser trochanter, and fixed with a few screws. After wound closure, the right lower limb was towed with mild hip abduction using the traction table. We then changed her body position from supine on the traction table to prone on the normal operating table. She then underwent CT scan in the prone position on the operating table. Fracture reduction, particularly the proximally displaced and externally rotated, could be obtained (Fig. 2). The "teepee" view with image intensifier, running along the posterior inferior iliac spine (PIIS) to anterior inferior iliac spine, was obtained, and the guide wires were inserted from PIIS. The $\phi 9.0$ – 110 -mm spinal screws (Expedium, Depuy Synthes, J&J Co, Paoli, PA) were inserted into the ilium, with two screws on each side. Four screws were connected with two 5.5-mm titanium rods and two cross connectors (Fig. 3).

Weight bearing was not allowed for 6 weeks postoperatively, after which the patient was allowed to progress to full-weight bearing.

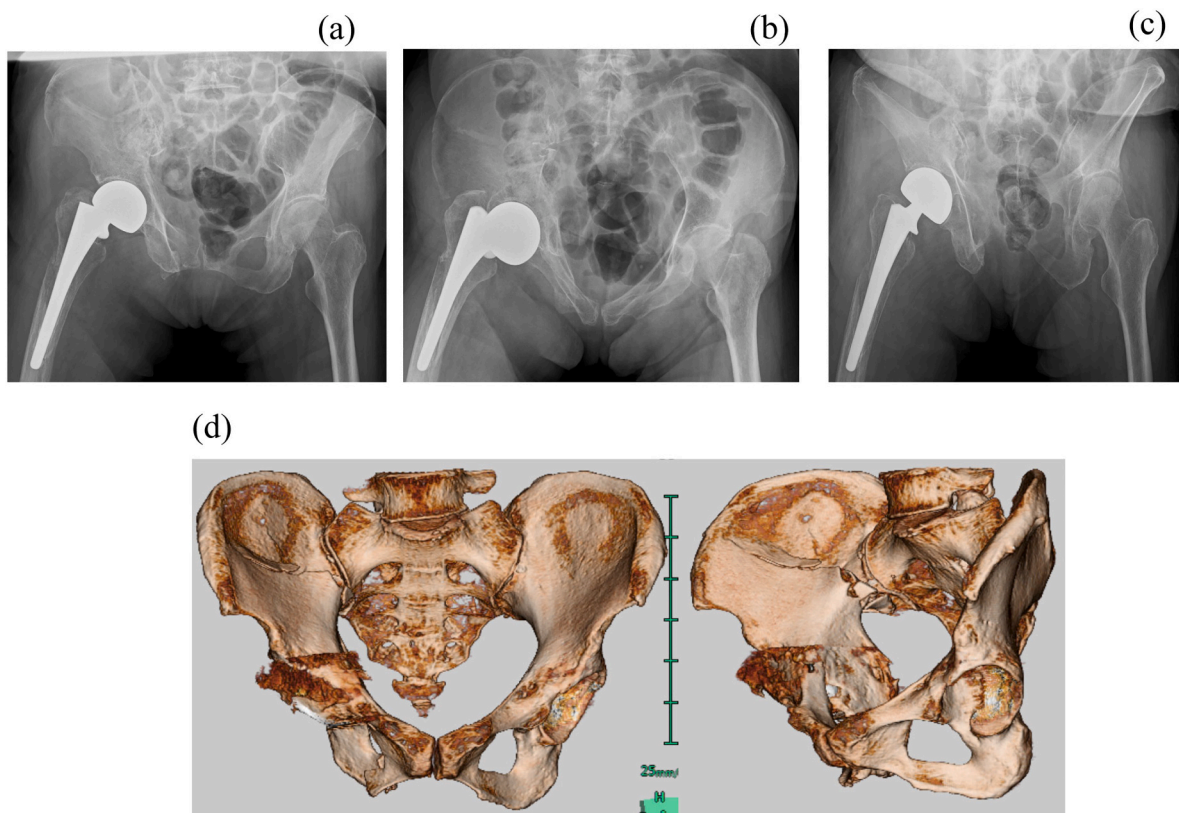


Fig. 1. Representative pre-operative X-ray images taken during admission for fragility fracture of the pelvic ring. (a) Pre-operative pelvic anteroposterior view. (b) Pre-operative pelvic inlet view. (c) Pre-operative pelvic outlet view. (d) Pre-operative 3D-CT.

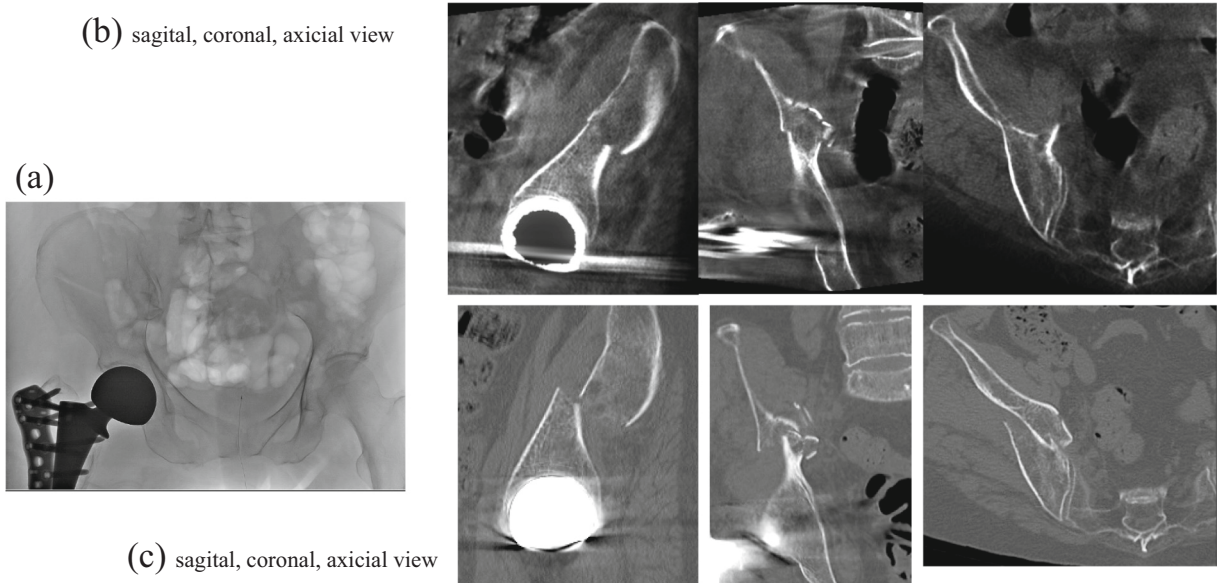


Fig. 2. Fluoroscopic image (a) and CT images (b) in prone position after femoral surgery. (c) Pre-operative CT images for comparison to Fig. 2(b).

She received parathyroid hormone injection daily for osteoporosis treatment. Bone union was observed at three months after surgery, and she was discharged from the rehabilitation hospital to her nursing home. She experienced no pain while walking using a walking stick and returned to most of her social activities as before the injury at six months after the surgery. The Modified Majeed score was 94 (except sexual intercourse, which was 4 points out of a possible 96) at six months postoperatively.

Discussion

The minimal invasive surgical technique is extremely useful, particularly in the elderly with some comorbidities. Minimally invasive stabilization preserves blood supply to the bones, limits scarring in the surrounding soft tissues, and causes lesser blood loss than that in the conventional open reduction and fixation techniques [4]. In case of FFP type IIIa, ORIF typically requires open reduction of the displaced ilium via an anterior intrapelvic approach and/or lateral window of the ilioinguinal approach [2]. Thus, Rommens recommends ORIF for FFP type IIIa, although treatment via minimally invasive surgery has been reported in recent years. This present approach is a non-invasive reduction method wherein a screw is inserted and percutaneously fixed to the pubis and the ilium. We had no prior experience of treating FFP type IIIa with percutaneous screw fixation, as mentioned in a past report [5], and we performed posterior pelvic ring fixation in the prone position. If closed reduction is possible, percutaneous screw fixation of the pubis and the ilium in the supine position can result in a less-invasive surgical treatment without requiring repositioning, as in the present case. In addition, the presently used method of fixation for FFP type IIIa did not involve fixation of the pubic fracture. Hence, it is necessary to carefully examine the bone union outcomes at the pubic fracture and stability of the entire pelvic ring as well as the clinical results. Some reports are straddled.

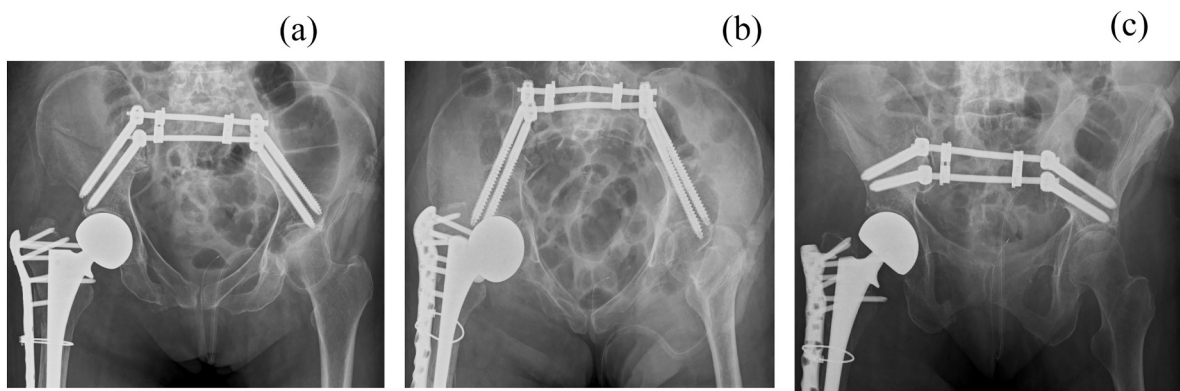


Fig. 3. (a) Post-operative pelvic anteroposterior view. (b) Post-operative pelvic inlet view. (c) Post-operative pelvic outlet view.

For Young–Burgess lateral compression type II (LC-II) fractures of high-energy pelvic ring fracture, the usefulness of minimally invasive surgery with percutaneous screw insertion fixation has been reported [4]. In an emergency case of multiple trauma patients, closed reduction and minimally invasive surgery (percutaneous screw fixation) is an alternative treatment that offers several advantages with benefits of lower blood loss and reduced infection rates [4]. The reduction of LC-II iliac fractures can be usually obtained either by manipulating the ilium manually or introducing a Schanz-pin into the iliac wing to use it as a handle as per the joystick technique [4,6]. Both LC-II pelvic fractures and FFP type IIIa fractures include fracture lines on the iliac wing. This type of surgical approach may be useful for FFP type-IIIa correction if closed reduction is obtained.

In the present case, a traction table was used because FFP type IIIa was accompanied with ipsilateral periprosthetic femur fracture. We have been operating with a radiolucent table till date while treating FFP type IIIa alone and never used a traction table for fracture reduction of this type. A study reported that longitudinal traction is useful for high-energy pelvic ring fractures with vertical instability [7]. In general, a Kirschner wire is inserted into the femur on the same side as the affected one and withdrawn to reduce it. Thus, it is introduced as a reduction technique via transcondylar traction [7]. The present case was a fracture of the iliac wing from the greater sciatic notch, and the fracture was shortened to the caudal direction with a third bone fragment. Hence, it was possible that the longitudinal traction caused by the traction table contributed to fracture reduction. In addition, the present case also involved inward and external rotation dislocations of the hemipelvis. In addition, it is possible that abduction and internal rotation force during the femoral fracture surgery were effective in reducing these displacements. We, thus, believe that there was no reduction effect in the prone position, which can be attributed to two reasons. One reason was that some of the FFP type IIIa cases in our hospital were treated by the same fixation method performed in the prone position, and there was no case wherein the reduction was achieved in only the prone position. The other reason was that the force applied to the iliac wing or the anterior superior iliac spine using a load may have imposed a force in the direction of shortening and external rotating of the fracture site [4].

In the present case, the patient had FFP type IIIa with the ipsilateral periprosthetic femur fracture, and we had not used a traction table for only FFP type IIIa till date. Therefore, we found that the limb traction on the affected side of the traction table was possibly effective for the closed reduction of FFP type IIIa. When treating fragility fractures in the elderly, it is desirable to avoid the surgical technique that greatly expands the exposure of the fracture site and soft tissues to reduce damage to the blood flow to the bone as far as possible [8,9]. Thus, for obtaining closed reduction of the iliac fracture in FFP type IIIa, a traction force may be useful. We believe that the findings of this report would help in the treatment of similar cases by fixation with closed reduction and minimally invasive surgery. In addition, we believe that the range of surgical options for treating FFP type IIIa will expand in the future through active research.

Funding

None.

Ethical approval

Due to the retrospective nature of this study, ethical approval was not required.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Declaration of competing interest

None.

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