



## Case report

## Nonunion following valgus subtrochanteric osteotomy for neglected femoral neck fracture: A case report

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## ABSTRACT

**Introduction and importance:** Femoral neck fractures account for roughly half of the two million hip fractures that occur each year worldwide. There is a high rate of neglected cases and potential complications such as nonunion or avascular necrosis (AVN) in developing countries. More than 30 % of patients may experience non-union following a femoral fracture. There is no consensus on the best neglected femoral neck fracture treatment.

**Case presentation:** A 30-year-old female known case of rheumatoid arthritis came with a neglected femoral neck fracture to our center. We salvaged the viable hip by subtrochanteric valgus osteotomy and fixation by angled blade plate (ABP). After eight months, she returned with left hip pain and nonunion of the fracture and osteotomy sites. We refixed the fracture with a longer ABP together with autografting of both sites. After two years, she had complete union, full hip range of motion, and painless ambulation.

**Clinical discussion:** Subtrochanteric valgus osteotomy is susceptible to nonunion especially in patients with medical comorbidities.

**Conclusion:** Careful selection of osteotomy site and appropriate fixation device might prevent of non-union.

### 1. Introduction

Femoral neck fractures account for roughly half of the two million hip fractures that occur each year worldwide [1]. Due to a high rate of neglected cases and potential complications such as nonunion or avascular necrosis (AVN) [2], the femoral neck fracture remains a diagnostic and therapeutic challenge [4].

Open reduction and internal fixation, internal fixation with bone grafting (vascularized or non-vascularized) [5], internal fixation with muscle pedicle bone graft [6], valgus osteotomy [2], and hip replacement [7] are all treatment options for neglected femoral neck fractures. However, there is no consensus in this regard.

In this report, we present a case of a neglected femoral neck fracture that was treated with subtrochanteric valgus osteotomy and a 130-degree angle blade plate (ABP) based on SCARE guideline [8]. The failure of fixation was caused by the delayed union of the osteotomy site. We discuss how to manage nonunion in the osteotomy site in order to preserve the native hip joint.

### 2. Case report

A 30-year-old female presented to our institution with left hip pain for three years. She had no previous history of trauma. She had rheumatoid arthritis (RA), which had been diagnosed for eight years. Her medications included methotrexate and prednisolone. She did not mention a history of previous surgery. She had no previous history of smoking. Her body mass index was 24. On examination, there was a limitation in her hip range of motion (ROM), especially during hip flexion. She had an antalgic gate. On radiography (Fig. 1), an old displaced femoral neck fracture was seen. There are no signs of femoral head avascular necrosis (AVN) or collapse. The Pauwels angle of the fracture was 103.49°, which is compatible with Pauwels type III (Fig. 2). We performed hip MRI to investigate femoral head viability and there was no sign of AVN (Fig. 3). We decided to preserve the femoral head and therefore plan to perform valgus osteotomy in order to correct the proximal femoral anatomy and redirect the forces across the fracture site from shearing to compression.

*Abbreviation:* ABP, Angled Blade Plate.

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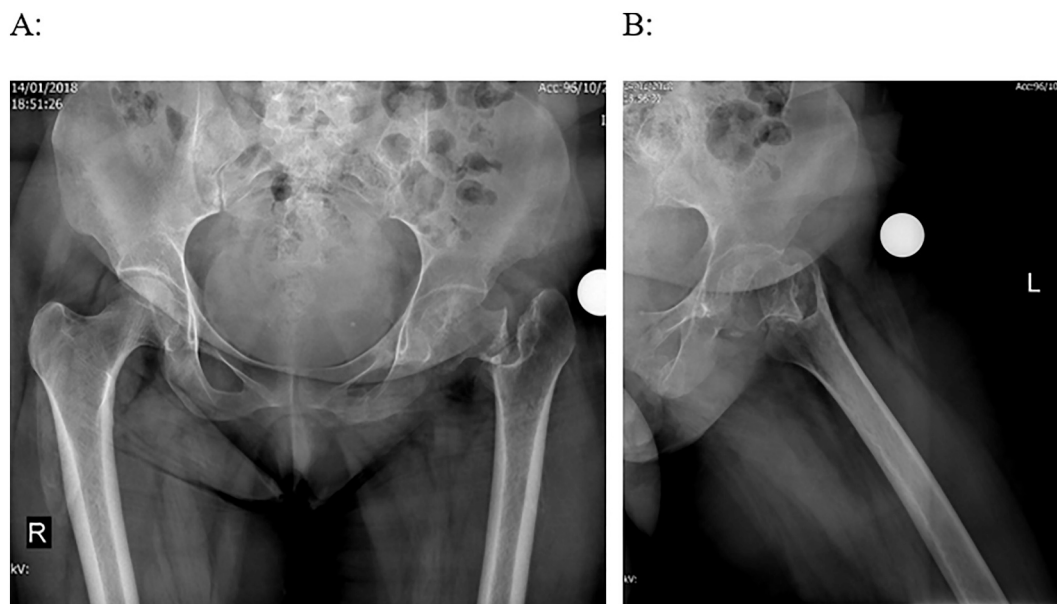


Fig. 1. Hip X-rays before the first surgery in A. Anteroposterior and B. Lateral views.

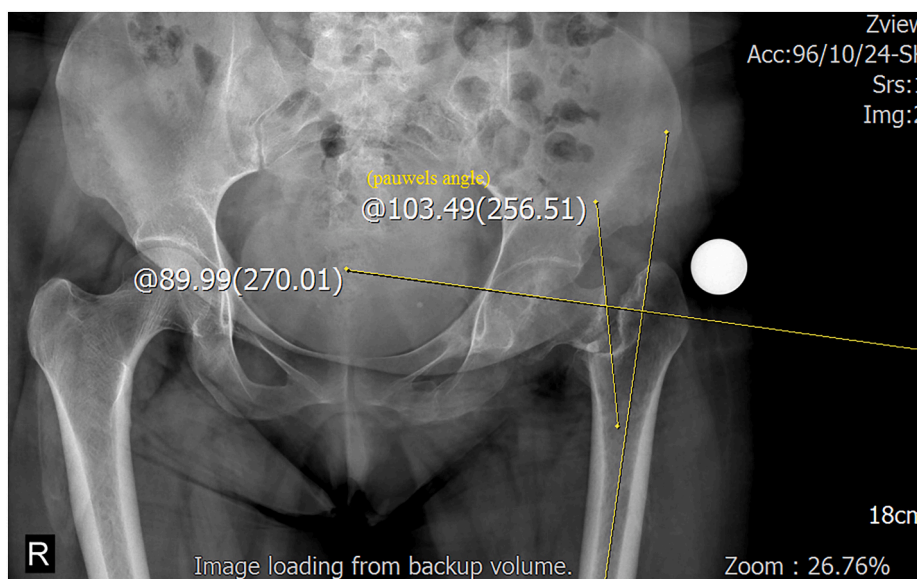


Fig. 2. Pauwels angle before the first surgery.

### 2.1. Preoperative planning

The left limb was shorter and the leg length difference (LLD) was 18 mm on pelvic X-ray. The caput-collum-diaphyseal angle (CCD angle) on her right side was  $125.7^\circ$  and on her left side (affected side) it was  $91^\circ$ . As there was not enough bone to perform an inter-trochanteric valgus osteotomy, we decided to do valgus osteotomy at a sub-trochanteric level. After accurate preoperative planning (Fig. 4), we did the osteotomy, and the osteotomy was fixed with an angle blade plate ( $130^\circ$ ) with four fully threaded screws distal to the osteotomy (Fig. 5). The blade was inserted at a 75-degree angle from the femoral anatomical shaft axis and 2.5 cm from the tip of the greater trochanter and, a 55-degree lateral closing wedge with a 28 mm diameter was performed. All of the procedures were controlled with the C-ARM guide (Fig. 6). During the

follow-up visits at two months, she was pain free and could walk with a walker. The patient felt some pain three months after surgery, but she could still walk with a walker. Her pelvic radiography at 3 months showed that union was progressing at the fracture site but there was no obvious union progression at the osteotomy site (Fig. 7); 6 months later, the patient came with severe pain and inability to walk. The pelvic x-ray revealed device failure and nonunion at the osteotomy site (Fig. 8).

We did a failure analysis and we assumed that the plate length was not suitable to maintain the fixation. Therefore, we proceeded with revision surgery using a 130-degree angle blade plate with the same blade length and 9-hole plate. After refreshing the previous osteotomy non-union site, we added an auto graft from her iliac crest to enhance the union process (Fig. 9). After revision surgery, everything was progressing along the osteotomy site. At 14 months following the revision

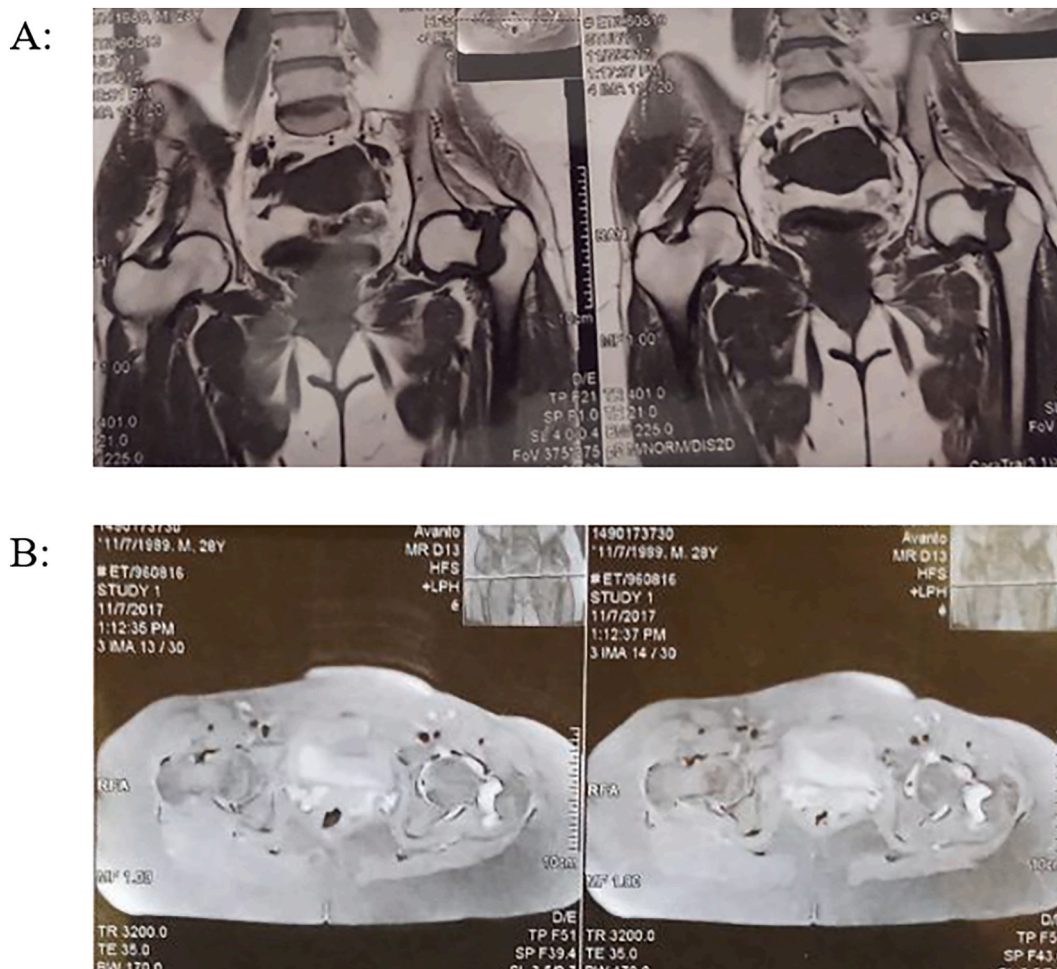


Fig. 3. Hip MRI before the first surgery in A. Coronal and B. Axial sections.

surgery, the union was complete both at the osteotomy and femoral neck fracture sites, and the patient was satisfied and had full hip range of motion with no pain (Fig. 10).

### 3. Discussion

A femoral neck fracture is considered “neglected” when there is at least a 30-day gap between the fracture and the first treatment introduced by Myers et al. [11]. Complications of a neglected femoral neck fracture include osteopenia, femoral neck resorption and avascular necrosis (AVN), femoral head salvage, and osteoarthritis which may lead to a high burden regarding the literature [12,13].

Internal fixation alone is rarely used as an absolute treatment in neglected femoral neck fractures and is only acceptable in non-displaced fractures with no evidence of femoral head AVN [7]. Lifeso et al. used internal fixation alone for non-displaced neglected femoral neck fractures in three patients, with one nonunion, one femoral head AVN, and one union [14].

In general, there are two types of valgus osteotomies: subtrochanteric valgus osteotomy and intertrochanteric valgus osteotomy. Intertrochanteric osteotomy is preferred over subtrochanteric osteotomy because there is more cancellous bone in the intertrochanteric location and faster healing, better ability to correct, and hip facility. Arthroplasty in the future, with at least two screws in the proximal segment [15]. We chose subtrochanteric valgus osteotomy in our patient due to a lack of space in the intertrochanteric site for osteotomy due to the shape of the fracture, and we fixation with four screw holes side barrel ABP.

The length of the side barrel of the ABP is important because if it is longer than suitable size, it may hold the fracture site in distraction and if it is shorter, it may not provide enough hold in the proximal fragment [16].

Kumar et al. conducted a study on 55 cases of neglected femoral neck fractures with an average age of 37 years treated with valgus intertrochanteric osteotomy using ABP. After a 30-degree wedge osteotomy, all 55 patients in the study received a 120-degree double angle blade plate insert. They reported that 90 % of fractures resulted in union, 3 patients had nonunion, and 2 patients cursed the device frailer [17]. Magu et al. performed valgus intertrochanteric osteotomy for the treatment of 48 cases of neglected femoral neck fracture with an average age of 48 years in the same study. On the patients, they achieved 91 % union [18].

Gupta et al. proposed valgus osteotomy and fixation with a dynamic hip screw (DHS) and a 135° angled barrel plate as a solution for these types of fractures, and they achieved 93.3 % union in 60 cases. DHS can apply compression force across the fracture that ABP cannot, but DHS may cause medialization of the femoral shaft, which ABP can correct [19]. So, DHS and a single angled barrel plate could be useful in our situation. In our patient, we used 130 ABP to improve compression at the fracture site.

Prior to surgery, patient optimization is a critical factor in achieving union. Rheumatoid arthritis may be an important risk factor for osteotomy site nonunion in the case presented. Nonunion after internal fixation is common in patients with rheumatoid arthritis (RA). This could be due to decreased bone mineralization, anemia, poor nutrition, and prolonged use of systemic corticosteroids [20]. Our patient had a

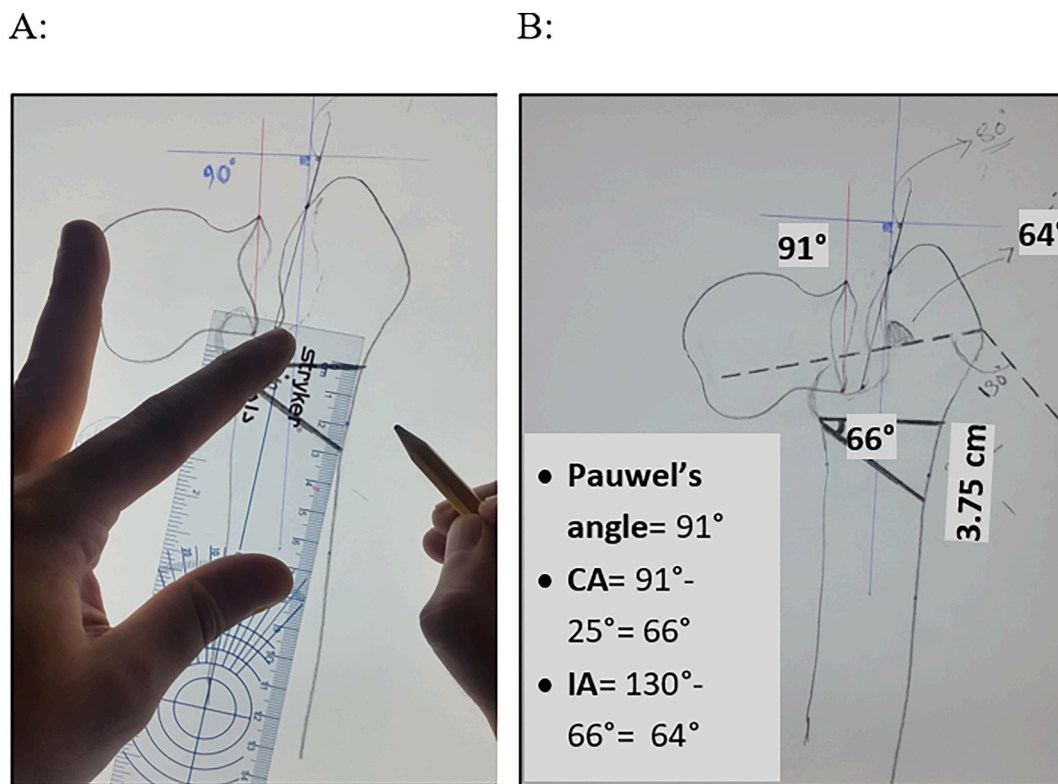


Fig. 4. Planning of the first surgery.

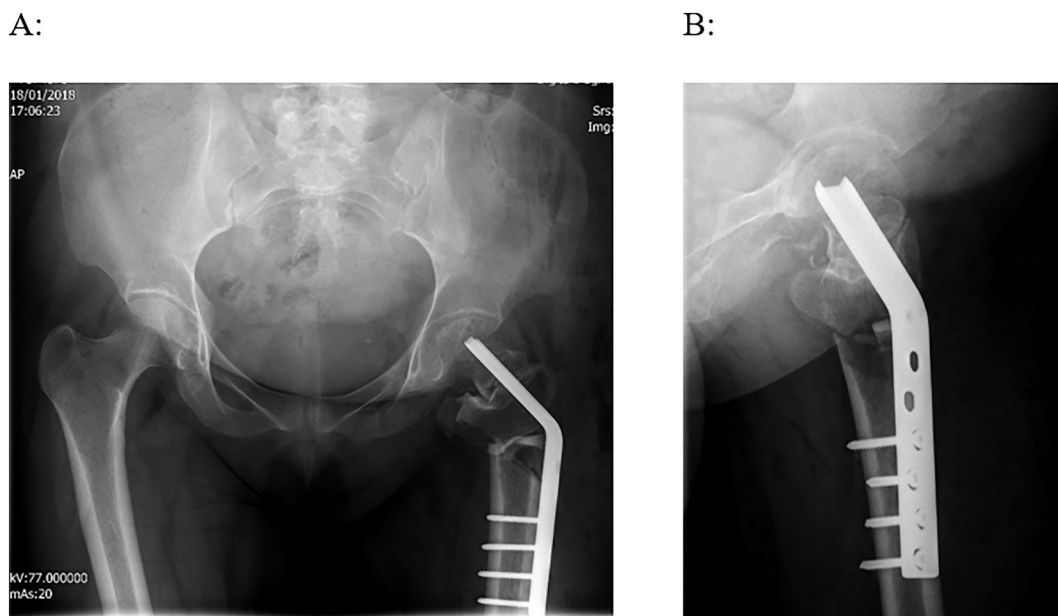


Fig. 5. Hip X-rays after the first surgery in A. Anteroposterior and B. Lateral views.

history of using systemic corticosteroids, which could explain her nonunion.

According to our case, her first osteotomy was at a subtrochanteric location, she was not optimized for her comorbidity, and the ABP used had a short side barrel for such an operation, which could be one of the reasons for our operation's failure. She got union in the second

operation, when we used longer ABP with auto graft and optimized the patient.

In **conclusion**, femoral neck fractures are a common orthopedic trauma that almost always requires surgical treatment. If a femoral neck fracture requires valgus osteotomy due to criteria such as nonunion or high shear force, it is preferable to perform the valgus osteotomy in the

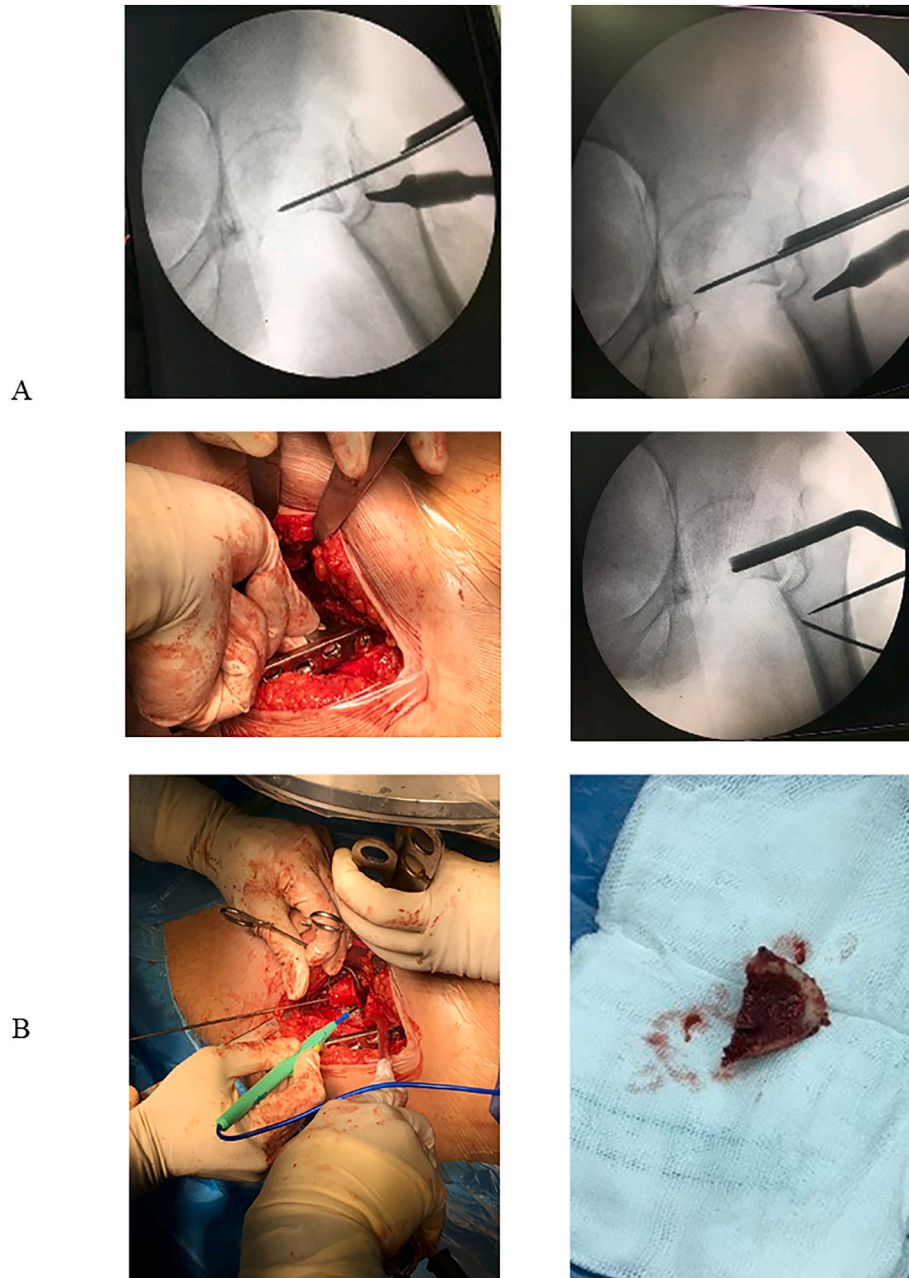


Fig. 6. A. Inserting angle blade plate with guide of CARM. B. Wedge osteotomy in subtrochanteric location.

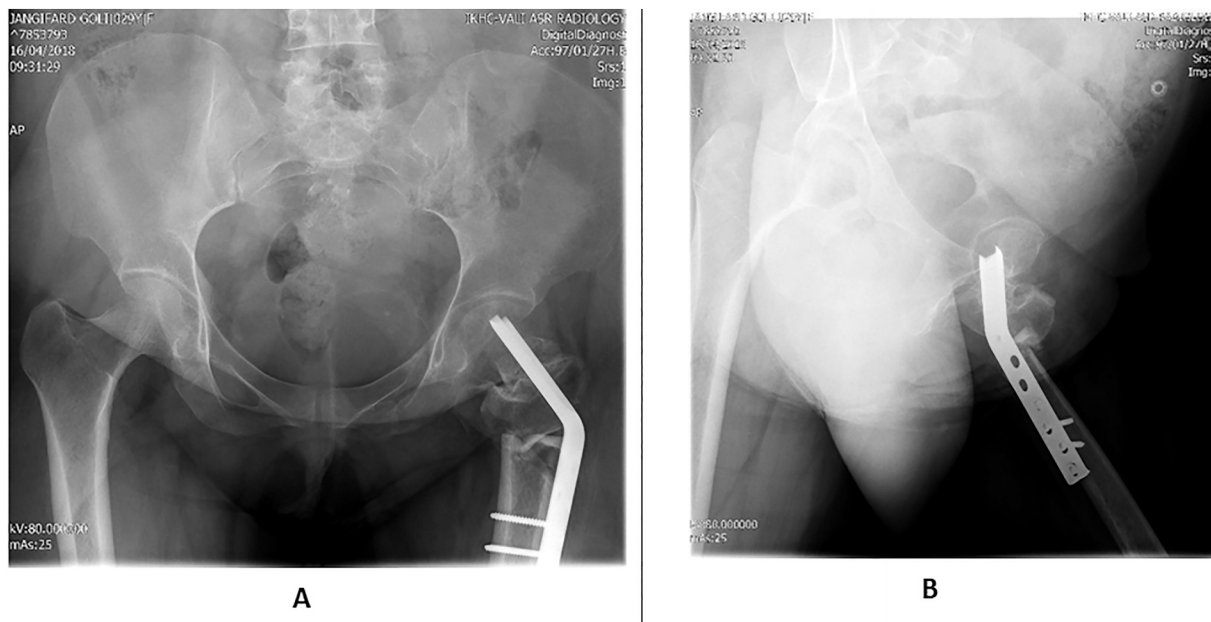


Fig. 7. Hip X-rays 3 months after the second surgery in A. Anteroposterior and B. Lateral views.

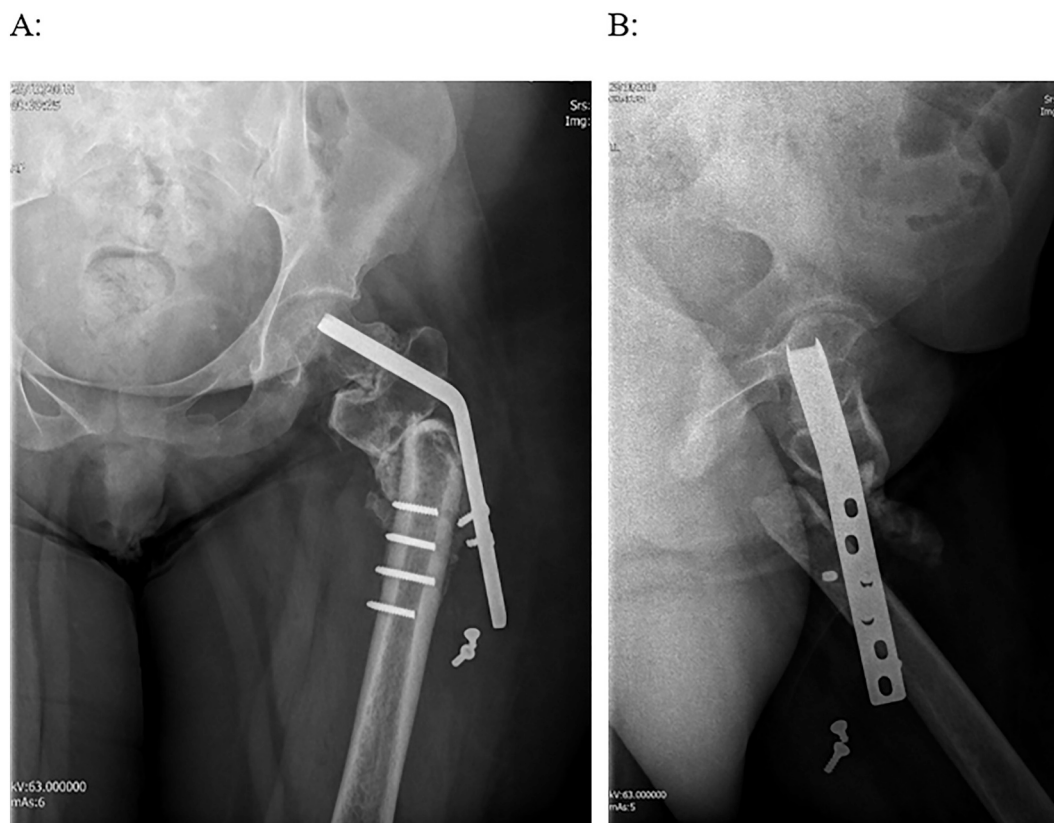


Fig. 8. Hip X-rays 8 months after the second surgery in A. Anteroposterior and B. Lateral views.

intertrochanteric region for better healing and with an appropriate device such as ABP of sufficient length after optimizing the patients.

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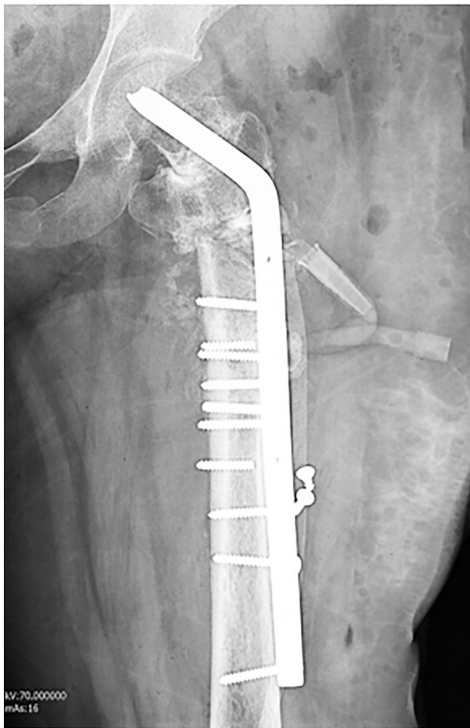
**Ethical approval**

Not Applicable.

**Consent**

Written informed consent was obtained from the patient for

A:



B:

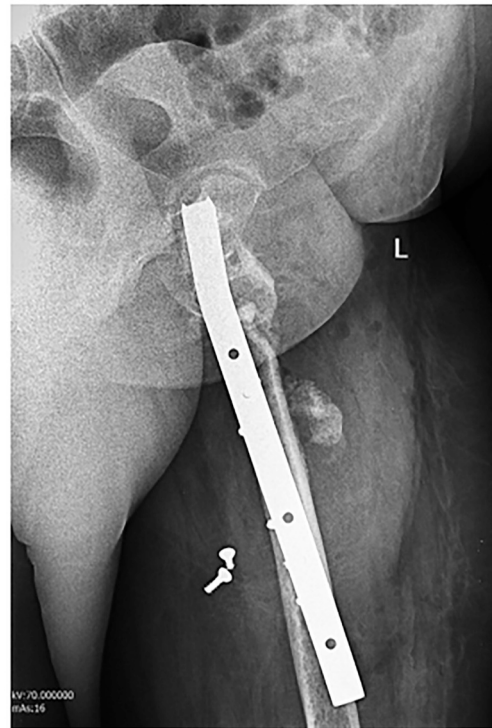


Fig. 9. Hip X-rays after the second surgery in A. Anteroposterior and B. Lateral views.

A:



B:



Fig. 10. Hip X-rays 11 months after the second surgery in A. Anteroposterior and B. Lateral views.

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.

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#### CRedit authorship contribution statement

All authors contributed in study design, data acquisition, drafting the paper and approved the final version.

#### Declaration of competing interest

None.

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