Geriatric Orthopaedic Surgery & Rehabilitation
Volume 13: 1–6

DOI: 10.1177/21514593221074179
journals.sagepub.com/home/gos
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Refracture After Removal of the PFNA in a Healed Intertrochanteric Femoral Fracture: Case Report

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Abstract

Hardware removal in a healed intertrochanteric fracture in elderly, which is not a routine procedure, should be needed in the case of irritable hardware. The reports of refracture after hardware removal can be seen as sparse in current literature, which are focused to secondary femoral neck fracture after removal of the lag screw or blade. We experienced a case of the intertrochanteric refracture and varus collapse after the PFNA removal in a healed fracture, treated with valgus trochanteric osteotomy and angled blade plate fixation. The PFNA is an innovative device for the treatment of the trochanteric fracture; however, the complications after removal never end. Therefore, the removal from healed fracture in elderly who have osteoporosis should not be recommended unless intractable pain had persisted.

Keywords

intertrochanter fracture, removal, refracture, opsteoporosis, PFNA

Introduction

Intertrochanteric fractures in elderly patients are one of the most common problems encountered in orthopedic practice; it accounts for 30% of all hip fractures.[1] Cephalomedually nail fixation is the mainstay for unstable intertrochanteric fractures treatment.[2] The proximal femoral nail anti-rotation (PFNA; Synthes, Paoli, Switzerland) was commonly used option for the treatment of almost all types of trochanteric fractures which has been reported reliable clinical outcomes.[3]

Although hardware removal from a healed intertrochanteric fracture is not a necessary procedure, there are many reports on the need of implant removal following the union of fractures in situations such as discomfort during activities of daily living, painful hardware, infection and metal allergy.[4] The majority of published papers bring into focus complications during its clinical use, such as inaccurate reduction, incorrect placement of blade in the femoral neck, wrong choice of length or medial migration of blade into the joint.[5]

The reports of complications associated with PFNA removal in healed trochanteric fracture can be seen as limited. Several authors have reported a femoral neck fracture after removal of lag screw or PFNA blade.[6,7] Varus collapse and intertrochanteric refracture after removal of PFNA from healed intertrochanteric fracture are rare in the previous clinical reports.

We report a case of unexpected varus collapse and refracture after removal of PFNA nail from healed intertrochanteric fracture which was treated by valgus intertrochanteric osteotomy and fixation with angled blade plate, to discuss about the causes of underlying problems.

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Submitted September 23, 2021. Accepted December 28, 2021

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The patient was informed that medical data concerning this case would be submitted for publication, provided agreement.Case

Report

A 69-year-old female patient was transferred to emergency room after simple slip on ground. The proximal thigh was swollen, tenderness at hip joint was remarkable and there was no sign of vascular injury. On plain radiograph showed AO/OTA 31A2.2 pertrochanteric fracture (Figure 1A). The day after trauma, she underwent internal fixation with PFNA-II after closed reduction. Postoperative X-rays showed the well apposition of the fracture site and correct position of blade (Figure 1B).

BMD was measured by Dual Energy X-ray Absorptiometry (DEXA) showed 0.479 g/cm^3, equal to a T-score of contralateral hip −2.9, which stands for osteoporosis. The walking ability of the patient before trauma was good and had no limitation at daily living activity. Parker and Palmer mobility score was counted as 9 points.

After 16 months, the patient complained of pain in the area of the greater trochanter; it was aggravated by sitting and standing up motion. But there was no pain at walking and daily living activity motion. The follow-up X-ray showed well united with consolidation but protruded proximal nail tip and fragmentation of the greater trochanter tip were notified (Figure 2A and 2B). The pain did not improve with medication. We determined that the protrusion of the nail tip was the cause of pain so we decided to remove the nail, which was performed at 18 months after the initial trauma (Figure 3A). Checked computed tomography (CT) scan image after removal of nail showed the solid union of the calcar femorale and cavitary bone defect of the trochanteric area (Figure 3B). Two weeks after removal, the hip pain was improved.

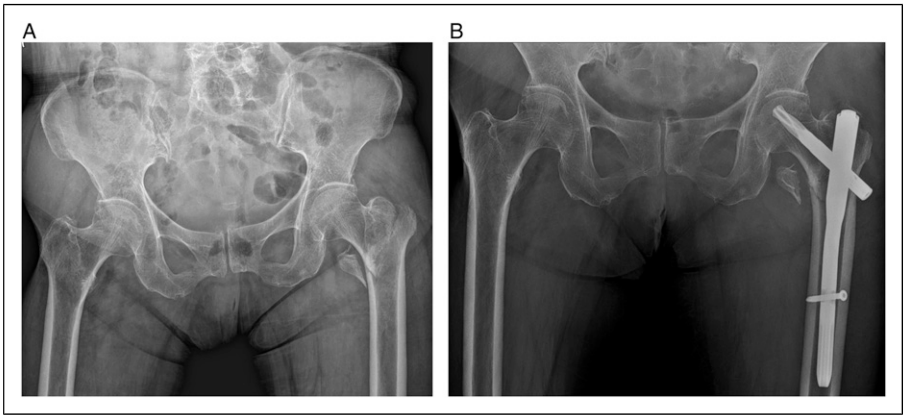

Figure 1. (A) Preoperative X-ray of the left hip intertrochanteric fracture. Anteroposterior radiograph showed AO/OTA classification A2.2 type intertrochanteric fracture. (B) Postoperative X-ray showed stable apposition of the medial cortex and correct position of blade with adequate tip-apex distance.

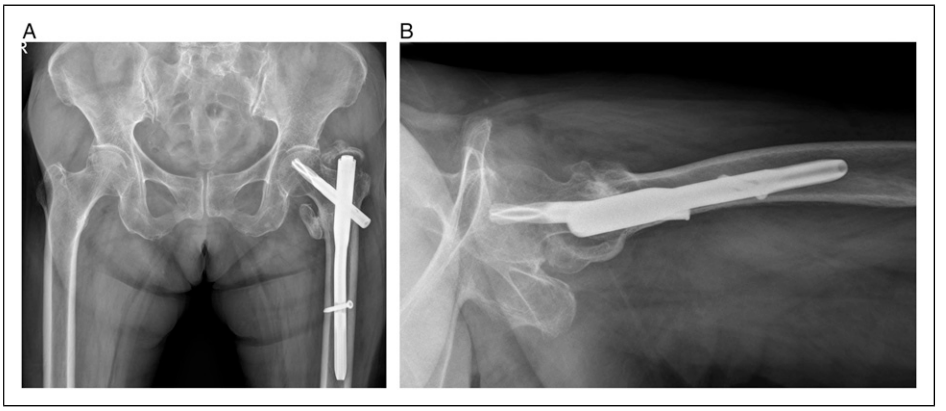

Figure 2. (A and B) 16 months after operation, follow-up X-ray showed well union of fracture site with consolidation and greater trochanter tip fragmentation.

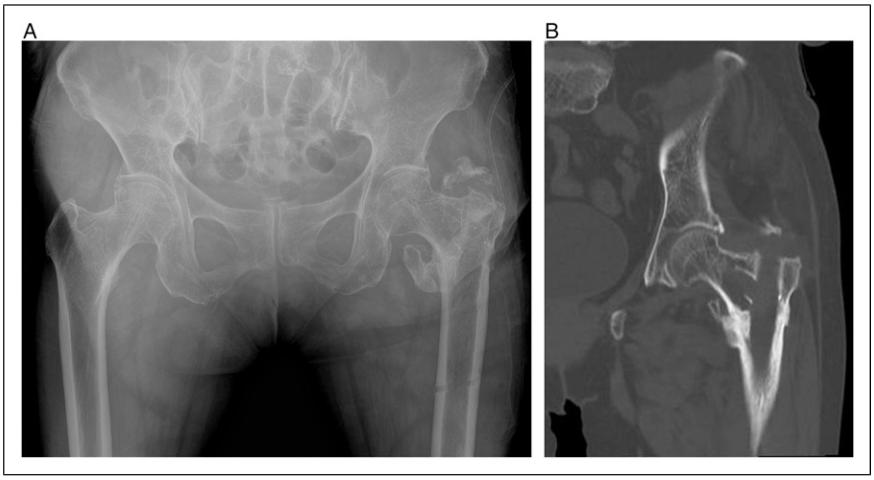

Figure 3. (A) X-ray after removal showed solid fracture site union and partial fragmentation of the greater trochanter tip. (B) CT scan image after removal showed solid union of medial cortex without change of the neck shaft angle.

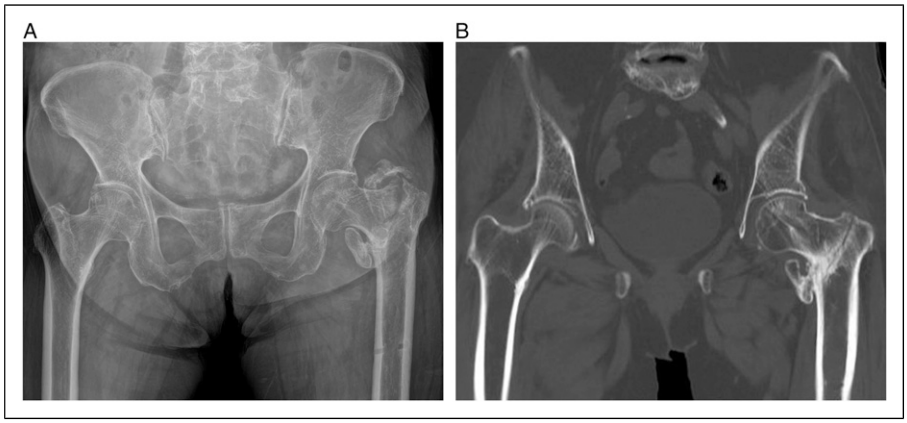

Figure 4. (A) 2 months after removal, follow-up X-ray showed decreased neck shaft angle and linear fracture line at trochanteric area. (B) Coronal CT image showed cavitary bone defect at the trochanteric area and extended refracture line from greater trochanter to lesser trochanter.

6 weeks after removal, the patient complained of pain during walking with no history of trauma. The X-ray showed decreased neck shaft angle measured 100° and fracture line extended from the greater trochanter to the lesser trochanter (Figure 4A). The CT scan showed cavitary bone defect at the greater trochanter area and pertrochanteric fracture line (Figure 4B). There was no evidence of femoral head necrosis or cartilage damage. We decided to correct the varus angulation and revision fixation, considering the patient's activity demand as a farm worker.

Intertrochanteric valgus osteotomy was done to correct the varus angulation, followed by fixation with angled blade plate without additional bone graft. Postoperative X-ray showed recovered neck shaft angle to 130° and stable apposition of the fracture site (Figure 5). After 4 months, the patient presented no pain and no limitation of daily living activity. The Harris hip score was 91 points. On the final follow-up X-ray and CT scan performed 2 years after revision surgery showed consolidation and well bone union without change of neck shaft angle, no evidence of AVN of femoral head (Figure 6A and B).

Discussion

Cephalomedullary nails are the most common choice of device for the treatment of all types of intertrochanteric fractures.[8] The evolution of cephalomedullary nails over time could resolve many technique-related complications. The PFNA-II was developed in 2004, specially designed to prevent rotational instability by use of helical-shaped blade, should provide anti-rotation and optimal stability into the femoral neck. Nail component has a 16.5 mm proximal diameter, 9–12 mm distal diameter and 5° medio-lateral bending angle. The PFNA is more suitable for the treatment of unstable fractures. It has biomechanical advantages over than sliding hip screw such as a shortened lever arm, weight-bearing axis closer to the hip joint and intramedullary buttress of the medial cortex.[9] Although the

PFNA have reliable advantages, many papers have reported complications related with technical problems such as inaccurate reduction, wrong choice of length, improper location of blade and fixation failure.[8,10]

Hardware removal from a healed intertrochanteric fracture may be inadvisable in elderly patients; however, many studies reported the occurrence of discomfort due to implant, which can affect the activities of daily living in approximately 10–40% of patients.[4,11] Furthermore, with increased life expectancy in the recent, more patients preferred the removal of hardware because of the pain, psychological discomfort.

The PFNA used to the proximal femur was reported to be a source of pain following fracture union.[10] When used in short statured patients, the anatomical feature of the PFNA does not match the femoral geometry, the risk of pain after operation may increase due to protruding proximal nail tip and eccentric contact to the femoral cortex at the distal nail end.[12] The length mismatch between the proximal femur and PFNA nail content causes the protruding nail tip which would induce friction between the nail and soft tissue, causing pain.[12,13]

Figure 5. X-ray after revision fixation showed recovered neck shaft angle and stable apposition of the medial cortex.

In our case, we assumed that the protruded nail tip and blade end were the cause of the pain, which needed hardware removal inevitably.

Information about indication and complications for hardware removal in healed trochanteric fractures can be seen as sparse in current literature. One study recommended hardware removal for patients with life expectancy greater than 5 years or for patients younger than 60 years old.[14] Complication rate after implant removal have a range from 3 to 20%, independent from device and localization.[15] Yoon et al[6] reported that the mean neck width of the fracture group was significantly smaller in neck fracture group than nonfracture group to evaluate the incidence of femoral neck fractures after removal of compression hip screw from healed intertrochanteric fractures. Non-medically–indicated implant removal should be avoided due to a high refracture rate.[15] Seibert et al[7] reported a femoral neck fracture after removal of PFNA blade from a completely healed fracture: due to persisting lack of cancellous bone in middle column of femoral neck and altered cancellous bone remodelling. Literally, femoral neck fracture after removal of hardware is not a refracture but a secondary fracture because the subsequent fractures were not at the previous fracture site. In our case, refracture was occurred at the completely healed previous fracture site.

A few studies have investigated how removal of the intramedullary device may affect the biomechanical stability of the proximal femur. In a cadaveric study, the femurs were equally good at tolerating normal weight-bearing load following implant removal regardless of implant type and age, but some lower BMD specimens had low failure load.[16] Bony stiffness was not affected by the age because of the preservation of cortical bone, which acts as the main stabilizer of the femur, but the cortical breakage following removal significantly lowers the stiffness, demonstrating structural weakness.[16] They suggested that

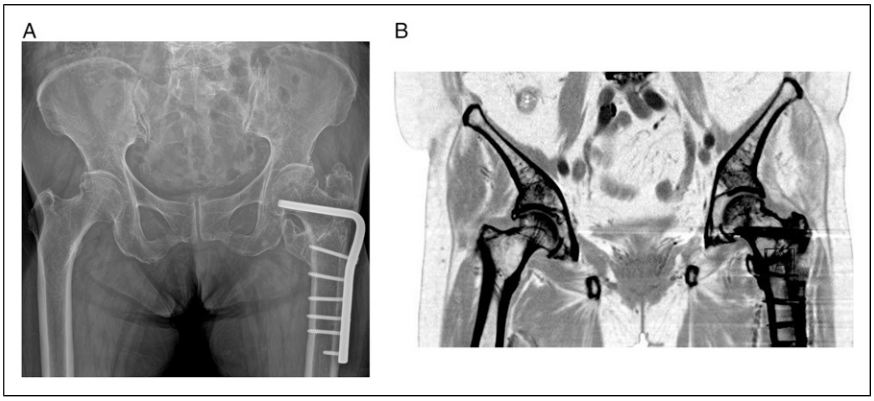

Figure 6. (A and B) Final follow-up X-ray showed solid union of the fracture site without neck shaft angle change.

the cavities had no effect on the type of secondary fracture, but the failure load of the femur correlated with BMD in the proximal femur.[16] The bone loss ratio of the femur could be affected by the fracture pattern.[16] In particular, the bone loss ratio after PFNA removal would be higher in patients with narrow bony diameter which is prone to increasing the fragility.

The decreased neck shaft angle of the proximal femur could change the compression force on the femoral head to more vertically on the femoral neck area. Consequently, the compression force is more concentrated at the greater to lesser trochanteric area which becomes vulnerable to fracture.

We assumed that the bending moment on the healed fracture site was gradually increased due to decreased neck shaft angle and the opening created by the nail removal on the tip of the greater trochanter may act as the starting point of a crack that extended along the intertrochanteric line to cause the refracture.

Although more detailed investigation in the trabecular structure was not performed, there was persistent lack of cancellous bone in the trochanteric area and the altered cancellous bone remodelling due to the change of the static in the presence of implant which is prone to increase fragility. In our case, we could presume that the causes of refracture. Relatively high loss ratio in the greater trochanteric area, cortical breakage on the greater trochanter after nail removal and lowered neck shaft angle: all of them attributed to refracture.

While the joint replacement is one option for the treatment for our case, we decided to preserve the hip joint because patient needed the activity as a farmer and evidence of the femoral head necrosis has not be seen as well as preserved joint cartilage could be confirmed by CT scan.

We performed valgus intertrochanteric osteotomy to recover the neck shaft angle followed by revision fixation with 95° angled blade plate. After removal of the PFNA, there was broad cavitary bone defect at trochanteric area, which makes it difficult to control the fracture site for reduction as well as the maintenance of alignment. While technically demanding, the angled blade plate is a useful alternative device for revision in failed cephalomedullary fixation. It can be made to achieve correction and fixation simultaneously, anatomic restoration and bone healing are nearly assured.[17,18]

Many technique-related complications and secondary fractures after removal had resolved by the evolution of cephalomedullary nails over time, but the risk of refracture after hardware removal in healed intertrochanteric fractures never stops. Although the evolution of innovative devices is continuing, the risk of refracture after removal of hardware from a healed intertrochanteric fracture has been continued. While the removal of the PFNA was needed inevitably, it was an imprudent judgement that should be evaluated more carefully, even though we got satisfactory result by secondary operation.

In elderly patients, hardware removal in healed intertrochanteric fracture should not be recommended unless intractable pain had been persisted, especially in cases of the patients with osteoporosis or lowered neck shaft angle.

Conclusion

In the case of the PFNA being removed inevitably due to persistent pain, careful consideration and awareness of the risk of refracture must be undertaken in elderly, even though the fracture site was headed with solid union. To prevent the proximal nail protrusion, careful assessment of the proximal femur should be taken in primary fixation, which can reduce the rate of hardware removal in elderly patients.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

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