



## Case report

## Bilateral displaced femoral neck stress fractures treated with valgus subtrochanteric osteotomy: A case report and two-year follow-up



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## ABSTRACT

Bilateral femoral neck stress fractures are uncommon injuries that are successfully treated with surgical treatment; however, there is a high complication rate, as well as the challenging issue of the joint preserving procedure. This study reports the rare case of simultaneous valgus subtrochanteric osteotomy with a satisfactory outcome. A twenty-year-old male military recruit, with no history of previous hip pain or significant injury, presented with gradually progressive bilateral hip pain for three months after recruitment into military training. He was unable bear weight on both hips for one day prior to hospital without risk of sudden injury. A preoperative radiograph revealed displaced bilateral femoral neck fractures, and magnetic resonance imaging (MRI) demonstrated no evidence of avascular necrosis of the femoral heads. A bilateral valgus subtrochanteric osteotomy procedure was simultaneously and successfully performed on both hips. Six months after surgery, the patient was able to walk independently without any complications, and radiographic unions were presented. The two-year follow up radiographs showed no evidence of avascular necrosis of the femoral heads. The valgus subtrochanteric osteotomy procedure is an effective joint preserving procedure in femoral neck stress fractures, including the uncommon bilateral cases.

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## 1. Introduction

Stress fractures commonly occur in lower limb; especially in the metatarsals, tibia, fibula, and tarsal bones.<sup>1</sup> Femoral neck stress fracture is an uncommon type in daily practice, accounting for 3–5% of all stress fractures, and are even more rare as bilateral fractures.<sup>2,3</sup> In the bilateral femoral neck stress fractures previously reported, the majority were of a non-displaced bilateral pattern; most of which were successfully treated with either conservative or operative treatment.<sup>4–6</sup> Controversy within the treatment of displaced fractures is due to the inconsistency of the outcomes of the various techniques.<sup>7,8</sup> The valgus subtrochanteric osteotomy has been a successfully applied surgical technique in many of these displaced cases; however, the simultaneous valgus subtrochanteric osteotomy of bilateral femoral neck stress fractures has not yet been reported.<sup>9</sup> This report demonstrates the successful case of simultaneous valgus subtrochanteric osteotomy for bilateral

displaced femoral neck stress fractures with a satisfactory two-year follow-up outcome.

## 2. Case report

A twenty-year-old male military recruit presented with acute on top of chronic gradually progressive bilateral hip pain, and was suddenly unable to bear weight on his hip joints. His Body Mass Index (BMI) was 23.8 kg/m<sup>2</sup>. This patient reported a three-month duration of bilateral hips pain; which was no significant injury and not previously investigated. Physical examination revealed marked tenderness and limited motion of both hips, without any sign of external injury or infection. Preoperative radiographies established the displaced bilateral femoral neck fractures with sclerotic borders, without any bone lesion or suspected pathological cause. The angles of fracture line were 48° on the right side, and 54° on the left side; which were classified as Type II and III of Pauwels' classification, respectively (Fig. 1A). Any possible infectious or metabolic etiologies were also investigated and excluded. The preoperative MRI confirmed a bone marrow contusion without evidence of osteonecrosis of the femoral heads (Fig. 1B).

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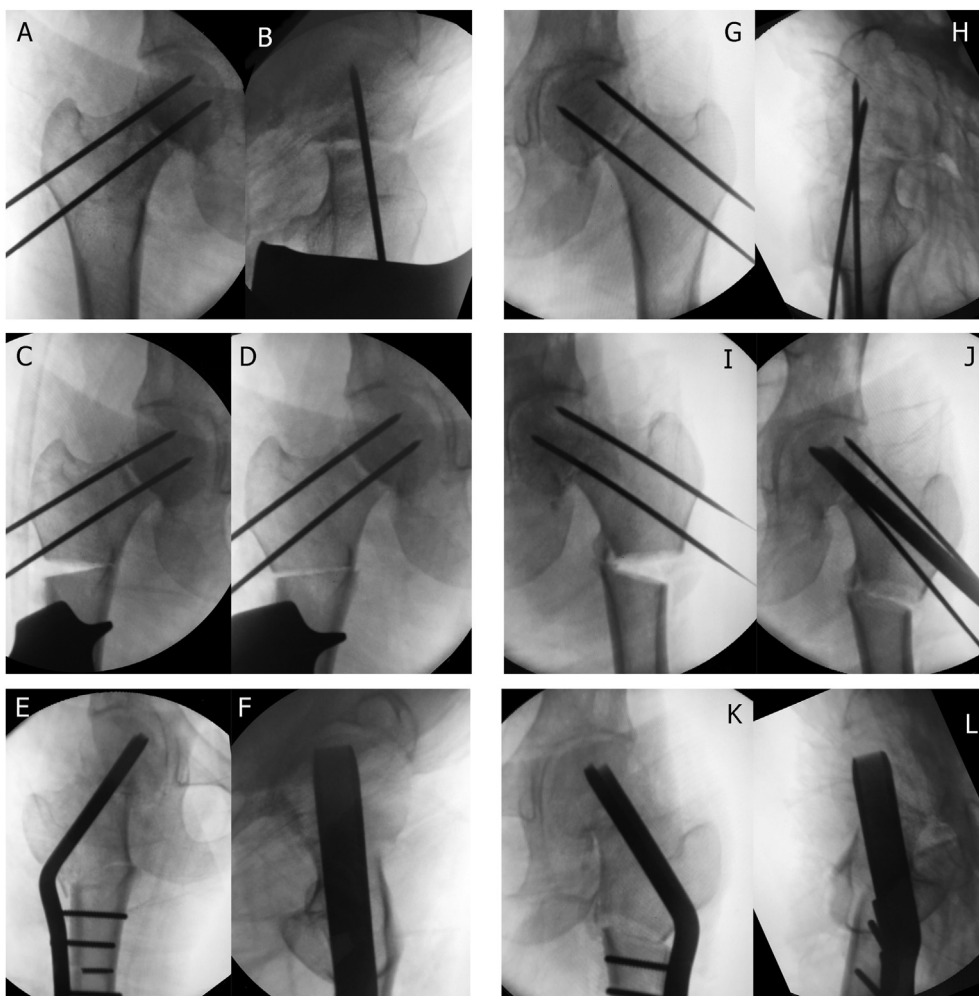
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**Fig. 1.** **A)** The preoperative plain radiograph of both hips demonstrating the bilateral displaced femoral neck stress fractures with superior translation of the femoral neck and sclerotic change at the fracture site. **B)** The preoperative magnetic resonance imaging of both hips showed the bone marrow contusion at the femoral heads without any sign of osteonecrosis.

The patient was initially treated with bilateral skin traction for a week in order to correct any shortening of the fractures. As the preoperative measurements of the angles of fracture site were 48° on right side, and 54° on the left side; the surgical procedure was planned to realign the initial angles of fracture site to 25° on both sides, regarding the degree of the resultant force of the hip joint. The calculated angles to correction were 23° on the right side and 29° on the left side. The angle blade plates were pre-bent which corresponded with the corrected neck-shaft angles.

The patient was sequentially twice set in the hemi-lithotomy position. Fracture displacements were successfully reduced by closed technique, under manual longitudinal traction and internal rotation, which were verified by the intraoperative image intensifier; and two temporary Kirschner wires were then inserted (Fig. 2A, B, G, H). The lateral longitudinal skin incision was made at the area of planned fixation. A closed-wedge osteotomy was performed at the level just below to the lesser trochanter, in regard to the planned correction angle (Fig. 2C, D, I, J). The bent angle blade



**Fig. 2.** Intraoperative intensifier imaging: the closed reduction of the femoral neck fractures successfully achieved through manual manipulation on the right side. **A, B)** Kirschner wires inserted along the femoral neck for temporary fixation. **C, D)** Closed wedge valgus subtrochanteric osteotomy sequentially conducted in regard to the determined preoperative osteotomy angle. **E, F)** The angle blade plate (in appropriated size and length) applied through the osteotomy site and the fracture site. **G-L)** A similar respective procedure was performed on the left side.



**Fig. 3.** A) The planned alignments of fracture site were surgically achieved, evidenced in the initial postoperative radiograph. B, C, D) The two-year follow-up radiographs demonstrated the complete union of each fracture and osteotomy site without evidence of femoral head osteonecrosis.

plate was also applied along the corrected neck-shaft angle under the image intensifier (Fig. 2E, F, K, L). Lastly, the fracture angles were corrected to 23° on the right side, and 22° on the left side, which was exhibited in the initial post-operative radiograph (Fig. 3A). The final limb lengths were not significantly different. The clinical hip pain gradually reduced, and was completely resolved within the second month. The patient ambulated in a wheelchair for five months, until completed bone union on both sides was achieved, as demonstrated in the follow-up radiographs. Full-weight bearing ambulation program was introduced in the sixth months, post-operatively, without any clinical pain or complications. At the two-year follow-up period, the patient presented satisfactory clinical results with a painless gait. Serial radiographs showed no evidence of avascular necrosis of the femoral heads (Fig. 3B, C, D). The patient had discontinued the military recruit training after finishing the course of treatment with his attention.

### 3. Discussion

This case report showed the extremely uncommon bilateral femoral neck stress fractures and the successful surgical technique; simultaneous bilateral valgus subtrochanteric osteotomy with angle blade plate fixation. The clinical and radiographic results at the two-year follow-up demonstrated a satisfactory outcome without any complication.

There were several retrospective studies of surgical outcomes in displaced femoral neck stress fracture that showed the good outcomes. Evans et al., 2012<sup>8</sup>; retrospectively reviewed the incidence and treatment outcomes of six patients, who presented with displaced femoral neck stress fractures, treated by internal fixation. The surgical outcomes showed no cases of avascular necrosis or surgical complications with 100% union rate. Lee et al., 2003<sup>7</sup>; reported 24 cases of displaced femoral neck stress fractures, surgically treated with compression hip screw or cannulated screw. They found that 28% avascular necrosis rate in the cannulated screw group and 17.6% in the compression hip screw group. Most of them (71.4%) had good functional results.

Bilateral femoral neck stress fractures are extremely uncommon pattern. Oliveira et al., 2016<sup>5</sup>; reported a case of bilateral non-displaced femoral neck stress fractures, which were successful treated by cannulated screws fixation. Yoon et al., 2021<sup>6</sup>; also reported the characteristics and presentations via the case series of 12 femoral neck stress fracture patients in South Korean male military recruits, four of these patients were bilateral pattern and all of the contralateral side were asymptomatic and later found under an investigation. Their appropriated treatments were considered according to their classification of fracture. Almost of the cases were presented earlier than 12 weeks of symptomatic duration which were different from the present study, which had a hip pain for 12 weeks. The delay of presentation is an important

factor for the justification of treatment. Naranje et al., 2012<sup>10</sup>; reported a case of bilateral displaced femoral neck fracture, which were also successfully treated with the closed reduction and cannulated screws fixation technique.

The surgical technique of valgus subtrochanteric osteotomy was initially introduced for treating the nonunion femoral neck fracture cases. The principle of this technique was also applied for resolving in case of femoral neck stress fracture. Aim of this technique is to change the angle of fracture site to be near the degree of resultant force of hip joint for creating the compression force at the fracture site. Naik et al., 2013<sup>11</sup>; reported four cases of bilateral femoral neck stress fractures. Some of them with coxa vara were successfully treated with subtrochanteric valgus osteotomy. Diwanji et al., 2007<sup>9</sup>; reported the two cases of femoral neck stress fractures, treated with valgus subtrochanteric osteotomy and applied the angle blade plate which was similar to this study, the satisfactory outcomes were also provided at two- and five-year follow-up.

The satisfactory results were demonstrated in this case report for two-year follow-up, nevertheless, the long term follow up is required for detect the late complications such as osteonecrosis, re-fracture or osteoarthritis.

### Conflicts of interest statement

The authors have no any conflicts of interest.

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