

Subtrochanteric Femur Fracture After Removal of Screws for Femoral Neck Fracture in a Child

Kwang Soon Song, MD, PhD, and Si Wook Lee, MD

Abstract

Displaced femoral neck fractures are rare in children and are associated with a high rate of complications. Subtrochanteric fractures after cannulated screw fixation of femoral neck fractures in adults are well recognized, and there are several reports on the topic. However, there are no reports on complications related to hardware or subtrochanteric fractures after removal of the screws in the treatment of femoral neck fractures in children.

Here we report the case of a 10-year-old boy who sustained a subtrochanteric fracture after the screw removal and healing that followed a femoral neck fracture.

Subtrochanteric fractures and other complications related to hardware removal in children with slipped capital femoral epiphysis (SCFE) have been well documented.¹⁻³ Subtrochanteric fractures after cannulated screw fixation of femoral neck fractures in adults have also been well recognized,⁴ and there are several reports on the topic.^{4,5} However,

there are no reports on subtrochanteric fractures after removal of the screws for femoral neck fractures in children.

In this article, we report the case of a child who sustained a subtrochanteric fracture after the screw removal and healing that followed a femoral neck fracture. The patient's parent provided written informed consent for print and electronic publication of this case report. In addition, our institutional review board approved this case report.

Case Report

A 10-year-old boy was brought to our emergency department with the chief complaint of left hip pain after a car accident. Anteroposterior and axial lateral radiographs showed a displaced cervicotrochanteric femoral neck fracture (Figures 1A, 1B). The patient was admitted to the hospital and underwent closed reduction and internal fixation with two 3.5-mm cannulated titanium screws within 12 hours of arrival. The screws did not cross the physis to avoid iatrogenic injury of the capital femoral epiphysis (Figures 2A, 2B). The entry point was located at the lower level of the lesser trochanter. The lateral cortex was penetrated only once by the guide wire for the placement of each screw.

The patient was discharged to home care with a crutch

Figure 1. (A) Anteroposterior radiograph of 10-year-old boy's left femoral neck shows displaced cervicotrochanteric fracture (Delbet type 3). (B) Axial radiograph shows cervicotrochanteric fracture of femoral neck.

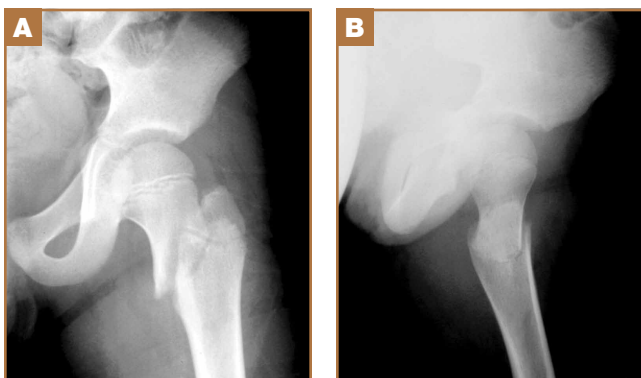
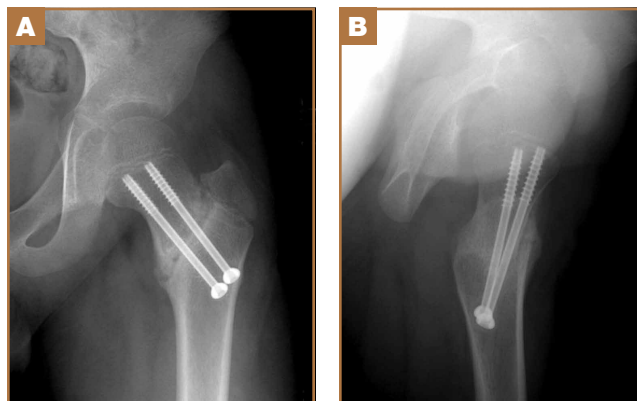


Figure 2. (A) Anteroposterior and (B) axial radiographs show two 3.5-mm cannulated titanium screws without crossing physis to avoid iatrogenic injury of capital femoral epiphysis.



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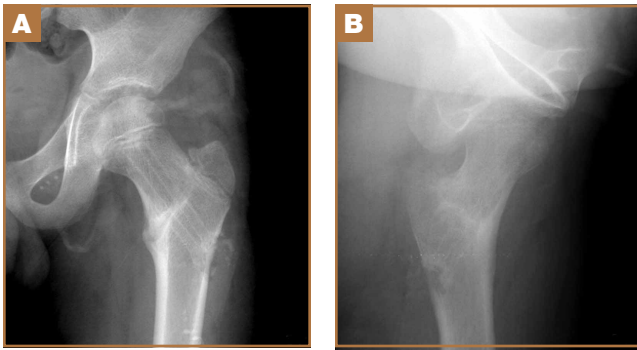


Figure 3. (A) Anteroposterior and (B) axial radiographs show defect and irregular small bone particles on lateral cortex surrounding screw heads, which were chiseled and damaged as result of very tight bone ingrowth and weak head sockets.

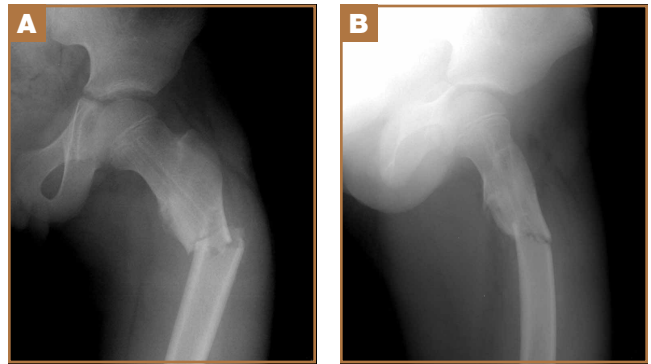


Figure 4. (A) Anteroposterior and (B) lateral radiographs show oblique subtrochanteric fracture at empty screw hole.

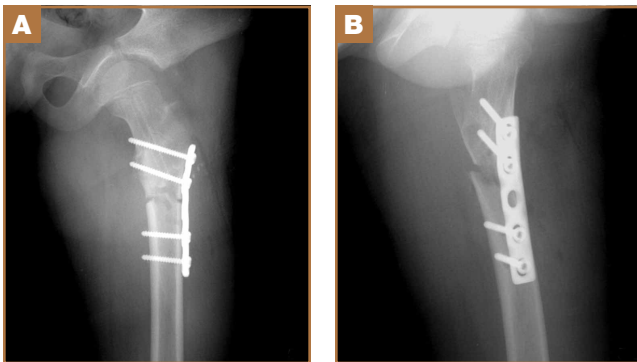


Figure 5. (A) Anteroposterior and (B) lateral radiographs show subtrochanteric fracture fixed with plate and 4 screws.

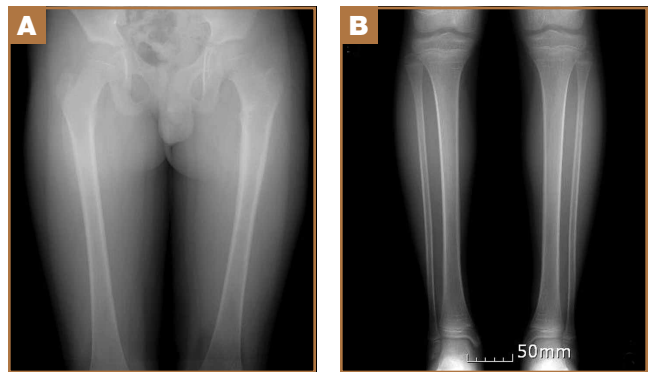


Figure 6. Teleroentgenogram shows complete healing without any complications, such as avascular necrosis of femoral head and leg-length discrepancy.

and an ischial weight-bearing long leg brace for protection from unexpected external force. Two months after surgery, we allowed the patient to walk with the brace and without the crutch. Full-weight-bearing ambulation was allowed 3 months after surgery.

About 9 months after initial surgery, we removed 2 titanium screws, which were completely covered with growing new bone. The lateral cortex surrounding the screw heads was chiseled from the lower level of the lesser trochanter to remove the completely immersed screw heads (Figures 3A, 3B).

After screw removal, we recommended non-weight-bearing crutch-walking for 2 weeks followed by partial weight-bearing with crutch for another month. However, the patient started full weight-bearing 2 weeks after screw removal. One month after screw removal, he was brought to the emergency department with severe left hip pain after missing a step on a path. Anteroposterior and lateral radiographs showed an oblique subtrochanteric fracture at the empty screw holes (Figures 4A, 4B). A plate and 4 screws were placed to stabilize the subtrochanteric fracture, and a hip spica cast was applied and was to be worn for 3 weeks (Figures 5A, 5B).

At final follow-up, 6 months after the second surgery, the

fracture was healed, and there had been no complications, such as avascular necrosis of the femoral head and leg-length discrepancy (Figures 6A, 6B).

Discussion

Although in situ pinning of SCFE is a common procedure with good results, the rate of complications of hardware removal can be as high as 34%; these complications are well documented.⁵ Subtrochanteric fracture as a complication of proximal femoral neck pinning in adults is also well documented.^{4,5} However, there are no reports on subtrochanteric fractures after screw removal in the treatment of femoral neck fractures in children.

Brooks and colleagues⁶ emphasized the point that multiple passes weakened the lateral cortex, decreased the energy-absorbing capacity by 55.2%, and increased local stress. Even if a screw is placed in a relatively safe zone above the lesser trochanter, pie-crusting of the cortex can weaken it enough to predispose it to failure under a relatively normal load.⁷ We inserted 2 cannulated titanium screws without repositioning or multiple drilling, and the femoral neck fracture was united.

The common denominator for subtrochanteric fractures after screw or pin fixation of femoral neck fractures in adults

seemed to be the entry point of the lateral cortex below the level of the most inferior edge of the lesser trochanter.⁴ The pin should have its entry site proximal to the level of the lesser trochanter. Paloski and colleagues⁷ and Canale and colleagues⁸ hypothesized that this screw acted as a stress riser to the normal bone, which underwent abnormal loads caused by the patient's habitus and later mechanism of injury. In our patient's case, the appropriate starting point for perpendicular penetration of the femoral neck fracture line was on the lateral femoral cortex at the level of the lesser trochanter. We thought this entry on the lateral cortex might predispose the patient to a subtrochanteric fracture. The starting point of the screw is considered the most important factor in preventing fracture after screw removal.

As titanium pins cause very tight bone ingrowth,^{9,10} the surface of titanium screws used for femoral neck fractures in children are smoothed to reduce turning force.¹ The hexagonal sockets wore off rapidly and proved to be too weak to overcome the necessary torque for loosening the pin from the bone.

Lee and colleagues¹⁰ found that significantly more operative time was needed to remove titanium pins (vs steel pins) after 12 months or longer. When Asnis III pins (Howmedica, Rutherford, New Jersey) were used in the treatment of femoral neck fractures in aged patients, similar problems did not occur. One possible explanation is that bone density is higher in adolescents than in adults. In addition, more bone ingrowth and higher bone compression might occur in adolescent bones.¹ Given the considerable disadvantages noted in their series, Ilchmann and Parsch¹ concluded that use of cannulated titanium screws should be suspended and that stainless steel pins are safe to use in SCFE.

In our patient's case, we also struggled to remove titanium screws. Subtrochanteric fractures can be complications after removal of screws for femoral neck fractures in children. If there are no specific screw-related symptoms, one should consider leaving the screw in place and avoiding screw removal.

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