Backout of the Helical Blade of Proximal Femoral Nail Antirotation and Accompanying Fracture Nonunion

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abstract

This article describes a case of backout of the helical blade, a rare complication of proximal femoral nail antirotation. A 31-year-old man had sustained a trochanteric fracture of his right femur. Fracture fixation using proximal femoral nail antirotation and autologous bone grafting 7 months later were performed at another hospital. However, bony union was not obtained, and the patient's pain and limp persisted. Therefore, he presented to the current authors. A radiograph taken at presentation revealed backout of the helical blade and fracture nonunion. A radiograph taken 1 month later showed a more advanced backout of the helical blade. The authors performed exchange nailing supplemented with transplantation of peripheral blood CD34-positive cells and autologous bone grafting. The proximal femoral nail antirotation was revised to a long gamma 3 nail, and a U-lag screw was used to obtain better stability. The postoperative course was uneventful. The patient regained ambulation without pain or support at 12 weeks postoperatively. Radiographic bony union was completed 9 months postoperatively. At 1-year follow-up, he could run and stand on the previously injured leg and had returned to work.

Backout of the helical blade should be considered as a possible complication of proximal femoral nail antirotation. Incomplete fixation of the helical blade is the possible reason for backout. The use of a helical blade in young patients may cause difficulty in insertion and result in incomplete fixation.

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doi: 10.3928/01477447-20120725-31
Proximal femoral nail antitrotation is a new generation of procedures using short femoral nails for the treatment of trochanteric femoral fractures. The most notable feature of proximal femoral nail antitrotation is its helical blade, which is inserted into the femoral head. The helical blade is considered to provide better purchase and stability in osteoporotic bone compared with screws (eg, gamma nail).\(^1,2\) Proximal femoral nail antitrotation reportedly has good clinical results\(^1,4\) and is comparable with repair procedures using proximal femoral nails\(^5\) and gamma nails\(^6\) and dynamic hip screws\(^7,8\) However, it is not free from complications. Reported implant-related postoperative complications, especially those involving the helical blade, include cutout\(^1-3\) and perforation\(^9,10\) of the femoral head by the helical blade. This article describes a case of backout of the helical blade, a rare complication that was accompanied by fracture nonunion.

**CASE REPORT**

A 31-year-old man sustained a trochanteric fracture of his right femur by falling from the third floor of a building. Surgical fracture repair was performed at another hospital. The fracture was fixed using the Japanese proximal femoral nail antitrotation (Synthes, Tokyo, Japan) after closed reduction. The Japanese proximal femoral nail antitrotation is the implant that was improved for a better fit in Japanese femurs in terms of its proportion and size; however, the basic concept is the same as that for the proximal femoral nail antitrotation used in Western countries. The diameter and length of the nail were 9 and 340 mm, respectively. The length of the helical blade was 95 mm. Bony union was not obtained, and autologous bone grafting was performed 7 months postoperatively at the same hospital. In addition, low-intensity pulsed ultrasound and hyperbaric oxygen therapy were performed at the same hospital to enhance the bone healing.

However, bony union was not obtained, and the patient’s pain and limp persisted. Therefore, he presented to the current authors for further treatment. A radiograph showed backout of the helical blade and fracture nonunion (Figure 1). The patient was a smoker and an obese man with a height of 174 cm, weight of 95 kg, and body mass index of 31.4 kg/m\(^2\). He walked without aid, although he experienced pain and had a limp. The patient was instructed to use crutches until hospital admission. A radiograph 1 month later showed a more advanced backout of the helical blade (Figure 2).

The authors performed exchange nailing supplemented with transplantation of peripheral blood CD34-positive cells and autologous bone grafting. The transplantation of peripheral blood CD34-positive cells is a part of a clinical trial for the enhancement of bone healing approved by the Ministry of Health, Labour, and Welfare, Japan.\(^11\) The proximal femoral nail antitrotation was revised to a long Gamma 3 nail (Stryker, Tokyo, Japan). The diameter and length of the nail were 10 and 360 mm, respectively. A 100-mm-long U-lag screw (Stryker) was used to obtain better stability. The postoperative course was uneventful. The patient regained ambulation without pain or support at 12 weeks postoperatively. Radiographic bony union was completed 9 months postoperatively (Figure 3). At 1-year follow-up, he could run and stand on the previously injured leg and had returned to work cleaning high building windows.

**DISCUSSION**

This type of excessive backout of the helical blade is rare. An extensive literature review revealed only 2 descriptions of lateral blade migration in 2 previous reports.\(^1,6\) However, the details of these lateral blade migrations were not described, and no radiographs were presented.

The causative factor of fracture nonunion may be multifactorial. However, the authors suggest that the main factor in this case was insufficient stability of the fracture site and that the blade fixation was incomplete at the initial surgery. Backout of the blade subsequently occurred, resulting in the failure of the proximal femoral nail antitrotation fixation and loss of stability.

On the radiograph taken at presentation, a tiny gap was evident in the helical blade (Figure 4). The gap should be diminished to complete the fixation of the helical blade intraoperatively by tightening the blade end. The helical blade develops its fixation capacity via the tightening of its end. The surgeon who performed the initial surgery did not remember how he tightened the blade end; however, he had...
spent a long time inserting the blade because the bone was hard and inserting the blade was difficult. The insertion of helical blades is accomplished by driving the device into position using several blows from a mallet. This differs from inserting screws, which is accomplished by drilling and tapping the bone to create a path for the insertion. Therefore, insertion of the helical blade into this young patient’s hard bone was difficult. The authors speculate that the backout of the blade occurred because the tightening of the blade end and fixation by the blade were insufficient. This case may suggest that the use of helical blades may be limited to elderly patients with osteoporotic bones, who were the original targets of blade fixation.

In addition, the current authors analyzed the radiographs taken at injury, which were provided by the previous hospital (Figure 5). The fracture was an intertrochanteric multifragmentary fracture and classified into 31-A3.3 according to Orthopaedic Trauma Association classification. The authors suggest the main cause of backout is the incomplete fixation capacity of the helical blade caused by incomplete tightening of its end. However, the fracture was unstable, and unstable fractures may also result in non-union and backout.

 CONCLUSION

Backout of the helical blade should be considered as a possible complication of proximal femoral nail antitrotation. Incomplete fixation of the helical blade is a possible reason for backout. The use of a helical blade in a young patient may cause difficulty in insertion and result in an incomplete fixation.

REFERENCES