Use of Huckstep nail in the periimplant femoral shaft fracture

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ABSTRACT
87-year-old female underwent open reduction of distal femoral fracture and internal fixation with locking compression plate and bone graft. She was operated for ipsilateral proximal femoral fractures and stabilized by intramedullary interlocked nail 5 years ago. She developed stress fracture proximal to locked plate. We inserted Huckstep nail after removal of the previous operated proximal femoral nail without removing the remaining plate and screws. At 15 month followup the fractures have united. The Huckstep nail has multiple holes available for screw fixation at any level in such difficult situations.

Key words: Femur, Huckstep nail, periimplant fracture, stress riser

INTRODUCTION
Senile osteoporotic insufficiency or fragile fracture present difficult surgical challenge. The method of treatment is well established particularly in peritrochanteric fractures and femoral shaft fractures, but there is still a lot of ongoing debate about the fracture of distal part of the femur. Antegrade or retrograde nailing is less invasive and more physiologic, but anatomical reduction is difficult. On the other hand, plating is more appropriate for anatomical reduction in this area, but it leads to stress rising fracture in the proximal part of the plate. We report a case who were recently treated with locked compression plate for distal femoral fracture and developed a stress rising fracture proximal to the plate in early postoperative period in view of treatment dilemma.

CASE REPORT
An 87-year-old female patient had a comminuted spiral fracture of left distal femur [Figure 1]. She was treated in our hospital with closed reduction and intramedullary nailing (PFN, Synthes, Davos, Switzerland) for the left proximal femoral fracture 5 years ago. A bone density study with Q-CT before the operation revealed osteoporosis with T-score -4.4. After thorough preoperative evaluation, we performed open reduction and anatomical reduction using locking compression plate (LCP, Synthes) under general anesthesia. The tricalcium phosphate (β-TCP) synthetic bone graft substitute Polybone® (Hanmi, Seoul, Korea) was added at the fracture site because of intraoperative bony insufficiency [Figure 2]. The patient was discharged on a wheel chair on the 8th day after the operation. During home care on the 9th day after the operation, the patient reported pain mid thigh after a trivial fall while her family was moving her. On X-ray a fracture between the existing proximal femoral nail and fixed locking compression metal plate [Figure 3] was
diagnosed. It was a stress riser fracture. We decided to insert Huckstep nail after removing proximal femoral nail. The Huckstep nail was being used during ankle fusion by us. Comparing the hole of Huckstep nail to be used with that of the LCP from the previous operation, we were sure that the hole of Huckstep nail corresponded with the one of LCP. Fortunately, we confirmed preoperatively that and we could insert at least two distal interlocking screws through the hole of plate with a lot of distal holes of Huckstep nail. The operation was performed in lateral decubitus position under fluoroscopy. We removed the existing proximal femoral nail. We inserted Huckstep nail connecting to guide and withdrew the existing screws by previous incision of distal under plate. We had some difficulty with reinsertion of the removed screws. We matched the two holes of plate and nail under fluoroscope and inserted Steinmann pin as a guide pin and reinserted the previous screws. Then, we inserted three threaded screws into a transverse hole with a washer in the proximal part [Figure 4]. We mobilised the patient on a wheelchair for 2 weeks after the operation, and she left the hospital after the stitches had been removed in the 2nd week after the second operation. She was followed up for 15 months after she was discharged from the hospital [Figure 5].

**DISCUSSION**

Periprosthetic fracture generally occurs after knee joint or hip joint replacement. The incidence is about 0.3–5.5% after knee replacement and up to 30%1 after revision TKA. The periprosthetic fracture after total hip joint replacement is relatively rare compared with knee joint fracture and reported to be about 0.1–2%, and commonly occurs around a prosthesis tip.2 The periimplantar fracture, which occurs around a plate or a nail, is caused when a plate tip and a nail tip act as a stress riser, particularly in aged people. In this case we inserted a plate for distal fracture which was not overlapping the proximal nail inserted for proximal fracture in the same bone otherwise the proximal nail should have been removed and then inserted by a longer nail inserted in a retrograde manner. We consider this as iatrogenic fracture which could have been prevented. In aged people, stress riser fracture must be considered before and after operation. Huckstep nail may be a very useful solution in such cases. In case of using a conventional nail, the number of holes in the distal part is limited and many recent designs of femoral nail are anatomical nails considering anterior bowing, so there are...
a lot of restrictions in making the hole in the distal part corresponding with the hole in a plate.

Developed and used first in 1967, Huckstep nail is usually available for the management of femoral nonunions, rigid immobilization for entire femoral shaft fracture, severe comminuted fracture, a fracture of both femoral shaft and neck, a patient for early weight bearing, a case which needs lengthening by bone graft due to bone cyst, knee, elbow, ankle joint arthrodesis, and difficult fracture of tibia and humerus. Literature review shows that Kim et al. reported solid fixation by Huckstep nail in 19 cases of difficult femoral fracture and Cho et al. reported good results from 15 cases. Christie et al. reported good results from 120 femoral fractures, and Kuo-an et al. and Choi et al. reported good results on using Huckstep nail in knee joint fusion. Thus, in most cases, it is being used in difficult femoral fracture or knee joint fusion. Hwang et al. presented a case report about treating Shepherd’s crook deformity that occurred in fibrous dysplasia.

Huskstep nail in periimplantar fracture like we used, has never been reported so far. Huckstep nail is four-sided, intramedullary compression nail of solid titanium. The material is $\alpha-\beta$ titanium alloy, a mix of 6% aluminum and 4% vanadium. It is very biocompatible because its modulus of elasticity is just about half of those of stainless steel and chrome cobalt. Also, it is about 1.1–1.8 times stronger than average femoral bones. Square cross section makes medullary blood supply better to help bone healing. Three kinds of diameters are available; the most common diameters of a nail are 12.5 mm, 11.5 mm and 10.5 mm. The whole length of a nail has 4.6-mm transverse holes at 15 mm intervals, where 4.5-mm fine thread screw should be inserted. In the proximal part, there are four oblique holes at an angle of 130°, which enable insertion of a lag screw at the neck of femur in the proximal fracture of femur.

Periimplantar fracture is very challenging. Prediction and prevention are the most important in periimplantar fracture in aged people, and we may consider Huckstep nail if we need to conduct an operation again with plates and screws as they are. Of course, Huckstep nail has an advantage of having multiholes, but does not have a variety of lengths and diameters; and since it is a straight nail, there might be a lot of restrictions in severe femoral bowing of the aged. Since in case it was an early periimplantar fracture in previous fracture distal femur had not shown any union it was considered a good solution to keep the existing plates and screws as they are.

In conclusion, prevention of periimplantar fracture in aged people is important however if one confronts a situation like this than Huckstep nail may be a good alternative.

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