The Journal of Arthroplasty Vol. 28 No. 2 2013

New Surgical Treatment Using a Docking Nail for Postoperative Periprosthetic Femoral Fracture After Total Hip Arthroplasty

Shunji Nakano, MD, PhD, Shinji Yoshioka, MD, Fumitake Tezuka, MD, Masaru Nakamura, MD, Takashi Chikawa, MD, and Tateaki Shimakawa, MD

Abstract: We report 2 cases of patients (75 and 81 years old) who had a femoral shaft fracture around the femoral prosthesis after total hip arthroplasty. Using information on the implanted stem and the preoperative radiographs, we cut and trimmed an ordinary supracondylar type intramedullary nail, after which we have termed a "docking nail." We then performed osteosynthesis using the docking nail, which is connected to the tip of the implanted stem to ensure proper alignment. Within 3 months, bony union with good alignment was observed in both patients without malunion or infection. Clinical and radiographic examination during the follow-up period showed good results. The advantages of this method are that it is less invasive and simpler compared with the conventional methods. **Keywords:** periprosthetic femoral fracture, osteosynthesis, total hip arthroplasty, intramedullary nail, stem implant.

The number of hip prosthesis replacement surgeries, particularly in elderly people with osteoporosis, has been increasing every year. Although postoperative periprosthetic femoral fracture is an uncommon complication, its treatment has become a critical problem. The treatment is technically demanding, with a high frequency of complications and reoperations [1-4].

There are 2 main surgical options for the treatment of these fractures: revision arthroplasty and osteosynthesis. In cases involving a loosened prosthesis, revision arthroplasty is preferable. However, the procedure is applicable to a limited number of prosthesis types and fracture sites and is relatively invasive. Osteosynthesis is generally the procedure of choice for the surgical treatment of fractures, provided the stem prostheses do not show loosening. Stable fixation of a periprosthetic femoral fracture is difficult in the elderly; such patients have osteoporotic bone, and most of the intramedullary space is occupied by the metal stem implanted in the proximal femoral shaft. To solve this problem, we developed a new surgical treatment of postoperative periprosthetic femoral fracture. Our procedure involves trimming an ordinary supracondylar-type intramedullary nail, which we have termed a *docking nail* (Fig. 1).

Patients and Methods

Cases of periprosthetic femoral fractures diagnosed as type B1 or type C according to the Vancouver classification [5] were considered for our new surgical method using a docking nail. Informed consent was acquired from the patients and their family after explanation of the surgical procedure.

Using information on the size and shape of the stem prosthesis as well as information from preoperative radiographs, we placed an order with the manufacturer for a supracondylar nail of the appropriate length and trimmed it to suit the cutting site to ensure that it was compatible with the tip of the stem. We then performed osteosynthesis using the docking nail. Specifically, we inserted the docking nail through the femoral intercondylar notch in a retrograde manner and connected the docking nail with the stem tip to ensure proper alignment. We never impacted the nail forcefully, as this would tend to make stem unstable. When we encountered difficulty repositioning the bone or when it was necessary to remove excess cement and bone from around the tip of the stem and graft a free bone in the bony defect, we exposed the fracture site as minimally as possible. Postoperatively, immobilization was individualized as appropriate for fracture and fixation stability.

From the Department of Orthopedic Surgery, Tokushima Municipal Hospital, Tokushima, Japan.
Submitted February 7, 2012; accepted May 6, 2012.
The Conflict of Interest statement associated with this article can be found at http://dx.doi.org/10.1016/j.arth.2012.05.003.
Reprint requests: Shunji Nakano, MD, PhD, Department of Orthopedic Surgery, Tokushima Municipal Hospital, 2-34 Kitajosanjima-cho, Tokushima City, 770-0812, Japan.

0883-5403/2802-0021$36.00/0
http://dx.doi.org/10.1016/j.arth.2012.05.003

Fig. 1. Photograph of the docking nail, a trimmed commercial supracondylar intramedullary nail used for docking with the tip of the femoral stem component.

For example, a cast brace was used if huge mechanical stress focused on the docking site corresponded with the fracture site in Vancouver type B1 cases. Partial weight bearing was allowed at 3 weeks, and full weight bearing, at 12 weeks.

Case Reports

Case 1

The patient, a 75-year-old woman, fell down while walking and fractured the left femur. The fracture was type B1 classified by Vancouver (Fig. 2A).

Previously, the patient had undergone 2 surgeries at a different hospital: cemented bipolar endoprosthesis for traumatic necrosis of the femoral head and cemented revision total hip arthroplasty for loosening implants 8 years later.

Using information concerning the implants obtained from the previous hospital, where the patient had undergone surgeries, we determined the suitable size of the supracondylar nail and trimmed the nail to overlap a 3-cm length of the tip of stem. We removed bone cement around the tip of the stem by minimal exposure around the facture site. We could readily remove 10 cm of cement mantle and cement restrictor in the distal femoral intramedullary canal using chisels and a high-speed drill; then, we pushed and tapped out residual bone cement by inserting the intramedullary rod through the entrance of the fracture site in the orthodromic direction and through the entrance of the femoral intercondylar notch in the retrograde direction. The docking nail was inserted through the femoral intercondylar notch in a retrograde manner and was connected with the distal stem tip. We added transverse locking screws for fixation of the distal femur and supplemented with autologous and artificial bone grafts.

As this was the first case in which we used the docking nail, the patient was protected in a cast brace for 4 weeks and started partial weight-bearing ambulation 3 weeks after the operation. The 2-month postoperative radiographs showed callus formation at the fracture site without deformity (Fig. 2B). At the 3-year follow-up, the patient had no pain at the fracture site or in the hip region. Radiography showed bony union except on the lateral aspect (Fig. 2C).

Case 2

The patient, an 81-year-old woman with dementia, underwent primary cementless total hip arthroplasty for primary hip osteoarthritis. She fell and sustained a displaced oblique femoral fracture 3 cm distal to the stem tip, 5 years after replacement surgery (Fig. 3).

We trimmed a supracondylar nail to fit with the distal tip dimensions of the existing stem implant, using information concerning the type and size of the stem that was used originally. We exposed the fracture site to a minimal extent and removed sclerotic bone and debris around the tip of the stem. We confirmed that the docking nail was suitable for connecting with the tip of the stem (Fig. 4A). The docking nail was inserted in a retrograde manner and impacted onto the tip of the stem, and the nail was supplemented with locking screws at its distal end. The length of contact between the stem tip and the nail was 1 cm.

The patient started on partial weight-bearing ambulation without postoperative immobilization 3 weeks after the operation. Three-month postoperative radiographs showed that fracture healing was achieved without deformity (Fig. 4B). The patient had no pain at the fracture site or in the hip region until about 1 year after surgery when she died of an unrelated lung disease.

Discussion

The prevalence of postoperative periprosthetic femoral fractures has been reported to range from 0.1% to 5%, representing a prevalence of approximately 1% after the primary procedure and approximately 4% after revisions[2,6,7]. Treatment of these complications is difficult, and there is a need for improved techniques that are less invasive and more straightforward to perform.

The most widely used classification scheme for these fractures is the Vancouver system, which is used to identify treatment options [1,4,5]. However, Lindahl et