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Use of a long distally fixed intramedullary stem to treat a periprosthetic femoral fracture following total hip arthroplasty using a thrust plate hip prosthesis: A case report

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ABSTRACT

INTRODUCTION: The thrust plate hip prosthesis (TPP; Zimmer, Winterthur, Switzerland) is a hip prosthesis that is no longer in production. Few reports have focused on periprosthetic fractures following total hip arthroplasty (THA) with the use of a TPP.
PRESENTATION OF CASE: We report a 57-year-old woman with a periprosthetic femoral fracture 13 years after THA with the use of a TPP. A plain radiograph showed a displaced subtrochanteric fracture of the right femur just below the distal tip of the lateral plate without implant loosening. She underwent revision surgery with a long distally fixed intramedullary stem in conjunction with a plate and cable system. Three months after surgery, bone union was confirmed using radiography and the patient was clinically asymptomatic.
DISCUSSION: We encountered three major problems while planning surgical treatment, these being, discontinuation of the TPP system, loss of proximal femoral cancellous bone, and difficulties with the type of subtrochanteric fracture. After considering these problems, we planned revision surgery using a long distally fixed intramedullary stem in conjunction with a plate and cable system.
CONCLUSION: This case shows that sufficient implant preparation based on precise preoperative planning is necessary to obtain good clinical results for the surgical treatment of periprosthetic femoral fractures following THA with the use of a TPP.

1. Introduction

A periprosthetic femoral fracture following total hip arthroplasty (THA) is recognized as a severe problem because treatment of such fractures is technically demanding and is associated with a high frequency of complications, a high mortality rate, and incomplete functional recovery [1]. A previous study reported a significant association between the implant design and the risk for periprosthetic fractures [2]. Several surgical treatment methods including revision only, open reduction and internal fixation (ORIF) of the fracture, and revision combined with an ORIF are generally adopted according to the fracture patterns as classified by Vancouver categories [3].

In 1978, the thrust plate hip prosthesis (TPP; Zimmer, Winterthur, Switzerland) was developed based on the concept of proximal bone preservation. This prosthesis did not use an intramedullary stem, which is its most characteristic feature [4]. Therefore, this prosthesis had been mainly used in younger patients with a high possibility of requiring revision THA because of the longer lifespan of these patients [4,5]. In previous studies, the clinical and radiological results following THA using the TPP were satisfactory [5–10]. However, few reports have focused on examined periprosthetic femoral fractures after THA performed with the TPP.

We recently experienced a case involving a periprosthetic femoral fracture following THA performed using the TPP. The patient's clinical course and detailed surgical treatment are discussed in this report. Written informed consent for publication of the case was obtained from the patient and this work has been reported in line with the SCARE criteria [11].

2. Presentation of case

A 44-year-old woman (body mass index, 24.1 kg/m^2) with alcohol-associated osteonecrosis of the right femoral head (stage 4, Association Research Circulation Osseous staging system [12])

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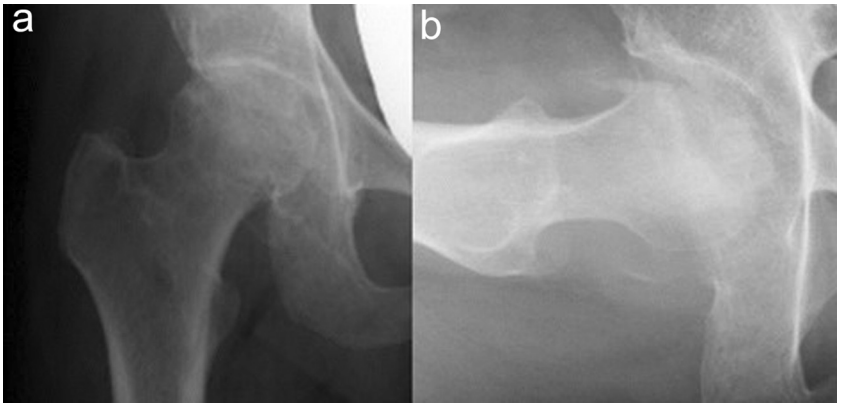

Fig. 1. Initial (a) anteroposterior and (b) lateral radiographs of the right hip showed osteoarthritis with joint space narrowing and collapse of the weight-bearing surface of the femoral head (stage 4, Association Research Circulation Osseous [ARCO] staging system).

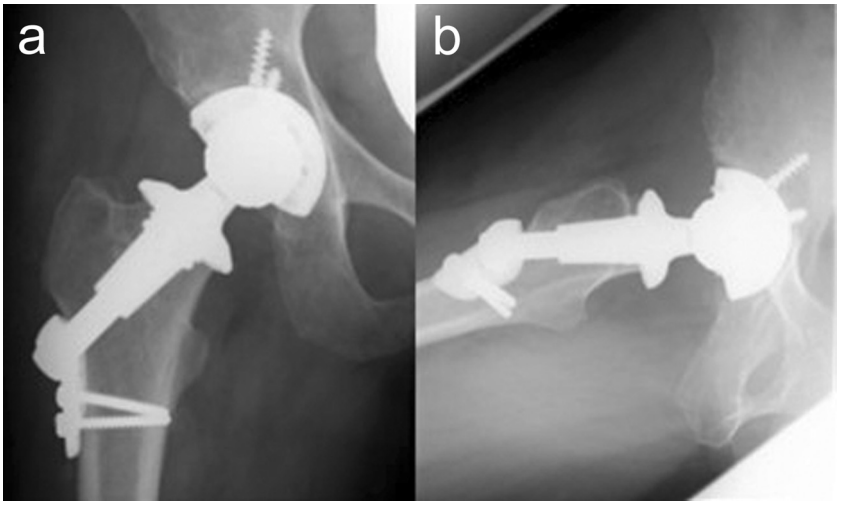

Fig. 2. (a) Anteroposterior and (b) lateral radiographs at the time of total hip arthroplasty (THA) with the thrust plate hip prosthesis (TPP). The insertion angle of the thrust plate to the femoral axis was 130° on the postoperative anteroposterior radiograph.

underwent THA with the use of a TPP at our hospital (Figs. 1 and 2). She had a history of alcohol consumption, but otherwise was healthy. The thrust plate was inserted at a femoral shaft-neck angle of 130° on an anteroposterior radiograph, which is reportedly the optimal insertion angle [13] (Fig. 2a). The thrust plate was placed in full contact with the medial cortical bone of the femoral head. The patient reported that her preoperative hip pain had resolved. Neither cup nor stem loosening was observed at annual clinical examinations.

Thirteen years after the THA, the patient slipped and fell to the floor and suffered a low energy trauma. She returned to our hospital where a plain radiograph showed a displaced subtrochanteric fracture of the right femur below the distal tip of the lateral plate without implant loosening (Fig. 3), which was classified as a type B1 fracture according to Vancouver categories [3]. The patient underwent revision combined with ORIF.

Intraoperatively, it was difficult to remove the TPP because of marked bone growth on the surface of the thrust plate. Thorough drilling around the thrust plate using a Kirschner wire was required to minimize the loss of cancellous bone at the proximal femur. Sufficient stability of the fracture sites was observed with the use of a long distally fixed intramedullary stem (K-MAX S-LOCK system; Japan Medical Materials, Osaka, Japan) in conjunction with a plate and cable system (Cable-Ready Greater Trochanteric Reattachment Plate; Zimmer, Warsaw, IN, USA) (Fig. 4). Partial weight-bearing walking was permitted 4 weeks after surgery, and full weight-bearing walking was initiated 2 months later. Bone union was radiographically confirmed 3 months after surgery. At her 18-month follow-up, the patient was mostly asymptomatic and her Harris hip score was 92 points.

3. Discussion

The incidence of periprosthetic femoral fractures is increasing as a consequence of broadening of indications for THA by including greater numbers of younger and elderly patients. This has resulted in an increase in periprosthetic femoral fractures following THA. In patients with periprosthetic femoral fractures, it is more difficult to obtain complete functional recovery than when primary THA is performed, and there is a higher possibility of complications such as massive bleeding and infection [2]. Additionally, periprosthetic femoral fractures are associated with a high 1-year mortality rate, exceeding 10% [14]. With respect to the correlation between the type of implant and risk for, or location of, periprosthetic fractures, a study performed by the Swedish Hip Arthroplasty Register reported that the Charnley flanged prosthesis (Cobra design) and Exeter prosthesis (polished) had a higher risk for periprosthetic fractures than did the Lubinus prosthesis (anatomically shaped) [2]. Löwenhielm et al. [15] reported that the fracture location differs depending on the implant design; the Lubinus prosthesis was more closely associated with distal fractures, and the Charnley prosthesis was more closely associated with proximal fractures.

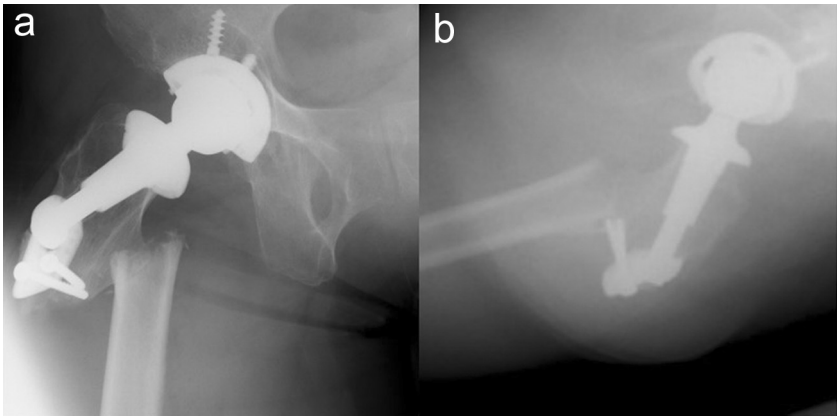

Fig. 3. (a) Anteroposterior and (b) lateral radiographs of right hip at the time of periprosthetic femoral fracture 13 years after the primary THA using a TPP. A displaced subtrochanteric fracture was seen below the distal tip of the lateral plate. Implant loosening was not observed around the medical cortex of the proximal femur.

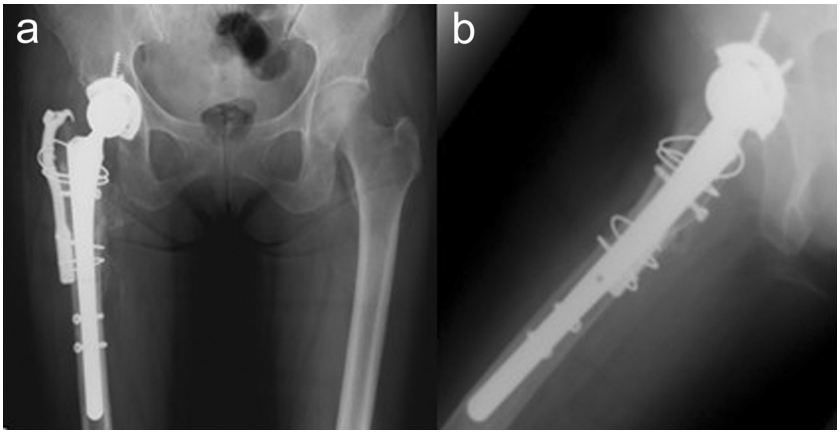

Fig. 4. (a) Anteroposterior and (b) lateral radiographs of the right hip after the revision surgery. The long distally fixed intramedullary stem was used in conjunction with a plate and cable system to obtain sufficient stability of the fracture sites.

Several varieties of bone-preserving hip prostheses, including hip resurfacing prostheses and those with a short femoral stem, have been developed for younger patients with a higher possibility of requiring revision THA in the future because of their long lifespan [16,17]. The TPP is also a hip prosthesis that is based on the concept of preserving the femoral diaphyseal bone [4]. High survival rates (90–98%) ranging from 2 to 17 years have been shown in previous reports [5–10]. The major reason for revision surgery following THA using a TPP is implant loosening in patients with conditions that cause bone fragility, such as rheumatoid arthritis [18]. Periprosthetic fractures can occur at various locations with an intramedullary stem, as shown in the Vancouver classification [3]. In contrast, a previous study [6] reported a periprosthetic fracture following the TPP that occurred at the same location (distal tip of the lateral plate) as in our case. Therefore, we consider that distal tip of the lateral plate is the most frequent location of a periprosthetic fracture following the TPP because of high mechanical stress. However, few reports have focused on surgical planning including implant selection and anticipated surgical difficulty [6–8,18,19].

We encountered three major problems while planning the surgical treatment in the current case. First, conversion to an extra-long lateral plate for ORIF was not available because the TPP system went out of production in 2008 [7,18,19]. Therefore, we had to remove the TPP and perform a revision with another prosthesis. Second, loss of the proximal femoral cancellous bone was of concern while removing the thrust plate because of enhanced bone growth on the surface of the thrust plate [6]. Finally, the subtrochanteric fracture was a transverse fracture, and stability and bone union of such fractures are difficult to obtain [20]. Considering these problems, we planned revision surgery with a long distally fixed intramedullary stem in conjunction with a plate and cable system.

4. Conclusion

The current case indicates that revision surgery with a long distally fixed intramedullary stem in conjunction with a plate and cable system is an optimal surgical method for the treatment of periprosthetic femoral fractures following THA using a TPP. This method should provide the necessary stability and bone union.

Conflict of interest statement

None.

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Ethical approval

The present case-report study was approved by review board in Kyushu University. (25-265)

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Author contribution

Dr. Hatanaka and Dr. Motomura collected data of this patient. Dr.Sonoda, Dr. Kubo and Dr. Utsunomiya analysed the data. Dr. Yamamoto and Dr. Nakashima supervised the writing. Dr. Hatanaka, Dr. Ikemura and Dr. Motomura were contributors in writing the manuscript. All authors read and approved the final manuscript.

Guarantor

Dr. Motomura.

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