Case Report

Knee Arthrodesis in Failed Total Knee Arthroplasty With Severe Osteolysis and Ipsilateral Long-Stem Total Hip Arthroplasty

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Abstract: We report a case of knee fusion after a failed total knee arthroplasty (TKA) with severe osteolysis including the epicondyle and ipsilateral total hip arthroplasty (THA) with long Wagner revision stem (Sulzer Orthopedics, Baar, Switzerland). The conventional devices for arthrodesis were unavailable in this case because of the long Wagner revision stem and poor bone stock. A connector was made between the long Wagner revision stem and an intramedullary nail (IM nail; Solco, Seoul, Korea). The custom-made connector was coupled with a femoral stem by cylindrical taper fit with additional cement augmentation and an intramedullary nail by screws. Osseous fusion was achieved without pain or instability. Key words: knee arthrodesis, total knee arthroplasty, osteolysis, total hip arthroplasty.

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There are a few treatment options for cases of a failed knee arthroplasty with an ipsilateral long hip arthroplasty. Treatment can be either a revision of the knee arthroplasty alone or a revision of both the knee and hip prosthesis. Knee arthrodesis can be used to treat a complicated TKA with bony osteolysis, multiple failed revisions, and resistant infection [1]. Many fixation devices have been introduced for arthrodesis such as dual compression plates, IM nail, external fixator, and Ilizarov fixator [2-5]. If a well-fixed ipsilateral hip prosthesis is close to the knee, it is difficult to use fixation devices commonly available. We present a case of knee fusion in a failed TKA with severe osteolysis and an ipsilateral THA with long stem, using the custom-made connector and an IM nail.

Case Report

A 72-year-old woman underwent bilateral TKA in 1988 for degenerative osteoarthritis and received a right total hip arthroplasty (THA) in 1997 for a femoral neck fracture. Four years after the THA, she underwent a revision THA with a long Wagner revision stem (Sulzer Orthopedics, Baar, Switzerland) as a result of loosening. Seven years after the primary total knee arthroplasty (TKA), she underwent a right revision TKA for instability. In 2006, she visited our clinic complaining of pain and disability that had gradually developed 6 years after the revision TKA. She had valgus deformity in her right knee and a gross varus deformity in her left. The range of motion was limited.

The physical examination revealed global instability in both knees. The radiographs showed severe loss of bone stock with osteolysis around the TKA femoral component. There was a type F3 bone defect including the lateral epicondyle in her right knee and a type F2 defect in her left knee according
to the Anderson Orthopedic Research Institute bone defect classification system [6]. The tibial component was rotated toward the medial side. There was a type T2 defect in both knees. In her right knee, although the distal tip of the long Wagner stem had penetrated the anterior cortex, there was no loosening around THA (Fig. 1).

A revision in such compromised femora might be accomplished using the technique suggested by Peters et al [7]. However, knee arthrodesis was chosen instead of a revision of both the hip and knee prosthesis for the following reasons. First, in the Republic of Korea, it is difficult to obtain or manufacture a custom-made component required for the revision. Second, the distance from the distal tip of the THA stem to the knee joint was too short to allow a secure fixation of femoral component of TKA. Third, revision of both the hip and knee prosthesis could be unsuitable when considering the patient’s advanced age with poor general condition and low level of activity although the modular devices can be obtained.

Therefore, a custom-made connector that could be connected both into long Wagner stem and intramedullary nail (IM nail; Solco, Seoul, Korea) was made, knee arthrodesis was performed in her right knee, and revision TKA was performed in her left knee.

**Surgical Technique**

A real-size template was used to determine the precise diameter and shape of distal portion of long Wagner stem and the custom-made connector was manufactured. The distal end of the long Wagner stem was made from titanium-aluminum-niobium alloy and was gradually tapered distally with multiple longitudinal ridges that could provide rotational stability. The custom-made connector was made of titanium and consisted of 2 parts, the inner side of the proximal part was cylindrical and size-matched by the distal tip of the long Wagner stem and could provide cylindrical taper fit between connector and long Wagner stem. The distal part had 2 screw holes that could be connected by screws to the IM nail (Fig. 2). The inner diameter of the proximal and distal part was 16 mm and 13 mm, respectively, and the thickness was 5 mm. A skin incision was made on the previous surgical scar. The femoral and tibial components of the previous knee arthroplasty were removed without additional bone loss. A bony window was made at the anterior cortex of the distal femur to expose the distal tip of the long Wagner stem. After making the bony window, the proximal part of connector was impacted into the distal end of the long Wagner stem. A secure cylindrical taper fit could be obtained and was augmented by additional cement fixation. After coupling procedure between connector and distal tip of long Wagner stem, IM nail was inserted distally into tibia through the exposed proximal tibia and proximally into the distal part of custom-made connector (Fig. 3).
Proximal locking was done by 2 screws between connector and IM nail. Once the leg length and rotation were carefully evaluated, distal locking was performed with 3 distal screws under fluoroscopic guidance. The remaining bone defect was filled with an allograft. Touch-down weight bearing was allowed for 6 months after surgery. We believe that the fusion is solid because the patient could walk without pain, and metal failure was not seen and bony trabeculae crossing the fusion site was observed on the last radiographs at postoperative 14 months (Fig. 4).

**Discussion**

Revision TKA or arthrodesis is common treatment option for a failed TKA. The bone defects are classified by the Anderson Orthopaedic Research Institute classification. Our case was a type III F3 defect, which showed a deficient metaphyseal segment including epicondyle and a reconstruction of the condyle and custom or hinged component would be needed.

The modular system was introduced in the limited condition of a failed TKA. Peters and colleagues [7] reported 7 revision TKAs with a stemmed component, which were linked to a well-fixed hip stem with a custom-made IM sleeve and suggested IM total femoral arthroplasty in the case of a severely compromised femora.

In our case, it was not considered necessary to perform revision THA because the patient had a securely fixed long Wagner stem. If revision TKA was performed, a customized hinged component would be needed because of massive bone defect including epicondyle. In addition, as the tip of the long Wagner stem reached about 6 cm proximal to the femoral component of the TKA, a special customized component that could be connected to existing stable long Wagner stem would be also needed. As mentioned above, we chose knee arthrodesis instead of a revision of both the hip and knee considering the low availability of a custom-made modular component for revision and the difficulty of secure fixation of the TKA to the long Wagner stem as a result of the short distance and poor bone stock.

The common options of arthrodesis for a failed TKA are dual compression plates, external fixator, and IM nail [2-5]. Nichols and colleagues [8] introduced a dual-plate technique and reported high fusion rate at a mean of 5.6 months.

Variable external fixators such as the Ilizarov device have been advocated as a method of arthrodesis since Chanley’s report [9]. However, plates and external fixators were not applicable in this case because of poor bone quality, loss of bone stock, and blockage by the long-stem. Intramedullary nailing is another useful method of arthrodesis with high fusion rates [3,10]. In addition, it provides immediate stability to allow early weight bearing [11]. A long IM nail has the advantage of providing stability across the long flexion-extension lever arm.

In addition, another type, a short IM nail such as Huckstep nail, Wichita fusion nail, and Neff nail

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**Fig. 3.** After connector was coupled with the long-stem THA by press-fit and an IM nail by screws. A, Postoperative radiogram of whole lower extremity. B, Intraoperative photograph.

**Fig. 4.** At 14 months postoperatively, follow-up radiograph revealed bony union. A, Anteroposterior view. B, Lateral view.
could be an excellent option for patients with an ipsilateral THA and provide high fusion rates [1]. However, these devices were unsuitable for this patient because of the mismatch of the nail and the long-stem of ipsilateral THA.

We felt the need for a new customized connector that can provide a stable connection between the securely fixed long Wagner stem and the IM nail. The proximal part of the customized connector was designed to allow cylindrical taper-fit with a long stem, and the distal part could be connected to the IM nail with screws.

Regarding the effect of the different metal composition between the connector and long stem, it is not believed that there will be any clinically significant hazardous effects because both had a similar metal composition. The former was made of titanium and the latter was made of titanium-based alloy.

Arthrodesis of knee in a difficult case was accomplished using the custom-made connector. It is believed that our customized connector might be a useful treatment option for knee arthrodesis in the case of a well-fixed long-stem THA.

References