Abstract
There are previous case reports in the literature that describe total knee and total hip arthroplasty (THA) in below-knee amputees, but we could find no case reports on above-knee amputees (AKAs) who have severe osteoarthritis of the hip. We present a case involving an AKA who developed severe osteoarthritis of the ipsilateral hip. Our patient underwent THA with a satisfactory postoperative outcome. Technical considerations for AKAs undergoing THA also are reviewed.

Patients with lower-limb amputations can have various musculoskeletal problems, such as osteoporosis (in the amputated limb), osteoarthritis (in the amputated or nonamputated limb), and spinal disorders. Both hip and knee arthroplasty in below-knee amputees (BKAs) have been described previously. We present a case of a patient who underwent total hip arthroplasty (THA) of the amputated limb as treatment for severe posttraumatic osteoarthritis. To our knowledge, there have been no other reports on above-knee amputees (AKAs) undergoing THA. The patient provided informed written consent for print and electronic publication of this case report.

Case Report
A 40-year-old man (body mass index, 54 kg/m²) previously had sustained bilateral pelvic fractures, a right acetabular fracture, and a mangled right lower extremity secondary to a war injury. He underwent an above-knee amputation for the latter condition, and since then, had managed to lead a relatively active lifestyle using a right lower limb prosthesis.

He presented 11 years postinjury with disabling posttraumatic hip arthritis affecting the right amputated lower limb. His use of the limb prosthesis became considerably limited and he needed to use axillary crutches for ambulating short distances. Clinical examination revealed hip flexion of 50°, external rotation of 10°, and internal rotation of 0°. Radiographs were consistent with severe posttraumatic arthritis of the hip joint (Figure 1). Preoperative templating confirmed that the above-knee femoral stump was of sufficient length to accommodate a standard diaphyseal locking uncemented femoral stem.

The patient was to undergo THA using a standard posterolateral approach (Figure 2). However, surgical dislocation was not possible because of significant posterior heterotopic ossification, a tight anterior capsule, and difficulty rotating and distracting the amputated lower limb. Standard trochanteric osteotomy was done, followed by in situ femoral neck osteotomy, and extensive capsular releases. Uncemented THA was then performed and the trochanteric osteotomy was secured using a trochanteric cable grip system.

Postoperative radiographs revealed satisfactory alignment of the implant components with good fixation of the trochanteric osteotomy fragment (Figure 3).

Figure 1. Preoperative anteroposterior radiograph of the 40-year-old man with a right above-knee amputation. He presented with extensive posttraumatic arthritis on the right side. There is a breach in Kohler’s line, which is indicative of acetabular protrusion deformity.
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Postsurgical stump edema and a conical stump shape were controlled by using rigid dressings, followed by the use of elastic bandages. The patient was prescribed a temporary prosthesis and allowed to weight bear as tolerated. The postoperative physical therapy program consisted of active, assisted range-of-motion exercises, isometric hip abductor strengthening, and progressive ambulation with a walker and then crutches. The patient later was fitted for an above-knee endoskeletal prosthesis (with ischial containment and total contact) that had a microprocessor-controlled knee. At the last follow-up (10 months), his hip flexion was 85°, abduction was 40°, and internal and external rotation was 30°. His Harris Hip Score was 90 and he was very satisfied with the THA outcome.

**DISCUSSION**

In AKAs, there are abnormal joint reaction forces, which can lead to degenerative hip arthritis on the amputated side.\(^1\)\(^2\)\(^5\) When compared to the general population, AKAs have an approximately twofold higher incidence of hip osteoarthritis in the normal lower limb, and a sixfold increased incidence in the amputated side.\(^2\) From the above descriptions, it would be evident that alternative surgical procedures (eg, synovectomy, osteotomy, and fusion) probably would have a limited indication and unpredictable outcomes in this group of patients.

Above-knee amputees with femoral fractures have had satisfactory outcomes following open reduction and internal fixation.\(^6\) Furthermore, fracture healing in AKAs is superior to that in BKAs because of diminished torque of the extremity.\(^7\) Also, we found 2 case studies of THA performed in BKAs that reported good clinical outcomes.\(^4\)\(^5\) In addition, gait analysis in THA recipients without previous amputations showed considerable postoperative increases in step frequency and walking efficiency.\(^3\) Therefore, it would be reasonable to expect that AKAs with hip osteoarthritis who already have compromised gait mechanics would benefit to an even greater extent from THA. The AKA in this report was able to achieve good functional recovery after THA and subsequently resumed a preinjury level of activity.

Based on a brief review of relevant literature and our limited experience from this case, we would like to suggest the following guidelines when AKAs are considered for THA:

1. It is important to critically review the indications for THA in the dysvascular amputee since it has been reported that they have a very poor rehabilitation potential.\(^9\)

2. Preoperative measurement of the patient’s residual limb length is important since it can predict rehabilitation potential.\(^6\)\(^10\) Implant templates should be used to confirm that the length of the femoral stump is sufficient to support the regular prosthesis.

3. When THA is done on the amputated limb, extensive soft-tissue releases may be required to address the significant hip flexion and/or abduction contractures.\(^11\)

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**Figure 2.** Patient was of a large body habitus (body mass index, 54 kg/m\(^2\)). Preoperative templating is important to ensure there is sufficient stump length to accommodate the femoral component.

**Figure 3.** Postoperative radiographs following a right total hip arthroplasty with a metal-on-metal bearing.
The possibility for trochanteric osteotomy must be anticipated; fixation with trochanteric grip devices should be used since trochanteric precautions would not be possible. However, in patients with moderate hip disease and minimal soft-tissue contracture, a traction pin may be considered to facilitate delivery and control of the hip joint.

(4) Following the use of prosthesis, the amputated limb would be subjected to significant joint loading during a gait cycle, thus implant fixation should be chosen to allow for full weight bearing.

(5) Femoral component malalignment in the amputated limb, such as retroversion, can be corrected cosmetically with prosthetic positioning. This, however, is not desirable since there is an increased predisposition to dislocation, compromised component survivorship, and abnormal gait kinematics (there are compensatory angular displacements in the hip). If the proximal femoral anatomy is normal, this should be used as a guide to determine femoral implant version. Following placement of the trial components, the component optimal rotation can be verified by Ranawat’s test; stability of the hip should be assessed intraoperatively using the Shuck test.

(6) Consideration should be given for larger femoral heads and alternative bearings to enhance hip stability and minimize wear in the high-demand AKA.

(7) For enhanced postoperative recovery, an aggressive physical therapy protocol, as well as input from a dedicated prosthetist, is crucial.

It has been noted that a majority of lower-limb amputees are able to regain mobility following major surgical procedures. Therefore, AKAs with debilitating hip arthritis should be considered as candidates for THA since the procedure can allow a return to prosthesis use, allowing the patient to regain mobility and to restore an independent lifestyle. The excellent clinical results described for this patient are encouraging for advocating the use of THA in AKAs presenting with degenerative disease of the hip. However, the long-term outcomes of THA in AKAs are not known at this stage.

**Authors’ Disclosure Statement**

The authors report no actual or potential conflict of interest in relation to this article.

**References**