Total Hip Arthroplasty in Patients With Above-Knee Amputation: A Case Report

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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.[1,2] Both hip and knee arthroplasty in below-knee amputees (BKAs) have been described previously.[3-5] 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/m^2) 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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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.

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.[8] 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.

Figure 3. Postoperative radiographs following a right total hip arthroplasty with a metal-on-metal bearing.

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]

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).[12] 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[13]; stability of the hip should be assessed intraoperatively using the Shuck test.[14]

(6) Consideration should be given for larger femoral heads and alternative bearings to enhance hip stability[15] and minimize wear in the high-demand AKA.[16,17]

(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.[5,6,18,19] 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

1. Burke MJ, Roman V, Wright V. Bone and joint changes in lower limb amputees. *Ann Rheum Dis*. 1978;37(3):252-254.
2. Kulkarni J, Adams J, Thomas E, Silman A. Association between amputation, arthritis and osteopenia in British male war veterans with major lower limb amputations. *Clin Rehabil*. 1998;12(4):348-353.
3. Pasquina PF, Dahl E. Total knee replacement in an amputee patient: a case report. *Arch Phys Med Rehabil*. 2000;81(6):824-826.
4. Prickett NM, Scanlon CJ. Total joint replacement in extremities with below-knee amputations. *Phys Ther*. 1976;56(8):925-927.
5. Salai M, Amit Y, Chechik A, Blankstein A, Dudkiewicz I. Total hip arthroplasty in patients with below-knee amputations. *J Arthroplasty*. 2000;15(8):999-1002.
6. Ficke AJ, Owens WF Jr. Femoral shaft fractures and the above-knee amputee: use of the compression plate. A report of three cases. *Clin Orthop Relat Res*. 1972;(87):200-203.
7. Pyka RA, Lipscomb PR. Fractures in amputees. *J Bone Joint Surg Am*. 1960;42-A:499-509.
8. Waters RL, Hislop HJ, Perry J, Antonelli D. Energetics: application to the study and management of locomotor disabilities. Energy cost of normal and pathologic gait. *Orthop Clin North Am*. 1978;9(2):351-356.
9. Denton JR, McClelland SJ. Stump fractures in lower extremity amputees. *J Trauma*. 1985;25(11):1074-1078.
10. Gottschalk F. Transfemoral amputation. Biomechanics and surgery. *Clin Orthop Relat Res*. 1999;(361):15-22.
11. Jaegers SM, Arendzen JH, de Jongh HJ. Changes in hip muscles after above-knee amputation. *Clin Orthop Relat Res*. 1995;(319):276-284.
12. Yang L, Solomonidis SE, Spense WD, Paul JP. The influence of limb alignment on the gait of above-knee amputees. *J Biomech*. 1991;24(11):981-997.
13. Ranawat CS, Maynard MJ. Modern techniques of cemented total hip arthroplasty. *Tech Orthop*. 1991;6:17-25.
14. Charnley J. *Low Friction Arthroplasty of the Hip: Theory & Practice*. New York, NY: Springer-Verlag; 1979.
15. Burroughs BR, Hallstrom B, Golladay GJ, Hoeffel D, Harris WH. Range of motion and stability in total hip arthroplasty with 28-, 32-, 38-, and 44-mm femoral head sizes. *J Arthroplasty*. 2005;20(1):11-19.
16. Kim SY, Kyung HS, Ihn JC, Cho MR, Koo KH, Kim CY. Cementless Metasul metal-on-metal total hip arthroplasty in patients less than fifty years old. *J Bone Joint Surg Am*. 2004;86-A(11):2475-2481.
17. Goldsmith AA, Dowson D, Isaac GH, Lancaster JG. A comparative joint simulator study of the wear of metal-on-metal and alternative material combinations in hip replacements. *Proc Inst Mech Eng H*. 2000;214(1):39-47.
18. Turney BW, Kent SJ, Walker RT, Loftus IM. Amputations: no longer the end of the road. *J R Coll Surg Edinb*. 2001;46(5):271-273.
19. Bowker JH, Rills BM, Ledbetter CA, Hunter GA, Holliday P. Fractures in lower limbs with prior amputation. A study of ninety cases. *J Bone Joint Surg Am*. 1981;63(6):915-920.