TOTAL KNEE REPLACEMENT IN PATIENTS WITH BELOW-KNEE AMPUTATION

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ABSTRACT

Total knee replacement (TKR) is reserved for patients with severe and disabling arthritis that is non-responsive to conservative measures. Based on existing data, total knee replacement is a safe and cost-effective treatment for alleviating pain and improving physical function in patients who do not respond to conservative therapy. Despite the large variation in health status of patients and types of prosthesis implanted, total knee replacement has proven to be a relatively low risk and successful operation. Each year in the United States surgeons perform approximately 300,000 TKR.[1] Likewise, lower extremity amputation is commonly performed in the United States with an annual incidence of 110,000 per year.[2] Nearly 70% of all lower extremity amputations are performed as the result of chronic vascular disease, followed by trauma (22%), congenital etiology and tumor (4% each).[3] Approximately 50% of all lower extremity amputations are performed secondary to complications from Diabetes Mellitus.

Norvell et al. demonstrated that patients who have previously undergone transtibial amputation and ambulate with a prosthesis are more likely to develop degenerative joint disease in the contralateral extremity than the ipsilateral extremity.[4] Further, radiographic changes consistent with osteoporosis have been demonstrated in up to 88% of limbs that have undergone transtibial amputation.[8] To our knowledge, there have been only three reported cases of total knee replacement in patients with ipsilateral transtibial amputation.[5-7] The purpose of the present study is to review the existing data on total knee replacement in patients who have undergone transtibial amputation. Further we present a patient with a transtibial amputation who underwent contralateral total knee replacement.

LITERATURE REVIEW

A review of the current literature identified three case reports of total knee replacement in patients with ipsilateral below-knee amputation.[5-7] Each report described a patient who developed degenerative osteoarthritis that was unresponsive to conservative therapy and were indicated for TKR. The studies differed in their approach to alignment of the tibial cut, rehabilitation after the procedure, and timing of the contralateral TKR. Pasquina et al. reported a case of a seventy-six year old man who underwent BKA for chronic osteomyelitis.[6] He developed OA in the ipsilateral knee and after failing conservative treatment underwent TKR. Prior to the procedure he was fitted for prosthesis with a larger socket to accommodate for post-operative swelling. He began physical therapy on post-operative day one and by post-operative day four was advanced to weight bearing as tolerated in the modified prosthesis. They reported an excellent surgical outcome (Table 1). The patient subsequently underwent TKR of the contralateral extremity.

Crawford et al. reported an eight month follow-up of bilateral total knee replacements in a seventy-five year old woman with a right BKA. They initially performed TKR of the contralateral limb followed by the ipsilateral limb four years later. Intra-operatively, when performing TKR on the ipsilateral limb, the knee was maintained in full flexion with the assistance of a sterile polystyrene packaging box. Despite limited insertion, an intramedullary guide rod was utilized to align the tibial cut. The patient remained non-weight bearing for six weeks following surgery (Table 1).

Konstantokos et al.[5] reported a man in his early 40s who was indicated for a TKR who had previously undergone ipsilateral BKA for a non-united open tibia fracture. Pre-operatively a modified prosthesis for his BKA was created to stabilize the tibia during the procedure. Intra-operatively an extramedullary jig was aligned with the prosthesis for the tibial cut. The patient underwent standard physical therapy and remained NWB for three weeks post operatively to allow for wound healing. They also reported an excellent functional outcome (Table 1).

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TABLE 1. Summary of Case Reports of TKR Performed in Patients with Ipsilateral BKA

Authors	Demographics	Residual Tibia	Surgical Technique	Rehabilitation	Functional Outcome
Pasquina et al. 1999[6]	76 year old male	17cm	Cemented TKR without discussion of maintaining tibial alignmenty	Weight bearing as tolerated on post-operative day 4 in modified prosthesis	• Independent ambulator • 0-105° flexion arc
Crawford et al. 2003[7]	75 year old female	12.5cm	Cemented cruciate-retaining TKR using sterile box to maintain flexion and tibial	Non-weight bearing for 6 weeks	• Independent ambulator with crutches to 100 yds • 10-115° flexion arc • Knee Society score 53 to 85 • Function Score 0 to 40
Konstantokos et al. 2008	male in early 40s	17cm	Posterior stabilized cemented TKR using a sterile customized prosthesis to support the tibia and maintain alignment	Non-weight bearing for 3 weeks	• 0-120° flexion arc • Knee Society score 44 to 80 • Function Score 10 to 40

CASE REPORT

A sixty-seven year old man presented to our institution in 2006 with severe posterior and medial knee pain of approximately one year duration. The patient had previously undergone a contralateral total ankle replacement which became infected and required a below knee amputation in 1999. At baseline he ambulated with the assistance of a cane. Radiographs at the time of presentation demonstrated Grade 4 osteoarthritis. Initial conservative therapy including activity modification, heel wedge, multiple Synvisc injections, non-steroidal anti-inflammatory drugs (NSAIDs), Ketorolac, and quadricep strengthening exercises provided only transient relief.

Given his ongoing pain and disability he was indicated for and underwent a posterior-stabilized total knee replacement. The procedure was uncomplicated. Postoperatively he underwent standard physical therapy without limitation due to his contralateral BKA. At his latest follow-up (6 weeks) his range of motion was 5-115 degrees he reported improved function and was ambulating without assistive devices.

DISCUSSION

Patients who present with symptomatic knee osteoarthritis after previously undergoing below knee amputation offer a unique challenge for orthopaedic surgeons. The aforementioned cases demonstrate that despite varying approaches this procedure can be performed safely and effectively. Two reports discussed the challenge of achieving adequate alignment of the tibial component.[5,7] Crawford et al. reported the use of a sterile polystyrene box to maintain flexion with the use of an intramedullary alignment guide.[7] The length of residual tibia limits the utility of this method. Konstanakos et al.[5] utilized a custom prosthesis intra-operatively to maintain tibial alignment. They argued that this provided a greater fulcrum to measure alignment, which may be particularly useful for patients with less residual tibia. Regardless of technique, it has been shown by Ritter et. al. that post operative tibial malalignment leads to an increased failure rate in TKR and demands careful consideration.[9]

The reports also differ in their post-operative protocol, specifically the time to full weight bearing. Pasquina et al.[6] advanced their patient to full weight bearing on post-operative day four with use of a temporary prosthesis, while the other patients remained non-weight bearing for three and six weeks post-operatively. Restrictions on return to full weightbearing were related to concerns regarding soft-tissue healing. No reports of wound complications were noted.

Another interesting difference was the timing of TKR in patients with BKA. Norvell et al. demonstrated in a large group of veteran traumatic amputees that the prevalence ratio of symptomatic knee arthritis in the intact limb was 1.4 as compared to only 0.1 for the knee of the amputated limb. They argued that compensatory gait alterations shifted loads away from the amputated limb increasing cumulative stresses seen across the intact limb.[4] Crawford et al.[7] in a patient with bilateral disease elected to perform a staged TKR beginning with the contralateral limb, followed by TKR of the ipsilateral knee. They felt that this enabled more comfortable weight bearing on that leg when attempting to mobilize following the second knee replacement. Another potential advantage cited by the authors was that an overall improvement in function following the first knee replacement may deter the patient from undergoing a further, more difficult joint replacement on the amputated leg. We described a patient with degenerative osteoarthritis in the contralateral extremity that failed conservative modalities and underwent successful TKR. Despite conflicting reports in the literature concerning the sequence of TKR in patients with BKA it should be noted that good outcomes where achieved regardless.

CONCLUSION

Total knee replacement has proven to be successful in alleviating pain and improving physical function in patients with debilitating arthritis. Given the incidence with which below knee amputations are performed, orthopedic surgeons are likely to encounter this unique situation with increasing frequency. We reviewed three cases that offer different approaches to determining optimal tibial alignment, post-operative rehabilitation, and management of symptomatic arthritis in patients with a BKA. We further reviewed our own experience of a patient who underwent a TKR opposite the side of a BKA. These cases demonstrate that TKR should be considered a practical treatment alternative for patients with debilitating arthritis following BKA who have exhausted conservative modalities.

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