Maintaining Function After an Amputation Revision: A Case Report

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ABSTRACT

Revision to a higher amputation level is a common procedure most often necessitated by injury to the residual limb, infection, ulceration, incision dehiscence, or critical limb ischemia. It is possible that a patient could actually increase functional status after an amputation revision, and this report documents the functional status of an individual before and after an amputation revision from the transtibial level to the transfemoral level due to critical limb ischemia and suggests possible causes of his success. Three assessments, the Locomotor Capabilities Index with a 5-point scale (LCI5), Instrumental Activities of Daily Living (IADL), and Amputee Mobility Predictor with a prosthesis (AMPpro), were administered 1 month before the revision and 3 months later. His LCI5 score increased by 10 points, the AMPpro score increased by 9 points, and the IADL status remained constant. There are several factors that likely contributed to this patient's success as a transfemoral amputee. First, this patient was 49 years old, and his first amputation was the result of a trauma, so he had a statistical advantage over most amputees. Second, the patient was highly motivated and well supported by his family. Finally, the patient was treated by a multidisciplinary team of prosthetists, physicians, and physical therapists who regularly reviewed his goals and progress. With each of these factors in place, the patient actually increased his functional status after the amputation revision. (J Prosthet Orthot. *2013;25:95-97.)*

Revision to a higher amputation level may occur because of injury to the residual limb, infection, ulceration, incision dehiscence, or critical limb ischemia.[1,2] Amputation revisions are common, occurring after approximately 20% of transtibial amputations.[1] Surgeons suggest additional transfemoral amputation for some patients with comorbidities such as peripheral vascular disease and diabetes because research suggests that transfemoral amputations have a higher success rate than transtibial amputations do.[3,4] However, the loss of the knee joint has been correlated to a decrease in ambulation and a potential loss of independent living status.[1] Therefore, one challenge faced by patients and prosthetists is the maintenance of mobility after an amputation revision to a higher level.

Little research has been conducted regarding the functional outcome of a patient after a failed transtibial amputation, and what has been published has yielded contradictory results. In the study of Stasik et al.[1] of nine patients who transitioned from transtibial to transfemoral amputations, none ambulated after the second amputation. Conversely, Cruz et al.[4] found that the 27 patients who transitioned to transfemoral amputation were the group with the highest percentage of ambulatory patients overall. Of the group, 21% of the patients were able to walk after amputation, which was higher than in the other groups being tested.[4] Statistically, there are factors that can help predict a patient's likelihood of success with a prosthesis. For instance, persons with trauma-related amputations are more likely than vascular amputees to walk after surgery,[5] and younger patients have been shown to be more successful with a prosthesis6 than older ones are. However, it is unclear what factors predict success during the rehabilitation process after a revision.

The following case report describes one patient's improved capabilities after undergoing an amputation revision to the transfemoral level after 17 years as a transtibial amputee.

CASE PRESENTATION

The subject in this case is 49 years old, is 6 ft tall, weighs 203.6 lb, and has type II diabetes. His other comorbidities include arthritis, lower-back pain, and occasional seizures. The patient's initial amputation at the transtibial level occurred in 1991 as a result of a motorcycle accident.

After his transtibial amputation, he was classified as a K4 ambulator by a physical therapist and his attending prosthetists. Ambulation was of particular importance to this patient because of his occupation as a local semi-truck driver and manual laborer. He continued towork for 17 years after the initial amputation.

He began experiencing sustained severe ischemic pain in 2010. Over the course of approximately 1 year, the patient attended regular appointments with his vascular surgeon, during which he was given the option to elect for a transfemoral amputation or continue experiencing pain from his debilitated limb. The patient's poor circulation within his residual limb eventually led to cellulitis, which was the final contributing factor to his transfemoral amputation. The amputation occurred in 2011 and was a transtibial to transfemoral conversion because of compromised blood supply to the distal portion of his residual limb.

TREATMENT

Immediately after the second amputation, the patient used crutches for assistance while walking. Less than 2 weeks after the amputation, the patient expressed interest in physical therapy to regain function. He attended therapy twice a week and was compliant with the physical therapist's recommendations for at-home exercise. The patient was focused on outcomes during physical therapy. For instance, he practiced sitting and standing both with and without his cane while holding a 10-lb weight so that he could hold his grandchildren. The patient progressed rapidly and was fit with a microprocessor-controlled knee 2 months after the amputation.

ASSESSMENT

Three assessments, the Locomotor Capabilities Index with a 5-point scale (LCI5), Instrumental Activities of Daily Living (IADL), and Amputee Mobility Predictor with a prosthesis (AMPpro), were administered to quantify patient progress 1 month before the amputation revision and 3 months later at physical therapy discharge.

The LCI is part of the Prosthetic Profile of the Amputee, but it can be used separately,[7,8] and a five-point scale was added to increase its effectiveness.[9] It asks the patient to rate his/her ability to perform certain tasks such as stepping off a curb or walking up a few steps without a handrail. The LCI5 has been proved to demonstrate good internal, test-retest reliability, and construct validity.[10,11] Researchers have concluded that this test is useful for determining the type of interventions to be used in rehabilitation but that it may not accurately assess the true function of the individuals within their community.[9] For this reason, it was used in conjunction with two other assessments.

The IADL is an instrument that measures the ability of an individual to live and care for himself/herself independently. Although it is not amputee specific, this test provides a general foundation for understanding patient debilitation. It is designed to assess everyday functional competence.[12]

The AMPpro is used to quantitatively measure patient function. The patient performs tasks such as standing from a seated position, walking up and down stairs, and reaching for an object. Scores are given based on the patient's ability to complete the task regardless of assistive devices used. The AMPpro has been proved comparable with the traditional 6-minute walk test and is a valid measure of amputee ability with or without a prosthesis.[13] It is most often used to determine the initial K-level of a patient, but it is possible to show functional improvement by using repeated AMPpro tests.[14] Little equipment and space are needed to conduct this test, making it a measure that can be used frequently throughout the clinical rehabilitation process to monitor improvement.[13,10]

OUTCOME

After the revision, the patient improved from a K2 to a K4, the highest level of ambulation (Table 1). After the amputation revision, the patient ambulated comfortably about the gym for approximately 100 ft while using his cane. His gait was smoother than before the revision, and he also appeared more stable while walking on inclined surfaces. His LCI5 scores increased by 10 points, which is higher than the minimum detectable change (MDC) found in the literature.[11] His AMPpro scores increased by 9 points, well outside

its reported MDC of 3.4 points.[14] The patient's IADL score remained constant.

Test	Before revision	After revision
LCI5 (out of 56)	44	54
IADL (out of 8)	5	5
AMPpro (out of 47)	34	43

LCI5, Locomotor Capabilities Index with a 5-point scale; IADL, Instrumental Activities of Daily Living; AMPpro, and Amputee Mobility Predictor with a prosthesis.

Table 1. LCI5, IADL, and AMPpro scores before the revisional amputation and at therapy discharge after the revisional amputation

DISCUSSION AND CONCLUSIONS

The purpose of this report is to determine if functional level is affected by an amputation revision. The LCI5 and AMPpro results indicate significant improvement in ambulation in the 4 months after the patient's revision surgery. The stagnant nature of the IADL assessment suggests that it was inappropriate for use with this patient, who never previously prepared food, went shopping, or did laundry. Scores greatly improved at the second administration of the LCI5, in which the patient indicated he was more confident performing nearly all tasks without assistance. The performance-based AMPpro results confirmed the patient's estimation of his increased capability.

There are likely several factors that contributed to this patient's successful revision to transfemoral amputation. These factors include demographics, motivation, continued care, and regular physical therapy appointments. At only 49 years old, this patient is much more likely than an older patient to be physically capable of ambulation, because age has been shown to be the most powerful predictor of effectiveness and autonomy in mobility.[6] His original amputation was the result of trauma, unlike most amputees who lose their limb because of disease,[15] and research suggests that this patient's success may be due in part to the cause of his amputation.[5,16]

This patient was highly motivated and supported by his community and family. For him, motivation was the thought of holding his first grandchild without worrying about losing his balance and falling. His success is consistent with the research ofUnwin et al.,[17] which found that social support is amore significant predictor of success than pain, age, sex, amputation level, or cause of amputation.

The continual measuring and monitoring of this patient's progressmay also be a contributing factor to his patient's success because it may have further inspired the patient to work harder at his exercises than he may have done otherwise. Because his improvement was documented with quantitative assessments, the patient was able to see the direct effects of practicing the exercises at home. The patient regularly attended recheck appointments, so contact and focus were maintained even when other health issues caused complications. Upon discharge from therapy, all initial goals were not only met but also surpassed. The physical therapist, the prosthetist, and the patient reviewed and recorded his functional goals several times a month, and the patient stated that this helped him stay focused and motivated. Unfortunately, the authors could find no literature investigating the link between quantitative progress tracking and the highest level of mobility.

One limitation that must be considered is the fact that only one patient was involved in this case. Additional

patients need to be evaluated to further understand how functional level is truly affected by higher level amputation. Furthermore, the patient's extremely high scores on the LCI5 and AMPpro indicate possible ceiling effects. Work is under way to develop assessments for higher-functioning patients,[18] but they need to be independently validated before they can be used for research purposes.

The highly successful patient highlighted in this report serves as a positive case of an amputee effectively overcoming obstacles and regaining mobility with continued follow-up, rehabilitation, and participation.

CONSENT

Written informed consent was obtained from the patient for publication of this case report and accompanying images.

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