THESIS ABSTRACT

LOWER LIMB AMPUTATION IN PATIENTS WITH VASCULAR DISEASE: INCIDENCE, POSTOPERATIVE CARE, AND PROSTHETIC FUNCTIONAL OUTCOME WITH FOCUS ON TRANS-TIBIAL AMPUTATION

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Degree program: PhD

ABSTRACT

The objectives of this thesis were to:
1. estimate the overall and age and gender-specific incidence rates of initial amputation, re-amputation and contra-lateral amputation, performed for peripheral vascular disease, in the at-risk Diabetic and nondiabetic general population;
2. investigate the mortality rate after lower limb amputation performed for peripheral vascular disease and after initial trans-tibial amputation;
3. introduce a Swedish version of the Locomotor Capabilities Index and evaluate its reliability and validity in patients who have undergone lower limb amputation;
4. compare a new rigid dressing with conventional Plaster of Paris rigid dressing after transtibial amputation with regard to the number of days to prosthetic fitting and function with a prosthesis;
5. evaluate the outcome of a new standardized treatment strategy in trans-tibial amputation in patients with peripheral vascular disease with regard to rate of prosthetic fitting and function with prosthesis and analyse potential baseline predictors of good walking ability with prosthesis.

This thesis is based on the following papers which will be referred to in the text by their Roman numerals:
I. Incidence of lower-limb amputation in the diabetic and nondiabetic general population: a 10-year population-based cohort study of initial unilateral and contralateral amputations and re-amputations.
II. The Locomotor Capabilities Index: validity and reliability of the Swedish version in adults with lower limb amputation.
III. Comparison of vacuum-formed removable rigid dressing with conventional rigid dressing after trans-tibial amputation: similar outcome in a randomized controlled trial involving 27 patients.
IV. Outcomes of a standardized surgical and rehabilitation program in trans-tibial amputation for peripheral vascular disease: a 10-year prospective cohort study.

CITATION


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KEYWORDS

Prosthetics, Rehabilitation, Amputee, Lower limb amputee, Prosthetic socket, Transtibial, Below knee,
The current prevalence of persons amputated at transmetatarsal level or higher in Sweden can be estimated to be between 5000 and 5500 persons (approx. 0.06 % of the population). The majority of these are patients with vascular disease (≈ 80%). In Sweden between 1000 and 1100 new amputees can be expected every year. Less than 5% of all amputations will be related to causes other than vascular disease.

Lower limb amputation (LLA) in patients with vascular disease may not only be a highly disabling surgical procedure but also costly in hospital management. The incidence differs between countries due to age structure of the population, prevalence of vascular disease and the prevalence of diabetes.

In Paper I we prospectively evaluated LLA performed at transmetatarsal level or higher during 10 years. The overall incidence of initial unilateral amputation in the diabetic population was eight times higher compared with that in the nondiabetic population (195 vs. 23 per 100,000 person years). The incidence of contralateral amputation among diabetic amputees was 17 and among the nondiabetic amputees 13 per 100 amputee-years. The most frequent contralateral amputation level among the diabetic and nondiabetic patients was trans-tibial. The incidence of re-amputation among the diabetic amputees was 19 and among the nondiabetic amputees 14 per 100 amputee-years. The most frequent re-amputation level among diabetic patients was trans-tibial and among nondiabetic patients was trans-femoral. The 1-year mortality rate, adjusted for age and gender, did not differ significantly between the two groups.

In Paper II we introduce a Swedish version of the Locomotor Capabilities Index (LCI) outcome instrument and evaluate its reliability and validity. Following the process of translation and cultural adaptation, the Swedish version of the LCI was found to be reliable and valid instrument that can provide a standardized measure of amputee-centered outcomes. The high ceiling effect of the LCI may imply that it would be most useful in assessing amputees with low to moderate function abilities.

In Paper III we tested two different dressings after trans-tibial amputation, the conventional rigid dressing of plaster of Paris and a new vacuum formed removable rigid dressing. The primary outcome measure was time to prosthetic fitting while the secondary outcomes included function with the prosthesis 3 months after amputation measured with the LCI and the Timed “Up and Go” (TUG) test. Twenty-seven consecutive patients were included and prosthetic fitting was achieved in 23 patients (mean age 76 years). The same postoperative treatment and rehabilitation was applied in both groups. To minimize the possible influence of using different types of prostheses in measuring functional outcome ICEX prosthetic sockets were used in all patients. The new vacuum-formed removable rigid dressing appeared to yield similar results regarding wound healing, time to prosthetic fitting and function, rate of socket changes during the first year or return to previous dwelling when compared with conventional plaster of Paris rigid dressing.

In Paper IV we prospectively evaluated the outcome of a standardized surgical and rehabilitation program in trans-tibial amputation in a large consecutive and population-based series of 219 patients. We analyzed the outcome regarding rate of prosthetic fitting, walking ability and mortality. A circular, plaster of Paris rigid dressing was applied by the surgeon in the operating room. This rigid dressing was removed after 5 to 7 days and compression treatment with a silicone liner was started. Ambulation with an ischial weight bearing training prosthesis was started when the plaster of Paris dressing was removed, with no load on the residual limb. A prosthetic socket that is cast and made directly on the residual limb using pressure casting technique, resulting in a definitive socket was used. Functioning was defined as good if the patient wore the prosthesis daily and was able to walk alone or with assistance outdoors or alone indoors. Functioning was defined as poor if the patient did not wear the prosthesis daily and was unable to walk indoors without assistance or used a wheelchair most or all the time or did not receive prosthesis. All prostheses were produced and delivered on the same visit to the prosthetic workshop. More than half of all amputees could be fitted with a prosthesis after a median time of six weeks and almost two-thirds of these have good function 3 months after amputation and the functional status remained unchanged at 1 year. Of the patients who could walk with or without an aid prior to the amputation and who survived at least 90 days after amputation, more than 80% could be provided with a prosthesis with 68% achieving good function. These patients can expect a median survival of approximately 3.5 years.
CONCLUSIONS
In the general population aged 45 years or older, the incidence of vascular lower limb amputation at or proximal to the transmetatarsal level is 8 times higher in diabetic persons than in nondiabetic persons. One in four amputees may require a contralateral amputation and/or re-amputation. Almost half of these patients died during the first year after initial amputation. When adjusted for age and gender no difference was found between diabetic and nondiabetic patients.

• The Swedish version of the Locomotor Capabilities Index (LCI) demonstrated good reliability and validity in adult amputees but the high ceiling effect may imply that it would be most useful in assessing amputees with low or moderate functional abilities.

• The use of a vacuum-formed removable rigid dressing compared with conventional plaster of Paris rigid dressing after trans-tibial amputation showed that the two dressings appear to yield similar results regarding time to prosthetic fitting. No statistically significant differences regarding wound healing, functional outcome after 3 months, rate of socket changes during the first year or return to previous dwelling at 1 year were observed. An easily applicable and removable vacuum-formed rigid dressing can be favorably used as an alternative to conventional cast rigid dressing after trans-tibial amputation.

• Evaluation of a new surgical and rehabilitation strategy in initial unilateral trans-tibial amputation in patients with PVD demonstrated that more than half of all amputees can be fitted with a prosthesis after a median time of six weeks. Almost two-thirds of these patients can obtain good function 3 months after amputation. Among amputees who could walk before the amputation and were fitted with prosthesis no baseline factors were found to be significantly associated with good function with prosthesis. The fitted patients can expect a median survival of approximately 3.5 years.

AUTHOR SHORT SCIENTIFIC BIOGRAPHY
Anton Johannesson is a European certified Prosthetist and Orthotist, graduated from the University of Jonkoping in Sweden 1990. He was previously the founder (1993), partner and CEO for Orthopedic Technology Inc. in Kristianstad, Sweden. Since 2014 he has served as a Clinical Manager Prosthetics at Össur Scandinavia, implementing new technique and education within the service part of the company and in cooperation with Össur R&D. In 2009 he finished his PhD in orthopedic from University of Lund, Sweden. The title of the Thesis was “Lower Limb Amputation in Patients with Vascular Disease: Incidence, postoperative care, and prosthetic functional outcome with focus on trans-tibial amputation” and this work has contributed to better understanding of the importance of well-defined postoperative treatment after limb amputation.