THE EFFECTS OF SELECTIVE SEROTONIN REUPTAKE INHIBITORS ON MOTILITY OF PERIPHERAL SMOOTH MUSCLES

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ABSTRACT

According to the World Health Organization, part of the quality of life is the perception of one's body concerning the culture and values of each individual. Limb amputation affects the quality of life through several defined aspects. Observing the available statistical data, after the amputation of the lower extremities, only 65% survived the first year, 52% survived the first two years, 37% survived three years, and five or more years, only up to 15% of patients with amputated limbs. Epidemiological data on the frequency of lower limb amputations are pretty similar to those in developed countries. Modern prostheses enable daily use, intending to replace the missing limb. Many factors influence the outcome of rehabilitation treatment and the result of functional recovery. Among the factors that influence the favorable outcome of rehabilitation and independence in activities of daily living is the level of amputation, age, and comorbidities. For patients after amputation of the lower extremities, the goal in rehabilitation is to achieve as much independence as possible within the activities of daily life. Our study aimed to examine daily functionality and activity through the Barthel and functional independence indices-FIM tests during post-operative rehabilitation and after one month.

Keywords: *Amputation, Barthel index, FIM test.*

INTRODUCTION

According to the World Health Organization, part of quality of life includes the perception of one's own body in relation to the culture and values of each individual. Limb amputation affects quality of life through multiple multidimensional aspects: psychological, physical, social, familial, housing, and sense of security. When considering statistics post-amputation, only 65% survive the first year, 52% the first two years, 37% three years, and five or more years only up to 15% of patients with amputated limbs. The high mortality rate among amputees is primarily attributed to depression, which influences patients to reject further therapeutic treatment methods. Epidemiological data on the frequency of lower limb amputations are quite similar to those in developed countries, with differences in the number of amputations, type, and cause. (1) Amputation originates from the Latin word "amputare" and can be literally defined as the complete or partial removal of a certain part of the body. (2) In rehabilitative medicine, the main goal for patients after lower limb amputation is to achieve better functionality in daily activities and walking with the aid of a prosthesis. (3) Modern prostheses enable daily use with the aim of replacing the missing limb. An important aspect is comprehensive and quality rehabilitation, enabling patients to return to everyday work activities, social life, or work with minimal functional limitations. The outcome of rehabilitation treatment and functional recovery results are influenced by numerous factors such as the cause and level of amputation, prosthesis design, presence of phantom pain, and the patient's psychosocial status. (4) Factors influencing favorable rehabilitation outcomes and independence in daily activities include the level of amputation, age, and comorbidities. (5) The goal of rehabilitation for patients after lower limb amputation is to achieve as much independence as possible in daily activities. (6) After lower limb amputation, adequate care for the residual limb, reduction of swelling and pain if present, and initiation of early rehabilitation and pre-prosthetic preparation of patients are necessary. (7)

The aim of our study was to investigate functionality and daily activities using the Barthel Index and the Functional Independence Measure (FIM) test during pre-prosthetic rehabilitation and after one month.

MATERIALS AND METHODS

Study Design and Study Population

The study was designed as a clinical prospective study, including participants of both sexes, aged 18 to 75 years, who were treated and underwent rehabilitation, both on an outpatient and inpatient basis, at the Department of Physical Medicine and Rehabilitation of the Clinical Center Kragujevac. The study was conducted from April 2023 for the next year, and the data used for the study were collected from April to November 2023.

The Ethics Committee of the University Clinical Center approved the study number 01-23/167 by decision of 08.05.2023. years. Patients were referred by a vascular surgeon or a chosen physician to a physiatrist after lower limb amputation. Each patient first underwent a consultative examination, and after establishing indications, was referred for hospitalization for further pre-prosthetic and prosthetic preparation for functional recovery. Patients signed informed consent for the study before inclusion. Inclusion criteria for study participants were:

- patients with unilateral lower limb amputation above the ankle level who were admitted for stationary pre-prosthetic and prosthetic rehabilitation at the Department of Physical Medicine and Rehabilitation;
- patients with unilateral transtibial or transfemoral and partial foot amputation according to Chopart;
- patients who were first fitted with a prosthesis (including patients who received the prosthesis during rehabilitation);
- patients who understand and speak the Serbian language.

Exclusion criteria for study participants were:

- cognitively impaired patients, with a score lower than 27 on the MMSE;
- individuals who refuse to participate in the study if there is another objective reason preventing or complicating participation in the study (other diseases and conditions affecting the general health condition and functionality of participants – infectious diseases, tuberculosis, malignancies, presence of deformities after trauma...);
- patients with bilateral transtibial or transfemoral amputations;
- patients with incomplete medical documentation.

Sampling of the study population was performed from the entire population of patients referred for rehabilitation after lower limb amputation. Each patient, upon admission for hospitalization and rehabilitation, was examined by the investigator successively to determine inclusion and exclusion criteria. Patients who met the criteria were included in the study up to the number calculated for the total sample size.

On the first day of hospitalization, after signing the consent to participate in the study, a physiatrist took a complete medical history from the patient and assessed the activities of daily living using the Barthel Index, FIM test, as well as the cognitive status using the MMSE.

During hospitalization, a kinesiotherapy program for functional recovery and pre-prosthetic preparation was conducted, including: residual limb bandaging, strengthening of the muscles of the residual limb, strengthening of the muscles of the contralateral lower limb, upper limbs, and patient verticalization. The physiotherapist, upon discharge or during hospitalization, assessed the mobility of the patient after amputation using the Amputee Mobility Predictor (AMP) test,

and if the patient had an adequate level of mobility according to the test, the prescription of an aid or prosthesis was indicated.

Upon discharge, the patient received the prescribed aid or prosthesis and in home conditions, with the help of a physiotherapist, continued the kinesiotherapy program for functional recovery, or if the aid was received during hospitalization, the program began stationary and continued in home conditions. One month after receiving the aid or prosthesis, patients came for a control examination, as outpatients, for functional testing of the aid, and on that occasion, a control testing was done by the investigator using the Barthel index and FIM test.

The Barthel Index was introduced into everyday practice in 1965 and is one of the most commonly used tools for assessing functional status, primarily for assessing activities of daily living. It scores personal hygiene, bathing, feeding, using the toilet, climbing stairs, dressing, bowel control, bladder control, transferring from chair to bed, mobility, and wheelchair mobility. The maximum score is 100, indicating complete independence in performing activities of daily living. The lowest score is 0, representing complete dependence. Specifically, 0-20 indicates complete dependence, 21-60 indicates severe dependence, and 61-90 indicates moderate dependence. (8)

FIM is a functional index that measures the motor and cognitive functioning of the patient. Items are divided into 6 groups: self-care, sphincter control, mobility, locomotion, communication, and social integration. Considering the required amount of assistance for each of the 18 items, a score from 1 (complete assistance) to 7 (complete independence) can be given. By summing up the scores, the total FIM can range from a minimum of 18 to a maximum of 126 points. The questionnaire consists of two parts. The first part comprises motor functions, and the second part comprises the aforementioned cognitive functions. Within motor functions, there are 4 major sections: self-care, sphincter control, mobility, and locomotion. Within them, there are a total of 13 smaller parts, each individually scored from 1 to 7. Thus, the number of points for motor functions must be between 13 and 91. Cognitive functions consist of two major sections: communication and social cognition. Within them, there are a total of 5 smaller parts, also scored from 1-7, so the number of points for cognitive functions must be between 5 and 35. Patients receive 6 and 7 points for a specific action, depending on whether they can perform it independently. 7 points are awarded if performed completely independently, and 6 if performed with the assistance of aids. Points 1 to 5 are given if assistance from another person is needed. 5 points are given if the subject does everything independently but requires supervision, 4 points are given if another person provides a little help, while 3 points are given when another person helps significantly, but the subject still does more than 50% of the work on their own. 1 and 2 points are given when the subject is entirely dependent, with 2 points awarded if the subject does more than 25% of the work themselves, and 1 point awarded if they do less than 25% on their own. Looking at the entire FIM questionnaire, we see that it consists of 18 parts, which are evaluated from 1 to 7 according to the rules mentioned above. The higher the number, the more independent the patient is and the better their functional status. (9)

The AMP index assesses the mobility of individuals after lower limb amputation and their existing or potential functional capabilities. Each item included in the AMP is selected for its contribution to the overall assessment of function in individuals after amputation. The AMP questionnaire is based on objective measurements and examines six different domains of mobility: sitting balance, transfers, standing balance, walking, stair climbing, and the use of assistive devices, through a total of 21 items. (10)

Statistical Analysis

The collected data were organized and entered into the statistical software SPSS version 20. The data were first descriptively analyzed; for continuous variables, measures of central tendency and measures of variability were determined, while for categorical variables, the frequency of individual categories was assessed. The significance of differences in observed values of continuous variables was tested using paired t-tests in the case of normal distribution (which was previously examined by the Kolmogorov-Smirnov test), or the Wilcoxon signed-rank test for results that do not follow a normal distribution.

RESULTS

In our study, there were 32 participants, of whom 8 (25%) were female and 24 (75%) were male. The largest percentage of participants were aged 61 to 70 years, accounting for 37.5% (12 participants), followed by the age group of 41 to 50 years, representing 31.3% (10 participants), the age group of 71 to 75 years, comprising 18.8% (6 participants), and the smallest percentage was the age group of 51 to 60 years, with 12.5% (4 participants). Participants with completed secondary education dominated at 56.3% (18 participants), followed by those with a university degree at 25% (8 participants), and those with completed primary education at 18.8% (6 participants). The majority of participants were in a marital union, comprising 68.8% (22 participants), while 18.8% were divorced (6 participants). There were 6.3% each in the widowed and single groups (2 participants each). Within a multimember family, 68.8% of participants lived (22), while 25% lived alone (8 participants), and 6.3% (2 participants) lived in a nursing home. Participants' occupations were predominantly retirees at 56.3% (18 participants), followed by professionals in their field at 18.8% (6 participants). Farmers and the unemployed were represented equally at 12.5% each (4 participants each) (Table 1). The majority of participants were cigarette smokers at 62.5% (20 participants), while 37.5% were non-smokers (12 participants). The average length of hospitalization for participants was 17.25 ± 4.040 days. Half of the participants had a right transfemoral

amputation (16 participants), 37.5% of participants had a left transfemoral amputation (12 participants), while 12.5% of participants had a right transtibial amputation. In the case of the majority of participants, 75% (24), amputations occurred as a result of vascular diseases, while trauma was the cause of amputations in 25% (8) of participants.

Table 1. Presentation of patients based on the type and cause of amputation

Type of amputation	N	%
Right transfemoral	16	50.0
Left transfemoral	12	37.5
Right transtibial	4	12.5
Left transtibial	0	0
Cause of amputation	N	%
Vascular diseases	24	75.0
Trauma	8	25.0

The functionality of the subjects was assessed using the Barthel Index and the Functional Independence Measure (FIM) test on the first day of hospitalization and one month after completion of hospital treatment and arrival of aids. The results indicate statistically significant improvement in functionality measured by the Barthel Index (<0.001), as well as by the FIM test (<0.001), motor sub-score, and overall FIM test. The cognitive sub-score remained identical at the first and follow-up assessments with a value above 26, according to the MMSE scale. The mobility index of patients after amputation (AMP) was 13.00 at the initial assessment, and it showed a statically significant increase during the follow-up assessment, reaching 16.50 (Table 2).

Table 2. The functionality of the patients

	Admission to the hospital	After one month of admission	p
FIM	85.38±14.630	90.44±15.629	<0.001*
FIM motor score	66.00±13.090	71.06±13.891	<0.001*
FIM cognitive score	19.38±1.540	19.38±1.738	
Barthel Index	75.0 (20)	80.0 (20)	<0.001**
AMP	13.00 (10)	16.50 (12)	<0.001**

**Paired-Samples T Test; **Wilcoxon Signed Ranks Test*

DISCUSSION

The results of our study showed a statistically significant improvement in the mean value of the Barthel index and the FIM test after one month compared to the values during pre-prosthetic rehabilitation. This finding is in line with recent studies that highlight the effectiveness of pre-prosthetic rehabilitation in enhancing patient outcomes. For instance, in a study conducted by Gailey et al. it was demonstrated that early and comprehensive rehabilitation interventions significantly improve functional independence in patients after lower limb amputation, particularly in terms of mobility and self-care activities (10). Similarly, a meta-analysis by Silva et al. further emphasized that structured rehabilitation programs lead to improved scores on functional assessments like the Barthel index and FIM, reinforcing the importance of these interventions in post-amputation care (11).

Pre-prosthetic rehabilitation aims to optimize the functional status of the residual limb and prepare the patient for the use of a prosthesis. This comprehensive approach includes wound care, pain management, range of motion exercises, strengthening exercises, gait training, and activities of daily living (ADL) training (12). Addressing these aspects is critical in preparing patients for successful prosthesis use. Studies have shown that interventions such as muscle strengthening, proprioception training, and balance exercises are pivotal in reducing the risk of falls and ensuring long-term functional independence (14). These elements are essential for improving muscle strength, balance, coordination, and proprioception, all of which are key factors for successful prosthetic use and overall mobility outcomes.

The Barthel index and the FIM test are widely used tools for assessing functional status and independence in performing daily activities, and they are crucial in evaluating the effectiveness of rehabilitation interventions (14). The Barthel index assesses basic activities such as bathing, dressing, grooming, feeding, and toileting, providing a focused evaluation of self-care abilities. On the other hand, the FIM test offers a broader scope, assessing mobility, locomotion, communication, and social integration. This dual assessment approach gives a comprehensive picture of a patient's recovery and adaptation following amputation. Our findings align with those of previous studies that have reported improvements in both scores following pre-prosthetic rehabilitation, further underscoring its importance. For example, a randomized control trial by Meier et al. showed that patients who participated in pre-prosthetic rehabilitation exhibited significant improvements in walking ability, ADL independence, and overall quality of life compared to those who did not receive such interventions (12). These results support the notion that pre-prosthetic rehabilitation plays a crucial role in fostering functional recovery and independence, especially in the early stages of post-amputation care (11,14).

The statistically significant improvement in the Barthel index and FIM test observed in our study is consistent with the growing body of literature advocating for early, structured rehabilitation interventions for patients after lower limb amputation. By improving muscle strength, balance, and proprioception, pre-prosthetic rehabilitation serves as a cornerstone for enhancing patient independence and quality of life, making it an essential component of post-amputation care (11,14).

CONCLUSION

Our study shows significant improvements in functionality and independence, as measured by the Barthel Index and FIM test, after one month of pre-prosthetic rehabilitation. Mobility increased, while cognitive function remained stable, highlighting the importance of rehabilitation in enhancing outcomes for patients following lower limb amputation.

CONFLICT OF INTEREST

The authors declare no confict of interest.

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None

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