

Effect of exercise program on functional ability of patients with lower limb amputation

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Abstract : Leg or foot amputation is the removal of a leg, foot or toes from the body

The aim of this study was assessment functional ability before application of exercise program, evaluation the effect of applying exercise program on functional ability of patients with lower limb amputation

Patient and Methods: A convenience sample of sixty adult patients divided equally into two groups (study group and control group). **First tool** "patient assessment sheet" **second tool** "assessment of activities of daily living measured by Barthel index"

Results: there is increase in patient's activities of daily living measured by Barthel index after application of exercise program than control group.

Conclusions: providing written exercise program for patients was much more effective on the functional ability.

Recommendations: A continuous educational and training program planned and offered on regular basis to amputated patients in vascular surgery department, outpatient clinic of the vascular surgery.

Keywords - amputation, exercise program, Barthel index

I. Introduction

Amputation is the calculated surgical removal of all or part of an extremity when its blood supply is irreversibly compromised by disease or severe injury. By contrast, traumatic amputation is the accidental severing of the body part [1].

Lower extremity amputation is performed to remove ischemic, infected, necrotic tissue or locally unrespectable tumor, and, at times, is a life-saving procedure. Peripheral artery disease, alone or in combination with diabetes mellitus, contributes more than half of all amputations; trauma is the second leading cause. The second Trans-Atlantic Inter-Society Consensus Working group (TASC II) documented an incidence of major amputations due to peripheral artery disease ranging from 12 to 50 per 100,000 individuals per year. [2].

The clinical indications for an amputation depend on the underlying disease or trauma. Amputation is required more often in persons engaged in hazardous occupations, with a greater incidence in men. common indications for amputation include circulatory impairment resulting from a peripheral vascular disorder , traumatic and thermal injuries , malignant tumors, uncontrolled or wide spread infection of the extremity (e.g. gas gangrene, osteomyelitis), and congenital disorders. These conditions may manifest as loss of sensation, inadequate circulation, pallor, and local or systemic manifestations of sepsis. Although pain is often present, it is not usually the primary reason for an amputation. The underlying problem dictates whether the amputation is performed as elective or emergency surgery. Consideration must also be given to the patient's ability to successfully use a prosthetic device [3].

Therapy programs for range of motion , conditioning exercises, correct positioning of the residual limb , ambulation with gait aids , relaxation techniques, and activities of daily living (ADLs) should be started as soon as medically appropriate. The patient is often better able to absorb and comply with a therapy program during the preoperative period than during the early postoperative period, when incisional pain, medication, or apprehension may interfere with the ability to participate. [4].

Contractures are preventable through postoperative therapy program that emphasizes range of motion exercises and early mobilization .strengthening of muscle groups that biomechanically substitute for the lost function of the limb is needed. exercise programs are required to accomplish this task .in the individual with LE amputation , the hip extensors , gluteal medius, hip flexors, and contralateral ankle plantar flexors all contribute to restoring ambulation ability [5].

The aims of the study:

To assess functional ability before application of exercise program for patients with lower limb amputation.

2. To evaluate effect of applying exercise program on functional ability of patients with lower limb amputation

Hypothesis:

The mean scores of functional ability of study group will be higher than mean scores of functional ability of control group

II. Patient And Methods

Research design:

Quasi-experimental research design was utilized in this study.

Study variables:

The independent variable in this study is a designed exercise program for lower limb amputation while the dependent variables are: patients with lower limb amputation

I. Technical design:

Setting:

The study was conducted in vascular surgery department, outpatient clinics of the vascular surgery at Assiut University Hospital.

Subjects:

- Sixty adult patients divided equally into two groups (study group and control group) thirty for each group.
- Both sexes (adult male and female)

Tools

Tool I: "Patient's structured assessment sheet"

This tool was constructed after reviewing the relevant literature: (Alice Rich, 2008, [6] VA/DOD, 2008, [7] ,Midwood, 2004[8]). It will be developed by researcher to assess patients. This tool will consist of the following four parts

part one: Socio-demographic data for the patient as (name, age, gender, occupation, level of education, residence, date of admission and date of discharge)

Part two: Medical data including: Medical diagnosis, affected side, present and past health history.

Part three: it include pre-operative assessment of each body systems (integumentary, nervous, respiratory, cardiovascular, musculoskeletal, nutrition, metabolism) in addition to vital signs, laboratory investigation and imaging studies

Part four: it include post-operative assessment vital signs, pain, nutrition, wound categories .

Tool II: "assessment of activities of daily living through Barthel index scale". It uses ten variables describing activities of daily living (Mobility (on level surfaces, Stairs, Transfers (bed to chair and back), Toilet use, Bladder, Bowels, Dressing, Grooming, Bathing, Feeding) (Mahony and Barthel, 1965 [9])

Scoring system of tool (II)

Scoring system of Barthel index scale, full credits have score (100) when patient not need minimal help or supervision during performance and physically independent, while a score of (75-90) is given when patient mildly disabled, subsequently a score of (50-70) is given when patient moderately disabled, while a score of (25-45) severely disabled and a score of (0-20) is given when patient very severely disabled and cannot perform activities of daily living. (Mahony and Barthel, 1965).

III. Methods:

The study was conducted through:

Data were collected at the vascular surgery department, outpatient clinics of the vascular surgery at Assiut University Hospital during the period from March 2014 to November 2014. The study tools and exercise program were formulated after review of literature. The content validity was done by 5 expertise (three vascular surgeon 'specialists) from the surgical field& (two nursing staff) from the medical-surgical nursing

For the control group; after taking the patient oral agreement for voluntary participation in the study, the researcher then fills the patient's structured assessment sheet and Barthel index scale .(pre-operative and immediately post-operative).After the patient's discharge from the hospital, the researcher meets the patient for follow up in vascular outpatient clinic (during his/her first visit {2 weeks after the surgery}), and then two months post lower limb amputation for re-evaluating the patient's condition.

For the study group; after filling the patient's structured assessment sheet, the researcher explains to the patient exercise program preoperative and post-operative in the following sequence: The exercise program were administered to the patient in three sessions, the duration of each session was about one hour, including 15 minutes for discussion and feedback. Each patient in the study group obtained a copy of the exercise booklet. Evaluation was carried out through introducing tool (I) and tool (II) for all studied sample "both control and study group" to distinguish between control and study group and between the initial assessment of studied group and their assessment at the time of follow up after two month after application of exercise program.

IV. Results

The current study was carried out to assess functional ability before application of exercise program, to evaluate effect of applying exercise program on functional ability of patients with lower limb amputation.

Table (1): Distribution of studied sample (both control and study groups) as regarding to their Sociodemographic characteristics.

Haracteristics	Study (n= 30)		Control (n= 30)		P-value
	No.	%	No.	%	
Age:					
< 50 years	4	13.3	5	16.7	0.271
50 - < 60 years	14	46.7	8	26.7	
≥ 60 years	12	40.0	17	56.7	
Mean ± SD	56.27 ± 6.66		55.10 ± 11.93		0.642
Sex:					
Male	14	46.7	17	56.7	0.438
Female	16	53.3	13	43.3	
Marital status:					
Single	2	6.7	1	3.3	0.247
Married	23	76.7	17	56.7	
Divorced	1	3.3	2	6.7	
Widow	4	13.3	10	33.3	
Educational level:					
Not educated	23	76.7	24	80.0	0.242
Secondary	7	23.3	4	13.3	
University	0	0.0	2	6.7	
Occupation:					
Employer	1	3.3	3	10.0	0.222
Housewife	15	50.0	12	40.0	
Retired	6	20.0	5	16.7	
Does not work	8	26.7	6	20.0	
Farmer	0	0.0	4	13.3	
Residence:					
Urban	4	13.3	13	43.3	0.010*
Rural	26	86.7	17	56.7	
Hospital stay:					
< 3 days	23	76.7	20	66.7	0.390
≥ 3 days	7	23.3	10	33.3	
Mean ± SD	2.90 ± 1.03		2.83 ± 0.83		0.784

Table (1) showed that more than half (56.7%) of control group their age was sixty and more while more than two fifth (46.7%) of the study group was fifty to less than sixty. Regarding to sex it was found that more than half (53.3%) of the study group was female compared to (43.3%) in control group. It was found that the highest percentages in both groups (study and control) married, illiterate, housewife and live in rural area. Regarding to hospital stay, it was found that the highest percentages in both groups (study and control) stay in hospital less than 3 days.

Fig. (1): percentage distribution of patients according to sex

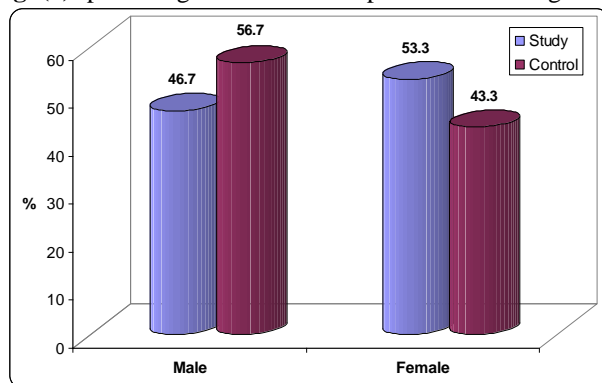
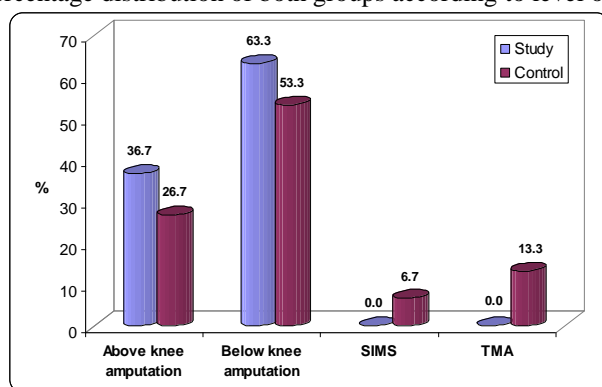


Fig. (2): percentage distribution of both groups according to level of amputation



Fig(1)As regarding level of amputation, It was found that more than three fifth (63.3%) of study group had BKA compared to (53.3%) of the control group.

Table (2): Distribution of studied sample (both control and study groups) as regarding to post-operative assessment

Post-operative assessment	Study (n= 30)		Control (n= 30)		P-value
	No.	%	No.	%	
Pain assessment:					
Tolerable	0	0.0	1	3.3	0.313
Distressing	0	0.0	1	3.3	0.313
Very distressing	0	0.0	2	6.7	0.472
Intense	24	80.0	23	76.7	0.754
Very intense	4	13.3	2	6.7	0.667
Excruciating unbearable	2	6.7	1	3.3	0.554
Appetite:					
Good appetite	3	10.0	3	10.0	--
Anorexia	27	90.0	27	90.0	
Route of food intake:					
Oral	30	100.0	28	93.3	0.472
Intravenous	0	0.0	2	6.7	
Wound healing:					
Category III	0	0.0	3	10.0	0.058
Category IV	25	83.3	26	86.7	
Category V	5	16.7	1	3.3	

This table showed that; the majority (80%) of study group suffered from intense pain after operation compared to (76%) in control group.it was found that the majority of patients (study and control) suffered from anorexia, take oral diet and had IV category of wound healing.

Table (3): Distribution of activities of daily living measured by Barthel index in post-operative and follow-up for both group

Barthel index	Study				Control			
	Post		Follow-up		Post		Follow-up	
	No.	%	No.	%	No.	%	No.	%
Very severely disabled	23	76.7	0	0.0	21	70.0	5	18.5
Severely disabled	5	16.7	5	17.2	8	26.7	15	55.6
Moderately disabled	2	6.7	15	51.7	1	3.3	4	14.8
Mildly disabled	0	0.0	9	31.0	0	0.0	2	7.4
Physical independent	0	0.0	0	0.0	0	0.0	1	3.7

Table (3) it is clear from this table that there is increase in patient's activities of daily living measured by Barthel index after application of program than control group. This appear through (31%) improved mildly disabled in study group while more than half (55.6%) severely disabled in control group.

Table (4): mean score of activities of daily living measured by Barthel index in post-operative and follow-up for both group

Barthel index	Study	Control	P-value
post:			
Mean ± SD	15.00 ± 14.80	18.50 ± 15.26	0.371
Range	0.0 – 55.0	0.0 – 65.0	
Follow-up:			
Mean ± SD	60.00 ± 19.27	38.33 ± 24.46	0.000*
Range	25.0 – 95.0	0.0 – 100.0	
P-value	0.000*	0.000*	

Table (4) illustrated that there was significant difference between control and study group at the time of follow up and there was no significant difference between control and study group post amputation.

Table (5): Distribution of studied sample (both control and study groups) as regarding to complications of lower limb amputation

Complications	Study		Control		P-value
	No.	%	No.	%	
Phantom pain	0	0.0	1	3.3	0.313
Non-healing of an amputation stump	4	13.3	5	16.7	0.718
Stump infection	8	26.7	0	0.0	0.008*
Stump hematoma	1	3.3	2	6.7	0.554
Pulmonary embolism and DVT	0	0.0	0	0.0	--
Flexion contracture	0	0.0	0	0.0	--
Bleeding	8	26.7	9	30.0	0.774
Death	1	3.3	4	13.3	0.350
None	16	53.3	13	43.3	0.438

This table illustrated that according to control group, there were five (16.7%) patients had nonhealing of an amputation stump , nine (30%) patients had bleeding and thirteen (43.3%) patients had none complications. While in the study group, there were eight (26.7%) patients had stump infection, eight (26.7%) patients had bleeding and sixteen (53.3%) patients had none complication.

V. Discussion

The current study revealed that, more than half (53.3%) of the study group was female compared to (43.3%) in control group. This study finding was in line with a study conducted at Rheumatology and Rehabilitation Department at Minia University Hospital by **Mohamed, (2014)** [10] entitled as Strategies of Daily Living Rehabilitative Activities for Post Stroke Patients at Minia University Hospital. Which revealed that; more than half of study group (53.3%) were female compared to (46.7%) in control group.

. The result of the present study revealed that, more than half (56.7%) of control group their age was sixty and more while more than two fifth (46.7%) of the study group was fifty to less than sixty. This result agreed with **Carmona et al, (2005)** [11] who stated that the rate of lower limb amputation varied from 1.8 to 11.4 /10000 patients /year , increased with age..

In the current study; it was found that the highest percentages in both groups (study and control) married, illiterate, housewife and live in rural area. Regarding to hospital stay, it was found that the highest percentages in both groups (study and control) stay in hospital less than 3 days. This study finding was supported by **Mahmoud, (2010)** [12] who carried out a study at orthopedic outpatient clinic of Assiut University Hospital entitled as "The effect of Rehabilitation program on self-care of patient with knee osteoarthritis which revealed that more than two third of study and control group were illiterate ,housewife and married.Asregarding to hospital stay , this study disagreed with **Awori and Ating'a, (2007)** [13] who stated that hospital stay of patients ranged from 9 to 58 days with the mean duration of 22.4 days. The majority of patients (108: 66.7%) had good recovery.

The result of the present study illustrated that, as regarding level of amputation, It was found that more than three fifth (63.3%) of study group had BKA compared to (53.3%) of the control group. As regarding to level of amputation **Chalya et al, (2012)** [14]stated that the most common indication for major limb amputation was diabetic foot complications in 41.9%, followed by trauma in 38.4% and vascular disease in 8.6% respectively. Lower limbs were involved in 86.4% of cases .Below knee amputation was the most common procedure performed in 46.3%. This study is also in line with **Masood et al, (2008)** [15] who stated that In the lower limb, the ratio of below knee amputation to above knee amputation was 1.2:1

As regarding to post-operative assessment , this study mentioned that the majority (80%) of study group suffered from intense pain after operation compared to (76%) in control group.it was found that the

majority of patients (study and control) suffered from anorexia, take oral diet and had IV category of wound healing. This study in line with **Bode, (2010)** [16] who stated that immediate postoperative pain is almost always present following amputation and is the direct result of the surgical trauma to bone, nerve, and soft tissue. Postoperative pain can be expected to resolve within three weeks or less, as with pain following any major surgical procedure. This pain is often described as sharp, is localized to the surgical site, is usually self-limiting, and resolves as the edema decreases and the surgical wound heals. This study is also supported by **Krasner et al, (2007)** [17] Lower limb amputation is often performed in patients who have co-morbidities associated with reduced wound healing ability and predisposition to infection, the commonest of these being old age, diabetes mellitus, smoking, ongoing bacterial colonization and underlying vascular disease leading to poor tissue perfusion.

The present study reported that increase in patient's activities of daily living measured by Barthel index after application of exercise program than control group. This appear through (31%) improved mildly disabled in study group while more than half (55.6%) severely disabled in control group. **Gallagher et al, (2011)** [18]. he was found that restrictions were most commonly experienced in the areas of sports and physical recreation, leisure and cultural activities, and employment. These findings indicate that the loss of a limb has a negative impact on people's level of participation, thus demonstrating the importance of including this aspect of functioning in examinations of disability among persons with amputations.

The present study reported that there was significant difference between control and study group at the time of follow up in patient's activities of daily living measured by Barthel index and there was no significant difference between control and study group post amputation.

Stefan et al, (2011) [19] reported that, successful rehabilitation depends on systematic treatment by an interdisciplinary team of experienced specialists, can provide patients with the best functional results. In the area of functional restoration, there has been major progress in our understanding of the physiology of learning, relearning, and training. Further experimental and clinical studies will be needed to expand our knowledge and improve the efficacy of rehabilitation.

The present study illustrated that according to control group, there were five (16.7%) patients had nonhealing of an amputation stump, nine (30%) patients had bleeding and thirteen (43.3%) patients had none complications. While in the study group, there were eight (26.7%) patients had stump infection, eight (26.7%) patients had bleeding and sixteen (53.3%) patients had none complication.

Stone (2006) [20] reported that Lower limb amputation is often performed in patients who have co-morbidities associated with reduced wound healing ability and predisposition to infection, the commonest of these being old age, diabetes mellitus, smoking, ongoing bacterial colonization and underlying vascular disease leading to poor tissue perfusion. Wound infection following lower limb amputation ultimately leads to a longer hospital stay, which in turn leads to greater risk of secondary morbidities such as hospital-acquired infections or more serious medical complications. For this reason, it is vital the post-operative wound be reviewed in a timely fashion with an objective documented assessment. Post-operative antibiotic prophylaxis needs to be considered if the patient is at a high risk of infection, if not in all patients following limb amputations.

Burke and Elizabeth Cole, (2012) [21]. emphasized that after amputation, patients spend more time sitting, the remaining joints of your leg, and even your back, will spend more time bent or flexed. Too much of this can cause problems for your muscles and joints because they get used to being in a shortened position and you may develop a contracture.

An extensive study of 959 lower limb amputations by looked at post-operative morbidity and mortality; and recorded post-operative wound infection rates of 5.5% and 6.7% for BKAs and AKAs. This reported by **Aulivola, (2004)** [22]

Nwankwo and Katchy (2004) [23]. emphasized that surgical site infection (SSI) was the most common post-operative complication accounting for 21.0% of cases. Of these, 24 (70.6%) specimens had positive bacterial growth within 48 hours of incubation while 10 (29.4%) had negative bacterial growth. Four out of 24 cultured specimens (16.7%) had polymicrobial bacterial growth while 20 (83.3%) had pure bacterial growth. Staphylococcus aureus was the most common bacteria isolated (7; 29.2%), followed by Escherichia coli 5 (20.8%) and Klebsiella pneumonia (4; 16.7%) Pseudomonas spp and Proteus spp were the least bacteria isolated.

VI. Conclusion And Recommendations

Conclusion:

The result of the present study concluded that; there is increase in patient's activities of daily living measured by Barthel index after application of exercise program than control group. This appear through (31%) improved mildly disabled in study group while more than half (55.6%) severely disabled in control group.

Recommendation:

For patients:-

- A continuous educational and training program planned and offered on regular basis to amputated patients in vascular surgery department, outpatient clinic of the vascular surgery .
- Increase patients' awareness about the importance of periodic check up to prevent developing any complications which can affect on their quality of life.

In services:-

- Providing a written exercise program is of great importance for the patients.

For nurses:-

- Newly employed nurses in vascular surgery department are required to successfully complete a test of a basic knowledge and skills before assuming independent responsibility for patient care.

For research:-

- Replication of the current study on larger probability sample is recommended to achieve generalize ability and wider utilization of the designed program.

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