FUNCTIONAL OUTCOMES FOLLOWING LOWER EXTREMITY AMPUTATION AT THE ARMED FORCES INSTITUTE OF REHABILITATION MEDICINE USING LOWER EXTREMITY FUNCTIONL SCALE

Sarah Razzaq, ***Sahibzada Nasir Mansoor, *Farooq Azam Rathore, Noreen Akhtar, **Rehana Yasmeen

Armed Forces Institute of Rehabilitation Medicine Rawalpindi, Combined Military Hospital, Rawalpindi***, Combined Military Hospital Panu Aqil*, Combined Military Hospital Sialkot**

ABSTRACT

Objective: To assess improvement in functional outcomes following prosthetic fitting after lower limb amputation using a lower extremity functional scale in a cohort of the Pakistani population.

Study Design: Quasi experimental Study.

Place and Duration of Study: Amputee rehabilitation ward (indoor) / OPD (out patient department) at Armed Forces Institute of Rehabilitation Medicine Rawalpindi. From August 2009 to August 2010.

Patients and Methods: Study was carried out in the amputee rehabilitation ward of the Armed Forces Institute of Rehabilitation Medicine, Rawalpindi, Pakistan. Fifty two consenting lower limb amputees fulfilling the inclusion criteria were enrolled. All patients were provided with modular prosthesis followed by gait training and integrated amputee rehabilitation program. An assessment was done at 0, 4 and 12 weeks after the provision of prosthesis. Results were analyzed by SPSS Version 15.

Results: Most of the patients were males (98.1%). Mean age was 30.17±9 years . Trauma was the main etiology (99%) followed by tumor (in only 1 patient who had osteosarcoma). Transtibial amputation level was the commonest (53.8%) followed by transfemoral in 32.7% patients and Syme's (7.7%). Lower extremity functional scale (LEFS) mean score in the first week was 35.56 (44.5% of maximum function), which improved to 49.40 (61.8% of maximum function) at week 4, and 59.27 (74.09% of maximum function) at the end of week 12. The *p*-value for each was 0.000.

Conclusion: Early and multidisciplinary amputee rehabilitation improves the functional ambulation level, quality of life and satisfaction level of the individual.

Keywords: Amputation, Functional outcomes, Rehabilitation.

INTRODUCTION

Lower limb amputation is eleven times greater than upper limb amputations[1]. The most frequent cause of amputation among the oldest is diabetes mellitus while in the young it is the road traffic accident[2]. Other causes include congenital limb deficiency, vascular insufficiency, cancer, and trauma[3]. About 1.9 million individuals in the US are living with an amputation, with approximately 113,000 lower limb amputations performed each year[4]. In Pakistan, 63 percent amputations are due to vascular disease, followed by trauma (23.28%) and tumors (13.69%) [7].

Correspondence: Maj Sahibzada Nasir Mansoor, Rehab Specialist, CMH Rawalpindi.
Email: drnasirmansoor@gmail.com
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Major limb amputation influences multiple aspects of an individual's life, body image, mobility, self-care activities, psychosocial health, vocational and avocational activities[5]. Rehabilitation programs for amputees are not simply prosthetic services, but involves the whole patient, their goals and ambitions[6]. A multidisciplinary team involving the orthopedic surgeon, rehabilitation specialist, physical therapist, prosthetist, psychologist, and the social welfare officer is more appropriate to provide optimal prosthetic rehabilitation[8]. Successful rehabilitation allows the individual with an amputation to return to his highest level of activity and function[9]. The most comfortable, cosmetic, functional and economical prosthesis is a major goal in the rehabilitation process[10].

In evaluating outcomes, different goals for rehabilitation are taken into account. These

include cosmesis, ability to perform transfers, home mobility, community ambulation, vocational and avocational activities[11].

There are different scales used to determine amputee functionality including Locomotor index, Russek's classification, timed up and go test, two minute walk test and lower extremity functional scale (LEFS) [13]. This study used LEFS to ascertain the role of rehabilitation in improvement of lower extremity function during the first three months after the provision of prosthesis and highlighted the importance of prosthetic rehabilitation.

MATERIAL AND METHODS

A one year Quasi-experimental study was conducted in the amputee rehabilitation ward, AFIRM, Rawalpindi (Aug 2009- Aug 2010). AFIRM is the largest rehabilitation institute in the country at present. It has a dedicated well equipped orthopedic technology workshop which provides latest modular upper and lower limb prosthesis to army personnel and their dependents all over the country. The amputee rehabilitation program was supervised by a physiatrist with a physical therapist, occupational therapist, orthotist, psychologist and vocational counselor as team members.

Permission from the hospital ethics committee was obtained. Fifty two patients were enrolled as per the inclusion criteria (traumatic and non traumatic lower limb amputations, in both genders with age between 18-60 years, presenting within three months of amputation) after informed consent. Patients having a relative contraindication for prosthetic fitting (e.g. severe cardiopulmonary dysfunction, neurologic disorders with residual deficits in balance, coordination, vision, or strength, severe and intractable pain in the residual limb aggravated by contact with prosthesis etc.) and those missing 2 consecutive follow up visits were excluded from the study. Purposive sampling was done. Extensive indoor rehabilitation was started including stump desensitization, shaping, strengthening exercises, prosthetic fitting and gait training by involving all the team members mentioned above. Prosthesis wearing time and exercises was gradually increased. Advanced training in the use of assistive devices, negotiating stairs, curbs, uneven surfaces and fall prevention were given. Length of stay in the hospital was 2-3 weeks. Patients were given home rehabilitation plan on discharge with regular outpatient follow up at amputee clinic. Patients were evaluated for functional outcomes extensively after 1, 4, and 12 weeks of provision of prosthesis by using detailed functional proforma of LEFS . LEFS as shown in figure 1 is a detailed scale based on a questionnaire about the patient's functional ability to perform everyday tasks and can be used as a tool to monitor progress and outcomes. Each question is scored between 0-4 depending upon the functional ability. The maximum score is 80. The total score was divided into 4 categories. Poor score ranged from 0-20, satisfactory score from 21-40, good score from 41-60 and very good score given to patients who got 61-80 score. Detailed assessment of patients was done on each visit and scores were recorded. A difference of nine points was considered a minimal clinically significant change in function. The *p* value of 0.001 was considered statistically significant.

Statistical Analysis

Data was entered and analyzed with the help of statistical program SPSS Version 15. Descriptive statistics i.e. mean and (SD) was calculated for age and outcome scores at 1, 4 and 12 weeks. Frequencies along with percentages were calculated for categorical (qualitative) variables including gender, level and cause of amputation. The *p* value of 0.001 was considered statistically significant.

RESULTS

Fifty two patients fulfilling the inclusion criteria were in the study. Fifty one (98%) were males and only one (2%) was a female. Mean age was 30.17 years and SD was 9. Trauma was the main etiology as most of the patients were from the military. The only other cause was a tumor.

Out of 52 patients, 32.7% of the patients had transfemoral amputation, 1.9% had knee disarticulation, 53.8% had transtibial, 7.7% had Syme's and 1.9% had Lisfranc and Chopart amputation respectively as shown in table no 1. The mean baseline LEFS score at week one was 35.56. Mean LEFS score improved by 23.71 from week 1 to 12 weeks after provision of prosthesis. An improvement of 9 points in LEFS is considered significant for the functional outcome. The mean score at week 1 was 35.56, in week 4 it was 49.40 (p-value 0.000) and improved to 59.27 (*p*-value 0.000) at the end of week[12].

THE LOWER EXTREMITY FUNCTIONAL SCALE

We are interested in knowing whether you are having any difficulty at all with the activities listed below because of your lower limb Problem for which you are currently seeking attention. Please provide an answer for **each** activity.

Today, do you or would you have any difficulty at all with:

	Activities	Extreme Difficulty or Unable to Perform Activity	Quite a Bit of Difficulty	Moderate Difficulty	A Little Bit of Difficulty	No Difficulty
1	Any of your usual work, housework, or school activities.	0	1	2	3	4
2	Your usual hobbies, re creational or sporting activities.	0	1	2	3	4
3	Getting into or out of the bath.	0	1	2	3	4
4	Walking between rooms.	0	1	2	3	4
5	Putting on your shoes or socks.	0	1	2	3	4
6	Squatting.	0	1	2	3	4
7	Lifting an object, like a bag of groceries from the floor.	0	1	2	3	4
8	Performing light activities around your home.	0	1	2	3	4
9	Performing heavy activities around your home.	0	1	2	3	4
10	Getting into or out of a car.	0	1	2	3	4
11	Walking 2 blocks.	0	1	2	3	4
12	Walking a mile.	0	1	2	3	4
13	Going up or down 10 stairs (about 1 flight of stairs).	0	1	2	3	4
14	Standing for 1 hour.	0	1	2	3	4
15	Sitting for 1 hour.	0	1	2	3	4
16	Running on even ground.	0	1	2	3	4
17	Running on uneven ground.	0	1	2	3	4
18	Making sharp turns while running fast.	0	1	2	3	4
19	Hopping.	0	1	2	3	4
20	Rolling over in bed.	0	1	2	3	4
	Column Totals:					

Minimum Level of Detectable Change (90% Confidence): 9 points **SCORE: ____/ 80**

Reprinted from Binkley, J., Stratford, P., Lott, S., Riddle, D., & The North American Orthopaedic Rehabilitation Research Network, The Lower Extremity Functional Scale: Scale development, measurement properties, and clinical application, Physical Therapy, 1999, 79, 4371-383, with permission of the American Physical Therapy Association.

Figure-1: Lower extremity functional scale (LEFS).

At week 1, poor score was seen in 19 patients (36.5%) and satisfactory score in 12 patients (23.1%). Most of the patients (96.7%) with initial poor scores had improvement only 3.3% didn't improve in 12 weeks. The maximum number of patients, 31 (59.6 %) in the very good category was seen at 12th week follow up.

Figure-2: A patient of transtibial amputation before provision of prosthesis.

Figure-3: A patient of transtibial amputation after provision of prosthesis.

DISCUSSION

Worldwide, vascular diseases (65%) are the leading cause of lower extremity amputation[14] and mostly occur in individuals older than 60 years of age[15]. Trauma is the second common cause (25%) and typically occurs in the young male population[15]. According to a research carried out at the department of Orthopedics, Baqai university hospital Karachi, the same prevalence is found in Pakistan[7].

In the recent years Pakistan underwent an increased incidence of terrorist attacks and low intensity conflicts including suicide bombings, improvised explosive devices (IED's), landmines and bullet injuries leading to sharp rise in the number of amputees in the Armed Forces. Most of these amputees are young soldiers injured in operational areas. All of these amputees from the Armed forces and civil paramilitary forces (Frontier Constabulary and Rangers) are admitted at AFIRM for the provision of prosthetic and amputee rehabilitation services.

Keeping in view the increased amputee load in the last few years it was important to know if the rehabilitation program was successful in improving the functional outcomes. Amputee research in the developed countries has shown that a young age, early prosthetic fitting and adequate and timely provision of rehabilitation services improves the functional and cosmetic outcome of the patient[16]. Such outcomes are promising in our setup as well and shown in figure no 2-3 showing completely rehabilitated patients.

A rehabilitation program for amputees are not simply prosthetic services[17]. It takes account of the whole patient, their goals and ambitions[18]. Immediately after the amputation once the wound is healed; aggressive rehabilitation including pre prosthetic training, immediate postoperative prosthesis (IPOP), prosthetic training, provision of final prosthetic and functional training is started[19]. Major gains are expected in that phase after which there is a functional plateau[20]. Research to date has made a contribution in identifying prognostic factors for

Table-1: Frequency of different levels of amputations.

Level of Amputation		Frequency	Percent
1	Transfemoral amputation	17	32.7
2	Knee disarticulation	1	1.9
3	Transtibial amputation	28	53.8
4	Syme's amputation	4	7.7
5	Chopart amputation	1	1.9
6	Lisfranc amputation	1	1.9
	Total	52	100

prosthetic rehabilitation[21]. In a review to assist in patient management, Matsen et al[12] attempted to identify factors that correlate with the perceived amputations result. Residual limb length made no difference in patients' perceptions. Factors that appeared to influence patients' perceptions included the condition of the contralateral limb, comfort of the residual limb, comfort, function, and appearance of the prosthesis; social factors, and the ability to participate in recreational activities. Additional emotional and physical impairment issues are post traumatic stress disorder, sexual dysfunction, and depression.

Leg strength is associated independently with functional performance[22]. Further study is needed to determine whether lower-extremity resistance training improves functioning in patients with peripheral arterial disease.

This study was carried out keeping one scale in view to determine patient's functional outcome. It has resulted in explaining the progression in functional independence of the person with different levels of amputations. The functional aspect of amputee rehabilitation was assessed using the LEFS. The emphasis was on the assessment of functional improvements over a period of time including daily life activities involving housing, school and sports. There was improvement in overall functioning of the individual after 12 weeks of rehabilitation management. The possible reasons for the improvement were the facility of dedicated rehabilitation centre with expertise and experience in amputee rehabilitation, early referral to rehabilitation centers, prevention of possible complications leading to poor rehabilitation outcomes, relatively young and fit individuals, better understanding of the disability and associated better adaptation.

There are two limitations of the study which warrant mention. This was a military hospital based study with the majority of the patients being males, hence the over sampling of males. The civil population of Pakistan has suffered more casualties than the military forces in the war against terror. Moreover the quality of amputee rehabilitation services available to military personals is much better than the services available to the general population. There is a possibility that this pattern of amputees and better functional outcomes is not truly representative of the general Pakistani population.

Keeping in view the increasing number of upper and lower limb amputees in Pakistan's military and the general population and also considering the fact that adequate rehabilitation helps in community re-integration of amputees as useful members, we offer the following recommendations

A national trauma database should be maintained including amputation as a sub category. Large scale studies should be conducted on demographics and functional outcomes in amputees. The amputee rehabilitation services in the government hospitals should be improved and upgraded. Patient support groups should be established to facilitate peer counseling and voicing concerns of amputees at appropriate forums.

CONCLUSION

Proper rehabilitation of the amputee can bring drastic change and improvement in the quality of life and satisfaction level of the individual keeping in view his personal preferences, family, social, vocational and recreational needs and helps him get back to the mainstream society with minimal sense of disability and handicap and to gain maximum from the advances in technology.

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