Functional Outcomes of Elderly after Unilateral Diabetic Transtibial Amputation: A Case Report

Elisabet Augustina, Melinda Harini

Department of Physical Medicine and Rehabilitation, Dr. Cipto Mangunkusumo National General Hospital, Faculty of Medicine, University of Indonesia, Jakarta, Indonesia

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Abstract: Foot ulceration is a major cause of morbidity in elderly with diabetes, as osteomyelitis and diabetic gangrene lead to amputation. After undergoing transtibial amputation, patients were referred to Rehabilitation Department for prosthesis prescription and rehabilitation to restore mobility and to successfully reintegrate the patient into community. This study aims to identify the current patient's mobility, independence and mental status following amputations. This study was done between May 2017 and August 2018, four patients above 60 years old were referred to Medical Rehabilitation outpatient clinic as candidates of prosthesis use after unilateral transtibial diabetic amputations. Mobility status, Barthel Index, Mini Mental State Examination and Geriatric Depression Scale were evaluated through medical records and interview. Two patients who completed rehabilitation programs, ambulate with prostheses without obstacles and are mild dependent with current better mental status. Two patients who did not, are moderate dependent ambulating with wheelchair. In conclusion, patients who completed rehabilitation were more independent, ambulatory with prosthesis and have better mental status. Factors such as social living conditions, initial cognitive and independence levels may be considered as functional outcome predictors. Further investigation with better method and larger sample size is needed.

1 INTRODUCTION

Diabetes Mellitus (DM) is the leading cause of nontraumatic lower extremity amputation in worldwide. Approximately 15% of individuals with DM develop a foot ulcer and a significant subset will ultimately undergo amputation (Powers, 2015). Every year more than one million people undergo a lower limb amputation as consequence of osteomyelitis and diabetic gangrene, which calculates to a limb lost due to diabetes every 30 seconds in the world (Braun, 2014).

Diabetics have a 15-fold higher risk for lower limb amputation. Risk factors for amputation among diabetic patients include: male sex, diabetes more than 10 years duration, peripheral neuropathy, abnormal structure of foot (bony abnormalities, callus, thickened nails), peripheral arterial disease, smoking, history of previous ulcer or amputation and poor glycemic control (Powers, 2015)

Transtibial amputation is the most common amputation level seen in general practice. It is performed one third of the way down tibia and a posterior myocutaneous flap is used to cover the residual tibia. At this length, the bulk of the posterior compartment muscles are available for a flap providing good soft tissue coverage over the distal tibia and the primary vascular structures for the lower limb are preserved in the flap (Clayton, 2009).

Rehabilitation management is crucial in the postoperative period. Early mobilization facilitates early functional improvements such as bed mobility, transfers and mobilization to chair or wheelchair (Lovegreen, 2015). Patients must be educated about positioning, range of motion (ROM) and strengthening exercises of the affected limb (Frykberg, 2006). Initiation of aerobic exercise is needed to increase endurance and cardiovascular fitness. As the patient progress, focuses are more on standing and balance in parallel bars and use of walking aid (Brigham, 2011).

Prosthetic fitting and gait training can usually be started within 3–6 weeks of surgery. Patients usually ambulate independently within one month of starting

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therapy using prosthesis. The residual limb continues to shrink during the first 6–8 months. After completing the final prosthetic evaluation, the patient will require a period of gait training under the supervision of the physical therapist (Lovegreen, 2015).

Rehabilitation programs are designed to endeavor restoring functional mobility and to successfully reintegrating the patient into community. Functional outcomes of amputees have been reported to be associated with early rehabilitation intervention and adherence rate of the patients to rehabilitation (Kosse, 2013). Most literature defines functional outcome only in terms of prosthetic use, but general measures of functional outcome with or without prosthesis are equally important (Van Eijk, 2012).

Factors such as age, Mini Mental State Examination (MMSE) and Barthel Index (BI) preoperative and at admission to rehabilitation are correlated significantly with later functional status (Van Eijk, 2011). Less use of prosthesis is significantly related to age, female sex, cognitive impairment, level of physical disability, possession of wheelchair and dissatisfaction (Bilodeau, 2000).

Status of ambulatory and mental have reciprocal connection in elderly with prostheses (Coffey, 2012). Patients with impairment in several areas of cognition including memory, attention and concentration, visuospatial function and organizational skills will face significant challenges in learning how to mobilize with prosthesis (O'Neil 2008; O'Neil, 2009). Meanwhile, one study found that years after major lower extremity amputation, amputees who do not use prostheses have more symptoms of depression than those who use (Remes, 2010).

The purpose of this case series was to follow-up and identify the current mobility, independence and mental status of elderly patients one to two years after unilateral diabetic transtibial amputation.

2 METHODS

Between May 2017 and August 2018, four patients older than 60 years old post unilateral transtibial amputation due to diabetic gangrene, were referred to Department of Medical Rehabilitation outpatient clinic, Cipto Mangunkusumo National General Hospital, Jakarta for prosthesis prescription and rehabilitation. The patients came within 1-4 months after surgery. Data is collected through medical records and interview during home visit. Informed consent was obtained from the patients.

Patients' status of mobility, independence and mental were evaluated at the first consultation and reevaluated during home visit on August 2019. Evaluation of mobility status is by observing and asking how the patient ambulate in daily life and the use of prosthesis or other ambulatory aids. BI-100 is used to evaluate the independence level of activity of daily living (ADL). Mental status is evaluated using MMSE and Geriatric Depression Scale (GDS). Medical history and social living condition are collected through medical records, interview and observation.

3 RESULTS

Table 1 shows the baseline characteristics of the patients. Among the patients are three males and one female, with age range 61–67 years old and amputation onset range 12–24 months with left legs as predominant sites.

Table 1: Patients' Characteristics.

	A	B	C	D
Age*	62	61	65	67
Sex	Male	Male	Male	Female
Leg sites	Left	Left	Right	Left
Amputation onset**	24	24	17	12
Post-operative to rehabilitation**	3	1	3	4
Rehabilitation attendance***	58.3	100	100	66.7

*in years; **in months; ***in percent

Rehabilitation care included 30-45 minutes of individual physical therapy, 2 times a week, consisting of improving transferring, upper and lower limb muscle strengthening, shaping residual limb for prosthesis, range of motion exercise to preventing flexion contracture of involved joint, massage of soft tissue adhesions, preparing for weight-bearing and prosthesis wearing. During consultation and follow-up, patient and caregiver were given education about stump care, positioning (avoiding prolonged knee flexion), risk of fall, home program and prosthesis use. There was no adverse event, no history of new wound and hospital readmission from all the patients.

Patient B and C completed the rehabilitation until prosthesis fitting and training. Patient A and D did

not do rehabilitation regularly. However, all of them eventually got prosthesis which consists of patellar tendon bearing socket, supracondylar cuff suspension, exoskeleton shank and solid ankle cushion heel foot. Table 2 shows comprehensive geriatric assessment (CGA). The functional outcomes (mobility, independence and mental status) are compared between now and the first consultation time. Figure 1 shows the progression of patients' mobility status between pre and postoperative.

Table 2: Comprehensive Geriatric Assessment.

Patient	Preoperative Mobility Level	Current Mobility Level*	Barthel Index		MMSE			Geriatric Depression Scale
			Then	Now	Then	Now	Δ	
A	Out: wheelchair In: bedridden	Out: wheelchair In: crawling/hopping	52	68	27	24	3	9
B	Out: wheelchair In: crutches	Out: prosthesis In: prosthesis	92	98	28	28	0	2
C	Out: crutches In: crutches	Out: prosthesis In: crutches	88	92	29	27	2	4
D	Out: wheelchair In: bedridden	Out: wheelchair In: wheelchair	66	64	24	19	5	7

*Out= outdoor; In=indoor

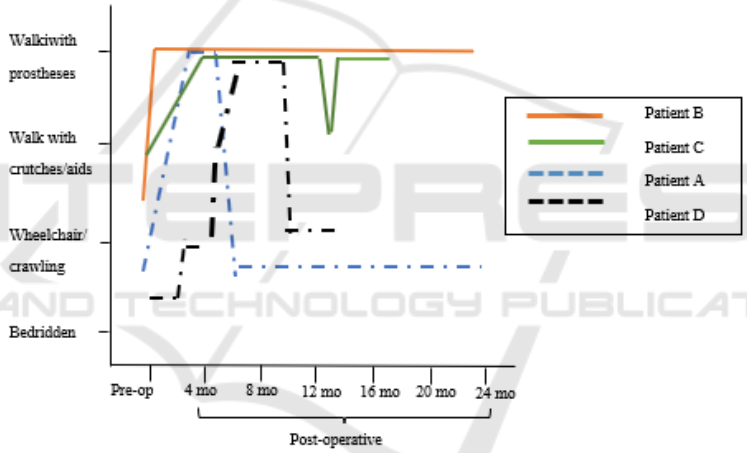

Figure 1: Mobility Status Progression.

4 DISCUSSION

Inspired by ICF (International Classification of Functioning, Disability and Health) model, aspects of health conditions, body structures and functions, personal and environmental factors were evaluated in this case-series. This study emphasizes on mobility, independence of ADL and cognitive status as body functions and presence of family support as the environmental factors.

The importance of following-up mobility status of elderly patients after lower limb amputation is because mobility is the key component of independent living, enabling the performance of activities of daily living (Bilodeau, 2000; Geertzen, 2005). In this study, we found among four patients with unilateral transtibial amputation due to diabetes, two of them still ambulate with prosthesis without obstacles. The other two patients only used the prostheses first couple months because they felt heavy and uncomfortable so they prefer wheelchair.

Patient A used to be bedridden for 3 weeks prior to amputation. After getting prosthesis, he complained of unfitness resulting skin excoriation on stump but refused to repair due to financial problem (as it is not covered by national health insurance). Patient D was bedridden about 2 months before amputation because refusing the idea of amputation and seeking for alternative treatment, but then post amputation, she gained ability on wheeling and partially using walker before getting prostheses. She apparently used prosthesis less than four months

and gradually became dominant wheelchair user, as she found it easier and less fatigue.

The patients who no longer use the prostheses apparently attended less than 70% of rehabilitation sessions. They have similarities, in which they only live with spouses who are also elderly with disabilities. Patient A's wife is a 60-year-old female with obesity, knee pain, hypertension and frequent headache, while patient D's husband is a 78-year old male with hearing problems and history of ischemic stroke. They could only go to hospital if their children or relative had time to accompany them. Not only difficulty to access and caregiver, financial issue also plays role. Rather than attending rehabilitation, patient A prefers accompanying his wife working (as street seller), as he quit working few months pre-amputation. On the other side, two patients who use prostheses attended rehabilitation regularly because they have supports from spouses, children or grandchildren who live together with the patients.

Family support is an important facilitator of the regaining ability to function by enabling social participation and encouraging self-care. This fact was evidenced by several studies in which individuals receiving greater social support present better health conditions, physical and psychological performance, in addition to greater adherence of the treatment (Junior, 2017). A study proved that adherence to rehabilitation has significant benefit, where patients who attended more than 80% scheduled sessions, the mean muscle power score in each side of the upper and lower limbs was significantly better and degree of dependency improved following rehabilitation (AlSofyani, 2016).

In this study, we found that BI score of patients using prostheses was higher at initial compared to the wheelchair patients and it increased at the current condition. On the other side, the first wheelchair patient has increased BI score but still categorized as moderate dependent. The second wheelchair patient in fact becomes more dependent in ADL. This is highly possibly related to the decrease of cognition. She has the highest decline of MMSE score among four of them. The two wheelchair patients are also categorized as probable depression based on GDS.

This finding is similar with one study (Van Eijk, 2011) that found patients who completed rehabilitation had increase of BI between first admitted to rehabilitation and one year in the afterwards (p=0.000), where patients who did not complete had no significant increase (p=0.932). In contrast, different from this result, previous studies found that pre-operative functional is the most important in predicting walking ability and prosthesis use after lower limb amputation, where post-operative functional status does not seem to be related. It is also recommended that evaluation of ambulation is useful rather than global functional assessment (Sansam. 2009).

Studies also established significant relation between cognitive abilities with the functional level and prediction of prosthetic use, as learning skills are important in order to adequately use prosthesis (Lee, 2018; Van Eijk, 2012). Using MMSE, cognitive status at 2-4 weeks after amputation was found to predict 20% of variance in mobility at 8-14 months post lower limb amputation (Coffey, 2012). The cognitive domains such as: memory, executive function, visuospatial cognition and language fluency are considered to be sensitive (Lee, 2018).

Depression following amputation in elderly, based on one study, appeared had no statistically significant relationship with prosthesis use (Bilodeau, 2000). Factors associated with depressive symptoms in lower limb amputees are female sex, lack of social support, unemployment, shorter time since amputation, smoking status and pain (Hawamdeh, 2008). Both wheelchair patients have similar risk factors: lack of support from family and being unemployed. Additional risk factors are smoking for patient A (as he still smokes occasionally) and female gender for patient D.

This is the first follow-up case series about functional outcomes of elderly transtibial amputation due to diabetes. In this small case series, we note limitation that this study only involved small numbers of patients, thus making it difficult to generalize the results for elderly amputees. This is because we only recruited and followed-up elderly transtibial amputees from Physical Medicine and Rehabilitation residents' case reports from 2017 to 2018. The other study limitation is related to the use of functional outcome parameters. This study only used status of prosthesis use, BI, MMSE and GDS. One meta-analysis (Fortington, 2012) states that there is still no standard of predictors or functional outcome measures of lower limb geriatric amputees. Further more comprehensive parameters involving physical, mental and social aspects should be utilized (Lee, 2018; Schoppen, 2003).

5 CONCLUSIONS

In conclusion, patients who completed rehabilitation are more independent, ambulatory with prostheses and have better mental status. Factors such as MMSE and BI, as well as patient's social living conditions may be considered as functional outcome predictors for the elderly patients undergoing diabetic transtibial amputation. The predictors could assist in determining suitability prosthetic or ambulatory aids use, ascertaining appropriate and realistic goals so that maximal mobility and independence are achieved. In this case, further investigation with better method and larger sample size is needed.

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