Factors Associated with Activities of Daily Living among Patients with Diabetic Foot Ulcers
A Pilot Study

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Keywords: Activity of Daily Living, Diabetic, Factors, Foot Ulcer.

Abstract: Patients with diabetic foot ulcers in general have a limited ability to perform activity daily living (ADL). However, currently, no studies are available that investigated factors associated with ADL among patients with diabetic foot ulcers. Therefore, the purpose of this study was to investigate factors related with ADL in patients with diabetic foot ulcers. This was a cross sectional study in patients with diabetic foot ulcers. Data analysis used Pearson's correlation, independent t-test, and multiple linear regression analysis. Multiple linear regression analysis showed that factors that had a significant impact on ADL in patients with diabetic foot ulcer included age and depression. Moreover, the dominant factor for predicting ADL in patients with diabetic foot ulcer was depression. This is the first study that investigated the factors associated with ADL among patients with diabetic foot ulcers. Age and depression were related with limited ADL in patients with diabetic foot ulcers. In the future, Nurses may be able to identify high-risk patients of disability and conduct preventive interventions.

1   BACKGROUND

Diabetic ulcers are an important cause of morbidity and mortality in patients with diabetes mellitus (DM). In a previous study, it was shown that the annual incidence of diabetic ulcers is 1-4 % with a prevalence of 10-15 % (Singh, Armstrong, & Lypski, 2005). During their lifetime, each patient with diabetes mellitus has a 15% chance to get ulcers (Singh, DG, & BA, 2005). Healed diabetic foot ulcers still have a risk of about 60% to develop recurrent ulcers within 3 year (Armstrong, Boulton, & Bus, 2017). Patients with foot ulcer are also at a high risk of amputation. A total of 73,000 amputations were performed on patients with DM, most of which are due to diabetic ulcers (Crews et al., 2016). In addition, the mortality rate 5 years after amputation is increased and may reach 80% (Crews et al., 2016).

Diabetic ulcers affect many aspects of patients. Previous studies have shown that diabetic ulcers reduce the quality of life, which is mostly due to reduced mobility. The limited ability to move affects the patients' ability to perform every day activities and tasks and to enjoy leisure activities (Crews et al., 2016).

In a study by Brod et al. (1998), the effects of diabetic foot ulcers on patients and their care caregivers' life was investigated. The data showed that diabetic foot ulcers had an effect on the physical, psychological, social, and economic status of patients and their caregivers because of the limited ability to move caused by the wound. In another study, it was revealed that patients with diabetic ulcers have a reduced ability to move. The reduction in mobility causes patients to loose self-esteem due to the difficulty to take care of themselves (de Jesus Pereira et al., 2014). Another study showed that the limited mobility due to diabetic ulcers affected physical activities, especially those that required the use of the ankle and foot. The inability of patients to perform activity daily living (ADL) finally also cause more physical problems. Previous study showed that the presence of diabetic foot ulcer interfere their live, resulted in worsened physical health and even cause foot complication (Evans & Pinzur, 2005).

The inability of patients to move and to perform ADL can have various psychological effects. Previous studies have shown that patients are frustrated, angry,

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have a loss of self, and guilt due to their limited ability to move and feeling being a burden to others to help them do ADL. In addition, previous studies have shown that the inability to move due to foot ulcers may cause unbearable depressions (Kinmond, McGee, Gough, & Ashford, 2003).

Many studies have been conducted to investigate the effect of diabetic ulcers on ADL and the effect of limited ADL due to diabetic foot ulcers on psychological effects (de Jesus Pereira et al., 2014; Kinmond et al., 2003). However, currently no studies are available that investigated the associated factors of ADL in patients with diabetic foot ulcers. Investigating ADL is crucial since limited ADL may have a fatal impact on patients, such as depression and foot complications. Data regarding factors associated with limited ADL are important for nurses so they could take preventive measures to prevent limited ADL. Therefore, the purpose of this study was to investigate the factors related with ADL in patients with diabetic ulcers. To our knowledge, this study is the first study to assess factors related with ADL in diabetic patients with foot ulcers.

2 METHODS

2.1 Study Design, Sample and Procedure

The design of this study was a cross sectional study. This study was conducted from January 20, 2017 to November, 2017. Fifty-seven patients were recruited from Kizu Wound Care Center and Prof Dr. Margono Hospital, Indonesia using convenience sampling. The inclusion criteria were: patients with diabetic foot ulcers, at the age of 35 or older who agreed to be included in this study. The exclusion criteria were: patients who did not have mental health or other conditions that hampered completion of the questionnaire.

Four nurses conducted the surveys using the face-to-face method. Before data was obtained, patients were informed about the aim and protocol of the study. Patients were also informed that the involvement in this study was not obligatory. They could decline at any time. The protocol of this study was approved by ethical committee of the medical faculty, Universitas Jenderal Soedirman, Purwokerto, Indonesia.

Independent variables in this study included age, education, employment status, gender, marital status, income, smoking, blood glucose level, body mass index (BMI), and ADL, grade of wound, and number of wounds.

2.2 Measures

ADL was obtained by using Barthel index (BI) questionnaires. The BI consisted of 10 aspects of ADL, including the ability to do personal toileting, getting on and off from the toilet, feeding, moving from wheelchair to bed and return, self-bathing skills, walking on a level surface, ascending and descending on stairs, dressing, controlling bowels, and controlling bladder. The total score ranged from 0 (total dependence) to 100 (total independence). A higher BI indicated a higher level of ADL and a lower BI indicated a lower level of ADL. The Barthel Index is widely used in Indonesia. The Cronbach alpha of BI in Indonesia was 0,938 (Iskandar, 2016).

The data of depression was adapted from questionnaires by Rochmayanti (2017) and consisted of 8 questions. The minimum value was 0 and the maximum value was 8. A higher value indicated worse depressive symptoms. In a previous study, it was revealed that the Cronbach's coefficient alpha for these questionnaires was 0,7999 and that all items were valid (Rochmayanti, 2017).

2.3 Data Analysis

In this study, descriptive statistics were used to express descriptive variables. Then, the Cronbach's alpha method was used to determine reliability. Data analyses were performed using SPSS version 20. The Pearson correlation, independent t-test, and multiple linier analyses were used.

For analysis of multiple linier regression, backward elimination was performed. Data was considered statistically significant when $P<0.05$. Adjusted R^2 was used to determine the variance of ADL.

3 RESULTS

3.1 Patient Characteristics

Demographic profile of respondents, characteristics of the wound, and ADL data are presented in Table 1. The age of most respondents was less than 65 years old, with a low educational background, female, having a job, were married, low income, normal BMI, having a controlled blood glucose. Regarding wound characteristics, most patients had grade 2 ulcers, and

Table 1: Characteristics of patients.

Variables	Values	Percentage
Age		
Less than 65	42	73, 4
More than 65	15	26, 3
Education		
No education	2	3.6
Low education	30	52,6
High education	25	43, 8
Employment		
Employed	30	52,6
Unemployed	27	47, 4
Gender		
Male	20	35,1
Female	37	64,9
Marital Status		
Married	52	91,2
Not married		8.8
Income		
Low	22	38,6
Moderate	11	19,3
High	24	42,1
Body mass index		
Slim	2	3,5
Normal	39	68,4
Excess weight	16	
Smoking		
Yes	3	5.3
No	54	94,7
Blood glucose		
Less than 200	31	54,4
Above 200 mg/dl	26	45,6
Grade		
Grade 2	40	70,2
Above grade 2	17	29,8
Number of ulcers		
One	42	73,7
More than one	15	26,3
Duration of ulcers		
Less than 6	50	87,7
Above 6 months	7	12,3
Blood glucose		
Less than 200	31	54,4
Above 200 mg/dl	26	45,6
Depression		
No depression	2	3.5 %
At least one	55	96,49%
ADL		
Severe disability	12	21.0
Moderate disability	8	14,0
Mild disability	16	28,1
No disability	21	36,9

Table 2: Patient ADL's ability.

ADL	Disability (number of persons)	No disability (number of persons)
Bowels	6	52
Bladder	9	48
Grooming	13	44
Toilet use	17	40
Feeding	12	45
Beed to chair and back	23	24
Mobility	22	25
Dressing	19	28
Stairs	23	24
Bathing	19	38

Table 3: Multiple correlation coefficient.

Variables	t/F	r	p Value
Age		-0.361	0.006
Education	1.684		0.098
Gender	0.693		0.491
Employment	-0.,664		0.510
Income	-0.714		0.478
Body mass index		-0.001	0.995
Grade of wounds		-0.301	0.023
Number of ulcers		-0.143	0.290
Duration of ulcer	-0.50		0.96
Blood glucose level	0.335	-0.335	0.011
Depression		-0.592	P<0,001

Table 4: Multiple regression analyses.

Variable	Depression	
	β	*p*
Depression	-0,174	P<0,001
Age	-0,245	0,035
Multiple correlation coefficient (R) = 0.690, Adjusted coefficient of determination (R2) = 0.4		

had one ulcer, which occurred less than 6 months ago. Most patients had symptoms of depression.

3.2 Bivariate and Multiple Regression Analyses

ADL data of participants showed that most patients had a disability, which were severe (21%), moderate (14%), and mild (28.1%), respectively. The mean score of ADL was 81 ± 25. The Pearson correlation showed that age, glucose levels, depression, and

grade of wound were significantly associated with ADL in patients with diabetic ulcers. In addition, the number of wounds and BMI were not significantly different. Independent t-test showed that there were no difference between gender, income, duration of ulcers, marital status, income, smoking, and employment status and ADL in patients with diabetic ulcers (Table 1).

In the table 2 shows the ADL characteristics among the study participants. Among the daily living activities, most of the study participants had a disability in bed to chair and back, and stairs. The Pearson correlation showed that age, blood glucose level, depression, and the wound grade were significantly associated with ADL in patients with diabetic ulcers, whereas the number of wounds and BMI were not significantly different. Independent T-test indicated no differences between gender, income, duration of ulcers, marital status, income, smoking, and employment status with ADL in patients with diabetic ulcers (Table 3).

The independent variables in multiple linear regression analysis included age, education, grade of wounds, depression, and blood glucose level. Age (t = -2.174, p=0.035) and depression (t = -3.967, p < 0.001) were determined as significant predictors for depression in patients with diabetic ulcers (Table 4). The multiple correlation coefficient (R) was 0.735, and the adjusted R^2 was 54 % (F = 14.97, p < 0.001).

4 DISCUSSION

To our knowledge, this is the first study to examine the factors associated with ADL in patients with diabetic ulcers. Our data showed that depression and age were main predictors for limited ADL in patients with diabetic ulcers. Moreover, in this study, we showed that diabetic patients who were elderly and had depressive symptoms were at risk for having a limited ability to perform ADL.

In this study, we used the BI as an index to assess ADL. In previous studies, the BI has been widely used to assess the ADL. The BI has been widely translated into other languages, and the results indicated that this index was highly valid and reliable (Khoei, Akbari, Sharifi, Fakhrzadeh, & Larijani, 2013; Minosso, Amendola, Alvarenga, & de Campos Oliveira, 2010; Pei et al., 2016).

It is recommended to use BI to assess ADL. The ability of patients in performing ADL used this index so that high-risk patients could be readily identified, and therefore early intervention could be conducted as soon as possible.

In our study, we found that most patients with diabetic ulcers had limitations in doing ADL. Our study corresponded with a previous study by Obilor & Adejumo, (2015). In their study, the authors stated that patients with diabetic ulcers had a more limited ability in performing ADL when compared with diabetic patients without ulcers. In another study by Obilor & Adejumo (2015) it was shown that patients with diabetic ulcers had limited ADL. Moreover, in a recent study, it was shown that limited ADL also occurred in other types of chronic wounds, such as venous ulcers (Szewczyk et al., 2005). A study by Minosso et al. (2010) showed that 55% of patients with venous ulcers had a limited ability to perform ADL.

In this study, we showed that depression was the most prominent factor leading to limited abilities. The results of our study were in line with the findings of a previous study in which was revealed that comorbid psychiatric issues, such as depression, can affect the ability to perform ADL (Mendes de Leon & Rajan, 2014). Another study reported that there was a strong association between depression and limited mobility, transferring, and dressing (Mendes de Leon & Rajan, 2014). A study by Piccinni et al. (2012) found that participants with moderate or severe depression had a worse score on ADL measures when compared to participants with mild/low levels of depression. Depression not only caused limited ADL, but can also lead to worse ADL. Depression can worsen ADL after help was provided to care recipients, and patients felt more helpless over their condition (Piccinni et al., 2012).

Our study demonstrated that age was one predictor for ADL in patients with diabetic ulcers. The results of our study were in line with the data presented in previous studies that showed that elderly persons aged 60 years and above were dependent in at least one ADL component using the BI (Gupta, Yadav, & Malhotra, 2016). Many studies have shown that the more advanced the age, the higher the percentage of persons with functional disabilities (Hu, Hu, Hsu, Hsieh, & Li, 2012). Based on this study, the elderly population with diabetic foot ulcers should become the priority of nurses in the prevention of functional disabilities.

Since depression and age are predictive factors of ADL in patients with diabetic ulcers, nurses should intervene so that patients with diabetic foot ulcers can recover their ability to gain functional independence. Health education to patients and practice of range of motion can help patients with diabetic ulcers to regain independence in certain aspects of daily activities.

Patients also need to be taught how to utilize assistive devices to help with their movements.

There were several limitations to this study. First, this study was conducted in a small sample size and the analyses may have yielded significant findings if the study involved additional areas in the sampling frame. Therefore, future studies that involve a large sample size are needed. Second, the design of this study was a cross sectional study, which may have resulted in the inappropriateness of drawing a causal relationship between variables and ADL. Therefore, future studies should use a cohort design so that drawing a conclusion of causal relationship could be made. However, this study also had significant strengths that are worth noting. For example, the originality of this study is high as this is the first study to assess the associated factors related with ADL in patients with diabetic ulcers. The data of our study provided critical evidence to the nurses in hospitals regarding the urgency to assess the ADL in patients with diabetic ulcers so that nurses could identify high risk patients. Therefore early intervention could be conducted to patients.

5 CONCLUSIONS

This is the first study to investigate associated factors of ADL in patients with diabetic ulcers. We demonstrated that depression and age were predictors of ADL. Based on this study, nurses should identify high-risk patients of disability and conduct preventive interventions according to related factors.

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