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**Correlation Between The History of Previous Lower Extremity Amputation as a Risk Factor for the Subsequent Lower Extremity Amputation in Diabetic Patients Among RSUD Dr. Soetomo Patients in 2018**

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**ABSTRACT**

Diabetes mellitus is a group of metabolic diseases characterized by hyperglycemia. Complications are common among patients with this condition, such as diabetic foot syndrome, which is the presence of foot ulcer associated with neuropathy, PAD, and infection, and is a major cause of LEA. Aim of this research is to analyze the correlation between previous LEA as a risk factor for the subsequent LEA in patients with Diabetic Foot among patients in RSUD Dr. Soetomo, Surabaya from January-December 2018. This is descriptive cross-sectional study. Data was analyzed using descriptive statistic and correlation test with Microsoft Excel 2007 and SPSS 20. Statistical testing was performed using Spearman's rank correlation and Cohen J criteria with significance level of  $P < 0.01$ . There are 45 patients, 54.3% are male and 45.7% are female. Largest age group is >55 years old (62.9%). Mostly have undergone LEA (74.3%) while the remaining have undergone LEA twice (17.1%). There is a significant correlation between initial LEA and the subsequent LEA ( $p < 0.01$ ) and is found to have a large correlation between the variables shown by the correlation coefficient (.634). There is no significant correlation between age and LEA as well as sex and LEA ( $p > 0.01$ ).

**Keywords:** diabetes mellitus; lower extremity amputation; risk factors; RSUD Dr. Soetomo

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**INTRODUCTION**

Diabetes mellitus is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion<sup>(1)</sup>. Diabetes complications are common among patients with T1DM or T2DM but, at the same time, are responsible for significant morbidity and mortality, such as diabetic foot syndrome which is a condition that has been defined as the presence of foot ulcer associated with neuropathy, PAD, and infection, and is a major cause of lower limb amputation<sup>(2)</sup>.

Diabetic foot ulcers (DFU) are common and estimated to affect 15% of all diabetic individuals during their lifetime. It is now appreciated that 15-20% of patients with such foot ulcers go on to need an amputation<sup>(3)</sup>. DFU may cause significant morbidity and if not treated aggressively, may lead to lower extremity amputation (LEA). Majority of DFU will heal, whereas 10-15% of them will remain active, and up to 24% of them will lead to LEA. There are various risk factors that would lead in individual into needing to undergo LEA and having underwent LEA previously is one of them alongside with many others, such as poor treatment and poor prevention of diabetic foot<sup>(4)</sup>.

**METHODS**

This was descriptive cross-sectional study. Data was analyzed using descriptive statistic and correlation test with Microsoft Excel 2007 and SPSS 20. Statistical testing was performed using Spearman's rank correlation and Cohen J criteria with significance level of  $P < 0.01$ . Ethical clearance was granted by KEPK RSUD Dr. Soetomo, Surabaya No. 2021/KEPK/VI/2020.

## RESULTS

Based on the table 1, it can be observed that the mean age of the subjects is 59.5 years old with an SD of  $\pm 10.4$ . Number of male subjects involved in the study is higher (19 subjects or 54.3%) than that of the female ones (16 or 45.7%). Most of the patients involved in this study are aged  $>55$  years old (22 subjects or 63%) whereas patients aged  $<55$  years old amounted to be the minority (13 subjects or 37%).

Table 1. Age and sex of research subjects

Variables	Sex		Total, n=35	
	Male	Female	n	%
Age <sup>1,2</sup>				
<55 years old	6	7	13	37
>55 years old	13	9	22	63

<sup>1</sup>Minimum age: 40 years old; maximum age: 78 years old; <sup>2</sup>Mean  $\pm$  SD: 59.5  $\pm$  10.4

Based on the table 2, the significant value (.891) is higher than the P-value (0.01), which means that there is no significant correlation between the variable of Age and Lower Extremity Amputation. Aside from that, the correlation coefficient (-0.24) is negative, which means that the variables are in non-linear correlation. Of all subjects with Type 2 Diabetes Mellitus (T2DM), most of them (32 or 91.4%) have undergone amputation whereas only a small portion of them did not go under amputation (3 or 8.6%) since they are only required to undergo a more minor intervention, such as debridement, thrombectomy or necrotomy.

Table 2. Correlation between age and lower extremity amputation

Variables	Age		Total, n=35	
	<55 Years Old	>55 Years Old	N	%
LEA				
No history of LEA	1	2	3	9
History of LEA	12	20	32	91
Correlation coefficient <sup>1</sup> = -0.024 <sup>**3</sup> p-value <sup>2</sup> = 0.891				

<sup>1</sup>Correlation Coefficient was in regards of Spearman's Rank Correlation and Cohen, J (1988); <sup>2</sup>p-value  $< 0.01$  = significant; <sup>3</sup>\*\*Correlation is significant at the 0.01 level (2-tailed)

Based on the table 3, the significant value (.102) is higher than the p-value (0.01), which means that there is no significant correlation between the variables of Sex and Lower Extremity Amputation. Aside from that, the correlation coefficient (-0.281) is negative, which means that the variables are in non-linear correlation.

Table 3. Correlation between sex and lower extremity amputation

Variables	Sex		Total, n=35	
	Male	Female	N	%
LEA				
No history of LEA	3	0	3	9
History of LEA	16	16	32	91
Correlation coefficient <sup>1</sup> = -.281 <sup>**3</sup> P-value <sup>2</sup> = .102				

<sup>1</sup>Correlation Coefficient was in regards of Spearman's Rank Correlation and Cohen, J (1988) <sup>2</sup>P-value  $< 0.01$  = significant <sup>3</sup>\*\*Correlation is significant at the 0.01 level (2-tailed)

Based on the table 4, the correlation coefficient (.634\*\*) is interpreted as having large correlation on the variables compared, which in this case would be Lower Extremity Amputation and Subsequent Lower Extremity Amputation. Aside from that, the correlation coefficient is positive (.245\*\*), which means that the variables are in linear correlation. As for the significant value (.000), is lower than P-value (0.01). This value goes to show that there is a significant correlation between Lower Extremity Amputation and the Subsequent Lower Extremity Amputation and it is considered to be a large correlation present between these two variables. From those subjects whom have undergone amputation, a minority (6 or 17.1%) have experienced two Lower Extremity Amputations (LEA) whereas the majority have only experienced one LEA.

Table 4. Correlation between sex and lower extremity amputation

Variables	Subsequent LEA			Total, n=35	
	No History of LEA	History of LEA once	History of LEA twice	n	%
No History of LEA	3	0	0	3	9
History of LEA	0	26	6	32	91
Correlation Coefficient <sup>1</sup> = 0.634 p-value <sup>2</sup> = 0.000 <sup>***3</sup>					

<sup>1</sup>Correlation Coefficient was in regards of Spearman’s Rank Correlation and Cohen, J (1988); <sup>2</sup>p-value <0.01 = significant; <sup>3</sup>\*\*.Correlation is significant at the 0.01 level (2-tailed)

**DISCUSSION**

**Individual Characteristics of Research Subjects**

Reasoning behind as for why the feet of diabetic patients are at risk for experiencing a large spectrum of conditions are due to what is called diabetic foot syndrome (DFS). A study reported that patients aged >55 years old is more prone to suffer from this condition<sup>(5)</sup>. Broad spectrum of risk factors leading to major LEA which are related to DFS have been reported, some of which are peripheral artery disease (PAD), associated cardiovascular comorbidities and old age<sup>(6)</sup>. Hence, from these studies, it may be said that patients who are suffering from diabetic foot aged above 55 years old are more prone to undergo LEA as management. For the gender group, it is thought that men are more susceptible in undergoing LEA due to diabetic foot condition, reasoning for this is due to men are more likely to experience diseases that directly link to formation of the risk factors of LEA, such as DFU, PAD, cigarette use, and peripheral neuropathy. Aside from that, women have better endothelial function since they have additional neural protection which plays part in micro and microvasculature. Not only that, men are also more prone to experience decrease in joint mobility and having higher foot pressure<sup>(7)</sup>. Hence, these facts lead men to be more susceptible in formation of DFU and hence, making men more susceptible in having conditions that is related to diabetes related LEA. Conditions such as decreased ankle brachial index (ABI) and transcutaneous oxygen pressure have been proven to be a vital role in predicting whether a patient whom has undergone LEA to be in the risk of undergoing the subsequent LEA. It is thought that almost 70% of hospital readmissions following an amputation, which typically requires reamputation as the treatment is caused by infection or a non-healing wound following initial amputation. Patients with initial amputation to the level of digital amputation were the treatment to almost 58% of reamputation<sup>(8)</sup>.

**Correlation between Age and Lower Extremity Amputation**

A study which was done to rule out risk factors for LEA in T2DM patients showed results that mainly the comorbidities that is present in patients whom eventually will lead to undergo amputations are first, the level of HbA1c, their duration of T2DM, what kind of antidiabetic treatments they are on, presence of chronic kidney disease (CKD). As for foot characteristics, it is shown that those who experience ischemia of the foot and have higher Wagner grade are at higher risk of LEA<sup>(9)</sup>. However, when speaking of age, the study showed no significant correlation between old age and the need for LEA with condition of T2DM although majority of the patients that participated are aged above 55 years old. Similar with this study, although most of the subject are aged above 55 years old (62.9%), it showed no significant correlation between age and LEA (p < 0.891).

**Correlation between Sex and Lower Extremity Amputation**

In a study that involved 5325 T2DM patients whom have undergone LEA, most of them happens to be male (72.54%)<sup>(9)</sup>. Another study supports this stand, among 572 diabetic patients, of 21 whom underwent LEA, most of them (52.4%) are found to be male. Not only that, it also showed that men were more likely to undergo T2DM related LEA as compared to women (p<0.0083)<sup>(10)</sup>. These claims from the result of the studies above may be supported by the fact that there are difference in behaviour when it comes to footwear with different gender, such as women are more likely to undergo prophylaxis foot care<sup>(11)</sup>. Another hypothesis that may support the stand would be men are more likely to neglect health status and care, not only that, men are also thought to be under constant pressure from their surroundings regarding expectations of having to be constantly fit and vigorous at all times<sup>(12)</sup>. In contrary, the result of this study showed the otherwise. Although majority of the subjects are male (54.3%), there is no significant correlation between sex and LEA in this study(p < 0.12).

**Correlation between Lower Extremity Amputation and Subsequent Lower Extremity Amputation**

In a study which focused on ruling the predictors for hospital readmissions as well as reamputation following LEA, it was found that among 717 patients whom undergone LEA, readmission occurred in 13.9%

and from 95% of those readmitted required reamputations<sup>(8)</sup>. This finding is then supported by another study which concluded that T2DM patients with comorbidity of hypertension, congestive heart failure, and chronic obstructive pulmonary disorder, have increased risk of up to 21% into being readmitted following LEA, whereby most of the actions taken needed following readmission would be the subsequent LEA<sup>(13)</sup>. Aside from the comorbidities mentioned, decreased ABI as well as transcutaneous oxygen pressure following LEA is established to be a prediction of poor wound healing, hence making it able to be a parameter of whether a patient whom undergone LEA will have the risk of undergoing the subsequent LEA<sup>(14)</sup>. Similar to the result of this study, it showed that there is a significant correlation between LEA and the subsequent LEA ( $p < 0.000$ ). Not only that, it is also found that there is a large correlation shown by correlation coefficient (.634) in accordance to the correlation grouping rank<sup>(15)</sup>.

### CONCLUSION

There is no significant correlation between age and LEA as well as sex and LEA, however there is a significant correlation between LEA and the subsequent LEA and is considered as a large correlation. From this study, it is suggested that people suffering from T2DM to go for regular check ups to nearest healthcare facility to be aware about the health status in order to prevent the condition from progressing to a worse stage, as well as have high compliance towards the therapy regimens by consuming the medicine given properly and lead a healthier lifestyle.

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