Proceeding
3rd International Nursing Conference
Community Health Empowerment: Step Up Action Attaining Sustainable Development Goals
Faculty of Nursing University of Jember
November 4-5, 2017 Royal Hotel Jember, East Java-Indonesia
ISBN: 976-602-5617-11-9

RISK FACTORS ANALYSIS OF DIABETIC FOOT ULCERS AMONG INDIVIDUAL WITH DIABETES MELLITUS

[1]Eko Prabowo, [2]Haswita, [3]Lina Agustiana Puspitasari
[1]Diploma of Nursing Program – Academy of Health RUSTIDA
Krikilan Glenmore Banyuwangi, East Java; e-mail: prabowo_e@yahoo.com
[2,3]Diploma of Nursing Program – Academy of Health RUSTIDA
Krikilan Glenmore Banyuwangi, East Java

ABSTRACT

Background: Diabetic foot ulcers are becoming a major health problem worldwide. And patients with diabetic foot ulcers are on the rise, ulcers are chronic and difficult to heal, infections and limb ischemia with the risk of amputation and even life-threatening. As well as these cases require substantial health resources, then providing a socio-economic burden for patients, communities, and countries. **Method**: This research is a Case Control Study, to determine the effect of risk factors on the occurrence of diabetic foot ulcers. The sampling technique used is concecutive sampling. The sample of this study consisted of 60 respondents, treatment group of 30 respondents that is diabetic foot ulcer patient and control group of 30 respondents, that is diabetic mellitus patient without diabetic foot ulcers. The instruments used were questionnaires and observation sheets. Bivariate analysis technique used Chi Square test (X^2) and multivariate analysis using multiple logistic regression. **Results**: The results of this research indicate that the variable blood pressure has an OR value of 8.887 with p value of 0.031. In conclusion among the five independent variables, blood pressure variables had the most dominant effect on diabetic foot occurrence in Diabetes Mellitus patients at Genteng and Blambangan Hospitals. **Conclusions**: Patient with Diabetes Mellitus faced a high blood pressure problem, so they have a greater risk of complication. The compication is diabetic foot ulcer. So the patients is recommended to control his health to decrease the incidence of the diabetic foot ulcers

Keywords: Diabetes Mellitus, Diabetic Foot Ulcer

INTRODUCTION

Diabetic ulcers are a chronic complication of Diabetes Mellitus (DM) as the main cause of morbidity, mortality, and disability of people with diabetes. High levels of LDL play an important role in the occurrence of Diabetic Ulcers through the formation of atherosclerosis plaque on blood vessel walls (Zaidah, 2005).

Based on the Riskesdas (2007) report released by the Health Research and Development Department of the Department of Health, local oxygen in chronic ulcers is about half that of normal, resulting in replication of fibroblasts, collagen deposition, angiogenesis, vasculogenesis, and leukocytes.Velazques (2007) has known that peripheral artery disease (PAD) is one form of vascular disorders in diabetic foot ulcers as a source of tissue hypoxia, as most diabetic foot ulcers are located in the

ISBN: 976-602-5617-11-9

extremities of ischemia due to vascular complications of chronic Diabetes Mellitus (Lerman, 2003).

For skin perfusion restorations due to tissue hypoxia due to PAD, in accordance with the approved PAD treatment guidelines (ACC/ AHA guidelines for PAD, 2006) include exercise programs, pharmacology, and revascularization either endovascular or bypass surgery (Hirsch et al., 2006). Another form of vascular disorder suspected to be the cause of tissue hypoxia is an increase in foot compartment pressure that occurs in diabetic foot ulcers (Jose, 2004; Flamini et al., 2008).

The risk factors for diabetic ulcers that illustrate diabetes legs in people with diabetes mellitus consist of irreversible risk factors and modifiable risk factors (Tambunan, 2006; Waspadji, 2006). Risk factors that cannot be changed include age, long diabetes mellitus ≥ 10 years. Meanwhile, risk factors that can be modified include neuropathy (sensory, motoric, peripheral), obesity, hypertension, uncontrollable Glycolization of Hemoglobin (HbA1C), uncontrolled blood glucose levels, smoking habits, non-adherence to diabetes mellitus diet, lack of physical activity, irregular treatment, irregular foot care, inappropriate footwear usage (Ahmed, Algamdi, Algurashi, 201 and Alex, Ratnaraj, Winston, 2017).

This study aims to analyze risk factors that affect the incidence of diabetic foot. By doing the analysis will be found which factors that can form a relationship to the occurrence of diabetic foot ulcers. So it can explain where the position of each factor and the most dominant factor can trigger the incidence of diabetic foot in patients with diabetes mellitus.

METHODS

This research is a Case Control Study aims to determine the effect of risk factors on the occurrence of diabetic foot ulcers. The sample of this study consisted of 60 respondents, treatment group of 30 respondents that is diabetic foot ulcer patient and control group of 30 respondents, that is diabetic mellitus patient without diabetic foot ulcers. The sampling technique is done by consecutive sampling method. This research was conducted in Genteng and Blambangan Hospitals Banyuwangi, from January to May 2017. Bivariate analysis is done by using Chi-Square test (X^2) to know the influence of each independent variable with the dependent variable. To interpret the effect is expressed by Crude Odds Ratio (COR) using Confidence Interval (CI) of 95%. For variables that have a zero value in the large contingency table the Odds Ratio value is estimated by adding a value of 0.5 to the cell in the contingency table. Multivariate analysis is done to see the relation of independent variables with the dependent variable and independent variable which is the biggest relation to the dependent variable. Multivariate analysis is done by connecting some independent variables (p-value <0.25 in the bivariate analysis) with one variable related together.

RESULTS

Based on table 1 it is known that respondents who have high blood sugar as

ISBN: 976-602-5617-11-9

many as 50 people (83.3%) and 28 of them that respondents are not obedient in the diet as much as 20 people (33.3%) and 14 of them (23.3%) do not have diabetic feet. Based on table 3 it is known that respondents have abnormal blood pressure as many as 48 people (80%) and 28 of them (46.7%) have diabetic feet. Based on table 4 it is known that most respondents have regular medication as many as 43 people (71.7%) and 25 of them (41.7%) do not have diabetic feet. Based on table 5 it is known that the respondents have regular foot care as many as 47 people (78.3%) and 27 of them (45.0%) did not have diabetic feet

Table 1. The influence of uncontrolled blood glucose factor on incidence of diabetic foot ulcer

Blood Glucose	Diabetic foot ulcer		Total		%	
	occur	%	no occur	%		
Moderate	2	3.3	8	13.3	10	16.70
High	28	46.7	22	36.7	50	83.30
Total	30	50.0	30	50.0	60	100.0
		Value	df	Asymp. Sig. (2-sided)		
Pearson Chi-Square		4.320[a]	1	0.038		

Table 2. The influence of dietary disability factors on the incidence of diabetic foot ulcer

Diet	Diabetic foot ulcer				Total	%
	occur	%	no occur	%		
No obedient	14	23.3	6	10	20	33.3
Obedient	16	26.7	24	40	40	66.7
Total	30	50.0	30	50	60	100
	Value		df	Asymp. Sig. (2-sided)		
Pearson Chi-Square	4.800[a]		1	0.028		

(46.7%) have diabetic feet. Table 2 shows

Table 3. The influence of hypertension factor on the incidence of diabetic foot ulcer

Blood Pressure	Diabetic foot ulcer				Total	%
	occur	%	No occur	%		
Normal	10	16.7	2	3.3	12	20.0
Abnormal	28	46.7	20	33.3	48	80.0
Total	38	50.0	22	50.0	60	100.0
		Value		df	Asymp. Sig. (2-sided)	
Pearson Chi-Square		6.667[a]		1	0.01	

Table 4. The effect of irregular treatment factors on the incidence of diabetic foot ulcer

Treatment	Diabetic foot ulcer				Total	%
	occur	%	no occur	%		
Irregular	12	20.0	5	8.3	17	28.3
Regular	18	30.0	25	41.7	43	71.7
Total	30	50.0	30	50.0	60	100.0
		Value	df	Asymp. Sig. (2-sided)		
Pearson Chi-Square		4.022[a]	1	0.045		

Table 5. The effect of irregular foot care factors on the incidence of diabetic foot ulcer

Foot care	Diabetic foot ulcer				Total	%
	occur	%	No occur	%		
Irregular	10	16.7	3	5.0	13	21.7
Regular	20	33.3	27	45.0	47	78.3
Total	30	50.0	30	50.0	60	100.0
		Value		df	Asymp. Sig. (2-sided)	
Pearson Chi-Square		4.812[a]		1	0.028	

ISBN: 976-602-5617-11-9

Table 6. Analysis of dominant factors that can trigger the incidence of diabetic foot ulcer

		B	S.E.	Wald	df	Sig.	OR	95% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	Blood sugar	-2.297	1.066	4.645	1	.031	.101	.012	.812
	Diet	1.425	.822	3.002	1	.083	4.156	.830	20.819
	Blood pressure	2.185	1.013	4.649	1	.031	8.887	1.220	64.734
	Treatment	-.036	.778	.002	1	.963	.965	.210	4.430
	Foot care	.321	.971	.109	1	.741	1.378	.206	9.241
	Constant	-.352	3.325	.011	1	.916	.703		

a. Variable(s) entered on step 1: Blood sugar, Diet, Blood Pressure, Treatment, Footcare.

The sixth hypothesis in this study is that blood pressure (X3) variable has the most dominant influence on diabetic foot (Y) incidence in Diabetes Mellitus patient in Genteng and Blambangan hospitals. Based on the results of regression analysis presented in table 6 seen the value of multiple logistic regression coefficients for each variable. Blood pressure variable has an OR value of 8.887 with a p-value of 0.031, which means Ha_3 accepted and Ho_3 rejected.

DISCUSSION

The influence of uncontrolled blood glucose factor on the occurrence of diabetic foot ulcer

Based on table 1 X2 test results with value ρ value = 0.038 smaller than α = 0.05, then the conclusion that Ha accepted and Ho rejected. Which means there is influence factor of uncontrolled blood glucose level (X1) to diabetic foot ulcus (Y) in Diabetes Mellitus patient at Genteng and Blambangan Hospital.

Diabetic foot ulcers are a microvascular complication (neuropathy) in patients with Diabetes Mellitus (Ignatavicius & Workman, 2006). Micro-vascular complications occur due to thickening of the basal membrane of small vessels. The cause of such thickening is directly related to high levels of glucose in the blood. Microvascular thickening causes ischemia and decreases the distribution of oxygen and nutrients to the tissues. Chronic hypoxia directly destroys and destroys cells (Corwin E. J, 2009). The results of research from Ahmed, Algamdi, Algurashi (2014), showed that of 350 respondents who caused diabetic foot was diabetic neuropathy 48% (n = 168). And result from Zubair, Malik and Ahmad (2015) showed that of 162 diabetic foot patients caused by neuropathy 50.6% (n = 82).

According to Black, J.M., & Hawks, (2009) factors associated with neuropathy include vascular insufficiency, elevated chronic blood glucose and metabolic factors. Another theory suggests that other risk factors that can cause diabetic neuropathy include increased age, long time suffering from DM and low blood sugar control. (Katulanda, P., Priyanga, R., Ranil, J., Gidwin, R.C., Rezvi, S., David, 2012). It was shown that the results of this study

ISBN: 976-602-5617-11-9

showed almost all respondents had high blood sugar as many as 50 people (83.3%) and 28 of them (46.7%) had diabetic foot ulcer.

The influence of non-adherence factor of diabetes mellitus diet to the occurrence of diabetic foot ulcer

Based on table 2 X2 test results with value ρ value = 0.028 smaller than α = 0.05, it can be concluded that Ha accepted and Ho rejected. Which means there are influence factors of non-adherence diet diabetes mellitus (X2) on the incidence of diabetic foot (Y) of diabetes mellitus patients in Genteng and Blambangan hospitals.

Adherence to diabetes mellitus diet is a very important effort in controlling blood glucose, cholesterol, and triglyceride levels close to normal so as to prevent chronic complications, such as diabetic foot ulcers (Tambunan, 2006; Waspadji, 2006). The goal of diet in diabetes mellitus is to maintain or achieve ideal body weight, maintain blood glucose levels close to normal, prevent acute and chronic complications and improve quality of life (Hasdianah, 2012).

Based on the data of the research results it is known that almost half of respondents have primary education as much as 26 people (43%). Brunner & Suddarth (2002) states that the factors that influence the level of compliance one of them are the factor of education. According to Notoadmojdo (2003), there are several factors that can influence changes in client behavior to be obedient/ disobedient to the treatment program, which among them is education. Where patient education can improve adherence throughout education is an active education such as reading books, attending seminars and tapes by patients independently.

The influence of hypertension factor to the occurrence of diabetic foot ulcer

Based on table 3 of test result X2 with value ρ value = 0.01 smaller than α = 0.05, it can be drawn a conclusion that Ha accepted and Ho rejected. Which means there is the influence of hypertension factor (X3) to the incidence of diabetic foot (Y) in diabetes mellitus patient at Genteng and Blambangan hospitals.

Hypertension (TD>130/80 mm Hg) in people with diabetes mellitus because of high blood viscosity will result in decreased blood flow resulting in vascular deficiency, in addition to hypertension blood pressure more than 130/80 mmHg can damage or cause lesions in the endothelium will lead to the occurrence of ulcers (Tambunan, 2006; Waspadji, 2006). Long-term diabetes has a severe impact on the cardiovascular system. In the macrovascular system in the endothelial lining of the arteries due to hyperglycemia, the permeability of endothelial cells increases so that the fat-containing molecules enter the arteries. Damage to endothelial cells will trigger an inflammatory reaction that eventually occurs depositional deposition of thrombocyte, macrophages, and fibrous tissue. Arterial wall thickening causes hypertension which will further damage the endothelial layer of the arteries as it gives rise to tearing of endothelial cells (Corwin, E. J, 2009).

Based on Alex, Ratnaraj, Winston, (2010), the Diabetes Mellitus patients with

ISBN: 976-602-5617-11-9

hypertension to be protected and will require greater care in preventing such ulceration. In this study showed all the patients with hypertension were on ACE inhibitors, a possible mechanism for such protection could be due to improved endothelial function leading to enhanced peripheral circulation.

The effect of irregular treatment factors on the incidence of diabetic foot ulcer

Based on table 4 X2 test results with value ρ value = 0.045 smaller than α = 0.05, it can be drawn a conclusion that Ha accepted and Ho rejected. Which means there is the influence of irregular treatment factor (X4) to the incidence of diabetic foot (Y) in Diabetes Mellitus patients at Genteng and Blambangan hospitals.

Irregular treatment involves examination of the legs classification of the diabetic foot based on the risk of occurrence that can be used as a reference in examining the legs of people with diabetes mellitus and prevention measures performed are as follows: (1) Normal sensation without deformity, (2) Normal sensation with deformity or high plantar stress, (3) Insensitivity without deformity, (3) Ischemia without deformity (4) Combination of insensitivity, deformity and/or ischemia (Tambunan, 2006; Waspadji, 2006).

Diabetes mellitus patients with high blood sugar require insulin therapy, if the treatment is not regular then uncontrolled blood sugar so it can lead to possibly reflecting a severe form and result in peripheral neuropathy. The presence of peripheral neuropathy seems to contribute to the development of ulceration and those with pre-ulceration, callosities and deformity (Alex, Ratnaraj, Winston, 2010).

The effect of irregular foot care factor on diabetic foot occurrence

Based on table 5 X2 test results with value ρ value = 0.028 smaller than α = 0.05, it can be drawn a conclusion that Ha accepted and H0 rejected. Which means there is the influence of irregular foot care factor (X5) to the incidence of diabetic foot (Y) in Diabetes Mellitus patients at Genteng and Blambangan Hospitals.

Diabetic ulcers may occur due to irregular foot care. Irregular foot care can facilitate wound infection and develop into diabetic ulcers. According to Johnson in Purwanti and Maghfirah (2016), foot care activity to prevent the occurrence of diabetic ulcers is examining the feet every day. It use to see if there are signs of redness, bruising, wounds, fungal infections or irritation of the feet; wash feet daily using water and soap; cutting nails adjusting to the shape of the nail and not cutting the nails too close to the meat or too short; moisturize dry feet using lotion; keep your feet clean. Regular foot care of people with diabetes mellitus will prevent or reduce the occurrence of chronic complications in the foot (Tambunan, 2006; Waspadji, 2006).

Dominant factors that can trigger the incidence of diabetic foot occurrence

The sixth hypothesis in this study is that blood pressure (X3) variable has the most dominant influence compared to blood sugar (X1), diet (X2), irregular treatment

(X4) and irregular foot care (X5) to diabetic foot (Y) in Diabetes Mellitus patients at Genteng and Blambangan Hospitals. Based on the results of regression analysis in table 6 seen the value of multiple logistic regression coefficients for each variable. Blood pressure variable has OR value of 8,887 with p-value equal to 0,031. Thus, among the five independent variables, the blood pressure variables (X3) had the most dominant influence on the incidence of diabetic foot (Y) in Diabetes Mellitus patients in Genteng and Blambangan hospitals, meaning Ha3 accepted and Ho3 rejected.

According to Gibney (2009), hypertension is a major risk factor for the occurrence of DM. Its association with type 2 Diabetes Mellitus is very complex, hypertension can make cells insensitive (insulin resistant) (Mihardja, 2009). Though insulin plays a role in increasing glucose uptake in many cells and in this way also regulates the metabolism of carbohydrates, so if there is insulin resistance by cells, then blood sugar levels can also be impaired (Guyton, 2008). In Diabetes Mellitus patients typically type 2, hyperglycemia is often associated with hyperinsulinemia, dyslipidemia, and hypertension, which together lead to cardiovascular disease and stroke. In this type of Diabetes Mellitus, low insulin levels are a prediction of hyperinsulinemia, which in turn affects hyperinsulinaemia. If hyperinsulinemia is not strong enough to correct hyperglycemia, this condition can be expressed as type 2 diabetes. Excessive insulin levels lead to increased sodium retention by renal tubules that can cause hypertension. Furthermore, high insulin levels can lead to the initiation of atherosclerosis, by stimulating the proliferation of endothelial cells and muscle cells of the blood vessels (Masharani and German in Mutmainah, 2013).

According to researchers based on the above description it is known that patients with diabetes with hypertension have a greater risk of complications of diabetic foot ulcers. This is in because the increase in blood sugar will trigger increased blood viscosity and trigger the occurrence of atherosclerosis. The condition will cause ischemia in the microvascular. In addition, hypertension with blood pressure of more than 130/80 mmHg will be able to damage or cause endothelial lesions that will lead to ulcers, especially on the feet of patients with diabetes mellitus.

CONCLUSION

There is influence of uncontrolled blood glucose (X1) factor, non-adherence factor of diabetes mellitus diet (X2), hypertension factor (X3), irregular treatment factor (X4), irregular foot care factor (X5) to diabetic foot event (Y) in patients with Diabetes Mellitus in hospitals Genteng and Blambangan. Blood pressure variable (X3) has the most dominant influence on diabetic foot (Y) incidence in Diabetes Mellitus patient at Genteng and Blambangan hospitals from logistic regression test of OR value of 8,887 with a p-value of 0,031. The suggestion of this study is patients who have been diagnosed by the medical team with Diabetes Mellitus should do promotive, preventive, curative, and rehabilitative

ISBN: 976-602-5617-11-9

aspects especially with hypertension. So that no diabetic foot ulcer is caused by hypertension factor. It is expected that the Health Service Institution (hospital) can provide health education to DM patients on the importance of checking blood sugar, regular blood pressure, explaining correct diet, how to care for the feet, and treatment. The researchers were further expected to explore the factors that may affect DM patients for diabetic foot events, as well as the intervention and implementation of diabetic feet.

REFERENCES

ACC/AHA guideline for PAD, 2006 Clinical practice Recommendations: Report of the Expert Committee on the Diagnosis and Classifications of Diabetes Mellitus Diabetes Care the USA

Andyagreeni. 2010 Tanda Klinis Penyakit Diabetes Mellitus. Jakarta: CV.Trans. Info Media

Ahmed, Algamdi, Algurashi, 2014. Risk Factors For Diabetic Foot Ulceration Among Patients Attending Primary Health Care Services. The Journal of Diabetic Foot Complications, 2014; Volume 6, Issue 2, No. 2, Pages 40-47

Alex, Ratnaraj, Winston, 2010. Risk Factors for Foot Ulcers in Patients with Diabetes Mellitus - A Short Report from Vellore, South India. Indian J Community Med. Volume 35 No.1. doi: 10.4103/0970-0218.62582

Black, JM. & Hawks, J.H. 2009. Medical-surgical nursing clinical management for positive outcome 8 th Edition. Philadelphia: W.B Saunders Company.

Brunner and Suddarth. 2002. Buku Ajar Keperawatan Medikal Bedah, edisi. 8 volume 2. Jakarta : EGC.

Corwin. JE. 2009. Buku Saku Patofisiologi. Jakarta: EGC.

David, 2012, Diagnosis dan Klasifikasi DM Terkini, *Penatalaksanaan DM Terpadu,* 17-21, Fakultas Kedokteran Universitas Indonesia, Jakarta.

Gibney, M.J., 2009. Gizi Kesehatan Masyarakat. Jakarta: EGC.

Guyton, A. 2008. Buku Ajar Fisiologi Kedokteran. Jakarta: EGC.

Hasdianah. 2012. Mengenal Diabetes Melitus pada Orang Dewasa dan. Anak-Anak dengan Solusi Herbal. Yogyakarta: Nuha Medika.

Hirsch dkk., 2006. Overweight and Obesity and their Association with Dietary Habits, and Sociodemographic Characteristics Among Male Primary School in Al-Hassa, Kingdom of Saudi Arabia. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2763675/. [Accessed on Juni 2017]

Ignatavicius, D.D., & Workman, M. L. 2006. Medical surgical nursing: Critical thinking for collaborative care. Fifth edition. St. Louis: Elsevier Saunders.

Jose, 2004. Central and peripheral regulation of food intake and physical activity: pathways and genes. Obesity (Silver Spring): S11-S22

Lerman, 2003, Medical-Surgical Nursing: Critical Thinking in Client Care, New Jersey, Pearson Prentice Hall

Mihardja, L. 2009. Faktor yang berhubungan dengan pengendalian kadar gula darah pada penderita diabetes mellitus di perkotaan Indonesia. Jakarta: Badan Penelitian Dan Pengembangan DepKes RI.

Mutmainah. 2013. Penyebab ketidak terisian diagnosis pada lembar resume medis pasien rawat inap di Rumah Sakit Khusus Bedah Islam Cawas Klaten. Karya tulis ilmiah ini (Tidak Dipublikasikan). Yogyakarta: Program studi D3 Rekam Medis Fakultas MIPA Universitas Gadjah Mada Yogyakarta

Notoatmodjo. 2003. Pendidikan Dan Perilaku Kesehatan. Jakarta. Rineka. Cipta.

Purwanti dan Maghfirah. 2016. Faktor Risiko Komplikasi Kronis (Kaki Diabetik) Dalam Diabetes Mellitus Tipe 2, The Indonesian Journal Of Health Science, Vol. 7, No. 1, Desember 2016

Sarwono Waspadji. 2006. Kaki Diabetes. Dalam: Buku Ajar Ilmu Penyakit Dalam. Jilid 3. Edisi IV. Jakarta: Departemen Ilmu Penyakit Dalam Fakultas Kedokteran Universitas Indonesia.

Subekti, 2006, Penatalaksanaan Diabetes Mellitus Terpadu, Cetakan V, Jakarta, Balai Penerbit FK UI

Tambunan, M. (2006).Perawatan Kaki Diabetes, Jakarta: FK UI.

Waspadji, 2006. Komplikasi Kronik Diabetes: Mekanisme Terjadinya, Diagnosis, dan Strategi Pengelolaan. Dalam: Buku Ajar Ilmu Penyakit Dalam. Edisi IV. Jakarta: Fakultas Kedokteran Universitas Indonesia

Zaidah 2005. Penatalaksanaan Ulkus Diabetikum. Jakarta: EGC

Zubair, Malik and Ahmad. 2015. Glycosylated Hemoglobin in Diabetic Foot and its Correlation with Clinical Variables in a North Indian Tertiary Care Hospital. Journal of Diabetes and Metabolism.6:571. ISSN 2155-6156 doi:10.4172/2155-6156.1000571