Indonesian Journal of Medicine (2023), 08(02): 179-185
Masters Program in Public Health, Universitas Sebelas Maret

Research

Correlations between Age and Hypertension on Diabetic Foot Ulcer

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ABSTRACT

Background: Diabetic foot ulcer is wound located on foot of diabetic patient, which is related to peripheral neuropathy or arterial disease. Hypertension can be related to diabetic foot ulcer by its mechanism that caused peripheral artery disease. Age also can be the one of risk factor of diabetic foot ulcer, because aging occurs reduction of insulin secretion, even insulin resistance. Insulin resistance occur macroangiopathy. The purpose of this study to determine the correlation between age and hypertension with diabetic foot ulcer.
Subjects and Method: This was a cross sectional study conducted at Arafah Islamic Hospital Rembang, Central Java. The dependent variable diabetic ulcers. The independent variables were age and hypertension. A sample of diabetic patients on using medical record from January 2022-June 2022. Data were collected using purposive sampling and analyzed using Chi Square test, and regression logistic test.
Results: Significant correlation found between age (OR= 3.80; 95% CI= 1.38 to 10.57; p<0.001) and hypertension (OR= 8.12; 95% CI= 2.70 to 24.40; p<0.001) with diabetic foot ulcer.
Conclusion: There is significant correlation between age and hypertension with diabetic foot ulcer.

Keywords: age, hypertension, diabetes, diabetic foot ulcers.

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Cite this as:
Marsya V, Mahmuda INN, Lestari N, Jatmiko SW (2023). Corelations between Age and Hypertension on Diabetic Foot Ulcer. Indones J Med. 08(02): 179-185. https://doi.org/10.26911/theijmed.2023.08.02.07.

BACKGROUND

Diabetes mellitus is a chronic disease characterized by blood glucose levels exceeding normal and impaired carbohydrate, fat and protein metabolism caused by relative and absolute lack of the hormone insulin. If this is left unchecked, acute metabolic complications and long-term vascular complications can occur, both microangiopathy and macroangiopathy (Hadisaputro, 2007). Diabetes mellitus has proven to be one of the health problems both internationally and nationally. In 2021, the International Diabetes Federation (IDF) estimates an increase in the prevalence of diabetes in terms of age groups. The lowest prevalence was in the age range category of 20-24 years (2.2%), and the highest in the age range category of 75-79 years (24.7%). IDF also projects the prevalence of diabetes mellitus by country, Indonesia is ranked 5th out of the top 10 countries that have the largest diabetes patients in the world, with an estimated number of diabetic patients of 19.5 million people, up from 7th in 2019, which means that Indonesia has a major

contribution to the incidence of diabetes in Landmark Asia (International Diabetes Federation, 2021).

The prevalence in Indonesia in 2018, the percentage of diabetics taken from a doctor's diagnosis at the age of ≥ 15 years is 2%, where this figure increases when compared to the prevalence in 2013, which was 1.5. Central Java itself ranks 11th in the prevalence of diabetics in Indonesia when divided by province (Infodatin, 2015). In Central Java, diabetes mellitus is one of the two main priorities for controlling non-communicable diseases (Dinas Kesehatan Jawa Tengah, 2019). In 2015, diabetes mellitus was ranked 11th as the disease with the most sufferers in Rembang Regency with 9,883 patients (Badan Pusat Statistik Kabupaten Rembang, 2015). In 2021, people with diabetes mellitus in Rembang Regency alone reached 15,894 patients (Dinas Kesehatan Kabupaten Rembang, 2021). Improper management of diabetes mellitus will lead to serious complications. One of the complications of diabetes mellitus is diabetic foot syndrome, which is characterized by injury to the feet, which correlates with neuropathy, peripheral artery disease, and infections. Diabetic ulcers on the feet are the cause of most foot amputations (Papatheodorou, 2018).

The incidence of diabetic ulcers is on the rise worldwide. As many as 15% of diabetes mellitus patients are expected to experience diabetic ulcers (Leone et al, 2012). A person's risk of diabetic ulcers in Indonesia is also estimated to be high, due to the large number of diabetes mellitus patients who are not well diagnosed. Diabetic ulcer is the most feared chronic infection of diabetes mellitus, in Indonesia the mortality and amputation rates due to diabetic ulcers are still fairly high, namely 16% and 25% (Waspadji et al, 2014). Along with diabetes mellitus, hypertension becomes one of the independent risk factors for the development of ulcers in the legs of diabetic patients. People with diabetes mellitus who have hypertension are usually at greater risk of cardiovascular disease, which then develops into nephropathy, retinopathy, and diabetic cardiomyopathy. Hypertension also increases the risk of micro and macrovascular injuries, as well as peripheral artery disease (Khan MIH, 2018).

Age is one of the risk factors for diabetic ulcers, because in the aging process there is a decrease in physiological body function, especially in the pancreas which produces the hormone insulin which results in reduced secretion to insulin resistance, this then causes glucose control in the body to be less optimal (Ferawati, 2014). As a result of insulin resistance, macroangiopathy occurs which can have an effect on reducing bleeding flow, including in large or moderate blood vessels in the legs, this causes diabetics to have diabetic ulcers more easily (Yazdanpanah, et al., 2018). Several studies have shown a strong correlation between age and diabetic ulcers, such as research by (Hameed A et al, 2020), showing that there is a relationship between diabetic ulcers and demographic characteristics including age, where the age group of 36-55 and >55 years has more diabetic ulcers. In contrast to research by (Ahmad, 2022) which shows that there is no significant correlation between age and diabetic ulcer.

Hypertension is one of the risk factors for modifiable macrovascular and microvascular complications of diabetes mellitus (De Boer, 2017). Both hypertension and diabetes have similar risk factors, such as obesity, dyslipidemia, and genetic factors, so that hypertension and diabetes have close continuity (Pastore, 2018).

Several studies on the relationship between hypertension and the incidence of

diabetic ulcers, such as those conducted (Panganugraha, 2016) show a strong correlation between hypertension and the incidence of diabetic ulcers. Contradictory results obtained from the research conducted (Huang, 2019), no significant difference was found between diabetes mellitus patients with or without hypertension.

From the various explanations above, the idea arose to carry out research on the relationship between age and hypertension history with the incidence of diabetic ulcers at the Arafah Rembang Islamic Hospital. This research was conducted because in Central Java itself, diabetes mellitus is one of the two priorities for controlling non-communicable diseases, and the high number of diabetes mellitus patients in Rembang Regency continues to increase.

SUBJECTS AND METHOD

1. Study Design

The type of research used in this study is analytical observational at RSI Arafah Rembang from January 2022 - June 2022.

2. Population and Sample

All diabetes mellitus patients recorded at RSI Arafah Rembang. The samples taken are those that meet the established restriction criteria. In sampling, the method used is a non-probability sampling method of purposive sampling type. With the sample size correction formula, the sample number of 83.3 is rounded to 84 samples.

3. Study Variables

The dependent variable were age and hypertension. The Independent variable of this study is diabetic ulcer.

4. Operational definition of variables

Age is the time since a person is born, can be measured by units of time, and can be viewed chronologically, and can be seen the degree of development anatomically and physiologically.

Hypertension is often called high blood pressure, this occurs if the systolic pressure is ≥140 mmHg and/or the diastolic pressure is ≥90 mmHn g.

Diabetic Foot Ulcer (DFU) is a disease of the feet of diabetics with characteristics of sensory, motor, autonomic neuropathy as well as macrovascular and microvascular disorders.

5. Study Instruments

Medical record data of patients with diabetes mellitus recorded at RSI Arafah Rembang.

6. Data analysis

Data processing is carried out using data processing software, namely the Statistical Program and Service Solution (SPSS) program. Bivariate analysis was tested with Chi Square test, while multivariate analysis was tested with logistic regression test.

7. Research Ethics

Ethical Clearance No.1.712/XII/HREC/2022 Health Research Ethics Comitte Dr.Moewardi General Hospital

RESULTS

1. Univariate Analysis

The results of the study in table 1 showed that most of the respondents were in the elderly (> 46 years) namely 85 people (81.3 %), and most of them were 79 people (70.5%) suffering from hypertension, while there were 33 people (29.5%) who did not experience hypertension. The distribution of respondents based on the incidence of Diabetic Ulcer was found to be 85 people (75.9%) had ulcers, while those who did not have diabetic ulcers were 27 people (24.1%).

2. Bivariate Analysis

The Chi-Square test found that age >46 years old increased the risk of diabetic ulcers (OR= 6.76; 95% CI= 2.42 to 18.86; p<0.001).

Hypertension increased the risk of diabetic ulcer (OR= 3.02; 95% CI= 1.22 to 7.47; p=0.015).

3. Multivariate Analysis

The results of the logistic regression test showed that hypertension and age had a p-value of < 0.005, so it can be concluded that hypertension (p = 0.010) and age (p<0.001) have a significant relationship with the incidence of Diabetic Ulcer. The odds ratio value indicates that age has the highest (OR= 8.12; 95% CI= 2.70 to 24.40). Thus it can be concluded that a person with an age of more than 46 years is at a higher risk of developing Diabetic Ulcer compared to the age of less than 46 years.

Table 1. Sample Characteristics

Variabel	Category	N	%
Age	Not Elderly (≤ 46 years old)	27	18.8
	Elderly (>46 years old)	85	81.3
Hypertension	Hypertension	79	70.5
	Not Hypertensive	33	29.5
Diabetic Ulcer	Ulcer	85	75.9
	No Ulcer	27	24.1

Table 2. Correlation between age and diabetic ulcer

Age	Incidence of Diabetic Ulcer				OR	(95% CI)		p
	Yes		No			Lower Limit	Upper Limit	
	N	%	n	%				
≤46 years old	9	42.9	12	57.1	6.76	2.42	18.86	<0.001
>46 years old	76	83.5	15	16.5				

Table 3. Correlation between hypertension and diabetic ulcer

Hipertension	Incidence of Diabetic Ulcer				OR	(95% CI)		p
	Yes		No			Lower Limit	Upper Limit	
	N	%	n	%				
Yes	65	82.3	14	17.7	3.02	1.22	7.47	0.015
No	20	60.6	13	39.4				

Table 4. Logistic regression analysis of variables related to diabetic ulcer

Variable	OR	95% CI		p
		Lower Limit	Upper Limit	
Hypertension	3.80	1.38	10.47	0.010
Age >46 years	8.12	2.70	24.40	0.001

DISCUSSION

The hypothesis that age is associated with the incidence of diabetic ulcers is acceptable, because bivariate analyses using the Chi Square test yielded a p-value of <0.001 with OR of 6,756 which mean that someone over 46 years is 6,756 time at risk of developing a diabetic ulcer. This is the same as a study (hameed et al, 2020), which showed that there was a reltionship between diabetic ulcers and demographic characteristics including age, where in that study most patients suffering diabetic ulcers came from the age group >55 years, this may be due to old age posing a risk of reduced ability to self-care due to poor vision, and impaired mobility. Age affects the development of ulcers in diabetes mellitus patients due to an increased risk of angiopathy in old age (Jeyaraman, 2019). There is a physiological decline that

causes a decrease in organ function as age develops, as in the theory put forward in the book (Ole Brunner and Suddarth, 2013), that with age, carbohydrate metabolism and insulin release change, it is influenced by the accumulation of glucose in the blood, and there is an obstacle to the release of glucose that enters the cells.

Factors related to the incidence of diabetic foot are proven through case control research in patients with type 2 diabetes mellitus at RSUP dr. M. Djamil Padang as a referral hospital for the West Sumatra region, related to various risk factors of diabetic foot including age, gender, long suffering from diabetes mellitus, glycemic control, dyslipidemia, obesity, hypertension, smoking habits, foot deformity, history of foot ulceration, history of trauma to the foot and history of amputation of the leg (Windarto, 2007). Al-Rubeaan (2015) also stated that the prevalence of diabetic ulcers increases with age and length of disease, and is dominated by men. Results from the study showed that age >45 years was a strong risk factor for diabetic ulcers, with an (OR= 2.81; 95%Cl; 2.31 to 3.34).

The relationship between hypertension and diabetic ulcer analyzed with bivariate analysis with the Chi Square test showed a p-value of 0.015 < 0.05 with an odds ratio of 3.018 which means that there is a significant correlation between hypertension and diabetic ulcer, and someone who suffers from hypertension is at risk of 3,018 times to experience diabetic ulcers which is in line with research by (Panganugraha, 2016), diabetes mellitus patients with hypertension are easier to experience endothelial dysfunction Since nitric oxide levels decrease and trigger macroangiopathy, this situation results in tissue hypoxia that triggers the formation of ulcers on the legs.

Similar results were also shown in a study conducted by (Pastore, 2022), where the group of patients with diabetic ulcers showed a high proportion of hypertension, which was 53% versus 31%, with a p-value of <0.0001. The incidence of hypertension is found in 56.78% of diabetic ulcer patients, and increases a person's risk of developing diabetic ulcers according to research conducted by (Al-Rubeaan, 2015).

The conclusion that can be drawn based on the results of the study is that there is a significant relationship between age and diabetic ulcer. There is a significant association between hypertension and diabetic ulcers. Age >46 years is at 8,118 higher risk of developing Diabetic Ulcer compared to age ≤46 years.

AUTHOR CONTRIBUTION

Iin Novita and Nining Lestari as a background designer and provider of input regarding research methods. Safari Wahyu as a giver of input in the literature review and writing a bobliography. Vitalia Marsya as a writer and data analysis and result discussion thinker.

ACKNOWLEGDEMENT

We are very grateful the database providers PubMed, Google Scholar and Science Direct.

FINANCIAL AND SPONSORSHIP

This study is self-funded.

CONFLICT OF INTEREST

There is no conflict of Interest in this study.

REFERENCE

AhmadAF (2022). Kejadian dan faktor risiko ulkus diabetikum pada pasien diabetes melitus (dm) tipe 2 di Rsu Pku Muhammadiyah Yogyakarta (Doctoral dissertation, Universitas Islam Indonesia).

Alexiadou K, Doupis J (2012). Management of diabetic foot ulcers. Diabetes Ther. 3(1): 1-15.

Al-Rubeaan K, Al Derwish M, Ouizi S, Youssef AM, Subhani SN, Ibrahim HM, Alamri BN (2015). Diabetic foot complications and their risk factors from a large retrospective cohort study. PloS one. 10(5). e0124446.

de Boer IH, Bangalore S, Benetos A, Davis AM, Michos ED, Muntner P, Rossing P., et al. (2017). Diabetes and hypertension: a position statement by the american diabetes association. Diabetes Care. 40(9): 1273-1284. Doi: 10.2337/dci17-0026. PMID: 28830958.

Dinas Kesehatan Provinsi Jawa Tengah (2019). Profil Kesehatan Provinsi Jateng Tahun 2019. (24): 273–5.

Dinas Kesehatan Provinsi Jawa Tengah (2021). Profil Kesehatan Provinsi Jateng Tahun 2021. Dinas Kesehat Provinsi Jawa Teng. (24):273–5.

Badan Pusat Statistik Kabupaten Rembang (2015). produk domestik regional bruto Kabupaten Rembang Tahun 2010-2014. BPS: Kabupaten Rembang.

Ferawati, Ira (2014). Faktor-faktor yang mempengaruhi terjadinya ulkus diabetikum pada pasien diabetes mellitus tipe 2 di Rsud Prof. Dr.Margono Soekarjo Purwokerto. Umsoed: Purwokerto

Hadisaputro S, Setyawan H. (2007). Epidemiologi dan Faktor-Faktor Risiko Terjadinya Diabetes Mellitus tipe 2. Dalam: Darmono, dkk, editors. Naskah Lengkap Diabetes mellitus Ditinjau dari Berbagai Aspek Penyakit dalam dalam rangka Purna Tugas Prof Dr.dr.RJ Djokomoeljanto. Badan Penerbit Universitas Diponegoro Semarang, 2007. 133-154.

Hameed M, Hafsa F, Khan MIH, Hamdani F, Malik U, Mehmood N (2018). Early age of onset of type 2 Diabetes and common risk factors among newly diagnosed people with type 2 Diabetes visiting diabetes clinic in Lahore General Hospital, Pakistan. In Diabetic Medicin.e 35: 200-200. 111 River St, Hoboken 07030-5774, NJ USA: WILEY.

Huang ZH, Li SQ, Kou Y, Huang L, Yu T, Hu A (2019). Risk factors for the recurrence of diabetic foot ulcers among Diabetic patients: a meta-analysisInt. Wound J. 16(6): 1373-1382.

International Diabetes Federation (2021). IDF Diabetes Atlas 10th ed.

Jeyaraman K, Berhane T, Hamilton M, Chandra AP, Falhammar H (2019). Mortality in patients with diabetic foot ulcer: a retrospective study of 513 cases from a single Centre in the Northern Territory of Australia. BMC Endocr Disord. 19:1. Doi: 10.1186/s12902-018-0327-2.

Kementerian kesehatan RI (2015). INFODATIN Pusat Data dan Informasi Kementerian Kesehatan RI Situasi Kesehatan Remaja. 2015.

Khan MIH, Azhar U, Zubair F, Khan ZA (2018). Can we link foot ulcer with risk factors in diabetics A study in a tertiary care hospital. Pak J Med Sci. 34(6): 1375.

Leone S, Pascale R, Vitale M, Esposito S (2012). Epidemiology of diabetic foot. Infez Med. 20: 8-13

Münter C, Price P (2012). Diabetic foot ulcers, prevention and treatment. Mount Waverley, Coloplast.

Nuswantari 1998. Kamus Kedokteran Dorland, (edisi 25). EGC.

Ole Brunner, Suddarth (2013). Buku Ajar Keperawatan Medikal Bedah Edisi 8(2). Jakarta EGC

Panganugraha IH (2015). Hubungan Hipertensi dengan Kejadian Ulkus Diabetikum (Diabetic Foot Ulcer) pada Pasien Diabetes Melitus Tipe 2 di RSUD dr. Soedomo Kab. Trenggalek (Doctoral

dissertation, University of Muhammadiyah Malang).

Pastore D, Deja-Simoni A, De Stefano A, Pacifici F, Cela E, Infante M, Coppola A., et al. (2022). Risk factors for diabetic foot ulcers: an Albanian retrospective study of inpatients with type 2 diabetes.

Papatheodorou K, Banach M, Bekiari E, Rizzo M, Edmonds M (2018). Complications of diabetes 2017. J. Diabetes Res. Waspadji S (2014). Komplikasi kronik diabetes: Mekanisme terjadinya, diagnosis, dan strategi pengelolaan. Dalam Setiati S, Alwi I, Sudoyo AW, Simadibrata M, Setiyohadi B, Syam AF. Buku ajar ilmu penyakit dalam. Edisi ke 6. Jakarta: Pusat Penerbitan Ilmu Penyakit Dalam FKUI. pp 2359-66.

Windarto (2007). Kencing Manis (Diabetik). Jakarta: PT Sunda Kelapa Pustaka.

Yazdanpanah L, Shahbazian H, Nazari I, Arti HR, Ahmadi F, Mohammadianinejad SE, Cheraghian B, et al. (2018). Incidence and Risk Factors of Diabetic Foot Ulcer: A Population-Based Diabetic Foot Cohort (ADFC Study)-Two-Year Follow-Up Study. Int J Endocrinol. 15: 7631659. Doi: 10.1155-/2018/7631659.