

Stroke among Type 2 Diabetes Mellitus Patients at Haji Adam Malik General Hospital, Medan, Indonesia

by Novita Sari Harahap

Submission date: 07-Mar-2021 11:43PM (UTC-0800)

Submission ID: 1527229749

File name: OAMJMS_Rina1.pdf (146.55K)

Word count: 2621

Character count: 15737

Stroke among Type 2 Diabetes Mellitus Patients at Haji Adam Malik General Hospital, Medan, Indonesia

Rina Amelia^{1*}, Novita Sari Harahap²

¹Department of Community Medicine/Public Health, Faculty of Medicine, ¹²Universitas Sumatera Utara, Jl. dr. Mansyur No. 5 Kampus USU, Medan 20155, North Sumatra, Indonesia; ²Department of Sports Sciences, Faculty of Sports Sciences, Universitas Negeri Medan, Medan, North Sumatra, Indonesia

Abstract

Citation: Amelia R, Harahap N. Stroke among Type-2 Diabetes Mellitus Patients at Haji Adam Malik General Hospital, Medan, Indonesia. *Open Access Maced J Med Sci*. 2019 Aug 30; 7(16):2643-2646. <https://doi.org/10.3889/AMJMS.2019.743>

Keywords: Type 2 Diabetes Mellitus; Stroke; Blood glucose level

***Correspondence:** Rina Amelia, ³Department of Community Medicine/Public Health, Faculty of Medicine, Universitas Sumatera Utara, Jl. Dr Mansyur No 5 Kampus USU, Medan 20155, North Sumatra, Indonesia. E-mail: rma2@usu.ac.id

Received: 08-June-2019; **Revised:** 25-July-2019; **Accepted:** 26-July-2019; **Online first:** 26-Aug-2019

Copyright: © 2019 Rina Amelia, Novita Sari Harahap. This is an open-access article distributed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (CC BY-NC 4.0).

Funding: The present research was supported by Research Institute Universitas Sumatera Utara by Research Contract (ALENTA Universitas Sumatera Utara) for the year 2017 No. 5338/LNS.1/R/PPM/2017 Date May 17

Competing interests: The authors have declared that no competing interests exist

BACKGROUND: Increasing Blood Sugar Level (BSL) in Diabetes Meletus can be various microvascular and macrovascular changes, in the end, will causing complications. The complications can occur in some organs, such as the heart, blood vessels, eyes, kidney, and nerves. Stroke is one of the complications from diabetes that is increasing every year.

AIM: The study aims to analyse the relationship between diabetes and the prevalence of stroke at Haji Adam Malik General Hospital Medan.

METHODS: This study is an analytical study with a cross-sectional approach. The population was all integrated Inpatient ward at Haji Adam Malik General Hospital Medan. The subjects were 180 people chosen by consecutive sampling technique.

RESULTS: The results showed that diabetes has a relationship with the prevalence of stroke ($p < 0.05$, CI = 95%). The risk of diabetes is 1,34 times higher than those without diabetes at Haji Adam Malik General Hospital Medan.

CONCLUSION: Based on the results, the diabetic patient has a higher risk of incidence of stroke. Excellent control for diabetic patients will prevent them from stroke and any complication.

Introduction

Diabetes Mellitus (DM) is a metabolic dysfunction with an increase in Blood Sugar Level (BSL) that can result in complications. The complications can occur in some organs, such as the heart, blood vessels, eyes, kidney, and nerves. The most complication resulted from diabetes is heart disease and vascular malformation (cardiovascular); diabetes will increase the risk of heart disease and vascular malformation in the brain (stroke). About 50% of diabetes patients will die due to heart disease and stroke [1], [2].

Stroke is a vascular disease in which the blood supply to the brain is disturbed or damaged, and the brain cells are damaged [3]. Since the brain is

the centre of control of everything we do, such as moving, balancing, thinking, speaking, understanding, remembering, seeing, and hearing, the brain damage caused by stroke will result in the disruption of brain functions and can also result in disability even death — the risk of diabetes patients suffering from strokes 2-5 times greater [4]. Patients with diabetes have a higher mortality rate but tend to have a more severe disability and from a stroke when compared with non-diabetic patients [4], [5].

The uncontrolled increase of blood glucose level in an extended period results in the disruption of the functions and structural changes in blood vessels in many tissues that cause the insufficient blood supply to the tissue. It will increase the risk of heart attack, stroke, final-stage kidney disease, retinopathy, ischemia, and gangrene on the leg [6]. Hypertension

and diabetes will increase the risk to the occurrence of stroke independently, and the combination of both will increase the risk to the occurrence of stroke drastically [7]. The cause of death on diabetes patients are 20% by a stroke. It can be said that diabetes patients have a risk 1,5 to 3 times to get a stroke than the general population [1], [2], [8].

Material and Methods

The research type is analytic with a cross-sectional design. The calculation of the number of the subject was by using a limited population proportion data with amount 180 patients, the sample of study chosen by consecutive sampling in which the researcher implemented the inclusion and exclusion criteria on the determination of subjects. The inclusion criteria in this study are patients who had hospitalised at Adam Malik General Hospital (proven by medical records), the determination of stroke is an expert (neurologist) by conducting a series of diagnosis enforcement checks, all required data was containing in medical records and data relating to diabetes disease he suffered. Exclusion criteria in this study were stroke patients caused due to previous diseases such as blood clotting disorders, tumours, and accidents, patients with pregnancy, patients whose examination data were not complete.

Prior, the research protocol has approval by the Research Ethics Committee of the Faculty of Medicine, Universitas Sumatera Utara. In this study using is the secondary data (medical records), therefor the demographic characteristics, the diagnosis of stroke and diabetes history.

The data collected from media records were separated into several groups, namely groups of diabetic and non-diabetic patients, patients who are having a stroke and not a stroke. Data were analysed using the Chi-square statistical test with SPSS for Windows program.

Results

Baseline Characteristics of patients T2DM at Haji Adam Malik General Hospital

Table 1 describe that the majority of patients in this study were women (53.3%), based on the most age group was early elderly (32.2%), based on the duration of diabetes, the majority of people had diabetes more than 10 years (56.6%).

Table 1: Characteristics of Patients T2DM at Haji Adam Malik General Hospital

	Frequency (n)	Percentage (%)
Gender		
Man	84	46.7
Woman	96	53.3
Age Group		
Early adulthood (26-35 years old)	34	18.9
End adulthood (36-45 years old)	28	15.6
Early elderly (46-55 years old)	58	32.2
End elderly (56-65 years old)	34	18.9
Elderly (> 65 years old)	26	14.4
Duration of illness		
<10 years	78	43.3
≥10 years	102	56.7

The Relationship T2DM and the Prevalence of Stroke at Haji Adam Malik General Hospital

Results Table 2 explains that of the 39 diabetic patients suffering from a stroke as much as 20%, while 141 non-diabetic patients suffered a stroke of 53.9%. Chi-square test results stated there was a relationship between diabetes and the incidence of stroke ($p < 0.05$). Then the calculation of risk factors, it is known that the risk of diabetes patients to suffer a stroke is 1.34 times greater than non-diabetic patients.

Table 2: Relationship between T2DM and Stroke at Haji Adam Malik General Hospital

	Stroke		Non-Stroke		Total	p	PR
	f	%	f	%			
Diabetic patients	36	20	3	1.7	39	0.003	1.34
Non-Diabetic Patients	97	53.9	44	24.4	141		

Discussion

The results showed that there was a relationship between diabetes and stroke at Adam Malik Hospital General Hospital Medan. The result is in line with other previous studies [9], [10]. Diabetes is one of the essential factors causing a stroke. There are several possible mechanisms of diabetes, causing a stroke. A stroke occurs because of vascular endothelial dysfunction, namely the occurrence of early atherosclerosis due to diabetes, systemic inflammation and thickening of the capillary basement membrane. The function of the vascular endothelium is vital to maintaining the structural and functional integrity of the vascular wall and vasomotor control. In the diabetes patients, the formed atherosclerosis plaque tends to be more clarified, the core of necrosis is covered by Receptor for Advanced Glycosylation Endproducts (RAGE), and infiltrated by T-cell and macrophage [8], [11]. Plaque in the diabetes patients tends to rupture due to the unstable plaque so that increases the risk of embolic and ischemic stroke, through the formation of thrombus and intraplaque haemorrhage caused by the inflammation on the tunica adventitia and vasa vasorum

neovascularisation [1], [8].

Chronic Hyperglycemia in diabetes patients also causes mitochondrial dysfunction that increases to Reactive Oxygen Species (ROS). Reactive Oxygen Species will inhibit the Endothelial Nitric Oxide Synthase (eNOS) synthesis, so that improve the production of superoxide anion (O₂⁻). The superoxide will then have a bond with nitric oxide (NO) to form peroxynitrite (ONOO⁻), a potent oxidant that selectively inhibits prostacyclin (PGI₂). The prostacyclin inhibition will induce the vasoconstriction of vessels, increase the vessels injury, endothelial dysfunction, platelet aggregation, pro-inflammatory cytokines adhesion, cells apoptosis, and aggregate platelet, adhesive cytokine-cytokine pro-inflames, apoptosis cell, and vascular smooth muscle cells activation [1], [12], [13].

These cytokines stimulate the proliferation of vascular smooth muscle cells and the recruitment of immune cells [12], [13]. The intimal smooth muscle cells also respond with the improved production of the extra-cells matrix that will cover plaque with a fibrous stamp. This plaque is very vulnerable to rupture and can be covered by thrombosis so that causes the blockage or acute obstruction on the vessels that can also result in strokes [1], [11], [14].

An increased inflammatory response often in individuals with diabetes; inflammation plays an essential role in the development of atherosclerotic plaques. C-reactive protein, cytokines, and adiponectin are primary serum markers of inflammation. C-reactive protein and plasma levels of these cytokines including interleukin-1, interleukin-6 and tumour necrosis factor- α are independent predictors of cardiovascular risk. Adiponectin appears to be a modulator of systemic lipid and inflammatory metabolism. Low levels of adiponectin it self-are also associated with cardiovascular disease [1].

In this study found that diabetes is the risk factor for stroke with PR of 1.34. Another study found diabetes has 1.5 times higher for stroke [8], and the other found 3 times [11]. The uncontrolled increase of glucose level in an extended period of diabetes causes the disruption of the function and structural changes in the tissues of the tissues that cause the insufficient blood supply to the tissues. It increases the risk of heart attack, stroke, final-stage kidney disease, retinopathy, ischemia, and gangrene on the leg [6]. Hypertension and diabetes increased the risk for stroke independently and the combination of both increased risk for the occurrence of stroke drastically; diabetes and other cardiovascular diseases [7], [8].

Stroke triggers a stress reaction that involves activation of the hypothalamic-pituitary-adrenal axis, thus increasing serum glucocorticoid levels, activation of the sympathetic autonomic nervous system and increased catecholamine release. Increased levels of stress hormones increase the rate of aerobic glycolysis, promote glucose release from

gluconeogenesis and glycolysis and inhibit insulin-mediated glycogenesis [1], [11], [12], [13], [14], [15].

Hyperglycemia increases brain lactate production, decreases the amount of collagen tissue and causes a larger final infarct size. Hyperglycemia further cause exacerbates the consequences of stroke through augmented reperfusion injury by increasing oxidative stress, stimulating systemic inflammation and increasing barrier permeability. Patients with acute ischemic stroke with diabetes and hyperglycemia experience increased platelet aggregation and adhesion to the endothelium. Uncontrolled diabetes makes the patients risky of ischemic and hemorrhagic stroke. In another study, significant differences were observed in patients with an ischemic stroke along with diabetes compared with nondiabetics the imaging of the brain showed with a higher frequency of lacunar infarction in the brain and hypertension [1], [15].

In conclusion, diabetes patients have more risks for stroke. Uncontrolled diabetes will further increase the risk of patients suffering from a stroke. With blood sugar control and lifestyle changes will control blood sugar levels and reduce the risk of stroke and death.

References

1. Fox CS, Golden SH, Anderson C, Bray GA, Burke LE, De Boer IH, Deedwania P, Eckel RH, Ershov AG, Fradkin J, Inzucchi SE. Update on prevention of cardiovascular disease in adults with type 2 diabetes mellitus in light of recent evidence: a scientific statement from the American Heart Association and the American Diabetes Association. *Circulation*. 2015. <https://doi.org/10.1161/CIR.0000000000000230> PMID:26246173
2. Zhang S, Zhu C, Sin JK, Mok PK. A novel ultrathin elevated channel low-temperature poly-Si TFT. *IEEE Electron Device Letters*. 1999; 20(11):569-71. <https://doi.org/10.1109/55.798046>
3. Mozaffarian D, Benjamin EJ, Go AS, Arnett DK, Blaha MJ, Cushman M, de Ferranti S, Despres JP, Fullerton HJ, Howard VJ, Huffman MD. American heart association statistics committee and stroke statistics subcommittee. Heart disease and stroke statistics-2015 update: a report from the American Heart Association. *Circulation*. 2015; 131(4):e29-322.
4. Guo L, Yu M, Zhong J, Wu H, Pan J, Gong W, Wang M, Fei F, Hu R. Stroke risk among patients with type 2 diabetes mellitus in Zhejiang: a population-based prospective study in China. *International journal of endocrinology*. 2016; 2016. <https://doi.org/10.1155/2016/6380620> PMID:27403161 PMID:PMC4923572
5. Shou J, Zhou L, Zhu S, Zhang X. Diabetes is an independent risk factor for stroke recurrence in stroke patients: a meta-analysis. *Journal of Stroke and Cerebrovascular Diseases*. 2015; 24(9):1961-8. <https://doi.org/10.1016/j.jstrokecerebrovasdis.2015.04.004> PMID:26166420
6. Guyton AC, Hall JE. *Textbook of Medical Physiology*. Jakarta. 11th ed., 2012.
7. Li W, Katzmarzyk PT, Horswell R, Zhang Y, Zhao W, Wang Y, Johnson J, Hu G. Body mass index and stroke risk among patients with type 2 diabetes mellitus. *Stroke*. 2015; 46(1):164-9.

- <https://doi.org/10.1161/STROKEAHA.114.006718> PMID:25468880
PMCID:PMC4276457
8. Rapanelli M, Pittenger C. Histamine and histamine receptors in Tourette syndrome and other neuropsychiatric conditions. *Neuropharmacology*. 2016; 106:85-90. <https://doi.org/10.1016/j.neuropharm.2015.08.019> PMID:26282120
9. Rahman A. Karakteristik Penderita Stroke Iskemik Akut di Rumah Sakit Umum Pusat Haji Adam Malik Medan Tahun 2016.
10. Feigin VL, Forouzanfar MH, Krishnamurthi R, Mensah GA, Connor M, Bennett DA, Moran AE, Sacco RL, Anderson L, Truelsen T, O'Donnell M. Global and regional burden of stroke during 1990-2010: findings from the Global Burden of Disease Study 2010. *The Lancet*. 2014; 383(9913):245-55. [https://doi.org/10.1016/S0140-6736\(13\)61953-4](https://doi.org/10.1016/S0140-6736(13)61953-4)
11. Low Wang CC, Hess CN, Hiatt WR, Goldfine AB. Clinical update: cardiovascular disease in diabetes mellitus: atherosclerotic cardiovascular disease and heart failure in type 2 diabetes mellitus-mechanisms, management, and clinical considerations. *Circulation*. 2016; 133(24):2459-502. <https://doi.org/10.1161/CIRCULATIONAHA.116.022194> PMID:27297342 PMCID:PMC4910510
12. Prasad GS, Govardhan P, Deepika G, Vakdevi V, Sashidhar RB. Anti-inflammatory activity of anti-hyperlipidemic drug, fenofibrate, and its phase-I metabolite fenofibric acid: in silico, in vitro, and in vivo studies. *Inflammopharmacology*. 2018:1-9.
13. Negro F. Facts and fictions of HCV and comorbidities: steatosis, diabetes mellitus, and cardiovascular diseases. *Journal of hepatology*. 2014; 61(1):S69-78. <https://doi.org/10.1016/j.jhep.2014.08.003> PMID:25443347
14. Wannamethee SG, Welsh P, Lennon L, Papacosta O, Whincup PH, Sattar N. Copeptin and the risk of incident stroke, CHD and cardiovascular mortality in older men with and without diabetes: The British Regional Heart Study. *Diabetologia*. 2016; 59(9):1904-12. <https://doi.org/10.1007/s00125-016-4011-7> PMID:27312697 PMCID:PMC4969339
15. Khan S, Shafique L, Miah MM. Risk Factors and Patterns of Stroke among Diabetic and Non-diabetic Patients. *Imperial Journal of Interdisciplinary Research*. 2017; 3(9).

Stroke among Type 2 Diabetes Mellitus Patients at Haji Adam Malik General Hospital, Medan, Indonesia

ORIGINALITY REPORT

20%

SIMILARITY INDEX

12%

INTERNET SOURCES

13%

PUBLICATIONS

8%

STUDENT PAPERS

PRIMARY SOURCES

1

www.ncbi.nlm.nih.gov

Internet Source

2%

2

Submitted to Universiti Putra Malaysia

Student Paper

1%

3

www.iufro.org

Internet Source

1%

4

Submitted to Toyo University

Student Paper

1%

5

www.fgd.org.uk

Internet Source

1%

6

www.endotext.org

Internet Source

1%

7

CJ Harrow. "Strokes and diabetes", Practical Diabetes International, 07/2005

Publication

1%

8

Emelia J. Benjamin, Salim S. Virani, Clifton W. Callaway, Alanna M. Chamberlain et al. "Heart Disease and Stroke Statistics—2018 Update: A

1%

Report From the American Heart Association", Circulation, 2018

Publication

9	dagensdiabetes.se Internet Source	1%
10	repositori.usu.ac.id Internet Source	1%
11	Clara Stegmann, Gerhard Hindricks. "Atrial Fibrillation in Heart Failure—Diagnostic, Therapeutic, and Prognostic Relevance", <i>Current Heart Failure Reports</i> , 2019 Publication	1%
12	Submitted to Universitas Pendidikan Indonesia Student Paper	1%
13	relaped.com Internet Source	1%
14	Yao Chen, Shu-ying Fang. "Potential genetic polymorphisms predicting polycystic ovary syndrome", <i>Endocrine Connections</i> , 2018 Publication	1%
15	Submitted to Institute of Technology, Nirma University Student Paper	1%
16	Yaqin Zhao, Jinjiang Li, Xin Zhong, Hongyan Shi. "Physical-layer security in fractional orbital angular momentum multiplexing under	1%

atmospheric turbulence channel", Optics

Express, 2019

Publication

17

"Poster Presentations : Abstracts", International Journal of Stroke, 2014.

Publication

1%

18

eprints.gla.ac.uk

Internet Source

1%

19

C B Silalahi, M Sinuraya, D S Hanafiah, R Sipayung. " The influence of Oryzalin concentrations on the plant growth of two tomato (L.) varieties ", IOP Conference Series: Earth and Environmental Science, 2020

Publication

<1%

20

Submitted to Mansoura University

Student Paper

<1%

21

N S Siregar, N S Harahap, R N Sinaga, A Affandi. "The Effect of Nutrition Knowledge on Nutritional Status in Sport Science Students", Journal of Physics: Conference Series, 2020

Publication

<1%

22

en.wikipedia.org

Internet Source

<1%

23

knepublishing.com

Internet Source

<1%

24

stroke.ahajournals.org

Internet Source

<1%

25

Indra, Christian Manginstar, Andi Asadul Islam, Daniel Sampepajung et al. "The relationship between NFKB, HER2, ER expression and anthracycline -based neoadjuvan chemotherapy response in local advanced stadium breast cancer: A cohort study in Eastern Indonesia", *Annals of Medicine and Surgery*, 2021

Publication

<1%

26

P Jousilahti. "Association of markers of systemic inflammation, C reactive protein, serum amyloid A, and fibrinogen, with socioeconomic status", *Journal of Epidemiology & Community Health*, 2003

Publication

<1%

27

M H S Ginting, R Hasibuan, M Lubis, F Alanjani, F A Winoto, R C Siregar. " Supply of avocado starch () as bioplastic material ", *IOP Conference Series: Materials Science and Engineering*, 2018

Publication

<1%

Exclude quotes Off

Exclude matches Off

Exclude bibliography Off