The Association of Diabetes Mellitus With The Incidence of Ischemic Stroke For Less Than 45 Years Old People

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Abstract: Diabetes is caused by complex interaction processes of genetic, environmental and lifestyle factors. Diabetes is also one of the main causes of ischemic stroke. Diabetes and ischemic stroke are degenerative diseases that often occur together. This study aimed to determine the association between diabetes mellitus and the incidence of ischemic stroke for less than 45 years old people. A case-control design was applied in the study. Eighty-six subjects were included, 43 cases and 43 control. The cases were all patients diagnosed with ischemic stroke, and controls were selected from the same hospital diagnosed with other than ischemic stroke. Samples were collected using consecutive sampling. Results of the analysis using the chi-square test showed that diabetes mellitus was associated with the incidence of ischemic stroke (P = 0.004; OR= 3.958; 95% CI = 1.535-10.206). This study concluded that diabetes mellitus has a higher risk of ischemic stroke 3.958 times than non-diabetes. **Keywords**: Ischemic Stroke, Diabetes Mellitus.

Introduction

Ischemic stroke is a disease that often occurs in the elderly, but now this disease has started to attack at a young age. Ischemic stroke in young age groups is predicted causing an increase in health problems in several countries, both developed and developing countries. Stroke is a dangerous disease and causes death and disability for sufferers. The incidence of stroke in young age is more heterogeneous than stroke in older age, this is due to a variety of risk factors that may occur (Boot *et al.*, 2020).

The stroke mortality rate in the world begins to decline, while the incidence of stroke and its remaining symptoms continues to increase (Krishnamurthi *et al.,* 2013, Mozaffarian *et al.,* 2016). Stroke sufferers in USA were estimated to be 7.0 million aged ≥20 years with an overall stroke prevalence of 2.5%. Acute ischemic strokes in young ages aged 18 to 54 years increased significantly from 1995 to 2012. The number of hospitalizations nearly doubled in men aged 18-34 and 35-44 years with a 41.5% increase in cases in men. aged 35-44 years (Benjamin *et al.*, 2019).

Bennet *et al.,* (2014) reported the findings from the Global Burden of Disease (GBD) study in 2010, that there were more than 11 million cases of ischemic stroke worldwide with nearly 3 million deaths, while 63% of them occurred in the country low and middle income countries. The incidence of ischemic stroke continues to increase with age, and 10% to 20% of them occur at the age of 18 to 50 years. A stroke will have an impact on the quality of life of the sufferer and become a threat and cause of long-term disability.

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The incidence of ischemic stroke in young ages varies widely in several countries. The incidence of stroke at a young age in Europe is between 7-8 per 100,000 person-years, in contrast to more than 100 per 100,000 person-years in Africa (Bejot *et al.,* 2016, Feigin *et al.,* 2016, Griffiths & Sturm, 2011, Bejot *et al.,* 2014, Sarfo *et al.,* 2018). This is likely due to differences in risk factor in young age related to age and stroke subtype, geographical differences, prevalence of comorbid diseases, history of risk of cardiovascular disease, and socioeconomic conditions (Griffiths & Sturm, 2011, Sarfo *et al.,* 2018, Ferro *et al.,* 2010).

Population-based studies in Iran reported the incidence of ischemic stroke at a young age of 8/100,000 (Ghandehari & Moud, 2006). Hospital-based studies in Taiwan reported the frequency of stroke at a young age was 7%, while in Korea it was 10%, and in India it was 30% (Lee *et al.,* 2002, Kwon *et al.,* 2000, Anand *et al.,* 2001). Several studies conducted in Asia on the incidence of ischemic stroke at a young age reported that men are higher than women, namely 71-76% (Lee *et al.,* 2002, Kwon *et al.,* 2000), in contrast to 44-60% in Europe. The international conference of neurologists in the UK reports that there are more than 1000 stroke sufferers under 30 years old, and stroke is also the leading cause of disability in the UK (Lloyd-Jones, 2010).

Diabetes is one of the main risk factors for inciden stroke. Although this risk is not well aware of diabetes patients due to a lack of knowledge about how diabetes can lead to raises the risk of stroke (Air and Kissela, 2007). Diabetes is also associated with higher morbidity and mortality rates in the incidence of stroke (Zhu *et al.,* 2015, Shou *et al.,* 2015, Shah *et al.,* 2015). Diabetes is also causes of microvascular and macrovascular changes that lead to stroke (Chen *et al.,* 2016). Diabetes mellitus can increase the risk of stroke two to five times compared to non-diabetes (Al-Rubeaan *et al.,* 2016). Diabetes type 1 and diabetes type 2 are risk factors for ischemic stroke. Diabetes type 1 tends to lead to an increasing risk at a young age (Sundquist & Li, 2006). Patients with diabetes type 1 have a higher risk for vascular events than patients with diabetes type 2 and non-diabetes (Putaala *et al.,* 2011). The purpose of this study is to determine the association between diabetes mellitus and the incidence of ischemic stroke for less than 45 years old people.

Methods

This research was conducted as on observasional analytic research with case control approach on the Regional Public Service Agency for the Cut Nyak Dhien Meulaboh General Hospital. The sample was determined based on inclusion criteria with a consecutive sampling technique. Each person who came for treatment at the neurological clinic with the inclusion requirements was used as a sample. The inclusion requirements here are outpatient and inpatient treatment at the neurological clinic, both ischemic stroke patients and non ischemic

stroke patients less than 45 years old. The number of samples is 86 people, consisting of 43 cases and 43 controls. The data was collected through an interview process using a questionnaire to the subject and also through medical record records. The data obtained were analyzed using the chi square test to test the hypothesis of the association between the independent variable and the dependent variable based on the level of significance (p <0.05) and OR> 1 at the 95% confidence level.

Result

Table 1. Analysis chi square test

Diabetes mellitus	Case		Control		OR	95% CI	P-value
	N	%	n	%			
Exposure	22	51,2	9	20,9	3,958	1,535-10,206	0,004
Unexposure	21	48,8	34	79,1			
Total	43	100,0	43	100,0			

The table above shows the data of respondents who suffered from diabetes mellitus were in the case group (51.2%) than in the control group (20.9%). Meanwhile, respondents with non-diabetes mellitus were found to be more in the control group (79.1%) than the case group (48.8%). Chi square test showed P-value (0.004), OR (3.958), and 95% CI (1.535-10.206), so that there was a association between diabetes mellitus and the incidence of ischemic stroke for less than 45 years old. The results of the chi-square test show that the OR value is > 1, meaning that a person with diabetes mellitus has a 3,958 times risk of developing ischemic stroke compared to people without diabetes.

Discusssion

This results showed a significant association between diabetes mellitus and the incidence of ischemic stroke. This is in line with research by Khairatunnisa (2017) where a person with diabetes mellitus has a 4.12 times greater risk of stroke compared to non-diabetes mellitus sufferers p = 0.003; OR = 4.12; 95% CI = 1.69-10.04). Research by Koolaee et al. (2018) also states that diabetes mellitus significantly increases the risk of ischemic stroke (p = 0.021). This study is different from the case control study Alchuriyah (2016) at Brawijaya Hospital Surabaya which shows that there is no effect of diabetes mellitus on the incidence of stroke at a young age (P = 0.236).

This study is also in accordance with the population-based cohort study conducted by Kivioja (2018) by comparing 961 ischemic stroke patients aged 25-49 years and 1403 controls, which showed a strong association between the two types of diabetes mellitus with the incidence of ischemic stroke (diabetes mellitus type 1; OR, 6.72; 95% CI, 3.15–14.33, diabetes mellitus type 2; OR, 2.31; 95% CI, 1.35–3.95). Diabetes mellitus will be able to increase a person's risk for ischemic stroke 1.8 times with age, where the increased risk occurs at age <55 years in black people and age <65 years in white people. The risk of stroke will increase in people with diabetes mellitus who have a history of hypertension and high cholesterol levels (Roger *et al.*, 2012).

Research O'Donnel, *et al.*, (2010) stated that the risk factor for stroke occurring in people with diabetes mellitus was 1.36 times compared to non-diabetes mellitus. Diabetes mellitus is a metabolic disease characterized by hyperglycemia and is caused by abnormalities in insulin

secretion, insulin activity or both. Hyperglycemia in stroke characterized by diabetes mellitus has non-diabetic hyperglycemia. This condition will result in changes in endothelial cell function and failure of vascular relaxation. Patients with diabetes mellitus who experience abnormalities in endothelial function can cause atherosclerotic lesions and are exacerbated by the presence of hypertension, which increases the risk of stroke.

Metabolic disorders caused by proaterogenic risk factors or abnormal fat accumulation in the arteries, hypertension, and hyperglycemia, which can increase the risk of 1, .5 times the occurrence of stroke. Diabetes accelerates the occurrence of atherosclerosis in all blood vessels, including brain blood vessels. Atherosclerotic changes occur due to insulin resistance in cells and hyperinsulinemia leading to diabetes and not due to high glucose levels or other risk factors (Alloubani 2018).

According to Anand *et al.,* (2011), diabetes mellitus patients who have hypertension or high systolic blood pressure are more likely to have a relationship with stroke incidence, especially in diabetes mellitus type 2 sufferers.The risk of death from stroke increases 2.8 times in people who DM. Diabetes is a chronic disease that requires treatment by a doctor as well as knowledge of sufferers and their families on how to self-care to prevent other critical illnesses. Diabetes and hypertension are risk factors for stroke and they have a correlation with atherosclerosis.

Conclusion

Based on the chi square test, it was found that diabetes has a association with the incidence of ischemic stroke. The conclusion from this study is shows that diabetes mellitus is association with an increasing risk of ischemic stroke for less than 45 years old people. Diabetes mellitus can increase the risk of ischemic stroke 3,958 times compared to non diabetes mellitus.

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