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Risk Factors Associated with Stroke in Patients at the Hospitalization Service

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Abstract

Stroke is a serious condition with a high risk of death and long-term disability. Hypertension is a major risk factor contributing significantly to both ischemic and hemorrhagic stroke. This study aims to identify risk factors associated with these two types of stroke. A cross-sectional design was used involving 173 hospitalized stroke patients from February 15 to July 29, 2022. Data were collected from medical records using a checklist and analyzed using univariate and bivariate methods with the Chi-square test. Independent variables included age, gender, hypertension, diabetes mellitus, and stroke type; the dependent variable was the incidence of stroke. Most patients were over 55 years old (62.8%), male (56.1%), and had hypertension (82.7%). Ischemic stroke occurred more frequently (68.2%) than hemorrhagic stroke (31.8%). Hypertension was significantly associated with stroke type ($p = 0.017$), whereas age ($p = 0.113$), gender ($p = 0.545$), and diabetes mellitus ($p = 0.778$) showed no significant association. Hypertension was the most prominent risk factor for stroke, particularly among individuals over 55. Preventive measures are essential to control hypertension. Nurses play a vital role in educating patients about the importance of maintaining healthy blood pressure and can develop stroke prevention programs based on significant risk factors. These programs may help reduce the prevalence of stroke and its impact on mortality and long-term disability.

INTRODUCTION

Stroke is a serious medical condition with a high risk of mortality. Individuals who suffer from stroke may experience various symptoms such as visual disturbances, speech difficulties, paralysis, and confusion. Each year, approximately 15 million people worldwide are affected by stroke, resulting in 5 million deaths and 5 million permanent disabilities, which impose a significant burden on families and society (World Health Organization, 2023). In the United States, stroke contributes substantially to both mortality and long-term disability (Pu et al., 2023).

Around 1 in 6 deaths from cardiovascular disease is attributed to stroke. Every 40 seconds, someone in the United States experiences a stroke, and every 3.5 minutes, one person dies as a result. More than 795,000 strokes occur annually, with nearly one-quarter of these affecting individuals who have previously had a stroke. Approximately 87% of all strokes are ischemic, caused by an obstruction in the blood flow to the brain. The financial impact is immense, with stroke-related costs reaching nearly $53 billion between 2017 and 2018, including expenses for healthcare services, medications, and lost productivity (CDC, 2022). In China, there were 3.94 million stroke cases reported in 2019, representing an 86% increase in incidence since 1990; 2.418 million of these were ischemic strokes, and 436,000 were hemorrhagic strokes, with the stroke mortality rate increasing by 32% (Ruan et al., 2021). The prevalence and mortality rates associated with stroke have risen significantly.

The 2018th Basic Health Research of Indonesia (Riskesdas) results showed that the prevalence of stroke in the said year was 10.9 per mile of the population. East Kalimantan and

Riau Islands have the highest prevalence, 14.7 per mile and 12.9 per mile, while Papua Province has the lowest figures, 4.1 per mile (Lembaga Penerbit Badan Penelitian dan Pengembangan Kesehatan, 2019). Based on the medical records analysis at Indrasari Rengat Riau District Hospital, the number of stroke sufferers hospitalized in 2020 was 111, and in 2021 was 69. Although the incidence of stroke is decreasing due to better control of high blood pressure and lower smoking rates, the number of strokes remains high. Therefore, stroke prevention and management measures must be a priority in Indonesia to reduce death rates and long-term disability due to stroke.

Stroke can be triggered by various risk factors, including elevated blood pressure, tobacco use, unhealthy eating habits, physical inactivity, diabetes mellitus, genetic predisposition, older age, sex, and obesity. To assess the impact of these risk factors, researchers use a metric called Disability-Adjusted Life Years (DALYs) (Beresniak et al., 2025). DALYs are a measure that reflects the overall burden of disease within a population by calculating the number of healthy years lost due to disability or premature death caused by a particular condition. A higher DALY value signifies a greater public health burden. In 2019, estimates of the global disease burden revealed that hypertension was the leading contributor to stroke risk, responsible for 79.6 million DALYs or 55% of the total stroke-related DALYs. Excess body weight contributed 24% of stroke-related DALYs, while behavioral factors such as smoking, poor diet, and lack of physical activity accounted for 47% (World Stroke Organization, 2022). Among these, hypertension remains the most influential risk factor in both ischemic and hemorrhagic strokes, followed by lifestyle and metabolic factors including smoking, alcohol consumption, sedentary behavior, family history of stroke, diabetes, and obesity (Fekadu et al., 2019; Yi et al., 2020).

Implementation of stroke prevention continues to be carried out in various health services, community services, and organizations. Well-planned interventions carried out consecutively can lessen the prevalence of stroke. However, the possibility of stroke recurrence remains and must be avoided at all costs. Promoting prevention by knowing risk factors and changing lifestyle are efficient in averting strokes and recurrent strokes (Pandian et al., 2018). This research is fundamental in identifying the relationship between risk factors and ischemic and hemorrhagic strokes so that people can become more aware and try to prevent stroke. This study aims to determine the risk factors associated with ischemic and hemorrhagic stroke.

RESEARCH METHODS

Study Design

This research was designed as a-cross-sectional study.

Settings and Samples

This study was conducted for six months, starting from February 15 to July 29, 2022. The location of the study was at Indrasari Rengat Regional Hospital, Indragiri Hulu Regency, Riau. The number of respondents was 173 patients. The sampling technique used a population census, namely taking the entire population as a sample. The inclusion criteria in this study were patients who were hospitalized and diagnosed with stroke by a doctor, had complete medical record data and were treated from February 15 to July 29, 2022. The exclusion criteria were patients who were outpatients and hospitalized but did not have complete medical record data.

Measurement and Data Collection

Data were collected using a questionnaire checklist containing relevant variables. The questionnaire was used to identify stroke risk factors such as age, gender, hypertension, type

of stroke (ischemic/hemorrhagic stroke), and diabetes mellitus. The independent variables in this study were stroke risk factors, namely age, gender, hypertension, type of stroke (ischemic/hemorrhagic stroke), and diabetes mellitus. The dependent variable in this study was stroke. The data collection process began with screening of medical records of stroke patients and then taking those who met the inclusion criteria as research data. Before collecting data, researchers had obtained consent from each stroke patient or patient's family.

Data Analysis

This study identified stroke risk factors, including age, gender, hypertension, type of stroke (ischemic/hemorrhagic), and diabetes mellitus, and presented the data in frequency and percentage. The researchers conducted a bivariate analysis using the chi-square test to identify the relationship between stroke risk factors and stroke. A p value <0.05 was used to indicate a significant relationship. The SPSS 21 software program was used to enter and analyze the data.

Ethical Considerations

This research has received research ethics approval from the Health Research Ethics Commission (KEPK) of the Riau Ministry of Health Polytechnic with ethical letter number LB.02.03/6/92/2022.

RESULT

Table 1. The age characteristics of the stroke sufferers were predominantly ≥55 (68.2%) and less than 55 (31.8%). Most stroke sufferers were men with 56.1%, followed by women with 43.9%. A high number of respondents had hypertension (82.7%). Respondents with diabetes mellitus were 29.5%, while those without diabetes mellitus were 70.5%. Ischemic strokes are more common (68.2%) than hemorrhagic strokes (31.8%). Less than half of the respondents had a history of recurrent stroke (34.7%), and the remaining percentage (65.3%) experienced a stroke for the first time.

Table 1. Risk Factor Associated with Stroke (n = 173)

Characteristic	Frequency (n)	Percentage (%)
Age		
a. Older Adults (≥ 55 years)	118	68.2
b. Adults (< 55 years)	55	31.8
Sex		
a. Man	97	56.1
b. Woman	76	43.9
Hypertension		
a. Yes	143	82.7
b. No	30	17.3
Diabetes Mellitus (DM)		
a. Yes	51	29.5
b. No	122	70.5
Stroke Type		
a. Ischemic	118	68.2
b. Hemorrhagic	55	31.8
Total	173	100

Table 2. The chi-square analysis results show a significant relationship between hypertension and ischemic and hemorrhagic stroke (p 0.017). The relationship between other risk factors, such as age, gender, and diabetes mellitus, was insignificantly correlated with ischemic and hemorrhagic stroke.

Table 2. Analysis Chi-Square Risk Factor Associated with Stroke (n = 173)

Risk Factor	Stroke				Total		p-value
	Ischemic		Hemorrhagic				
	N	%	N	%	N	%	
Age:							
Adults (< 55 years)	33	60	22	40	55	31.8	0.113
Older Adults (≥ 55 years)	85	72	33	27.97	118	68.2	
Total	**118**	**68.2**	**55**	**31.79**	**173**	**100**	
Sex:							
Man	68	70.1	29	29.90	97	56.1	0.545
Woman	50	65.8	26	34.21	76	43.9	
Total	**118**	**68.2**	**55**	**31.79**	**173**	**100**	
Hypertension:							
Yes	92	64.3	51	35.66	143	82.7	0.017*
No	26	86.7	4	13.33	30	17.3	
Total	**118**	**68.2**	**55**	**31.79**	**173**	**100**	
Diabetes Mellitus:							
No	84	68.9	38	31.15	122	70.5	0.778
Yes	34	66.7	17	33.33	51	29.5	
Total	**118**	**68.2**	**55**	**31.79**	**173**	**100**	

*Sig ($\alpha \leq 0.05$)

DISCUSSION

A decade's worth of research conducted in China from 2007-2018 using a post hoc method showed that respondents aged 57-75 years had a significant relationship with ischemic stroke sufferers (Xu et al., 2022). Based on previous research, age is still a risk factor for increasing stroke incidence. However, the data gleaned from this present research showed that age had no relationship with the incidence of stroke. According to the CDC, the older one gets, the more at risk for stroke, but stroke can occur at any age. In 2014, more than thirty percent of stroke sufferers aged under 65 were recorded (CDC, 2022). Age as a risk factor has not been widely studied, especially its direct link to increasing the risk of stroke. It is difficult to determine the relationship between age as a factor causing stroke. Stroke sufferers under 50 years are statistically associated with smoking habits, overweight, and pathological conditions, while those over 50 years are associated with diabetes mellitus, hypertension, and unhealthy living habits (Barthels & Das, 2020; Xia et al., 2019). Age as a stroke risk factor may be ignored because of more critical factors such as hypertension, diabetes mellitus, and a history of stroke (Pu et al., 2023). The age factor may not be very relevant in increasing the risk of stroke.

In this study, male stroke patients appeared to be more predominant than female stroke patients, with no significant relationship with either ischemic or hemorrhagic stroke. This finding is by the research results which also have more men who suffer from stroke (Ganguly

et al., 2021). This research was conducted to identify gender-related stroke risk factors. However, differences in views regarding gender-based approaches to stroke prevention emphasize the importance of this issue. Stroke risk factors are not specific to gender (Maksimova & Airapetova, 2019). Male gender was irrelevant to any stroke subtype but was to dyslipidemia and smoking (Gebreegziabher et al., 2021). Gender as a risk factor accompanied by hypertension, smoking, and diabetes mellitus is a more significant stroke risk factor compared to gender itself as a stroke risk factor.

Epidemiological evidence indicates that men are generally at greater risk of experiencing stroke than women; however, the risk for women increases significantly after menopause (Maksimova & Airapetova, 2019; Thomas et al., 2021; Xu et al., 2022). Moreover, there are gender-specific risk contributors among women, such as elevated blood pressure during pregnancy and the use of hormonal contraceptives. Factors that uniquely predispose women to stroke include the age of menarche onset, pregnancy, gestational diabetes, pre-eclampsia, hormonal imbalances, use of combined oral contraceptives, and hormone replacement therapy. Stroke in women displays distinct differences from men in terms of epidemiology, causes, clinical outcomes, and underlying pathophysiological processes. Younger women are especially vulnerable to stroke related to reproductive health conditions, such as pregnancy, the postpartum period, hormonal contraception, and migraine. Furthermore, post-stroke quality of life in women tends to be worse than in men, and recent data show a rising trend in stroke incidence among younger women (Thomas et al., 2021). This highlights the need for tailored public health strategies to prevent stroke and maintain women's health prior to its onset, as well as the importance of including more women in clinical trials to develop appropriate treatment approaches.

Hypertension is identified as the most prevalent risk factor for stroke in Asian populations, with both elevated blood pressure and fluctuations in blood pressure levels being positively linked to stroke incidence (Turana et al., 2021). Clinical interventions to lower blood pressure have been shown to decrease stroke risk by 25%–30% and are also effective in preventing stroke recurrence (Kitagawa, 2022). Recommendations from both the American and European guidelines on hypertension management emphasize the role of antihypertensive therapy, especially in older adults, to minimize the risk of stroke and hypertensive crises (Wajngarten & Silva, 2019). Monitoring systolic and diastolic blood pressure in stroke patients is essential, as persistent hypertension can exacerbate both ischemic and hemorrhagic types of stroke. Studies consistently report that hypertension is the leading risk factor for stroke, with 80% of stroke patients showing a history of high blood pressure (Nutakki et al., 2021; Xia et al., 2019). In the present study, 82.7% of stroke patients were found to have hypertension, with significant associations with both ischemic and hemorrhagic types.

Other research indicates that individuals living with hypertension for more than one year are at greater risk for stroke, and the risk becomes higher as the duration of hypertension increases, particularly among patients younger than 65 years (T. H. Kim et al., 2019). Conversely, stroke risk tends to be lower in those who successfully maintain blood pressure control. Uncontrolled hypertension, regardless of whether in high-income or low-to-middle-income countries, is significantly linked with hemorrhagic stroke (Aycock et al., 2019; Nutakki et al., 2021). The high prevalence of stroke also suggests that cerebral small vessel disease may play a key role in the development of ischemic strokes. This variation may be due to the better management of hypertension in high-income countries, where the proportion of patients achieving controlled blood pressure through antihypertensive medications is significantly higher. Hence, implementing effective blood pressure control strategies is crucial, especially for those at risk of stroke in lower-resource settings.

Diabetes mellitus is a chronic condition characterized by elevated blood glucose levels, resulting from metabolic disruptions related to insufficient insulin secretion, impaired insulin

action, or both. This disease affects vascular health and increases the likelihood of both cardiovascular and cerebrovascular complications, including stroke. Diabetic individuals have a 2- to 6-fold increased risk of stroke and face greater chances of mortality or severe disability following acute ischemic stroke episodes (Maida et al., 2022). Moreover, stroke recurrence is more likely in patients with diabetes than in non-diabetics (Xu et al., 2022). Among various risk factors for stroke, diabetes mellitus and family history account for the largest share, with 56.8% associated with ischemic stroke, followed by 18.6% for hemorrhagic stroke, and the remainder for recurrent cases (Ram et al., 2021). Earlier studies reveal that around one-third of stroke patients have diabetes, with a prevalence rate of 28% (95% CI: 26–31) found among hospitalized stroke populations (Lau et al., 2019). Additionally, the presence of acute hyperglycemia and diabetes has been associated with poorer outcomes post-stroke, including higher mortality rates, more severe neurological deficits, decreased functional recovery, increased risk of hospital readmission, and stroke recurrence.

Diabetes mellitus is significantly associated with stroke; the risk of stroke increases correspondingly with diabetes (4.123 times) (H. Kim & Lee, 2023). The incidence of stroke is exceedingly higher in people with diabetes mellitus than in those without diabetes. However, this research shows that diabetes mellitus has no significant relationship with stroke. Diabetes mellitus may be related to stroke in terms of its pathological course. Different findings may indicate other more critical risk factors, one of which is hypertension. The results of this study show that hypertension is more critical as a risk factor than diabetes mellitus. Diabetes mellitus is not the only risk factor that causes stroke. Diabetes mellitus remains a factor associated with in-hospital mortality of stroke patients. The stroke mortality rate in hospitals in Ethiopia reached 18% (Alene et al., 2020). Diabetes mellitus plays a role in various microvascular and macrovascular diseases. Hyperglycemia can worsen the condition of ischemic or hemorrhagic stroke patients, and diabetes therapy has been proven to improve stroke (Rangel et al., 2019). This present research implied a different result from previous studies that correlated diabetes with stroke, possibly due to a lack of variation in stroke patients, which amounted to only 29.5%.

This study reveals a more dominant gender and age group, male and over 50, to have suffered from a stroke, but age and gender are unrelated to any stroke subtype. Nurses must pay attention to stroke risk factors such as hypertension, diabetes mellitus, smoking, and unhealthy lifestyles in patients to help prevent recurrent strokes. This research identifies hypertension as the most common risk factor and correlates hypertension with stroke incidence. Reducing blood pressure has been proven to reduce the risk of stroke by 25% - 30% and significantly reduces the risk of recurrent stroke. Hypertension is an influential factor in increasing the risk of stroke, so a hypertension prevention and management approach is essential in efforts to prevent stroke. Hypertension management guidelines from global health organizations recommend anti-hypertensive treatment and blood pressure control at certain levels, depending on additional risk factors and the patient's health condition.

Efforts to prevent and control hypertension can increase awareness to maintain health and promote a healthy lifestyle. Treating hypertension and educating patients about blood pressure management in nursing can be crucial in caring for patients at risk of stroke. Emphasizing the prevention and management of hypertension in nursing education can be part of the curriculum to increase nurses' awareness of the risk of stroke and the efforts that can be taken to prevent it. Efforts to improve hypertension monitoring, prevention, and management in health policy can be part of national and international stroke prevention strategies.

The limitation of this study is that the number of stroke patients with diabetes mellitus is incommensurate with the number of stroke patients with hypertension. Stroke patients with hypertension are more often recorded in medical records. The lack of variation is likely to influence the results of the significance of the relationship between the diabetes mellitus risk

factor and stroke. Various studies and pathological science show that diabetes mellitus is associated with ischemic and hemorrhagic stroke. This research was limited to one hospital only and conducted for only a year. The limitations of this research occurred due to the limited length of time the research was permitted to be conducted at the hospital as it concerned confidential patient documents.

CONCLUSION

Age as a risk factor may not be as significant in increasing the risk of stroke as hypertension and diabetes mellitus as risk factors due to its less criticality. Men have a higher risk of stroke than women, but gender is not an indicative risk that increases the prevalence of stroke. Hypertension is the most common risk factor in Asia, and lowering blood pressure has been shown to reduce the risk of stroke by 25-30% and significantly reduce the risk of recurrent stroke. Hypertension is considerably associated with ischemic and hemorrhagic stroke. Therefore, preventing hypertension with good control management is very helpful in reducing the risk of ischemic and hemorrhagic stroke.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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