# Stroke Vulnerability: An Exploration to the Contributing Stroke Risk Factor

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**Abstract**

Stroke is an emergency disorder of the brain's blood vessels that can cause prolonged brain damage, long-term disability, or even death. Apparently, there are some factors that can cause stroke. The risk factors are divided into modifiable risk factors and non-modifiable risk factors. These risk factors are age, gender, race/ethnicity, family history of stroke, hypertension, diabetes mellitus, dyslipidemia/hyperlipidemia, lifestyle, atrial fibrillation, obesity, and oral contraceptives. This review article aims to evaluate and explore the risk factor in stroke based on various prior studies.

Keywords: Stroke, Risk Factor, Modifiable, Non-Modifiable

## 1. Introduction

Stroke is an emergency disorder of the brain's blood vessels that occurs due to a disruption in the blood supply to parts of the brain or when a blood vessel in the brain ruptures. Stroke can cause lasting, long-term brain damage, or even death (Centers for Disease Control and Prevention, 2019). Stroke is the second cause of death in the world responsible for approximately 11% of total deaths. Stroke is the main cause of death and disability in various countries. In 2013, there were around 25.7 million stroke sufferers in the world. Of these cases, around 6.5 million stroke sufferers died, 113 million experienced disability adjusted for Disability-Adjusted-Life-Years (DALYs), and there were around 10.3 million new cases of stroke (Feigin et al., 2015). In Indonesia, based on 2018 Basic Health Research (Riskesdas) data, the prevalence of stroke is 10.9 per 1,000 population. This has increased compared to the 2013 Riskesdas results of 7.0 per 1000 population.

Risk factors are factors that can make it worse or easier for someone to experience a stroke. The risk factors for hemorrhagic stroke and ischemic stroke are more or less the same. The risk factors themselves can be divided into two main factors, namely Risk Factors that cannot be modified and Risk Factors that can be modified. Non-modifiable risk factors include age, gender, race/ethnicity, and family history of stroke. Modifiable risk factors include hypertension, diabetes mellitus, dyslipidemia/hyperlipidemia, lifestyle, atrial

fibrillation, obesity, and oral contraceptives (Chugh, 2019). Patients need to be more aware of these risk factors so that they can know the risk factors and can carry out self-screening to prevent stroke earlier.

## 2. Non-Modifiable Risk Factor

a. Age

Aging of the cardiovascular system and the long-term progressive nature of stroke can increase the risk factors for ischemic stroke (Meschia et al., 2014). The greatest risk of stroke often occurs in the 55-64 year age group. The incidence of stroke increases with age, and the risk can double each decade of age between the ages of 45 and 85 years (Choudhury et al., 2015). Strokes predominate in the middle and later years of life. The incidence of stroke increases with age and affects many people in their golden years. Stroke rarely occurs under 40 years of age (Miah et al., 2012).

b. Sex

Strokes occur more often in men than women. A study shows that gender is a marker of stroke risk and cannot be changed. The incidence of stroke is 1.25 times higher in men because women tend to live longer than men. However, more women than men die from stroke every year (Miah et al., 2012). At a young age, women have a high or higher risk of stroke than men, although at an older age, the relative risk is slightly higher in men (Eriksson et al., 2021).

c. Race/Ethnicity

An epidemiological study suggests that race can influence risk factors for stroke. Studies conducted on several races in the United States stated that Blacks and some Hispanic/Latino Americans had a higher incidence of all types of stroke and higher mortality rates compared with whites (Cruz-Flores et al., 2011). It is still unclear whether these racial differences are caused by several factors such as genetics, environment, or interactions between the two. Possible reasons for the higher incidence and mortality rates of stroke in blacks include a higher prevalence of prehypertension, hypertension, obesity, and diabetes mellitus (Glasser et al., 2011).

d. Family History of Stroke

Genetic factors are also known to be risk factors for stroke that cannot be modified with parental history and family history increasing the risk of stroke (Saeed, 2004). The influence of genetics on stroke risk can be considered based on its influence on individual risk factors, genetics of common types of stroke, and rare or rare causes of stroke in the family (Meschia et al., 2014). A parental or family history of stroke increases a person's chances of developing a neurological disorder. Rare single gene mutations may contribute also to the pathophysiology in which stroke is the primary clinical manifestation, such as in cerebral autosomal dominant arteriopathy. Stroke can be one of many side effects of some syndromes caused by genetic mutations, such as sickle cell anemia. Several common genetic variants are associated with an increased risk of stroke, such as the genetic polymorphism at 9p21 (Matarin et al., 2008).

## 3. Modifiable Risk Factors

a. Hypertension

Hypertension is the most important modifiable risk factor for stroke, with a strong, direct, linear and continuous relationship between blood pressure and stroke risk (Boehme, Esenwa and Elkind, 2017). Definitions and categories of hypertension have evolved over the years, but there is consensus that persistent

blood pressure readings of 140/90mmHg or more should warrant treatment with a usual therapeutic target of 130/80mmHg or less (Iqbal and Jamal, 2023). In individuals aged 40–69 years, a 20 mmHg increase in systolic blood pressure or a 10 mmHg increase in diastolic blood pressure regardless of baseline value was associated with more than a doubling of the risk of stroke or ischemic heart disease death. Meanwhile, reducing blood pressure by 5 mmHg can reduce stroke mortality by 14% and cardiovascular disease mortality by 9%. At older ages (≥80 years), the corresponding relative risks are slightly lower, but the absolute risks are much greater than earlier in life. For example, a 20 mmHg difference in systolic blood pressure between 120 and 140 mmHg is associated with an annual difference in absolute risk that is almost ten times greater at ages 80-89 years than at ages 50-59 years (Iqbal and Jamal, 2023).

b.  Diabetes Mellitus

Diabetes is an independent risk factor for stroke with a 2-fold increase in stroke risk for diabetes patients, and stroke accounts for approximately 20% of deaths in diabetes sufferers (Banerjee et al., 2012). Diabetes patients who experience stroke tend to be younger and have a higher prevalence of other stroke risk factors. Increased diabetes may explain some of the increased risk of stroke in younger populations (Kissela et al., 2005).

c.  Dyslipidemia/Hyperlipidemia

The relationship between dyslipidemia and stroke risk is very complex, with an increase in the risk of ischemic stroke with an increase in total cholesterol, and a decrease in the risk of ischemic stroke with an increase in HDL (High Density Lipoprotein) cholesterol (Kurth et al., 2007). Hyperlipidemia makes some contribution to the risk of stroke even in the elderly, with a more common role for HDL than LDL (Low Density Lipoprotein) and assessment of the lipid profile should be taken into account in estimating the individual risk of stroke (Choudhury et al., 2015). Low HDL levels (<0.90 mmol/L), high total triglyceride levels (>2.30 mmol/L) and hypertension are associated with a twofold increase in the risk of stroke-related death in the population (Kuriakose and Xiao, 2020).

d.  Lifestyle

There are several factors that can influence a person's lifestyle, including smoking, alcohol, drug abuse, and physical activity. Smoking almost doubles the risk of ischemic stroke with a clear dose-response relationship. In the Framingham Study and the Nurses' Health Study, smoking cessation led to a reduced risk of stroke within 2 to 4 years (Choudhury et al., 2015). There is evidence of a link between alcohol consumption and the risk of ischemic stroke, with light to moderate alcohol consumption (up to 2 drinks per day in men and up to one drink per day in women) being protective against stroke, and heavy drinking associated with an increased risk of ischemic stroke (Boehme, Esenwa and Elkind, 2017). Abuse of illicit substances, including cocaine, heroin, amphetamines, and ecstasy is associated with an increased risk of ischemic stroke (Esse et al., 2011). Moderate amounts of physical activity at work were associated with a 36% reduction in stroke risk compared with being inactive at work. High levels of leisure time physical activity are associated with a 20-25% reduction in stroke risk when compared with being inactive during leisure time. The risk reduction when comparing moderate leisure time physical activity with inactivity is 15% (Gallanagh et al., 2011).

e.  Atrial Fibrillation

Atrial fibrillation can increase the risk of stroke by two to five times depending on the age of the individual concerned (Wolf, Abbott and Kannel, 1991). Atrial fibrillation contributes to 15% of all strokes and results in more severe disability and higher mortality than strokes not related to Atrial fibrillation (Romero, Morris and

Pikula, 2008). A link between atrial fibrillation and stroke has long been assumed because blood stasis in the fibrillated left atrium causes thrombus formation and embolization to the brain, but recent data challenges this assumption (Boehme, Esenwa and Elkind, 2017).

f.  Obesity

Stroke, along with hypertension, heart disease, and diabetes mellitus, is associated with being overweight or obese (Meschia et al., 2014). According to National Center for Health Statistics data from the Department of Health and Human Services, in 2009 and 2010, the prevalence of obesity was 35.7% in adults and 16.9% in children, with a higher prevalence in adults >60 years of age. and adolescents (Ogden et al., 2014). There is mounting evidence showing a multilevel positive association between stroke and obesity regardless of age, lifestyle, or other cardiovascular risk factors. Prospective studies of the relationship between body weight (or measures of adiposity) and stroke incidence show that in the BMI (Body Mass Index) range of 25 to 50 kg/m2 there is a 40% increase in stroke mortality with every 5-kg/m2 increase in BMI. However, in the BMI range of 15 to 24 kg/m2, there is no relationship between BMI and mortality (Prospective Studies Collaboration, 2009).

g.  Oral Contraception

Oral contraceptives containing >50 g of estrogen, preparations used in the 1960s and 1970s, are strongly associated with stroke risk. Recently a study of low-dose oral contraceptives (<50 g estrogen) revealed no increased risk of stroke in more than 3.6 million woman-years of observation (Song et al., 2005).

## 4. Conclusions

Risk factors that cannot be modified can be prevented by educating the public so that they are more aware of these factors and can realize that they have a high risk of stroke. For risk factors that can be modified, education is also esential to the public so they can be more aware that of these risk factors. By knowing the risk factor, they can also change their lifestyle so that they can further avoid stroke.

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