

Hemorrhagic Stroke: a Scoping Review

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Article Info	Abstract
Article History Received: 2026-03-02 Revised: 2026-06-06 Published: 2026-09-28 Keywords: characteristics; hemorrhagic stroke; Indonesia	<i>Hemorrhagic stroke remains a leading cause of death and disability in Indonesia. However, comprehensive national data on its demographic and clinical characteristics across various age groups remain limited. Understanding these characteristics is crucial for improving prevention and management strategies. This literature review was conducted in February 2026 using the Google Scholar, PubMed, ScienceDirect, and Garuda databases. Articles published between 2016 and 2026 were identified using keywords based on the Population-concept-context framework. Study selection followed the PRISMA guidelines. Data extraction included study characteristics and key findings, and the analysis was conducted narratively. The initial search yielded 1125 articles. After the screening process, 11 articles remained. Hemorrhagic stroke most frequently occurs in patients aged ≥ 45 years and is generally more common in men. Intracerebral hemorrhage (ICH) is the dominant subtype, with bleeding primarily located in the deep cerebral and supratentorial regions. Hypertension is the most significant risk factor, often accompanied by other comorbidities such as diabetes mellitus, dyslipidemia, chronic kidney disease, and heart disease. Hemorrhagic stroke in Indonesia is strongly associated with hypertension and typically involves intracerebral hemorrhage in the deep brain regions, highlighting the importance of strict risk factor control, education regarding the early symptoms of hemorrhagic stroke, and the development of a more structured national stroke registry.</i>
Artikel Info	Abstrak
Sejarah Artikel Diterima: 2026-03-02 Direvisi: 2026-06-06 Dipublikasi: 2026-09-28 Kata kunci: Indonesia; karakteristik; stroke hemoragik	Stroke hemoragik tetap menjadi kontributor utama mortalitas dan disabilitas di Indonesia. Namun, data nasional komprehensif yang menggambarkan karakteristik demografis dan klinisnya di berbagai kelompok usia masih terbatas. Memahami karakteristik ini sangat penting untuk meningkatkan strategi pencegahan dan penanganan. Tinjauan literatur ini dilakukan pada Februari 2026 menggunakan database Google Scholar, PubMed, ScienceDirect, dan Garuda. Artikel yang diterbitkan antara tahun 2016 dan 2026 diidentifikasi menggunakan kata kunci berdasarkan kerangka kerja <i>Population-concept-context</i> . Seleksi studi mengikuti pedoman PRISMA. Ekstraksi data mencakup karakteristik studi dan temuan utama, dan analisis dilakukan secara naratif. Pencarian awal didapatkan 1125 artikel. Setelah dilakukan screening tersisa 11 artikel. Stroke hemoragik paling sering terjadi pada pasien berusia ≥ 45 tahun dan umumnya lebih sering terjadi pada laki-laki. Perdarahan intraserebral (ICH) adalah sub tipe yang dominan, dengan perdarahan terutama terletak di daerah serebral dalam dan supratentorial. Hipertensi adalah faktor risiko paling signifikan, sering disertai dengan komorbiditas lain seperti diabetes melitus, dislipidemia, penyakit ginjal kronis, dan penyakit jantung. Stroke hemoragik di Indonesia sangat terkait dengan hipertensi dan umumnya melibatkan perdarahan intraserebral di daerah otak bagian dalam, yang menyoroti pentingnya pengendalian faktor risiko secara ketat, edukasi terkait gejala awal stroke hemoragik, dan pengembangan registry stroke nasional yang lebih terstruktur.

INTRODUCTION

Stroke remains one of the major health problems in Indonesia. Based on data from the 2023 Indonesian Health Survey (IHS), the national prevalence of stroke reached 8.3% of the total population. Age distribution shows a predominance in the

elderly group above 75 years at 41.3%, whereas in young adults it is only 0.1% (Badan Kebijakan Pembangunan Kesehatan, 2023). In terms of sex, prevalence is higher in males (8.8%) compared to females (7.9%) (Annisa et al., 2022). Globally, the Global Burden of Disease (GBD) 2021

report states that stroke is the third leading cause of death worldwide. Hemorrhagic stroke (HS) accounts for 28.8% of all stroke incidents, with mortality reaching 3,308,367 cases (45.6%) out of a total of 7,252,678 stroke-related deaths. Southeast Asia, East Asia, and Oceania, including Indonesia, contribute 53.3% to the total global disability-adjusted life years (DALYs) due to stroke, reflecting the high burden of mortality and disability associated with this disease (Institute for Health Metrics and Evaluation., 2023). Specifically in Indonesia, the prevalence of hemorrhagic stroke is 29.6% (Timur et al., 2025).

At the regional level, data from Cirebon City indicate that hemorrhagic stroke patients are predominantly elderly and male. The most common site of hemorrhage is the thalamic region (Nurkholifah et al., 2024). Similar findings have also been reported in the United States, where HS is more common in elderly males, with mortality increasing up to 70% in the fifth year after the first attack (Magid-Bernstein et al., 2022). In the pediatric population, HS accounts for approximately 50% of all stroke cases in children and is among the top ten causes of death and long-term disability in individuals under 18 years of age (Askarova & Zhurkabayeva, 2024). Unlike in adults, the etiology of HS in children is more often associated with congenital abnormalities or hematological disorders such as von Willebrand disease, vitamin K deficiency, and cerebral venous thrombosis.

Despite the high burden of hemorrhagic stroke in Indonesia, the

availability of comprehensive national data regarding HS characteristics across all age groups remains limited. Most studies are regional and do not yet reflect variations in risk factors, demographic distribution, and clinical outcomes comprehensively. This is evident from the scarcity of national data specifically on hemorrhagic stroke. Currently, data is typically available only regarding the prevalence of stroke in general. Furthermore, integrated analyses regarding differences in characteristics between adult and pediatric populations in Indonesia are still rarely conducted. Most studies appear to focus only on stroke in adults, even though it can also occur in people other than adults. This limitation may hinder the formulation of evidence-based prevention strategies and health policies.

Therefore, this study aims to identify the characteristics and risk factors of hemorrhagic stroke in Indonesia across different age groups. The results of this study are expected to serve as a basis for developing more targeted prevention strategies, supporting efficient health policy planning, and helping optimize health budget allocation in the management of hemorrhagic stroke.

METHODS

This literature review was conducted in February 2026. The databases used in this study included Google Scholar, PubMed, ScienceDirect, and Garuda. Literature searches in the databases were performed using keywords combined with Boolean operators. The keywords were structured

based on the Population–Concept–Context framework.

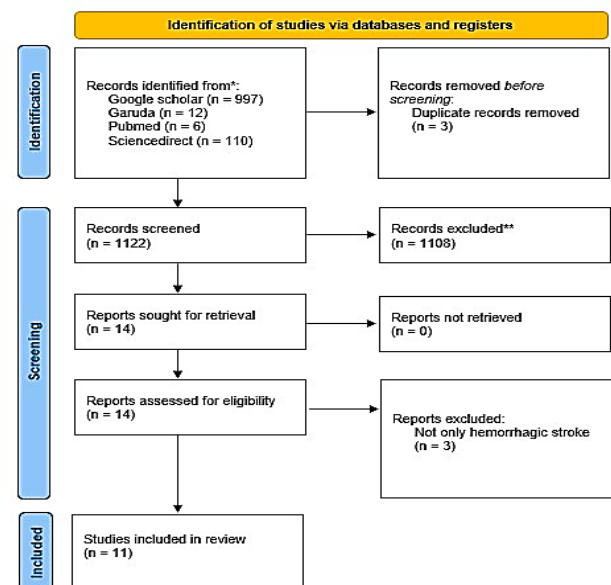
The search on PubMed and ScienceDirect used the keywords (((profile) OR (characteristics)) AND (hemorrhagic stroke)) AND (Indonesia). On Google Scholar, the keywords were (karakteristik OR profil OR gambaran) AND (stroke hemoragik), and on Garuda, they were (karakteristik) AND (stroke hemoragik).

The population in this study was patients with hemorrhagic stroke. The concept of this study was clinical and demographic characteristics. The context of this study was the Indonesian region. Article selection was carried out using the PRISMA guidelines.

Initially, 1,125 articles were screened for duplicates. 1,122 articles remained at this stage. Next, 1,108 articles were excluded due to discrepancies between the title and abstract. 14 articles remained at this stage. The articles were then screened based on availability of access. No articles were excluded at this stage. Last, we selected 14 articles by reading their full texts. We excluded 3 articles at this stage. 11 articles remained to be included in this scoping review.

The inclusion criteria applied in this study were articles published within the last 10 years (2016–2026), discussing the characteristics of hemorrhagic stroke in Indonesia, observational studies, and articles published in Indonesian or English. The exclusion criteria were grey literature, conference abstracts, letters to the editor, and articles that were not fully accessible.

Data extraction included authors, year of publication, study design, location, sample, and results. The analysis was conducted narratively.



Gambar 1. PRISMA Flowchart

RESULTS AND DISCUSSION

Tabel 1. Data Extraction

Author, Year	Study Design	Location	Sample	Results
(Benita et al., 2024)	Descriptive	Raden Mattaher Regional Hospital, Jambi	109 patients	Age Late adulthood (36–45):10.1% Early elderly (46–55) : 28.4% Late elderly (56–65) : 37.6% Old (>65): 23.9% Sex Male : 46.8% Female : 53.2% Type of hemorrhage ICH : 66.1%

				SAH : 5.5% VH : 5.5% ICH + IVH: 21.1% ICH + IVH + SAH: 1.8% Blood pressure Prehypertension : 7% Grade 1 hypertension: 17.4% Grade 2 hypertension: 38.5% Hypertensive emergency: 36.7% Hemorrhage location Deep cerebral (putaminal, basal ganglia, and thalamus): 31.2% Lobar: 15.6% Brainstem (pons and medulla oblongata) : 8.3% Cerebellar : 0.9% Subarachnoid : 5.5% Intraventricular : 5.5% ICH + IVH: 17.4% ICH + IVH + SAH: 1.8% No data: 13.8%
(Abukarim et al., 2024)	Descriptive	Dr. H Chasan Boesoirie Regional Hospital, Ternate	26 patients	Age <45 years : 19.2% 45–65 years : 57.7% >65 years : 23.1% Sex Male: 38.5% Female: 61.5% Blood pressure Normal: 7.7% Prehypertension: 15.4% Grade 1 hypertension: 19.2% Grade 2 hypertension: 57.7%
(Lumbantobi ng et al., 2024)	Descriptive	Hermina Daan Mogot Hospital	22 patients	Age <40 years: 9.1% 40–49 years: 4.5% 50–59 years: 31.8% ≥60 years: 54.5% Sex Male: 45.5% Female: 54.5% Hemorrhage location Thalamus: 4.5% Intracerebellum: 9.1% Lobar: 4.5% Basal ganglia: 22.7% Subarachnoid: 18.2% Intraventricular: 31.8% Mixed: 9.1%
(Nurkholifah et al., 2024)	Descriptive	Waled Hospital, Cirebon	68 patients	Age Late adulthood (36–45): 11.8% Early elderly (46–55): 26.5% Late elderly (56–65): 36.8% Old (>65): 25% Sex Male: 52.9% Female: 47.1%

					Blood pressure Normal: 4.4% Prehypertension: 13.2% Grade 1 hypertension: 10.3% Grade 2 hypertension: 72.1% Hemorrhage location Thalamus: 39.7% Basal ganglia: 16.2% Cerebellum: 8.8% Lobar: 35.3%
(Nurasyah et al., 2023)	Descriptive	BPJS Health Office, Jakarta	Head Central	Various (secondary data)	Sex Male: 53% Female: 47% Age 18–25 years: 63% (male) and 37% (female) 26–45 years: 54% (male) and 46% (female) 46–65 years: 52% (male) and 48% (female) >65 years: 51% (male) and 49% (female)
(Yulianti et al., 2022)	Descriptive	Muhammadiyah Hospital, Palembang		26 patients	Sex Male: 38.4% Female: 61.6% Age ≤80 years: 96.1% >80 years: 3.9% Hemorrhage location Supratentorial: 100% Infratentorial: 0% Intraventricular hemorrhage Yes: 50% No: 50%
(Aulia et al., 2022)	Observational analytic	Undata Regional Hospital, Sulawesi Province		44 patients	Sex Male: 54.5% Female: 45.5% Age Early adulthood (26–35): 2.3% Late adulthood (36–45): 11.4% Early elderly (46–55): 40.9% Late elderly (56–65): 34.1% Old (>65): 11.4% Hypertension Yes: 56.8% No: 43.2%
(Pandhita et al., 2017)	Observational historical cohort	RSIJ Pondok Kopi, East Jakarta		47 patients	Sex Male: 55% Female: 45% Age <45 years: 21% 45–64 years: 58% >64 years: 21% Hemorrhage location Supratentorial: 85.4% Infratentorial: 14.6%
(Hartono et al., 2022)	Descriptive	Neurology ward,		36 patients	Sex

al., 2019)		Dr. Ramelan Naval Hospital, Surabaya	patients	Male: 52.78% Female: 47.22% Age <55 years: 47.22% 55–64 years: 30.56% ≥65 years: 22.22% Blood pressure Normal: 5.56% Prehypertension: 8.33% Stage 1 HT: 16.67% Stage 2 HT: 69.44%
(Mahayani & Putra, 2019)	Descriptive	Neurology inpatient ward, Sanglah Hospital, Denpasar	45 patients	Sex Male: 60% Female: 40% Age Mean 54.22 years Hypertension Yes: 77.8% No: 22.2% Hemorrhage location Basal ganglia: 37.8% Lobular: 28.9% Thalamus: 8.9% Intraventricular: 8.9% Internal capsule: 6.7% Pons: 4.4% Cerebellum: 4.4%
(Natha et al., 2023)	Descriptive	Prof. Dr. I.G.N.G Ngoerah Hospital, Bali	96 patients	Sex Male: 68.8% Female: 31.2% Age <30 years: 3.1% 30–60 years: 53.1% ≥60 years: 43.8% Type of hemorrhage Intracerebral hemorrhage: 50.0% Subarachnoid hemorrhage: 9.4% Intracerebral hemorrhage with edema: 39.6% Subarachnoid hemorrhage with edema: 1.0%

Age

The majority of included studies indicate that the population most commonly experiencing stroke consists of patients aged ≥45 years. Lumbantobing et al., (2024) explained that the risk of experiencing stroke increases after the age of 45. This increased risk is caused by the decline in body function, particularly related to the elasticity of blood vessels as

age advances (Abukarim et al., 2024; Benita et al., 2024; Natha et al., 2023; Nurkholifah et al., 2024). In addition, increasing age also raises the risk of developing other diseases such as hypertension, which may lead to blood vessel rupture (Aulia et al., 2022). This becomes one of the causes of hemorrhagic stroke. Alkahtani, (2022) stated that hypertension can alter the structure of vascular smooth muscle

through activation of angiotensin II, which may increase reactive oxygen species (ROS).

However, a study by Natha et al., (2023) showed that the majority of the patient population was aged 30 years. This may indicate a shift in the trend of hemorrhagic stroke patients toward younger age groups. Hartono et al., (2019) stated that current human lifestyles tend to be unhealthy, such as poor dietary patterns and lack of physical activity. These results are consistent with Nehme & Li, (2026), who also reported a shift in age trends.

Sex

Seven studies showed that hemorrhagic stroke was more commonly experienced by males. This may be caused by several factors, such as the higher risk of hypertension in men. This is consistent with the study by Defianna et al., (2021) which reported that the prevalence of hypertension in males is higher than in females. Furthermore, from a lifestyle perspective, men tend to engage in unhealthy behaviors such as smoking and alcohol consumption (Aulia et al., 2022; Natha et al., 2023; Nurkholifah et al., 2024)

However, four studies showed that the majority of hemorrhagic stroke cases occurred in females. When associated with the majority age of hemorrhagic stroke patients beginning at 45 years, this phenomenon may be related. On average, women begin to experience menopause at the age of 45 (Anggraini et al., 2024). At this age, estrogen hormone levels, which play a role in preventing stroke, decline drastically (Abukarim et al., 2024). In addition, several factors such as preeclampsia and the use of

oral contraceptives may also contribute to this condition (Benita et al., 2024).

Type of Hemorrhagic Stroke

Study by Benita et al., (2024) and Natha et al., (2023) are consistent with previous research by Poana et al., (2020) which reported that the characteristics of ICH patients at RSUP Prof. Dr. R.D. Kandou Manado reached 84.34%. Studies by Magid-Bernstein et al., (2022) and Venketasubramanian also explained that ICH is the most common type of hemorrhagic stroke among all hemorrhagic stroke cases, directly supporting the findings of this study.

In the study by Benita et al., (2024) there were a considerable number of ICH+IVH cases (21.1%). This condition leads to the extension of hemorrhage from the brain parenchyma into the ventricular system. This has important clinical implications because intraventricular hemorrhage extension is associated with a poorer prognosis. Sadewo et al. explained that hemorrhage extension into the ventricles increases the risk of hydrocephalus and mortality due to higher intracranial pressure.

Distribution Pattern of Hemorrhage Location

A study by Benita et al. at RSUD Raden Mattaher Jambi reported that the most common hemorrhage location was in the deep cerebral area (putamen, basal ganglia, and thalamus), accounting for 31.2% of cases, followed by combined ICH+IVH locations (17.4%), lobar (15.6%), brainstem (8.3%), subarachnoid and intraventricular hemorrhage each at 5.5%, combined ICH+IVH+SAH (1.8%), and the least

common location in the cerebellar area at 0.9%.

The study by Mahayani & Putra, (2019) at RSUP Sanglah Denpasar reported that the most frequent hemorrhage location was the basal ganglia (37.8%), followed by lobular (28.9%), thalamus and intraventricular each at 8.9%, internal capsule (6.7%), while hemorrhage in the pons and cerebellum was each found in only 4.4% of cases. Similar findings were also reported by Nurkholifah et al., (2024) at RSUD Waled Cirebon in hemorrhagic stroke patients who underwent surgery, where the most common hemorrhage location was the thalamus (39.7%), followed by lobar (35.3%), basal ganglia (16.2%), and cerebellum (8.8%). These findings are consistent with previous research by Surdji et al., (2025) which classified hemorrhagic stroke locations into 17 regions and reported that the most frequent location was the basal ganglia (18%), followed by the parietal lobe (14%).

The study by Yulianti et al., (2022) at RS Muhammadiyah Palembang classified hemorrhage locations differently into supratentorial and infratentorial regions. This classification was also intended to determine patient prognosis. The researchers reported a dominance of hemorrhage in the supratentorial area, where 100% of the study samples experienced hemorrhage in the supratentorial region, with 50% of them accompanied by extension into the ventricles (intraventricular hemorrhage). Similar findings were reported by Pandhita et al., (2017) at RS Islam Jakarta Pondok

Kopi, who found that 85.4% of patients experienced hemorrhage in the supratentorial location, while the remaining 14.6% were located in the infratentorial region. This is consistent with the study by Aulia et al., which reported that the majority of hemorrhage locations were in the supratentorial area (80.9%).

Although hemorrhage locations generally occurred in the deep cerebral area, there were notable variations in the order of prevalence across studies. Benita et al. reported the most frequent hemorrhage location in the deep cerebral region (31.2%). Mahayani & Putra, (2019) identified the basal ganglia as the most frequent location (37.8%), while Nurkholifah et al., (2024) reported the thalamus as the most dominant location (39.7%). These differences may be due to variations in sample characteristics, as Benita et al., (2024) categorized hemorrhage locations into a broader category, namely "deep cerebral," which includes the putamen, basal ganglia, and thalamus. In contrast, Nurkholifah et al., (2024) and Mahayani & Putra classified hemorrhage locations more specifically.

Lumbantobing et al., (2024) reported slightly different findings, where the most frequent hemorrhage location was found in the intraventricular region (31.8%), followed by basal ganglia (22.7%), subarachnoid (18.2%), intracerebellar (9.1%), and both thalamic and lobar locations at 9.5% each. The high proportion of intraventricular hemorrhage in this study may be related to patient severity, considering that the study was conducted in

a referral hospital with a mortality rate reaching 50%.

A hemorrhagic stroke occurs when a blood vessel in the brain ruptures, causing bleeding that reduces the supply of oxygen and nutrients to the brain. The most common cause of intracerebral hemorrhage is hypertension; other causes, such as aneurysms, arteriovenous malformations (AVMs), and trauma, more often result in subarachnoid hemorrhage (SAH) (Ahmed et al., 2024). Under normal conditions, blood remains within blood vessels. However, when an intracerebral hemorrhage occurs, erythrocytes, thrombin, and fibrin enter the brain tissue and are recognized as foreign bodies by the immune system. Consequently, brain immune cells are activated, cerebral edema forms, and the blood-brain barrier is damaged. Although inflammation can be damaging, immune cells also function to repair tissue by phagocytosing ruptured erythrocytes, consuming dead tissue remnants, and clearing hematoma debris (Maida et al., 2024).

History of Comorbidities

The occurrence of hemorrhagic stroke is generally a complication of previously existing medical conditions in patients. It is rare for patients to develop this condition without prior comorbidities. Based on a study by Natha et al., (2023) 81.2% of hemorrhagic stroke patients had a history of previous diseases, including hypertension, diabetes mellitus (DM), dyslipidemia and hypercholesterolemia, chronic kidney disease (CKD), and heart disease. The progression of this condition is generally accompanied by pathological

processes such as anemia, accumulation of homocysteine, nitrates, oxidative stress, inflammation, and coagulopathy (Natha et al., 2023).

The main factor in the occurrence of hemorrhagic stroke is vascular abnormalities caused by blood pressure. Hypertension is the primary risk factor, especially when it reaches grade 2 hypertension, defined as systolic pressure ≥ 160 mmHg and diastolic pressure ≥ 100 mmHg. A study by Abukarim et al., (2024) reported that 80.8% of hemorrhagic stroke patients had a history of hypertension, similar to the findings of Mahayani & Putra, (2019) at 77.8%. The statement regarding grade 2 hypertension is supported by studies from Benita et al., (2024) at 38.5%, Nurasyah et al., (2023) at 75%, Aulia et al., (2022) at 56.8%, and Hartono et al., (2019) at 69.44%. Increasing blood pressure is directly proportional to the increased risk of hemorrhagic stroke Hartono et al., (2019) Patients with hypertension have a 21-fold higher risk of experiencing hemorrhagic stroke compared to non-hypertensive individuals (Mahayani & Putra, 2019).

The development of hemorrhagic stroke in hypertensive patients is caused by impaired vascular elasticity. Long-term elevated blood pressure may lead to vascular stiffness due to hyalinization, causing arterial wall damage and reduced elasticity. This condition makes blood vessel walls more susceptible to dilation, narrowing, and sudden rupture (Benita et al., 2024; Hartono et al., 2019). If a blood vessel ruptures, it causes an intracerebral hemorrhage (ICH) (Ahmed et al., 2024).

This condition may be exacerbated by a history of smoking due to nicotine and active chemical substances that directly damage the vascular endothelium (Nurasyah et al., 2023).

Another metabolic factor that may increase stroke risk is diabetes mellitus (DM). Diabetes is more frequently associated with ischemic stroke than hemorrhagic stroke. A study by Benita et al., (2024) reported that hemorrhagic stroke patients with diabetes accounted for only about 15.6%. This finding is followed by studies from Abukarim et al., (2024) at 23.1%, Lumbantobing et al., (2024) at 9.1%, Nurasyah et al., (2023) at 19%, Mahayani & Putra, (2019) at 8.9%, and Hartono et al., (2019) at 38.89%. These data indicate that the impact of diabetes on hemorrhagic stroke is not as significant as hypertension. This may be due to the role of elevated blood glucose in thrombus formation, which is more commonly associated with ischemic stroke, and the process of fibrinoid necrosis of small vessels, which occurs more frequently in hypertensive patients than in diabetic patients (Benita et al., 2024).

Despite its relatively low incidence, diabetes still plays a role in the occurrence of hemorrhagic stroke. Persistently high blood glucose levels may cause progressive vascular endothelial damage, reducing vascular elasticity. Diabetic patients have a 1.3–3 times higher risk of experiencing hemorrhagic stroke (Abukarim et al., 2024; Mahayani & Putra, 2019). This condition may be worsened if diabetic patients also have hypertension. Both conditions may lead to small vessel disorders accompanied

by severe atherosclerosis, thereby increasing the risk of both hemorrhagic and ischemic stroke (Hartono et al., 2019). Additionally, diabetes is correlated with an increased risk of intracerebral hemorrhage with longer disease duration (Lumbantobing et al., 2024). Hemorrhagic stroke patients with a history of diabetes are more commonly found among females and are associated with poorer prognosis. This is attributed to the progressive decline in the protective function of estrogen in women with advancing age, leading to more significant vascular dysfunction (Nurasyah et al., 2023).

Hypercholesterolemia and dyslipidemia are also known risk factors for increased stroke risk. According to Abukarim et al., (2024), 53.8% of patients with hypercholesterolemia experienced hemorrhagic stroke. This finding is supported by Nurasyah et al., (2023), who reported that hypercholesterolemic patients experienced hemorrhagic stroke at rates of 49% in 2021 and 51% in 2022, predominantly among females (51%). Elevated cholesterol levels in the body cause lipid accumulation in the vascular lumen, contributing to atherosclerosis formation (Abukarim et al., 2024). This risk is further increased in women, especially after menopause, due to decreased estrogen levels, which reduce LDL clearance and increase cholesterol synthesis (Nurasyah et al., 2023).

Dyslipidemia may be a risk factor for stroke; however, based on several studies, it is not commonly found in hemorrhagic stroke patients. A study by (Benita et al.,

2024) reported that dyslipidemia was present in only 29.3% of hemorrhagic stroke patients. Similar findings were reported by Mahayani & Putra, (2019) at 26.7% and Namale et al., (2018) at 18.6%. These findings contrast with the results of Riaz et al., (2015) who concluded that dyslipidemia was a protective factor with an odds ratio of 0.9 and a 95% confidence interval ranging from 0.3–2.6. Dyslipidemia is more commonly found in ischemic stroke patients than in those with hemorrhagic stroke (Mahayani & Putra, 2019). Nevertheless, dyslipidemia may still have an indirect effect on hemorrhagic stroke through cholesterol-induced deformation of cell membranes. The glycerophospholipid content of cholesterol may reduce membrane stiffness and increase cellular fragility, leading to angionecrosis and microaneurysm formation that may result in hemorrhagic stroke (Benita et al., 2024).

A history of heart disease is often associated with an increased risk of stroke. According to Natha et al. (2023), heart disease may be a risk factor for hemorrhagic stroke. However, Mahayani & Putra, (2019) reported that only about 13.3% of patients with heart disease experienced hemorrhagic stroke. A meta-analysis by (Namale et al., 2018) explained that the proportion of heart disease in hemorrhagic stroke patients, particularly atrial fibrillation, was only 2.3%. This reflects that heart disease is not a major risk factor for hemorrhagic stroke due to differences in underlying mechanisms. Heart disease may cause vascular occlusion through atherosclerotic thrombus

formation, thereby increasing the risk of embolism leading to cardioembolic ischemic stroke (Mahayani & Putra, 2019).

The likelihood of hemorrhagic stroke is further increased in patients with secondary diagnoses, one of which is chronic kidney disease (CKD). According to Nurasyah et al., (2023), 40% of hemorrhagic stroke patients had a history of CKD in 2021, which increased to 60% in 2022. This indicates a high morbidity of hemorrhagic stroke among patients with a history of CKD. Additionally, hemorrhagic stroke patients with CKD were predominantly male (64%). This may be attributed to smoking habits commonly found in men. Nicotine and other chemicals in cigarettes may cause endothelial damage in renal blood vessels and increase adrenaline hormone levels, triggering renal hypertension and further kidney damage (Nurasyah et al., 2023).

Blood Pressure at Hospital Admission

The increased risk of hemorrhagic stroke may be influenced by the patient's blood pressure at the time of hospital admission. Based on a study conducted by (Abukarim et al., 2024), hemorrhagic stroke patients were predominantly those with grade 2 hypertension, accounting for 57.7%. Similar findings were reported by Yulian et al., (2019), who stated that 57.9% of patients with grade 2 hypertension experienced hemorrhagic stroke. Elevated blood pressure may rapidly trigger vascular degeneration, leading to intracerebral hemorrhage (Abukarim et al., 2024)

The risk of hemorrhagic stroke may further increase in patients with a history of chronic hypertension. Persistently elevated

blood pressure leads to loss of vascular elasticity and reduced vascular autoregulation. This condition may trigger the formation of Charcot-Bouchard microaneurysms, which may rupture at any time when blood pressure rises suddenly (Abukarim et al., 2024). In addition, continuously high blood pressure may lead to the formation of atherosclerotic plaques accompanied by cerebral hematoma formation. These hematomas often cause symptoms of increased intracranial pressure, including headache, confusion, dizziness, nausea and vomiting, and decreased consciousness (Nurkholifah et al., 2024).

Level of Consciousness

The level of patient consciousness varies widely, ranging from a Glasgow Coma Scale (GCS) score of 3 to 15. Loss of consciousness may occur because hemorrhage increases intracranial pressure and disrupts the Ascending Reticular Activating System (ARAS) (Abukarim et al., 2024; Lumbantobing et al., 2024). In contrast, conscious patients may still experience hemorrhagic stroke if the bleeding volume is relatively small and does not cause increased intracranial pressure. This can be reflected in treatment selection, where the majority of patients did not undergo operative intervention.

CONCLUSION

Hemorrhagic stroke in Indonesia predominantly affects older adults and is strongly associated with hypertension as the primary risk factor. Intracerebral hemorrhage is the most common subtype,

typically occurring in deep cerebral and supratentorial regions.

These findings emphasize the urgent need for targeted public health interventions in Indonesia. First, primary healthcare facilities (Puskesmas) must intensify routine screening and strict blood pressure control programs, specifically targeting adult and elderly male populations. Second, the high prevalence of deep cerebral lesions underscores the importance of public education regarding early stroke symptoms (such as the *SeGeRa Ke RS* campaign) to minimize pre-hospital delays. Lastly, these clinical characteristics can serve as a baseline for developing a more structured, centralized national stroke registry to improve neuro-restorative and preventive strategies across regions.

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