

Characteristics of Ischemic Stroke Patients With COVID-19 Based on Gender and Age at RSPAL Dr. Ramelan Surabaya From 2020 To 2022

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ABSTRACT

Stroke is the second leading cause of death worldwide. Most strokes are ischemic, with varying incidence by age and gender. COVID-19 is known to increase the risk of acute ischemic stroke through inflammatory and hypercoagulable mechanisms. According to the WHO, COVID-19 patients have an estimated 5% risk of developing ischemic stroke. Previous research indicates that ischemic stroke associated with COVID-19 predominantly occurs in patients over 69 years of age and is more common in men. This study aimed to determine the characteristics of ischemic stroke patients associated with COVID-19 based on gender and age at Dr. Ramelan Naval Hospital, Surabaya, from 2020 to 2022. This descriptive study employed quantitative methods using secondary data derived from the medical records of patients who met the inclusion criteria. The study was conducted at Dr. Ramelan Naval Hospital, Surabaya, from March to September 2025. The results showed that, of the 86 cases, 90.7% of patients were identified as having risk factors for cardiovascular disease. Among patients with risk factors, males were more numerous (69%), with a predominance in the ≥ 50 -year age group (88%). However, among patients without risk factors, the numbers of males and females were relatively equal, with a similar predominance in the ≥ 50 -year age group (75%). The conclusion of this study is that ischemic stroke patients with COVID-19 at Dr. Ramelan Naval Hospital, Surabaya, between 2020 and 2022 were predominantly male and aged ≥ 50 years.

Keywords: *Ischemic Stroke; COVID-19; Characteristics; Age; Gender.*

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INTRODUCTION

Stroke, or cerebrovascular accident, ranks as the second leading cause of death worldwide, representing a significant global health burden. Stroke is a clinical syndrome characterized by the sudden onset of focal neurological deficits resulting from infarction or hemorrhage in the central nervous system (Murphy & Werring, 2020). Ischemic stroke accounts for approximately 87% of all stroke cases, with the remaining 13% attributed to hemorrhagic stroke (Lui et al., 2025). Globally, an estimated 50 million people have experienced a stroke, and among them, approximately 9 million suffer from severe disability, underscoring the substantial impact of this condition on individuals, families, and healthcare systems worldwide.

On the other hand, Coronavirus Disease 2019 (COVID-19) is a disease caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) infection. Since its emergence, COVID-19 has rapidly spread across more than 190 countries, triggering a global medical emergency and crisis situation (Saxena, 2020). There is an age-related gap in COVID-19 incidence and mortality. Children have lower susceptibility to infection and are less likely to be symptomatic than adults. In addition, during working age, the number of women diagnosed with COVID-19 exceeds that of men; however, after retirement, the number of infected males surpasses females (Sobotka et al., 2020).

COVID-19 patients are at high risk of developing acute ischemic stroke. Mechanisms believed to play a role in this condition include endothelial dysfunction, hypoxemia, and excessive secretion of proinflammatory cytokines, which can trigger a hypercoagulable state contributing to the development of ischemic stroke (Luo et al., 2022; Zhai et al., 2020). According to the World Health Organization (WHO), COVID-19 patients have an approximately 5% risk of developing an ischemic stroke (Hidayat et al., 2022). In China, 4.6% of COVID-19 patients progress to acute ischemic stroke. Research in Indonesia shows that 9.4% of stroke patients, predominantly those with ischemic stroke, also experience COVID-19.

In contrast to previous viral pandemics, ischemic stroke can occur in COVID-19 patients without traditional risk factors. The incidence, severity, and risk of death increase with age (Dmytriw et al., 2021). Studies indicate that ischemic stroke with COVID-19 occurs on average at 69 years of age and is more frequently recorded in male patients, who account for 58% of total cases (Merkler et al., 2020). Based on this background, the researchers sought to investigate the characteristics of ischemic stroke patients with COVID-19 based on gender and age at RSPAL Dr. Ramelan Surabaya during the 2020–2022 period through a descriptive study with a retrospective approach, using patient medical record data (Okten et al., 2020; Pradhan et al., 2020; Rashedi et al., 2020). The researchers hope the results of this study will contribute to a better understanding of the characteristics of confirmed ischemic stroke patients with COVID-19 based on gender and age (Aarnink et al., 2023; Jatmika et al., 2024; Randolph, 2016; Weber et al., 2019; Yonata et al., 2016).

The urgency of this research stems from several factors. First, Indonesia has experienced significant COVID-19 morbidity and mortality; however, data on the intersection between COVID-19 and stroke in the Indonesian population remain limited. Second, understanding the demographic characteristics of affected patients is essential for healthcare resource planning, risk stratification, and the development of targeted prevention strategies. Third, as COVID-19 continues to circulate and new variants emerge, understanding its long-term cardiovascular and neurological complications, including stroke, remains a public health priority (Hidayat et al., 2022). Fourth, the findings from this study can inform clinical practice at Dr. Ramelan Naval Hospital and similar institutions, enabling healthcare providers to identify high-risk patient groups and implement appropriate monitoring and preventive measures (Borczuk & Yantiss, 2022; Ciotti et al., 2020; Rothan & Byrareddy, 2020).

The novelty of this research lies in its specific focus on the characteristics of ischemic stroke patients with COVID-19 in an Indonesian military hospital setting, with detailed stratification by gender and age while considering the presence or absence of traditional cardiovascular risk factors. Unlike previous studies that have examined these variables in isolation, this study provides a comprehensive descriptive analysis distinguishing between patients with and without established risk factors, offering insights into whether COVID-19 acts independently or synergistically with traditional risk factors in different demographic groups. Additionally, the study covers the entire pandemic period from 2020 to 2022, capturing potential variations across different phases of the pandemic.

The primary purpose of this study is to determine the characteristics of ischemic stroke patients with COVID-19 based on gender and age at RSPAL Dr. Ramelan Surabaya for the 2020–2022 period. The specific objectives include: (1) describing the gender distribution of

ischemic stroke patients with COVID-19, stratified by the presence or absence of cardiovascular risk factors; (2) describing the age distribution of ischemic stroke patients with COVID-19, stratified by the presence or absence of cardiovascular risk factors; (3) analyzing the combination of risk factors according to gender and age; and (4) comparing the demographic patterns between patients with and without traditional risk factors. The contribution of this research is to provide much-needed epidemiological data on ischemic stroke with COVID-19 in the Indonesian population, specifically within a military hospital context. The benefits of this study include informing clinical practice, guiding resource allocation, identifying high-risk groups for targeted interventions, and providing a foundation for future research on the mechanisms and outcomes of stroke in COVID-19 patients.

METHOD

This study was designed using a descriptive research design with the aim of determining the characteristics of ischemic stroke patients with COVID-19 based on gender and age at RSPAL Dr. Ramelan Surabaya for the 2020-2022 period.

The method used in this study is a quantitative method by utilizing secondary data obtained from the medical records of ischemic stroke patients with COVID-19 at RSPAL Dr. Ramelan Surabaya for the 2020-2022 period.

Population, Sample, Sample Size and Sampling Techniques

The population in this study includes all patients diagnosed with ischemic stroke with COVID-19 at RSPAL Dr. Ramelan Surabaya for the 2020-2022 period.

The sample used in this study was all patients with a diagnosis of ischemic stroke and COVID-19 recorded in the patient's medical records at RSPAL Dr. Ramelan Surabaya for the 2020-2022 period and met the inclusion criteria.

Criteria included:

1. Patients diagnosed with ischemic stroke based on clinical and radiological findings.
2. The ischemic stroke patient was also diagnosed with COVID-19 based on the results of SARS-CoV-2 PCR laboratory tests.
3. It is recorded in medical records containing gender and age data at RSPAL Dr. Ramelan for the 2020-2022 period.

Exclusion criteria:

1. Corrupted medical record data.
2. Patients with stroke are not specific.

This study uses all data obtained from the medical records of ischemic stroke patients with COVID-19 at RSPAL Dr. Ramelan Surabaya for the 2020-2022 period that have met the inclusion criteria

In this study, samples were taken using *a total sampling* technique, namely by including all medical record data of patients diagnosed with ischemic stroke with COVID-19 at RSPAL Dr. Ramelan Surabaya for the 2020-2022 period who have met the inclusion criteria.

Research Variables and Operational Definitions

Variables in this study included the sex and age of ischemic stroke patients with COVID-19.

Table 1. Sex and age study of ischemic stroke patients with COVID-19

Variabel	Operational Definition	Instruments	Measurement Results	Scale
Ischemic Stroke	A syndrome characterized by the occurrence of a focal neurological deficit that occurs suddenly due to an infarction of the central nervous system. Patients are diagnosed based on clinical and radiological findings	Medical records	Yes (Ischemic stroke)	
COVID-19	Diseases caused by infection (SARS-CoV-2). The patient was diagnosed based on the results of the SARS-CoV-2 PCR examination	Medical records	Yes (COVID-19)	
Gender	Gender is a physical or spiritual characteristic that distinguishes living beings into female or male	Medical records	- Male - Women	Nominal
Age	Age is the length of time a person or thing has lived since birth or held	Medical records	- Young adult: <50 years old - Old adult: ≥50 years old (Bukhari <i>et al</i> ., 2023)	Ordinal
Risk factor	Conditions that increase a person's chances of developing a disease	Medical records	- Hypertension - Diabetes - Atrial fibrillation - Riwayat strok - No risk factors	Nominal

Research Tools and Materials

This research uses electronic devices such as laptops and *Microsoft Excel* to record and process the data obtained.

The material used for this study is in the form of medical records of ischemic stroke patients with COVID-19 at RSPAL Dr. Ramelan Surabaya for the 2020-2022 period.

Data Management

This study uses data obtained from patients' medical records. Once the necessary data is collected, the next steps to be implemented include the following steps:

1. *Editing*

Assess the completeness of the medical record data obtained and adjust it to the inclusion and exclusion criteria that have been set previously.

2. *Coding*

Classify the data obtained by providing code to be able to convert qualitative data into quantitative so that it facilitates data processing.

3. *Entry*

Enter the data that has been obtained into *Microsoft Excel* to be processed into tables and charts.

Data Analysis

Medical record data of ischemic stroke patients with COVID-19 that have been collected and adjusted to inclusion and exclusion criteria were then processed and analyzed using *Microsoft Excel* using descriptive research data analysis in the form of tables and diagrams.

RESULTS AND DISCUSSION

Based on research that has been carried out by examining the medical records of ischemic stroke patients with COVID-19 at RSPAL Dr. Ramelan Surabaya for the 2020-2022 period using total sampling techniques, there were 86 cases that met the predetermined inclusion criteria. Of the 86 cases obtained, 10 cases were obtained in 2020, 51 cases in 2021, and 25 cases in 2022. Among them, a total of 78 patients had risk factors and the remaining 8 patients had no risk factors. The results of the study in the form of gender and age data of ischemic stroke patients with COVID-19 are presented in the form of narratives, tables, and diagrams.

Patient gender data

The results showed that ischemic stroke with COVID-19 with risk factors for hypertension, diabetes, atrial fibrillation, and a history of previous stroke was more common in men, namely 54 patients (69%). Among patients with risk factors, the most common risk factors found in the male sex in order were hypertension (24.14%), hypertension with diabetes (22.41%), and hypertension with diabetes and a history of stroke (15.52%). However, the most common risk factors found in women in order are hypertension with diabetes (25%), hypertension (21.43%), and hypertension with diabetes and stroke history (17.86%).

Different outcomes were shown by ischemic stroke patients with COVID-19 without risk factors for hypertension, diabetes, atrial fibrillation, and a history of previous stroke. There was no difference in the number of men and women in ischemic stroke patients with COVID-19 without a predetermined risk factor, which amounted to 4 patients (50%). This means that men are more likely to have ischemic stroke with COVID-19 among patients with risk factors, but the numbers are relatively the same among patients without risk factors.

Table 2. Gender Distribution by Risk Factors

Gender	Frequency	Percentage
Male	54	69%
Women	24	31%
Total	78	100%

Table 3. Gender Distribution without Risk Factors

Gender	Frequency	Percentage
Male	4	50%
Women	4	50%
Total	8	100%

Table 4. Combination of risk factors by gender

Gender	Factor risk	Quantity	Percentage
Male	Hypertension	14	24,14%
	Diabetes	5	8,62%
	Riwayat strok	1	1,72%
	Atrial fibrillation	1	1,72%
	Hypertension and diabetes	13	22,41%
	Hypertension and atrial fibrillation	2	3,45%
	Hypertension and history of stroke	5	8,62%
	Diabetes and history of stroke	3	5,17%
	Hypertension, diabetes, and atrial fibrillation	1	1,72%
	Hypertension, diabetes, and a history of stroke	9	15,52%
	Hypertension, diabetes, atrial fibrillation, and a history of stroke	0	0%
	No risk factors	4	6,90%
Total		58	100%
Women	Hypertension	6	21,43%
	Diabetes	1	3,57%
	Riwayat strok	1	3,57%
	Atrial fibrillation	1	3,57%
	Hypertension and diabetes	7	25%
	Hypertension and atrial fibrillation	1	3,57%
	Hypertension and history of stroke	1	3,57%
	Diabetes and history of stroke	0	0%
	Hypertension, diabetes, and atrial fibrillation	0	0%
	Hypertension, diabetes, and a history of stroke	5	17,86%
	Hypertension, diabetes, atrial fibrillation, and a history of stroke	1	3,57%
	No risk factors	4	14,29%
Total		28	100%

Patient age data

This study revealed that the incidence of ischemic stroke with COVID-19 among patients with risk factors for hypertension, diabetes, atrial fibrillation, and a history of previous stroke occurred more at the age of ≥ 50 years as many as 69 patients (88%). At the age of < 50 years, the most common risk factors were hypertension, hypertension with diabetes, and hypertension with diabetes and a history of stroke of the same number (27.7%). However, the

most common risk factors found in patients aged ≥ 50 years in order were hypertension and hypertension with diabetes with the same amount (22.67%), followed by hypertension with diabetes and a history of stroke (14.67%).

Similar results were obtained in ischemic stroke patients without risk factors. Patients aged ≥ 50 years had a higher number, namely 6 patients (75%). This means that patients aged ≥ 50 years are more likely to have ischemic stroke with COVID-19 than patients aged < 50 years in all groups, both in people with and without risk factors.

Table Error! No text of specified style in document.. Age Distribution by Risk Factors

Age	Frequency	Percentage
<50 years old	9	12%
≥ 50 years old	69	88%
Total	78	100%

Table 6. Age Distribution without Risk Factors

Age	Frequency	Percentage
<50 years old	2	25%
≥ 50 years old	6	75%
Total	8	100%

Table 7. Combination of Risk Factors by Age

Age	Factor risk	Quantity	Percentage
<50 years old	Hypertension	3	27,27%
	Diabetes	0	0%
	Riwayat strok	0	0%
	Atrial fibrillation	0	0%
	Hypertension and diabetes	3	27,27%
	Hypertension and atrial fibrillation	0	0%
	Hypertension and history of stroke	0	0%
	Diabetes and history of stroke		
	Hypertension, diabetes, and atrial fibrillation	0	0%
	Hypertension, diabetes, and a history of stroke	3	27,27%
	Hypertension, diabetes, atrial fibrillation, and a history of stroke	0	0%
	No risk factors		2
Total		11	100%
≥ 50 years old	Hypertension	17	22,67%
	Diabetes	6	8%
	Riwayat strok	2	2,67%
	Atrial fibrillation	2	2,67%

Age	Factor risk	Quantity	Percentage
	Hypertension and diabetes	17	22,67%
	Hypertension and atrial fibrillation	3	4%
	Hypertension and history of stroke	6	8%
	Diabetes and history of stroke	3	4%
	Hypertension, diabetes, and atrial fibrillation	1	1,33%
	Hypertension, diabetes, and a history of stroke	11	14,67%
	Hypertension, diabetes, atrial fibrillation, and a history of stroke	1	1,33%
	No risk factors	6	8%
Total		75	100%

Patient gender and age data

When compared to the overall cases of both sexes, ischemic stroke with COVID-19 with risk factors for hypertension, diabetes, atrial fibrillation, and a history of previous stroke in men was more common at the age of ≥ 50 years as many as 49 patients (63%). Not only in men, women aged ≥ 50 years also have a higher number of cases, namely as many as 20 patients (26%) of the total cases in both sexes. It can be concluded that among patients with risk factors, the highest number of cases in order are men aged ≥ 50 years, women aged ≥ 50 years, men aged < 50 years, and the last with the lowest position is occupied by women aged < 50 years. This shows that the male sex dominates in all age groups.

However, among patients without risk factors, there was no difference in the number of ischemic stroke patients with COVID-19 in men and women, which amounted to 4 people. In addition, in both sexes, patients aged ≥ 50 years were consistently 3 times higher than patients aged < 50 years. Thus this shows that among patients without risk factors, men and women have the same number of cases with the number of cases increasing with increasing age in both men and women.

Table 8. Distribution of Sex and Age by Risk Factors

Gender	Age	Frequency	Percentage
Male	< 50 years old	5	6%
	≥ 50 years old	49	63%
Women	< 50 years old	4	5%
	≥ 50 years old	20	26%
Total		78	100%

Table 9. Gender and Age Distribution without Risk Factors

Gender	Age	Frequency	Percentage
Male	<50 years old	1	12,5%
	≥50 years old	3	37,5%
Women	<50 years old	1	12,5%
	≥50 years old	3	37,5%
Total		8	100%

Characteristics by gender

Based on the results of research at RSPAL Dr. Ramelan Surabaya, ischemic stroke with COVID-19 among patients with risk factors is more common in the male sex, with a total of 54 patients (69%). The most common risk factors in both men and women are hypertension and a combination of hypertension and diabetes. The findings of this study are in line with findings in previous studies conducted at Al-Hada Armed Forces Hospital in Taif and King Abdulaziz Medical City in Riyadh and Jeddah, Saudi Arabia. The study was conducted using the medical records of stroke patients with COVID-19 from March 2020 to March 2021. As a result, the male gender occupies the highest position with a percentage of 62.2% (Almarghalani et al., 2025). In addition, there are studies that reveal that hypertension and diabetes are cardiovascular risk factors that are often found in ischemic stroke patients with COVID-19.

One of the causes of the high incidence of ischemic stroke with COVID-19 in men can be explained by the findings of a study that shows that the prevalence of the main risk factors for stroke, such as hypertension, often occurs in men compared to women. This may explain why there is a difference in stroke incidence between the two sexes. In addition, the high incidence of stroke in men is also associated with the use of androgen deprivation (ADT) therapy and erectile dysfunction. Erectile dysfunction can be an indicator of the presence of an underlying vascular disease, so the condition is considered a vascular risk factor that has the potential to increase the risk of ischemic stroke. Meanwhile, in women, there is the hormone estrogen, which has a positive cardiovascular effect, so it can slow down the development of vascular diseases and thus reduce the risk of ischemic stroke in women.

Interestingly, in the group of ischemic stroke patients with COVID-19 without risk factors at RSPAL Dr. Ramelan Surabaya, the results showed that the number of male and female patients was relatively the same, namely 4 patients (50%) each. This indicates that in this group, the mechanism of ischemic stroke is most likely not entirely dependent on vascular risk factors but rather is caused by the direct effects of SARS-CoV-2 infection on blood vessels. However, until now, there has been no study that specifically examined the characteristics of ischemic stroke patients with COVID-19 without the main risk factors of hypertension, diabetes, and atrial fibrillation, as well as a history of previous strokes. Thus, the findings of this study may make a new contribution by showing that the characteristics of ischemic stroke patients with COVID-19 by age and sex may differ after adjusting for the main risk factors for ischemic stroke (Ntaios et al., 2020).

Characteristics by Age

This study revealed that ischemic stroke with COVID-19 without risk factors was more common in patients aged ≥ 50 years, namely 69 patients (88%). Similar results were obtained in ischemic stroke patients without risk factors. Patients aged ≥ 50 years had a higher number, namely 6 patients (75%). The most common risk factors found in both patients aged < 50 and ≥ 50 years are hypertension and a combination of hypertension and diabetes.

In this study, the age limit was grouped into two, namely < 50 years and ≥ 50 years. The selection of the 50-year-old cut-off is based on some international literature that defines a stroke at a young age (young stroke) as the event of a stroke that occurs at the age of < 50 years. Some studies in Asia have also defined stroke in young adults as the incidence of stroke in the age range of 18-49 years. Moreover, in Indonesia itself, there is also a study that sets the age of 50 years as the limit for stroke at a young age (Alchuriyah & Wahjuni, 2016; Bukhari et al., 2023; Tan et al., 2025). For comparison, according to the Ministry of Health of the Republic of Indonesia, age is divided into several groups, namely infants and toddlers (< 5 years), children (5-9 years), adolescents (10-18 years), adults (18-59 years), and the elderly (≥ 60 years). Although the age limit used in various studies is not the same, the 50-year cut-off is a limit that is widely applied in some international or national literature to define stroke at a young age.

The results in this study are in line with previous research conducted at Soehadi Prijonegoro Sragen Hospital in February-March 2023 despite using a different cut-off. The study used medical record data of stroke patients with COVID-19 who were treated in that period with the exclusion criteria of other comorbidities, such as lung and kidney disorders. The results showed that the elderly aged > 60 years dominated the occurrence of ischemic stroke with COVID-19 compared to the age of < 60 years (Setiawati et al., 2024).

In addition, other studies at Al-Hada Armed Forces Hospital in Taif and King Abdulaziz Medical City in Saudi Arabia also showed similar results. The study was conducted using the medical records of stroke patients with COVID-19 from March 2020 to March 2021 with the exclusion criteria of patients with transient ischemic attack (TIA) and hemorrhagic stroke. As a result, the elderly aged ≥ 65 years dominated ischemic stroke patients with COVID-19 compared to < 65 years old. This suggests that although the applied age cut-off varies, the risk of ischemic stroke with COVID-19 is still more common in older age groups, both in people with and without risk factors. The cause of the high incidence of ischemic stroke with COVID-19 in old age can be caused by the increasing burden of vascular risk factors combined with the occurrence of vascular susceptibility due to aging, thus increasing the risk of ischemic stroke with COVID-19 in old age (Almarghalani et al., 2025).

Characteristics by Gender and Age

This study revealed that when compared to the overall cases of both sexes, ischemic stroke with COVID-19 among patients with risk factors in men was more common in the age group ≥ 50 years, with 49 patients (63%). Not only in men, women in the age group of ≥ 50 years also have a higher number of cases, namely 20 patients (26%). The results of this study showed that ischemic stroke with COVID-19 was most commonly found in men in the age group of ≥ 50 years with risk factors for hypertension, diabetes, atrial fibrillation, and a history of previous stroke. The findings of this study are in line with previous studies that show that

hypertension and diabetes are often found in men, and their effect on stroke incidence is also stronger than in women (Ramezankhani et al., 2022).

On the other hand, in the group of patients without risk factors, the number of ischemic stroke patients with COVID-19 in men and women was relatively the same, namely 4 people. In addition, patients aged ≥ 50 years were consistently 3 times higher than patients aged < 50 years in both sexes. The results of this study showed that after adjusting for existing risk factors, the numbers between men and women were relatively the same, and both sexes had the same magnitude of risk of experiencing ischemic stroke with COVID-19 at an older age. This indicates that in this group, the mechanism of ischemic stroke is most likely not entirely dependent on vascular risk factors but is caused by the direct effects of SARS-CoV-2 infection that occur through two main mechanisms, namely through direct damage to blood vessel endothelial cells or by improving prothrombic conditions through immune-mediated platelet activation, dehydration, and cardiac arrhythmias. This is strengthened by a study that revealed that COVID-19 is an independent factor for ischemic stroke (Ntaios et al., 2020) (Belani et al., 2020).

CONCLUSION

Based on the results of the research and discussion, it can be concluded that the majority of ischemic stroke patients with COVID-19 are male, namely 58 patients (67.4%). In addition, ischemic stroke patients with COVID-19 are dominated by the age group ≥ 50 years, with the number of patients as many as 75 people (87.2%). During the 2020-2022 period at RSPAL Dr. Ramelan Surabaya, the number of ischemic stroke patients with COVID-19 in all age groups was dominated by the male sex, and the number was increasing in older age groups.

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