Stroke and Aphasia in Tertiary Hospital in East Java

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Abstract

Introduction: Aphasia is a language disorder caused by damage in the language areas of the brain. One of the main causes of aphasia is stroke. There are currently not many studies describing the profiles of stroke patients, especially those with aphasia. This study aims to describe and compare the profiles of stroke patients, with and without aphasia. Method: This study used a descriptive analytic design with a cross-sectional method to describe the profiles of a sample of 217 stroke patients who were admitted to Dr. Soetomo General Hospital Surabaya in 2019–2020. Medical records were used to collect the data. Results: Aphasia occurrence was observed in 13.3% of the patients. The mean age of the population was 57.6±12.1 years, and the majority of the patients were male. Hemorrhagic stroke was the most seen type of stroke, but the aphasia ratio was higher in ischemic stroke patients. Global aphasia occurred in 37.93% of the aphasic patients. As much as 48.27% of patients with aphasia had strokes on the left hemisphere. No significant difference has been found between patients with and without aphasia for age, gender, risk factor, and stroke hemisphere variables, but there is an inclination towards aphasia in patient with left hemisphere strokes. Conclusion: Aphasia is seen more in middle-aged male patients and ischemic stroke patients in the left hemisphere. Global aphasia is the most seen subtype of aphasia. There is a tendency of patients with stroke on the left hemisphere to have aphasia.

Keywords: aphasia, hemorrhagic, human & disease, ischemic, stroke

1. Introduction

Aphasia is a language disorder caused by a damage in the language areas of the brain. Aphasia may be caused by cerebrovascular disorders such as stroke that causes hypoperfusion into the brain tissue. In addition, aphasia may also be caused by neurodegenerative diseases, brain tumor or brain injury [1]. Patients with aphasia exhibit disorders in their language functions depending on their aphasia subtype, and the language functions disturbed may include expression, comprehension, word repetition, etc [2]. As these disorders merely happened on the language areas of the brain, aphasia is thus not a sensory, motor, psychiatry, or intellectual disorder [2].

Stroke is a commonly seen cerebrovascular disorder, with the stroke prevalence among ≥15 years old population in Indonesia rising from 0.7% in 2013 to 1.09% in 2018 [3]. The occurrence of post-stroke aphasia occurs in 17-38% of acute stroke patients [4]. The most common stroke types are ischemic and hemorrhagic strokes. Ischemic stroke is mostly caused by atherosclerosis or thrombosis in vertebral, basilar, or arteries in the Circle of Willis [5], [6], and hemorrhagic stroke is mostly caused by hypertension, aneurysm rupture,

blood vessel malformation, or other hemorrhagic causes [7]. Stroke can also cause myocardial infarction, sleep apnea, dysphagia, infection, incontinence, fatigue, brain edema and sleep disorders [8]–[10]. Patients with language difficulties due to aphasia may have problems communicating with their family or health workers, leading to a lowered quality of life in addition to the patient's functional problems from their primary diseases [11].

Research regarding the profiles of aphasic patients have been done in various places, but there are still limited research about this in Indonesia. Thus, this study aims to describe the profiles of stroke patients, with and without aphasia, in order to be used as a reference for future studies relating to aphasia.

2. Method

This research was an observational analytic study with a cross-sectional approach. The population of this study was stroke patients admitted in Dr. Soetomo General Hospital Surabaya, East Java, Indonesia. The sampling method used is confidence interval for proportion, and 223 data were obtained. The inclusion factors of this study are patients diagnosed with stroke and patients admitted to Dr. Soetomo General Hospital in 2019–2020. The instrument used in this study was the data from the patients' medical records. The variables in this study include sex, age, stroke type, aphasia subtype and stroke hemisphere. Brain area and stroke risk factors were also noted. Analytical statistics were done using Chi-square test in SPSS application, with *p*-value of <0.05 considered significant. This study has received ethical clearance from Dr. Soetomo General Hospital Health Research Ethics Committee with the certificate number 0170/LOE/301.4.2/XII/2021.

3. Results

From the obtained patient data, 6 of them were excluded from this study, leaving 217 patient data who met the criteria for this study. Among those, 120 patients were admitted in 2019 and 97 were admitted in 2020. The proportion of aphasic patients in 2019 and 2020 can be seen in Figure 1. There is a slight decrease in the occurrence of aphasia from 2019 to 2020.

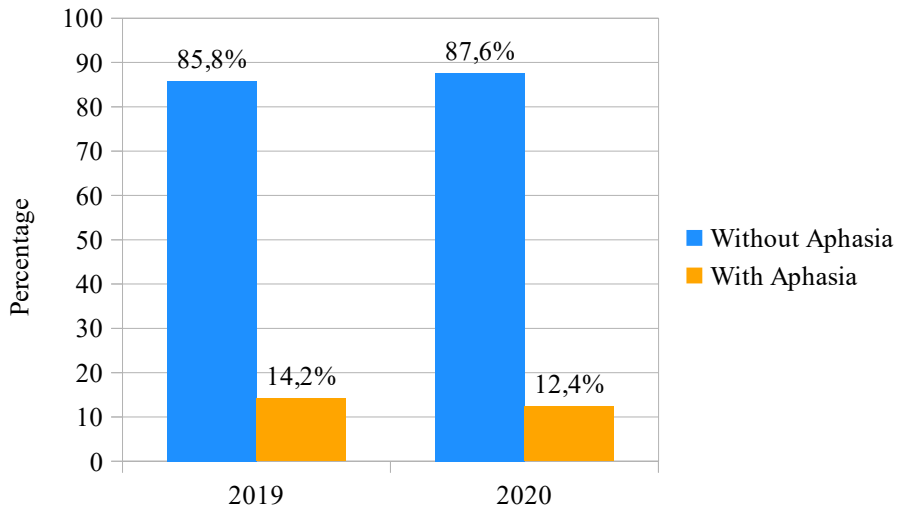

Fig. 1. Proportion of patients with and without aphasia by year of admission

Table 1 displays the patient demographic information. The most common age group of stroke patients, with and without aphasia, was in the 50-59 year group, with the average age of 57.6±12.1 years (57.6±12.5 in males, 57.6±11.6 in females). The most common education level group was senior high school, and the most common occupation group was housewife followed by privately employed.

Table 1. Demographic data of stroke patients in Dr. Soetomo General Hospital in 2019–2020 (n=217)

Demographic data	Aphasia				Total	
	No		Yes		(n — %)	
	(n — %)		(n — %)			
Year of admission						
2019	103	54.8	17	58.6	120	55.3
2020	85	45.2	12	41.4	97	44.7
Total	188	100	29	100	217	100
Sex						
Male	101	53.7	16	55.2	117	53.9
Female	87	46.3	13	44.8	100	46.1
Total	188	100	29	100	217	100
Age group (years)						
20-29	2	1.1	0	0	2	0.9
30-39	11	5.8	1	3.4	12	5.5
40-49	33	17.6	4	13.8	37	17.0
50-59	67	35.6	14	48.3	81	37.3
60-69	42	22.3	4	13.8	46	21.2
≥70	33	17.6	6	20.7	39	18.0
Total	188	100	29	100	217	100
Education level						
Unschooled	10	5.3	3	10.3	13	6.0
Elementary school	30	16.0	5	17.2	35	16.1
Junior high school	19	10.1	4	13.8	23	10.6
Senior high school	100	53.2	13	44.8	113	52.1
University-level education	26	13.8	4	13.8	30	13.8
Other	3	1.6	0	0	3	1.4
Total	188	100	29	100	217	100
Occupation						
Unemployed	22	11.7	4	13.8	26	12.0
Civil worker	10	5.3	1	3.4	11	5.1
Housewife	56	29.8	9	31.0	65	30.0
Retired	16	8.5	2	6.9	18	8.3
Self-employed	23	12.2	4	13.8	27	12.4
Private employed	47	25.0	6	20.7	53	24.4

Other	14	7.4	3	10.3	17	7.8
Total	188	100	29	100	217	100

The patient stroke type data is shown in Table 2. More patients were diagnosed with hemorrhagic stroke (54.37%) than ischemic stroke (42.39%). There were 3 patients diagnosed with subarachnoid hemorrhage, 2 patients with transient ischemic attack, and 2 patients with other stroke diagnosis.

Table 2. Patients of Dr. Soetomo General Hospital in 2019–2020 based on stroke type (n=217)

Stroke type	Aphasia				Total	
	No		Yes		(n — %)	
	(n — %)		(n — %)			
Ischemic	79	42.02	13	44.82	92	42.39
Hemorrhagic	104	55.31	14	48.27	118	54.37
Subarachnoid hemorrhage (SAH)	2	1.06	1	3.44	3	1.38
Transient ischemic attack (TIA)	1	0.53	1	3.44	2	0.92
Other	2	1.06	0	0	2	0.92
Total	188	100	29	100	217	100

The aphasia subtype data of the patients is shown in Table 3. Among the patient sample, 86.6% patients did not have aphasia and 13.3% patients had aphasia. Among patients with aphasia, the most common subtype being the global aphasia (37.9%), followed by motoric aphasia (31.0%) and then sensoric aphasia (13.8%). There are 17.3% patients exhibiting aphasia symptoms but subtype is not explained on the medical record.

Table 3. Patients of Dr. Soetomo General Hospital in 2019–2020 based on aphasia subtype (n=29)

Aphasia subtype	Patients (n — %)	
Global aphasia	11	37.9
Motoric aphasia	9	31.0
Sensoric aphasia	4	13.8
Not explained	5	17.3
Total	29	100

The stroke location data is taken from the patient imaging notes and is shown in Table 4. Three most common stroke locations among the patients were corona radiata (19.35%), parietal lobe (17.97%) and basal ganglia (17.51%). Among aphasic patients, these three locations were also the most common stroke locations, each with 7 patients.

Table 4. Patients of Dr. Soetomo General Hospital in 2019–2020 based on stroke location (n=217)

Brain area	Aphasia		Total
	No	Yes	(n — %)
	(n — %)	(n — %)	

No data	55	25.34	5	2.30	60	27.64
Frontal lobe	13	5.99	4	1.84	17	7.83
Parietal lobe	32	14.74	7	3.22	39	17.97
Temporal lobe	27	12.44	4	1.84	31	14.28
Occipital lobe	5	2.30	2	0.92	7	3.22
Centrum semiovale	11	5.06	0	0	11	5.06
Corona radiata	35	16.12	7	3.22	42	19.35
Basal ganglia	31	14.28	7	3.22	38	17.51
Internal capsule	16	7.37	0	0	16	7.37
External capsule	5	2.30	1	0.46	6	2.76
Thalamus	14	6.45	1	0.46	15	6.91
Cerebellum	13	5.99	0	0	13	5.99
Pons and brainstem	14	6.45	0	0	14	6.45
Ventricles	5	2.30	1	0.46	6	2.76
Non-specific areas: cerebral arteries						
Middle cerebral artery	5	2.30	3	1.38	8	3.68
Posterior cerebral artery	0	0	1	0.46	1	0.46

Table 5 shows the data from the patients' cerebral hemisphere where the stroke occurred. The stroke hemisphere data from 63 patients were not available. More patients had stroke on the right hemisphere (46.7%) than the left hemisphere (37.7%). However, there were more aphasic patients with the stroke happening on the left hemisphere (58.3%) compared to the right hemisphere (29.2%). It was also noted that 15.6% patients experienced stroke comprising both brain hemispheres, and 12.5% of the aphasic patients had stroke on both hemispheres. Almost half of the patients with aphasia had stroke on the left hemisphere.

Table 5. Patients of Dr. Soetomo General Hospital in 2019–2020 based on stroke hemisphere (n=154)

Brain hemisphere	Aphasia				Total	
	No		Yes		(n — %)	
	(n — %)		(n — %)			
Left	44	33.8	14	58.3	58	37.7
Right	65	50.0	7	29.2	72	46.7
Both	21	16.2	3	12.5	24	15.6
Total	130	100	24	100	154	100

The patients' stroke risk factor data is taken from previous history and is shown in Table 6. Three most common risk factors among both aphasic and non-aphasic patients were hypertension, diabetes mellitus, and dyslipidemia. Nevertheless, the factors with the biggest aphasic patient proportion were obesity (25% of all patients), diabetes mellitus (20%) and previous stroke history (17.6%), whereas hypertension is next after with 13.55%.

Table 6. Patients of Dr. Soetomo General Hospital in 2019–2020 based on stroke risk factors (n=217)

Risk factor	Aphasia				Total	
	No		Yes		(n — %)	
	(n — %)		(n — %)			
Hypertension	153	70.51	24	11.05	177	81.56
Diabetes mellitus	44	20.27	11	5.06	55	25.34
Dyslipidemia	34	15.66	7	3.22	41	18.89
Obesity	12	5.52	4	1.84	16	7.37
Previous stroke history	28	12.90	6	2.76	34	15.67
Heart diseases	17	7.83	2	0.92	19	8.75
Smoking habit	5	2.30	0	0	5	2.30

Table 7 shows the patients' risk factor data based on the stroke type of the patient. In both ischemic and hemorrhagic strokes, the risk factors had similar frequencies. There were more ischemic stroke patients with diabetes mellitus and previous stroke history compared to hemorrhagic stroke patients, and there were more hemorrhagic stroke patients with hypertension and heart diseases compared to ischemic stroke patients.

Table 7. Patients of Dr. Soetomo General Hospital in 2019–2020 based on stroke risk factors and stroke type

Risk factor	Stroke type										Total	
	Ischemic		Hemorrhagic		SAH		TIA		Other		(n — %)	
	(n — %)		(n — %)		(n — %)		(n — %)		(n — %)			
Hypertension	66	37.3	106	59.9	2	1.13	2	1.13	1	0.6	177	100
Diabetes mellitus	31	56.4	22	40.0	1	1.8	0	0	1	1.8	55	100
Dyslipidemia	20	48.8	21	51.2	0	0	0	0	0	0	41	100
Obesity	7	43.7	9	56.3	0	0	0	0	0	0	16	100
Previous stroke history	20	58.9	13	38.2	0	0	1	2.9	0	0	34	100
Heart diseases	8	42.1	11	57.9	0	0	0	0	0	0	19	100
Smoking habit	3	60.0	2	40.0	0	0	0	0	0	0	5	100

This study also analyzed the comparison of aphasia occurrence within variables, as well as measuring the odds ratio of the risk factors. This study used the two-tailed Chi-square method with the p-value of <0.05 considered significant. For the stroke hemisphere variable, unexplained data were not included in the analysis. The p-values and the odds ratio of the variables collected in this study are presented in Table 8. The odds ratio for smoking can not be calculated due to the value of 0 being present in the data. In this study, no variables showed a significant difference between patients with aphasia and without aphasia. Among the risk factors, none of the risk factors have significant odds ratio within 95% confidence interval.

Table 8. Comparison and odds ratio analysis of each variable in the study

Variable	p-value	Odds ratio (95% CI)
Year of admission	0.699	
Sex	0.884	
Age group	0.722	
Stroke type	0.415	
Stroke hemisphere	0.071	
Risk factors		
Hypertension	0.859	1.098 (0.392–3.0179)
Diabetes mellitus	0.094	2.000 (0.879–4.553)
Dyslipidemia	0.438	1.441 (0.570–3.646)
Obesity	0.155	2.347 (0.702–7.843)
Previous stroke history	0.424	1.491 (0.557–3.988)
Heart diseases	0.704	0.745 (0.163–3.408)
Smoking habit	0.374	—

4. Discussion

The occurrence of aphasia in stroke patients in this study was 13.3%, similar to the study in North Sulawesi by Purnomo, Sengkey and Damopolii [12], in which the occurrence was 13.2%, and is slightly lower than the review of studies in nine countries by Ellis et al. [4], which was 18-38%. Other studies have also found varying numbers of aphasia rates, from 20% to 40% [13], [14]. In the latter case, the rate was postulated as due to the different brain representation of language across speakers of different languages [14]. The incidence of aphasia might be lower than in the actual population because of the significant variability in patient natural recovery between tests, especially in the acute stages [15], [16] and the less accurate diagnostic procedures for post-stroke aphasia. Therefore, a robust diagnostic test to identify post-stroke aphasia is needed [17].

The ratio of aphasia between sexes (male to female) is 1.23:1, not much different from the previous study in North Sulawesi, namely 1.4:1 [12]. This is in line with other findings stating that there are more male aphasic patients than female patient (2.25:1) and that there is no correlation between sex and aphasia [14], [18]. This also supports the analysis showing no difference between sexes in the occurrence of aphasia. This can be understood as there are no principal difference in aphasia pathophysiology between sexes.

There is a decrease in the proportion of aphasic patients between 2019 and 2020, of which there was not a significant difference according to the analysis. This decrease is due to the lower number of patient admission in hospitals in Indonesia during the COVID-19 pandemic, including in Dr. Soetomo General Hospital, Surabaya, as it was the main referral hospital for COVID-19 patients in East Java. For ischemic stroke patients, the decrease was more than 50% between 2019 and 2020 [19].

Aphasia happens most commonly among the age group of 50-59 years (mean age 57±9.82 years), with aphasia to non-aphasia ratio of 1:4.78. Some other studies have also found the mean age group of aphasic patients to be in the range of 50-59 year age group, with 55.8±10.6 in Khedr et al. and 52.19±10.96 in Lahiri et al. [13], [14]. In contrast to this, the North Sulawesi study found that the most common age group with aphasia is 40-49 years with aphasia to non-aphasia ratio of 1:3.67. Other studies finding different mean ages

include Kadojić et al. (75) and Mitchell et al. (78±13). The varying patient age distribution in these studies is a possible explanation for the differing mean age among aphasic patients. Together with the analysis showing no difference between age groups in the occurrence of aphasia, Lahiri's study also stated the lack of correlation between these two [14].

Based on the patient stroke type, hemorrhagic stroke was the more common stroke type seen in this study, unlike previous studies' findings which stated that ischemic stroke was more common than hemorrhagic stroke [14], [20]. The reason for this may relate to the most common risk factor of each stroke type. In this study, the most common risk factor in hemorrhagic stroke patients was hypertension. This is consistent with other findings stating that hypertension is the leading factor of hemorrhagic strokes, reported in about 64% of stroke patients [20], [21]. Hypertension may cause vascular remodelling resulting in arteriolar dissections which rupture and allow high pressure blood extravasation to the brain [22]. In comparison, a common ischemic stroke risk factor in this study was diabetes mellitus which is also consistent with another finding stating patients with diabetes mellitus as having ischemic stroke odds ratio of 1.66 [23]. Diabetes may contribute to stroke by causing vascular endothelial dysfunction and increasing inflammatory responses, all leading to the cascade of atherosclerosis [24].

Our findings revealed that the ratio of stroke patients with and without aphasia in ischemic stroke were higher than in hemorrhagic stroke. This is in contrast with the North Sulawesi study reporting the ratios of patients with and without aphasia in non-hemorrhagic stroke were lower than in hemorrhagic stroke patients [12]. Although ischemic stroke is indeed responsible for more aphasia cases [25], the analysis of our study shows that there is no difference between patients of each stroke type in the occurrence of aphasia. The study by Mitchell et al. has also noted that stroke type has no correlation with the likelihood of communication impairment [18], and Lahiri also found that the proportion of aphasic patients between ischemic and hemorrhagic stroke did not differ significantly, with the ratios for ischemic and hemorrhagic strokes are 1:2.5 and 1:2.56 respectively [26].

The most common aphasia subtype in this study is global aphasia, followed by motoric and sensoric aphasia. This is similar to findings of several studies [13], [27], but different to some other studies finding motoric aphasia as the most common aphasia subtype [12], [14]. This might be because of difference in the distribution of patients' stroke site. The most common brain lesion sites in the aphasic patients in this study are the corona radiata, the parietal lobe, and the basal ganglia. Although both of the main language areas of the brain, Broca's and Wernicke's area, are not mostly in the parietal lobe, they are close to the parietal lobe and all receive vascularization from the middle cerebral artery [28], [29], one of the most common sites for ischemic stroke [30]. Corona radiata and basal ganglia are both in the deeper part of the brain near the putamen and subcortical white matter, a common site for hemorrhagic strokes [20]. While these most common lesion sites are due to the patient sample distribution, Lahiri et al. have also noted a relatively higher sub-cortical aphasia occurrence in their study, also due to the higher frequency of sub-cortical strokes in the population of the study [14].

Aphasia is found more in patients with left-hemisphere strokes (aphasic patient to non-aphasic patient ratio 1:3.14) compared to right-hemisphere strokes (1:9.28). The North Sulawesi study noted patients' contralateral hemiparesis to indirectly take note of the stroke hemisphere, and similar finding was found, as well as the study by Kadojić et al. stating the correlation between left hemisphere strokes and aphasia [31]. The comparison analysis in this study does not show a significant difference in the occurrence of aphasia between stroke hemispheres, however there is a tendency for patients with strokes on the left hemisphere to have aphasia. This can be understood since the language areas of the brain are more commonly located on the left hemisphere, even on some left-handed patients with a dominant right hemisphere [32], [33]. On the other hand, some patients with right hemisphere strokes also had aphasia. This may be because the patients are left-handed or the patient had crossed aphasia [2]. Unfortunately, the data for patient handedness was not available.

The four most common stroke risk factors seen in our data are obesity, diabetes mellitus, previous stroke history, and hypertension. Obesity and diabetes mellitus as a stroke risk factor are also noted in some studies in aphasic patients. Obesity, together with increase in patient's fat tissues, is associated with increase of vascular disease risk including stroke [23]. Diabetes may cause an endothelial dysfunction and increase inflammatory responses, also increasing the risk of stroke [24]. Previous stroke history may leave chronic lesions that may get worse on subsequent strokes. Hypertension may cause micro-bleedings, silent infarctions, and other lesions [23]. However, this study found no difference between patients with or without these factors in the occurrence of aphasia, and their odds ratios are not significant.

This study used secondary data from the medical records of a sample of the patients and thus may not reflect the actual condition of patients. This study was conducted in a tertiary referral hospital in eastern Indonesia which might reflect similar findings in other hospitals. In further studies, researchers should explore more about patient handedness and more extensive symptoms of aphasia or other communication problems.

5. Conclusion

There are more male stroke patients with and without aphasia. Stroke happens more in age groups above 40, with the most common aphasia occurrence seen in 50-59 years age group. The most common stroke type is hemorrhagic stroke, but the aphasia ratio on ischemic patients is higher. The most common aphasia subtype is global aphasia. Strokes on the left hemisphere most often cause aphasia. The most common stroke risk factors are hypertension, diabetes, and past stroke history. There is a tendency of patients with stroke on the left hemisphere to have aphasia.

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