

## APHASIA TYPES ACCORDING TO STROKE HEMISPHERE: A CROSS- SECTIONAL STUDY AT DR. SOEDONO REGIONAL GENERAL HOSPITAL, MADIUN, INDONESIA

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### ABSTRACT

**Background:** Stroke is a leading cause of mortality and long-term disability worldwide. One of its common neurological complications is aphasia, a language disorder affecting speaking, comprehension, reading, and writing. Aphasia impairs communication, daily functioning, and quality of life. Although it is commonly associated with lesions in the dominant cerebral hemisphere, evidence comparing aphasia between left- and right-hemispheric stroke remains limited. **Objective:** This study aimed to compare the occurrence of aphasia in patients with left hemispheric stroke and right hemispheric stroke. **Methods:** A descriptive comparative study was conducted among 51 stroke patients admitted to the Stroke Unit and Wijaya Kusuma Ward of Dr. Soedono Regional General Hospital, East Java Province, Indonesia. Participants were selected using accidental sampling. Data were collected through interviews and direct observation of language abilities using a self-developed aphasia assessment instrument. Inter-observer reliability was tested using Cohen's Kappa on 10 patients ( $\kappa = 0.683$ , 80% agreement). Data were analyzed using the Chi-square test and Fisher's Exact Test with a significance level of  $\alpha = 0.05$ . **Results:** Of the participants, 70.6% had left hemispheric stroke and 29.4% had right hemispheric stroke. Motor aphasia and sensory aphasia each accounted for 33.3% of cases in the left hemispheric group, whereas sensory aphasia was most common in the right hemispheric group (46.7%). Overall, sensory aphasia was the predominant subtype (37.3%). No significant difference was found between stroke hemisphere and aphasia type (Chi-square,  $p = 0.447$ ; Fisher's Exact Test,  $p = 0.497$ ). **Conclusion:** No statistically significant association was identified between stroke hemisphere and aphasia type in this sample. However, the findings should be interpreted cautiously because of the small sample size and unequal group distribution. Comprehensive communication assessment and individualized rehabilitation should therefore be provided for all stroke patients regardless of lesion location.

**Keywords:** stroke; aphasia; left hemisphere; right hemisphere;

## INTRODUCTION

Stroke remains one of the leading causes of mortality and long-term disability worldwide, posing a substantial burden on individuals, families, and healthcare systems. According to the World Health Organization (WHO), stroke is responsible for millions of deaths annually and is a major contributor to permanent neurological impairment. In Indonesia, stroke is the leading cause of disability among adults and continues to be one of the most costly catastrophic diseases in the national health insurance system. The prevalence of stroke has continued to increase due to population aging and the growing incidence of hypertension, diabetes mellitus, dyslipidemia, obesity, and unhealthy lifestyles.

One of the most disabling neurological complications following stroke is aphasia, an acquired language disorder resulting from damage to cortical language networks. Aphasia impairs an individual's ability to express or comprehend spoken and written language, affecting speaking, listening, reading, and writing. Beyond language impairment, aphasia significantly reduces patients' independence, social participation, emotional well-being, and overall quality of life. Communication difficulties frequently lead to frustration, depression, social isolation, and increased caregiver burden, making aphasia one of the most challenging consequences of stroke for both patients and healthcare professionals.

The occurrence and characteristics of aphasia are closely associated with the location and extent of brain injury. Traditionally, language function is predominantly localized in the left cerebral hemisphere, particularly within Broca's area, Wernicke's area, and their connecting neural pathways. Consequently, left hemispheric stroke is generally considered the principal cause of aphasia. Patients with lesions involving Broca's area commonly present with motor (expressive) aphasia, whereas damage to Wernicke's area often results in sensory (receptive) aphasia. Extensive lesions involving multiple language areas may produce global aphasia, representing the most severe form of language impairment. Despite increasing recognition of bilateral and distributed language networks, limited evidence is available regarding the distribution of clinically diagnosed aphasia subtypes according to stroke hemisphere in Indonesian hospital settings. This study therefore examined whether aphasia type differed between patients with left- and right-hemispheric stroke.

In addition, it is important to distinguish aphasia from broader right-hemisphere communication disorders. While left-hemisphere lesions typically result in classical aphasic symptoms such as expressive or receptive language deficits, right-hemisphere lesions may cause communication impairments involving pragmatics, prosody, discourse, and contextual interpretation without necessarily constituting classical aphasia.

Although aphasia is classically associated with left hemispheric stroke, growing evidence suggests that communication disorders may also occur following right hemispheric stroke. The right hemisphere contributes to language pragmatics, prosody, discourse organization, emotional expression, and contextual interpretation.



Lesions affecting the right hemisphere may therefore produce communication impairments that resemble aphasic symptoms or coexist with language deficits. Furthermore, interindividual differences in cerebral language dominance, bilateral cortical activation, and neural network connectivity indicate that the relationship between lesion location and aphasia is more complex than previously understood. These findings suggest that patients with right hemispheric stroke should also undergo comprehensive communication assessment during clinical evaluation.

Previous studies have consistently reported a higher prevalence of aphasia among patients with left hemispheric stroke. However, evidence regarding differences in aphasia types between left and right hemispheric stroke remains inconsistent. Some investigations have demonstrated significant associations between lesion location and aphasia subtype, whereas others have found no statistically significant relationship after considering lesion size, stroke severity, age, educational level, and neuroplastic adaptation. These inconsistencies indicate that lesion laterality alone may not fully explain the occurrence or severity of aphasia, highlighting the need for additional clinical research in different healthcare settings and populations.

From a nursing perspective, early identification of communication impairment is essential for planning comprehensive rehabilitation and improving patient outcomes. Nurses play a central role in assessing communication abilities, facilitating patient–family interactions, implementing therapeutic communication strategies, and coordinating multidisciplinary rehabilitation programs involving neurologists, speech-language therapists, and rehabilitation specialists. Understanding the distribution of aphasia according to stroke hemisphere may assist nurses in developing individualized nursing interventions and optimizing communication-centered care throughout hospitalization and recovery.

Despite the increasing burden of stroke in Indonesia, evidence describing aphasia among Indonesian stroke patients remains limited, particularly studies comparing aphasia patterns between left and right hemispheric stroke. Most previous studies have focused primarily on neurological outcomes without specifically examining language disorders within the context of nursing care. Consequently, locally generated evidence is needed to support evidence-based nursing practice and communication rehabilitation programs for stroke survivors.

Therefore, this study aimed to compare the occurrence of aphasia among patients with left hemispheric stroke and those with right hemispheric stroke treated at Dr. Soedono Regional General Hospital, East Java Province, Madiun. The findings are expected to provide scientific evidence regarding the distribution of aphasia based on lesion laterality and contribute to improving nursing assessment, communication rehabilitation, and multidisciplinary stroke management.



## METHODS

### Study Design

The study sample consisted of patients who met the inclusion and exclusion criteria. Inclusion criteria were: (1) patients diagnosed with stroke; (2) confirmed left- or right-hemispheric involvement based on clinical and/or neuroimaging findings; (3) age  $\geq 40$  years; and (4) able to undergo communication assessment. Exclusion criteria were: (1) pre-existing aphasia, dementia, or severe psychiatric disorder; (2) severe hearing impairment; (3) reduced level of consciousness; and (4) declined to participate. A total of 51 stroke patients participated in the study. Participants were recruited using consecutive sampling during the one-month study period.

### Variables and Instruments

Data were collected using a structured assessment instrument developed by the researchers based on standard diagnostic criteria for aphasia. The instrument assessed expressive language, receptive language, and naming ability. Content validity was established through expert judgment by two neurologists and one speech therapist. Inter-observer reliability was tested using Cohen's Kappa on 10 patients and showed substantial agreement with a Kappa value of 0.683 and an agreement percentage of 80.0%. Data collection was conducted through structured interviews and direct observation of patients' language abilities. The assessment focused on patients' capacity to communicate verbally, understand spoken language, and demonstrate language impairment consistent with the clinical characteristics of aphasia.

### Data Collection Procedure

Data collection was initiated after obtaining approval from the Research and Community Service Institute (LPPM) of STIKES Karya Husada Kediri and permission from Dr. Soedono Regional General Hospital. Ethical approval was obtained before participant recruitment. Eligible patients were approached during hospitalization, informed about the purpose of the study, and invited to participate voluntarily. Language assessments were conducted through interviews and clinical observations with the assistance of nurses working in the Stroke Unit and Wijaya Kusuma Ward. Data collection continued until the required number of participants was obtained.

### Ethical Considerations

This study received ethical clearance from the authorized institutional ethics committee prior to data collection. Permission to conduct the research was granted by Dr. Soedono Regional General Hospital, East Java Province, Madiun. Participation was voluntary, and informed consent was obtained from all participants or their legal representatives before enrollment. Participant confidentiality and anonymity were maintained throughout the study.

Ethical Approval Number: 400.14.5.4/8709/102.9/2026, issued by RSUD Dr. Soedono, East Java Provincial Hospital, Madiun, Indonesia

### Data Analysis



Data were analyzed using descriptive and inferential statistics. Descriptive statistics were used to summarize participants' demographic and clinical characteristics using frequencies and percentages. The association between stroke hemisphere and aphasia type was analyzed using the Chi-square test. Because several contingency table cells had expected frequencies of less than five, Fisher's Exact Test was additionally performed to ensure the validity of the statistical analysis. Statistical significance was determined at a 95% confidence level ( $\alpha = 0.05$ ). All statistical analyses were conducted to compare the distribution of aphasia types between patients with left and right hemispheric stroke.

## RESULTS

Categorical data were analyzed using the Chi-square test. Because several expected cell frequencies were less than five, the analysis was supplemented with the Fisher-Freeman-Halton exact test, which is an extension of Fisher's exact test for tables larger than  $2 \times 2$ . Statistical significance was set at  $p < 0.05$ . All statistical analyses were performed using Jamovi version 2.6.44. A total of 51 stroke patients participated in this study. Data collection was conducted between March and April 2026 at Dr. Soedono Regional General Hospital, East Java Province, Madiun. Among the participants, 52.94% were female, 39.22% were housewives, 39.22% had a history of hypertension, and 29.41% had both hypertension and diabetes mellitus. The largest age group was 56–65 years (49.02%). Most participants (64.71%) experienced their first stroke, whereas 17.65% had a second stroke and 17.64% had experienced a third or fourth stroke episode.

**Table 1.** Distribution of Aphasia Types According to Stroke Hemisphere (n = 51)

| Stroke Hemisphere | Motor Aphasia n (%) | Global Aphasia n (%) | No Aphasia n (%) | Sensory Aphasia n (%) | Total n (%) |
|-------------------|---------------------|----------------------|------------------|-----------------------|-------------|
| Left hemisphere   | 12 (33.3)           | 3 (8.3)              | 9 (25.0)         | 12 (33.3)             | 36 (100.0)  |
| Right hemisphere  | 6 (40.0)            | 1 (6.7)              | 1 (6.7)          | 7 (46.7)              | 15 (100.0)  |
| Total             | 18 (35.3)           | 4 (7.8)              | 10 (19.6)        | 19 (37.3)             | 51 (100.0)  |

There was no statistically significant association between stroke hemisphere and aphasia type (Fisher-Freeman-Halton exact test,  $p = 0.497$ ). Level of significance ( $\alpha$ ) = 0.05

As presented in Table 1, 36 participants (70.6%) had left hemispheric stroke, while 15 participants (29.4%) had right hemispheric stroke.

Among patients with left hemispheric stroke, motor aphasia and sensory aphasia were equally common, each accounting for 33.3% of cases. No aphasia was identified in 25.0% of patients, whereas global aphasia was the least frequent subtype (8.3%).

In contrast, among patients with right hemispheric stroke, sensory aphasia was the predominant subtype (46.7%), followed by motor aphasia (40.0%). Global aphasia and no aphasia were each observed in 6.7% of patients.

Overall, sensory aphasia was the most prevalent aphasia subtype (37.3%), followed by motor aphasia (35.3%), no aphasia (19.6%), and global aphasia (7.8%).

The Chi-square analysis yielded a value of  $\chi^2 = 2.49$  with a p-value of 0.447. Because several expected cell frequencies were below five, Fisher's Exact Test was also performed, producing a p-value of 0.497. Since both p-values exceeded the significance threshold of 0.05, there was no statistically significant difference between stroke hemisphere and aphasia type among the study participants. These findings indicate that the occurrence of aphasia in this population was not significantly associated with the laterality of the cerebral lesion.

## DISCUSSION

This study involved 51 hospitalized stroke patients at Dr. Soedono Regional General Hospital, East Java Province, Madiun. Most participants were female (52.94%), aged 56–65 years (49.02%), and had a history of hypertension (39.22%) or both hypertension and diabetes mellitus (29.41%). In this sample, no statistically significant association was observed between stroke hemisphere and aphasia type. This finding should not be interpreted as evidence that lesion laterality has no influence on aphasia, particularly given the small sample size, unequal group distribution, and absence of detailed lesion characteristics. The present study found that 70.6% of participants had left hemispheric stroke, whereas 29.4% had right hemispheric stroke. This finding is consistent with the classical neuroanatomical concept that the left cerebral hemisphere is the dominant center for language processing in most individuals. Lesions involving Broca's area, Wernicke's area, or the connecting arcuate fasciculus commonly result in expressive, receptive, or mixed language impairments. Consequently, communication disorders are more readily recognized among patients with left hemispheric lesions because of their pronounced effects on speech production and language comprehension.

Among patients with left hemispheric stroke, motor aphasia and sensory aphasia each accounted for 33.3% of cases, whereas global aphasia was relatively uncommon (8.3%). These findings suggest that damage to the dominant hemisphere does not invariably result in severe language impairment. Rather, the clinical presentation depends on several factors, including lesion size, lesion location, cerebral perfusion, collateral circulation, and the integrity of remaining neural networks. Patients with focal lesions may present with isolated expressive or receptive language deficits, whereas extensive cortical damage is more likely to produce global aphasia.

An interesting finding of this study was the relatively high proportion of sensory aphasia among patients with right hemispheric stroke (46.7%), followed by motor aphasia (40.0%). Traditionally, the right cerebral hemisphere has been associated with language pragmatics, prosody, emotional expression, discourse organization, and



nonverbal communication rather than the core linguistic functions mediated by the left hemisphere. Nevertheless, recent neuroimaging studies have demonstrated that language processing involves distributed bilateral neural networks. Individual variability in cerebral language dominance, interhemispheric connectivity, and neural plasticity may explain why communication disturbances resembling aphasia can also occur following right hemispheric stroke. Therefore, language impairment should not be considered exclusive to left hemispheric lesions, and comprehensive communication assessment should be performed regardless of lesion laterality.

Overall, sensory aphasia was the most frequently observed aphasia subtype (37.3%), followed by motor aphasia (35.3%), no aphasia (19.6%), and global aphasia (7.8%). The predominance of sensory aphasia indicates that language comprehension is substantially affected among stroke survivors in this setting. Impaired comprehension can hinder effective communication between patients, families, and healthcare professionals, potentially reducing adherence to treatment recommendations and participation in rehabilitation programs. Consequently, early identification of receptive language deficits is essential for developing individualized rehabilitation strategies that optimize functional recovery and improve patients' quality of life.

Inferential statistical analysis demonstrated no significant association between stroke hemisphere and aphasia type (Chi-square  $p = 0.447$ ; Fisher's Exact Test  $p = 0.497$ ). These findings indicate that the occurrence of aphasia in this study was not significantly influenced by the laterality of the cerebral lesion. Similar observations have been reported in several studies suggesting that lesion laterality alone cannot fully predict language impairment because aphasia is a multifactorial neurological disorder influenced by both anatomical and individual patient characteristics.

Several factors may explain the absence of statistically significant differences between the two groups. First, the relatively small sample size, particularly among patients with right hemispheric stroke, may have reduced the statistical power to detect meaningful differences. Second, aphasia is determined not only by lesion laterality but also by lesion volume, precise anatomical location, stroke severity, cerebral perfusion, and preservation of language-related neural pathways. Third, patient-specific factors such as age, educational level, premorbid cognitive function, and neuroplastic adaptation may influence language recovery and clinical presentation. Finally, variations in communication impairment among stroke patients may reflect the complexity of functional brain organization rather than simple hemispheric localization.

From a nursing perspective, these findings emphasize the importance of comprehensive communication assessment for all stroke patients regardless of lesion location. Nurses play a crucial role in early identification of language disorders, implementation of therapeutic communication strategies, patient and family education, and coordination with speech-language therapists and multidisciplinary rehabilitation teams. Routine communication screening during hospitalization may facilitate timely rehabilitation interventions and improve patients' functional



independence and psychosocial well-being. Individualized communication rehabilitation programs based on patients' specific language deficits are expected to enhance recovery and optimize nursing outcomes.

This study has several limitations. The relatively small sample size and the use of accidental sampling may limit the generalizability of the findings. In addition, lesion characteristics such as infarct size, cortical location, stroke subtype, and severity were not analyzed, although these variables are known to influence aphasia outcomes. Future studies with larger multicenter samples, neuroimaging-based lesion analysis, and standardized aphasia assessment instruments are recommended to further clarify the relationship between lesion location and language impairment among stroke patients.

## CONCLUSION

The majority of stroke patients in this study experienced left hemispheric stroke (70.6%), with most participants aged 56–65 years. Sensory aphasia was the most common subtype of aphasia (37.3%), followed by motor aphasia (35.3%), no aphasia (19.6%), and global aphasia (7.8%). Among patients with left hemispheric stroke, motor and sensory aphasia occurred with equal frequency, whereas sensory aphasia predominated among patients with right hemispheric stroke.

Statistical analysis using the Fisher-Freeman-Halton exact test demonstrated no statistically significant association between stroke hemisphere and aphasia type ( $p = 0.497$ ). In this hospital-based sample, the findings suggest that lesion laterality alone may be insufficient to characterize post-stroke language impairment; however, larger studies incorporating lesion characteristics, stroke severity, and standardized aphasia assessments are required.

The findings underscore the importance of comprehensive communication screening and language assessment for all stroke patients, irrespective of lesion location. Early identification of communication impairment and individualized rehabilitation interventions should be integrated into nursing care to improve functional recovery, communication ability, and quality of life among stroke survivors.

## IMPLICATIONS FOR NURSING PRACTICE

The findings of this study have several important implications for nursing practice. First, comprehensive communication assessment should be routinely performed for all stroke patients regardless of whether the lesion is located in the left or right cerebral hemisphere. Since no statistically significant difference was found between stroke hemisphere and aphasia type, nurses should not rely solely on lesion laterality when identifying communication disorders.

Second, early screening for aphasia should be incorporated into the initial nursing assessment to facilitate timely referral to speech-language therapy and multidisciplinary rehabilitation services. Nurses should incorporate structured communication screening into the initial assessment of patients with stroke and



facilitate timely referral to speech-language professionals when impairment is identified. Communication interventions should be individualized according to the patient's specific deficits and clinical needs. Furthermore, the findings contribute to evidence-based nursing practice by providing clinical data on the distribution of aphasia among hospitalized stroke patients. These data may serve as a foundation for developing standardized communication assessment protocols, nursing education materials, and future clinical research on post-stroke language rehabilitation in Indonesia.

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## ETHICAL STATEMENT AND CONFLICT OF INTEREST

This study received ethical approval from the appropriate Health Research Ethics Committee prior to data collection. Permission to conduct the research was obtained from Dr. Soedono Regional General Hospital, East Java Province, Madiun. Written informed consent was obtained from all participants or their legal representatives before participation. Participant confidentiality and anonymity were maintained throughout the study.

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