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Characteristics of Vascular Cognitive Impairment in Acute Stroke Patients at Prof. Dr. I.G.N.G. Ngoerah General Hospital, September-October 2023

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ABSTRACT

Background: Vascular cognitive impairment (VCI) is a medical term that encompasses a spectrum of cognitive impairments resulting from cerebral vascular disease. This includes a range of conditions, from mild cognitive impairment to dementia, which is caused by damage to the brain's blood vessels.
Objective: There have been few studies that provide a comprehensive understanding of vascular cognitive impairment, particularly in acute stroke patients. This study was therefore conducted to describe the characteristics of gender, age, type of stroke, and cognitive function in patients with acute stroke.
Methods: This research is a descriptive retrospective study designed to describe the characteristics of cognitive impairment in stroke patients in the Stroke Unit of Prof. Dr. I.G.N.G. Ngoerah Hospital, Denpasar, Bali, during the period of September-October 2023. The data collected included demographic data on the distribution of research samples, such as age, gender, type of stroke, and stroke location. Additionally, a cognitive function assessment was conducted.
Results: A total of 52 samples were included in this study, comprising 28 male and 24 female participants. The results indicated that the most prevalent cognitive impairment among the study participants was mild cognitive impairment (MCI), affecting 22 individuals (42.3%). The majority of these cases were attributed to non-hemorrhagic stroke, with 14 samples (26.92%). Moderate cognitive impairment was observed in 10 samples (19.23%), while severe cognitive impairment was present in 14 samples (26.92%), with both groups comprising the majority of patients with non-hemorrhagic stroke.
Conclusion: VCI is a common complication of stroke and contributes to the poorer health status of stroke survivors. Regular cognitive function assessments are recommended so that patients can be properly diagnosed and the progression of VCI to Stroke Cognitive Impairment can be prevented.

Keywords: Stroke, Vascular Cognitive Impairment, Post Stroke Cognitive Impairment

INTRODUCTION

Stroke is defined as the rapidly developing clinical signs of focal or global impairment of brain function due to blockage or rupture of a

blood vessel in the brain, with symptoms lasting 24 hours or more. It is important to note that these symptoms cannot be attributed to any other cause other than vascular disorders. Stroke is a major cause of long-term disability, and post-stroke disability can be classified into four categories: motor, sensory, autonomic, or cognitive impairment. Post-stroke cognitive impairment is frequently undetected and overlooked by patients, families, and healthcare workers. This is because it is not as prominent or as easily recognizable as other neurological deficits. However, cognitive impairment significantly reduces the quality of life of stroke survivors.[1,2,3]

Vascular cognitive impairment (VCI) is a medical term that encompasses a spectrum of cognitive impairments resulting from cerebral vascular disease.[4] This encompasses a range of conditions, from mild cognitive impairment to dementia, which is caused by damage to the brain's blood vessels. VCI can be caused by a range of brain vascular diseases, including stroke, small cerebral vessel disease, and other brain vascular diseases.[5,6]

The epidemiology of vascular cognitive impairment presents a significant challenge for study due to the heterogeneity of presentation and limitations of current diagnostic criteria. In the population-based Rotterdam Study, which employed the conservative NINDS-AIREN criteria, the incidence of vascular dementia was 0.1 per 1,000 person-years in those aged 60 to 64 years. The incidence of vascular cognitive impairment increased with age, reaching 7.0 per 1000 person-years in those aged 90 to 94 years. There was a higher risk for vascular dementia in men. In a population-based study of autopsied dementia cases in Olmsted County, Minnesota, 13% exhibited pure vascular dementia, while another 12% exhibited a significant vascular contribution to their pathology. These findings indicate that vascular disease is an important component of at least 25% of dementia cases. In a community-based cohort of dementia participants, 38% exhibited Alzheimer's disease and infarcts, 30% displayed pure Alzheimer's disease pathology, 12% exhibited infarcts alone, and 4% exhibited Alzheimer's disease with infarcts and Lewy body disease pathology. These findings suggest that vascular disease may be a contributing factor in up to 54% of dementia cases.[4,6,7,8.]

One test that can be utilized in stroke patients to assess cognitive function is the Montreal Cognitive Assessment (MoCA). The MoCA can be administered within 10 minutes with a total score of 30 points and encompasses eight domains of cognitive function, namely memory, executive function, visuospatial, language, attention, concentration, orientation, abstract ability, and naming. A total MoCA score of less than 26 is indicative of cognitive impairment. In 90% of cases of stroke, the Montreal Cognitive Assessment (MoCA) can be completed in less than 10 minutes. The MoCA-INA is a language-adapted and validated version of the MoCA that can be used as a screening test for cognitive function. [8,9.]

The decline in cognitive function is more pronounced in stroke patients over the age of 65 years. A significant proportion of stroke patients (47.3%) experience cognitive impairment three months after the initial stroke. Several risk factors have been identified that are associated with the occurrence of cognitive impairment, including advanced age, low educational attainment, a history of diabetes mellitus, and the presence of silent infarcts.[10]

Cognitive impairment, manifested as memory loss or executive dysfunction, can impede a person's ability to perform daily activities, thereby reducing their quality of life. To date, there have been few studies that provide a comprehensive understanding of vascular cognitive impairment, particularly in acute stroke patients. This study was therefore conducted to describe the characteristics of gender, age, type of stroke, and cognitive function in patients with acute stroke.

METHODS

This research is descriptive and employs a retrospective study design to describe the characteristics of cognitive impairment in stroke patients in the Stroke Unit of Prof. Dr. I.G.N.G. Ngoerah Hospital, Denpasar, Bali, during the period of September-October 2023. The data collected included demographic data on the distribution of research samples, such as age, gender, type of stroke, and stroke location. Additionally, a cognitive function assessment was conducted. The research sample was selected based on data from the patient's medical records. All patients who met the inclusion criteria were included in the study. The sample size for this study was 52 patients. The inclusion criteria for this study were as follows: (1) Diagnosis of stroke: Patients diagnosed with stroke during the study period (proven by clinical or imaging) were included in the study. Additionally, patients with cognitive impairment were identified. Cognitive impairment was documented by the examining physician, with a Glasgow coma score (GCS) of 15 or with no decrease in the quantity and quality of consciousness (including inattention, disorientation, altered thought processes, decreased psychomotor activity, and/or agitation). The exclusion criteria were patients with cognitive effects related to tranquilizers, patients with a Glasgow Coma Score (GCS) of less than 15, or patients with a decreased quantity and quality of consciousness.

RESULTS

This study utilized a sample of stroke patients in the Stroke Unit of Prof. Dr. I.G.N.G. Ngoerah Hospital, Denpasar, Bali, during the period of September-October 2023. A total of 52 samples were included in this study. The characteristics of the respondents were assessed in this study, including age, gender, stroke type, and cognitive function.

Table 1. Demographic Data of Research Sample

Variable	N	%
Age Group		
<30	1	1.9
31-40	6	11.5
41-50	12	23.1
51-60	14	26.9
61-70	9	17.3
71-80	9	17.3
>81	1	1.9
Gender		
Male	28	53.8
Female	24	46.2
Type of Stroke		
ICH	15	28.8
SAH	2	3.8
SNH	35	67.3
Total	52	

Table 2. Distribution of Subjects Based on Stroke Type

Stroke Type	Gender		Age Group						
	Male	Female	<30	31-40	41-50	51-60	61-70	71-80	>81
ICH	8 (53,3%)	7 (46,7%)	-	1 (6,7%)	6 (40%)	5 (33,3%)	2 (13,3%)	1 (6,7%)	-
SAH	1 (50%)	1 (50%)	-	1 (50%)	-	1 (50%)	-	-	-
SNH	19 (54,3%)	16 (45,7%)	1 (2,9%)	4 (11,4%)	6 (17,1%)	8 (22,9%)	7 (20%)	8 (22,9%)	1 (2,9%)

The majority of the study sample was male (28 patients, 53.8%), while the female gender was represented by 24 patients (46.2%). The age group with the highest prevalence was 51 to 60 years, with 14 patients (26.9%). In contrast, the age group with the lowest number of cases was <30 and >81, with a single case (1.9%). The type of hemorrhagic stroke was identified in 15 patients (28.8%), while subarachnoid hemorrhagic patients were two, and non-hemorrhagic stroke patients were 35 (67.3%).
Table 2 presents the frequency distribution of research subjects based on the type of stroke they suffered. In general, the majority of hemorrhagic stroke patients were male, with eight patients (53.3%) suffering from the condition and seven patients (46.7%) female. The highest age range affected by hemorrhagic stroke was 41-50 years, with six patients (40%) falling within this age bracket. In patients with non-hemorrhagic stroke, the majority of patients were male (19 patients, 54.3%) and female (16 patients, 45.7%). The age group with the highest frequency was in the age range of 51-60 years and 71-80 years, with a total of eight patients (22.9%)

Table 3. Stroke Type and Location Table

Stroke Location	Hemorrhagic stroke		SNH (n=35)
	ICH (n=15)	SAH (n=2)	
Right Frontal	-	-	3
Right Temporal	2	-	1
Right Parietal	1	-	4
Right Occipital	1	-	-
Left Frontal	-	-	7
Left Temporal	1	-	7
Left Parietal	2	-	5
Left Occipital	1	-	2
Cerebellum	3	-	-
Subarachnoid	-	2	-
Right Subcortex	4	-	14
Left Subcortex	2	-	16
Pons	1	-	-

Table 4. Distribution of Severity of Cognitive Impairment in Research Subjects

Type of Stroke	Score MoCA-INA			
	0-9	10-17	18-25	>26-30
ICH (n=15)	4 (26.66%)	4 (26.66%)	7 (46.66%)	-
SAH (n=2)	1 (50%)	-	1 (50%)	-
SNH (n=35)	9 (25.71%)	6 (17.14%)	14 (40%)	1 (2.85%)
Total	14 (26.92%)	10 (19.23%)	22 (42.3%)	1 (1.92%)

The data obtained from the physical examination and computed tomography (CT) scan of the head without contrast or magnetic resonance imaging (MRI) examination (Table 3) were used to diagnose patients with stroke. The location of the lesion was then further examined. In some patients, multiple lesion locations are obtained, which is influenced by the degree of stroke experienced by the patient. In hemorrhagic stroke, the most prevalent location was in the right subcortex area, with four patients, while in non-hemorrhagic stroke, the most prevalent location was the left subcortex area, with 16 patients, followed by the right subcortex area, with 14 patients. In this study, two patients with subarachnoid hemorrhage (SAH) were identified.
A cognitive assessment using the Montreal Cognitive Assessment-Indonesian (MoCA-INA) questionnaire revealed that 51 of the 52

research subjects exhibited cognitive impairment. The degree of cognitive impairment was classified as follows: normal (score 26-30), mild cognitive impairment (MCI) (score between 18-25), moderate cognitive impairment (score between 10-17), and severe cognitive impairment (score 0-9). In this study, we found that the group with MCI was the largest, comprising 22 individuals (42.3%). The majority of these cases were attributed to non-hemorrhagic stroke, with 14 samples (26.92%). Moderate cognitive impairment was observed in 10 samples (19.23%), while severe cognitive impairment was present in 14 samples (26.92%), with both groups predominantly comprising patients with SNH.

Table 5. Distribution of Domain Affected in Cognitive Impairment

Domain Affected in Cognitive Impairment	Type of Stroke		
	SAH (n=2)	ICH (n=15)	SNH (n=35)
Global Aphasia	-	-	1
Motor Aphasia	-	-	1
Sensory Aphasia	-	-	1
Motor transcortical aphasia	-	-	1
Attention	1	4	10
Visuospatial and Executive	2	6	11
Naming	-	3	2
Memory	2	15	11
Language	1	4	7
Abstractions	-	5	1
Delayed recall	2	15	11
Orientation	-	3	2

Based on the results of this study obtained from 2 subjects who experienced SAH, there were visuospatial, executive, memory, and language domain disorders. Whereas in ICH patients (n = 15), it was found that most domain disorders were in the memory domain (15 subjects), followed by visuospatial and executive domain disorders (6 subjects). While in SNH there are several subjects who experience aphasia, namely 1 subject with global aphasia, 1 subject with motor aphasia, 1 subject with sensory aphasia, and 1 subject with transcortical motor aphasia, while the most impaired domains are visuospatial, executive and memory domains (11 subjects), followed by the attention domain (10 subjects).

DISCUSSION

Cognitive impairment was found in 51 of 52 subjects (98.07%). Screening examination or screening for cognitive impairment using MoCA is a quick and sensitive method to detect cognitive impairment in post-stroke patients with a broad cognitive domain assessment of cognitive impairment. The MoCA-INA test has been validated in Indonesia and based on Husein's research in 2010, it was concluded that the Indonesian version of the MoCA test is valid and reliable to detect cognitive impairment.[8]

The highest prevalence of stroke cases was found to be male ICH as much as 53.3% and SNH as much as 54.3%. While the largest age group was in the age group of 51-60 years (26.9%). Cognitive function in women is better than in men because risk factors such as cardiovascular disease are more common in men. Gender differences also cause the stroke process and the cognitive impairment that occurs to be different between men and women. Women suffer more cardioembolic strokes, while men suffer more lacunar strokes, which explains why women have a higher risk of cognitive impairment than men.[13,14,17]

In principle, all stroke etiologies (small vessel disease, large artery atherosclerosis, cardioembolism, etc.) can cause VCI, but several neuroimaging and brain pathology studies have identified vascular causes and brain parenchymal damage associated with cognitive impairment. Some of these etiologies include Multiple infarcts, strategic infarcts, lesions in the substantia alba and lacuna, and hemorrhagic stroke. In this study, it was found that the majority of patients with stroke experienced mild cognitive impairment 42.3%. accompanied by impaired cognitive domains that varied, this could be related to the location of the stroke experienced by the subject. This is consistent with research by Yuwanda et al. and Jacquin et al. [5,9]

VCI is a complication of stroke that occurs due to damage or lesions in the brain, specifically in the location that regulates cognitive function. The various regions of the brain are responsible for regulating different functions, and damage to the brain regions that control cognitive processes will result in cognitive impairment. It is well established that cognitive function is essential for an individual's capacity to learn, receive, and process information. Damage to the left hemisphere of the brain resulting from a stroke will result in impaired language, reading, writing, counting, verbal memory, and skilled motor movements. Damage to the right hemisphere will result in impaired visuospatial function, visuomotor, neglect, visual memory, and motor coordination. Impaired cognitive function is closely related to brain function, as the ability to think is influenced by the brain. A real stroke event is at risk of causing cognitive impairment, especially if there is a recurrent stroke. The presence of cerebral hemodynamic disorders in the brain area has a profound effect on cognitive function. The greater the area of damage in the brain due to vascular disorders, the more pronounced the decline in cognitive function. In the general population, small vessel disease (SVD) is the leading cause of vascular cognitive impairment (VCI) and dementia.[1,8,7,9]

In the post-stroke population, the risk of developing large vessel disease and embolic infarction is relatively greater. The risk factors for Post Stroke Cognitive Impairment (PSCI) are influenced by the presence of cognitive impairment before stroke, the presence of conditions that increase cerebral vulnerability (e.g., age, presence of cerebral small vessel disease, previous education, and intellectual level), and stroke severity. Therefore, it is important to evaluate cognitive function starting from screening to determine the level of cognitive function ability early, so that it can determine the intervention and follow-up examination plan. Periodic cognitive function checks are also important to conclude that cognitive impairment is transient or persistent.[1,2,13,14.]

Cognitive impairment in post-stroke patients is related to the location of the lesion and, in some cases, overlaps with diffuse cerebral vascular injury. Therefore, a reassessment of cognitive function is necessary after the acute phase of the stroke has passed especially if the patient has VCI in the acute stroke phase. Domain-specific impairments in the acute phase may include attention and language, depending on the dominant or non-dominant hemisphere affected. Alternatively, the memory domain may be impaired if the stroke lesion is in the paramedian thalamus. In general, vascular cognitive impairment will primarily involve impairment in executive function, attention, visuospatial abilities, and slowed processing speed. This is based on the assumption that impairments occur as a result of brain vascular pathology, especially white matter dysfunction. In a study conducted by Weaver NA, it was stated that lesions in the left frontotemporal, thalamus, and right parietal regions were strongly associated with post-stroke cognitive impairment (PSCI). Research by Zhao L, et al. indicated that global cognitive impairment was strongly associated with

lesions in the left angular gyrus and left basal ganglia. Posterior circulation, particularly brainstem infarction, is an infrequent cause of post-stroke cognitive impairment (PSCI).[14,15,16]

CONCLUSION

VCI is a common complication of stroke and contributes to the poorer health status of stroke survivors. Early detection of VCI is important, regular cognitive function assessments are recommended so that patients can be properly diagnosed and progression of VCI to PSCI can be prevented. VCI often occurs alongside other stroke-related deficits and comorbid conditions such as depression, which adds complexity to its diagnosis and treatment. The management of VCI necessitates a multidisciplinary approach that encompasses the evaluation and management of comorbidities. Consequently, the comprehensive management of patients with VCI should entail interdisciplinary collaboration between patients and caregivers with healthcare professionals.

Declaration by Authors

Ethical Approval: This research ethical clearance has been approved by Komisi Ethics Research FK UNUD/ Prof. Dr. I.G.N.G Ngoerah No: 1534/UN14.2.2.VII.14/LT/2024

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