The effect of five activities daily living on improving cognitive function in ischemic stroke patients

Frana Andrianur, Dwi Prihatin Era, Arifin Hidayat, Ismansyah Ismansyah, Diah Setiani

Department of Nursing, Poltekkes Kemenkes Kalimantan Timur, Samarinda, Indonesia

Correspondence: Frana Andrianur, Department of Nursing, Poltekkes Kemenkes Kalimantan Timur, Jalan Wolter Monginsidi No.38, Samarinda East Kalimantan 75123, Indonesia.
E.mail: franaandrianur@gmail.com

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Abstract

This study aimed to assess the effects of five activities of daily living (ADL) interventions on improving cognitive function in patients with ischemic stroke. The study employed a quasi-experimental design with 16 ischemic stroke patients (n=8 per group) in an inpatient ward at a regional hospital in Samarinda, Indonesia. Inclusion criteria were: i) confirmed ischemic stroke via medical records, ii) effective communication, iii) current inpatient status, and iv) hemiparesis. Data collection used an ADL activity instrument sheet, while cognitive function was assessed with the MoCA-Ina screening (maximum score: 30 points). Data analysis included the Wilcoxon test and independent T-Test, with significance set at $p<0.05$. After the intervention, the intervention group's cognitive function significantly improved (from mean 20.25±2.60 to 25.13±1.81), while the control group changed from mean 17.13±2.10 to 20.50±2.00. The intervention group showed a significant cognitive improvement compared to the control group ($p<0.05$). In conclusion, ADL interventions enhance cognitive function in ischemic stroke patients, aiding recovery and serving as an effective hospital nursing intervention.

Introduction

Stroke occurs due to insufficient oxygen supply, resulting in cell death. This damage often leads to hemiparesis, characterized by weakness in one part of the body, significantly impacting basic activities such as dressing, eating, and walking.[1,2] Interruption of cerebral blood flow for more than 24 hours can result in brain death and functional impairment, making it the third leading cause of death.[3,4] Based on data from the East Kalimantan Health Office in 2019, mentioned that stroke ranked first, hypertension ranked second and diabetes mellitus ranked third all over Indonesia.

Impaired cognitive function can be attributed to reduced blood flow caused by occlusions in specific brain regions, resulting in neurological deficits. These effects may occur due to neuroanatomical lesions in strategic areas such as the hippocampus or lesions in the white matter of the brain.[5,6] Persistent disruption of cerebral blood flow, lasting more than 24 hours, can lead to the death of brain cells – a condition that occurs in both ischemic and hemorrhagic strokes. In general, ischemic strokes account for approximately 87% of cases.[3,7–9] Patients who have experienced a stroke face a three-fold risk of decreased cognitive function.[6,10]

Stroke often leads to memory and cognitive problems, where every minute of information processing and organization in the brain becomes crucial.[11,12] Various efforts have been made to prevent a decline in brain function, including involving families in supporting activities of daily living (ADL) to enhance quality of life and promote patient recovery.[6,13] Research has emphasized the significance of physical activity in preventing cognitive decline.[14]

Intervention research focusing on ADL is particularly important. These five activities include: i) teeth brushing, ii) dressing, iii) hair grooming, iv) telephone use, and v) eating and drinking. Specifically, in the case of ischemic stroke patients, performing these daily activities is expected to stimulate and induce the neuroplasticity process, thereby potentially expediting patient recovery. Recognizing the critical role of nurses in providing round-the-clock care, both independently and collaboratively, is essential to preventing cognitive decline in ischemic stroke patients. Studies have demonstrated an association between ADL and the cognitive function of stroke patients.[15] Additionally, upper extremity disorders, particularly those affecting the hands and wrists, are linked to impaired cognitive function.[16] Thus, assessing cognitive function in hospitalized post-stroke patients becomes essential.[15,16]

While ADL are often conducted in hospitals, they are typically limited to just one or two activities and may not follow a daily schedule. Moreover, there is a tendency to focus on the stronger hand to assist the weaker upper extremity. This research, however, concentrates on five daily activities specifically designed for the weaker hand, particularly in patients experiencing hemiparesis in the upper extremity. Patients will undergo gradual training, aiming to engage in stimulating activities using the hemiparetic upper extremity. This approach is anticipated to promote nerve cell recovery, with active participation in daily activities stimulating neuroplasticity, enabling the brain to reorganize and adapt. Consequently, this can lead to improved cognitive function, memory, attention, and executive function.

Based on this rationale, the researchers have designed this study to investigate the impact of ADL intervention on the cognitive function of ischemic stroke patients receiving treatment in the inpatient rooms of a regional public hospital in Samarinda, Indonesia.

Materials and Methods

A quasi-experimental research design was employed, utilizing a control group pretest-posttest approach, with measurements taken before and after the intervention for both the intervention and control groups. The study population consisted of all ischemic stroke patients in the stroke treatment unit at the regional public hospital in Samarinda, Indonesia. Purposive sampling was employed, aligning with predefined outcome criteria. The sample size for this study comprised 16 patients, divided into two groups, all of whom were diagnosed with ischemic stroke. Inclusion criteria included: i) confirmed ischemic stroke diagnosis based on medical records, ii) effective communication skills, iii) current hospitalization, iv) hemiparetic condition, and v) willingness to participate as respondents. Exclusion criteria consisted of: i) patients who passed away during hospitalization, and ii) clinical conditions unrelated to stroke.

The intervention involved five daily activities designed to stimulate and improve the condition of hemiparetic patients over a 7-day period, with sessions conducted twice a day. On the first day, while patients awaited stabilization, family members acting as caregivers were instructed in these five daily activities. Guidelines were provided to facilitate the process. From the second to the seventh day, patients, with the assistance of their family caregivers, performed these activities in the morning and afternoon. The daily living activities included: i) tooth brushing, ii) dressing, iii) hair grooming, iv) telephone use, and v) eating and drinking. ADL interventions for stroke patients were to be carried out daily by the patients themselves, targeting the upper extremities experiencing weakness. Caregivers and nurses provided motivation and assistance, using a provided booklet as a reference for guidance in performing these five daily activities.

The measurement instrument employed was the Montreal Cognitive Assessment Indonesia (MoCA-Ina) screening, which comprises 30 points. This instrument underwent validation and reliability testing, yielding a validity coefficient of r=0.529 and p=0.046, as well as a reliability test result of p=0.027. The Pearson correlation test yielded a value of r=0.963 and p=0.000.[17]

The Indonesian version of the MoCA-Ina is a 10-minute assessment that is easy to administer, consisting of 11 items: i) alternating trail making, ii) constructional visual abilities (cube), iii) constructional visual capabilities (wall clock), iv) naming, v) memory, vi) attention, vii) sentence repetition, viii) language fluency, ix) abstract ability, x) delayed memory, and xi) orientation ability. A total score of 26 or higher is considered within the normal range. The measurement was administered both before and after the intervention for both the intervention and control groups to assess changes in cognitive function scores among the patients.

Patients were provided with explanations regarding the research and provided informed consent by signing, with the option to decline or withdraw from participation at any point during the study. This study received ethical approval from the Ethics Committee at the regional public hospital in Samarinda, Indonesia, under approval No. 072/KEPK-AWS/V/2022. Data collection took place from May to November 2022 in the stroke treatment unit at the regional public hospital in Samarinda, Indonesia. Univariate data were analyzed using descriptive frequency distribution. All data were previously assessed for normality. Data analysis included the Wilcoxon signed test ($p<0.05$) to assess pre- and post-intervention differences, and the Independent T-Test ($p<0.05$) to compare cognitive function scores between the intervention and control groups of ischemic stroke patients.

Results

An overview of the research results, including respondent characteristics, is presented in Table 1. Table 1 revealed that the control group predominantly consists of individuals aged over 65 years (62.5%), while the intervention group is evenly distributed between those aged 46-55 and 56-65 years, each comprising 25.0%. In both groups, the majority of respondents are female, with 62.5% in the control group and 75.0% in the intervention group. Regarding education level, 50.0% of the intervention group had a high school/vocational school education, while 50.0% of the control group had only completed elementary or junior high school.

Table 2 describes the cognitive function of respondents in the intervention group before the ADL intervention. All cognitive function scores were abnormal for 100% of the respondents. After the ADL intervention, 31.3% of respondents scored normal cognitive function, while 100% of the control group respondents had abnormal cognitive function both before and after the intervention.

Table 3 displays the cognitive function scores in the intervention group before the ADL intervention, with a median score of 20.00, ranging from 17 to 24, and a standard error (SE) of 0.92. After the ADL intervention, the median score increased to 25.13, with a range of 23 to 27 and an SE of 0.64. In the control group, the initial score was 17.00, with a range of 14 to 20 and an SE of

0.74, while after the intervention, the median score was 20.00, with a range of 18 to 23 and an SE of 0.71.

Table 4 presents pre-test and post-test p-values in the intervention group of 0.011 and in the control group of 0.017 ($p<0.05$). Based on this data, it can be concluded that there were significant differences in cognitive function in both the intervention and control groups after the ADL intervention. The pre-intervention p-value is 0.454 ($p<0.05$), and the post-intervention p-value is 0.002 ($p<0.05$). Based on this data, it can be concluded that there were significant differences in the cognitive function of respondents in the control and intervention groups before and after the ADL intervention.

Discussion

Stroke is more prevalent among individuals aged 55 to 65 years, leading to vascular constriction and blockage, thus increasing the stroke risk. Lower education levels are predictive of cognitive impairment, a condition often associated with strokes, making it challenging to retain information due to a lack of awareness about the importance of regular check-ups.[18,19] The risk of impaired cognitive function and verbal memory is higher in women, primarily due to the influence of endogenous sexual hormones. Stroke patients may experience decreased executive function and motor weakness, which require careful consideration.[20] These issues can

Table 1. Distribution of respondent data (n=16).

Patient characteristics	Control group		Intervention group		p
	f	%	f	%	
Age (Years)					
< 46	1	12.5	2	25.0	0.631*
46-55	0	0	2	25.0	
56-65	2	25.0	4	50.0	
>65	5	62.5	0	0	
Gender					
Male	3	37.5	2	25.0	1.000**
Female	5	62.5	6	75.0	
Education level					
Elementary – junior high	5	62.5	4	50.0	0.596**
Senior high and above	3	37.5	4	50.0	

*Mann-Whitney test; **Fisher's exact test; statistically significant at p≤0.05.

Table 2. Cognitive function of ischemic stroke patients (n=16).

Function cognitive	Intervention				Control			
	Before		After		Before		After	
	f	%	F	%	f	%	f	%
Normal	0	0	5	31.3	0	0	0	0
Abnormal	8	100	3	18.8	8	100	8	100

Table 3. Cognitive function score of ischemic stroke patients (n=16).

Score of cognitive function	Median	(Min-Max)	SE
Intervention			
Before	20.00	17 - 24	0.92
After	25.13	23 - 27	0.64
Control			
Before	17.00	14 - 20	0.74
After	20.00	18 - 23	0.71

Table 4. Mean difference in cognitive function scores of ischemic stroke patients (n=16).

Variables Cognitive level score	N	Pre Test Mean±SD	N	Post Test Mean±SD	p
Intervention	8	20.25±2.60	8	25.13±1.81	0.011*
Control	8	17.13±2.10	8	20.50±2.00	0.017*
p		0.454**			0.002**

*Wilcoxon signed test ($p<0.05$); **Independent T-Test ($p<0.05$).

be mitigated through methods that enhance neuronal plasticity to restore impaired function. Neuromodulation interventions, aimed at regulating neural plasticity, play a significant role in facilitating faster recovery.[21,22]

The Five ADL intervention's biological mechanism has been shown to optimize cognitive function in ischemic stroke patients by providing routine stimulation through activities such as dressing, eating, and cleaning. These activities can be carried out by nurses in the hospital or at home, leading to increased neural activity and improved brain tissue repair. ADL interventions increase blood flow and oxygen supply to the brain, potentially enhancing neural plasticity, brain tissue recovery, reducing inflammation, and mitigating oxidative stress. These processes ultimately result in improved connectivity and recovery of brain tissue damaged by stroke. Patients experiencing motor learning disabilities may undergo changes in cognitive function. ADL interventions can yield positive outcomes, emphasizing the need to address motor processes. These interventions can also serve as a foundation for future stroke patient interventions.[23,24] Daily living activities, including upper extremity training, grip strength, and finger manipulation (*e.g.*, dressing), have been proven beneficial in increasing motivation, active participation, and cognitive function.[24,25]

Activities such as combing, especially upper extremity activities, must be taught to patients experiencing weakness or hemiparesis. These activities help patients indirectly establish brain patterns to relearn motor skills, increasing neuron connections, synapse activity, and cortical activity.[26,27] ADL, particularly for unilateral areas, differs from the concept of range of motion (ROM) exercises. ADL interventions aim to induce hemiparesis patients to perform daily activities, addressing the phenomenon of "learned non-use." Research supports interventions to improve post-stroke upper limb function, focusing on proximal arm non-use as a treatment target.[28–30] Brain rehabilitation, combined with cognitive training, has been shown to enhance cognitive function and daily activities in patients.[31]

ADL encompass essential self-care tasks, including eating, drinking, mobility, and using personal equipment, which can be challenging for stroke patients. Proper education on ADL and healthcare information, such as routine care, medication schedules, and bed movement, is vital.[32,33] Assessing a person's daily habits at home over several days can provide valuable insights into recovery, particularly in the upper extremities.[34] Addressing the impact of functional activity dysfunction, especially in the upper extremities following a stroke, is crucial for providing individuals with a meaningful life.[35,36]

The provided stimulation can be developed further, leading to increased brain plasticity and the potential for nerve bypass to aid in recovery. These aspects require further research.[37] Early mobilization, starting approximately 24 hours after a stroke, is crucial for reducing the risk of cognitive function decline. The family also plays a significant role in this process.[6,38,39] Upper limb effectiveness is more pronounced during the initial rehabilitation phase.[40]

The researchers argue that conducting exercises involving the upper extremities with weakness for seven days, utilizing five daily activity equipment, can facilitate the healing process. This activity serves as a stimulus that enhances brain plasticity in the nerves and should be initiated promptly to prevent a decline in cognitive function. Daily activities, especially upper extremity functions, have therapeutic effects and can improve cognitive function in stroke patients.[41,42] Learning techniques, such as using a toothbrush, indirectly engage motor skills, resulting in a visceral response, such as reducing heart rate. This, in turn, enhances oxygen and nutrient delivery to the brain, optimizing brain function.[43] Stroke patients often struggle with basic activities, such as dressing and performing various tasks, which can lead to disability.[44] The family's role as caregivers and a support system is paramount in conducting ADL to promote stroke patients' independence. Evidence supports physical training, including upper body strength training.[45–47]

Researchers assume from the results of research supporting proven and appropriate improvement in cognitive function of ischemic stroke patients after being given stroke education interventions and information media can be used as guidelines that can be used for activity day living activities to help brain recovery to prevent extensive neuron damage due to stroke.

Notably, this study has certain limitations. First, the study's results may not be generalizable due to the small number of respondents meeting the inclusion criteria. Second, during the transitional period of the COVID-19 pandemic, access to the hospital for direct observation of daily activities was limited. Third, the study did not examine all potential risk factors. Future research should explore the impact of extended stimulation and brain rehabilitation on stroke patients. Despite these limitations, this study provides valuable insights into the potential benefits of ADL interventions for improving cognitive function in ischemic stroke patients. These findings can serve as a foundation for future research in this area.

Conclusions

The Five ADL have demonstrated their effectiveness in improving the cognitive function of ischemic stroke patients. By engaging in these activities twice a day over a seven-day period, and with an emphasis on comprehension, repetition, and prompt action, cognitive function enhancement is accelerated. The establishment of guidelines for implementing these five daily activities holds the potential to facilitate brain recovery and mitigate extensive neuron damage resulting from stroke.

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