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THE IMPACT OF COGNITIVE IMPAIRMENT AFTER STROKE ON QUALITY OF LIFE AND DAILY LIFE ACTIVITIES

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Abstract
Stroke is a major cause of death and disability worldwide. Cognitive impairment is commonly seen after stroke and might significantly affect the functional outcome. The study aimed to investigate the impact of cognitive impairment after stroke on quality of life and daily life activities. This was a cross-sectional study involving 38 post stroke patients, consisted of 23 males (60.5%) and 15 females (39.5%). All patients underwent neuropsychology examination and assessment of quality of life and activity daily living. The proportion of post-stroke cognitive impairment was 44.7%. Cognitive impairment after stroke affects several domains, including attention, memory, executive function and visuospatial. Cognitive impairment was significantly associated with worse performance in daily life activities

Introduction
Stroke is considered a major cause of long term physical disabilities in adults; it is the second most common cause of cognitive impairment and dementia.[1] The prevalence of post stroke cognitive impairment ranges from 20% to 80% which varies across different countries, studies and diagnostic criteria. The risk of post-stroke cognitive impairment is related to both the demographic factors like age, education and occupation and vascular factors.[1,2] Studies in post stroke patients have been mainly focus on physical disabilities, while cognitive impairment, an important aspect for stroke survivors—has been rather neglected. Stroke survivors are at increased risk of developing cognitive impairment, related to the brain damage caused by stroke, increasing age and pre-existing vascular risk factors.[3] Cognitive impairment may lead to decreased functional capacity, therefore affect rehabilitation outcomes in stroke. The loss of functional capacity, which refers to the ability to carry out the daily activities in a normal or accepted way, leads to an increased morbidity and mortality.[4] Several studies have shown that cognitive impairment might have negative effect on quality of life and activities of daily living (ADL). [4-6] Cognitive deficits following a stroke are very frequent and are heteregenous, may vary in type, severity, and impacts on the accomplishment of ADL. Cognitive impairment after stroke might affect several domains, including episodic memory, working memory, executive function, visuospatial function and language.[4] The study aimed to determine the impact of cognitive impairment after stroke on quality of life and ADL.

Methods
This was a cross-sectional study involving 38 post stroke patients which were recruited from the Memory Clinic Neurology Department Adam Malik General Hospital Medan North Sumatera Indonesia, between April and July 2018. We included patients with history of stroke for more than three months to two years, mild to moderate physical disability (modified rankin scale score was less than 3), able to speak Bahasa Indonesia fluently and to read and write. We excluded patients who had other psychiatric disorders, an aphasia and history of dementia prior to stroke. All patients underwent routine neurologic examination and complete neuropsychology examination consisted of Mini Mental State Examination (MMSE), clock drawing test (CDT), forward digit span (FDS), backward digit span (BDS), word list memory task, constructional praxis, verbal fluency test, Boston naming test, word list recall, word list recognition, trail making test A, trail making test B and recall of construction praxis

The quality of life was assessed using medical outcomes study general health survey (SF-36), activity of daily living (ADL) and instrumental activity of daily living (IADL) scales. Originally developed as a multipurpose health survey instrument, SF-36 has become the most extensively validated and used generic instrument for measuring quality of life. It is an instrument that has extensive applications for population health surveys, comparisons of relative burden of diseases, and differentiation of health benefits across groups produced by

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diverse interventions and consist of eight subdomain assessing physical functioning, role physical, bodily pain, general health, vitality, social functioning, role emotional and mental health.[7]

The ADL scale is a carer-rated instrument consisting of six daily-living abilities including basic tasks of personal care in everyday life, including bathing, continence, transfers, feeding, dressing and transferring. For this study, the questionnaire responses were made on to a Likert scale ranging from 0 (independent) to 2 (completely dependent).[8] The Instrumental Activities of Daily Living (IADL) scale measures the activities related to independent living. It is a carer-rated instrument consisting of seven daily-living abilities includes items related to using the telephone, preparing meals, taking medicine, traveling, shopping for groceries or personal items, performing light or heavy housework and managing money. For this study, the questionnaire responses were made using a Likert scale ranging from 0 (independent) to 2 (completely dependent).[9] All statistical procedures were performed with SPSS. We used the the Spearman correlation to measure the correlation between cognitive scores and SF-36, ADL and IADL. The independent t-test was used to determine the differences of cognitive profiles between patients with cognitive impairment ant those with intact cognitive function. Statistical significance was assumed at <0.05. The Health Research Ethical Committee Medical Faculty of Universitas Sumatera Utara/H. Adam Malik General Hospital approved this study.

Results

This study included 38 subjects consisted of 23 males (60.5%) and 15 females (39.5%). The mean age was 58.84 years old with SD 10.38. Most of the subjects had 12 years of education, had hypertension and history of ischemic stroke. Table 1 summarizes the clinical characteristics of the patients.

Table 1. Subject Characteristics

Characteristic	Total (n=38) N (%)
Sex	
Male	23 (60.5)
Female	15 (39.5)
Age (years), mean ± SD	58.84±10.38
Age group, years old	
<45	2 (5.3)
46-50	6 (15.8)
51-55	5 (13.2)
56-60	9 (23.7)
61-65	7 (18.4)
66-70	4 (10.5)
71-75	3 (7.9)
>75	2 (5.3)
Educational level	
Primary	4 (10.5)
Junior High School	4 (10.5)
High School	16 (42.1)
Diploma	2 (5.3)
University	12 (31.5)
Occupation	
Employee	14 (36.8)
Housewive	6 (15.8)
Entrepreneur	7 (18.4)
Farmer	1 (2.6)
Unemployed	10 (26.3)
Stroke aetiology	
Ischemia	36 (94.7)
Haemorrhage	2 (5.3)
Hypertension	
Yes	35 (92.1)
No	3 (7.9)

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Diabetes Mellitus	
Yes	16 (42.1)
No	22 (57.9)
Atrial fibrillation	
Yes	2 (5.3)
No	36 (94.7)
Coronary Heart Disease	
Yes	6 (15.8)
No	32 (84.2)

There were differences in cognitive profiles between subjects with and without cognitive impairment. Cognitive scores for each domain were higher in subjects with MMSE score above 24, including memory, attention, language, executive function and visuospatial. There were also differences in the ability of performing daily life activities (ADL and IADL scores), although no significant differences found in SF-36 scores that assessed the quality of life (Table 2).

Table 2. The differences in cognitive scores, quality of life and daily life activities between subjects with and without cognitive impairment

Variable (mean±SD)	**Total (n=38)**	**Subjects without cognitive impairment (n=21)**	**Subjects with cognitive impairment (n=17)**	**p**
FDS	4.87±1.166	5.29±1.007	4.35±1.169	0.012
BDS	3.47±1.158	4.00±1.304	2.82±1.704	0.026
BNT	11.24±2.926	12.29±1.848	9.94±3.508	0.020
Verbal Fluency	12.89±4.373	14.57±4.154	10.82±3.795	0.012
Word List Task	12.66±5.809	14.33±5.953	10.59±5.050	0.043
Word List Recall	3.08±2.019	3.67±2.058	2.35±1.766	0.041
Word List Recognition	7.88±1.861	8.69±1.346	6.88±1.956	0.003
Constructional Praxis	7.47±2.391	8.57±1.777	6.12±2.395	0.001
TMT A, time, second	89.92±55.01	74.14±26.633	109.41±73.354	0.008
TMT A, error	2.29±4.787	0.38±1.322	4.65±6.334	0.014
TMT B, time, second	204.84±86.69	169.14±84.524	248.94±68.636	0.003
TMT B, error	11.45±9.53	7.14±8.218	16.76±8.445	0.001
ADL	1.58±2.647	0.19±0.512	3.29±3.19	0.001
IADL	2.63±4.258	0.38±1.071	5.41±5.06	0.001
SF 36				
-physical functioning	58.82±21.131	58.33±24.358	59.41±17.037	0.874
-role physical	27.63±30.640	35.71±33.139	17.65±24.630	0.062
-role emotional	50.874±36.131	52.37±35.856	49.01±37.486	0.781
-vitality	51.71±14.671	50.71±14.255	52.94±5.518	0.651
-mental health	53.47±27.782	53.14±27.717	53.88±28.709	0.937
-social functioning	54.27±31.067	58.33±31.208	49.26±31.084	0.378
-bodily	57.43±33.764	53.45±32.801	62.35±35.283	0.431
-Kondisi kesehatan umum	47.76±18.769	45.71±20.693	50.29±16.343	0.451

We found a significant negative correlation between cognitive function and daily life activities in post stroke patients. Worse cognitive function was related to lower ADL and IADL scores (table 3).

Table 3. Correlation between cognitive function and daily life activities

Variabel fungsi kognitif	**ADL**		**IADL**	
	r	**p**	**r**	**P**
MMSE	-0.772	<0.001	-0.757	<0.001
FDS	-0.430	0.007	-0.443	0.005
BDS	-0.362	0.026	-0.413	0.010
BNT	-0.488	0.002	-0.413	0.010
Verbal Fluency	-0.398	0.013	-0.395	0.014

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Word List Task	-0.475	0.003	-0.324	0.048
Word List Recall	-0.017	0.307	-0.100	0.549
Word List Recognition	-0.286	0.082	-0.303	0.065
Constructional Praxis	-0.441	0.006	-0.345	0.034
TMT A,time	0.430	0.007	0.344	0.035
TMT A, error	0.440	0.006	0.339	0.037
TMT B, time	0.469	0.003	0.407	0.011
TMT B, error	0.683	<0.001	0.543	0.001

Discussion

This was a cross sectional study involving 38 post stroke patients, consisted of 23 males (60.5%) and 15 females (39.5%). There was 17 patients (44.7%) with cognitive impairment, marked with MMSE score 24 or lower. This proportion was similar to that reported by previous study by Ferreira et al that found 37.8% post stroke patients presented with cognitive impairment.[6] Almost half of stroke survivors have a certain degree of cognitive impairment and even more common than stroke recurrence. Cognitive impairment cause loss on independence for activities of daily living and may accelerate the need of institutionalization and declined quality of life. Cognitive impairment without dementia is also related to poor quality of life.[10-12]

Post-stroke cognitive impairment can be evaluated through several neuropsychological examinations. Different neuropsychological tools are used to evaluate different cognitive domains. This study used comprehensive neuropsychological examinations, including MMSE for global cognitive function and other tools to assess each domain individually. We found that patients with impaired global cognitive function significantly had worse cognitive function on each domain and also were less independent in performing daily life activities compared to those who were cognitively intact. A higher MMSE score was associated with a better performance on other cognitive tasks that assessed executive function, attention, working memory, recent memory and delayed recall, language (naming), and visuospatial function. This is consistent with previous studies that reports higher scores of all cognitive domains in patients with normal cognitive function compared to cognitively impaired post stroke patients.[4-6] Clinically, different neuropsychological assessments are used to assess cognitive dysfunction in terms of cognitive domain. Several international guidelines recommend cognitive and mood assessment for all stroke survivors and cognitive assessment should be part of the routine neurological examination in clinical practice. Several cognitive assessment tools are available for assessing cognitive function in post-stroke patients. Choice of assessment should also be guided by other factors such as availability, familiarity and feasibility, in particular in conditions that may preclude lengthy neuropsychological testing.[3]
Cognitive impairment after stroke may include all cognitive domains, but there is likely to be a preponderance of so-called "executive" dysfunction, such as slowed information processing, impairments in the ability to shift from one task to another, and deficits in the ability to hold and manipulate information (ie, working memory). Neuropsychological assessment must therefore be both sensitive to a wide range of abilities and especially attuned to the assessment of executive function. Because different protocols serve different purposes, the Neuropsychological Working Group produced protocols that contain recommended tests in 4 domains: executive/ activation, language, visuospatial, and memory.[13]

We found a significant association between cognitive function and daily life activities in post-stroke patients.This is in line with several previous studies. Ferreira et al 2015 showed that the presence of neuropsychological impairment affected the functional abilities in post-stroke patients, particularly IADL.[6] Orso,et al studied 75 post-stroke patients and found that cognitive dysfunction had a strong impact on ADL dysfunction.[4] Cognitive impairment has also been reported to be associated with post-stroke rehabilitation. Malouin et al 2004 reported that working memory negatively correlated with the level of improvement. Their result suggested that the functional outcome after practice depended on the ability to maintain and manipulate information in working memory.[14]

Our study did not find a significant correlation between cognitive function and quality of life as measured by SF-36. This is similar with the finding from Paker et al that did not find any statistically significant differences in functional status improvement between stroke patients with and without cognitive impairment, although they found that the community ambulation rate was higher in cognitively normal group at the sixth month visit[15], but our study did not investigate this relationship further. This was also probably because the SF-36 assessed many other aspects of general health that the patients' report might also related to the physical disability, although the

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MRS score in our study was lower than 3, meaning the patients had only minimal symptoms and minor physical disability. Quality of life can be defined as a multidimensional concept that incorporates physical, psychological, and social domains of health and well-being, nested in the context of individual's values, expectations, and cultural beliefs. Handicap, physical impairment, and disability after stroke were all independent predictors of health-related quality of life, as well as dementia and depression.[7] As such, there is a need for further research to identify strategies that can improve cognition in stroke survivors and to investigate the potential reflections on their quality of life.

The strength of our study was that we used a comprehensive neuropsychological assessment that was able to evaluate each cognitive domain and might clearly showed the impact of stroke to each cognitive ability. In conclusion, post-stroke cognitive impairment, may negatively affect daily life activities. This result is important because cognitive dysfunction after stroke has implications for rehabilitation and treatment strategies.

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