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ORIGINAL RESEARCH **INTENSIVE CARE**

Development and validation of 'Cognitive Assessment Scale for Stroke Survivors'

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Abstract

Background & Objectives: Stroke is a leading cause of death and it causes significant long-term disabilities. It affects cognition and physical impairment in the patients. Cognitive impairments caused by stroke include loss of memory, disorientation, impaired attention, reasoning, and social perception. It may also lead to interaction deficit and inability to problem-solving, etc. The precise knowledge about the degree of cognitive impairment is essential to address the issue with appropriate measures. We aimed to develop a cognitive measurement scale for stroke patients.

Methodology: The phenomenon was explored through in-depth interviews of 12 stroke survivors in different hospitals in Lahore, Pakistan. Seventeen items were generated. After factor analysis, 15 items were included in the scale and a pilot study was conducted on 15 participants. A sample of 106 patients was selected to administer the scale Cognitive Assessment Scale for Stroke Survivors (CASS) and Mini-Mental State Examination (MMSE) scale for concurrent validity.

Results: The Principal Component Factor Analysis through Varimax rotation yielded three factors, e.g., *'Social Cognition'*, *'Focus and Attention'*, and *'Orientation'*. The results have shown significant values with good psychometric properties. The Cronbach's Alpha value of the developed scale is 0.88 which indicates it as a highly reliable scale.

Conclusion: This research reported that stroke survivors experience cognitive impairment after the stroke incidents. The developed scale to measure cognitive impairment after a stroke incident was proved to be valid and reliable, and can be used in medical practice.

Abbreviations: CASS – Cognitive Assessment Scale for Stroke Survivors; MMSE – Mini-Mental State Examination.

Key words: CASS; Cognitive Assessment Scale for Stroke Survivors; Cognition; Cognition Disorders / epidemiology; Cognition Disorders / etiology; Cognition / Measurement; Humans; Male; MMSE; Mini-Mental State Examination Scale Development; Stroke / complications; Stroke / epidemiology

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1. Introduction

Stroke is a leading health problem that causes major disabilities in adults. There are several factors that cause strokes, such as aging, hypertension, obesity, drug abuse, harmful diet, and sluggish lifestyle. Stroke is a common health problem that may lead to early death in developing countries.[1] It is one of the major health problems that can lead to mental and physical disabilities, by damaging major areas of the brain dealing with cognition and motor movements.[2] The aged people in the age range of 45-84 y are more affected by stroke and the frequency is higher in men as compared to the women.[3]

There is a 26% chance of a recurrent stroke within the first 5 y post-stroke.[4] There are mainly two types of strokes; ischemic stroke and hemorrhagic stroke. Ischemic stroke is caused by a disturbance in blood supply due either to thrombosis (blood clotting) or embolus (clot, air or fat) in the blood vessels that supply blood to the parts of the brain. Hemorrhagic stroke can happen by the disruption of blood vessels that supply blood to the brain, and is the leading cause of death in the stroke patients.[5]

Ischemic stroke is the type of stroke in which a blockage appears in the arteries of the brain that leads to cerebral ischemia, and approximately 87% of strokes happen due to this cause.[6] It may lead to lifelong disability, motor movement impairment, cognition and memory impairment.[7] Cognitive impairment can be mild to severe in the first three months after stroke. It is related to a recurrence of stroke, dependency on others, and a burden on the healthcare resources.[8]

An estimated 15 million people die every year due to circulatory disease and it is approximately 30% of overall deaths in a year. Both industrial and non-industrial countries are affected by stroke and almost two-thirds of death from strokes were reported from non-industrial countries.[9] Brain scanning should be done at the time of admission, even in acute stroke cases within 24 h.[10]

The stroke affects the ability to communicate, behavior and the social perceptions. It may be manifested by aggressive behavior and as crying and laughing, in approximately 20% of patients within 6 months after a stroke.[4] Generally, physical impairment is considered important after a stroke incident, and cognitive impairment is ignored. Studies show that cognitive impairment is caused by a deficiency in rehabilitation. Major cognitive impairment occurs in the early days and months after the stroke incident. General screening tools are available to measure cognitive impairment but they are not specific enough to find out the particular impairment or specific strengths and weaknesses.[4] Cognition includes memory, perception, attention, reasoning, problem-solving, etc. These faculties are not separately examined.[4]

Attention is the basic cognitive function needed in daily activities. In the early days and weeks after a stroke incident, attention is highly affected due to damage in the right hemisphere. It includes focusing, concentration, and sustained attention that is influenced by a stroke incident. It also generates general slowness in activities and mental processing, and mood disturbance, fatigue, and inability to live independently.[4]

Memory is also affected by stroke, which is generally measured through formal assessment tools. Memory loss has consequences on patients' recovery because it causes personal safety issues, and distress to patients and their families. Almost 20% of the stroke survivors experience dementia within 6 months after a stroke incident.[4] Perception is the process of analyzing the approaching sensation that is required to perform daily activities. It includes the awareness of things, recognition, and orientation. Impairment in perception is expected in stroke patients, specifically in the starting months after stroke.[4]

It was all this information in the mind, which compelled us to develop a cognitive measurement scale and to prove its validity in measurable terms.

2. Methodology

There are two major parts of this study, the first part is the brief information about developing a cognitive measurement scale and the second part consist of measuring the scale's validity.

Section I: Scale Development

Step 1: Gathering problem

The first step of developing a scale is exploring phenomenology through in-depth interviews with stroke survivors who faced cognitive impairment. These phenomenological interviews were conducted in different hospitals of Lahore, Pakistan. In total, 12 semi-structured in-depth interviews were conducted with stroke survivors of both genders, to get information about cognitive decline.

Step II: Item generation

Raw data was collected and items were generated on the basis of information received from the stroke survivors. Verbatim of the stroke survivors were used to generate items that were relevant to cognitive decline and exclude irrelevant information. Items were generated by considering different domains of cognition.

Step III: Empirical validation through experts

Table 1: Factor Loadings of CASS with Varimax Rotation (N=106). *Note: Factor loading > .40.*

Item No	F1	F2	F3
1			.613
2			.602
3		.739	
4	.555		
5	.518		
6		.747	
7		.730	
9	.567		
10	.789		
11	.718		
12		.639	
13			.842
15			.846
16	.642		
17	.538		
Eigen Values			6.02
% of Variance			37.66
% of Total Variance			37.66

After creating a rough scale, the next step was expert validation. In which experts analyzed the scale and made items more reliable by using suitable information and precise words. Expert analysis was conducted by four experts, two of them were clinical psychologists with more than 6 years of experience. The other two experts were Urdu language specialists who analyzed items according to the most relevant and specific words. The Likert scale was developed consisting of 17 items with 4 points Likert scale, value of each item from 0 to 3 where 0 = 'Never', 1 = 'Sometimes', 2 = 'Often' and 3 meant 'Every time'.

Section II: Scale Validation

Scale validation is required to find out the relevancy of the scale. Scale validation is a process to find out the validity of the scale, which means to ascertain that the scale is measuring what it is supposed to measure. There were two steps in scale validation, first was a pilot study in which data was collected from a small number of samples to find out if, the scale was finding relevant results and the second step was the actual study in which data was collected from a large number of population to compare already existed cognitive measurement scale with newly developed scale.

Table 2: Cronbach's Alpha of Total of CASS (N=106)

Factors	No of items	*A*
F-1. Social Cognition	7	.82
F-2. Focus and Attention	4	.76
F-3. Orientation	4	.80
CASS	15	.88
MMSE	11	.85

Note: α= Cronbach's Alpha, CASS= Cognitive Assessment Scale for Stroke Survivors, MMSE= Mini-Mental State Examination.

Step I: Pilot Study

The pilot study was conducted after the construction of the scale to find out the user amiability of the newly developed scale. It was conducted on 15 participants with a 1-year post-stroke period. Data were collected on two scales, Mini-Mental State Examination (MMSE) and CASS (CASS). The patients were asked to rate the issues according to their current situation after the stroke incident. Both scales were administered with proper attention and concentration. The main objectives of the study were explained to all participants and asked for their consent to participate.

Step II: Main Study

The main study had two objectives; the first one was to measure the psychometric properties of the scale and the second was to find out the concurrent validity of the developed scale.

The institute ethical committee approval was obtained to conduct the study and permission was taken from all participants. The study was conducted on 106 participants from different hospitals. Concurrent validity was used for scale validation that was measured by an already existing cognitive scale (MMSE) and was compared with the newly developed CASS scale. Factor analysis was used to analyze the data and report the validation of the scale. The exploratory factor analysis (EFA) was used for this process and 15 items were included after factor analysis. The maximum score on the scale was 45 and the minimum score was 0.

3. Results

Results of this study consist of psychometric properties of the developed scale − CASS, and its validity by comparing with the already existing scale MMSE. Exploratory factor analysis was used on a scale with Kaiser-Meyer-Olkin (KMO) and Bartlett's test of specificity. Factor analysis was also used in this study to find out factorial validity, principal component analysis along with Varimax rotation method of 106 responses of

Table 3: Inter-factor correlation, mean and SD on 3 factors and total of CASS (N=106)

Factors	Factor 1	Factor 2	Factor 3	Total
F1. Social Cognition	---	.62***	.47***	.91***
F2. Focus and Attention	---	---	.40***	.79***
F3. Orientation	---	---	---	.69***
Total	---	---	---	---
Mean ± SD	9.03 ± 4.07	3.83 ± 2.31	3.10 ± 2.11	20.17 ± 7.83

*Note: ***p < 0.001*

Table 4: Pearson correlation, mean and standard deviation of CASS and MMSE (N = 106)

Variable	CASS	MMSE
CASS	---	−.43***
MMSE	---	---
Mean ± SD	20.17 ± 7.83	23.22 ± 5.59

*Note. CASS= Cognitive Assessment Scale for Stroke Survivors, MMSE= Mini-Mental State Examination, ***P < 0.001*

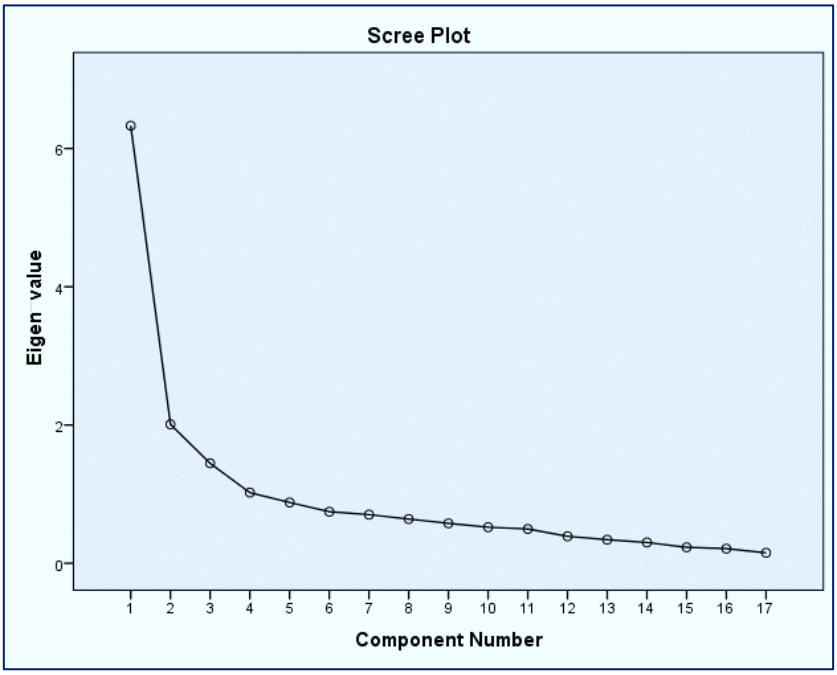

Figure 1: Scree plot for factor structure of Cognitive Assessment Scale for Stroke Survivors in 106 responses

the sample to bring of indigenous scale. In order to keep factors, the Eigen value was tested to be greater than 1. The Eigen value that is shown in the result was inspected on a Scree plot that identifies the structure of the factors and the number of factors in the scale. In these analyses correlation of the items and total scale, Alpha reliability, and internal consistency were also included in the

psychometric properties of the scale. The result shows a KMO value of 0.82 at P < 0.001.

Figure 1 consists of the three-factor on the CASS having cross-loading items greater than .40. Three factors were constructed after the extraction of items based on the theme and content of each item.

Factor Description

Three factors were constructed after factor analysis and these factors emerged in an in-depth study of the theme originated by items. These were named according to the themes that appeared by the researcher.

Factor 1: Social cognition: 'Social cognition' is the first factor that includes 7 items. This factor has emerged on the basis of a common theme. In this factor, items are related to 'social cognition', such as attitude, behavior, and social perception.

Factor 2: Fous and attention: This factor includes 4 items. These items have emerged on the basis of the theme, and are related to 'focus and attention'.

Factor 3: Orientation. The third factor is orientation and it contains 4 items. This factor is also constructed on the common theme that is 'orientation'.

Inter-factor correlation

Inter-factor correlation is the statistical technique to find out the correlation between factors of the scale. The inter-factor correlation was used to find out the relationship between three factors of the CASS and the total of the CASS.

Psychometric Properties

Psychometric properties of the developed scale (CASS) is shown in Tables 2, 3 and 4.

Age and Cognitive Impairment

The result shows that age group 51−82 y revealed more cognitive impairment as compared to age group 28−50 y. Cognitive

Table 5: Independent sample t-test for age on CASS (N = 106)

Variable	Age (y)	Mean ± SD	t	P	95%		Cohen's d
					Lower limit	Upper limit	
CASS	28-50	17.43 ± 7.95	3.28	.001***	−7.74	−1.91	0.64
	51-82	22.27 ± 7.12					

****P < .001*

impairment is common in old age people as compared to young one. The result is shown in Table 5.

4. Discussion

This research is about the development of a new scale for the cognitive impairment and finding out its validity. For this purpose, a scale was developed through the scale construction process and factor analysis was used to find out the internal consistency of the scale. The developed scale measures cognitive impairment in stroke survivors. Factor analysis distributed the scale into three factors. These are 'Social Cognition', 'Focus & Attention', and 'Orientation'. These three factors show a positive correlation with each other and with overall cognitive impairment. The result shows a significant relationship and shows high reliability that is .88. The developed scale CASS showed a negative moderate correlation with MMSE. It showed a negative correlation because MMSE has the reverse scoring. The results displayed that the developed scale is valid.

An earlier study reported that people older than 45 y of age experience stroke incidents more as compared to young adults.[9] This study reported that one man out of four experiences stroke incidents and one woman out of five experiences stroke incidents once in their lifetime after 45 y of age and if they live to 85 y of age. The results of our research also report that older people experience more stroke incidents as compared to young adults. In this research, the age category was divided from 28-50 y and 51-82 y. The results revealed that people in 51-82 y of age were more prone to stroke incidents.

We discovered three factors of the scale, e.g., *Social Cognition*, *Focus & Attention*, and *Orientation*. These three factors showed a positive correlation with each other and had Cronbach's Alpha values greater than .76 which showed highly reliable factors. A study by Coco DL et al. reported that the major domains affected by the stroke incidents are memory, attention, orientation, and social perception.[11] These areas of cognition are needed to be considered for cognitive impairment improvement in stroke survivors.

The results showed overall CASS reliability of Cronbach's Alpha was 0.88, which proved its good reliability. Cronbach's Alpha values for three factors of this scale were Social Cognition 0.82, Focus and Attention 0.76, and Orientation 0.80. These values indicate that all three factors are reliable. Brown JD in his study, explained that Cronbach's Alpha is an important tool to find out the reliability of the scale.[12] It also gives us the consistency of the items that were administered to the participants. It is also known as internal consistency reliability. Its value is between .00 to 1.00. If the scale Cronbach's Alpha value is .88 that means the scale is 88% reliable which shows good reliability.

5. Limitations

The data was collected from hospitals of one city of Pakistan only. A large, multi-centered and multi-ethnic study is needed to confirm the validity of the scale across the board.

6. Conclusion

There was no specific tool to measure cognitive impairment caused by the stroke in the stroke survivors, hence we developed Cognitive Assessment Scale for Stroke Survivors (CASS) for this purpose. The factor analysis process distributed scale into three factors, these are 'Social Cognition', 'Focus and Attention', and 'Orientation'. These factors are also reliable as Cronbach's Alpha values were high. The developed scale is reliable and valid, and its indigenous property makes it helpful for healthcare professionals to measure cognitive impairment in stroke survivors and manage accordingly.

7. Conflict of Interest

The authors declare no conflict of interest.

8. Data availability

Data generated during this research is available with the authors.

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10. Authors' contribution

SQ: Concept, data collection, manuscript drafting

MNI: Conceptualize, statistical analyses

MR: Expert review, methodology

IUC: Expert review, conceptualize

KM; Data collection

11. References

1. Sridharan SE, Unnikrishnan JP, Sukumaran S, Sylaja PN, Nayak SD, Sarma PS, et al. Incidence, types, risk factors, and outcome of stroke in a developing country: the Trivandrum Stroke Registry. Stroke. 2009 Apr;40(4):1212-8. [PubMed] DOI: 10.1161/STROKEAHA.108.531293
2. Srivastava A, Taly AB, Gupta A, Murali T. Post-stroke depression: prevalence and relationship with disability in chronic stroke survivors. Ann Indian Acad Neurol. 2010 Apr;13(2):123-7. [PubMed] DOI: 10.4103/0972-2327.64643
3. Sudlow CL, Warlow CP. Comparable studies of the incidence of stroke and its pathological types: results from an international collaboration. Stroke. 1997 Mar;28(3):491-9. [PubMed] DOI: 10.1161/01.str.28.3.491
4. Intercollegiate Stroke Working Party. National clinical guideline for stroke. 4th Edition. London: Royal College of Physicians; 2012 Sep. Available at: https://www.strokeaudit.org/Guideline/Historical-Guideline/National-Clinical-Guidelines-for-Stroke-fourth-edi.aspx
5. Maida CD, Norrito RL, Daidone M, Tuttolomondo A, Pinto A. Neuroinflammatory mechanisms in ischemic stroke: focus on cardioembolic stroke, background, and therapeutic approaches. Int J Mol Sci. 2020;21(18):6454. [PubMed] DOI: 10.3390/ijms21186454
6. Mant J, Walker MF, editors. ABC of Stroke. (Accessed on 20 July, 2021) John Wiley & Sons; 2011. Available on: https://www.wiley.com/en-us/ABC+of+Stroke-p-9781444397796
7. Qin C, Yan X, Jin H, Zhang R, He Y, Sun X, et al. Effects of remote ischemic conditioning on cerebral hemodynamics in ischemic stroke. Neuropsychiatr Dis Treat. 2020;16:283. [PubMed] DOI: 10.2147/NDT.S231944
8. He M, Wang JE, Liu N, Xiao X, Geng S, Meng P, et al. Effects of blood pressure in the early phase of ischemic stroke and stroke subtype on poststroke cognitive impairment. Stroke. 2018 Jul;49(7):1610-7. [PubMed] DOI: 10.1161/STROKEAHA.118.020827
9. Wolfe CD. The impact of stroke. Br Med Bull. 2000 Jan 1;56(2):275-86. [PubMed] DOI: 10.1258/0007142001903120
10. Akinyemi RO, Owolabi MO, Ihara M, Damasceno A, Ogunniyi A, Dotchin C, et al. Stroke, cerebrovascular diseases and vascular cognitive impairment in Africa. Brain Res Bull.. 2019 Feb 1;145:97-108. [PubMed] DOI: 10.1016/j.brainresbull.2018.05.018
11. Coco DL, Lopez G, Corrao S. Cognitive impairment and stroke in elderly patients. Vasc Health Risk Manag. 2016;12:105. [PubMed] DOI: 10.2147/VHRM.S75306
12. Brown JD. The Cronbach alpha reliability estimate. JALT Test Eval SIG Newsletter. 2002 Feb;6(1):17-18. [FreeFullText]

