Vascular Health and Risk Management

Dovepress

open access to scientific and medical research

Open Access Full Text Article

ORIGINAL RESEARCH

Prevalence and Associated Factors of Cognitive Impairment Among Stroke Survivors at Comprehensive Specialized Hospitals in Northwest Ethiopia: Multi-Centered Cross-Sectional Study

Kassahun Cherkos, Gashaw Jember, Tewodros Mihret, Molla Fentanew

Department of Physiotherapy, School of Medicine, College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia

Correspondence: Molla Fentanew, University of Gondar, P.O. Box. 196, Gondar, Ethiopia, Tel +251935686860, Email molefentapt@gmail.com

Background: Deficit in cognitive impairment is the most serious of the stroke sequelae. Post-stroke cognitive impairment is associated with impaired daily living activities and decreased capacity for independent living and functional performance. As a result, the purpose of this study was to determine the prevalence and associated factors of cognitive impairment among stroke survivors at comprehensive specialized hospitals in Ethiopia's Amhara region by 2022.

Methods: A multi-centered cross-sectional study was designed at an institution. During the study period. Data was gathered by conducting structured questionnaire interviews with participants and reviewing medical charts with trained data collectors. The participants were chosen using a systematic random sampling technique. The Montreal cognitive assessment basic was used to assess cognitive impairment. Descriptive statistics, binary and multivariate logistic regression methods were used to analyze the data. The Hosmer-Lemeshow goodness-of-fit test was used to assess the fitness of the model. The AOR with a P value of 0.05 at 95% CI was reported, and variables were considered statistically significant.

Results: This study enrolled 422 stroke survivors. Overall, 58.3% of stroke survivors had cognitive impairment (95% CI 53.4–63.0%). The study participants' age with AOR; 7.12 (4.40–11.45), being hypertensive with AOR; 7.52 (3.46–16.35), arriving at the hospital after 24 hours with AOR; 4.33 (1.49–12.05), less than three months after stroke with AOR; 4.83 (3.95–12.19), dominant hemisphere lesion with AOR; 4.83 (3.95–12.19) and being illiterate with AOR; 5.26 (4.43–18.64) were found significant factors.

Conclusion: Cognitive impairment was discovered to be relatively common among stroke survivors in this study. More than half of stroke survivors who attended comprehensive specialized hospitals during the study period were found to have cognitive impairment. Age, hypertension, arriving at the hospital after 24 hours, less than three months after stroke, dominant hemisphere lesion, and illiterate educational status were all significant factors in cognitive impairment.

Keywords: - cognitive impairment, prevalence, stroke survivors, Ethiopia

Introduction

Stroke is the second leading cause of cognitive impairment and disability in adults worldwide.[1,2] According to the WHO, stroke is associated with the world's fourth highest disease burden.[3] Stroke causes cell damage and cell death in the brain, resulting in cognitive dysfunction.[4] Post-Stroke Cognitive Impairment (PSCI) is one of the most common causes of disability and dependency in stroke survivors.[5,6] It has been reported that it significantly increases the risk of cognitive impairment by 5 to 8 times.[7,8] Cognitive impairment occurs when a person loses focus, executive function, recall, producing and understanding language, problem solving, and decision-making.[9]

Received: 4 February 2023
Accepted: 22 April 2023
Published: 27 April 2023

Deficits in cognitive function are among the more serious stroke sequelae, delaying and frequently jeopardizing rehabilitation efforts.[10] The prevalence of cognitive impairment after stroke is high worldwide, ranging from 11.6% to 68.2% in various hospital-based studies.[11] It was discovered to be 56.3% in Austria,[12] 68.2% in Indonesia,[4] 21% in Russia,[13] 54.5% in Singapore,[14] 55% in Portugal,[15] and 63% in Uganda.[16]

Post-stroke cognitive impairment (PSCI) is associated with impaired activities of daily living, which may lead to increased use of health-care services, decreased capacity for independent living, and decreased functional performance.[17] PSCI patients are more likely to be re-admitted to the hospital.[18] Patients with stroke who have cognitive impairments in addition to physical impairments have less physical function recovery, more reliance in living after stroke, and a lower quality of life.[19,20] During the first year after a stroke, the costs of care were three times higher for patients with cognitive impairments.[21]

Many factors contribute to cognitive impairment; for example, age and late onset of hospitalization are common risk factors for post-stroke cognitive impairment.[22,23] From age-related risk factors, overweight, high blood pressure, excessive alcohol consumption and sedentary lifestyle are modifiable factor for stroke.[24] PSCI prevalence increased with age and peaked at age >70 years (34.7%).[4] At all-time points, the rate of cognitive impairment in stroke survivors was strongly related to age, and it progressively increased after 5 years of stroke for patients aged 65–85.[1] Low educational attainment is associated with decreased functional cognitive reserve, and it may also influence lifestyle and risk factor profile.[25] The higher educational status and personal history of prior stroke help to increase the knowledge of warning signs, risk factors, and prevention mechanisms.[26]

PSCI was also higher in recurrent stroke survivors.[27] When cognitive impairment occurs after a stroke, the patient's life is significantly impacted, and posing a significant burden on families and society;[28] As a result, early detection and elimination of risk factors for cognitive impairment in stroke patients is critical for the effective prevention and treatment of cognitive impairment. According to our extensive search, there is a scarcity of data in Ethiopia on the prevalence and factors associated with cognitive impairment among stroke patients. The purpose of this study was to determine the extent and associated factors of cognitive impairment among stroke survivors in comprehensive specialized hospitals in Ethiopia's Amhara region.

Methods and Materials

Study Design and Setting

A multi-centered institutional-based cross-sectional study was conducted from April to June 2022 at comprehensive specialized hospitals in Ethiopia's Amhara region (University of Gondar comprehensive specialized hospital (UOGCSH), Felege Hiwot comprehensive specialized hospital (FHCSH), and Dessie comprehensive specialized hospital (DCSH)) to assess the prevalence of cognitive impairment and associated factors among stroke survivors.

According to the Central Statistics Agency of Ethiopia (CSA), the region's population in 2015 was estimated to be 24,276,235 people.[29] The region has 80 hospitals (4 comprehensive specialized, 4 referral, and 72 primary), 847 health centers, and 3342 health posts.[30]

Sample Size Determination and Sampling Techniques

A single population proportion formula was used to calculate the sample size. Because no studies on cognitive impairment among stroke survivors were found in our country, any attempt to obtain baseline prevalence from another setting may have an impact on the representativeness of the current study. In order to increase the precision of the study's results, the maximum sample size assumption was used, with P = 50% prevalence among stroke survivors, a margin of error (d) of 5%, and a 95% level of confidence.

$$n = \frac{(Z\alpha/2)^2 p\,(1-p)}{D^2}$$

Where =zα/2 = 95% =1.96

p=0.5

q=1-p =1-0.5 =0.5

D =0.05

$N = 1.96^2 \times 0.5 \times 0.5/0.05^2$

$= 3.8416 \times 0.25/0.0025$

384.37~384;

Taking the 10% non-response rate into account, the final sample size is 422. Proportional allocation was used to determine the number of stroke survivors in each comprehensive specialized hospital. To collect data from each stroke survivor, a systematic random sampling technique was used to select study participants. The study participants were obtained systematically in each comprehensive and specialized hospital using card numbers at every two intervals (k = 2) until the required sample size of 422 was reached.

Variables of the Study

Outcome Variable

The outcome variable in this study was cognitive impairment, which was assessed using the Montreal Cognitive Assessment Basic (MOCAB). It is a brief cognitive screening tool with eight items and a maximum score of thirty. It was designed for people with limited education and varying levels of literacy. Subjects with a MOCAB score of less than 25 were classified as cognitively impaired, while those with a score of more than 25 out of 30 were classified as normal.

Independent Variables

This study's independent variables were classified as socio-demographic characteristics (age, sex, religion, marital status, occupation, level of education, place of residence). Medical complications (Diabetes mulitas and Hypertension). Clinical factors (hospitalization time, recurrent stroke, dominant hemisphere, stroke type, and time after stroke) as well as personal lifestyle habits (active smoker, excessive alcohol consumption).

Operational Definitions

Cognitive Impairment

When a study subject score ≤25 on the Montreal cognitive assessment basic, they have cognitive impairment.

Smoker

Current smoker defined by CDC as an adult who smokes cigarettes daily/everyday.[31]

Alcoholics

The person who drank two or more bottles of any type of alcohol per day was classified as alcoholic.[32]

Eligibility Criteria for Study Participants

All stroke survivors who were attending comprehensive specialized hospitals whose age >18 year were included. However. subjects with a history of Alzheimer, epilepsy, visual impairment, auditory impairment, coma, severe aphasia were excluded in the study.

Data Collection Tool and Procedure

To collect socio-demographic information, a structured questionnaire was prepared for an interview. Three qualified physiotherapists and two supervisors gathered the information. All study participants were asked to provide written consent and were interviewed about their sociodemographic information. Cognitive impairment was assessed using the Montreal cognitive assessment basic (MOCAB).[33,34] The patients medical record has been reviewed to gather medical and clinical information about the patient. The questionnaire was written in English and translated into Amharic; to ensure consistency, the meaning of the Amharic was translated back into English.

Data Management and Quality Control

Data collectors and supervisors were trained to ensure data quality. The data tools were pre-tested prior to data collection to ensure response accuracy, language clarity, and tool appropriateness. The study was piloted on 5% of the total sample size (21 subjects). It was completed within a week of the actual data collection period for the population at Tibebegion specialized hospital, which has similar characteristics to the population chosen for the actual study. Based on the results of the pre-test, the necessary changes were made for the actual study. The supervisor conducts routine checks to ensure that the data is complete and consistent.

Data Processing and Statistical Analysis

Epi info version 7 was used to enter data, and SPSS version 22 was used to analyze it. Bi-variable logistic regressions analysis was employed to show the relationship between dependent and independent variables. To account for confounder of variables found to be associated with cognitive impairment were modeled using multivariate logistic regression. All possible predictors which were significant in the bivariate analysis (p-value <0.25) were included in the multivariable logistic model. The chi-square test was checked to interpret the possible differences in the categorical variables based on cognitive impairment. The Hosmer-Lemeshow goodness-of-fit test was used to assess the fitness of the model. Multicollinearity among the explanatory variables was checked using Variance Inflation Factor (VIF >10). The AOR calculated using back ward step wise multivariate logistic regression. Finally, an AOR was used with a 95% confidence interval and p-value of less than 0.05 was considered statistically significant. The results of study analysis were presented in descriptive statistics, frequency tables, graphs, percentages, means, and standard deviations.

Result

Socio Demographic Characteristics, Medical Conditions and Behavioral Factors

The study included a total of 422 participants, with a 100% response rate. The majority of respondents 274 (64.9%) were male, regarding marital status 345 (81.8%) were married, on the occupation aspect 204 (48.3%) were retired and the average age of study participants was 68 (SD = 8.02). Most of the participants 274 (64.9%) had recurrent type of stroke and 261 (61.8%) had hemorrhagic. Most of participants (299, 70.9%) were hypertensive. Twenty participants (4.7%) were excessive alcohol consumer and 10 (2.3%) were smoking cigarettes daily (Table 1). In terms of duration since stroke was happened most participants (35.8%) were between 3 and 6 month, <3 month (32.7%), >6 month (31.5%), respectively (Figure 1).

Prevalence of Cognitive Impairment Among Stroke Survivors

In this study, the overall prevalence of cognitive impairment among stroke survivors was 58.3% (95% CI 53.4–63.0%). Cognitive impairment was found in 53.6% of males and 66.7% of females. The prevalence of cognitive impairment among elder populations was 70.10%.The 65.1% in the urban residence, 58.6% among married, 84.7% in the retired population, and 76.7% among illiterates (Table 2).

Factors Associated with Cognitive Impairment Among Stroke Survivors

Explanatory Variables with a significant association in bivariate logistic regression (p 0.25) were fitted to multivariate logistic regression analysis. After considering possible confounders of the variables like age, hypertension, illiteracy, dominant hemisphere lesion, time after stroke, and time in hospital were all found to be significantly associated with cognitive impairment in stroke survivors (p 0.05). In multivariable regression, variables such as stroke history, diabetes, and type of stroke were not significantly associated (Table 3).

Discussion

The purpose of this study was to determine the prevalence of cognitive impairment and associated factors among stroke survivors attending comprehensive specialized hospitals in Ethiopia's Amhara region. According to the findings of this study, the overall prevalence of cognitive impairment among stroke survivors was 58.3% (95% CI 53.4–63.0%). This

Table 1 Socio-Demographic Characteristics, Behavioral Factors and Clinical Conditions of Study Participants at UOGCSH, FHCSH and DCSH Amhara Region Ethiopia 2022 (n = 422)

Variable		Frequency	Percentage
Gender	Male	274	64.9%
	Female	148	35.%
Age	18–4	110	26.1%
	46–73	168	39.8%
	73–100	144	34.1%
Place of residence	Urban	289	68.5%
	Rural	133	31.5%
Marital status	Single	17	4.0%
	Married	345	81.8%
	Divorced	45	10.7%
	Widowed	15	3.6%
Religion	Orthodox	258	61.1%
	Protestant	46	10.9%
	Muslim	118	28.0%
Educational level	Illiterate	129	30.6%
	1–6 years	120	28.4%
	>6 years	173	41.0%
Occupation	Unemployed	31	7.4%
	Employed	43	10.2%
	Private worker	204	48.3%
	Retired	144	34.1%
Smoking status	Yes	10	2.3%
	No	412	97.7%
Drinking status	Yes	21	4.9%
	No	401	95.1%
Hypertension	Yes	299	70.9%
	No	123	29.1%
Diabetic mellitus	Yes	46	10.9%
	No	235	55.7%
Type of stroke	Ischemic	161	38.2%
	Hemorrhagic	261	61.8%

(*Continued*)

Table 1 (Continued).

Variable		Frequency	Percentage
Stroke history	First time stroke	148	35.1%
	Recurrent stroke	274	64.9%
Dominant hemisphere lesion	Yes	187	44.3%
	No	235	55.7%
Time to hospital	<6hr	160	37.9%
	6–12hr	100	23.7%
	12–24hr	95	22.5%
	>24hr	67	15.9%
Time after stroke	<3 month	138	32.7%
	3–6 month	151	35.8%
	>6 month	133	31.5%

study in line favorably to studies conducted Singapore (54.5%),[14] Uganda (63%)[16] and Ireland (56.6%).[35] The possible reason for this could be similarity in age of study participants with comparable sample size and methodology used in Ireland study. Uganda's study was cross-sectional study with comparable age group and most of socio-demographic characteristics of participants are nearly similar. Also, Singapore's study was done on same setting (institutional; hospital-based study) and with comparable time since stroke onset of study participants with both types of strokes.

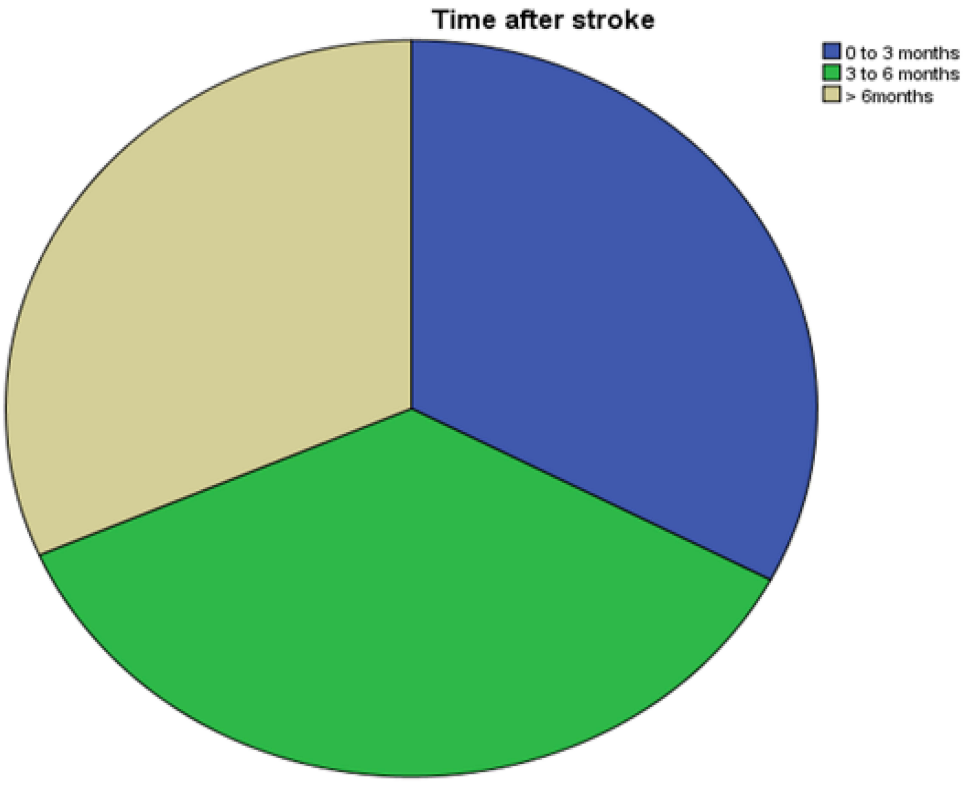

Figure 1 Time after stroke.

Table 2 The Prevalence of Cognitive Impairment of Study Participants Among Different Variables at UOGCSH, FHCSH and DCSH Amhara Region Ethiopia 2022 (n = 422)

Variables	Cognitive Impairment	
	Yes	No
Gender		
Male	147 (53.6%)	127 (46.4%)
Female	99 (66.9%)	49 (33.1%)
Age		
18–45	39 (35.5%)	71 (64.5%)
46–72	106 (63.1%)	62 (36.9%)
73–100	101 (70.1%)	43 (29.9%)
Place of residence		
Urban	148 (65.1%)	101 (34.9%)
Rural	58 (43.6%)	75 (56.4%)
Marital status		
Single	11 (64.7%)	6 (35.3%)
Married	202 (58.6%)	143 (41.4%)
Divorced	19 (42.2%)	26 (57.8%)
Widowed	14 (93.3%)	1 (6.7%)
Religion		
Orthodox	144 (55.8%)	114 (44.2%)
Protestant	22 (47.8%)	24 (52.2%)
Muslim	80 (67.8%)	38 (32.2%)
Occupation		
Unemployed	18 (58.1%)	13 (41.9%)
Employed	19 (44.2%)	24 (55.8%)
Private workers	87 (42.6%)	117 (57.4%)
Retired	122 (84.7%)	22 (15.3%)
Educational level		
Illiterate	99 (76.7%)	30 (23.3%)
1–6 years	85 (70.8%)	35 (29.2%)
>6years	62 (35.8%)	111 (64.2%)
Smoking		
Yes	31 (96.9%)	1 (3.1%)
No	215 (55.1%)	175 (44.9%)

(*Continued*)

Table 2 (Continued).

Variables	Cognitive Impairment	
	Yes	**No**
Drinking		
Yes	170 (55.6%)	40 (34.5%)
No	76 (65.5%)	136 (44.4%)
Hypertension		
Yes	208 (69.6%)	91 (30.4%)
No	38 (30.9%0	85 (69.1%)
Diabetes mellitus		
Yes	33 (71.7%)	13 (28.3%)
No	213 (56.6%)	163 (43.4%)
Type of stroke		
Ischemic stroke	62 (38.5%)	99 (61.5%)
Hemorrhagic stroke	184 (70.5%)	77 (29.5%)
Stroke history		
First time stroke	66 (44.6%)	82 (55.4%)
Recurrent stroke	180 (65.7%)	94 (34.3%)
Dominant hemisphere lesion		
Yes	146 (78.1%)	41(21.9%)
No	100 (42.6%)	135(57.4%)
Time to hospital		
<6hr	69 (43.1%)	91 (56.9%)
6–12hr	56 (56.0%)	44 (44.0%)
12–24hr	70 (73.7%)	25 (26.3%)
>24hr	51 (76.1%)	16 (23.9%)
Time after stroke		
<3 months	99 (71.7%)	39 (28.3%)
3–6 months	101 (66.9%)	50 (31.3%)
>6 months	46 (34.6%)	87 (65.4%)

However, this study was more extensive than the one conducted in France (16.3%),[36] Egypt (25.3%)[37] and China (39.4%).[38] The possible reason for this difference could be participants were first ever stroke with different in methodology (prospective study) and difference in educational status of the study participants were attending at least primary education in France study. The difference in Egypt study could be due to difference in time after stroke; most of the participants were acute stroke patients (<3 moths). China's study was follow-up and first ever ischemic stroke age

Table 3 Factors Associated with Cognitive Impairment in Bivariate and Multivariate Logistic Regression Analysis of Study Participants at UOGCSH, FHCSH and DCSH Amhara Region Ethiopia 2022 (n = 422)

Variable	Cognitive Impairment		OR 95% CI	
	NO	YES	COR 95% CI	AOR 95% CI
Hypertension				
Yes	91	208	5.113 (3.244–8.058)	7.517 (3.457–16.346) ***
No	85	38	1	1
Age				
18–45	71	39	1	1
46–72	62	106	3.112 (1.886–5.136)	2.866 (1.290–6.365) *
73–100	43	101	4.276 (2.519–7.258)	7.115 (4.403–11.451) **
Type of stroke				
Ischemic	99	62	1	1
Hemorrhagic	77	184	3.816 (2.552–5.773)	0.749 (0.371–1.512)
Time to hospital				
<6hr	91	69	1	1
6–12hr	44	56	1.679 (1.014–2.778)	0.901 (0.416–1.951)
12–24	25	70	3.693 (2.123–6.423)	4.283 (1.901–9.652) *
>24hr	16	51	4.204 (2.210–7.7995)	4.328 (1.490–12.054) **
Time after stroke				
<3 months	39	99	4.801 (2.869–8.033)	4.871 (2.857–9.323) **
3–6 months	50	101	3.820 (2.335–6.252)	2.866 (1.290–6.365) *
>6 months	87	46	1	1
Diabetic mellitus				
Yes	13	33	1.943 (0.991–3.809)	0.808 (0.284–2.300)
No	163	213	1	1
Education level				
Illiterate	30	99	5.908 (3.536–9.871)	5.077 (2.256–11.430) **
1–6 years	35	85	4.348 (2.633–7.179)	1.835 (0.500–6.730)
>6 years	111	62	1	1
Stroke history				
First time stroke	82	66	1	1
Recurrent stroke	94	180	2.379 (1.581–3.581)	1.273 (0.580–2.791)*
Dominant hemisphere				
YES	41	146	4.807 (3.120–7.407)	4.832 (3.943–12.194) **
NO	135	`100	1	1

Notes: *p < 0.05, **p < 0.01, ***p < 0.001,1=reference category.

from 14 to 45 years and also most of study participants were literate individuals which might bring a difference in prevalence to our study findings.

The finding of this study was higher than studies in Chile (39%)[39] and Ghana (50%).[40] The reason for this difference could be in methodology and study participants were at least three months after stroke with small sample size (147

participants) in Ghana study which was different from this study. In Chile's study, the difference could be due to differences in socio-demographic characteristics of study participants.

On the other hand, this study was lower than study done in China (80%);[27] and Indonesia (68.2%).[4] The possible explanation for this difference could be in China's study setting which is community based whereas our study setting is institutional based (hospitals) and study participants were older individuals (age >55) but in our study all adult stroke survivors were included. The possible reason for Indonesia's study could be difference in stroke type included which is ischemic type only but in our study participants with all types of strokes were included.

This study found that hypertensive people were 7.5 times more likely to develop cognitive impairment than non-hypertensive people, which was supported by research from Malaysia[41] and China.[27] Hypertension may cause vascular changes that lead to cognitive impairment by causing hypoperfusion, ischemic and hemorrhagic stroke, and white matter injury.[42,43]

The odds of developing cognitive impairment in Participants whose Age 73 years and above were 7.1 more likely compared with stroke survivors age between 18 and 45 years. This was supported by studies done in Egypt,[37] Ghana[40] and Nigeria.[44] The cause could be due to the nature of stroke, which hastens cognitive decline with age.[45]

The likelihood of developing cognitive impairment in illiterate stroke survivors was 7.0 times greater than in educated >6 years. It was supported by the results of the study conducted in Nigerian[44] as well as China.[27] One possible explanation is that education reduces the negative effects of severe white matter lesions (which cause severe cognitive impairment).[46] Another reason could be that higher education provides good dynamic-based cognitive stimulation and is effective in improving cognitive performance.[47]

The odd of developing cognitive impairment after stroke in time between before 3 months were 4.8 times more likely when compared with greater than 6 months, which was supported by a study done in Croatia.[48] The possible reason could be the recovery of the entire structure which controls cognitive function and run fast after stroke needs long period of time.[49,50] Participants with less than three months were more likely to develop cognitive impairment than those with more than three months. That could be one of the reasons. Even though it may persist, cognitive impairment is a major concern during the acute phase of a stroke, with more than half of all stroke survivors experiencing some form of long-term cognitive deficit.[35]

The odd of developing cognitive impairment in those who were admitted to hospital after 24 hours of the onset of stroke were 4.3 times more likely when compared with those early admission (before 6hrs) to hospitals, which was supported by the study done in Indonesia.[4] The reason for this could be due to the fact that late onset of hospital admission may increase the number of structures and area of lesson in the brain, because large infarctions are expected to cause more cognitive impairment than small infarctions.

Participants with dominant hemisphere lesion involvement were 4.8 times more likely to develop cognitive impairment than participants with non-dominant hemisphere lesion. This finding was supported by a study conducted in Egypt.[51] One possible explanation is that hemispheric dominance involvement was more common in patients with cognitive impairment. This could be because intelligence or cognitive efficiency is heavily reliant on the accuracy of language processing and hemispheric dominance.[51,52]

Conclusion

Cognitive impairment was found to be relatively common among stroke survivors in this study. More than half of stroke survivors who visited comprehensive specialized hospitals in the Amhara region during the study period were found to have cognitive impairment. Age, hypertension, arriving at the hospital after 24 hours, less than three months after stroke, dominant hemisphere lesion, and illiteracy were all significant factors in cognitive impairment. It is preferable that health-care providers and caregivers focus their attention on the elderly, hypertensive patients with acute stroke and dominant hemisphere lesion who are later admitted to the hospital, and non-educated stroke survivors. According to the findings of this study, they were more likely to develop cognitive impairment.

Strength and Limitation of the Study

The multicentered-cross sectional study used in this study was one of its strengths; all types of stroke survivors were included, and the study's findings identified common factors for cognitive impairment in stroke survivors. Implications for health-care practitioners include educating elderly patients on possible methods of preventing recurrent strokes and controlling hypertension. Furthermore, researchers should conduct a prospective study in order to gather more evidence demonstrating the temporal relationship.

Undiagnosed mental illnesses could have influenced the study subjects' performance on the MOCAB items, and thus their overall score, as one of the study's limitations. Because it is a cross-sectional study, it cannot determine the temporal relationship and does not show a strong association of causes and effects.

Abbreviations

Cerebrovascular Accident (CVA): WHO stands for World Health Organization. Cognitive Impairment (CI), PSCI is an acronym for Post Stroke Cognitive Impairment. MOCAB is an abbreviation for Montreal Cognitive Assessment Basic. COR stands for Crude Odds Ratio, and AOR stands for Adjusted Odds Ratio. Ethiopian Birr (ETB): DM stands for Diabetes Mellitus. HTN stands for high blood pressure. SPSS is an abbreviation for Statistical Package for Social Sciences. FHCSH: Felege Hiwot Comprehensive Specialized Hospital, DCSH: Dessie Comprehensive Specialized Hospital.

Data Sharing Statement

The data of this study can be available for reasonable request from the corresponding author.

Ethical Approval and Consent to Participate

The proposal was reviewed and approved by the Research and Ethical Review Committee of the Institutional Review Board (IRB) of the University of Gondar, College of Medicine and Health Science, and ethical clearance was obtained. The study's objectives and significance were explained to the participants, and each participant provided informed consent. The study's confidentiality was maintained at all levels. Participants' participation in the study was voluntary; those who were unwilling to participate in the study or who wished to withdraw at any time were informed that they could do so without restriction. Participants in the study were identified using codes to ensure confidentiality, and no unauthorized individuals had access to the collected data. Only the principal investigator had access to the computerized data. All the data were carried out in this study have been conducted with the accordance to the principles of Helsinki declaration.

Acknowledgment

We are grateful to college of medicine and health sciences, University of Gondar for funding the project. We would like to express our special thanks to all study participants for giving their willingness and time during data collection.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Funding

Our source of fund for this work was University of Gondar. The funder has no role in the data collection, analysis, design of the study and interpretation of data for this manuscript.

Disclosure

All the authors declared that they have no competing interests in this work.

References

1. Douiri A, Rudd AG, Wolfe CD. Prevalence of poststroke cognitive impairment: South London stroke register 1995–2010. *Stroke*. 2013;44(1):138–145. doi:10.1161/STROKEAHA.112.670844
2. Strong K, Mathers C, Bonita RJ. Preventing stroke: saving lives around the world. *Lancet Neurol*. 2007;6(2):182–187. doi:10.1016/S1474-4422(07)70031-5
3. Wolfe C, Rudd AJ. The burden of stroke white paper: raising awareness of the global toll of stroke-related disability and death; 2007.
4. Pinzon RT, Sanyasi RDL, Totting SJ. The prevalence and determinant factors of post-stroke cognitive impairment. *PLoS One*. 2018;5(1):78–83.
5. Zulkifly MFM, Ghazali SE, Din NC, Subramaniam P. The influence of demographic, clinical, psychological and functional determinants on post-stroke cognitive impairment at day care stroke center, Malaysia. *MJMS*. 2016;23(2):53.
6. Levine DA, Wadley VG, Langa KM, et al. Risk factors for poststroke cognitive decline: the REGARDS study (reasons for geographic and racial differences in stroke). *Stroke*. 2018;49(4):987–994. doi:10.1161/STROKEAHA.117.018529
7. Merino JG. Dementia after stroke: high incidence and intriguing associations. *Stroke*. 2002;33(9):2261–2262.
8. Srikanth VK, Thrift AG, Saling MM, et al. Increased risk of cognitive impairment 3 months after mild to moderate first-ever stroke: a community-based prospective study of nonaphasic English-speaking survivors. *Stroke*. 2003;34(5):1136–1143. doi:10.1161/01.STR.0000069161.35736.39
9. Jeganathan J, Seemanthini TJ. Memory impairment in young type 2 diabetes mellitus males: an alarming concern! *Global J Res Anal*. 2014;3(6):172–173.
10. Cumming TB, Marshall RS, Lazar RM. Stroke, cognitive deficits, and rehabilitation: still an incomplete picture. *Int J Stroke*. 2013;8(1):38–45. doi:10.1111/j.1747-4949.2012.00972.x
11. Patel MD, Coshall C, Rudd AG, Wolfe CD. Cognitive impairment after stroke: clinical determinants and its associations with long-term stroke outcomes. *J Am Geriatr Soc*. 2002;50(4):700–706. doi:10.1046/j.1532-5415.2002.50165.x
12. Ladurner G, Iliff L, Lechner HJ. Neurosurgery, Psychiatry. Clinical factors associated with dementia in ischaemic stroke. *J Neurol Neurosurg Psychiatry*. 1982;45(2):97–101. doi:10.1136/jnnp.45.2.97
13. Verbitskaya S, Parfenov V, Reshetnikov V, Kozlov V, Kabaeva AJN. Neuropsychiatry, Psychosomatics. Post-stroke cognitive impairment (results of a 5-year follow-up). *Nevrol Nejropsihiatr Psihosom*. 2018;10(1):37–42.
14. Saxena SK. Prevalence and correlates of cognitive impairment in stroke patients in a rehabilitation setting. *Int J Psychosoc Rehab*. 2005;10(2):39–47.
15. Madureira S, Guerreiro M, Ferro JJ. Dementia and cognitive impairment three months after stroke. *Eur J Neurol*. 2001;8(6):621–627. doi:10.1046/j.1468-1331.2001.00332.x
16. Mukisa R, Ddumba E, Musisi S, Kiwuwa SJ. Prevalence and types of cognitive impairment among patients with stroke attending a referral hospital in Uganda. *Afr J Neurol Sci*. 2011;30(2):25.
17. Oros RI, Popescu CA, Iova CA, Mihancea P, Iova SO. The impact of cognitive impairment after stroke on activities of daily living. *Hum Vet Med*. 2016;8(1):41–44.
18. Callahan KE, Lovato JF, Miller ME, Easterling D, Snitz B, Williamson JD. Associations between mild cognitive impairment and hospitalization and readmission. *J Am Geriatr Soc*. 2015;63(9):1880–1885. doi:10.1111/jgs.13593
19. Zinn S, Dudley TK, Bosworth HB, et al. The effect of poststroke cognitive impairment on rehabilitation process and functional outcome. *Arch Phys Med Rehabil*. 2004;85(7):1084–1090. doi:10.1016/j.apmr.2003.10.022
20. Paker N, Buğdaycı D, Tekdöş D, Kaya B, Dere Ç. Treatment. Impact of cognitive impairment on functional outcome in stroke. *Stroke Res Treat*. 2010;2010:15.
21. Claesson L, Lindén T, Skoog I, Blomstrand CJ. Cognitive impairment after stroke–impact on activities of daily living and costs of care for elderly people. *Cerebrovasc Dis*. 2005;19(2):102–109. doi:10.1159/000082787
22. Snaphaan L, de Leeuw F. Poststroke memory function in nondemented patients: a systematic review on frequency and neuroimaging correlates. *Stroke*. 2007;38(1):198–203. doi:10.1161/01.STR.0000251842.34322.8f
23. Alexandre A, Valente I, Consoli A, et al. Posterior circulation endovascular thrombectomy for large-vessel occlusion: predictors of favorable clinical outcome and analysis of first-pass effect. *Am J Neuroradiol*. 2021;42(5):896–903. doi:10.3174/ajnr.A7023
24. Soto-Cámara R, González-Bernal JJ, González-Santos J, Aguilar-Parra JM, Trigueros R, López-Liria R. Age-related risk factors at the first stroke event. *J Clin Med*. 2020;9(7):2233. doi:10.3390/jcm9072233
25. Alexandrova ML, Danovska MPJ. Cognitive impairment one year after ischemic stroke: predictors and dynamics of significant determinants. *Turk J Med Sci*. 2016;46(5):1366–1373. doi:10.3906/sag-1403-29
26. Soto-Cámara R, González-Bernal JJ, González-Santos J, Aguilar-Parra JM, Trigueros R, López-Liria R. Knowledge on signs and risk factors in stroke patients. *J Clin Med*. 2020;9(8):2557. doi:10.3390/jcm9082557
27. Qu Y, Zhuo L, Li N, et al. Prevalence of post-stroke cognitive impairment in China: a community-based, cross-sectional study. *PLoS One*. 2015;10(4):e0122864. doi:10.1371/journal.pone.0122864
28. Sturm JW, Donnan GA, Dewey HM, et al. Quality of life after stroke: the North East Melbourne stroke incidence study (NEMESIS). *Stroke*. 2004;35(10):2340–2345. doi:10.1161/01.STR.0000141977.18520.3b
29. E CSA. Population projection of Ethiopia for all regions at wereda level from 2014–2017. *Central Stat Agency Ethiopia*. 2013;1:167–176.
30. Chanyalew MA, Yitayal M, Atnafu A, Tilahun BJ. Routine health information system utilization for evidence-based decision making in Amhara national regional state, northwest Ethiopia: a multi-level analysis. *BMC Med Inform Decis Mak*. 2021;21(1):1–10.
31. Hsu WL, Chien YC, Huang YT, et al. Cigarette smoking increases the risk of nasopharyngeal carcinoma through the elevated level of IgA antibody against Epstein-Barr virus capsid antigen: a mediation analysis. *Cancer Med*. 2020;9(5):1867–1876. PubMed PMID: 31925935. Pubmed Central PMCID: PMC7050088. doi:10.1002/cam4.2832
32. Bachani AM, Jessani NS, Pham VC, Nguyen PN, Passmore J, Hyder AA. Drinking & driving in Viet Nam: prevalence, knowledge, attitudes, and practices in two provinces. *Injury*. 2013;44:S38–S44. doi:10.1016/S0020-1383(13)70211-0

33. Griffiths J, Thaikruea L, Wongpakaran N, Munkhetvit PJD, Extra GCD. Prevalence of mild cognitive impairment in rural Thai older people, associated risk factors and their cognitive characteristics. *Dement Geriatr Cogn Dis Extra*. 2020;10(1):38–45. doi:10.1159/000506279
34. Julayanont P, Tangwongchai S, Hemrungrojn S, et al. The Montreal cognitive assessment—basic: a screening tool for mild cognitive impairment in illiterate and low-educated elderly adults. *J Am Geriatr Soc*. 2015;63(12):2550–2554. doi:10.1111/jgs.13820
35. Mellon L, Brewer L, Hall P, Horgan F, Williams D, Hickey A. Cognitive impairment six months after ischaemic stroke: a profile from the ASPIRE-S study. *BMC Neurol*. 2015;15(1):1–9.
36. Jacquin A, Binquet C, Rouaud O, et al. Post-stroke cognitive impairment: high prevalence and determining factors in a cohort of mild stroke. *J Alzheimer's Dis*. 2014;40(4):1029–1038. doi:10.3233/JAD-131580
37. Esmael A, Elsherief M, Eltoukhy KJ. Prevalence of cognitive impairment in acute ischaemic stroke and use of Alberta Stroke Programme Early CT Score (ASPECTS) for early prediction of post-stroke cognitive impairment. *Neurol Neurochir Pol*. 2021;55(2):179–185. doi:10.5603/PJNNS.a2021.0006
38. Huang Y, Yang S, Jia JJ; research c. Factors related to long-term post-stroke cognitive impairment in young adult ischemic stroke. *Med Sci Monit*. 2015;21:654. doi:10.12659/MSM.892554
39. Delgado C, Donoso A, Orellana P, et al. Frequency and determinants of poststroke cognitive impairment at three and twelve months in Chile. *Dement Geriatr Cogn Disord*. 2010;29(5):397–405. doi:10.1159/000305097
40. Sarfo FS, Akassi J, Adamu S, Obese V, Ovbiagele BJ, Diseases C. Burden and predictors of poststroke cognitive impairment in a sample of Ghanaian stroke survivors. *J Stroke Cerebrovasc Dis*. 2017;26(11):2553–2562. doi:10.1016/j.jstrokecerebrovasdis.2017.05.041
41. Sahathevan R, Brodtmann A, Donnan GA. Dementia, stroke, and vascular risk factors; a review. *Int J Stroke*. 2012;7(1):61–73. doi:10.1111/j.1747-4949.2011.00731.x
42. Birhanu TE, Kassa MA, Getachew B, Dereje D, Gerbi AJE. Prevalence and predictors of cognitive impairment among hypertensive patients on follow up at Jimma University medical center, Jimma, Southwest Ethiopia. *eJ Cardiovasc Med*. 2019;7(3):117–125.
43. Sun J-H, Tan L, Yu J. Post-stroke cognitive impairment: epidemiology, mechanisms and management. *Ann Transl Med*. 2014;2(8). doi:10.3978/j.issn.2305-5839.2014.08.05
44. Abba MA, Khalid Mukhtar B, Usman MY; Researches G. Prevalence and pattern of post-stroke cognitive impairment in Kano, Nigeria. *Arch Physiother Glob Res*. 2020;24(1):7–11.
45. De Ronchi D, Palmer K, Pioggiosi P, et al. The combined effect of age, education, and stroke on dementia and cognitive impairment no dementia in the elderly. *Dement Geriatr Cogn Disord*. 2007;24(4):266–273. doi:10.1159/000107102
46. Mortamais M, Portet F, Brickman AM, et al. Education modulates the impact of white matter lesions on the risk of mild cognitive impairment and dementia. *Am J Geriatr Psychiatry*. 2014;22(11):1336–1345. doi:10.1016/j.jagp.2013.06.002
47. Casemiro FG, Quirino DM, Diniz MAA, Rodrigues RAP, Pavarini SCI, Gratão AC. Effects of health education in the elderly with mild cognitive impairment. *Rev Bras Enferm*. 2018;71:801–810. doi:10.1590/0034-7167-2017-0032
48. Prlić N, Kadojić DJ, Kadojić M. Quality of life in post-stroke patients: self-evaluation of physical and mental health during six months. *Acta Clin Croatica*. 2012;51(4):601–607.
49. Shi D, Chen X, Li ZJ. Diagnostic test accuracy of the Montreal Cognitive Assessment in the detection of post-stroke cognitive impairment under different stages and cutoffs: a systematic review and meta-analysis. *Neurol Sci*. 2018;39(4):705–716. doi:10.1007/s10072-018-3254-0
50. Pasquini M, Leys D, Rousseaux M, Pasquier F, Henon HJ; Neurosurgery, Psychiatry. Influence of cognitive impairment on the institutionalisation rate 3 years after a stroke. *J Neurol Neurosurg Psychiatry*. 2007;78(1):56–59. doi:10.1136/jnnp.2006.102533
51. Lo Coco D, Lopez G, Corrao S. Cognitive impairment and stroke in elderly patients. *Vasc Health Risk Manag*. 2016;12:105–116. PubMed PMID: 27069366. Pubmed Central PMCID: PMC4818041. doi:10.2147/VHRM.S75306
52. Fridriksson J, den Ouden DB, Hillis AE, et al. Anatomy of aphasia revisited. *Brain*. 2018;141(3):848–862. PubMed PMID: 29360947. Pubmed Central PMCID: PMC5837461. doi:10.1093/brain/awx363