Original Research Article

Prevalence of Post-Stroke Cognitive Impairment and Dementia in a Sudanese Cohort: A Single-Center Retrospective Study

ABSTRACT

Background: Post-stroke cognitive impairment (PSCI) and dementia are major contributors to disability worldwide. However, data from low- and middle-income countries (LMICs), including Sudan, remain limited. This study aimed to determine the prevalence of PSCI and dementia among Sudanese stroke survivors and identify associated risk factors.

Methods:A hospital-based study was conducted at Al-Nou Hospital in Omdurman, Sudan. We adopted a cross-sectional design rather than a purely retrospective one. Eighty-one patients with a prior stroke diagnosis were recruited via purposive sampling (initially targeting 93 based on estimated stroke mortality but adjusted due to local constraints). A structured questionnaire and review of hospital records were used to collect demographic and clinical data; the Montreal Cognitive Assessment (MoCA) was used for cognitive evaluation. Descriptive statistics were obtained for all variables. Bivariate analyses (chi-square or Fisher-Freeman-Halton exact tests, depending on assumptions) and ordinal logistic regression were used to examine associations with four-level MoCA outcomes.

Results: Of 81 stroke survivors (mean age 61.9±13.9 years), 72.8% had ischemic stroke, and 27.2% had hemorrhagic stroke. Hypertension (61.2%) and diabetes mellitus (36.2%) were the most common comorbidities. Right-hemisphere strokes were more frequent (64.2%) than left-hemisphere events (35.8%). In a four-level MoCA analysis, sex (female) and higher education were significantly associated with better cognitive outcomes ($p<0.05$).

Comorbidity categories approached significance (p=0.075; exact p=0.063). Ordinal logistic regression confirmed higher education as an independent predictor of improved cognitive status (adjusted OR=4.07, p=0.018).

Conclusion: PSCI was highly prevalent in this Sudanese stroke cohort, underscoring the need for systematic cognitive screening and aggressive management of vascular risk factors, particularly hypertension. Higher education and female sex were associated with better cognitive outcomes.

Keywords: Stroke, Cognitive Impairment, Dementia, MoCA, Sudan

Introduction

Stroke ranks as the second most common cause of death worldwide and one of the leading causes of adult disability, contributing significantly to morbidity and healthcare burden(1, 2). Although improvements in acute stroke management have increased survival rates, post-stroke complications (particularly cognitive impairment and dementia) remain substantial challenges(1, 3). Post-stroke cognitive impairment (PSCI) spans a spectrum of deficits, including memory, executive function, language, and visuospatial processing, all of which can greatly reduce quality of life and increase caregiver burden.(4, 5).

Recent epidemiological data underscore that stroke disproportionately affects low- and middle-income countries (LMICs), especially in sub-Saharan Africa, due to demographic transitions, inadequate control of risk factors, and limited healthresources(6).Large-scale analyses of the global burden of disease confirm a rise in stroke incidence, a higher post-stroke disability, and limited access to rehabilitation services in LMICs. Identifying PSCI rates within these settings is crucial to plan evidence-based interventions.

PSCI is strongly influenced by classical vascular risk factors such as hypertension, diabetes, and dyslipidemia, alongside social determinants of health such as educational level and socioeconomic status(7-9). Controlling these modifiable risk factors (especially hypertension) plays an essential role in mitigating not only stroke incidence but also subsequent cognitive impairment.Although there are multiple screening instruments for cognitive evaluation, the Montreal Cognitive Assessment (MoCA) has been recognized as superior in detecting subtle cognitive changes (e.g. executive dysfunction, visuospatial problems) compared to traditional tools such as the Mini-Mental State Examination (MMSE) (10, 11).However, most published data originate from high-income settings, with relatively few studies validating MoCA in African populations.

Beyond global deficits, lesion laterality can influence domain-specific outcomes, with right-hemisphere strokes more commonly linked to visuospatial disturbances, while left-hemisphere lesions often manifest as aphasia and language-related impairments (12, 13).Understanding the specific PSCI patterns enables targeted rehabilitation measures.

In Sudan, stroke is increasingly recognized as a major public health challenge. However, data on stroke outcomes and PSCI remain sparse, and published studies are often hospital-based with small sample sizes. Larger epidemiological surveys or multicenter analyses are lacking (9).Therefore, investigating PSCI at Al-Nou Hospital in Omdurman provides an opportunity to generate locally relevant findings.

Methods

Study Design and Setting

This cross-sectional, hospital-based study was conducted at Al-Nou Hospital in Omdurman, Sudan. While some patient data were extracted from existing records, prospective administration of the Montreal Cognitive Assessment (MoCA) ensured direct cognitive testing. The neurology clinic serves both urban and rural communities, thereby offering a broad representation of Sudanese stroke survivors.

Study Population

All adult patients ≥18 years old with a documented ischemic or hemorrhagic stroke at least one month before assessment were considered eligible. Individuals who presented with a new stroke diagnosis of less than one month or who had severe communication difficulties without a caregiver were excluded. This approach was taken to allow sufficient time post-stroke for cognitive assessment.

Sampling Technique and Sample Size

A purposive sampling method was employed. Initially, 93 participants were targeted based on a 9.4% stroke mortality rate in Sudan, aiming for a 90% confidence level and 5% margin of error. Due to military-related challenges, enrollment concluded at 81 participants, conferring an effective confidence level of ~88%.

Data Collection Tools and Procedures

Data were gathered through a structured questionnaire (covering demographics, comorbid conditions, and stroke-specific details)plus a review of hospital records. The MoCA (11, 14),was then administered in person; caregivers assisted those with significant speech or motor deficits. This scale assesses executive function, memory, language, attention, visuospatial skills, and orientation, yielding a total score from 0 to 30.

Data Management and Analysis

Demographic and clinical information was collected from each participant using a validated questionnaire. Data were cleaned and coded before being exported to SPSS version 29 for statistical analysis. Descriptive statistics (frequencies and percentages) were produced for categorical variables, while continuous variables (e.g., MoCA scores) were summarized using mean ± standard deviation. Bivariate analyses (Pearson’s chi-square and Fisher–Freeman–Halton exact test) assessed associations between candidate predictors and the four-level

MoCA outcome (Severe: 0-10; Moderate: 11-18; Mild: 19-25; Normal: 26-30).Subsequently, ordinal logistic regression was performed to identify independent predictors of cognitive status using a stepwiseforward approach.

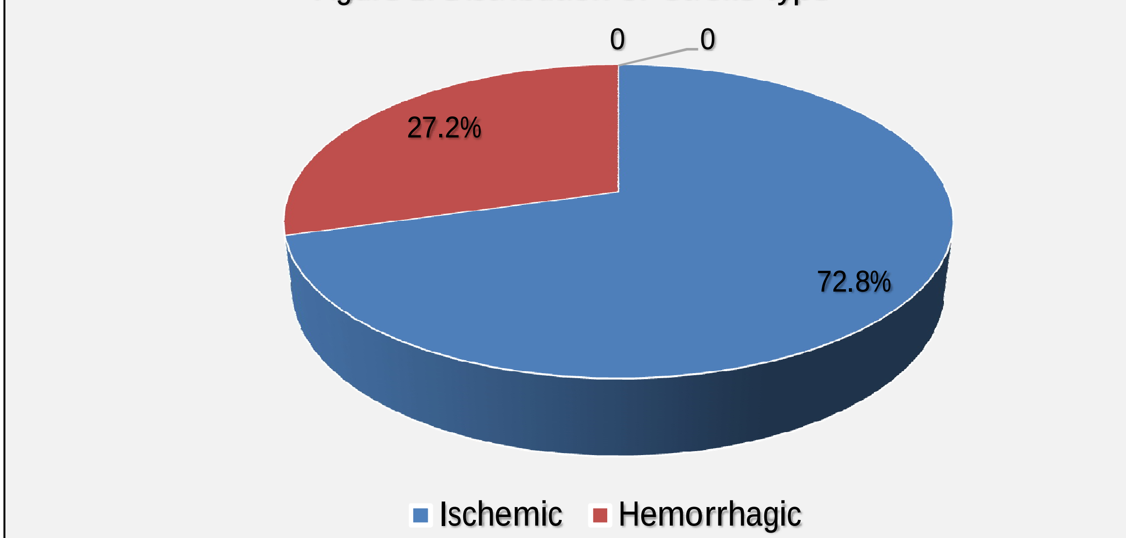
Results

A total of 81 stroke survivors were included in this study. Over half (50.6%) were 61–80 years old, and 56.8% were male. Regarding education, 32.1% had completed secondary school, 24.7% had a university degree, and 3.7% had post-graduate qualifications. Ischemic stroke was predominant (72.8%). Hypertension was the most frequent comorbidity (61.2%), occurring alone (42.0%) or together with diabetes mellitus (18.5%). More than half (54.3%) of those with hypertension were taking antihypertensive medications, and 36.2% of all participants had diabetes mellitus. See (Table 1) for more details.

Table 1. Demographic and Clinical Profile of the Participants (N=81)

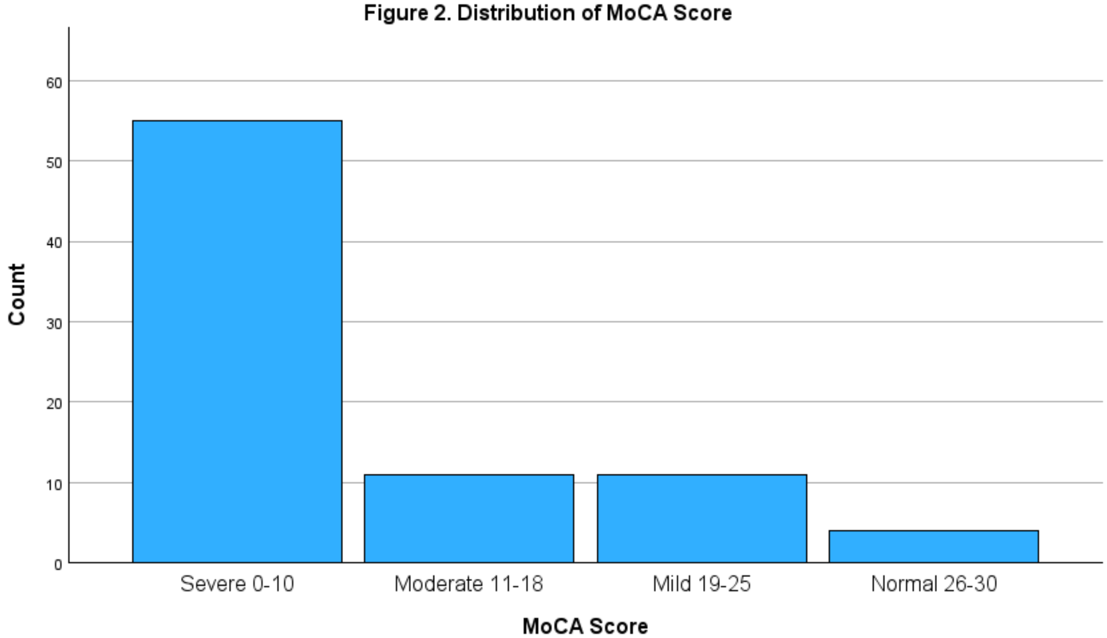
Characteristic	Category	n	%
Age Group	18–40 years	12	14.8
	41–60 years	23	28.4
	61–80 years	41	50.6
	>80 years	5	6.2
Sex	Male	46	56.8
	Female	35	43.2
Educational Level	No formal education	14	17.3
	Primary school	18	22.2
	Secondary school	26	32.1
	University	20	24.7
	Postgraduate	3	3.7
Occupation	Self-employed	21	25.9
	Housewife	21	25.9
	Skilled workers	17	21
	Unemployed	22	27.2
Family Hx. of Stroke	Yes	27	33.3
	No	54	66.7
Type of Stroke	Ischemic	59	72.8
	Hemorrhagic	22	27.2
Hemisphere affected	Right	52	64.2
	Left	29	35.8
Time Since Dx	<5 years	74	91.4
	≥5 years	7	8.6
Dominant Hand	Right	69	85.2
	Left	12	14.8
Stroke Medications	Anti-Platelets	40	49.4
	Statins	19	23.5
	Both	17	21
	None	5	6.2
Comorbidities	Hypertension	34	42
	Diabetes mellitus	13	16
	Both	15	18.5
	None	19	23.5
Medications for Comorbidity	Antihypertensive	35	43.2
	Hypoglycemics	20	24.7
	Both	7	8.6
	None	19	23.5

Figure 1. Distribution of Stroke Type



(Figure 1) presents the proportions of ischemic versus hemorrhagic stroke among the 81 participants. A clear majority (72.8%) had ischemic stroke, while 27.2% experienced hemorrhagic stroke.

Figure 2. Distribution of MoCA Score



(Figure 2) shows the full range of MoCA scores (0–30) recorded in this study. In particular, more than half of the participants scored at the severe end (0–10),and some participants scored in the upper normal range (26–30).

Bivariate Analysis

(Table 2) shows cross-tabulations of the four-category MoCA outcome (Severe (0–10), Moderate (11–18), Mild (19–25), and Normal (26–30)) with each variable. Sex ($p = 0.006$; exact = 0.004) and education ($p = 0.034$; exact = 0.026) were significant, while comorbidity categories approached significance ($p = 0.075$; exact = 0.063). All other variables did not reach $p < 0.05$.

Table 2. Association between Demographics / Clinical Variables and Four-Level MoCA Outcomes

Variable	**Categories**	**Severe (0-10)**	**Mod (11-18)**	**Mild (19-25)**	**Normal (26-30)**	**Exact p-value**
Age	18–40 yrs	9	2	0	1	0.824
	41–60 yrs	15	3	3	2	
	61–80 yrs	27	6	7	1	
	>80 yrs	4	0	1	0	
Sex	Male	28	10	8	0	0.004
	Female	27	1	3	4	
Education	Less Education	27	1	2	2	0.026
	High Education	28	10	9	2	
Stroke Type	Ischemic	41	9	7	2	0.556
	Hemorrhagic	14	2	4	2	
Dominant Hand	Right hand	47	8	10	4	0.628
	Left hand	8	3	1	0	
Medications for Stroke	Anti-Platelets	23	6	8	3	0.173
	Statins	12	5	1	1	
	Both	16	0	1	0	
	None	4	0	1	0	
Co-Morbidity	HTN Only	26	4	1	3	0.063
	DM Only	6	4	3	0	
	Both	9	1	5	0	
	None	14	2	2	1	
Medication for Co-Morbidity	Antihypertensive	26	5	1	3	0.103
	Hypoglycemic	11	4	5	0	
	Both	4	0	3	0	
	None	14	2	2	1	

(Table 3)shows that all sixteen potential predictors were first evaluated using univariate ordinal logistic regression using a four-tier MoCA outcome classification (Severe: 0–10; Moderate: 11–18; Mild: 19–25; Normal: 26–30). Of these, only education level, antiplatelettherapy, and the combination of statins plus antiplatelets showed either $p < 0.20$ or were considered clinically relevant and were therefore entered into the multivariate model. Variables for diabetes ($p = 0.16$) and the use of hypoglycemic drugs ($p = 0.23$) were included. In the final model, higher education remained independently significant ($p = 0.018$; adjusted OR = 4.07). Meanwhile, the effect of antiplatelet therapy was no longer significant after adjustment, and the protective effect of statins plus antiplatelets approached but did not reach the 0.05 threshold ($p = 0.113$). All other factors were excluded for lack of significance in the univariate analysis, multicollinearity, or minimal clinical contribution to the model.

Table 3. Univariate and Multivariate Ordinal Logistic Regression for Four-Level MoCA Outcomes

Variable	Unadjusted OR(95% CI)	P-value	Adjusted OR(95% CI)	P-value
Age < 40	0.65(0.14-2.35)	0.536		
Age 41–60	1.26(0.45-3.38)	0.451		
Age > 60	1.02(0.41-2.61)	0.472		
Sex (Male vs. Female)	1.64(0.63-4.53)	0.321		
Education (High vs. Low)	3.5(1.23-11.6)	0.026	4.07(1.35-14.26)	0.018
Stroke Type (Ischemic vs. Hemorrhagic)	0.67(0.25-1.90)	0.437		
Dominant Hand (Right vs. Left)	1.14(0.34-4.47)	0.841		
Anti-Platelets (Yes vs. No)	2.77(1.09-7.44)	0.036	2.02(0.71-6.15)	0.198
Statins (Yes vs. No)	1.1(0.37-3.03)	0.859		
Statin + Anti-Platelets combination (Yes vs. No)	0.1(0.005-0.54)	0.031	0.17(0.008-1.10)	0.113
Hypertension (HTN vs. No HTN)	0.6(0.22-1.52)	0.485		
Diabetes meletus (DM vs. No DM)	2.18(0.71-6.49)	0.163	1.21(0.23-6.53)	0.82
Hypertension + Diabetes Melitus (Yes vs. No)	1.64(0.51-4.94)	0.387		
Use of antihypertensive drugs (Yes vs. No)	0.6(0.22-1.52)	0.597		
Use of hypoglycemic drugs (Yes vs. No)	1.83(0.66-4.92)	0.232	1.74(0.35-7.73)	0.473
Use of both (Anti-HTN + hypoglycemic) (Yes vs. No)	1.96(0.37-8.64)	0.389		

Discussion

Our single-center study underscores a high prevalence of post-stroke cognitive impairment in Sudan, with over 60% of participants categorized as Severe (MoCA 0-10). This is consistent with previous African research indicating that 40-66% of stroke survivors exhibit marked cognitive deficits(15, 16).

Most of the participants (72.8%) experienced an ischemic stroke, paralleling global epidemiological trends in which ischemic events predominate. Hemorrhagic strokes, though less common (27.2%), remain a critical concern due to typically higher mortality. As expected, most of the participants were in the older age bracket (>60 years), mirroring the well-known relationship between advancing age and stroke incidence.(1, 2, 6).Although more men were included overall (56.8%), our bivariate findings revealed that female sex ($p = 0.004$) was significantly associated with better MoCA scores (an observation that may reflect protective hormonal factors, differences in vascular risk profiles, or other gender-related influences(17).

Education emerged as the strongest independent predictor of cognitive status, with those with university or postgraduate qualifications up to four times more likely to achieve better MoCA results (adjusted OR=4.07, p=0.018). This finding supports the cognitive reserve hypothesis(18), whereby extended formal education, enhanced health literacy, and earlier engagement in preventive care each contribute to more favorable post-stroke cognitive trajectories(16, 19)

Hypertension dominated the comorbidity landscape (61.2%), confirming its status as a primary modifiable risk factor for stroke onset and recurrence(2, 9).In particular, a combined presence of hypertension and diabetes mellitus approached statistical significance ($p = 0.075$), suggesting that multiple coexisting vascular pathologies may further exacerbate PSCI.Although diabetes alone was prevalent (36.2%), it did not achieve independent

significance in our regression model (a finding that, while somewhat unexpected, echoes other studies reporting modest or indirect diabetic effects on cognitive decline)(20, 21).
The high proportion of right-hemisphere strokes (64.6%) corresponded with a notable frequency of visuospatial or visual complaints (84% among those with pre-stroke cognitive symptoms). This reinforces evidence that right-sided lesions often disrupt spatial processing, attention, and perceptual tasks(13). Although we did not perform a lesion-specific analysis in our regression, future neuroimaging-based studies in Sudanese populations could shed light on more nuanced associations between lesion location and post-stroke cognitive domains.
Taken together, our findings emphasize both the predominance of ischemic stroke and the severe burden of PSCI in this Sudanese cohort. Education clearly emerged as a protective factor, while combined vascular comorbidities warrant further investigation in larger, possibly multicenter, studies.

Conclusion

Among 81 Sudanese stroke survivors, PSCI was highly prevalent, with severe MoCA deficits in over half of the participants. Higher education independently predicted better cognitive outcomes, underscoring the protective value of cognitive reserve. Hypertension remained the most frequent comorbidity, highlighting the need for aggressive blood pressure control strategies. Although combined hypertension-diabetes approached significance, larger samples are needed to confirm synergistic impact. Systematic cognitive screening, comprehensive rehabilitation, and robust public health measures targeting vascular risk factors are crucial to mitigate PSCI in Sudan.

Limitations

Single-Center: Findings from Al-Nou Hospital might not generalize across all Sudanese stroke populations or other regions.Reduced Sample Size: Ongoing turmoil constrained enrollment, limiting specific subgroup analyses.Partial Record Reliance: Some data were extracted from hospital records, possibly introducing inaccuracies or missing information.

Data Availability

The dataset underlying this article is not publicly available due to institutional and ethical constraints. However, it can be shared upon reasonable request with the corresponding author and with permission from the Research Committee of Al-Neelain University.

Ethical Approval and Consent:

Ethical clearance was obtained from the relevant Research Committee of the Community Department, Faculty of Medicine at Al-Neelain University, in accordance with the Declaration of Helsinki. All participants (or their caregivers) gave informed consent, and no personal identifiers were retained in the final dataset.

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