

Supplementary Material

Table S1. Introduction to the evaluation of the cognitive function.

Number	The name of the scale	Introduction of the scale	sensitivity and specificity of the scale
1	Mini-Mental State Examination (MMSE)	The MMSE assesses different cognitive domains: orientation to time and place, registration and recall, attention and calculation, language abilities, and basic motor skills. The test consists of 11 items with a maximum score of 30 points.	A score of 23 or lower indicates cognitive impairment, with the pooled sensitivity of 88.3% and specificity of 86.2% for dementia [1, 2].
2	Montreal Cognitive Assessment (MoCA)	The MoCA is a widely used screening tool for cognitive impairment, designed to detect mild cognitive dysfunction [3]. It assesses various cognitive domains, including visuospatial abilities, memory, attention, language, abstraction, and executive function. The MoCA is typically administered in about 10 minutes and scored out of 30.	A score of 26 or lower indicates cognitive impairment [3]. A study conducted in China found that MoCA have a sensitivity of 89.0% and specificity of 80.0% in vascular dementia patients [4].
3	Addenbrooke's Cognitive Examination III (ACE-III)	The ACE-III is a comprehensive cognitive assessment tool that evaluates attention, memory, verbal fluency, language, and visuospatial abilities, with scores ranging from 0 to 100 [5].	Cognitive impairment was defined as an ACE-III score below 87, which has been validated in the Chinese population, with the sensitivity of 75.0% and specificity of 89.0% [6].
4	Cerebellar Cognitive Affective Syndrome scale (CCAS-s)	The CCAS-s was used to assess Cerebellar Cognitive Affective Syndrome[7]. The scale contains 10 items and each item has a designated cut-off score to determine pass or fail. CCAS is considered possible if one test is failed, probable if two tests are failed, and definite if three or more tests are failed.	Based on the definition, the sensitivity of the Chinese version of CCAS-s to identify possible/probable/definite CCAS was 80.0%/53.3%/40.0% and the specificity was 40.0%/80.0%/96.7% [8].
5	Trail Making Test (TMT)	The TMT is a neuropsychological assessment of visual attention and task switching. It consists of two parts, A and B, in which the individual is instructed to connect a set of 25 dots as	The sensitivity and specificity of TMT B were 28.0% and 94.0% with a cutoff of 26, whereas for TMT A, they

		quickly as possible while still maintaining accuracy [9].	were 44.0% and 91.0% with a cutoff of 30 [10].
6	Digit Span Test (DST)	The forward and backward DST are widely used measures of working memory capacity and have been used in various populations, including individuals with vascular dementia [11, 12]. The Digit Span Test is a subtest of the Wechsler Adult Intelligence Scale and is a simple and effective way to assess working memory. The Digit Span Forward (DSF) process involves reading a sequence of digits at a rate of one digit per second, with the subject asked to repeat it immediately in sequential form. On the other hand, the Digit Span Backward (DSB) process entails reading a sequence of digits at a rate of one digit per second, and the subject is required to repeat it immediately in reverse order.	DSF demonstrated a sensitivity of 46.0% and specificity of 77.0% at the optimal cutoff of 8. In comparison, DSB exhibited a sensitivity of 77.0% and specificity of 78.0% at the optimal cutoff of 3 [13].
7	Rey Complex Figure (RCF) test	The RCF test is a widely used neuropsychological assessment tool that involves copying, immediate recall, and delayed recall of a complex figure [14]. The RCF test is a sensitive measure of visuospatial and constructional abilities, and visual memory. The test involves the presentation of a two-dimensional figure that the examinee must copy (i.e., the Copy Trial) and reproduce from memory after 3-min and 30-min delay periods.	The sensitivity of this scale for detecting mild cognitive impairment is among 78.0-85.0%, while the specificity is among 50.0-90.0% [15].
8	Boston Naming Test (BNT)	The BNT measures an individual's ability to name objects or items presented to them [16]. Subjects were asked to spontaneously name 30 pictures and were considered to be in error if they answered incorrectly or could not answer within 20 seconds.	The sensitivity of this scale for detecting mild cognitive impairment is 74.5% with a cutoff value of 25, while the specificity is 54.5%. For detecting dementia, the sensitivity of this scale is

		The indicator of observation is the number of correct naming.	63.5% with a cutoff value of 22, while the specificity is 82.2% [17].
9	Rey Auditory Verbal Learning Test (RAVLT)	Rey Auditory Verbal Learning Test (RAVLT) is a widely used neuropsychological assessment tool that evaluates an individual's ability to encode, consolidate, and retrieve verbal information [18]. This test involves the presentation of a list of 12 unrelated words multiple times, followed by a delayed recall and recognition phase.	The scale showed strong classification accuracy in detecting mild memory impairment with a cut-score of 13, achieving a sensitivity of 82.0% and a specificity of 89.0%. Although accuracy decreased in individuals with severe memory impairment, it still demonstrated significance with an alternative cut-score of 11, achieving a sensitivity of 37.0% and a specificity of 88.0% [19].
10	Verbal fluency test (VFT)	This test provides valuable information about language and executive functioning abilities. There are two main types of VFT: Phonemic Fluency and Semantic Fluency. In Phonemic fluency, participants are asked to generate as many words as possible that begin with a specific letter: 车 (The word means 'car' in English) within one minute. Semantic fluency involves generating words that belong to a specific category (animals) within one minute [20, 21].	Phonemic Fluency showed a sensitivity of 80.0% and specificity of 57.0% at the optimal cutoff of 7. The sensitivity and specificity of Semantic Fluency were 83.0% and 42.0% at the optimal cutoff of 14 [22].
11	the Stroop test	The Stroop Test examines an individual's cognitive processing speed and their ability to inhibit automatic responses, it also assess cognitive functioning and detect impairments in executive functions, such as attention, cognitive flexibility, and response inhibition [23]. In the Stroop Test, individuals are presented with a series of color words (e.g., red, blue, green)	The test had a sensitivity of 79.0% and a specificity of 89.0% in differentiating between AD patients and healthy controls [24].

		<p>that are printed in incongruent colors (e.g., the word "red" printed in blue ink). The task requires the individual to name the color of the ink while ignoring the written word. The interference effect observed when individuals struggle to inhibit the automatic response of reading the word is used to evaluate cognitive control and attentional processing.</p>	
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Table S2. Demographic and clinical characteristics of patients with cerebellar infarction, patients with frontal infarction, and healthy controls.

	Cerebellar infarction patients n=50	Frontal infarction patients n=38	Healthy controls n=39	<i>P</i> value
Age (y)	53.1±12.5	49.8±11.7	50.8±7.8	0.31
Male, n (%)	39 (78.0)	27(71.1)	30 (76.9)	0.73
Education (y)	11.1±3.0	11.6±3.1	11.0±2.0	0.74
BMI (kg/m ²)	23.4±0.4	22.9±0.3	22.7±0.4	0.33
Smoking (n, %)	15 (30.0)	20 (52.6)	12 (30.8)	0.18
Drinking (n, %)	16 (32.0)	12 (31.6)	10 (25.6)	0.65
Medical History (n, %)				
Hypertension	34 (68.0)	29 (76.3)	24 (61.5)	0.38
Diabetes	18 (36.0)	11 (28.9)	12 (30.8)	0.36
Dyslipidemia	11 (22.0)	11 (28.9)	15 (38.5)	0.24
Disease duration (d)	8.7±4.9	7.3±4.5	-	0.05
Lesion volume (cm ³)	17.0±8.1	16.9±7.8	-	0.90
NIHSS score	1.1±0.9	1.1±1.3	-	0.52
ICARS score	7.5±6.9	-	-	-
BBA score	11.0±1.4	-	-	-
SAS score	36.3±5.5	35.7±6.6	31.6±6.0	0.002 ^{a, b}
SDS score	35.7±6.7	35.6±6.4	35.6±5.8	0.96

^a: patients with cerebellar infarction were significantly different from healthy controls ($P < 0.05$);

^b: patients with supratentorial infarction were significantly different from healthy controls ($P < 0.05$). Abbreviations: BMI: Body mass index; NIHSS: National Institute of Health stroke scale; ICARS: International Cooperative Ataxia Rating Scale; BBA: Brunel balance assessment; SAS: self-rating anxiety scale; SDS: self-rating depression scale.

Table S3. ROC analyses for MMSE, MoCA, ACE-III, CCAS-s total score and CCAS-s failed items number to differentiate patients with cerebellar infarction, patients with supratentorial infarction, and patients with frontal infarction from cognitively normal controls

Groups	AUC	95% Confidence interval	cutoff value	Sensitivity (%)	Specificity (%)
Patients with cerebellar infarction vs. Healthy controls					
MMSE	0.50	0.38-0.62		-	
MoCA	0.56	0.44-0.68		-	
ACE-III	0.72***	0.62-0.83	88	100.0	40.0
CCAS-s	0.67**	0.56-0.78	91	94.9	48.0
Number of CCAS-s failed tests	0.69***	0.59-0.80	2	44.0	87.2
Patients with supratentorial infarction vs. Healthy controls					
MMSE	0.62*	0.51-0.72	25	100	38.3
MoCA	0.70***	0.60-0.80	25	100	38.3
ACE-III	0.80***	0.72-0.89	88	100	53.3
CCAS-s	0.79***	0.70-0.88	91	94.9	60.0
Number of CCAS-s failed tests	0.82***	0.74-0.90	2	71.7	87.2
Patients with frontal infarction vs. Healthy controls					
MMSE	0.57	0.43-0.70		-	
MoCA	0.68**	0.56-0.81	25	100	42.1
ACE-III	0.74***	0.62-0.85	88	100	52.6
CCAS-s	0.76***	0.65-0.87	91	94.9	57.9
Number of CCAS-s failed tests	0.79***	0.69-0.89	2	68.4	87.2

Abbreviations: ROC: receiver operating characteristic; AUC: Area Under Curve; MMSE: Mini-Mental State Examination; MoCA: Montreal Cognitive Assessment; ACE-III: Addenbrooke's Cognitive Examination III; CCAS-s: Cerebellar Cognitive Affective Syndrome scale. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Table S4. Performance on neuropsychological tests of patients with cerebellar infarction, patients with supratentorial infarction, and healthy controls

Neuropsychological tests	Cerebellar infarction patients n=50	Supratentorial infarction patients n=60	Healthy controls n=39	P value
Attention				
TMT-A (s)	42.7±20.0	44.0±13.0	35.6±12.2	0.003 ^b
Forward digit span	8.6±1.2	7.6±1.0	9.4±0.9	<0.001 ^{a, b, c}
Visuospatial function				
RCF copy	34.9±2.1	34.9±2.0	34.7±1.9	0.08
Language function				
BOSTON naming	26.4±2.1	26.7±2.0	26.5±1.7	0.67
Episodic memory				
RCF (%)	56.6±17.8	58.3±17.3	62.3±14.2	0.26
RAVLT (%)	80.0±18.1	72.9±17.3	81.7±13.6	0.01 ^b
Executive function				
TMT B-A (s)	40.3±20.7	38.4±14.3	39.3±16.4	0.96
Phonemic fluency	9.9±3.1	10.1±3.4	11.6±2.2	0.01 ^{a, b}
Semantic fluency	18.3±3.1	18.1±3.4	21.1±2.2	<0.001 ^{a, b}
SIE-time (s)	36.8±17.9	36.0±16.7	32.5±12.2	0.49
SIE-correct	1.8±2.1	2.0±2.3	0.8±1.1	0.01 ^b

a: patients with cerebellar infarction (CI) were significantly different from healthy controls (HC) ($p<0.05$); b: patients with supratentorial infarction (SI) were significantly different from healthy controls ($p<0.05$); c: patients with supratentorial infarction were significantly different from patients with cerebellar infarction ($p<0.05$). Missing data: TMT-A: 4CI, 2SI; Forward digit span: 2CI; RCF copy: 2CI; BOSTON naming: 2CI; RCF: 7CI, 7SI; RAVLT: 1HC, 9CI, 4SI; TMT B-A: 5CI, 2SI; SIE-time: 4CI, 6SI; SIE-correct: 4CI, 6SI. Abbreviations: TMT: Trail Making Test; RCF: Rey Complex Figure; RAVLT: Rey Auditory Verbal Learning test; SIE: Stroop Interference Effect.

Table S5. Performance on neuropsychological tests of patients with cerebellar infarction, patients with frontal infarction, and healthy controls

Neuropsychological tests	Cerebellar infarction patients n=50	Frontal infarction patients n=38	Healthy controls n=39	P value
Global cognitive function				
MMSE	27.7±1.6	26.2±3.7	27.7±1.3	0.45
MoCA	27.5±1.5	26.3±2.3	27.9±1.3	0.01 ^b
ACE-III	89.8±4.7	89.4±4.8	93.3±2.9	<0.001 ^{a, b}
CCAS-s	93.1±10.1	90.4±9.1	99.0±6.1	<0.001 ^{a, b}
Number of CCAS-s failed tests	1.8±1.7	2.03±1.3	0.7±0.8	<0.001 ^{a, b}
Attention				
TMT-A (s)	42.7±20.0	43.2±12.3	35.6±12.2	0.02 ^b
Forward digit span	8.6±1.2	7.6±1.0	9.4±0.9	<0.001 ^{a, b, c}
Visuospatial function				
RCF copy	34.9±2.1	34.9±2.0	34.7±1.9	0.09
Language function				
BOSTON naming	26.4±2.1	26.8±2.1	26.5±1.7	0.46
Episodic memory				
RCF (%)	56.6±17.8	60.0±18.4	62.3±14.2	0.26
RAVLT (%)	80.0±18.1	79.5±17.5	81.7±13.6	0.77
Executive function				
TMT B-A (s)	40.3±20.7	38.7±14.8	39.3±16.4	0.98
Phonemic fluency	9.9±3.1	9.9±3.6	11.6±2.2	0.007 ^{a, b}
Semantic fluency	18.3±3.1	17.8±3.4	21.1±2.2	<0.001 ^{a, b}
SIE-time (s)	36.8±17.9	36.3±18.2	32.5±12.2	0.49
SIE-correct	1.8±2.1	1.7±2.4	0.8±1.1	0.06

a: patients with cerebellar infarction (CI) were significantly different from healthy controls (HC) ($p<0.05$); b: patients with frontal infarction (FI) were significantly different from healthy controls ($p<0.05$); c: patients with supratentorial infarction were significantly different from patients with cerebellar infarction ($p<0.05$). Missing data: TMT-A: 4CI, 1FI; Forward digit span: 2CI; RCF copy: 2CI; BOSTON naming: 2CI; RCF: 7CI, 7FI; RAVLT: 1HC, 9CI, 4FI; TMT B-A: 5CI, 1FI; SIE-time: 4CI, 5FI; SIE-correct: 4CI, 5FI. Abbreviations: MMSE: Mini-Mental State Examination; MoCA: Montreal Cognitive Assessment; ACE-III: Addenbrooke's Cognitive Examination III; CCAS-s: Cerebellar Cognitive Affective Syndrome scale; TMT: Trail Making Test; RCF: Rey Complex Figure; RAVLT: Rey Auditory Verbal Learning test; SIE: Stroop Interference Effect.

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