

Cognitive and Mood Assessment Tools for Use in Stroke

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Should Stroke Physicians Assess Cognition and Mood?

It would seem intuitive that for a brain disease, such as stroke, the examination of memory, thinking, and mood would be fundamental to the clinical assessment. Yet in contemporary stroke practice, we have tended to focus on the physical manifestations of stroke and neuropsychological aspects have received little, if any, attention.¹ Thankfully the landscape is changing, and there is an increasing recognition of the importance of the psychological consequences of stroke and a growing evidence base and standardization around assessment.²⁻⁴ The stroke physician cannot be expected to take on the role of the neuropsychology specialist, and there will always be cases where expert input is required. However, a basic appreciation of how to approach cognitive and mood assessment should now be mandatory for all working in stroke care.

In this review, we discuss assessment of cognitive function and mood. We have drawn on evidence from recent research, particularly systematic review.³ We do not offer a comprehensive critique of all cognitive and mood assessment tools. Rather, we suggest a framework for assessment that emphasizes the need for differing approaches to testing at differing points in the stroke pathway (Figure 1).

Importance of Cognition and Mood in Stroke

The arguments in favor of assessing cognition and mood in stroke are underscored by 2 fundamental facts. Cognitive and mood problems are common after stroke and are both associated with poor outcomes. One in 3 people will experience stroke, dementia, or both.⁵ The definitive systematic review describing cognitive problems after stroke reports incident dementia rates of $\approx 10\%$, rising to 30% with recurrent events.⁶ Immediately after stroke, cognitive impairments are seen in $\approx 70\%$ of patients.⁷ The patient with cognitive problems has increased risk of poor functional outcome, increased length of stay, and increased mortality.⁵ In recent research and policy, the focus has shifted from those with frank dementia syndromes to the much larger population of stroke survivors with cognitive impairments that are not sufficient to meet diagnostic criteria but still impact on quality of life. Here, there is greater potential for prevention, modification, or adaptation.

The data are similar for poststroke depression. At any point in time, around one third of stroke survivors have depression, and this is associated with increased disability and mortality.⁸ Perhaps, the most compelling argument for the importance of the psychological aspects of stroke comes from stroke survivors themselves. In a recent priority setting exercise, stroke survivors voted that cognitive aspects of stroke are their key priority.⁹ This finding is echoed by results from patient and carer workshops organized by the Stroke Association, UK, and other third sector groups.¹⁰

Screening for Cognitive and Mood Issues After Stroke

There are 2 broad approaches to neuropsychological assessment in stroke, targeted assessment of patients where there is concern about a cognitive or mood problems and unselected screening of all patients with stroke. The 2 are not mutually exclusive, and the patient who passes a screening test but complains of cognitive or mood issues should not be denied a more detailed assessment.

The rationale for screening all patients with stroke is plausible, and guidelines from specialist societies recommend early screening (Figure 2). Psychological problems are common, and early identification should allow treatment initiation, rehabilitation that is personalized to the individual, and appropriate goal setting. However, we have no empirical evidence of clinical or cost benefit of this approach. Those who argue against early cognitive screening cite the limited understanding of the natural history of the condition, the lack of any proven treatment, and the potential harms of mislabeling a patient as having a neuropsychological syndrome. If we consider the Wilson–Jungner criteria¹¹ for assessing a screening program, in the context of stroke cognitive screening we see that there are several areas where knowledge is lacking and research in this field is urgently required (Table 1).

Assessing Prestroke Problems

Although the theme of this review is poststroke assessment, to put these tests into context, it is necessary to understand the prestroke state. Stroke is a disease of older adults, and older adults often have cognitive and mood problems. Systematic

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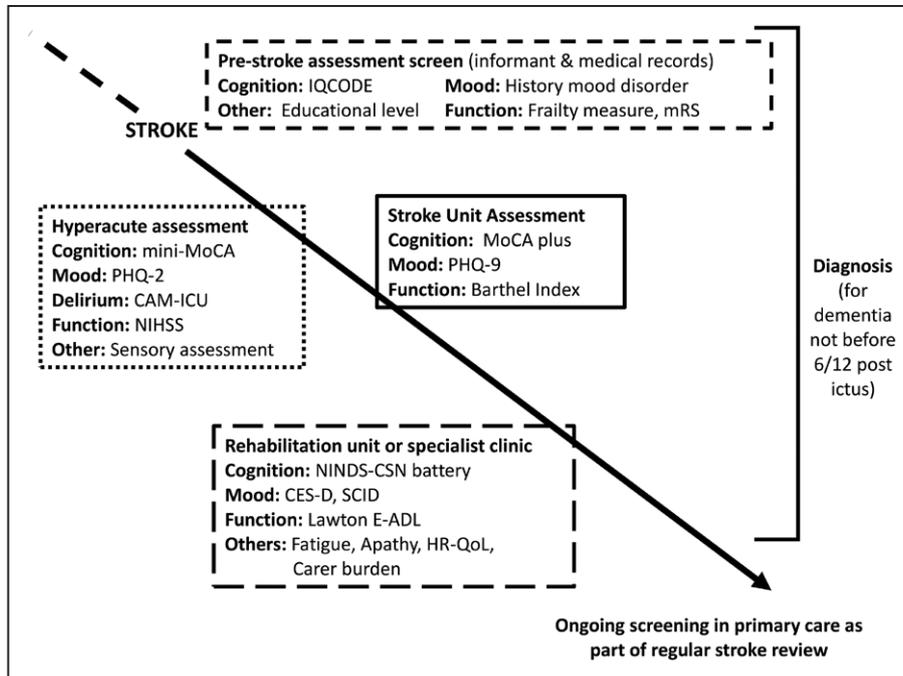


Figure 1. Neuropsychological assessment throughout the stroke pathway. Schematic illustrating a potential approach to neuropsychological assessment at various stages in the stroke pathway. The tests named are given as examples rather than recommendations. Note how all elements are used to inform the clinical diagnosis. Note also that the early assessments focus on prestroke cognition, delirium, and stroke impairments rather than detailed cognitive assessment. CAM-ICU indicates Confusion Assessment Method for the Intensive Care Unit; CES-D, Centre for Epidemiologic Studies Depression; E-ADL, Extended Activities of Daily Living; HR-QoL, Health-Related Quality of Life; IQCODE, Informant Questionnaire for Cognitive Decline in the Elderly; MoCA, Montreal Cognitive Assessment (mini-MoCA, short form of the MoCA; MoCA plus, MoCA with additional test as recommended by European Stroke Organisation); mRS, modified Rankin Scale; NIHSS, National Institutes Health Stroke Scale; NINDS-CSN, National Institute Neurological Disorders and Canadian Stroke Network; PHQ, Patient Health Questionnaire; and SCID, Structured Clinical Interview Depression.

reviews suggest that at least 10% of stroke admissions have a dementia diagnosis prestroke,⁵ with similar prevalence for prestroke depression.¹² These figures are likely to be an

underestimate, often cognitive, and mood problems are only detected by healthcare professionals when the person is assessed for another medical conditions, such as stroke.

UK National Clinical Guideline for Stroke	"Routine screening should be undertaken.... using standardised measures"
NHS Improvement	Weeks 1-3 MoCA or ACE-R. Week 4 Ravens coloured matrices if aphasic, Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) if not
European Stroke Organisation	"Assessment for cognitive deficits appears desirable"
American Heart Association/American Stroke Association	"Screening for cognitive deficits is recommended for all stroke patients before discharge home"
The Canadian Stroke Strategy	"All patients should be screened for cognitive impairment using a validated screening tool"
The Stroke Foundation, Australia	"All... should be screened for cognitive and perceptual deficits using validated & reliable tools"

Figure 2. Guidelines on neuropsychological assessment in stroke. ACE-R indicates Addenbrookes Cognitive Examination Revised; MoCA, Montreal Cognitive Assessment; and NHS, UK National Health Service.

Table 1. Wilson–Jungner Criteria Applied to Early Cognitive Assessment

Criteria for Neuropsychological Screening	Applicable to (H)ASU
Condition must be important	Yes
Epidemiology and prognosis should be understood	Partly
Test should be simple and safe	Partly
Test should be validated for population	Partly
Test should be acceptable to patients/testers	Unknown
There should be an effective treatment	No
There should be RCT evidence of screening efficacy	No
The opportunity and economic cost should be described	No

(H)ASU indicates (Hyper) Acute Stroke Unit; and RCT, randomized controlled trial.

Various tools exist to retrospectively assess for cognitive impairments and if used in the immediate period after stroke can give a picture of the prestroke state. The usual format is a short questionnaire completed by a collateral information source, for example, a spouse or relative. Examples include the Informant Questionnaire for Cognitive Decline in the Elderly¹³; the Ascertain Dementia Eight-Item screen¹⁴; and the informant component of the General Practitioner assessment of Cognition.¹⁵ These tools have features that make them suitable for assessment immediately after stroke. They are short, standardized, and offer a method of describing function when the patient may be too unwell for direct assessment. Informant tools have reasonable test accuracy for detection of dementia in community and memory clinic settings¹⁶ and by using the informant's perception of cognitive and functional change these tools are less prone to cultural biases seen with other tests. However, to date, there has been no validated assessment of their performance for the detection of prestroke dementia.¹⁷ Informant Questionnaire for Cognitive Decline in the Elderly at time of stroke may also have prognostic use; a higher Informant Questionnaire for Cognitive Decline in the Elderly score is a specific but insensitive tool for predicting future dementia.¹⁷ There are limitations to informant questionnaires. The availability of an informant who is willing or able to comment on the patient's prestroke state is not guaranteed. If the tool is not used early after the stroke event, then informants may struggle to give an account of prestroke cognition and often describe the cognitive problems that they see after the stroke.

The clinician may wish to assess other aspects of the prestroke condition. As part of a more formal neuropsychological assessment, a measure of premorbid intelligence is often useful. The National Adult Reading Test is used in this regard as vocabulary is said to be better preserved in neurodegenerative conditions than other cognitive abilities.¹⁸ However, the correlation between National Adult Reading Test and early life intelligence is not perfect¹⁸ and whether National Adult Reading Test is useful in acute stroke, particularly dominant hemisphere stroke, is less clear.

Informant-based depression screens have been described and could be used in a similar way to assess prestroke mood. However, as with cognitive assessments, these tools have

not been validated for use in acute stroke.¹⁹ Screening medical records for a previous diagnosis of mood disorder can be equally useful with a low opportunity cost. Assessment of cognition and mood should always be accompanied by an assessment of function. Traditionally, the assessment of prestroke function has used the modified Rankin Scale.²⁰ Newer assessments designed to describe physical and cognitive frailty may also provide useful information.

Assessment in the Hyperacute Stroke Unit

Cognitive and mood assessment may not seem an immediate priority in the early period after stroke. A comprehensive multidomain assessment is unlikely to be feasible, but brief assessments are possible and potentially useful in the hyperacute setting. Even in time limited settings, assessments for prestroke cognition, delirium, and brief cognitive testing are possible and may be useful in guiding subsequent management (Figure 1).

Examples of bedside cognitive tests of <5 minutes duration include Hodkinson 10-point Abbreviated Mental Test²¹; the Mini-Cog²²; and abbreviated forms of the Montreal Cognitive Assessment (MoCA).²³ All have proven validity in assessment of older adults, but the evidence base for their use in stroke is limited.²⁴ Short screens for mood disorder are also available, for example, the 2-question–based Patient Health Questionnaire-2.²⁵ These tests are clearly not diagnostic but can be used as a triage tool in the acute period. If a patient struggles with the brief assessments, then the need for further assessment to determine the nature of the impairment can be highlighted to the team. Certainly, short tests are more sensitive to cognitive problems than unstructured clinical assessment.²⁶

Perhaps, more pertinent to the hyperacute setting is screening for delirium. The syndrome of delirium is a common complication of acute illness. Delirium is less well studied in stroke than in other conditions, but where data are available, these suggest that delirium is seen in 1 in 4 patients with stroke during the acute period.²⁷ The finding of delirium has implications for both the short and longer term.²⁷ Incident delirium can signal the emergence of a stroke-related complication, such as pneumonia, and in the longer term the presence of delirium is associated with poor outcomes. Screening tools for delirium are available, and many have good accuracy when compared with gold standard clinical assessment. The 4-A test is a short screening tool for delirium that is available in several languages and is quick to administer with little training and has some supportive data in stroke.²⁶ The Confusion Assessment Method also has proven accuracy for diagnosis of delirium in stroke.²⁸ For patients with aphasia or other communication problems, the Confusion Assessment Method modified for use in Intensive Care Settings can be used because it does not require any verbal response for completion.²⁹

It is routine to assess stroke-related neurological impairments on admission using a standardized tool, such as the National Institutes of Health Stroke Scale. The information from this assessment can also be useful for subsequent cognitive and mood testing. National Institutes of Health Stroke Scale will detect those with severe communication or visuospatial problems who may require an adapted approach to assessment. Physical impairments detected by National

Institutes of Health Stroke Scale may also be relevant to the cognitive assessment, for example, the person with severe weakness in the dominant hand may struggle with pencil and paper-based assessments. Although not part of the traditional stroke examination, a screening assessment to detect major hearing or visual impairments will also inform any future testing.

Assessment in the Stroke Unit

The opportunity for slightly more detailed cognitive and mood assessment can come once the patient has stabilized medically. A full neuropsychological battery or diagnostic interview may still not be appropriate or feasible at this point; however, a multidomain screening tool can be a useful part of the clinical assessment.

The number of cognitive screening tests available to the clinician is large and continues to grow. Historically, there has been little consistency in the cognitive or mood test used in stroke³⁰ and choice of assessment often elicits strong opinion that is not always grounded in evidence. Stroke-specific data on the properties of psychological assessment tools has recently become available, and we no longer have to extrapolate from studies performed in community or memory clinic settings.

There is no perfect psychological assessment, and the preferred tool will vary with the intended purpose of testing, the case mix of the population, and the skills of the person administering the test. We suggest some criteria for a psychological screening tool to be used in the stroke unit (Figure 3). The key features are feasibility for use in acute stroke setting, acceptable test properties, and coverage of core cognitive domains (*Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition*, suggests including tests of complex attention; executive function; learning and memory; language; perceptual-motor; social cognition). Most screening tests cover these domains to a greater or lesser extent, and if the clinician is particularly interested in assessing a certain domain, then this can guide the preferred test strategy (Table 2). Assessment of cognition and mood must be interpreted in the context of language and culture. Local adaptation with robust validation is required for international use of assessment tools, indeed this was the core rationale for the National Institute of Neurological Disorders and Stroke–Canadian Stroke Network Harmonization effort.⁴

Test accuracy is an important consideration, that is, does the test correctly select people with the condition of interest as diagnosed by a gold standard.³¹ In the context of acute stroke, it is debatable which gold standard is the appropriate comparator. Diagnostic testing for dementia is not recommended immediately after stroke and so comparison with a clinical diagnosis may not be suitable. Arguably, a more meaningful analysis would compare a short screening test with a more detailed assessment. Alternatively, one could look at how well a screening tool assessment predicts subsequent cognitive problems (delayed verification).³¹ The optimal test accuracy is also not straightforward. There is an inverse relationship between the test properties of sensitivity and specificity and depending on the purpose of testing one may be preferred over the other. For example, if the intention is to pick up all patients with possible psychological problems, at the cost of false positives, then a higher sensitivity may be preferred.

Recent reviews have used novel meta-analytic techniques to collate and compare the test accuracy of cognitive and mood assessments in the stroke setting.^{19,24} For cognitive assessment in stroke, despite the large number of tests potentially available, only 2 tests had sufficient numbers of papers to allow meta-analysis: Folstein Mini-Mental State Examination and MoCA.²⁴ The pooled data show that at usual test threshold, MoCA is extremely sensitive but has poor specificity. Using an adjusted threshold (MoCA < 22), the sensitivity and specificity are less extreme (Table 2). Defining the optimal threshold for a stroke assessment scale is an area that requires more research, ideally this work should be based on data from the population in which the test will be used. Since the publication of this review, new screening tools developed specifically for stroke have been described, such as the Oxford Cognitive Screen.³² Initial data suggest that Oxford Cognitive Screen may have some advantages over other cognitive screens. In particular, it is designed to offer domain-specific results rather than a reductionist pass/fail; it allows finger pointing response to minimize bias from aphasia and incorporates assessment of apraxia and neglect.

For depression assessments, 5 tests had sufficient data to allow meta-analysis (Beck Depression Index, Patient Health Questionnaire-2, Patient Health Questionnaire-9, Hospital Anxiety and Depression Score, and Hamilton Rating Scale for Depression).¹⁹ Accuracy was broadly similar across the tests, and all were best suited to rule-out depression. The majority of these tests assess for symptoms of depression rather than diagnose the clinical syndrome of depression. When using these tools, there may be overlap of potential depression symptoms with nonpsychological stroke effects, for example, weight loss is often seen after acute illness, such as stroke. A depression screen with less weighting for somatic symptoms would seem reasonable in acute stroke settings.

Poststroke neuropsychological recovery is a dynamic process, and this must be borne in mind when interpreting cognitive and mood screening tools. In studies describing assessment in the first days poststroke, the majority of patients screen positive for cognitive and mood disorders.³³ This is perhaps not surprising in the context of a potentially life changing brain injury. Over the next days and weeks,

<p style="text-align: center;">Must have</p> <ul style="list-style-type: none"> • Administration time < 20 minutes • Covers core cognitive domains • Appropriate test accuracy 	<p style="text-align: center;">Should have</p> <ul style="list-style-type: none"> • Culturally sensitive translations • Freely available training • Guidance on item non-completion
<p style="text-align: center;">Could have</p> <ul style="list-style-type: none"> • Aphasia friendly questions • Telephone, postal, e-versions • Stroke normative values 	<p style="text-align: center;">Won't have</p> <ul style="list-style-type: none"> • Diagnostic purpose • Requires specialist equipment / training • Copyright issues

Figure 3. MuSCoW chart (Must Should Could Won't) detailing preferred properties of a neuropsychological screening tool.

Table 2. Domain-Specific Content and Properties of Commonly Used Cognitive Screening Tools (Using DSM-5 Domains)

	ACE-R	MMSE	MoCA	OCS	TICS-m
Duration	15–20 min	≤10 min	10 min	15–20 min	10 min
Copyright status	Freely available	Copyrighted, charge for use	Freely available	Freely available	Freely available
Complex attention	Serial subtraction	Serial subtraction	Digit span	Calculations	Serial subtraction
	Backwards spelling		Letter A tapping		Count backwards
			Serial subtraction		
Executive function	Verbal fluency		Trails	Trails	
			Verbal fluency		
			Abstraction		
Learning and memory	Orientation	Orientation	Orientation	Orientation	Orientation
	Three item recall	Three item recall	Five item recall	Sentence recall	Ten item recall
	Address recall			Recognition	Semantics
	Recognition			Semantics	
Language	Reading	Object naming	Animal naming	Object naming	
	Comprehension	Repetition	Repetition		Repetition
	Writing	Reading		Sentence reading	
	Repetition	Writing			
	Naming				
Perceptual motor	Intersecting pentagons	Intersecting pentagons	Cube copy	Gesture imitation	
	Clock draw		Clock draw	Cancellation test	
	Cube copy				
	Counting dots				
	Identify letters				
Social cognition					
Sensitivity	Cutoff <88	Cutoff <27	Cutoff <26		
Specificity	0.96 (0.90–1.00)	0.88 (0.82–0.92)	0.95 (0.89–0.98)		
	0.70 (0.59–0.80)	0.62 (0.50–0.73)	0.45 (0.34–0.57)		

Table of commonly used multidomain screening tools and domain-specific content. Domain items are labeled as per test authors. We recognize that test items often overlap, and an item may test >1 domain. Test accuracy data are against reference standard of neuropsychiatric battery or clinical assessment using data from meta-analyses where available. ACE-R indicates Addenbrookes Cognitive Examination Revised; DSM-5, *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition*; MMSE, Mini-Mental State Examination; OCS, Oxford Cognitive Screen; and TICS-m, Telephone Interview for Cognitive Status Modified.

many show improvement, highlighting the need for continued assessment over time. Poststroke checklists for use in outpatient services have been described that could be used in this regard. Differing patients have differing cognitive and mood trajectory, and the time point of neuropsychological stability, if such a state exists, is not clear.

Assessment in the Rehabilitation Unit or Outpatient Clinic

After acute period, detailed assessment becomes more feasible, and comprehensive neuropsychological assessment may have a role. A neuropsychological battery (NPB) is considered a gold standard for detection of cognitive impairments although is not sufficient alone to make a diagnosis of a dementia syndrome. Neuropsychological batteries are substantially longer than screening tests with associated increased test burden for the patient. The administration and interpretation of NPB data

require specialist training, and ideally test results should be judged against population normative data. For these reasons, assessment using an NPBs is reserved for selected patients (guidance suggests deferring this until at least 3 months post-ictus).³⁴ Even with case selection, the aspiration of comprehensive neuropsychological assessment may be challenging to realize in a stroke setting. Issues include, but are not limited to, training, availability of assessors, appropriate test materials, and space for testing.

NPBs comprise a series of individual tasks designed to assess each cognitive domain. There is not a preferred battery for use in stroke and even within each domain, and there is no agreed consensus on a preferred test. Often the assessor will individualize the tests specific to the patient’s problems or the clinical question to be answered. National Institute of Neurological Disorders and Stroke–Canadian Stroke Network Harmonization workshops have suggested a suite of NPBs for

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detection of vascular cognitive impairment⁴ with test protocols suitable for screening (5 minutes); multidomain testing (30 minutes); and comprehensive assessment (60 minutes). The National Institute of Neurological Disorders and Stroke–Canadian Stroke Network comprises validated domain-specific tests, with population normed data and validated versions in several languages.⁴

Although our focus is on formal psychological assessment, we should not underestimate the use of functional assessment in the stroke unit or rehabilitation facility. Direct observation of a patient attempting a task, such as meal preparation, can give useful information on many aspects of cognition, and this approach is often used by allied health professionals in their assessment. A multidisciplinary assessment informed by neuropsychological testing, functional assessment, and results of investigations, such as neuroimaging, are the ingredients required to make a diagnostic formulation and treatment plan.

Assessment in Clinical Trials

Historically, end points for stroke trials have mirrored those seen in cardiology with a composite outcome comprising vascular events and mortality. For primary and secondary prevention trials, this outcome is suitable but is overly reductionist for studies looking at stroke recovery. In this instance, the guidance is to assess function, and the most commonly reported measures are modified Rankin Scale, National Institutes of Health Stroke Scale, and Barthel Index.⁴ These assessments all focus on physical function and are poor measures of neuropsychological recovery. Despite calls to include cognitive assessments in stroke trials, an assessment of cognition or mood is the exception rather than the rule and where psychological assessments are used in trials, there is little consistency in the choice of tool or the method of application.³⁰

The recent European Stroke Organisation/Karolinska Stroke Update offers guidance on the preferred measures for trials.³⁵ The consensus statement recommends use of an informant measure, such as Informant Questionnaire for Cognitive Decline in the Elderly, to assess prestroke cognitive impairment for participant selection or case mix adjustment. Two approaches to patient assessment are described, a short battery that can be administered by most researchers (MoCA, trail making tests and digit span) and an extended multidomain test battery. In addition, they recommend consideration of other neuropsychological factors, such as depression, fatigue, apathy, and caregiver status.

In clinical practice, direct assessment is preferable, but in the context of a large multicentre trials or registries, remote centralized assessment may need to be considered for logistic and economic reasons. Options include assessment via telephone, postal questionnaire, internet-based questionnaires, or remote video interview. The most commonly used telephone cognitive assessment is the Telephone Interview for Cognitive Status (TICS). TICS is based on Mini-Mental State Examination although subsequent modification offers a more comprehensive memory assessment. TICS and modified TICS have reasonable test accuracy for detection of Alzheimer dementia, but properties in stroke are less well studied.³⁶ Modifications of the MoCA

to make it suitable for telephone assessment have been described for use in stroke cohorts, with test accuracy similar to modified TICS.³⁷ An obvious disadvantage of telephone assessment is that pencil and paper tests and assessment of visuospatial function are not possible. In the future, we will see increasing use of internet-based self-assessment questionnaires. Use of e-health resources is high and increasing among older adults in Europe making this a potentially feasible platform. However, validation in stroke cohorts will still be required before this approach could be recommended.

The analysis of cognitive and mood data for trials presents further challenges. A dichotomous outcome of impairment present or absent allows for ease of analysis but lacks granularity and may not have power to show between group differences. Other approaches include creating hierarchical categories, assessment as a continuous scale, and assessing against population normative data. A composite of vascular events, physical recovery, and cognition may have particular use in trials of minor stroke or transient ischemic attack.³⁸ If a study is to include a range of stroke severities, then inevitably not all assessments or items within an assessment will be completed. For cognitive assessment, this is a particular challenge and study protocols should have clear rules for how these missing data are handled in analyses.³⁹

Additional Assessments

For this review, we have focused on assessment of cognition and depression. Within the rubric of psychological consequences of stroke are several other equally common and disabling conditions that should also be considered. There is considerable overlap between many of these conditions, and often in screening for one condition, the assessor may notice issues suggestive of another neuropsychiatric problem. Depression is not the only mood disorder associated with stroke, and anxiety in various forms is increasingly recognized as a poststroke phenomenon. Compared with depression, there are fewer anxiety-screening tools and little validation of these tools in stroke cohorts. For an initial brief screening assessment, the 2-item Generalized Anxiety Disorder-2 could be considered. Other syndromes, such as fatigue, emotionalism, and apathy, are also common although under-researched in the context of stroke. There are assessment tools for all these conditions but no consensus on the optimal assessment strategy. The Neuropsychiatric Inventory Questionnaire for informants is often used in stroke cohorts and has been validated for this purpose.⁴⁰

Cognitive Assessment to Assign a Diagnostic Label

An important purpose of assessment should be to make a diagnosis of dementia or depression. However, none of the tools discussed in this review are diagnostic in their own right. The clinical label of dementia requires more than a demonstration of cognitive impairments. This should not detract from the use of cognitive screening. Forming a dementia diagnosis is not the only rationale for assessing cognition. Understanding a patient's cognitive problems can help target the rehabilitation approach, can provide useful prognostic information, and can highlight the emergence of complications, such as delirium.

Historical definitions of dementia that required impaired memory and evidence of progression over time were problematic in stroke where the patient could have disabling cognitive problems but preserved memory and where the cognitive deficits would not necessarily show a steady temporal decline. The new terminologies of neurocognitive disorder as outlined in *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition*, are better suited to stroke. Whichever classification is used, evidence of cognitive impairment is only part of the assessment there must also be an assessment of functional ability. In *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition*, the ability to perform instrumental activities of daily living distinguishes minor from major neurocognitive disorder while loss of basic activities of daily living defines severe neurocognitive disorder. The importance of functional assessment should not be underestimated, and recent reviews describe the tools available.⁴ In stroke, we are familiar with using scales modified Rankin Scale and Barthel Index, and we should also incorporate these assessments into cognitive formulations.

Going beyond, unspecified dementia to assign a more detailed pathological dementia diagnostic label comes with increased complexity. *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition*, recognizes poststroke cognitive impairment as a distinct condition, but this is only one of several terms that have been used to describe dementia in the context of stroke disease.³⁵ Recent attempts to provide a harmonized framework for the classification of vascular cognitive impairments are welcome and will hopefully be adopted by the clinical and research community.^{2,4} Most classifications define poststroke dementias based on time from stroke, for example, "...cognitive decline that begins after, but within six months of the stroke and does not recover."² The implications for assessment are that we should avoid assigning a diagnostic label until at least 6 months post-ictus, and longer periods of assessment may be preferable.

Future Directions

Neuropsychological assessment in stroke is moving from a niche, opinion-based endeavor to an evidence-based part of the standardized stroke assessment. Considerable progress has been made in our understanding of cognitive and mood assessment in stroke, but there is more work to be done (Figure 4). Future research should look at the use of the early assessment recommended in many guidelines. Prospective cohorts with multidomain

Assessment of cognition and mood in stroke

- Consider the pre-stroke state
- Adapt the assessment to the stage in the stroke pathway
- In the hyperacute phase remember delirium screening
- Integrate cognitive & mood testing with functional assessment
- Choice of screening tool varies with purpose of testing
- Defer diagnosis of dementia till at least six months post stroke

Figure 4. Key messages for cognitive and mood assessments in stroke.

assessment will allow a better understanding of the natural history of cognitive and mood problems. Finally, we should not forget the patient and carer's voice, and we need qualitative work to identify which neuropsychological aspects are of greatest importance and how the experience of cognitive and mood assessment can be optimized. As we collect study-level cognitive and mood data, we should share this resource with other researchers and registries, such as VISTA-Cog, are important in this regard.

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