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EARLY DETECTION OF POST-STROKE COGNITIVE IMPAIRMENT AND CONTEMPORARY PRINCIPLES OF MULTIDISCIPLINARY REHABILITATION AFTER ISCHEMIC STROKE

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ABSTRACT: Post-stroke cognitive impairment may affect attention, executive control, memory, language, visuospatial function and the capacity to manage everyday activities even when the motor deficit appears mild. The article presents a practical, staged approach to early recognition and multidisciplinary rehabilitation after ischemic stroke.

Keywords: ischemic stroke, post-stroke cognitive impairment, early screening, Montreal Cognitive Assessment, neuropsychological assessment, cognitive rehabilitation, secondary prevention

Introduction

Cognitive consequences of ischemic stroke are clinically important because they may determine medication adherence, safety, return to social roles and the ability to benefit from motor rehabilitation. A patient can regain independent walking yet continue to have slowed processing, reduced initiative, impaired planning, visual neglect or subtle language dysfunction. These problems are not interchangeable with dementia: they may be focal, fluctuating or partially reversible, and their impact is best understood in relation to the person's daily activities [1-5].

The vascular lesion is only one component of the cognitive outcome. Pre-stroke cognition, cerebral small-vessel disease, recurrent vascular events, delirium, depression, sleep disturbance, sensory loss, medication burden and social support may all modify performance. For this reason, a single screening score should not be treated as a final diagnosis or as a stand-alone target for treatment [1, 6, 7].

Aim

To summarize a clinically practical pathway for early detection of post-stroke cognitive impairment and for individualized multidisciplinary rehabilitation after ischemic stroke.

Materials and methods

Clinical and functional criteria relevant to post-stroke cognitive impairment, neuropsychological screening, rehabilitation and secondary prevention were considered in the formulation of the staged assessment and rehabilitation pathway.

Clinical phenotype and the first assessment

The first clinical task is to distinguish a cognitive deficit from acute confounders. Delirium, infection, pain, hypoxia, metabolic disturbances, sleep deprivation, sedating medication, severe aphasia, hearing loss and uncorrected visual impairment can all invalidate a formal screen. The evaluator should document the language of testing, use an interpreter when needed and record whether hemianopia, neglect or dominant-hand weakness could have affected performance.

Cognitive impairment after stroke commonly involves executive function and processing speed, but the profile depends on lesion location and pre-existing brain vulnerability. Attention may be compromised by right-hemisphere injury or fatigue; language-mediated tasks may be misleading after aphasia; visuospatial tasks may identify neglect or posterior cortical dysfunction; and memory complaints can reflect failed encoding, executive retrieval or depression. Functional information from the patient and a reliable informant is therefore essential [2, 6, 15-18].

Table 1. Practical domains of early post-stroke cognitive assessment

Domain	Bedside clue	Useful assessment	Interpretive safeguard
Attention and processing speed	Distractibility, slowed response, difficulty following multistep instructions	Digit span, trail-making type tasks, cancellation tasks	Check fatigue, delirium and sensory impairment
Executive function	Poor planning, impulsive choices, medication errors	Set shifting, verbal fluency, goal-management observation	A normal memory score does not exclude executive dysfunction
Memory and learning	Repeated questions, missed appointments, poor new learning	Delayed recall with cueing; informant history	Separate encoding failure from language or attentional barriers
Language and communication	Naming difficulty, comprehension errors, reduced discourse	Aphasia assessment; speech-language evaluation	Do not classify aphasia alone as global cognitive decline
Visuospatial function and neglect	Collisions, omitted food, unsafe transfers	Clock/copying tasks, cancellation, functional observation	Interpret together with visual-field assessment and limb weakness

Staged cognitive screening and diagnostic clarification

Brief instruments such as the Montreal Cognitive Assessment are useful for identifying patients who need further evaluation, particularly because they sample executive and visuospatial elements more broadly than purely orientation-based screens. Their result must be interpreted in the context of education, language, aphasia, motor deficits and the time elapsed since stroke. When impairment is suspected, a domain-based evaluation and observation of real-life tasks are more informative than repeating the same global score alone [13, 14, 19].

A fuller assessment is especially important when cognition affects consent, finances, medicines, driving, work, self-care or caregiver burden. Neuroimaging should be reviewed for infarct location, recurrent infarcts, strategic lesions, white-matter disease and microbleeds. Laboratory assessment should be targeted to potentially reversible contributors such as glucose disturbance, thyroid disease, vitamin deficiency, anaemia, infection or renal and hepatic dysfunction. This is not a fixed panel; it is guided by phenotype and context [1, 6, 7, 18].

Figure 1. Clinical pathway for early cognitive assessment after ischemic stroke

Clinical stability and delirium check	Brief screen plus bedside domain examination	Functional and informant assessment	Targeted neuropsychology and differential diagnosis	Individual rehabilitation and follow-up plan

Table 2. Suggested timing of assessment and the clinical decision it supports

Time point	Core question	Priority actions	Output
Acute phase	Can cognition be assessed reliably now?	Screen for delirium and confounders; document aphasia and sensory barriers	Baseline reliability statement
Before discharge	Which deficits threaten safety and self-management?	Brief screen, ADL observation, caregiver interview, discharge education	Support needs and referral priorities
Early post-acute review	Which domains persist after stabilization?	Domain-focused reassessment; mood and sleep review; rehabilitation goals	Individualized intervention plan
Long-term follow-up	Is there recovery, stability or decline?	Repeat functional and cognitive outcomes; secondary prevention review	Escalation, maintenance or new diagnostic work-up

Principles of multidisciplinary rehabilitation

Rehabilitation should be functional rather than score-centred. The relevant question is not only whether a test value improves, but whether the patient can learn a safe transfer sequence, recognize medication times, use a memory aid, communicate needs, prepare food or return to

a personally valued role. The programme should specify a limited number of measurable daily-life goals, the cognitive barrier to each goal, the strategy taught and the person who will reinforce it [8, 10-12].

Metacognitive strategy training, external memory aids, error-reduced learning when appropriate, environmental simplification and repeated practice embedded in meaningful activity are compatible with occupational therapy and speech-language work. Physical activity, balance training and aerobic conditioning should not be separated from cognitive care because fatigue, mobility and participation directly affect cognitive engagement. Mood, sleep and caregiver strain should be actively addressed; otherwise, apparent non-adherence can be mistaken for lack of motivation [8, 10, 20].

Table 3. Core components of individualized multidisciplinary rehabilitation

Component	Primary target	Examples of delivery	Outcome to monitor
Neuropsychological and cognitive strategy work	Attention, planning, memory, awareness	Goal-management, error-reduced learning, diaries, spaced practice	Goal attainment and task independence
Occupational therapy	Instrumental daily activities and safety	Medication routines, kitchen and travel simulations, home adaptation	Errors, supervision needs, participation
Speech-language therapy	Aphasia, cognitive-communication, discourse	Supported conversation, language practice, communication aids	Functional communication success
Physical rehabilitation	Mobility, endurance, dual-task tolerance	Progressive exercise and safe dual-task practice	Mobility plus cognitive safety
Caregiver education and secondary prevention	Carry-over and recurrence risk	Written plans, risk-factor control, review of barriers	Adherence, recurrent events, caregiver burden

Digital tools and remote follow-up

Computerized exercises, tele-rehabilitation and virtual environments can expand practice time and access, but they should not replace clinical formulation. A digital intervention is useful when it fits the patient's sensory, language, motor and technological capacity; includes clear goals; and is reviewed by a professional. Evidence supports continued study rather than a universal prescription, particularly for people with severe aphasia, neglect, fatigue or poor insight [1, 24].

Figure 2. Rehabilitation cycle focused on real-life cognitive participation

Identify the daily-life barrier	Select one compensatory or restorative strategy	Practise in a meaningful task	Review errors and caregiver feedback	Adjust goal and continue follow-up

Risk stratification and clinical red flags

Risk stratification is not intended to deny rehabilitation to people with severe stroke. Its purpose is to identify who requires an earlier, more detailed assessment and more frequent review. A history of prior stroke or transient ischemic attack, established cognitive difficulty before the index event, advanced cerebral small-vessel disease, recurrent vascular risk exposure, delirium, depression, reduced social support and poor functional recovery should prompt proactive follow-up. These features increase the probability that a brief bedside screen will not capture the whole cognitive burden [1-7, 18].

Several patterns should lead the clinician to reconsider a simple vascular explanation. Rapid progression unrelated to a recurrent vascular event, marked fluctuation after medical stabilization, severe early psychiatric symptoms, progressive gait disorder without a clear focal correlate, prominent hallucinations, a strong family history of young-onset dementia or disproportionate focal neurological signs may indicate a mixed, neurodegenerative, inflammatory, toxic or other process. Such red flags do not replace post-stroke care; they identify the need for an expanded differential diagnosis and, where available, specialist memory or neuropsychology input [1, 6, 7].

Table 4. Features that support earlier specialist cognitive evaluation

Feature	Why it matters	Initial response
Cognitive concern before the index stroke	Pre-stroke vulnerability may influence interpretation of new deficits	Obtain an informant history and prior functional baseline
Recurrent vascular events or extensive small-vessel disease	Cumulative brain injury may produce multidomain impairment	Review imaging and reinforce secondary prevention

Feature	Why it matters	Initial response
Persistent functional errors despite apparent motor recovery	Executive or visuospatial deficits may be concealed by a normal conversation	Observe real tasks and involve occupational therapy
Marked fluctuation, rapid decline or atypical neurological signs	A mixed or non-vascular cause should be considered	Check reversible factors and arrange appropriate referral

How to measure meaningful recovery

A rehabilitation record should state what will count as meaningful improvement before the intervention begins. Depending on the patient, this may be using a calendar without prompts, correctly organizing medicines for one week, taking part in a family conversation, travelling safely to a local service, or resuming a valued domestic role. These outcomes can coexist with a stable global screening score because compensatory strategies may improve participation before underlying test performance changes.

Repeated assessment should use a similar testing environment and record factors that may alter performance, including sleep, pain, mood, recent medical illness, medication changes and the presence of a family member. The clinician should distinguish inability to perform a task from unwillingness, fatigue, language barrier or an unsuitable environmental demand. This approach reduces the risk of attributing every difficulty to an immutable cognitive deficit [8, 10-12, 20].

When a caregiver is involved, the caregiver's observations are outcome data rather than a mere supplement. The report should identify whether the patient applies the learned strategy without prompting, whether supervision has reduced, and whether the family can safely maintain the plan. A discrepancy between the patient's self-report and observed functioning may itself indicate impaired awareness and should be discussed supportively rather than punitively.

Communication, family partnership and equity

Cognitive assessment and rehabilitation are vulnerable to inequity when language, literacy, culture or access to services are ignored. Instructions must be clear, short and presented in the patient's preferred language. Written plans should use practical wording, large print when necessary and a format that the family can maintain. An interpreter can assist communication but cannot automatically make a language-loaded cognitive score comparable with its original validation population.

Family partnership is particularly important when the patient has impaired insight, aphasia or executive dysfunction. Caregivers should be taught how to provide one cue at a time, how to avoid doing every task for the patient, and when to seek medical help. At the same time, the burden on the caregiver should be assessed, because an unrealistic plan can fail even when the chosen cognitive strategy is appropriate.

Secondary prevention as part of cognitive care

Cognitive rehabilitation cannot be separated from prevention of recurrent brain injury. Blood-pressure management, diabetes care, smoking cessation, appropriate antithrombotic therapy, lipid management, sleep assessment, physical activity and treatment adherence should be coordinated with the patient's cognitive capacity. Written medication schedules, pill organizers and caregiver confirmation are not administrative details; they are cognitive supports that help turn secondary prevention into an achievable daily routine [9, 22].

The level of support should be revised as recovery evolves. Some patients become able to manage their plan independently, whereas others need long-term supervision or a simplified regimen. A collaborative discussion with the patient, family and relevant clinicians is preferable to assuming that the same discharge plan remains safe at six or twelve months.

Implementation from stroke unit to community care

Continuity is often the weakest point in post-stroke cognitive care. A discharge summary should state the observed cognitive barriers, the reliability limits of the screening result, the communication needs, the practical strategies that were successful during admission, and the person responsible for follow-up. A statement that "cognition was normal" without noting the assessment context is less useful than a brief, specific description of what the patient can and cannot yet manage independently.

The first community review should revisit high-risk tasks rather than merely repeat a global questionnaire. This includes medication organization, falls risk, ability to recognize worsening symptoms, cooking and eating safety, appointment management and communication with family. When formal neuropsychology is not readily available, structured observations and a carefully obtained informant history remain valuable. Referral pathways should be clear for persistent aphasia, depression, severe fatigue, sleep problems, visual impairment and suspected dementia.

Limitations of the evidence and research priorities

The literature on post-stroke cognitive rehabilitation is limited by heterogeneity of stroke severity, timing of recruitment, cognitive outcomes, treatment content and the degree to which studies measure participation. A positive change on a laboratory-style task cannot automatically be assumed to improve independence at home. Conversely, a compensatory strategy may provide clinically meaningful benefit even if it does not alter the underlying cognitive test score. Future trials should report both domain-specific outcomes and patient-important functional end points.

Research also needs to include people often excluded from cognitive trials: those with aphasia, sensory

impairment, severe fatigue, low literacy, multimorbidity, rural residence or limited access to technology. These groups are common in routine stroke care and may benefit from adapted assessment rather than being treated as impossible to assess. Transparent reporting of the intervention dose, therapist training, caregiver role and follow-up period will make future evidence more useful for clinical implementation.

Assessment in aphasia and other communication barriers

Aphasia can limit the validity of language-dependent cognitive tasks, but it should not result in the automatic abandonment of cognitive assessment. The clinical team can combine non-verbal or minimally verbal tasks, observation during self-care, collateral history and speech-language findings to identify possible attention, executive or visuospatial difficulties. The assessment record should describe the method used and the uncertainty remaining, rather than reporting an apparently precise global score that is dominated by a language deficit.

The same principle applies to hearing loss, visual-field impairment, low literacy and culturally unfamiliar materials. Adaptation does not lower the clinical standard; it makes the conclusions more defensible. When direct standardized comparison is not possible, repeated functional observations using consistent conditions can reveal whether a strategy improves safety and independence over time [1, 13, 14].

Table 5. Practical adaptation of assessment to common barriers

Barrier	Potential distortion	Pragmatic adaptation	Documentation point
Aphasia	Language-loaded items may understate non-language cognition	Use speech-language findings, non-verbal tasks and functional observation	State the language limitation explicitly
Hearing impairment	Instructions may be misunderstood	Ensure hearing support; provide short written cues if appropriate	Record the communication modality
Visual deficit or neglect	Copying and cancellation tasks may be falsely poor	Pair task findings with field/neglect examination and real-life observation	Specify the visual barrier and affected side
Low literacy or unfamiliar test language	Score may reflect educational exposure rather than cognitive decline	Use culturally understandable examples and informant-based functional data	Avoid overinterpreting a single cut-off

Practical follow-up documentation

A concise follow-up note can make cognitive care reproducible across settings. It should identify the primary daily-life concern, the assessment conditions, the main cognitive hypothesis, the strategy currently used, the level of cueing or supervision required, the caregiver's observations and the date for reassessment. This format keeps the care plan understandable for the patient and family while allowing the hospital, rehabilitation and primary-care teams to follow the same functional objectives.

The plan should also name an escalation threshold. Examples include new functional errors, increased supervision needs, recurrent vascular symptoms, emerging behavioural change, persistent depression, dangerous medication mistakes or rapid decline after an initially stable period. Naming these events in advance helps families seek help promptly and prevents a change in cognition from being dismissed as an inevitable consequence of stroke.

Team communication and goal review

Multidisciplinary care is effective only when the different interventions reinforce the same practical goal. For example, a medication-management goal may require the physician to simplify the regimen where clinically possible, the occupational therapist to practise the routine in a realistic setting, the neuropsychology team to teach a cueing strategy, and the family to use the same written schedule at home. A plan that contains unrelated exercises from each discipline may increase effort without improving daily performance.

Goal review should be scheduled rather than delayed until a crisis occurs. At each review, the team can ask whether the selected strategy is being used, whether the level of assistance has changed, whether the target activity remains meaningful and whether a new vascular, mood, sleep or sensory problem is reducing participation. Goals may be upgraded after recovery, changed when circumstances shift or replaced with a compensatory approach when restoration alone is no longer realistic.

The patient's preference remains central to this process. Some individuals prioritize independence in personal care, whereas others value safe communication with family, resumption of work-related roles or participation in community life. Recording this priority makes the outcome measure clinically relevant and helps avoid equating a higher test score with a better lived outcome.

Discussion

International guidance supports recognition of post-stroke cognitive impairment as a multidimensional clinical problem, while also emphasizing limitations of the existing intervention evidence [1]. This has a practical consequence: it is more defensible to describe a transparent, individualized rehabilitation plan than to promise a uniform effect from one test or technique. Meaningful follow-up includes cognition, activity, safety, mood, caregiver burden and vascular risk control rather than a sole total score.

A staged model also avoids two common errors. The first is under-recognition, in which a patient with apparently good physical recovery leaves care without

evaluation of planning, attention or self-management. The second is over-diagnosis, in which poor performance during an acute illness, aphasia or uncorrected sensory loss is labelled as irreversible dementia. Reassessment after clinical stabilization is often the key to a fair interpretation [1, 2, 13, 14].

Conclusion

Early post-stroke cognitive assessment should begin with recognition of confounders and proceed from screening to domain-specific and functional clarification. Rehabilitation is most useful when it is tied to daily-life goals, supported by a multidisciplinary team and caregiver, and revisited over time. Secondary vascular prevention remains part of cognitive care because recurrent cerebrovascular injury and uncontrolled risk factors may worsen long-term cognitive outcome. the conditions under which the reported relationships can be expected to hold.

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