REVIEW

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Indications for neuropsychological assessment

ABSTRACT

A neuropsychological evaluation can help in narrowing the differential diagnosis of cognitive dysfunction, choosing treatments, and evaluating the efficacy of an intervention on an ongoing basis. In patients with documented neurologic disorders, information from neuropsychological assessment can define the patient's functional limitations or residual cognitive strengths. Proper use of neuropsychological assessment can improve the quality of care.

KEY POINTS

A referral for neuropsychological assessment is appropriate whenever there is doubt about a patient's cognitive functioning or competency.

Neuropsychologists assess a broad range of cognitive domains, not just memory.

Neuropsychological assessment can detect pathological processes before structural abnormalities are observable on neuroimaging and in cases where no abnormalities can be visualized.

Imaging studies can specify the location of many structural lesions, but the functional implications of brain pathology can be identified only through neuropsychological testing.

MS. SMITH, a 57-year-old woman, presents to her primary care physician because she is concerned about short-term memory loss. She began to notice the problem approximately 1 year ago, and it has been getting steadily worse. Her memory difficulty is affecting her performance at work and causing substantial embarrassment for her.

Family members say they have also noticed that the patient has some difficulty remembering information over the short term, but that she can recall long-ago events.

Ms. Smith has a history of hypertension that has been moderately controlled to this point. Her husband died unexpectedly approximately 3 years ago.

She is oriented to place, person, and time, she is aware of current events, and she scores 29 (of a possible 30) on the Folstein Mini-Mental State Examination (MMSE). Her lone error on the MMSE is the inability to recall one of three words.

SCOPE OF THIS PAPER

In an age of positron emission tomography and magnetic resonance imaging of the brain, what can old-fashioned paper-and-pencil neuropsychological testing still contribute to patient care?

A lot. This case, typical of many seen by primary care physicians, represents an instance in which a neuropsychological evaluation might be useful.

This article briefly describes:

- What neuropsychology is
- How it has evolved
- What a neuropsychological assessment can tell us
- When a neuropsychological assessment is indicated.

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WHAT IS NEUROPSYCHOLOGY?

Neuropsychology, the intersection of neurology, psychology, and psychiatry, is an applied science that examines the behavioral manifestations of brain dysfunction.[1]

More than memory testing

Neuropsychological assessment is often seen as simply a means of testing memory, but it is more than that. A comprehensive assessment covers a range of cognitive domains, including intelligence, learning, memory, receptive and expressive language, visuospatial reasoning, motor functioning, executive functioning, and psychopathology.[1–3]

A brain injury or psychological disorder can disrupt any of these cognitive domains, which in turn can potentially affect other domains. For example, memory difficulties may be due to a poor attention span, disruption in language abilities, sensory problems, or slowed processing due to emotional disruption. All potentially contribute to the difficulty that is experienced as "memory disruption."[2,3]

Disrupted cognition is a symptom of many disorders

Disrupted cognition can signify many problems, in much the same way that fatigue and pain can be due to many disorders and pathologic processes. Determining the exact nature of the deficit is important.

Thorough neuropsychological assessment can provide information that might be used to refine a diagnosis, plan treatment, or establish a baseline against which improvement or deterioration can be compared.

What the patient can expect

Patients referred to a neuropsychologist spend a day taking tests of general intellect, higher-level executive skills (eg, sequencing, reasoning, problem-solving), attention, concentration, learning, memory, language, visuospatial skills, motor skills, sensory skills, mood, and personality.[4]

Many patients say that the experience is like "being back in school" or "being on a game show." The tests are not physically painful, although some patients may become mildly anxious over their performance. In those instances, redirection and reassurance generally suffice to make the patient more comfortable and reduce anxiety.

Sometimes the psychologist personally gives the tests, but other times a technician who has been thoroughly trained in administration of the measures may do it. In either case, the psychologist is responsible for interpreting the data obtained.

Most patients receive feedback from the psychologist about their performance, or from the referring physician if the evaluation is part of a larger assessment. Patients are generally told that their test scores will be compared with those of people who are similar to them in important ways. They can also be informed that the test results can be used in a number of manners, including identifying weaknesses in specific areas, differentiating among illnesses, establishing a baseline against which future assessments can be compared, and planning treatments that accommodate their functional deficits.[4]

According to the most recent practice survey by the American Psychological Association, neuropsychological evaluations typically take 4 to 8 hours (average 6). The average charge in 1990 was approximately $100/hour[5]; the current cost is likely higher. Neuropsychological evaluation is often covered by insurance when it is deemed medically necessary and is often reimbursed under the patient's medical benefit.

HISTORY OF A DISCIPLINE

The first evidence of behavioral consequences of cerebral dysfunction is from an Egyptian papyrus written between 2500 and 3000 BCE.[6]

The unknown author describes behavioral manifestations of serious head injuries in numerous patients he or she observed, including "his eye is askew…he walks with shuffling with his sole." The author also recognized the lateralization of functions, going on to state that the effects of injuries varied among different patients depending on the side of the body affected.

Later work, including that of Broca,[7] Wernicke,[8] Brodmann,[9] Penfield,[10] and Milner,[11] furthered our understanding of complex brain-behavior relationships.

Neuropsychological assessment began in earnest in the 20th century with the construc-

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tion of batteries of tests aimed at identifying and evaluating the severity of behavioral deficits in patients with brain damage and aiding in diagnosis. One goal of these assessments was to pinpoint the location of brain lesions, as sophisticated neuroimaging had not yet been developed.

The most commonly used test battery was devised by Halstead and Reitan,[1,3,12] who correlated test results with findings on autopsy after the patients died. Their goal was to determine the site of lesions by noninvasive means as an aid in diagnosis.

The Halstead-Reitan battery was found useful in assessing not only severe deficits but also moderate and mild dysfunction. It also proved helpful in describing the functional deficits that arise from brain dysfunction. Furthermore, it allowed physicians to make reasoned judgments about whether the deficits observed were "organic" (ie, due to neurologic factors) or "psychiatric" (ie, due to psychological factors).

Ways of assessing cognitive function have since been expanded and refined. However, central to all approaches is the notion that the pattern of data obtained from the tests provides information about the location and effect of brain lesions and the functional deficits that accompany them.

Patients who perform well on the MMSE are not necessarily healthy

NEUROPSYCHOLOGY VS NEUROIMAGING

Now that we have the technology to image previously hidden areas of the brain, today's neuropsychologists are less often asked to deduce the location of brain lesions. Nevertheless, they still have an important role in characterizing the behavioral sequelae of brain injuries and illnesses, for several reasons:

Structure does not equal function. Neuroimaging can locate structural lesions accurately, but we cannot accurately predict the functional sequelae (the cognitive and behavioral changes that follow a neurologic insult) using structural data alone: substantial variability exists among patients with regard to their structural and functional integrity. Indeed, one could argue that, for the patient, function is more important than structure.

The nature and extent of behavioral deficits and retained abilities can be defined only through formal neuropsychological testing. The tests provide useful information about the patient's competency and decision-making capacity and have implications for the choice of treatment.

Structural changes are not always visible. Many neurologic disorders result from structural changes that are invisible to even the highest-resolution scanners. Examples include Alzheimer disease, transient ischemic attacks, many epilepsies, and many infections of the brain and spinal cord.

Neuropsychological assessment is also useful in many disorders of children in which no markers can be visualized, such as attention deficit/hyperactivity disorder, specific verbal and nonverbal learning disabilities, neurotoxic exposure, and some concussions and infectious processes.[13] In some instances, neuropsychological examinations provide objective data that help specify the diagnosis.

Even when a diagnosis can be made with specific physical markers, neuropsychology can play an important role. For example, although Down syndrome is readily identified by its physical manifestations and specific genetic abnormality (trisomy 21), neuropsychological assessment can provide invaluable prognostic information to families concerning their children's abilities.[13] Once again, the functional capabilities mean as much as the structural abnormalities, if not more.

Symptoms often precede visible structural changes.[1,2,6] If some diseases are detected early by their behavioral symptoms, physicians can often provide better care and manage symptoms better. For example, if a progressive incurable disorder such as Alzheimer disease is diagnosed early, the patient and family members have more time to plan for the inevitable deterioration in function.

Neuropsychological evaluation is useful for serial assessment, providing objective measures of progressive deterioration or recovery following traumatic brain injuries or strokes.[1–3,6]

Serial assessments are, however, confounded by repeated exposure to the test, a phenomenon called "practice effect" or "test-retest effect." To counteract this effect, researchers have estimated the amount of improvement that might be expected on vari-

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ous measures as a result of repeated testing, thus allowing for more refined estimates of cognitive improvement or decline. Furthermore, neuropsychologists have developed multiple measures that tap similar functional areas without repeating specific content.[1–3]

Consequently, sometimes testing can be done numerous times over the course of a patient's treatment without duplicating measures, thereby limiting the effects of practice.

NEUROPSYCHOLOGY VS MENTAL STATUS TESTING

Short and easy-to-give tests such as the MMSE have grown in popularity as screening measures of cognitive abilities. They have the advantages of being brief, objective, and quantitative.[14]

On the other hand, although these tests give some information about the patient's general abilities, recent research suggests that they are not as useful as a thorough cognitive assessment.

Anthony et al[15] and Dick et al[16] found that the MMSE gives an overabundance of false-positive results for people over 60 years of age or with less than 9 years of education.

In addition, the MMSE has a low "ceiling." That is, even with cognitive decline, persons with high verbal intelligence quotients tend to score higher on the MMSE than the recognized cutoff score (24) that indicates cognitive impairment. Thus, those who perform well are not necessarily cognitively intact.[16]

Physicians often ask what cutoff scores suggest that a referral should be made, but the high number of false-negatives that would result from the use of cutoffs makes such recommendations inadvisable. Instead, physicians should use the MMSE to frame areas of difficulty and use patients' reports of cognitive difficulties as better indicators.

WHEN TO REFER?

Although neurologists and psychiatrists make most referrals for neuropsychological services,[5] internists, family practice physicians, and other primary health care professionals are often the first to see the indications of cognitive impairment.

TABLE 1

Clinical indications for neuropsychological assessment

Changes in memory
- Amnesia
- Poor short-term recall
- Frequently loses items
- Gets lost easily
- Fails to recognize familiar persons

Poor attention and concentration
- Doesn't appear to listen
- Gets confused in conversations
- Does poorly in complex situations

Changes in language functioning
- Aphasia
- Agnosia
- Dysfluency

Changes in visuospatial abilities
- Difficulty drawing
- Difficulty navigating (using a map or understanding directions)
- Misperceiving the environment

Impaired executive function
- Perseverative
- Poor judgment
- Rigidity in thought

Changes in emotional functioning
- Increased anxiety
- Increased depression
- Psychoses

Fluctuations in mental status
- Disorientation

A referral for neuropsychological evaluation should be considered any time there is a question about a patient's cognitive functioning (TABLE 1). Some common complaints that might signal a need for testing include:

- Short-term memory problems
- Losing items frequently
- Confusion
- An unexplained change in personality
- Poor decision-making
- Unexplained neurologic complaints
- Inability to care for finances
- Failure to recognize peers
- Language difficulty
- Poor attention and concentration.

In addition, a neuropsychological evaluation should be considered if there is a question

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as to a patient's competency. The evaluation can provide evidence of a patient's ability to act purposefully, think rationally, and deal effectively with the environment.[2,3]

Specify what you want from the referral

When referring a patient for a neuropsychological evaluation, the physician should specify the diagnostic and functional questions that he or she is trying to answer. Referrals should address the areas of concern and the type of conclusions requested (eg, treatment planning, competency, functional limitations, diagnostic accuracy).

CASE CONTINUED

Ms. Smith was referred for a neuropsychological evaluation. The referring physician asked whether her neurocognitive deficits were consistent with a neurodegenerative process or were more likely the result of psychological disruption.

The evaluation showed that Ms. Smith had significant psychomotor slowing, impaired attention and concentration, mild memory impairments, and significant depressive symptoms, including fatigue, loss of appetite, and poor self-concept. The pattern of her performance was not indicative of a progressive neurodegenerative process.

Ms. Smith was referred for psychiatric consultation for medication management and for individual psychotherapy. She was encouraged to use memory aids during the interim, including notebooks to record important information.

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