04 - 5.4 Clinical Neuropsychology and Intellectual

5.4 Clinical Neuropsychology and Intellectual Assessment of Adults

5.4 Clinical Neuropsychology and Intellectual Assessment of Adults Clinical neuropsychology is a specialty in psychology that examines the relationship between behavior and brain functioning in the realms of cognitive, motor, sensory, and emotional functioning. The clinical neuropsychologist integrates the medical and psychosocial history with the reported complaints and the pattern of performance on neuropsychological procedures in order to determine whether results are consistent with a particular area of brain damage or a particular diagnosis. NEUROANATOMICAL CORRELATES The early history of neuropsychology was driven in large part by the goal of linking behavioral deficits to specific neuroanatomical areas of dysfunction or damage. Although this early assessment method helped to validate neuropsychological tests that are commonly used today, the localizing function of neuropsychological assessment is now considered less important in light of recent advances in neuroimaging techniques. Increasing knowledge in the neurosciences has also led to a more sophisticated view of brain–behavior relationships, in which complex cognitive, perceptual, and motor activities are controlled by neural circuits rather than single structures within the brain. An understanding of these brain–behavior relationships is particularly helpful when evaluating patients with focal damage. It is crucial to ensure that the neuropsychological evaluation adequately assesses relevant behavior that is likely to be associated with that area and its interconnecting pathways. Hemispheric Dominance and Intrahemispheric Localization Many functions are mediated by both the right and left hemispheres. However, important qualitative differences between the two hemispheres can be demonstrated in the presence of lateralized brain injury. Various cognitive skills that have been linked to the left or right hemisphere in right-handed individuals are listed in Table 5.4-1. Although language is the most obvious function that is largely

controlled by the left hemisphere, especially among right-handed individuals, the left hemisphere is also generally considered to be dominant for limb praxis (i.e., performing complex movements, such as brushing teeth, to command, or imitation), and it has been associated with the cluster of deficits identified as Gerstmann syndrome (i.e., finger agnosia, dyscalculia, dysgraphia, and right–left disorientation). In contrast, the right hemisphere is thought to play a more important role in controlling visuospatial abilities and hemispatial attention, which are associated with the clinical presentations of constructional apraxia and neglect, respectively. Table 5.4-1

Selected Neuropsychological Deficits Associated with Left or Right Hemisphere Damage Although lateralized deficits such as these are typically characterized in terms of damage to the right or left hemisphere, it is important to keep in mind that the patient's performance can also be characterized in terms of preserved brain functions. In other words, it is the remaining intact brain tissue that drives many behavioral responses following injury to the brain and not only the absence of critical brain tissue. Language Disorders. Appreciation for the special role of the left hemisphere in the control of language functions in most right-handed individuals has been validated in many studies. These include the results of sodium amytal testing in epilepsy surgery patients, as well as the incidence of aphasia following unilateral stroke to the left versus right hemisphere. Although it is rare for right-handed individuals to be right hemisphere dominant for language, it does occur in about 1 percent of the cases. Hemispheric dominance for language in left-handed individuals is less predictable. About two-thirds of left-handed individuals are actually left hemisphere dominant for language, while about 20 percent each are right hemisphere dominant or bilaterally dominant. A number of classification systems have been developed over the years for describing various patterns of language breakdown. A common method takes into account the presence or absence of three key features: (1) fluency, (2) comprehension, and (3) repetition (i.e., intact ability to repeat verbally presented words or phrases). BROCA'S APHASIA. Broca's aphasia (also called nonfluent or expressive aphasia) has traditionally been characterized by nonfluent speech but intact auditory comprehension and somewhat impaired repetition. It has long been thought to be associated with damage to Broca's area (i.e., left inferior frontal convolution) or Brodmann area 44 (Fig. 5.4-1). However, more recent neuroimaging data in stroke patients have shown that the full syndrome of Broca's aphasia, including agrammatism (telegraphic speech), is found only in the presence of more extensive damage, which encompasses the suprasylvian area from Broca's area to the posterior extent of the sylvian fissure.

FIGURE 5.4-1 Brodmann's areas of the human cortex, showing convex surface (top) and medial surface (bottom). (From Elliott HC. Textbook of Neuroanatomy. Philadelphia: Lippincott; 1969, with permission.) WERNICKE'S APHASIA. Wernicke's aphasia (also called fluent or receptive aphasia) is characterized by fluent speech, impaired comprehension, and somewhat impaired repetition. It has been associated with damage to Wernicke's area in the region of the superior temporal gyrus. The impaired ability to comprehend language directly affects the individual's ability to self-monitor language output and may be related to a breakdown of the syntactic structure of language. Unlike patients with Broca's aphasia, who are usually painfully and obviously aware of their communication difficulty, patients with Wernicke's aphasia are typically not aware of their communication problems, because Wernicke's area is critical for comprehending their own speech as

well as the language of others. This lack of insight is similar to the condition of anosognosia, in which patients fail to appreciate their own deficits, and presents a particularly frustrating condition for many family members and caregivers. CONDUCTION APHASIA. Patients with conduction aphasia demonstrate relatively intact auditory comprehension and spontaneous speech, due to the preservation of Wernicke's and Broca's areas. However, the ability to repeat words and phrases is specifically impaired and has traditionally been attributed to damage to the arcuate fasciculus, which interconnects Wernicke's and Broca's areas. This type of aphasia is much more subtle and tends to have less negative impact on daily functioning. GLOBAL APHASIA. Another common classification, global aphasia, is characterized by impairment in all three dimensions of fluency, comprehension, and repetition due to damage to the core language areas on the lateral surface of the left hemisphere. In reality many aphasic patients cannot be neatly classified within a specific system because the pattern of deficits does not exactly fit clear descriptive categories. In fact, detailed language assessment of most aphasic patients typically demonstrates deficits in all three areas, although the degree of deficit among the three areas varies. Limb Apraxia. Limb apraxia and other cognitive-motor skills deficits are more commonly seen with left than with right hemisphere damage. However, Kathleen Haaland and Deborah Harrington reviewed data showing that the difference in the incidence of limb apraxia after left or right hemisphere damage is not as great as with language, suggesting that left hemisphere dominance for disorders of complex movement is not as strong as that for language. Although limb apraxia has not traditionally been considered to be of substantial functional importance, recent data reviewed by Leslie Rothi and Kenneth Heilman also suggest that limb apraxia significantly affects rehabilitation outcome. Conceptual apraxia might result in using the wrong object to perform a movement, such as attempting to use a toothbrush to eat. Finally, sequencing errors and ideational errors can lead to disrupted activities, such as trying to light a candle before striking the match. Arithmetic. Arithmetic skills can be impaired after either left or right hemisphere damage. Left hemisphere damage, especially of the parietal lobe, produces difficulty in reading and appreciating the symbolic meaning of numbers (number dyslexia). Left hemisphere damage also can be associated with impaired conceptual understanding of the arithmetic problem (anarithmetria). In contrast, the deficits in arithmetic computation that can accompany right hemisphere damage are more likely to be observed in written problems. These emerge as problems with the spatial aspects of arithmetic, such as errors resulting from hemispatial visual neglect, poor alignment of columns, or visual misperceptions and rotations that can result in confusion of signs for addition and multiplication. Spatial Disorders. Right hemisphere damage in right-handed individuals is

frequently associated with deficits in visuospatial skills. Common assessment techniques include drawings and constructional or spatial assembly tasks. VISUOSPATIAL IMPAIRMENT. Distinctive qualitative errors in constructing block designs and in drawing a complex geometric configuration (e.g., Rey-Osterrieth Complex Figure test) can be seen with either right or left hemisphere damage. In the presence of lateralized damage to the right hemisphere, impaired performance often reflects the patient's inability to appreciate the "Gestalt" or global features of a design. In the example shown in Figure 5.4-2, this is seen in the patient's failure to maintain the 2 × 2 matrix of blocks and instead converting this matrix into a column of four blocks. In contrast, damage to the left hemisphere commonly results in inaccurate reproduction of internal details of the design, including improper orientation of individual blocks, but the 2 × 2 matrix (i.e., the Gestalt) is more likely to be preserved. Many neuropsychologists emphasize that a neuropsychological understanding of the impairment depends not just on a set of test scores but also on a qualitative description of the type

of error. This often allows the impairment to be linked to a specific neuroanatomical region as well as enabling a better understanding of the mechanisms of the deficit for rehabilitation purposes. This qualitative focus on the type of error is similar to the pathognomonic approach that is often used by behavioral neurologists. FIGURE 5.4-2 Examples of block design construction seen in a right hemisphere stroke patient and a left hemisphere stroke patient. (From Sadock BJ, Sadock VA, Ruiz P. Kaplan & Sadock's Comprehensive Textbook of Psychiatry. 9th ed. Philadelphia: Lippincott Williams & Wilkins; 2009, with permission.) In another example, damage to the right hemisphere tends to be associated with decreased appreciation of global features of visual stimuli, while left hemisphere damage tends to be associated with decreased analysis of local features and detail. This notion is illustrated in Figure 5.4-3, where a patient with left hemisphere damage focuses on the larger Gestalt of the triangle or letter M with no regard for the internal characters that actually make up the designs. In contrast, the "local" approach of a patient with right hemisphere damage emphasizes the internal details (small rectangles or letter Z)

without appreciation of the Gestalt that is formed by the internal details. This example also illustrates the important point that behavioral responses (including errors) are driven as much by preserved regions of intact brain functioning as by the loss of other regions of brain functioning. FIGURE 5.4-3 Global local target stimuli with drawings from memory by a patient with right hemisphere cerebrovascular accident (CVA) and by a patient with left hemisphere CVA. (From Robertson LC, Lamb MR. Neuropsychological contributions to theories of part/whole organization. Cognit Psychol. 1991;23:325, with permission from Elsevier Science.) NEGLECT. Neglect syndromes are characterized by failure to detect visual or tactile stimuli or to move the limb in the contralateral hemispace. They are most commonly associated with right hemisphere damage in the parietal region, but damage to other areas within the cerebral cortex and subcortical areas can also produce this problem. Although neglect syndromes have a similar incidence and may co-occur with visual field cuts or somatosensory deficits, the neglect syndrome is distinct and not explained by any motor or sensory problems that may be present. Visual neglect can be assessed with line cancellation and line bisection tasks, in which the paper is placed at the patient's midline, and the patient is asked to either cross out all of the lines on the page or to bisect the single line presented. The method of double simultaneous stimulation or visual extinction is another standard procedure for demonstrating the deficit. Neglect syndromes can have devastating functional effects on safety and the ability to live independently and should be taken into account as a standard consideration in the evaluation process. DRESSING APRAXIA. The syndrome of dressing apraxia tends to arise in association with spatial deficits following right hemisphere damage. The resulting difficulty in

coordinating the spatial and tactual demands of dressing can be seen in the patient's difficulty in identifying the top or bottom of a garment, as well as right–left confusion in inserting his or her limbs into the garment. As a result, dressing time can be painfully protracted, and the patient may actually present with a greater level of functional dependence than might otherwise be expected from assessment of simple motor or spatial skills alone. Memory Disorders. Memory complaints constitute the most common referral to neuropsychology. Thorough neuropsychological examination of memory considers the modality (e.g., verbal vs. spatial) in which the material is presented, as well as presentation formats that systematically assess different aspects of the informationprocessing and storage system that forms the basis for memory. Accumulated research indicates that specialized processing of verbal and spatial memory material tends to be differentially mediated by the left and right hemispheres, respectively. In addition to

interhemispheric differences in functional localization, specific memory problems can be associated with breakdown at any stage in the information-processing model of memory. These stages include (1) registration of the material through attention, (2) initial processing and encoding of the material within short-term memory, also known as working memory, (3) consolidation and storage of material in long-term memory, and (4) retrieval processes, in which material moves from long-term memory storage back into consciousness. A great advantage of neuropsychological assessment is that these various types of memory problems can be readily isolated and described in the course of the examination procedures. Once identified, the specific nature of the deficit can then have important implications for diagnosis, treatment, and prognosis. ENCODING. The initial encoding of new material can be influenced by a variety of factors, including deficits in attention, language, and spatial processing abilities. It is usually measured by immediate recall of newly learned information (e.g., narrative stories or designs) or by demonstrating the ability to learn new material that has been presented across multiple “learning trials” (e.g., word lists). Attention itself is a relatively fragile cognitive function that can be affected by many factors, including neurologically based disorders (e.g., head injury or acute confusional state) and psychiatric disorders (e.g., depression or anxiety), so it is a crucial aspect of a proper assessment of memory. STORAGE AND RETRIEVAL. Deficits in recall can be associated with impaired storage of information, or it can be due to impaired retrieval, in which case the material is still present but not readily accessible. The best way of differentiating these problems is to examine recognition memory, in which a patient is typically asked to choose from a set of multiple-choice alternatives or to discriminate target words from false-positive foils. If the patient demonstrates accurate recognition but poor recall, then the problem most likely lies in poor retrieval. However, if recognition is impaired, then the problem is more likely to be related to impaired storage of new information. This distinction is important because the functions of retrieval and storage are subserved by different

neuroanatomical structures. Impaired storage is more often associated with dysfunction of the medial temporal lobe–diencephalic systems, whereas impaired retrieval can be associated with a variety of structures, including the frontal lobes. Executive Function. The prefrontal lobes and their interconnections to the rest of the brain are known to play an important role in executive functions, which are essential in planning and organizing, self-monitoring, and controlling complex problem-solving responses. Damage to the frontal lobes also has been associated with significant personality changes. This was historically exemplified by the famous 19th-century case of Phineas Gage, who became irresponsible, socially inappropriate, and unable to carry out plans after a tamping iron was blown through his frontal lobes. As conceptualized by Muriel Lezak, the executive functions include volition (i.e., formulation of a goal, motivation to achieve the goal, and awareness of one’s own ability to achieve the goal), planning, purposive action (response selection and initiation, maintenance, switching, and stopping), and execution, which involves self-monitoring and self-correction as well as control of the spatiotemporal aspects of the response. Hemispheric differences in the control of executive functions by the frontal lobes have not been as well documented as in the parietal and temporal lobes. Motor Skills. The neuropsychological evaluation commonly includes formal tests of motor skills, such as measures of finger tapping speed, grip strength, and fine motor dexterity. These tests, which have demonstrated validity and reliability, are useful for assessing lateralized motor impairment and have implications for functioning in daily life as well as vocational planning. GENERAL REFERRAL ISSUES Referents turn to neuropsychology for many reasons that include differential diagnosis, baseline measurement, and treatment planning, as well as opinions regarding causality and decisional capacity. Because many referents

have limited experience and knowledge of the scope of neuropsychology, it is both reasonable and important for the neuropsychologist to take an active role in refining the specific questions that are asked and providing realistic information about the limitations of the consultation. Level of Functioning A common referral issue involves documentation of level of functioning for a variety of purposes, including assessment of change or capacity to make decisions, especially in the presence of diagnoses such as dementia, stroke, and head injury. Differential Diagnosis Like any other diagnostic procedure, the results of a neuropsychological examination must be interpreted in light of all available information, including the history and any

associated medical factors that are documented or reported for the individual. Many neurological and psychiatric disorders have similar clusters of symptoms in common, with complaints of concentration or memory problems being among the most frequently reported problems. Age- or Stress-Related Cognitive Change. Many middle-aged and older adults have concerns about everyday concentration and memory failures, and with heightened public awareness about conditions such as Alzheimer's disease, an increasing number of these individuals seek evaluations for these concerns. Neuropsychological testing provides a detailed, objective picture of different aspects of memory and attention, which can be helpful in reassuring healthy persons about their abilities. It also provides an opportunity for assessing undetected mood or anxiety disorders that may be reflected in cognitive concerns and for offering suggestions about mnemonic strategies that can sharpen everyday function. A 77-year-old, left-handed man with a high school education was referred for neuropsychological assessment by his primary care physician after the patient mentioned a recent episode of getting turned around while driving. Results of neuropsychological assessment indicated variable performance on tests of attention and concentration. His performance was excellent on tests of memory, language, and executive problem-solving abilities, but visual-spatial and constructional abilities were moderately impaired. Mild Traumatic Brain Injury. Traumatic brain injury (TBI) is usually classified as mild, moderate, or severe. However, the vast majority of TBI cases referred for neuropsychological consultation involve mild TBI. A significant proportion of persons who have suffered a mild TBI complain of problems with attention and inefficient information processing, memory, and mood, in addition to headache or other forms of pain, for many months after the injury. Neuropsychological testing plays a crucial role in determining the extent of objective cognitive deficit and examining the possible role of psychological factors in perpetuating cognitive problems. The neuropsychologist should bear in mind that many patients with mild TBI are involved in litigation, which can complicate the neuropsychologist's ability to identify the causes for impairment. Although outright malingering is probably relatively infrequent, subtle presentations of chronic illness behavior should be a prominent consideration when potential legal settlements or disability benefits are in question. This is a particularly important factor in the case of mild head injury, when subjective complaints may be disproportionate to the objectively reported circumstances of the injury, especially because most follow-up studies of mild head injury indicate return to neuropsychological baseline with no objective evidence of significant cognitive sequelae after 3 to 12 months following injury.

Poststroke Syndromes. After the acute phase of recovery from stroke, patients may be left with residual deficits, which can affect memory, language, sensory/motor skills, reasoning, or mood. Neuropsychological testing can help to identify areas of strength, which can be used in planning additional rehabilitation and can provide feedback on the functional implications of residual deficits for work or complex activities of daily living. Assessment of functional skills can also be helpful to a

psychiatrist who is managing mood and behavioral symptoms or dealing with family caregivers. Detecting Early Dementia. Conditions that particularly warrant neuropsychological assessment for early detection and potential treatment include HIVrelated cognitive deficits and normal pressure hydrocephalus. When concerns about a person's memory functioning are expressed by relatives instead of the patient, there is a higher probability of a neurological basis for the functional problems. Neuropsychological testing, combined with a good clinical history and other medical screening tests, can be highly effective in distinguishing early dementia from the mild changes in memory and executive functioning that can be seen with normal aging. Neuropsychological evaluation is particularly helpful in documenting cognitive deterioration and differentiating among different forms of dementia. An additional incentive for early diagnosis of dementia now lies in the fact that a portion of patients with early dementia may be candidates for memory-enhancing therapies (e.g., acetylcholinesterase inhibitors), and testing can provide an objective means of monitoring treatment efficacy. Distinguishing Dementia and Depression. A substantial minority of patients with severe depression exhibit serious generalized impairment of cognitive functioning. In addition to problems with attention and slowing of thought and action, there may be significant forgetfulness and problems with reasoning. By examining the pattern of cognitive impairment, neuropsychological testing can help to identify a dementia syndrome that is associated with depression, usually known as pseudodementia. Mixed presentations are also common, in which symptoms of depression coexist with various forms of cognitive decline and exacerbate the effects of cognitive dysfunction beyond what would be expected from the neurological impairment alone. Neuropsychological testing in this case can be very helpful by providing a baseline for measuring the effect of antidepressant or other therapy in alleviating cognitive and mood symptoms. A 75-year-old man with a Ph.D. in the social sciences sought neuropsychological reexamination for ongoing memory complaints, stating that "several of my friends have Alzheimer's." In an initial examination 1 year prior, he had performed in the expect range (above average) for most procedures, despite variable performance on measures of attention and concentration. Results of the follow-up examination again clustered in the expected above average range with variable performance on

measures of attention. On list learning tests of memory, his initial learning of a word list was lower than expected, but delayed retention of the material was above average, with excellent discrimination of target items on a recognition subtest. He also endorsed a large number of symptoms of depression on a self-report inventory. Change in Functioning Over Time Because many neurological diagnoses carry clear expectations regarding normal rates of recovery and decline over time, it is frequently important to re-examine a given patient with follow-up neuropsychological assessment after 6 months to a year. For example, it might be important to monitor declines in independent functioning that could be associated with a progressive dementia or to identify improvement following a stroke or tumor resection. Follow-up examinations also provide an opportunity to objectively examine complaints of long-standing or worsening cognitive sequelae following mild head trauma, even though the current literature indicates that the greatest proportion of recovery of function is likely to occur over the initial 6 months to 1 year postinjury. Although continuing subtle signs of recovery can continue after that period, failure to improve following the injury—or worsening of complaints—would suggest the possibility of contributing psychological factors or the existence of a preexisting or coexisting condition, such as substance abuse, dementia, or outright malingering. Assessment of Decision-Making Capacity Neuropsychologists are often asked to assist in determining an individual's capacity to make

decisions or to manage personal affairs. Neuropsychological testing can be useful in these cases by documenting areas of significant impairment and by identifying areas of strength and well-preserved skills. Opinions about decision-making capacity are seldom based on test findings alone and usually rely heavily on information gleaned from clinical interview, collateral interviews with family or caregivers, and direct observations (e.g., in-home assessment) of everyday function. In fact, appraisal of an individual's level of insight and capacity to appreciate his or her own limitations is typically the single most important aspect of the assessment. Standards for decisionmaking capacity are generally defined by state statutes, and, of course, the ultimate determination of competence rests in the authority of the presiding judge. However, the neuropsychologist or other health care professional can play a significant role in shaping the judge's ruling by providing a professional opinion that is supported by compelling behavioral data that have strong face validity. As a general rule of thumb, consideration of decision-making capacity is usually best approached in the narrowest possible sense so as to infringe as little as possible on the individual's freedom to represent his or her own interests. Therefore, consultation requests for assessment of decision-making capacity should identify specific areas of decision making and behavior that are of concern. Frequent concerns having to do with decision-making capacity involve the areas of (1) financial and legal matters, (2) health care and medical

treatment, and (3) ability to live independently. Some capacity issues involve higher standards, such as ability to drive, ability to work, or practice in a given profession (e.g., air traffic controller, surgeon, or financial advisor). In such cases, it is particularly important for the neuropsychologist to rely on normative expectations that are appropriate for the type of activity, as well as the patient's demographics. Forensic Evaluation Neuropsychological evaluation of individuals in matters pertaining to criminal or civil law usually requires specialized knowledge beyond expertise in neuropsychology. Neuropsychologists are frequently called upon as experts in matters involving head injury, especially in the case of mild head injury associated with a motor vehicle accident. As a distinct subspecialty, this area of practice requires integration of knowledge of statutes, laws, precedents, and legal procedures as well as expertise in identifying and describing the impact of an injury or event on cognitive, emotional, and behavioral functioning. APPROACHES TO NEUROPSYCHOLOGICAL ASSESSMENT The neuropsychological examination systematically assesses functioning in the realms of attention and concentration, memory, language, spatial skills, sensory and motor abilities, as well as executive functioning and emotional status. Because deficits in cognitive performance can only be interpreted in comparison to a person's longstanding or premorbid level of functioning, overall intellectual abilities are typically examined in order to measure the current level of overall functioning and to identify any changes in intellectual functioning. Psychological contributions to performance are also considered with regard to personality and coping style, emotional lability, presence of thought disorder, developmental history, and significant past or current stressors. The expertise of the neuropsychologist lies in integrating findings that are obtained from many diverse sources, including the history, clinical presentation, and several dozen discrete performance scores that make up the neuropsychological data. Battery Approach The battery approach, exemplified by the Halstead-Reitan Neuropsychological Test Battery (HRNTB) or the Neuropsychological Assessment Battery (NAB), grew directly out of the psychometric tradition in psychology. This approach typically includes a large variety of tests that measure most cognitive domains as well as sensory and motor skills. Traditionally, all parts of the test battery are administered regardless of the patient's presenting problem, although the NAB has a screening exam that covers all appropriate domains. The battery

approach has the advantage of identifying problems that the patient might not have mentioned and that the medical history may not necessarily predict. However, it has the disadvantage of being very time-consuming (i.e., 6- to 8hour examination for the HRNTB).

Hypothesis Testing Approach The qualitative hypothesis testing approach is historically best exemplified by the work of Alexander Luria and more recently developed as the Boston Process Approach by Edith Kaplan and her colleagues. It is characterized by detailed evaluation of areas of functioning that are related to the patient's complaints and predicted areas of impairment, with relatively less emphasis on aspects of functioning that are less likely to be impaired. The hypothesis testing approach has been particularly helpful in illuminating the differential roles of the two hemispheres, as discussed above. This approach has the advantage of efficiently honing in on areas of impairment and producing a detailed description of the deficits from a cognitive processing standpoint, but it has the shortcoming of potentially overlooking unexpected areas of deficits. Screening Approaches Many practitioners have moved away from strict battery or hypothesis testing approaches since the 1990s and developed more flexible and efficient screening approaches. In this model, the neuropsychologist utilizes a core set of screening procedures as a first step in determining whether a diagnosis can be made with less information or whether additional testing is necessary in order to identify more subtle problems. Therefore, a screening protocol that efficiently assesses the major areas of neuropsychological functioning may or may not be followed by more detailed testing in selected areas that might provide better understanding of the reasons for the deficits demonstrated on the screening evaluation. Mental Status Examinations In some cases, usually involving very acute or severe cognitive impairment, it is simply not feasible to administer extensive cognitive examination procedures, so the neuropsychologist might appropriately rely on bedside mental status examination or very brief cognitive screening procedures to address the referral issues. However, research has shown that, even with brief screening procedures, the systematic use of a structured examination format can greatly increase the accuracy of detecting cognitive impairment. One of the most widely used screening instruments for documenting gross changes in mental status is the Mini-Mental State Examination (MMSE). However, it is important to note that the MMSE does have distinct limitations. Other than serial seven counting, the MMSE does not really assess executive functions, which are often impaired in dementing patients. In addition, the MMSE is likely to underestimate the prevalence of cognitive deficits in well-educated older persons with early Alzheimer's disease or in younger adults with focal brain injury, but it is more likely to overestimate the presence of cognitive deficits in persons with little education. Therefore, cutoff scores should be adjusted for age and education before concluding that impairment is present. Although mental status examinations can be very useful in screening for gross signs of cognitive impairment, they do not provide a sufficient foundation for diagnosing specific etiologies of cognitive impairment, and they are not interchangeable with neuropsychological testing.

DOMAINS OF FORMAL NEUROPSYCHOLOGICAL ASSESSMENT The past decade has seen a virtual explosion in the growth of more sophisticated and better standardized tests and procedures for neuropsychological evaluation. A list of examples of common neuropsychological tests and techniques is provided in Table 5.4-2. Table 5.4-2 Selected Tests of Neuropsychological Functioning

Interview The clinical interview provides the single best opportunity for identifying the patient's concerns and questions, eliciting a direct description of current complaints from the patient, and

understanding the context of the patient's history and current circumstances. Although the patient typically serves as the primary interview source, it is important to seek corroborating information for the patient's account from interviews with caregivers or family members as well as thorough review of relevant records, such as medical and mental health treatment, educational, and employment experiences. Intellectual Functioning Assessment of intellectual functioning serves as the cornerstone of the neuropsychological examination. The Wechsler Intelligence Scales have represented the

traditional gold standard in intellectual assessment for many years, based on carefully developed normative standards. The scope and variety of subtests on which the summary IQ values are based also provide useful benchmarks against which to compare performance on other tests of specific abilities. The latest revision of this instrument, the Wechsler Adult Intelligence Scale III (WAIS-III), offers the additional advantage of greatly extended age norms (ages 16 to 89) that are directly related to normative performances on the Wechsler Memory Scale III (WMS-III). The Wechsler Intelligence Scales utilize a broad set of complex verbal and visuospatial tasks that have traditionally been summarized as a verbal IQ, a performance IQ, and full-scale IQ. In the context of a neuropsychological examination, the patient's performance across the procedures provides useful information regarding long-standing abilities as well as current functioning. Most neuropsychologists recognize that the summary IQ values provide only a ballpark range for characterizing an individual's general level of functioning. Therefore, it is usually more appropriate and meaningful to characterize an individual's intellectual functioning in terms of the range of functioning (e.g., borderline, low average, average, high average, or superior) that is represented by the IQ value rather than the specific value itself. Careful examination of the individual's performance across the various verbal and performance subtests can provide information regarding the patient's pattern of strengths and weaknesses as well as the degree to which these performance characteristics are consistent with the history and performance on other aspects of the neuropsychological examination. Tests of long-standing knowledge, such as for vocabulary or general information, provide a basis for estimating an individual's longstanding (or premorbid) level of intellectual abilities, which in turn can help to gauge the degree to which an individual may have deteriorated. The verbal IQ and performance IQ (VIQ and PIQ) have historically been reported to be associated with left and right hemisphere functioning, respectively. However, more recent research indicates that, in addition to language and spatial skills, the subtests of the Wechsler Intelligence Scales reflect other contributions such as speed, sustained concentration, and novel experience. Therefore, experienced neuropsychologists do not simply assume that a discrepancy between VIQ and PIQ is due to unilateral hemispheric damage. Important clues to the nature of the contributing problem can often be gleaned by considering the pattern of performance across other aspects of the examination and by carefully analyzing the types of errors that are observed. Attention Attention underlies performance in virtually all other areas of functioning and should always be considered a potential contributor to impairment on any tests that require sustained concentration and vigilance or rapid integration of new information. Measures of attention and concentration have traditionally been included in the Wechsler Intelligence and Wechsler Memory Scales in order to assess orientation and "freedom from distractibility." These procedures also provide a useful basis for

"previewing" the individual's ability to comprehend, process information, and otherwise engage in the assessment process. Digit span requires patients to repeat increasingly longer strings of digits

as a way of assessing ability to process relatively simple information, while digit span backward reflects more complex simultaneous processing and cognitive manipulation demands or working memory. Memory Complaints of memory problems constitute one of the most common reasons for referral to neuropsychology. As described above, the neuropsychologist utilizes an informationprocessing approach to assess memory problems that might involve difficulty with encoding, retrieval, or storage of new information. The WMS-III is the latest revision of a widely used battery of subtests that utilizes several measures of attention, memory, and new learning ability. Language Assessment of language examines both expressive abilities and comprehension. However, most neuropsychologists screen for language impairment rather than administer an extensive formal language assessment battery, such as the Boston Diagnostic Aphasia Examination. Expressive language is commonly assessed by measures of verbal fluency, which require the patient to rapidly generate words within semantic (e.g., names of animals) and phonetic categories (e.g., words beginning with specified letters of the alphabet). Visuospatial Functions Complex visuospatial abilities can be assessed through procedures that were developed in Arthur Benton's laboratory, such as facial recognition and judgment of line orientation. Measures of visual constructional ability examine the person's ability to draw spatial designs or assemble two- or three-dimensional figures (see Fig. 5.4-3). In addition to the significant visuospatial component, these tasks reflect contributions of executive planning and organizational abilities. More impaired individuals can be asked to copy simple geometric forms, such as a Greek cross or intersecting pentagons, in order to examine visuospatial abilities that are less influenced by planning and organization. The widely used technique of clock drawing provides a surprisingly sensitive measure of planning and organization, especially for older individuals who are at risk for dementia. Although problems involving poor organization, perseveration, and possible neglect are obvious in the drawing that is illustrated in Figure 5.4-4, more subtle difficulties can also be detected, especially when a patient's performance is evaluated in light of premorbid expectations.

FIGURE 5.4-4 Clock drawing by a patient with vascular dementia, showing poor planning and organization, perseveration, and possible neglect. (From Sadock BJ, Sadock VA, Ruiz P. Kaplan & Sadock's Comprehensive Textbook of Psychiatry. 9th ed. Philadelphia: Lippincott Williams & Wilkins; 2009, with permission.) Sensory and Motor Functions Double simultaneous stimulation in the visual, tactile, and auditory modalities is a standard component of the HRNTB and can be useful for assessing the integrity of basic sensory functions as well as neglect if deficits are present on one side only on the bilateral simultaneous trials and not when stimulation is unilateral. Grip strength and rapid finger tapping are commonly used measures of motor strength and speed that are sensitive to lateralized brain dysfunction. Executive Functions One of the most important aspects of the neuropsychological examination lies in the assessment of higher executive functions, which play an important role in the planning and initiation of independent activities, self-monitoring of performance, inhibition of inappropriate responses, switching between tasks, and planning and control of complex motor and problem-solving responses. Although the prefrontal lobes have long been regarded as an important component in mediating these functions, more recent developments in the neurosciences have also led to an increased appreciation for the essential role that is played by extensive cerebral interconnections between subcortical

and cortical regions of the brain. Psychological Factors A key component of any neuropsychological examination involves consideration of the degree to which long-standing personality or other psychological factors (including current stressors) might contribute to the patient's presentation.

Common techniques for assessing personality and psychological factors include the Minnesota Multiphasic Personality Inventory 2 (MMPI-2) and paper and pencil techniques, such as the Beck Depression Inventory II. Assessment of Effort and Motivation Because the results of neuropsychological examinations may eventually be introduced as evidence in litigation or other forensic proceedings or be used for determining disability compensation, it is important for the neuropsychologist to address any possible concerns about effort and motivation as a routine matter. Several instruments have been developed recently that directly assess a patient's level of effort and motivation to perform at his or her best. Normative research indicates that patients with histories of bona fide brain injury or even dementia perform close to perfect levels on many such instruments, so poor performance suggests poor effort or tendencies to exaggerate symptoms. Many other indicators of effort are based on the pattern of an individual's performance on standard procedures in a neuropsychological examination. A 32-year-old woman with 13 years' education was seen for disability evaluation, claiming current "trouble remembering things." Her account of personal history was vague, and she "forgot" information, such as her own birth date and mother's maiden name. Response latencies were extremely long, even for highly familiar information (e.g., count from 1 to 20), she could not repeat more than three digits forward consistently, and on a word list learning procedure, she was not able to correctly recognize more items (only five) than she could freely recall (also five). Despite otherwise fluent language, she was only able to generate five examples of animals in 1 minute. When asked to recall 15 items on a procedure (Rey's Memory Test) that is presented as a challenging task, but in reality is fairly simple, her performance demonstrated exaggerated errors of commission (Fig. 5.4-5). The evaluation concluded that current levels of cognitive functioning could not be conclusively established, due to overt symptoms exaggeration.

FIGURE 5.4-5 Rey's Memory Test with example of a response that is typical of exaggerated "memory" problems. (From Sadock BJ, Sadock VA, Ruiz P. Kaplan & Sadock's Comprehensive Textbook of Psychiatry. 9th ed. Philadelphia: Lippincott Williams & Wilkins; 2009, with permission.) THERAPEUTIC DISCUSSION OF RESULTS A key component of the neuropsychological examination process is found in the opportunity to discuss results of the examination with the patient and family or other caregivers. This meeting can represent a powerful therapeutic opportunity to educate and clarify individual and relationship issues, which can impact the identified patient's functioning. If the patient's active cooperation in the initial examination has been appropriately enlisted, then the patient will be prepared to invest value and confidence in the findings of the examination. At the time of the results discussion, it is useful to review the goals of the examination with the patient and supportive family or caregivers and to clarify the expectations of those who are present. Typically, these sessions will include information about the patient's diagnosis, with emphasis on the natural course and prognosis as well as compensation and coping strategies for the patient and family. Given the impact of chronic neurological disease on the family system as well as the patient, explicit discussion of these issues is critical in maximizing adjustment to brain injury. It is equally important to relate the impact of the results to the patient's current living circumstances, future goals, and course of adjustment. It is not unusual for strong emotions and underlying tensions within family relationships to come to light in the context of honest discussion, so the results discussion can represent an important therapeutic opportunity to model effective communication and problemsolving techniques. REFERENCES Allott K, Proffitt TM, McGorry PD, et al. Clinical neuropsychology within adolescent and young-adult psychiatry: Conceptualizing theory and practice. Appl Neuropsychol Child. 2013;2(1):47–63. Boosman H, Visser-Meily JM, Winken I, van Heugten CM. Clinicians' views on learning in brain injury rehabilitation. Brain Inj.

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Revision #1
Created 2026-01-04 19:50:40 UTC by Omar Ayman
Updated 2026-01-04 19:50:40 UTC by Omar Ayman