Neuropsychologist

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***It has been estimated that at least half of individuals with multiple sclerosis (MS) experience some degree of cognitive dysfunction, which can negatively affect employment status and quality of life. Many MS patients are referred for neuropsychological evaluation to assess their cognitive abilities. This article describes the evaluation process and the role of the neuropsychologist on a multidisciplinary MS health-care team. A neuropsychologist is trained in relationships between brain functioning and behavior and can administer cognitive tests and provide feedback on the individual's cognitive strengths and weaknesses. The findings can be used to recommend specific types of compensation strategies or other interventions that may help the patient maintain employment and independent functioning. Int J MS Care.* 2009;11:32–37.**

Multiple sclerosis (MS) is a disease of the central nervous system with prominent physical symptoms such as muscle weakness and spasticity that lead to limitations in mobility.[1] Although MS care often focuses on the assessment and treatment of these physical symptoms, changes in cognition can be of greater concern to people with MS and their families. It is believed that at least half of people with MS eventually experience some degree of cognitive dysfunction,[2] which can occur early in the disease and progress over an interval as short as 2 years.[3] Cognitive impairment in MS is associated with loss of employment,[4] reduced driving skills,[5] diminished socialization,[6] and dependence on others for activities of daily living (ADLs).[4] Subtle changes in cognitive efficiency may be readily noticed by a person with MS but overlooked by health-care providers and misunderstood by family members and coworkers. For this reason, cognitive dysfunction is often referred to as an "invisible" symptom of MS. Because cognitive decline may not be readily apparent at bedside examination,[7] a neuropsychological evaluation can be invaluable in providing information about brain function to people with MS and their health-care teams. Additionally, test results can be used to support an application for disability benefits or school/work accommodation. Repeat testing can identify changes or stability over time, following relapses, or with treatment. Test results can also guide development of compensation strategies. In addition to conducting a cognitive evaluation, neuropsychologists can provide treatment in the form of individual psychotherapy, family counseling, behavior management, and cognitive rehabilitation.

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What Is Neuropsychology?

A clinical neuropsychologist is a licensed psychologist with specialized training in the relationship between brain functioning and abilities such as memory, attention, language, and reasoning. Following completion of a doctoral program, neuropsychologists undergo further training and supervision in the practice of neuropsychology through a clinical internship and then a 2-year postdoctoral residency or fellowship. Clinical neuropsychology is a specialty recognized by the American and Canadian Psychological Associations. After completion of training and a period of independent practice, an individual can go through the examination process to be certified through the American Board of Professional Psychology.

The primary clinical service provided by neuropsychologists to people with MS is assessment of cognitive functioning. While a magnetic resonance imaging or computed tomographic scan can provide information about the structural integrity of the brain, a neuropsychological evaluation documents functional capacity. Neuropsychologists typically administer a series of stan-

dardized tests to systematically assess different cognitive domains. A standardized test has specific instructions, questions, and stimulus materials, and it is administered and scored the same way across examiners and locations. This allows for a reliable and valid comparison of test results over time or across people. Inclusion in clinical practice implies that a test is known to be reliable, sensitive, and valid in populations with neurologic disorders. This is important for individuals with MS, as test scores from initial and follow-up evaluations can be meaningfully compared even if the assessments are performed by different neuropsychologists. Another advantage of standardized tests is that scores can be compared with those obtained from a "normative sample" to determine the patient standing relative to people of the same age and educational level and the presence of an objective impairment in a particular cognitive domain.

Cognitive Domains Commonly Affected in MS

There is individual variability in the pattern and degree of cognitive dysfunction in MS,[8] but impairments in new learning and memory, working memory, cognitive processing speed, visual/spatial abilities, and executive functioning are often found.[9] In particular, cognitive processing speed may be affected early in the disease.[10] Although many people with MS experience word-finding problems, language functioning is generally found to be intact when carefully examined with neuropsychological tests. General intellectual abilities are also preserved in most cases.[11] Many people with relapsing-remitting MS (RRMS) exhibit only mild decline relative to baseline on cognitive tests, but these changes coupled with fatigue and physical symptoms can cause significant disability in employment or ADLs.[4]

Physical disability and the presence of cognitive deficits are not strongly correlated in MS,[12] but cognitive impairment may be predictive of physical progression of the disease.[13] Magnetic resonance imaging findings associated with cognitive dysfunction include indices of whole-brain atrophy and overall lesion burden (as reviewed by Rao).[11] Measurement of third-ventricle width (an index of atrophy) has been shown to be predictive of cognitive impairment in individuals with a relapsing-remitting course.[14] Cognitive functioning is often worse during a relapse, with improvements in attention during remission that correlate with a reduction in gadolinium-enhancing lesions for some patients.[15] Further, white-matter atrophy has been associated with reductions in cognitive processing speed and working memory, while gray-matter atrophy has been associated with deficits in verbal memory.[16] A recent study showed a correlation between volume loss in the CA1 region of the hippocampus and reduced performance on a verbal-learning task in a group of RRMS patients.[17]

Across different disease courses, people with MS often show reduced or impaired performance relative to age-matched controls.[2] Individuals with a progressive course typically do not perform as well as those with a relapsing-remitting course, but less consistent findings regarding cognitive abilities have emerged in comparisons of those with secondary progressive MS (SPMS) versus primary progressive MS (PPMS).[18-22] Studies that have focused on specific cognitive processes rather than overall performance have shown that people with SPMS are worse at acquisition of new material but better at subsequent recall than those with PPMS.[23] In addition, although both SPMS and PPMS subjects show deficits in working memory tasks, those with SPMS perform relatively better when the tasks include a speed-of-processing component.[24]

A Neuropsychological Evaluation

A cognitive evaluation at the time of initial diagnosis is valuable to document an individual's baseline level of functioning against which disease progression can be measured.[25] In many cases, however, the patient is not referred for testing until a problem is apparent to family members or an employer. At that point, an evaluation that documents deficits can support an application for disability benefits. Test results often suggest that the cognitive changes are relatively mild, and a neuropsychologist may be able to suggest job accommodations that would allow for continued employment. The types of accommodations vary according to the individual's needs but can include flexible hours (including some work from home), rearranging the work area to be less distracting, structuring work tasks to minimize disruptions, and using electronic calendars or other devices to provide prompts and reminders. As a member of an MS care team, a neuropsychologist can provide information about the individual's cognitive strengths and weaknesses that can be incorporated into an overall

compensation strategy and symptom management plan that includes input from other specialists, including occupational, speech, and physical therapists.

The cost of a neuropsychological evaluation is usually covered by Medicare, Medicaid, and most insurance carriers. There may be restrictions, however, such as a required referral from a neurologist, mandatory preauthorization, or a limit on the number of hours of testing covered. In some cases, the patient may have to cover part of the cost.

Typically, an individual with MS is interviewed by the neuropsychologist and then tested by the neuropsychologist or a trained technician in a one-on-one setting. The length of the evaluation depends on the reason for the referral and on the type of test battery selected by the neuropsychologist. Although many well-validated tests are available, the neuropsychologist often begins an evaluation with measures designed to assess the cognitive domains most likely to be affected by MS.[9,26] One option is the Minimal Assessment of Cognitive Function in MS (MACFIMS).[27] This test battery is composed of seven commercially available measures and takes approximately 90 min to administer. The cognitive domains assessed include processing speed, working memory, learning and memory, executive functioning, visual/spatial processing, and rapid word generation. An individual's pattern of performance on these measures might suggest the need for further evaluation of certain domains along with cognitive abilities that might not be expected to be affected by MS.[28] Although long test batteries may be somewhat burdensome to the person being tested, they can provide information about cognitive stamina that could have implications for employment.

Interpretation of Test Results

Many people with MS complain of memory problems, and thus may worry that they also suffer from Alzheimer's disease. Careful assessment of the memory system can differentiate the types of memory deficits typically seen in MS from memory failure indicative of Alzheimer's. In order to remember information, a person must first learn or encode it, retain the information over time, and then recall or retrieve the information from memory at a later time. It has been suggested that people with MS have difficulty with memory because of failure to efficiently and fully encode the information.[29] For example, they may require several repetitions of material such as a list of words in order to learn it. When asked later to recall the information, they may not remember as many words as their neurologically intact peers, but they can often recall most of what they learned. Importantly, they often perform in the normal range when tested in a recognition format (ie, they are asked to indicate whether a particular word was on the list they were asked to learn). This intact recognition indicates that the material was retained even if the person was unable to retrieve it without cues. This contrasts with the pattern of memory failure in Alzheimer's disease, in which material is not retained over time and thus not available for recall or recognition.[30] For people with MS, the pattern of retrieval failure with intact recognition suggests that compensation strategies during the learning phase or the use of prompts or cues for recall can be beneficial.

Another common complaint of people with MS is that they have difficulty with multitasking, or performing several tasks simultaneously or in rapid alternation. Examples include holding a conversation while looking at e-mail, preparing a meal while supervising small children, or driving while doing almost anything else. Test results from a screening battery may indicate intact basic attention, but further testing can reveal problems with more complex tasks in which good performance requires attentional abilities as well as rapid processing or decision-making. Studies have shown that people with MS have difficulty performing tasks simultaneously[31] or with rapidly shifting attentional resources.[32] A common-sense strategy to address this problem is for the person to attempt only one task at a time and fully complete it before moving on to another task.

One possible outcome of a neuropsychological evaluation is that the person's cognitive functioning is found to be consistent with expectations based on age and education level. In this case, feedback regarding intact abilities can be reassuring to the person with MS, and the neuropsychologist could suggest modifications in the environment to minimize distractions or fatigue to support better day-to-day functioning.

As the above examples suggest, a neuropsychological evaluation is not just about tests. The job of the neuropsychologist is to place an individual's test scores into context so that feedback can be meaningful and helpful. For example, it is crucial to take into consideration a person's likely presymptomatic level of abilities when interpreting cognitive test results. This is particularly

important for individuals with high baseline abilities and jobs with very high cognitive demands. A drop from the superior to the average range may mean that the person is fully functional for ADLs yet unable to perform his or her typical job duties. Such an individual may have had a high degree of cognitive efficiency at baseline so that decisions incorporating several sources of information could be made quickly, ideas were expressed fluidly, and information was retrieved effortlessly. That person may now need to exert a great deal of effort to do things that once seemed automatic. As a result, the person may see himself or herself as significantly impaired. Feedback from a neuropsychological evaluation may simultaneously validate the person's experience of cognitive decline and provide reassurance that his or her abilities remain in the normal range. This may also help family members understand why work or other cognitively demanding tasks "wipe out" the person.

Another important factor to consider is the presence of depression, which is common in people with MS.[33] Depression can exacerbate cognitive difficulties, particularly in the domains of processing speed, working memory, executive functioning, and verbal fluency.[34,35] The neuropsychologist should always evaluate the patient's psychological functioning and screen for the presence of psychiatric disorders. Sleep disturbance is also common in MS and can contribute to fatigue and cognitive inefficiency.[36] When evaluating test results, it is also important to consider possible cognitive side effects of medications.[37] Thus the neuropsychologist incorporates several aspects of the person's experience in interpreting test scores and preparing a report. The neuropsychologist may then meet with the patient to provide feedback. Many neuropsychologists view this as the most valuable service they perform, as it helps the individual understand his or her experience as well as factors such as fatigue or depression that can affect cognitive efficiency. Feedback regarding neuropsychological test results can also help family members understand the impact of cognitive dysfunction on a person's ability to perform household tasks and function in customary social roles. As noted above, the cognitive strengths and weaknesses identified in a full evaluation may suggest the types of compensation strategies or workplace accommodations needed to allow the person with MS to remain employed. Finally, a finding of improved cognitive abilities following an exacerbation or treatment for depression can support an individual's plan to return to work or other activities.

Treatment for Cognitive Dysfunction

Recent studies have explored the use of medications to address cognitive dysfunction in MS. One anticholinesterase medication that has been approved by the US Food and Drug Administration for use in Alzheimer's disease (donepezil) has been shown to improve performance on memory tests in individuals with MS in a placebo-controlled trial,[38] while another (rivastigmine) has not.[39] Stimulant medications (eg, *l*-amphetamine sulfate) have shown some promise in enhancing cognitive functioning in MS.[40] It has also been reported that a combination of cyclophosphamide and methylprednisolone has positive effects on cognitive functioning.[41] Unfortunately, agents such as 4-aminopyridine[42] and ginkgo biloba[43] have not resulted in statistically significant improvements in cognitive functioning in placebo-controlled trials.

The results of computer-based training to remediate cognitive deficits in MS have been mixed.[44,45] However, training in the effective use of a personal digital assistant (PDA) has yielded improvements in everyday functioning that were maintained at a follow-up assessment.[46] Another avenue of treatment involves the use of strategies to enhance learning and, in turn, recall. In particular, it has been demonstrated that people with MS learn and recall information better when they have generated some of it themselves rather than having it provided to them.[47] This strategy capitalizes on a deeper level of encoding and can make the material more personally meaningful and thus easier to access later. This learning strategy has been shown to be effective for recall of name-face pairings, object locations, and appointment dates and times.[48] Moreover, the technique has been effectively applied by people with MS to real-world tasks such as meal preparation and bill payment.[49]

Conclusion

It is clear that a neuropsychologist can play an important and ongoing role in the assessment and care of an individual with MS. As a member of the MS care team, the neuropsychologist can provide information about the person's cognitive and emotional health that may facilitate effective interventions to minimize the impact of cognitive dysfunction on quality of life. Although the focus of this article has been the clinical

PracticePoints

- The primary clinical service provided by neuropsychologists to people with MS is assessment of cognitive functioning. The results can yield information about disease progression, identify cognitive strengths for the development of compensation strategies, and help document deficits to support an application for disability benefits.
- The cognitive domains most frequently affected by MS are new learning and memory, working memory, cognitive processing speed, visual/spatial abilities, and executive functioning.
- Feedback from a neuropsychological evaluation can help the patient, family members, and the health-care team better understand how MS affects that individual and what types of treatment may be beneficial.

practice of neuropsychology, the number and variety of studies cited demonstrate the lead role that many neuropsychologists have taken in research designed to clarify how MS affects brain functioning. Neuropsychologists are employed in a variety of settings, including academic medical centers, rehabilitation hospitals, and private practice. Most are members of one or more professional organizations, including the American Psychological Association (APA, Division 40; www.div40.org), National Academy of Neuropsychology (NAN; www.nanonline.org), International Neuropsychological Society (INS; www.the-ins.org), and American Academy of Clinical Neuropsychology (AACN; www.theaacn.org). Each organization maintains a membership roster that can be searched by state or city to locate a practitioner.

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