

HOW TO DO IT

Use a diagnostic neuropsychology

Pract Neurol: first published as 10.1046/j.1474-7766.2003.08148.x on 1 June 2003. Downloaded from <http://pn.bmj.com/> on June 22, 2021 by guest. Protected by copyright.

Neuropsychology services in the UK are a precious resource. In our own Northern region there is a ratio of 5 : 1 between the number of consultant neurologists and neuropsychologists who see neurological referrals for diagnostic assessment. Furthermore, the neuropsychological status of patients with degenerative and other brain disorders can be much more informative (in terms of diagnosis, prognosis, and management) than brain imaging, on which so much more money is usually spent. In our cognitive neurology clinic we provide an opinion based on joint consultations with a neurologist and neuropsychologist. This allows the optimal use of neuropsychology resources, where the initial joint assessment guides any further more detailed assessment. However, most neuropsychology assessments are requested by neurologists or their trainees working in isolation. We hope this article will provide some guidance on the appropriate use of neuropsychology services in such circumstances. They reflect our personal views and, hopefully, a degree of common sense.

REALIZE WHAT YOU CAN DO YOURSELF

Reference is often made in notes and letters to 'formal' neuropsychometry. There is nothing 'informal' about what can be achieved by neurologists without referral to a neuropsychologist.

In the cognitive clinic we carry out an initial screen for early onset dementia using simple instruments including the mini mental state (MMSE; Folstein *et al.* 1983) and the extended version of the mini mental state developed by Hodges and others in Cambridge (the Adenbrookes Cognitive Examination, ACE; Mathuranath *et al.* 2000). The good news is that the ACE seems to work as well in Tyneside as in East Anglia! This test is available free, does

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Practical Neurology, 2003, 3, 170–175

service properly

not require any neuropsychological training and takes about 5 mins. The tests of new verbal learning and recall in the ACE are particularly helpful in the identification of early onset Alzheimer's disease, the most common reason for referral to our clinic. The verbal and category fluency tasks in the ACE ('p words' or 'animals' in 1 min) are useful pointers to organic cognitive impairment but without precise localizing significance (referred to by Hodges as the 'ESR of cognitive testing'). The additional tests of drawing in the ACE are more sensitive indicators of parietal lobe dysfunction than the intersecting pentagons in the MMSE. This is helpful in picking up dementia with Lewy bodies, where parietal dysfunction can be an early prominent feature.

Other instruments are also available, including the screening battery developed by Warrington ('the Green Book') available from the National Hospital for Neurology and Neurosurgery in London. This takes longer, and has not been validated in terms of how well it predicts dementia.

Apart from the scores themselves, carrying out these tests in the clinic also allows an assessment of *how* the tests are carried out. Early frontal-lobe disorders, in particular, may not produce abnormal scores even when patients show clearly abnormal behaviour during testing. For this reason we recommend screening testing in the clinic even if the patient is going to be referred on to a neuropsychologist.

Believe it or not, neurologists in the UK are classified as 'specialists in the management of dementia'. As such, they are permitted to prescribe cholinesterase inhibitors according to the 2001 NICE guidelines (DOH NICE 2001). These guidelines include a requirement for monitoring the response to the drugs, and mention the MMSE. However, we feel the MMSE is not an adequate measure, but that the ACE may be helpful. We have recently shown a significant increase in performance on the ACE in a small group of patients treated for 6 months with rivastigmine that could only otherwise be demonstrated using the performance IQ index from the full WAIS (which we would *not* recommend for general monitoring of cholinesterase inhibitor response). However, the most useful guide to response to cholinesterase inhibitors, in our view, is the report of the family about what the patients can actually do. Again, you certainly do not require a neuropsychologist to establish that.

Many patients with frontal-lobe disorders exhibit behavioural features that can be documented just as well by a neurologist

UNDERSTAND WHAT NEUROPSYCHOLOGISTS CANNOT DO

Lack of direct communication between neurologists and neuropsychologists can lead to misunderstandings. Occasional referrals suggest an image of neuropsychologists as voodoo practitioners capable of resurrecting the dead or curing the insane. They can do neither. It is virtually impossible to assess a patient confined to bed on a busy ward or unable to sit up. It is cruel to submit the severely ill or the recently bereaved to prolonged testing. It is cruel to neuropsychologists to ask them to assess patients with florid psychosis, or severe behavioural disorders. In the latter category we often see patients with frontal-lobe disorders in the clinic who are impossible to assess using conventional neuropsychological measures. Many patients with frontal-lobe disorders exhibit behavioural features that can be documented just as well by a neurologist.

BOX 1 COMMENTS ON SOME COMMON NEUROPSYCHOLOGICAL TESTS**National Adult Reading Test (NART)**

Reading aloud a list of words with irregular spelling. Takes about 5 min. This ability is relatively preserved in a number of degenerative disorders because it is resistant to the effects of cortical damage. It is therefore a good measure of premorbid intellectual function. Other tests, e.g. oral vocabulary, can be used for the same purpose if there is a particular problem with written language.

Wechsler Adult Intelligence Scale (WAIS)

The mainstay of most neuropsychological assessments. Takes more than 40 min; different neuropsychologists use different combinations of subtests (see Box 2) depending on the particular questions being asked. From a neurological perspective the important thing to realize is that the individual tests are far from 'pure' tests of specific cognitive functions, or the function of specific brain areas. The WAIS yields indices of verbal intelligence (Verbal IQ or VIQ) and non-verbal or performance intelligence (Performance IQ or PIQ). These measures have a mean of 100 and standard deviation of 15 (in the healthy general population of the UK and North America), so that 95% of the population will be within the range 70–130. VIQ and PIQ are age-scaled (they do not vary with age). There are robust population norms that allow comparison with estimates of premorbid VIQ and PIQ from the NART.

Until recently assessment was based on the revised version, the WAIS-R. A new version, the WAIS III, incorporates new subtests, and allows the calculation of age-scaled subtest scores as well as age-scaled indices. In addition to indices of verbal and performance IQ the WAIS III also yields four other indices (Verbal Comprehension, Perceptual Organization, Working Memory and Processing Speed), but these are not often given in reports. The WAIS III takes less account of timed motor speed to calculate PIQ, which is useful if you are interested in cognitive deficits associated with extrapyramidal disorders, for example.

Apart from the indices, the WAIS also yields scores for the component subtests. Interpretation of these is a craft (not surprisingly considering the large number of cognitive processes involved in each task) and neuropsychologists often do not report them. If supplied, the data to examine are the age-scaled subscores; these have a mean of 10 and standard deviation of 3, so that the 95% population limits are between 4 and 16 (the comparison population is aged 20–34 for the WAIS-R and age matched for the WAIS III). It is often helpful if scores are presented as percentiles for ease of comparison. More helpful sometimes than the individual scores is the 'profile' of score results to see if any individual scores stand out as particularly bad.

In addition to a robust indication of deterioration, the WAIS allows the generation of specific hypotheses about cognitive deficits that can be tested using other measures.

Wechsler Memory Scale (WMS)

One of a number of memory assessment batteries available. Others include the AMIPB (Adult Memory and Information Processing Battery). We like the WMS because it yields indices of memory that can be compared directly with the WAIS indices. For example, in difficult cases of suspected Alzheimer's disease it allows easy comparison of the general memory index from the WMS with the PIQ and VIQ from the WAIS to show if there is a significant drop in memory function compared to the other indices (the significance levels vary with age and can be looked up in the manual, but a difference of 15 between the general memory index and PIQ or VIQ will always be significant at the $P < 0.05$ level). WMS-R and WMS III versions are available.

'Frontal lobe' or 'executive function' tests: Stroop, Trails, Wisconsin Card Sorting Test (WCS), Hayling Test and Brixton Test

We see a number of patients with frontal lobe disorders (mainly frontotemporal dementia) where the most florid changes are in behaviour due to involvement of the orbitofrontal lobes or their connections. Questionnaires designed to assess these behavioural changes have been developed and validated on patients with head injury. However, it must be stressed that the most commonly used 'frontal lobe tests' assess cognitive planning and strategy dependent on the function of dorsolateral prefrontal cortex. In view of this, the behaviour reported by relatives and observed during assessment is just as important as the test data.

The **Stroop** is based on asking patients to read the names of colours written in incongruent colours. **Trails A and B** test the ability of patients to follow sequences of letters or numbers on a page. The **WCS** requires patients to work out rules that determine the selection of symbols of different colour and shape. The **Brixton test** is a rule-following task which is simpler than the WCS and the **Hayling test** is a measure of verbal suppression of a familiar response.

Perceptual tests

There are a number of batteries of visual perception. Those used on a regular basis are the **Visual Object and Spatial Perception Test (VOSP)** and the **Behavioural Inattention Test (BIT)**. The VOSP includes measures of shape detection, incomplete figure detection, silhouette recognition, position discrimination and 3D visualization. The BIT includes standard measures to detect unilateral visual neglect across various modalities.

Box 2 WAIS subtests

WAIS SUBTEST	WHAT IS IT?
WAIS-R	
Verbal	
Information	Questions on general knowledge
Digit span	Digit span forwards and backwards
Vocabulary	Definitions of words
Arithmetic	Mental arithmetic
Comprehension	Open-ended questions requiring logic and reasoning
Similarities	Recognition of similarities between pairs of items
Performance	
Picture completion	Spot missing items in incomplete pictures
Picture arrangement	Put cartoon pictures in sensible order to make a story
Block design	Make patterns using red and white blocks
Object assembly	Put together jigsaw figures
Digit symbol	Use a key to assign symbols to digits in a random list of digits
ADDITIONAL WAIS III TESTS	
Verbal	
Letter-number sequencing	Extract separate sequences of letters/numbers from mixed sequence of both
Performance	
Matrix reasoning	Forced-choice completion of a matrix of symbols
Symbol search	Look for either of two symbols in a symbol sequence

ASK AN APPROPRIATE QUESTION

Appropriate question for neuropsychology referral include:

- Is there evidence of an organic dementia?
- What cognitive deficits are present after traumatic or vascular brain injury?
- Is this patient's memory function sufficient for them to continue living alone?

Examples of inappropriate referrals include:

- Assessment of a confused patient who is being aggressive to the nursing staff. Neuropsychological assessment is an extremely effective way of annoying a patient with poor anger control!
- Reassessment after inappropriate intervals. Neuropsychologists might be asked to provide a full assessment, for instance, only 2 months after a previous assessment. Practice effects in the tests are bound to occur and there are limits to the number of parallel tests available (i.e. different forms of the same test which are equivalent to each other). Most neuropsychologists accept that reassessment after 6 months is unlikely to produce significant practice effects.

- Requests for a full neuropsychological assessment when a selective assessment will do. Situations where this applies include: monitoring recovery from anoxic brain damage; measuring the effect of anticonvulsant withdrawal; and assessment pre- and post lumbar puncture in suspected normal pressure hydrocephalus.

HAVE A WORKING KNOWLEDGE OF THE TESTS USED

Unlike assessments such as neurophysiology and imaging, most UK neurologists do not have much exposure to neuropsychology during their training. But we feel it is helpful for neurologists to have a working knowledge of the tests used by neuropsychologists – they should sit in with neuropsychologists to see what we do and even perhaps get some hands on experience. That is *not* to say that neuropsychology is something that should be 'tried at home' by neurologists, or that neurologists should start 'ordering' specific tests from their neuropsychology colleagues. But a knowledge of the uses and limitations of the tests is helpful in terms of making appropriate referrals, and understand-



Administration of block design from the WAIS in a typical clinical setting (cramped hospital side room)!

ing the reports. The boxes comment on some of the more commonly used tests. Detailed descriptions of most neuropsychological tests can be found in Lezak (1995).

TALK TO THE NEUROPSYCHOLOGIST

This applies to the provider of any test result, of course, but is critical in the case of neuropsychology, where an extensive range of possible tests are available. Although there are assessments that many neuropsychologists consider central (especially the WAIS), there is no such thing as a 'standard' or 'routine' neuropsychology assessment. Discussion of the patient in advance can save a lot of wasted time. In certain cases (where there is a suspicion of a factitious disorder, for example) it is particularly helpful to have the opportunity to share impressions that might not be explicit in the actual referral or report. This would guide the way in which neuropsychological assessment proceeds. Tests measuring malingering, depression or anxiety could be incorporated if deemed appropriate.

THE FUTURE

Cognitive neurology has only recently become an established neurological subspecialty. Now that it has, we hope that a training structure will become established within neurology that will remove any need for articles such as this. Cognitive neurology represents a partnership between neurology and neuropsychology, which we hope will lead to greater expansion of diagnostic neuropsychology.

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